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DICTIONARY OF ORGANIC COMPOUNDS

VOLUME 1



# DICTIONARY OF ORGANIC COMPOUNDS

The Constitution and Physical and Chemical Properties of the Principal  
Carbon Compounds and their Derivatives, together with the relevant  
Literature References

VOLUME ONE

**ABADOLE — CYTOSINE**

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## PREFACE

WHEN the Dictionary was first produced during the years 1934–37 it was intended that it should be kept up to date by complete revision every five or six years. A new edition of Volume I, covering the letters A to D, was published in 1943. As explained in the Preface to that Volume, the war made completion impracticable. Volumes II and III were reprinted with short supplements containing new entries of special interest and importance for which data and information had been gathered meanwhile. For several years nothing further could be done but, with the approach of more normal conditions following the cessation of hostilities, the task of preparing a new and completely revised edition was taken up again.

Progress in many lines of research had inevitably been arrested, with the consequent diminution in the flow of new compounds and data. On the other hand, war conditions had created fresh demands, resulting in rapid developments in all branches of chemistry, none, perhaps, more striking than those in the field of biochemistry. Further, in the manufacturing sphere new industries were set up to produce materials such as plastics, synthetic fibres and other polymers, directly or indirectly required for war purposes. As a result many new organic compounds, both natural and synthetic, have come into prominence.

In view of these developments and the subsequent revival of peace-time research activities, revision of the Dictionary was now clearly required. In this new edition the whole of the text has been carefully scrutinized and brought up to date to the end of 1950. In addition, every opportunity has been taken during passage through the press to include results of more recent research even up to the early months of 1953. Over 2,500 compounds appear for the first time as principal entries, while some thousands of additions or amendments have been made to existing entries following upon the publication of fuller or more accurate data and information.

In order to facilitate easier handling, it has been decided to issue the Dictionary in four volumes instead of three. Considerable economy of space has been achieved by deletion of many superfluous constitutional formulæ and by increasing the type area of each page. No other changes have been made either in format or lay-out because the original style appears to have met with wide approval.

Once again our thanks are due to the printers for the exemplary care and precision which they have given to the work at every stage in its preparation.

July, 1953.

I. M. H.  
H. M. B.







## INTRODUCTION

ALL the compounds in this dictionary are arranged in strictly alphabetical order. The dictionary is therefore its own index, and any required data and information should be readily accessible. A difficulty sometimes arises, however, on account of the fact that most organic compounds possess more than one name, and questions of orientation introduce a further complication. An alphabetical classification is thus inadequate *per se*, and some further rules are necessary if that otherwise simple system is to possess its maximum utility. In order to facilitate the use of the dictionary an explanation of the general rules which have been adopted and followed throughout the work is given in the following notes.

### Arrangement of the Text

#### PRINCIPAL REFERENCES

The majority of compounds can be named in a variety of ways, some popular (or trivial) and others systematic or strictly chemical. But in practice it is found that for any one compound preference is usually given to one particular name, and it is this name which has been selected for the principal reference. It sometimes happens, however, that such a compound is one of a number of isomers having a systematic or chemical name. In certain cases of this kind the general rule has been departed from, the whole series of isomers being grouped together under the systematic name. For example, Orthanic, Metanilic, and Sulphanilic Acids are not separated under letters O, M, and S, but are given together under letter A as Aniline-*o*-, *m*-, and *p*-sulphonic Acids respectively. Similarly Gamma Acid, J-Acid, M-Acid, and S-Acid are included with the other Aminonaphthol-sulphonic Acids. Trade and proprietary names are not used for the principal references, except where they come within the general rule as being in common use or where, usually for reasons of complex structure, no other names are feasible.

The name selected for a parent compound is, with a few exceptions, retained for all its derivatives. For example, Alizarin having been chosen for 1:2-Dihydroxyanthraquinone, all the derivatives of the latter will be found as derivatives of Alizarin.

#### CROSS-REFERENCES

A generous number of cross-references, sometimes as many as three or four, are given, by means of which the principal references can readily be found. For instance *N*-Carboxyurea, Carbamyl-carbamic Acid, and Ureidoformic Acid are given as cross-references to Allophanic Acid. Where cross-references are given for a parent compound, these are not, in general, repeated for the derivatives. Thus Diphenyl Ketone will be found as a cross-reference to Benzophenone, but Amino- and Bromo-diphenyl Ketones are not given as cross-references to Amino- and Bromo-benzophenones. Owing to their large number many nitriles are not included under Cyano-: those not so given will be found either under their own name (e.g. Acetonitrile, Benzonitrile) or under the parent acid.

#### FORMULÆ

The full constitutional formula is given for each compound with, of course, the exception of those whose constitutions have not yet been ascertained. In the case of many compounds of the carbohydrate, steroid, and polyterpene classes, the constitution is represented by simple skeletal structures and configuration by heavy or dotted lines in conformity with modern practice. Where there is a group of isomers, however, it is considered to be sufficient in most cases to set out the full formula for the first member only. This applies also to the molecular formula and molecular weight. For instance, the complete formula is given for *o*-Chlorotoluene, but none for the *m*-, and *p*-, which follow. For acyclic compounds, however, particularly those with long or branched chains or with varying degrees of unsaturation, orientation is less simple, and full formulæ are given in every case, e.g., the Hexenols.

The order of the elements in the molecular formulæ is C H O N Cl Br F S P, other elements following in alphabetical order. In calculating molecular (formula) weight the following approximate atomic weights have been employed: C 12, H 1, O 16, N 14, Cl 35.5, Br 80, I 127, F 19, S 32, P 31, Fe 56, Mg 24, Pb 207, Se 79, Si 28, and for other elements the whole number nearest to the atomic weight adopted by the International Committee on Atomic Weights in 1942.

## DERIVATIVES

Functional derivatives, as distinct from substitution compounds, are given under the parent compound except where they are sufficiently important to justify separate inclusion as principal references. Thus under an acid will be found its esters, halides, anhydride, amide, nitrile, anilide, etc. Esters in which the alcohol or phenol component is of more importance than the acid component are given under the alcohol or phenol, as, *e.g.*, in the case of the acetates and benzoates of Borneol, Resorcinol and *sec.-n*-Octyl alcohol. Under a base are given its salts, acyl derivatives, addition compounds, etc.; under an alcohol or phenol, the ethers and certain esters (*v. supra*); under an aldehyde or ketone, the acetals, oximes, semicarbazones, phenylhydrazones, etc.

## LITERATURE REFERENCES

The literature references relate primarily to the best method of preparation, but in some cases publications are cited which refer to earlier methods of preparation or which contain useful summaries or bibliographies. Where considerations of molecular structure or constitution are of importance, reference is made to the most recent views on the subject. This is particularly the case with many of the complex naturally occurring compounds. To some of the very common compounds, *e.g.*, Acetone, Acetic acid and Ethyl alcohol, no useful references can be given.

The journal abbreviations used are listed in the Table on p. xiii. They are largely those adopted for the *Chemical Abstracts* of the American Chemical Society (Index to *Chemical Abstracts*, 45, 1951).

## Nomenclature and Orientation

In the introduction to Richter's *Lexicon* (1910) the following passage occurs: "Of the many difficulties which, in writing this work, presented themselves, the greatest was undoubtedly the question 'which nomenclature is to be adopted for the sake of uniformity and clearness.'" The vast number of compounds already known when that was written has since been continuously added to, and new types of compound have appeared, thus rendering the problem of nomenclature more difficult and complex to-day than it was in 1910. The only system which can be regarded as having the merit of completeness is that of Beilstein, but it is very complicated, and possesses other features which reduce its value as a practical scheme. The Geneva system, although occasionally utilised for aliphatic compounds, has never found universal favour. Many attempts have been made in recent years to introduce new systems both of nomenclature and of orientation, but none of these has been exclusively used in this Dictionary. Preference has usually been given to the nomenclature and orientation employed in the original publication, but, in cases where ambiguity may arise, adjustment has sometimes been necessary in the interests of clarity.

In order to avoid re-setting in a large number of compounds scattered over the 3,000 pages of this edition, the recently introduced convention of using small roman capitals, D, L, in place of italic, *d*-, *l*-, for optically active compounds, has not been adopted except in a few instances.

## NOMENCLATURE

The prefixes cyclo-, homo-, iso-, etc., are treated as part of the name. Thus Cyclopentane, Homocatechol, Isophthalic Acid, are to be found under letters C, H, I, respectively. The prefixes allo-, epi-, and nor-, have also in general been preferred as part of the name, but where this has not been convenient sufficient cross-references have been given. An exception is made in the case of pseudo-, which is represented by the Greek letter  $\psi$ ,  $\psi$ -Aconitine (Pseudo-aconitine), for instance, being included under letter A and not letter P. The prefixes benz- and naphtha- are used for condensed (fused) benzene and naphthalene rings, not benzo- and naphtho-. *E.g.*, Benzthiazole, Benzcarbazole, Naphthfluorene. For compounds containing the fused naphthalene ring and for whose names both benz- and naphtha- have been used, the preference has been given to the former in principal references, *e.g.*, Benzcoumarin not Naphthacoumarin, Benzacridine not Naphthacridine. For acetylenic compounds -in- has been replaced by -yn-, *e.g.*, Butyne not Butine, Hexynol not Hexinol, and similarly ethynyl instead of ethinyl.

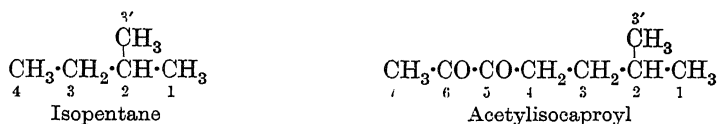
All "double" derivatives take the prefix di-. *E.g.*, Diallyl sulphide, not Allyl sulphide; Diethyl Ether, not Ethyl Ether; Dimethyl sulphate, not Methyl sulphate. The Greek di- is preferred to the Latin bi- or bis-, *e.g.*, di-semicarbazone, di-phenylhydrazone.

In substituted or derived compounds the order in which the substituent group names appear in the compound name is that given in the Table on p. xv, List of Substituents. Thus, for the common substituents the order is, Halogen (F, Cl, Br, I), Nitro, Hydroxy, Amino, Alkyl, Aryl, Acyl. Wherever possible, the aldehyde, carboxyl, and sulphonic groups are preferred as suffixes. *E.g.*, Anthraquinonesulphonic Acid, not Sulphoanthraquinone (but cf. *e.g.*, Disulphobenzoic Acid, Aldehydosalicylic Acid); Chloroanthraquinonecarboxylic Acid, not Chlorocarboxyanthraquinone.

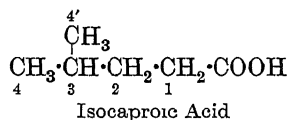
## ORIENTATION

*Acyclic Compounds.* The numbering system is used in preference to Greek letters. The CHO, CN, and COOH groups are generally regarded as substituents and, as such, their carbon atoms are not numbered.

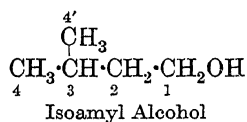
In the *saturated branched chains* numbering commences in the longest chain at the terminal carbon nearest to the side-chain. If there are two or more side-chains or groups of different lengths, numbering commences at the end carbon nearest to the shortest of such side-chains. *E.g.*,



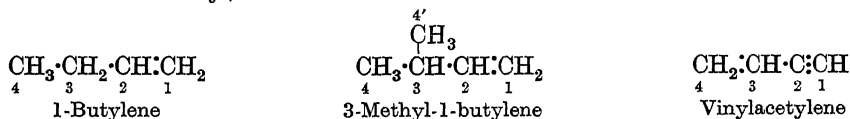
There are two exceptions to the above rule. (1) Where the chain contains a CHO, CN, or COOH group, numbering begins at the carbon carrying this group. *E.g.*,



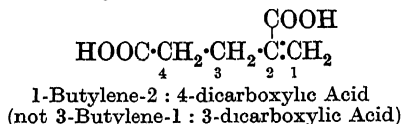
(2) In the primary alcohols numbering commences at the carbon of the  $-\text{CH}_2\text{OH}$  group. *E.g.*,



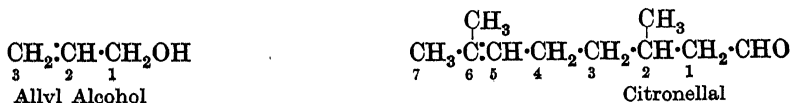
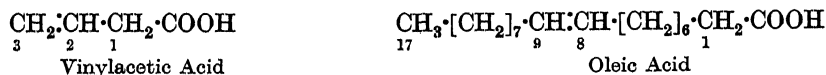
In the *unsaturated* compounds the double or triple bonds are given the lowest numbers possible whether the chain is branched or not. Where both double and triple bonds are present, the latter takes the lowest number. *E.g.*,



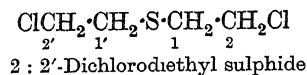
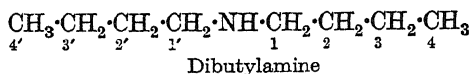
The rule applies to compounds containing the CHO, CN, or COOH groups provided the name of the parent hydrocarbon is retained. *E.g.*,



but in all other cases the rule for saturated compounds is followed, viz. numbering begins at the carbon carrying the CHO, CN, or COOH group or, in the case of primary alcohols, at the carbon of the  $\text{CH}_2\text{OH}$  group. Thus



In the case of carbon chains interrupted by O (ethers), NH (secondary amines), S (sulphides), etc., numbering commences at the carbon atoms attached to the oxygen, nitrogen, sulphur, etc. *E.g.*,

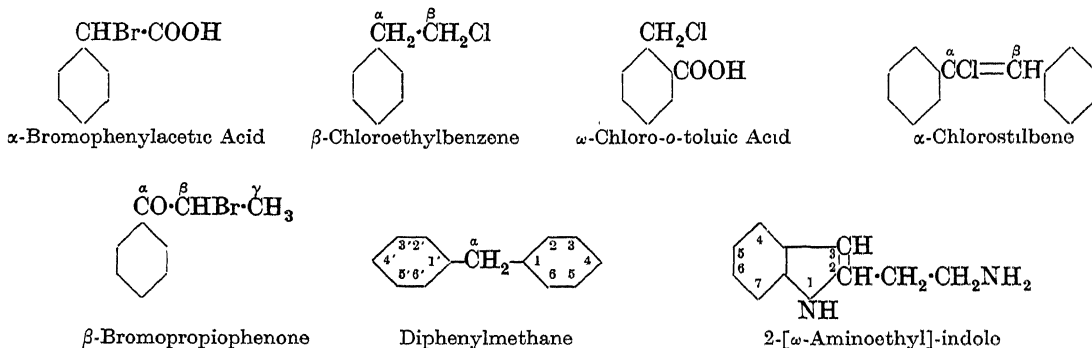


*Homocyclic and Heterocyclic Compounds.* As stated above, no one system of orientation of ring compounds has been exclusively followed, and no new departures have been made from those already in use. Where there is any doubt numbers have been inserted in the constitutional formulæ of the parent compounds. The numbering adopted for any particular ring system can therefore be readily ascertained by reference to the text. In the methylbenzenes (*i.e.* toluene and its derivatives) numbering begins in most cases at the carbon to which the methyl group is attached.

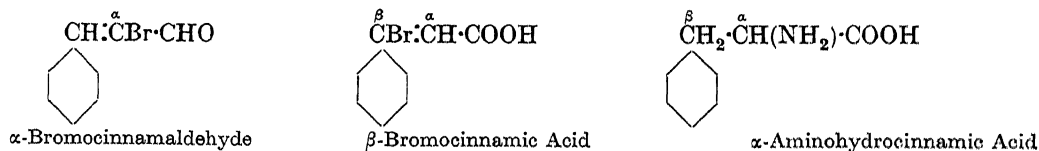
In heterocyclic rings containing both oxygen (or sulphur) and nitrogen the lowest number is given to the oxygen (or sulphur). *E.g.*, in the oxazoles (or thiazoles) numbering commences at the oxygen (or sulphur).

Where there is a choice of numbering of polysubstituted compounds the lowest number is, wherever possible, assigned to the functional groups (OH, NH<sub>2</sub>, etc.). *E.g.*, 5-Chloro-1-aminoanthraquinone, not 1-Chloro-5-aminoanthraquinone, such a compound being regarded as a chloro derivative of aminoanthraquinone rather than an amino derivative of chloroanthraquinone. Similarly 6-Bromo-3-hydroxybenzyl Alcohol, not 2-Bromo-5-hydroxybenzyl Alcohol.

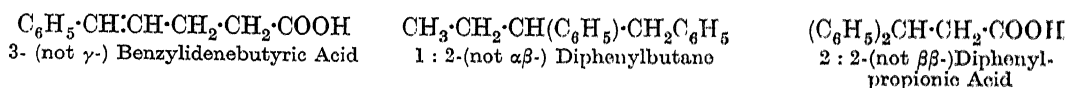
*Aromatic-aliphatic (aralkyl) compounds.* In the aralkyl compounds the general rule given above for the numbering of aliphatic chains has been departed from, the carbons in the aliphatic part of the molecule being designated by Greek letters in order to avoid confusion with the numbers of the rings. *E.g.*,



The letters begin at the carbon attached to the ring except in the case of the aromatic-aliphatic acids, aldehydes, nitriles, or primary alcohols. In these cases lettering begins at the carbon carrying the COOH, CHO, or CN group or at the carbon of the CH<sub>2</sub>OH group. *E.g.*,



In many aralkyl compounds, however, the aromatic radical can, from the point of view of the name, be regarded merely as a substituent. In such cases the numbering of the parent aliphatic compound is retained provided no ambiguity is likely to result. Thus,



### General Remarks

In the descriptive matter in the text the same order has been followed in all cases, viz. : sources, where of interest; physical properties (melting point, boiling point, solubility, density, refractive index, heat of combustion, optical rotation, etc.) : chemical properties (typical reactions, analytical tests, etc.). The data for derivatives then follow under separate sub-headings.

As regards abbreviations, these have been used freely in the text, but all abbreviations and contractions, such as Me, Et, Ph, CO<sub>2</sub>H, etc., have been rigidly excluded from the constitutional formulæ.

As would be expected, the original literature reveals numerous instances of divergent and sometimes contradictory data for the same compound. As far as possible palpable inconsistencies have not been recorded, but where a choice could not be safely made the alternative data, *e.g.*, melting and boiling points, densities, etc., are given in parentheses. In some cases the information given in the literature is so scanty and uncertain that it has been considered advisable to omit the compound altogether. Nevertheless, although in some instances the recorded facts regarding chemical and physical properties are very meagre, the compound has been included by virtue of other valuable information contained in the literature references, such as method of preparation or proof of constitution.

## TABLE OF ABBREVIATIONS

<i>A</i>	Acid ( <i>A</i> <sub>2</sub> , two mols of acid).	Insol.	Insoluble.
Å	Angstrom unit. (10 <sup>-8</sup> cm.).	I.U.	International Unit.
Abs. EtOH	Absolute alcohol.	Jap. P.	Japanese Patent.
AcOH	Acetic acid.	<i>k</i>	Dissociation constant.
Ac <sub>2</sub> O	Acetic anhydride.	<i>l</i>	Lævorotatory.
AcOEt	Ethyl acetate.	Liq.	Liquid.
Add.	Additive.	<i>m</i>	Meta (position).
Add. comp.	Addition compound, molecular compound, adduct.	Max.	Maximum.
Addn.	Addition.	Me	Methyl.
A.G.F.A.	Aktien-Gesellschaft für Anilinfabrikation.	MeOH	Methyl alcohol.
Alc.	Alcohol, alcoholic.	Me <sub>2</sub> CO	Acetone.
Alc. NH <sub>3</sub>	Alcoholic ammonia.	Min.	Mineral (inorganic).
Al.Hg.	Aluminium amalgam.	Misc.	Miscible.
Alk.	Alkaline.	M.L.B.	Meister, Lucius & Bruning.
[ <i>a</i> ]	Specific rotation.	mm.	Millimetre(s).
Amorph.	Amorphous.	Mod.	Moderately.
Anhyd.	Anhydrous.	Mol.	Molecule, molecular, molar.
Aq.	Aqueous.	M.p.	Melting point.
as.	Asymmetric.	<i>ms</i>	Meso (position).
Atm.	Atmosphere(s), atmospheric.	MW	Molecular weight (formula weight).
<i>B</i>	Base ( <i>B</i> <sub>2</sub> , two mols of base).	mgm.	Milligramme(s).
Badische	Badische Anilin und Sodafabrik.	mμ	Millimicron(s). (10 <sup>-7</sup> cm.).
Belg. P.	Belgian Patent.	<i>n</i>	Normal (chain).
B.D.C.	British Dyestuffs Corporation.	<i>n</i> <sub>D</sub>	Refractive index (D line, etc.).
Bibl.	Bibliography.	Na.Hg	Sodium amalgam.
B.p.	Boiling point.	NH <sub>3</sub>	Ammonia, aqueous ammonia.
B.P.	British Patent.	NH <sub>3</sub> .AgNO <sub>3</sub>	Ammoniacal silver nitrate.
<i>c</i>	Concentration.	<i>o</i>	Ortho (position).
<i>C</i> <sub>p</sub>	Constant pressure.	Ord.	Ordinary.
<i>C</i> <sub>v</sub>	Constant volume.	Org.	Organic.
Cal.	Calories.	Ox.	Oxidise, oxidation.
Can. P.	Canadian Patent.	<i>p</i>	Para (position).
Col.	Colour, coloration.	P	Patent.
Comb.	Combustion.	pH	— log <sub>10</sub> hydrogen ion concentration.
Comp.	Compound.	pK	— log <sub>10</sub> <i>k</i> (dissociation constant).
Conc.	Concentrated.	Part.	Partly, partial.
Corr.	Corrected.	Pet. ether	Petroleum ether.
Crit.	Critical.	PhNO <sub>2</sub>	Nitrobenzene.
Cryst.	Crystals, crystalline, crystallise.	PhOH	Phenol.
(COOH) <sub>2</sub>	Oxalic acid.	Ppd.	Precipitated.
(CH <sub>2</sub> COOH) <sub>2</sub>	Succinic acid.	Ppt.	Precipitate.
<i>D</i>	Density.	Pptn.	Precipitation.
<i>D</i>	Dextro-.	Prac.	Practically.
<i>d</i>	Dextrorotatory.	Press.	Pressure(s).
<i>dl</i>	Racemic. Optically inactive by external compensation.	ψ	Pseudo.
Decomp.	Decomposed, decomposition.	Py	Pyridine.
Deriv.	Derivative.	<i>r</i>	Racemic.
Dil.	Dilute, dilution.	Red.	Reduce, reduction.
Diss.	Dissolves, dissolved.	Ref.	Reference.
Dist.	Distil, distillation.	Russ.P.	Russian Patent.
D.R.P.	German Patent.	S.C.I.	Société pour l'industrie chimique à Basle.
Et	Ethyl.	Sec.	Secondary.
Et <sub>2</sub> O	Ether (diethyl ether).	Sol.	Soluble, solution.
EtOH	Ethyl alcohol.	Spar.	Sparingly.
Evac.	Evacuated.	Sp. gr.	Specific gravity.
Fluor.	Fluoresces, fluorescence.	Sp. heat	Specific heat.
F.p.	Freezing point.	Sp.	Species.
F.P.	French Patent.	Suppl.	Supplement.
Form.	Formation.	Sym.	Symmetrical.
<i>γ</i>	10 <sup>-6</sup> gm. or 10 <sup>-3</sup> mgm. (microgrammes).	Temp.	Temperature(s).
gm.	Gramme(s).	Tert.	Tertiary.
Hyd.	Hydrolyses, hydrolysed, hydrolysis.	Undecomp.	Undecomposed.
<i>i</i>	Optically inactive by internal compensation.	Unsym.	Unsymmetrical.
I.C.I.	Imperial Chemical Industries.	UV.	Ultraviolet.
I.G.	Interessen Gemeinschaft Farbenindustrie Aktien-Gesellschaft.	Vac.	Vacuum.
		Vap.	Vaporisation.
		Vol.	Volume.

# JOURNAL ABBREVIATIONS

Journals not listed here are given their full titles in the text.

<i>Acta Chem. Scand.</i>	Acta Chemica Scandinavica.	<i>Bull. soc. chim.</i>	Bulletin de la société chimique de France.
<i>Acta Phytochim.</i>	Acta Phytochimica (Japan).	<i>Bull. soc. chim. Belg.</i>	Bulletin de la société chimique de Belgique. Now Bulletin des sociétés chimiques Belges.
<i>Am. Chem. J.</i>	American Chemical Journal.	<i>Bull. soc. chim. biol.</i>	Bulletin de la société de chimie biologique.
<i>Am. J. Pharm.</i>	American Journal of Pharmacy.	<i>Can. Chem. Met.</i>	Canadian Chemistry and Metallurgy.
<i>Am. J. Sci.</i>	American Journal of Science.	<i>Can. J. Research</i>	Canadian Journal of Research.
<i>Anales asoc. quim. Argentina</i>	Anales de la Asociación Química Argentina.	<i>Chem. Abstracts</i>	Chemical Abstracts (of the American Chemical Society).
<i>Anales soc. españ. fis. quim.</i>	Anales de la sociedad española de física y química.	<i>Chem. Ind.</i>	Die Chemische Industrie.
<i>Angew. Chem. Ann.</i>	Angewandte Chemie.	<i>Chem. Met. Eng.</i>	Chemical and Metallurgical Engineering.
<i>Ann. chim.</i>	Annales de chimie.	<i>Chem. News</i>	Chemical News (and Journal of Industrial Science).
<i>Ann. chim. applicata</i>	Annali di chimica applicata.	<i>Chem. Reviews</i>	Chemical Reviews.
<i>Ann. chim. phys.</i>	Annales de chimie et de physique.	<i>Chem.-Tech. Rundschau</i>	Chemische-Technische Rundschau.
<i>Ann. pharm. franç.</i>	Annales Pharmaceutiques Française.	<i>Chem. Trade J.</i>	Chemical Trade Journal (and Chemical Engineer).
<i>Ann. phys.</i>	Annales de physique.	<i>Chem. Umschau</i>	Chemische Umschau (auf dem Gebiete der Fette, Oele, Wachse, und Harze). Now Fettchemische Umschau.
<i>Ann. Physik</i>	Annalen der Physik.	<i>Chem. Weekblad</i>	Chemisch Weekblad.
<i>Ann. Rev. Biochem.</i>	Annual Review of Biochemistry.	<i>Chem. Zentr.</i>	Chemisches Zentralblatt.
<i>Ann. Sci. Univ. Jassy</i>	Annales scientifiques de l'Université de Jassy.	<i>Chem.-Ztg.</i>	Chemiker-Zeitung.
<i>Ann. Trop. Med. and Parasit.</i>	Annals of Tropical Medicine and Parasitology.	<i>Compt. rend.</i>	Comptes rendus (hebdomadaires des séances de l'académie des sciences).
<i>Arch. Biochem.</i>	Archives of Biochemistry (name changed to next in 1951).	<i>Compt. rend. acad. sci. U.R.S.S.</i>	Comptes rendus de l'Académie des Sciences de l'U.R.S.S.
<i>Arch. Biochem. Biophys.</i>	Archives of Biochemistry and Biophysics.	<i>Compt. rend. soc. biol.</i>	Comptes rendus des séances de la société de biologie.
<i>Arch. Pharm.</i>	Archiv der Pharmazie (und Berichte der deutschen pharmazeutischen Gesellschaft).	<i>Color Trade J.</i>	Color Trade Journal and Textile Chemist.
<i>Arkiv Kemi, Mineral. Geol.</i>	Arkiv för Kemi, Mineralogi och Geologi.	<i>Dinglers polytech. J.</i>	Dinglers polytechnisches Journal.
<i>Atti acad. Lincei</i>	Atti della reale accademia nazionale dei Lincei.	<i>Fettchem. Umschau</i>	Fettchemische Umschau.
<i>Ber.</i>	Berichte der deutschen chemischen Gesellschaft. Now Chemische Berichte.	<i>Gazz. chim. ital.</i>	Gazzetta chimica italiana.
<i>Ber. deut. pharm. (Ges.)</i>	Berichte der deutschen pharmazeutischen Gesellschaft.	<i>Giorn. chim. applicata</i>	Giornale di chimica applicata.
<i>Ber. ges. Physiol. exptl. Pharmacol.</i>	Berichte über die gesamte Physiologie und experimentelle Pharmakologie.	<i>Giorn. chim. ind.</i>	Giornale di chimica industriale.
<i>Bihang till Svenska Vet.-Akad. Handlingen</i>	Bihang till Kungliga Svenska Vetenskapsakademiens Handlingen.	<i>Giorn. chim. ind. applicata</i>	Giornale di chimica industriale ed applicata.
<i>Biochem. J.</i>	Biochemical Journal.	<i>Helv. Chim. Acta</i>	Helvetica Chimica Acta.
<i>Biochem. Z.</i>	Biochemische Zeitschrift.	<i>Ind. Eng. Chem.</i>	Industrial and Engineering Chemistry.
<i>Biol. Zentr.</i>	Biologisches Zentralblatt.	<i>Jahresber. Fortsch. Chem.</i>	Jahresbericht über die Fortschritte der Chemie.
<i>Brit. Chem. Abstracts</i>	British Chemical Abstracts.	<i>Japan. J. Chem.</i>	Japanese Journal of Chemistry.
<i>Brit. J. Exptl. Path.</i>	British Journal of Experimental Pathology.	<i>J. Am. Chem. Soc.</i>	Journal of the American Chemical Society.
<i>Brit. J. Pharmacol.</i>	British Journal of Pharmacology and Chemotherapy.	<i>J. Am. Pharm. Assocn.</i>	Journal of the American Pharmaceutical Association.
<i>Bull. acad. sci. U.S.S.R.</i>	Bulletin of the Academy of Sciences of the U.S.S.R.	<i>J. appl. Chem.</i>	Journal of Applied Chemistry. Formerly Journal of the Society of Chemical Industry.
<i>Bull. Chem. Soc. Japan</i>	Bulletin of the Chemical Society of Japan.	<i>J. Applied Chem., U.S.S.R.</i>	Journal of Applied Chemistry U.S.S.R.
<i>Bull. Imp. Inst.</i>	Bulletin of the Imperial Institute.	<i>J. Bact.</i>	Journal of Bacteriology.
<i>Bull. Inst. Phys. Chem. Research, Tokyo</i>	Bulletin of the Institute of Physical and Chemical Research, Toyko.		
<i>Bull. sci. acad. roy. Belg.</i>	Bulletin de la classe des sciences, academie royale de Belgique.		
<i>Bull. sci. pharmacol.</i>	Bulletin des sciences pharmacologiques.		

<i>J. Biochem. Japan</i>	Journal of Biochemistry of Japan.	<i>Pharm. Zentralhalle</i>	Pharmazeutische Zentralhalle
<i>J. Biol. Chem.</i>	Journal of Biological Chemistry.	<i>Phil. Mag.</i>	Philosophical Magazine and Journal of Science.
<i>J. Chem. Education</i>	Journal of Chemical Education.	<i>Physiol. Rev.</i>	Physiological Reviews.
<i>J. Chem. Ind. Japan</i>	Journal of Chemical Industry (Japan). Now <i>J. Soc. Chem. Ind. Japan</i> .	<i>Physiol. Rev.</i>	Physiological Review.
<i>J. Chem. Physics</i>	Journal of Chemical Physics.	<i>Proc. Acad. Sci., Amsterdam</i>	Proceedings of the Royal Academy of Sciences of Amsterdam.
<i>J. Chem. Soc.</i>	Journal of the Chemical Society (London).	<i>Proc. Chem. Soc.</i>	Proceedings of the Chemical Society (London).
<i>J. Chem. Soc. Abstracts</i>	Abstracts of the Chemical Society (London).	<i>Proc. Imper. Acad., Tokyo</i>	Proceedings of the Imperial Academy, Tokyo.
<i>J. Chem. Soc. Japan</i>	Journal of the Chemical Society of Japan.	<i>Proc. Ind. Acad. Sci.</i>	Proceedings of the Indiana Academy of Science.
<i>J. chim. phys.</i>	Journal de chimie physique.	<i>Proc. Indian Acad. Sci.</i>	Proceedings of the Indian Academy of Science.
<i>J. Chinese Chem. Soc.</i>	Journal of the Chinese Chemical Society.	<i>Proc. Roy. Soc.</i>	Proceedings of the Royal Society (London).
<i>J. Gen. Chem. U.S.S.R.</i>	Journal of General Chemistry, U.S.S.R.	<i>Proc. Soc. Exptl. Biol. Med.</i>	Proceedings of the Society for Experimental Biology and Medicine, New York.
<i>J. gen. Microbiol.</i>	Journal of General Microbiology.	<i>Quart. J. Indian Chem. Soc.</i>	Quarterly Journal of the Indian Chemical Society.
<i>J. Indian Chem. Soc.</i>	Journal of the Indian Chemical Society.	<i>Quart. J. Pharm. Pharmacol.</i>	Quarterly Journal of Pharmacy and Pharmacology.
<i>J. Indian Inst. Sci.</i>	Journal of the Indian Institute of Science.	<i>Rec. trav. chim.</i>	Recueil des travaux chimiques des Pays-Bas.
<i>J. Inst. Petroleum</i>	Journal of the Institute of Petroleum.	<i>Rev. chim. ind.</i>	Revue de chimie industrielle.
<i>J. Org. Chem.</i>	Journal of Organic Chemistry.	<i>Rev. prod. chim.</i>	Revue des produits chimiques.
<i>J. pharm. Belg.</i>	Journal de pharmacie de Belgique.	<i>Sci. Papers Inst. Phys. Chem. Research, Tokyo</i>	Scientific Papers of the Institute of Physical and Chemical Research (Tokyo).
<i>J. pharm. chim.</i>	Journal de pharmacie et de chimie.	<i>Sci. Proc. Roy. Dublin Soc.</i>	Scientific Proceedings of the Royal Dublin Society.
<i>J. Pharm. Soc. Japan</i>	Journal of the Pharmaceutical Society (Japan).	<i>Sci. repts. Natl. Tsinghua Univ.</i>	Science Reports of the National Tsinghua University.
<i>J. Pharmacol.</i>	Journal of Pharmacology and Experimental Therapeutics.	<i>Sci. repts. Natl. Univ. Peking</i>	Science Reports of the National University of Peking.
<i>J. Pharm. Pharmacol.</i>	Journal of Pharmacy and Pharmacology.	<i>Sitzb. Akad. Wiss. Wien</i>	Sitzungsberichte Akademie der Wissenschaften in Wien.
<i>J. Phys. Chem.</i>	Journal of Physical Chemistry.	<i>Svensk Farm. Tids. Svensk Kem. Tid.</i>	Svensk Farmaceutische Tidskrift. Svensk Kemisk Tidskrift.
<i>J. prakt. Chem.</i>	Journal für praktische Chemie.	<i>Trans. Faraday Soc.</i>	Transactions of the Faraday Society.
<i>J. Proc. Roy. Soc. N.S. Wales</i>	Journal and Proceedings of the Royal Society of New South Wales.	<i>Trans. Roy. Soc.</i>	Transactions of the Royal Society (London).
<i>J. Russ. Phys.-Chem. Soc.</i>	Journal of the Russian Physical-Chemical Society.	<i>Trans. Roy. Soc. Canada</i>	Transactions of the Royal Society of Canada.
<i>J. Soc. Chem. Ind. Now J. appl. Chem.</i>	Journal of the Society of Chemical Industry.	<i>Z. anal. Chem.</i>	Zeitschrift für analytische Chemie.
<i>J. Soc. Chem. Ind. Japan</i>	Journal of the Society of Chemical Industry (Japan).	<i>Z. angew. Chem.</i>	Zeitschrift für angewandte Chemie. Later <i>Angewandte Chemie</i> , now <i>Die Chemie</i> .
<i>J. Soc. Dyers Colourists</i>	Journal of the Society of Dyers and Colourists.	<i>Z. anorg. allgem. Chem.</i>	Zeitschrift für anorganische und allgemeine Chemie.
<i>Mem. Coll. Sci., Kyoto Imp. Univ.</i>	Memoirs of the College of Science, Kyoto Imperial University.	<i>Z. Chem.</i>	Zeitschrift für Chemie.
<i>Monatsh.</i>	Monatshefte für Chemie und verwandte Teile anderer Wissenschaften.	<i>Z. Elektrochem.</i>	Zeitschrift für Elektrochemie und angewandte physikalische Chemie.
<i>Naturwiss.</i>	Naturwissenschaften.	<i>Z. ges. Naturwiss.</i>	Zeitschrift für die gesamte Naturwissenschaft.
<i>Org. Chem. Ind. U.S.S.R.</i>	Promischlennosti Organitscheskoi Khimii, U.S.S.R.	<i>Z. physik. Chem.</i>	Zeitschrift für physikalische Chemie.
<i>Pharm. Acta Helv.</i>	Pharmaceutica Acta Helvetiae.	<i>Z. physiol. Chem.</i>	Zeitschrift für physiologische Chemie (Hoppe-Seyler).
<i>Pharm. J.</i>	Pharmaceutical Journal and Pharmacist.		
<i>Pharm. Weekblad</i>	Pharmaceutisch Weekblad.		
<i>Pharm. Ztg.</i>	Die deutsche Pharmazeutische Zeitung.		



# LIST OF SUBSTITUENTS

In the following table is given a list of the principal substituent groups as they are used in the dictionary.

1 —F	Fluoro	54 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>7</sub> ·CH <sub>3</sub>	Nonyl
2 —Cl	Chloro	55 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>8</sub> ·CH <sub>3</sub>	Decyl
3 —Br	Bromo	56 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>9</sub> ·CH <sub>3</sub>	Undecyl
4 —I	Iodo	57 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>10</sub> ·CH <sub>3</sub>	Dodecyl
5 —NO	Nitroso	58 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>11</sub> ·CH <sub>3</sub>	Tridecyl
6 —NO <sub>2</sub>	Nitro	59 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>12</sub> ·CH <sub>3</sub>	Tetradecyl
7 —N=N→N	Azido, Triazo	60 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>13</sub> ·CH <sub>3</sub>	Pentadecyl
8 —OH	Hydroxy (followed by —OCH <sub>3</sub> , Methoxy, —OC <sub>2</sub> H <sub>5</sub> , Ethoxy, —O·CH <sub>2</sub> ·O— methylenedioxy, —OC <sub>6</sub> H <sub>5</sub> , Phenoxy, —O·CO·CH <sub>3</sub> , Acetoxy, etc. in the order of the group attached to the oxygen)	61 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>14</sub> ·CH <sub>3</sub>	Cetyl, Hexadecyl
9 —SH	Mercapto	62 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>15</sub> ·CH <sub>3</sub>	Heptadecyl
10 —SO	Thonyl, Sulphenyl	63 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>16</sub> ·CH <sub>3</sub>	Octadecyl
11 —SO <sub>2</sub>	Sulphonyl	64 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>17</sub> ·CH <sub>3</sub>	Eicosyl
12 —SO <sub>2</sub> ·CH <sub>3</sub>	Mesyl	65 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>18</sub> ·CH <sub>3</sub>	Henicosyl
13 —SCN	Thiocyano	66 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>19</sub> ·CH <sub>3</sub>	Ceryl
14 =O (in C—CO—C)	Keto	67 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>20</sub> ·CH <sub>3</sub>	Myricyl, Melissyl
15 >NH	Imino	68 —CH—   CH <sub>2</sub>	Cyclopropyl (followed by Cyclobutyl, Cyclopentyl, Cyclohexyl, Cycloheptyl (Suberyl) in that order)
16 =N·OH	Isonitroso, Oximino	69 —CH·CH <sub>2</sub>	Vinyl
17 —S—	Thio	70 —CH·CH·CH <sub>3</sub>	Propenyl
18 —SO <sub>2</sub> H	Sulpho	71 —C(CH <sub>3</sub> ) <sub>2</sub> ·CH <sub>3</sub>	Isopropenyl
19 —NH <sub>2</sub>	Amino	72 —CH <sub>2</sub> ·CH·CH <sub>3</sub>	Allyl
20 —NH·C <sub>6</sub> H <sub>5</sub>	Anilino, Phenylimino	73 —CH·CH·CH <sub>2</sub> ·CH <sub>3</sub>	<i>α</i> -Butenyl
21 —NH·C <sub>6</sub> H <sub>4</sub> ·CH <sub>3</sub>	Toluidino	74 —CH <sub>2</sub> ·CH·CH·CH <sub>3</sub>	<i>β</i> -Butenyl, Crotyl
22 —NH·CO·NH <sub>2</sub>	Ureido	75 —CH <sub>2</sub> ·CH <sub>2</sub> ·CH·CH <sub>3</sub>	<i>γ</i> -Butenyl, Allylomethyl
23 —NH·C(NH)·NH <sub>2</sub>	Guanidino	76 —CH·CH·CH <sub>2</sub> ·CH <sub>2</sub> ·CH <sub>3</sub>	<i>α</i> - ( <i>β</i> - etc.) Pentenyl
24 —NH·OH	Hydroxylamino	77 —CH·CH·[CH <sub>2</sub> ] <sub>3</sub> ·CH <sub>3</sub>	<i>α</i> - ( <i>β</i> - etc.) Hexenyl
25 —NH·NH <sub>2</sub>	Hydrazino	78 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>7</sub> ·CH·CH·[CH <sub>2</sub> ] <sub>7</sub> ·CH <sub>3</sub>	Octadecenyl
26 —NH·NH—	Hydrazo	79 —C·CH	Ethyneyl, Acetylenyl
27 —N·N—	Azo	80 —CH <sub>2</sub> ·C·CH	Propargyl
28 ·N·N <sup>+</sup> X	Diazonium, Diazo (X = OH, Cl, etc.)	81 —C <sub>6</sub> H <sub>5</sub>	Phenyl
29 —N=N—   O	Azoxy	82 —C <sub>6</sub> H <sub>4</sub> ·CH <sub>3</sub>	Tolyl
		83 —CH <sub>2</sub> ·C <sub>6</sub> H <sub>5</sub>	Benzyl
		84 —CH <sub>2</sub> ·C <sub>6</sub> H <sub>4</sub> ·OH (- <i>o</i> )	Salicyl
		85 —CH <sub>2</sub> ·C <sub>6</sub> H <sub>4</sub> ·OCH <sub>3</sub> (- <i>p</i> )	Anisyl
		86 —CH <sub>2</sub> ·CH <sub>2</sub> ·C <sub>6</sub> H <sub>5</sub>	Phenylethyl
		87 —CH <sub>2</sub> ·C <sub>6</sub> H <sub>4</sub> ·CH <sub>3</sub>	Xylyl
		88 —CH <sub>2</sub> ·C <sub>10</sub> H <sub>7</sub>	Menaphthyl
		89 —C <sub>6</sub> H <sub>4</sub> ·CH(CH <sub>3</sub> ) <sub>2</sub>	Cumyl
		90 —C <sub>6</sub> H <sub>3</sub> (CH <sub>3</sub> ) <sub>3</sub> (1 : 2 : 4)	<i>ψ</i> -Cumyl
		91 —C <sub>6</sub> H <sub>3</sub> (CH <sub>3</sub> ) <sub>3</sub> (1 : 3 : 5)	Mesityl
		92 —CH·CH·C <sub>6</sub> H <sub>5</sub>	Styryl
		93 —CH <sub>2</sub> ·CH·CH·C <sub>6</sub> H <sub>5</sub>	Cinnamyl
		94 —C <sub>10</sub> H <sub>7</sub>	Naphthyl
		95 —C <sub>6</sub> H <sub>4</sub> ·C <sub>6</sub> H <sub>5</sub>	Diphenyl, Xenyl
		96 —CH(C <sub>6</sub> H <sub>5</sub> ) <sub>2</sub>	Benzhydryl, Diphenylmethyl
		97 —C <sub>14</sub> H <sub>9</sub>	Anthryl, anthranyl
		98 —C <sub>14</sub> H <sub>9</sub>	Phenanthryl
		99 —C(C <sub>6</sub> H <sub>5</sub> ) <sub>3</sub>	Triphenylmethyl
		100 —CH <sub>2</sub> ·CH <sub>2</sub> —	Ethylene, Dimethylene
		101 —CH(CH <sub>3</sub> )·CH <sub>2</sub> —	Propylene
		102 —CH <sub>2</sub> ·CH <sub>2</sub> ·CH <sub>2</sub> —	Trimethylene
		103 —CH <sub>2</sub> ·CH <sub>2</sub> ·CH <sub>2</sub> ·CH <sub>2</sub> —	Tetramethylene
		104 —C(CH <sub>3</sub> ) <sub>2</sub> ·CH <sub>2</sub> —	Isobutylene
		105 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>3</sub> ·CH <sub>2</sub> —	Pentamethylene
		106 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>4</sub> ·CH <sub>2</sub> —	Hexamethylene
		107 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>5</sub> ·CH <sub>2</sub> —	Heptamethylene
		108 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>6</sub> ·CH <sub>2</sub> —	Octamethylene
		109 —CH·CH—	Vinylene
		110 —C <sub>6</sub> H <sub>4</sub> —	Phenylene
		111 —C <sub>6</sub> H <sub>4</sub> (CH <sub>3</sub> )—	Tolylene
		112 —CH <sub>2</sub> —	Methylene
		113 =CH·CH <sub>2</sub>	Ethylidene
		114 =CH·CH <sub>2</sub> ·CH <sub>3</sub>	Propylidene
		115 =C(CH <sub>3</sub> ) <sub>2</sub>	Isopropylidene
		116 =CH·CH <sub>2</sub> ·CH <sub>2</sub> ·CH <sub>3</sub>	Butylidene
30 —As·As—	Arseno		
31 —NH·N·N— (open)	Diazoamino		
32 —NH·N·N— (cyclic)	Azimino		
33 —CH <sub>3</sub>	Methyl		
34 —CH <sub>2</sub> OH	Hydroxymethyl, Methylol		
35 —C <sub>2</sub> H <sub>5</sub>	Ethyl		
36 —CH <sub>2</sub> ·CH <sub>2</sub> ·CH <sub>3</sub>	<i>n</i> -Propyl		
37 —CH(CH <sub>3</sub> ) <sub>2</sub>	Isopropyl		
38 —CH <sub>2</sub> ·CH <sub>2</sub> ·CH <sub>2</sub> ·CH <sub>3</sub>	<i>n</i> -Butyl		
39 —CH <sub>3</sub> ·CH·CH <sub>2</sub> ·CH <sub>3</sub>	<i>sec</i> -Butyl		
40 —CH <sub>2</sub> ·CH(CH <sub>3</sub> ) <sub>2</sub>	Isobutyl		
41 —C(CH <sub>3</sub> ) <sub>3</sub>	<i>tert</i> -Butyl		
42 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>3</sub> ·CH <sub>3</sub>	<i>n</i> -Amyl		
43 —CH <sub>3</sub> ·CH·CH <sub>2</sub> ·CH <sub>2</sub> ·CH <sub>3</sub>	<i>sec</i> -Amyl		
44 —CH <sub>2</sub> ·CH <sub>2</sub> ·CH(CH <sub>3</sub> ) <sub>2</sub>	Isoamyl		
45 —CH <sub>3</sub> ·CH·CH(CH <sub>3</sub> ) <sub>2</sub>	<i>sec</i> -Isoamyl		
46 —CH <sub>2</sub> ·CH—   CH <sub>3</sub>   C <sub>2</sub> H <sub>5</sub>	<i>active</i> Amyl		
47 —C—   CH <sub>3</sub>   C <sub>6</sub> H <sub>5</sub>   CH <sub>3</sub>	<i>tert</i> -Amyl		
48 —CH(CH <sub>2</sub> ·CH <sub>3</sub> ) <sub>2</sub>	Diethylmethyl		
49 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>4</sub> ·CH <sub>3</sub>	<i>n</i> -Hexyl		
50 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>5</sub> ·CH(CH <sub>3</sub> ) <sub>2</sub>	Isohexyl		
51 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>6</sub> ·CH <sub>3</sub>	<i>n</i> -Heptyl, Oenanthy		
52 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>6</sub> ·CH(CH <sub>3</sub> ) <sub>2</sub>	Isoheptyl		
53 —CH <sub>2</sub> ·[CH <sub>2</sub> ] <sub>8</sub> ·CH <sub>3</sub>	Octyl, Capryl		

117	$\text{=CH}\cdot\text{CH}(\text{CH}_2)_2$	Isobutylidene	146	$\text{—CO}\cdot\text{C}_6\text{H}_4\cdot\text{OCH}_3$ ( <i>-p</i> )	Anisoyl
118	$\text{H}_2\text{C} \begin{array}{l} \diagup \text{CH}_2\text{—CH}_2 \\ \diagdown \text{CH}_2\text{—CH}_2 \end{array} \text{C=}$	Cyclohexylidene	147	$\text{—CO}\cdot\text{CH}_2\cdot\text{C}_6\text{H}_5$	Phenylacetyl
119	$\text{=C}\cdot\text{CH}_2$	Vinylidene	148	$\text{—CO}\cdot\text{C}_6\text{H}_4\cdot\text{CH}_3$	Toluyyl
120	$\text{=CH}\cdot\text{CH}\cdot\text{CH}_2$	Allylidene	149	$\text{—CO}\cdot\text{CH}\cdot\text{CH}\cdot\text{C}_6\text{H}_5$	Cinnamoyl
121	$\text{CH}_3\cdot\text{CH}\cdot\text{CH}\cdot\text{CH=}$	Crotylidene	150	$\text{—CO}\cdot\text{C}_{10}\text{H}_7$	Naphthoyl
122	$\text{=CH}\cdot\text{C}_6\text{H}_5$	Benzylidene	151	$\text{—CO}\cdot\text{CO—}$	Oxalyl
123	$\text{=CH}\cdot\text{C}_6\text{H}_4\cdot\text{OH}$ ( <i>-o</i> )	Salicylidene	152	$\text{—CO}\cdot\text{CH}_2\cdot\text{CO—}$	Malonyl
124	$\text{=CH}\cdot\text{C}_6\text{H}_4\cdot\text{OCH}_3$ ( <i>-p</i> )	Anisylidene	153	$\text{—CO}\cdot\text{CH}_2\cdot\text{CH}_2\cdot\text{CO—}$	Succinyl
125	$\text{=CH}\cdot\text{C}_6\text{H}_4\cdot\text{CH}(\text{CH}_3)_2$ ( <i>-p</i> )	Cuminyldene	154	$\text{—CO}\cdot\text{C}_6\text{H}_4\cdot\text{CO—}$	Phthaloyl, Isophthaloyl, Terephthaloyl
126	$\text{=CH}\cdot\text{CH}\cdot\text{CH}\cdot\text{C}_6\text{H}_5$	Cinnamylidene	155	$\text{—COOH}$ ( $\text{—CO}\cdot\text{OCH}_3$ , $\text{—CO}\cdot\text{OC}_2\text{H}_5$ , etc.)	Carboxy, (Carbomethoxy, Carboethoxy, etc.)
127	$\text{—CH}_2\cdot\text{CO}\cdot\text{CH}_3$	Acetonyl	156	$\text{—CO}\cdot\text{NH}_2$	Carbamyl
128	$\text{—CH}_2\cdot\text{CO}\cdot\text{C}_6\text{H}_5$	Phenacyl	157	$>\text{CO}$	Carbonyl
129	$\text{—CH}_2\cdot\text{CO}\cdot\text{C}_6\text{H}_4\cdot\text{CH}_3$	Tolacyl	158	$\text{—C}(\text{NH})\cdot\text{NH}_2$	Guanyl
130	$\text{C}_6\text{H}_5\cdot\text{CH}\cdot\text{CO}\cdot\text{C}_6\text{H}_5$	Desyl	159	$\text{—CN}$	Cyano
131	$\text{—CHO}$	Aldehydo, Formyl	160	$\text{—CO}\cdot\text{CH}_2\cdot\text{NH}_2$	Glycyl
132	$\text{=CH}$	Methynyl	161	$\text{—CO}\cdot\text{CH}(\text{NH}_2)\cdot\text{CH}_3$	$\alpha$ -Alanyl
133	$\text{—CO}\cdot\text{CH}_3$	Acetyl, Aceto	162	$\text{—CO}\cdot\text{CH}_2\cdot\text{CH}_2\cdot\text{NH}_2$	$\beta$ -Alanyl
134	$\text{—CO}\cdot\text{CH}_2\cdot\text{CH}_3$	Propionyl	163	$\text{—CO}\cdot\text{CH}(\text{NH}_2)\cdot\text{CH}(\text{CH}_3)_2$	Valyl
135	$\text{—CO}\cdot\text{CH}_2\cdot\text{CH}_2\cdot\text{CH}_3$	Butyryl	164	$\text{—CO}\cdot\text{CH}(\text{NH}_2)\cdot\text{CH}_2\cdot\text{CH}(\text{CH}_3)_2$	Leucyl
136	$\text{—CO}\cdot\text{CH}(\text{CH}_3)_2$	Isobutyryl	165	$\text{—CO}\cdot\text{CH}_2\cdot\text{NH}\cdot\text{CO}\cdot\text{C}_6\text{H}_5$	Hippuryl
137	$\text{—CO}\cdot\text{CH}_2\cdot[\text{CH}_2]_2\cdot\text{CH}_3$	Valeryl	166	$\text{—C}_4\text{H}_9\text{O}$	Furyl
138	$\text{—CO}\cdot\text{CH}_2\cdot\text{CH}(\text{CH}_3)_2$	Isovaleryl	167	$\text{—C}_4\text{H}_9\text{S}$	Thienyl
139	$\text{—CO}\cdot\text{CH}_2\cdot[\text{CH}_2]_3\cdot\text{CH}_3$	Caproyl	168	$\text{—CH}_2\cdot\text{C}_4\text{H}_9\text{O}$	Furfuryl
140	$\text{—CO}\cdot\text{CH}_2\cdot[\text{CH}_2]_{13}\cdot\text{CH}_3$	Palmityl	169	$\text{=CH}\cdot\text{C}_4\text{H}_9\text{O}$	Furfurylidene
141	$\text{—CO}\cdot\text{CH}_2\cdot[\text{CH}_2]_{15}\cdot\text{CH}_3$	Stearyl	170	$\text{—CO}\cdot\text{C}_6\text{H}_5\text{O}$	Furoyl, Pyromucyl
142	$\text{—CO}\cdot[\text{CH}_2]_7\cdot\text{CH}\cdot\text{CH}\cdot[\text{CH}_2]_7\cdot\text{CH}_3$	Oleyl	171	$\text{—C}_4\text{H}_9\text{NH}$	Pyrryl
143	$\text{—CO}\cdot\text{COOH}$	Oxalo	172	$\text{—C}_5\text{H}_9\text{N}$	Pyridyl
144	$\text{—CO}\cdot\text{C}_6\text{H}_5$	Benzoyl	173	$\text{—C}_5\text{H}_{10}\text{N}$	Piperidyl
145	$\text{—CO}\cdot\text{C}_6\text{H}_4\cdot\text{OH}$ ( <i>-o</i> )	Salicyloyl	174	$\text{—NC}_5\text{H}_{10}$	Piperidino

# DICTIONARY OF ORGANIC COMPOUNDS

## A

### Abadole.

See 2-Aminothiazole.

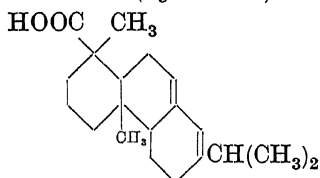
### Abienol

$C_{17}H_{28}O$  MW, 248

Viscous oil. B.p.  $160^{\circ}/0.5$  mm.  $[\alpha]_D +7.9^{\circ}$  in  $Et_2O$ .  $D_{20} 0.9808$ .  $n_D^{20} 1.5326$ . Readily sol. most common org. solvents. Obtained by dehydration of abienol hydrate, isolated from turpentine of *Abies pectinata*. Probably an unsaturated tricyclic tert. alcohol.

Wienhaus, Mucke, *Ber.*, 1942, 75, 1830.

### *l*-Abietic Acid (*Sylvic acid*)



$C_{20}H_{30}O_2$  MW, 302

The name "abietic acid" has been applied indiscriminately to a number of "rosin" acids which consist of mixtures of *l*-abietic acid with other isomeric acids. Many of the primary oleoresin acids are isomerised by heat or by treatment with mineral acids to *l*-abietic acid.

Isolated from American colophony (rosin). Plates. M.p.  $170-4^{\circ}$ .  $[\alpha]_D -102^{\circ}$  in  $EtOH$ . Sol.  $MeOH$ ,  $EtOH$ ,  $Et_2O$ ,  $AcOH$ ,  $Me_2CO$ ,  $CHCl_3$ ,  $C_6H_6$ . Insol.  $H_2O$ . Forms additive compound with maleic anhydride. Dehydrogenation with selenium  $\rightarrow$  retene. Absorption maximum at  $237.5$  m $\mu$ .

Krestinskiĭ, Persiantseva, Novak, *Chem. Abstracts*, 1940, 34, 3277.

Hasselstrom, McPherson, *J. Am. Chem. Soc.*, 1939, 61, 2247.

Ruzicka, Sternbach, *Helv. Chim. Acta*, 1938, 21, 565.

Fieser, Campbell, *J. Am. Chem. Soc.*, 1938, 60, 159.

Palkin, Harris, *J. Am. Chem. Soc.*, 1934, 56, 1935.

Ruzicka, de Graaf, Müller, *Helv. Chim. Acta*, 1932, 15, 1300.

Ruzicka, Ankersmit, Frank, *Helv. Chim. Acta*, 1932, 15, 1289.

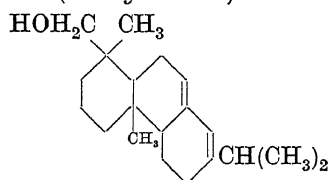
Levy, *Z. angew. Chem.*, 1928, 41, 233 (*Bibl.*).

Dict. of Org. Comp.—I.

Raudnitz, Lederer, Kahn, *Ber.*, 1938, 71, 1273.

Barton, *Quarterly Reviews*, 1949, III, 1.  
Simonsen, Barton, *The Terpenes*, Vol. III, 374. (Cambridge University Press, 1952).

### Abietinol (*Abietyl alcohol*)

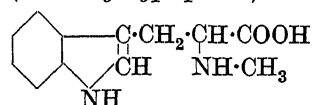


$C_{20}H_{32}O$  MW, 288

B.p.  $169-72^{\circ}/0.2$  mm.  $D_4^{17} 1.0345$ .  $n_D^{17} 1.5487$ . Obtained by red. of an ester of abietic acid.

Ruzicka, Meyer, *Helv. Chim. Acta*, 1922, 5, 581.

### Abrine (*N*-Methyltryptophane)



$C_{12}H_{14}O_2N_2$  MW, 218

From seeds of *Abrus precatorius*. Prisms from  $H_2O$ . Decomp. at  $295^{\circ}$ .  $[\alpha]_D^{21} +44.4^{\circ}$  in dil.  $HCl$ .

*B, HCl*: needles. M.p.  $221.5^{\circ}$ .

*B, HNO3*: needles. M.p.  $143^{\circ}$  decomp.

*N-Nitroso*: m.p.  $121^{\circ}$ .

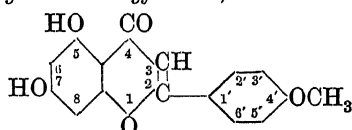
*N-Acetyl*: cryst. from  $EtOH.Aq$ . M.p.  $286-7^{\circ}$ .

*Picrate*: red prisms from  $H_2O$ ,  $EtOH$ , or  $AcOH$ . Decomp. at  $149^{\circ}$  ( $194^{\circ}$ ).

Hoshino, *Ann.*, 1935, 520, 31.

Ghatak, *Chem. Zentr.*, 1935, I, 576.

### Acacetin (*Apigenin 4'-methyl ether, 5:7-dihydroxy-4'-methoxyflavone*)



$C_{16}H_{12}O_5$  MW, 284

Colouring matter of common acacia. Pale yellow needles from  $EtOH$ . M.p.  $261^{\circ}$ . Sol.

## Acaciabiuronic Acid

EtOH. Insol. Et<sub>2</sub>O. Sol. alkalis with pale yellow col. KOH fusion → phloroglucinol + *p*-hydroxybenzoic acid.

7-Acetyl: m.p. 203–8°.

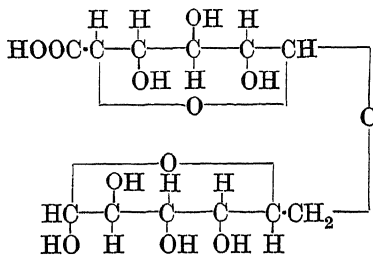
Diacetyl: needles from EtOH. M.p. 203°.

Dibenzoyl: m.p. 201°.

Robinson, Venkataraman, *J. Chem. Soc.*, 1926, 128, 2344.

Hattori, *Acta Phytochim.*, 1925, 2, 99.

## Acaciabiuronic Acid (6-β-Glucuronisidogalactose)



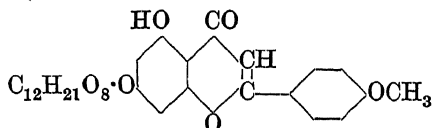
C<sub>12</sub>H<sub>20</sub>O<sub>12</sub> MW, 356

Cryst. +2H<sub>2</sub>O from aq. EtOH. M.p. 118–19°. [α]<sub>D</sub> +11.6° initial, –8.56° final, in H<sub>2</sub>O. Isolated from hyd. products of gum acacia.

Heidelberger, Kendall, *J. Biol. Chem.*, 1929, 84, 639.

Goebel, Reeves, *J. Biol. Chem.*, 1938, 124, 207.

## Acaciin



C<sub>28</sub>H<sub>32</sub>O<sub>13</sub>·4H<sub>2</sub>O MW, 648

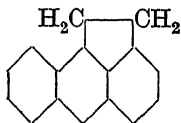
From *Robina pseudacacia*. Needles. Sinters 250°. M.p. 260° decomp. Sol. H<sub>2</sub>O, EtOH, CHCl<sub>3</sub>, alkalis. FeCl<sub>3</sub> → reddish-brown col. H<sub>2</sub>SO<sub>4</sub> → acacetin.

Hepta-acetyl deriv.: m.p. 135–40°.

Hepta-benzoyl deriv.: m.p. 180–1°.

Hattori, *Acta Phytochim.*, 1925, 2, 99.

## Aceanthrene



C<sub>16</sub>H<sub>12</sub> MW, 204

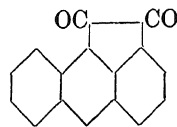
Pale yellow plates from EtOH. M.p. 113°.

Picrate: dark red needles. M.p. 120°.

Liebermann, Zsuffa, *Ber.*, 1911, 44, 852.

Fieser, Peters, *J. Am. Chem. Soc.*, 1932, 54, 4373.

## Aceanthrenequinone (3:4-Benzacenaphthenequinone, 1:9-oxalylanthracene)



C<sub>16</sub>H<sub>8</sub>O<sub>2</sub>

MW, 232

Red prisms from C<sub>6</sub>H<sub>6</sub>. M.p. 270°. Spar. sol. EtOH, AcOH. Readily sublimes. Forms bisulphite comp. Sol. conc. H<sub>2</sub>SO<sub>4</sub> with green col. CrO<sub>3</sub> in AcOH → anthracene-1:9-dicarboxylic acid + anthraquinone-1-carboxylic acid.

Monoxime: yellow prisms from AcOH. M.p. 251° decomp.

Monophenylhydrazone: orange needles from C<sub>6</sub>H<sub>6</sub>. M.p. 203°.

Liebermann, Zsuffa, *Ber.*, 1911, 44, 202.

## Aceconitic Acid.

See Cyclopropane-1:2:3-tricarboxylic Acid.

## Acenaphthanthracene.

See Naphthacenaphthene.

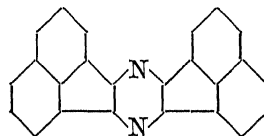
## Acenaphthapyridine.

See Pyridinoacenaphthene.

## Acenaphthaquinoline.

See Pyridinoacenaphthene.

## Acenaphthazine



C<sub>26</sub>H<sub>12</sub>N<sub>2</sub>

MW, 352

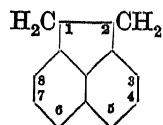
Deep red. M.p. 438°. Spar. sol. CHCl<sub>3</sub>, AcOH. Insol. EtOH.

B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>: orange. M.p. 286° decomp.

Graebe, Gfeller, *Ann.*, 1893, 276, 9.

Schiedt, *J. prakt. Chem.*, 1941, 157, 203.

## Acenaphthene



C<sub>12</sub>H<sub>10</sub>

MW, 154

Needles from EtOH. M.p. 96°. B.p. 279°. Sol. EtOH to 4% at 20°, 40% at 70°. Sol. CHCl<sub>3</sub> to 27% at 20°. Sol. toluene to 24% at 20°, 74% at 60°. D<sub>20</sub> 1.024. n<sub>D</sub><sup>20</sup> 1.6048. Heat of comb. C<sub>7</sub>, 1521 Cal. K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> → acenaphthylene + acenaphthenequinone + naphthalic anhydride. PbO<sub>2</sub> → acenaphthylene.

Picrate: orange-red prisms from EtOH. M.p. 162°.

**Acenaphthene-5-acrylic Acid**

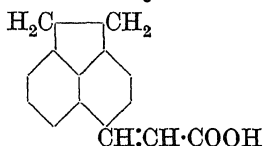
3

1 : 3 : 5-*Trinitrobenzene add. comp.*: yellow needles from EtOH. M.p. 168°.

Hahn, Holmes, *Ind. Eng. Chem.*, 1921, 13, 822 (*Bibl.*).

Jones, *J. Am. Chem. Soc.*, 1945, 67, 2127.

Schönberg, Moubasher, Mostafa, *J. Chem. Soc.*, 1946, 966.

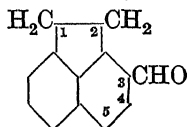
**Acenaphthene-5-acrylic Acid**

$C_{15}H_{12}O_2$  MW, 224

Pale yellow needles from EtOH. M.p. 251-2° decomp.

*Me ester*: yellow cubes. M.p. 105°. B.p. 204°/6 mm.

Fieser, Jones, *J. Am. Chem. Soc.*, 1942, 64, 1666.

**Acenaphthene-3-aldehyde**

$C_{13}H_{10}O$  MW, 182

Pale yellow needles from Et<sub>2</sub>O-pet. ether. M.p. 99.5-100.5°.

Feiser, Hershberg, *J. Am. Chem. Soc.*, 1940, 62, 49.

**Acenaphthene-5-aldehyde.**

Plates from EtOH.Aq. or pet. ether. M.p. 87° (107-8°).  $H_2SO_4 \rightarrow$  red sol.

*Oxime*: needles from pet. ether. M.p. 126.5°.

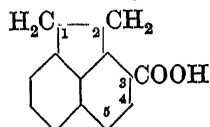
*Semicarbazone*: needles from MeOH. M.p. 234°.

*Phenylhydrazone*: orange needles from EtOH.Aq. M.p. 140°.

2 : 4-*Dinitrophenylhydrazone*: scarlet needles from EtOH. M.p. 273°.

*Anil*: orange needles from Et<sub>2</sub>O-pet. ether. M.p. 97°.

Hinkel, Ayling, Beynon, *J. Chem. Soc.*, 1936, 341.

**Acenaphthene-3-carboxylic Acid**

$C_{13}H_{10}O_2$  MW, 198

Prisms from AcOH. M.p. 256-7°.

*Chloride*: tan needles. M.p. 110-11°.

**Acenaphthene-5 : 6-disulphonic Acid**

*Amide*: needles from EtOH. M.p. 227-8°.

Fieser, Hershberg, *J. Am. Chem. Soc.*, 1939, 61, 1272.

Fieser, Cason, *J. Am. Chem. Soc.*, 1939, 61, 1740.

**Acenaphthene-5-carboxylic Acid.**

Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 219°.

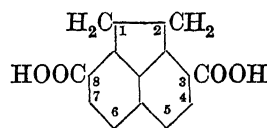
*Amide*: m.p. 198°.

*Nitrile*: m.p. 110-11°.

Liebermann, Zsuffa, *Ber.*, 1911, 44, 207.

Gattermann, Harris, *Ann.*, 1888, 244, 58.

Gattermann, Rossolymos, *Ber.*, 1890, 23, 1198.

**Acenaphthene-3 : 8-dicarboxylic Acid**

$C_{14}H_{10}O_4$  MW, 242

Yellow needles from EtOH. M.p. 355° decomp.

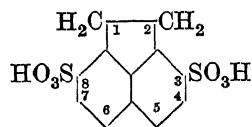
Dziewoński, Spirer, *Chem. Zentr.*, 1932, I, 939.

**Acenaphthene-5 : 6-dicarboxylic Acid.**

M.p. 293-4°. Spar. sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, AcOH, CHCl<sub>3</sub>. Heat.  $\rightarrow$  anhydride.  $KMnO_4 \rightarrow$  naphthalene-1 : 4 : 5 : 8-tetracarboxylic acid.  $H_2SO_4 \rightarrow$  yellow sol. with blue fluor.

*Anhydride*: C<sub>14</sub>H<sub>8</sub>O<sub>3</sub>. MW, 224. M.p. 293-4°.

Freund, Fleischer, *Ann.*, 1913, 399, 223.

**Acenaphthene-3 : 8-disulphonic Acid**  
*Acenaphthene-β-disulphonic acid*

$C_{12}H_{10}O_6S_2$  MW, 314

*Diamide*: C<sub>12</sub>H<sub>12</sub>O<sub>4</sub>N<sub>2</sub>S<sub>2</sub>. MW, 312. Needles from H<sub>2</sub>O. M.p. 301° decomp.

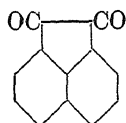
Dziewoński, Stolyhwo, *Ber.*, 1924, 57, 1531.

**Acenaphthene-5 : 6-disulphonic Acid**  
*(Acenaphthene-α-disulphonic acid).*

*Di-Me ester*: C<sub>14</sub>H<sub>14</sub>O<sub>6</sub>S<sub>2</sub>. MW, 342. Needles from ligroin. M.p. 170-1°.

*Diamide*: needles from H<sub>2</sub>O. M.p. 282° decomp.

Dziewoński, Stolyhwo, *Ber.*, 1924, 57, 1531.

**Acenaphthenequinone** (*Acenaphthaquinone*)

$C_{12}H_6O_2$  MW, 182

Yellow needles from AcOH. M.p. 261°. Sol. hot  $C_6H_6$ , hot toluene. Spar. sol. EtOH, AcOH. Sublimes. Gives bisulphite comp.  $K_2Cr_2O_7$  in AcOH  $\rightarrow$  naphthalic acid. Zn + AcOH  $\rightarrow$  acenaphtheneone.

*Monoxime*: exists in two forms. (i) Prisms from EtOH. Aq. M.p. 230°. *Acetyl*: cryst. from EtOH. M.p. 247°. (ii) Yellow cryst. from AcOH. M.p. 207° decomp. Prolonged heating in AcOH  $\rightarrow$  (i).

*Dioxime*: prisms from EtOH. M.p. 223° decomp.

*Monosemicarbazone*: prisms. M.p. 192-3°.

*Disemicarbazone*: plates from EtOH. M.p. 271°.

*Monohydrazone*: yellow prisms. M.p. 241°.

*Monophenylhydrazone*: orange needles from EtOH. M.p. 179°.

*Di-phenylhydrazone*: yellow needles from AcOH. M.p. 219°.

*Mono-o-nitrophenylhydrazone*: orange-red needles from AcOH. M.p. 249°.

*Mono-m-nitrophenylhydrazone*: yellow needles from AcOH. M.p. 229-30°.

*Mono-p-nitrophenylhydrazone*: orange-red needles from AcOH. M.p. 247°.

*Mono-p-bromophenylhydrazone*: yellow needles. M.p. 193°.

*Mono-o-tolylhydrazone*: red needles from AcOH. M.p. 175°.

*Mono-p-tolylhydrazone*: orange-red cryst. from AcOH. M.p. 163°.

*Monoanil*: yellow cryst. M.p. 189-90°.

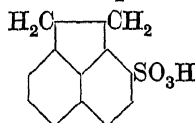
*Azine*:  $C_{12}H_6N_2$ . MW, 178. Yellow prisms. M.p. 164°.

Francesconi, Pirazzoli, *Gazz. chim. ital.*, 1903, 33, I, 42.

Graebe, Gfeller, *Ann.*, 1893, 276, 4.

Buu-Hoi, Cagniant, *Compt. rend.*, 1942, 214, 315; *Organic Syntheses*, 1944, XXIV, 1.

Schönberg, Moubasher, Mostafa, *J. Chem. Soc.*, 1946, 966.

**Acenaphthene-3-sulphonic Acid**

$C_{12}H_{10}O_3S$  MW, 234

*Aniline salt*: m.p. 284-6°.

*Me ester*:  $C_{13}H_{12}O_3S$ . MW, 248. Needles. M.p. 122-3°.

*Et ester*:  $C_{14}H_{14}O_3S$ . MW, 262. Needles from ligroin. M.p. 137-9°.

*Chloride*:  $C_{12}H_9O_2ClS$ . MW, 252.5. M.p. 113-14°.

*Amide*:  $C_{12}H_{11}O_2NS$ . MW, 233. Needles from  $H_2O$ . M.p. 196-9° (222-3°).

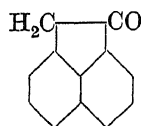
Dziewoński, Grunberg, Schoen, *Chem. Zentr.*, 1931, I, 3684.

Dziewoński, Galitzerówna, Kocwa, *Chem. Zentr.*, 1926, II, 2816.

Dziewoński, Stolyhwo, *Ber.*, 1924, I, 1531. Oliveri-Mandalà, *Atti acad. Lincei*, 1912, 21, I, 779.

**Acenaphthenol.**

See Hydroxyacenaphthene.

**Acenaphtheneone**

$C_{12}H_8O$  MW, 168

Colourless needles or plates. M.p. 121°. Sol. EtOH,  $CHCl_3$ ,  $C_6H_6$ . Spar. sol. ligroin. Volatile in steam. Zn + HCl  $\rightarrow$  acenaphthylene. Hot aq. NaOH  $\rightarrow$  naphthalic acid.

*Oxime*: plates from EtOH. M.p. 175°.

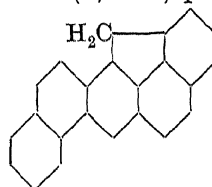
*Phenylhydrazone*: cryst. from EtOH. M.p. 90°.

*Picrate*: yellow needles. M.p. 113°.

Graebe, Jequier, *Ann.*, 1896, 290, 198.

Marquis, *Compt. rend.*, 1926, 182, 1227.

Buu-Hoi, Cagniant, *Compt. rend.*, 1942, 214, 315.

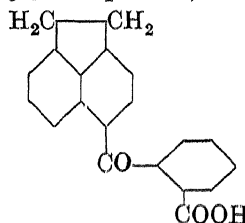
**13-Acenaphtho-(1,8-ab)-phenanthrene**

$C_{23}H_{14}$  MW, 290

Greenish yellow prisms, m.p. 266-7° corr.

*Dipicrate*: orange needles. M.p. 201° corr.

Fieser, Hershberg, *J. Am. Chem. Soc.*, 1935, 57, 1681.

**o-[5-Acenaphthoyl]-benzoic Acid** (5-[o-Carboxybenzoyl]-acenaphthene)

$C_{20}H_{14}O_3$  MW, 302

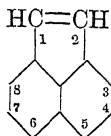
M.p. 200°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Spar. sol. C<sub>6</sub>H<sub>6</sub>. Insol. ligroin, CS<sub>2</sub>.

*Me ester*: C<sub>21</sub>H<sub>16</sub>O<sub>3</sub>. MW, 316. M.p. 128°. *Picrate*: m.p. 135°.

*Et ester*: C<sub>22</sub>H<sub>18</sub>O<sub>3</sub>. MW, 330. M.p. 111°. *Picrate*: m.p. 126°.

Graebe, Perutz, *Ann.*, 1903, 327, 99.

### Acenaphthylene



C<sub>12</sub>H<sub>8</sub> MW, 152

Yellow plates from EtOH. M.p. 92–3°. B.p. 265–75° decomp. Sol. EtOH, Et<sub>2</sub>O, pet. ether. NaHg → acenaphthene. Ox. → naphthalic acid. Polymerised by strong acids.

*Picrate*: yellow needles. M.p. 201–2°.

1 : 3 : 5-*Trinitrobenzene add. comp.*: yellow needles. M.p. 221°.

1 : 2-*Dibromide*: 1 : 2-dibromoacenaphthene. M.p. 121–3°.

Dziwoński, Rapalski, *Ber.*, 1912, 45, 2491.

Flowers, U.S.P., 2,390,363. (*Chem. Abstracts*, 1946, 40, 1543).

Jones, *J. Soc. Chem. Ind.*, 1949, 68, 225; *J. appl. Chem.*, 1951, 568.

Kynaston, Jones, *J. Soc. Chem. Ind.*, 1949, 68, 228.

Kaufman, Williams, *J. appl. Chem.*, 1951, 489.

### Acenaphthylene Glycol.

*See* 1 : 2-Dihydroxyacenaphthene.

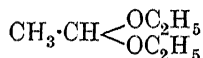
### Aceritol.

*See* 1 : 5-Anhydro-D-sorbitol.

### Acesal.

*See under* Diplosal.

**Acetal** (*Acetaldehyde diethyl acetal, ethylidene diethyl ether, 1 : 1-diethoxyethane*)



C<sub>6</sub>H<sub>14</sub>O<sub>2</sub> MW, 118

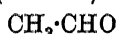
B.p. 103.2°/761 mm., 50–1°/120 mm., 21°/22 mm. Sol. 18 vols. H<sub>2</sub>O at 25°. Misc. EtOH. D<sub>4</sub><sup>20</sup> 0.8314. n<sub>D</sub><sup>20</sup> 1.38193. Heat of comb. C<sub>p</sub> 930 Cal. Stable to alkalis. Acids → acetaldehyde + C<sub>2</sub>H<sub>5</sub>OH. Ox. → acetic acid. Readily polymerises.

Adkins, Nissen, *Organic Syntheses*, Collective Vol. I, 1.

Pauer, *Monatsh.*, 1931, 58, 1.

Vericat, *Chem. Zentr.*, 1944, I, 58.

### Acetaldehyde (*Ethanal*)



C<sub>2</sub>H<sub>4</sub>O

MW, 44

Colourless fuming liq. M.p. –121°. B.p. 21°. Misc. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O all proportions. D<sub>16</sub><sup>10</sup> 0.79509, D<sub>18</sub><sup>16</sup> 0.78761. n<sub>D</sub><sup>20</sup> 1.3316. Heat of comb. C<sub>p</sub> 281.9 Cal. Burns with luminous flame. Gives bisulphite comp. Gives Na deriv. Reduces NH<sub>3</sub>, AgNO<sub>3</sub>. NaHg → ethyl alcohol. PCl<sub>5</sub> → CH<sub>3</sub>·CHCl<sub>2</sub>. Readily polymerises.

*Oxime*: acetaldoxime. Needles. M.p. 47°. B.p. 115°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 0.9656. n<sub>D</sub><sup>20</sup> 1.42567. *Me ether*: liq. B.p. 47.5°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. *Et ether*: liq. B.p. 71–1.5°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O.

*Semicarbazone*: needles from H<sub>2</sub>O or EtOH. M.p. 163°.

*Thiosemicarbazone*: cryst. M.p. 146°.

4-*Phenylsemicarbazone*: m.p. 151–2°.

o-*Tolylsemicarbazone*: m.p. 143–5°.

p-*Tolylsemicarbazone*: m.p. 174–5°.

*Phenylhydrazone*: exists in two forms. (i) Needles. M.p. 98–101°. B.p. 236–7°/21 mm.

(ii) Needles. M.p. 57°. B.p. 133–6°/21 mm.

p-*Chlorophenylhydrazone*: m.p. 98–9°.

p-*Bromophenylhydrazone*: yellow needles from ligroin. M.p. 87°.

p-*Iodophenylhydrazone*: m.p. 224°.

o-*Nitrophenylhydrazone*: m.p. 124°.

m-*Nitrophenylhydrazone*: yellow prisms. M.p. 142°.

p-*Nitrophenylhydrazone*: yellow needles. M.p. 128.5°.

2 : 4-*Dinitrophenylhydrazone*: exists in two forms. (i) Yellow plates from EtOH. M.p. 163.5–4.5°. (ii) Orange cryst. M.p. 146°.

*Diphenylhydrazone*: plates or prisms from pet. ether. M.p. 60–1°. B.p. 177–9°/11 mm.

β-*Naphthylhydrazone*: prisms from EtOH. M.p. 128–9°.

β-*Naphthylhydrazone*: m.p. 109–10°.

*Di-Me acetal*: C<sub>4</sub>H<sub>10</sub>O<sub>2</sub>. MW, 90. B.p. 64.5°. D<sub>4</sub><sup>20</sup> 0.85015. n<sub>D</sub><sup>20</sup> 1.3668.

*Di-Et acetal*: *see* Acetal.

*Dipropyl acetal*: C<sub>8</sub>H<sub>18</sub>O<sub>2</sub>. MW, 146. B.p. 146–8.5°. D<sub>4</sub><sup>20</sup> 0.8256. n<sub>D</sub><sup>20</sup> 1.3971.

*Di-isopropyl acetal*: b.p. 82–4°. D<sub>4</sub><sup>25</sup> 0.7855. n<sub>D</sub><sup>25</sup> 1.3790.

*Dibutyl acetal*: C<sub>10</sub>H<sub>22</sub>O<sub>2</sub>. MW, 174. B.p. 197–8°. D<sub>4</sub><sup>26</sup> 0.8312. n<sub>D</sub><sup>26</sup> 1.4071.

*Di-isobutyl acetal*: b.p. 168–9°. D<sub>4</sub><sup>24</sup> 0.8123. n<sub>D</sub><sup>25</sup> 1.4021.

*Diamyl acetal*: C<sub>12</sub>H<sub>26</sub>O<sub>2</sub>. MW, 202. B.p. 114–16°/16 mm. D<sub>4</sub><sup>24</sup> 0.8282. n<sub>D</sub><sup>25</sup> 1.4169.

*Di-isoamyl acetal*: b.p. 211°. D<sub>4</sub><sup>23</sup> 0.8278. n<sub>D</sub><sup>25</sup> 1.4139.

*Cyanhydrin*: *see under* Lactic Acid.

*Dimedone deriv.*: cryst. from EtOH. M.p. 141–2°.

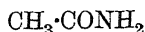
*Azine*: acetaldazine. B.p. 95–6°. Sol. H<sub>2</sub>O. D<sub>17</sub><sup>0</sup> 0.832.

*Ammonia comp.*: *see* 1-Aminoethyl Alcohol.

*Anil*: *see* Ethylideneaniline.

**Acetaldol.**

See Aldol.

**Acetamide**C<sub>2</sub>H<sub>5</sub>ON

MW, 59

Hexagonal cryst. Odourless when pure. M.p. 82–3°. B.p. 222°. D<sub>4</sub><sup>20</sup> 1.159. Sol. H<sub>2</sub>O to 97% at 20°. Sol. EtOH to 31% at 20°, 72% at 60°. Sol. CHCl<sub>3</sub>, glycerol. Prac. insol. Et<sub>2</sub>O. Reacts neutral. n<sub>D</sub><sup>20</sup> 1.4274. k (base) = 3.1 × 10<sup>-15</sup> at 25°, 4.1 × 10<sup>-13</sup> at 60°. Heat of comb. 288.0 Cal. Triboluminescent. Combines with metals and metallic salts. Combines with min. acids. P<sub>2</sub>O<sub>5</sub> → acetonitrile. Hyd. by acids or alkalis to acetic acid.

B<sub>2</sub>HBr: needles. M.p. 138–9°.B.HNO<sub>3</sub>: m.p. 98°.

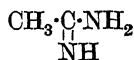
Picrate: m.p. 117°.

Hg salt: m.p. 196–7°.

N-Xanthryl: m.p. 238–40°.

N-Diphenyl: see under Diphenylamine.

N-Acetyl: see Diacetamide.

N-Allyl: b.p. 215°, 118°/17 mm. Misc. all proportions H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. D<sup>15</sup> 0.9608.Coleman, Alvarado, *Organic Syntheses*, Collective Vol. I, 3.**Acetamidine**C<sub>2</sub>H<sub>6</sub>N<sub>2</sub>

MW, 58

Unstable. Aq. sol. decomp. on warming → acetic acid + NH<sub>3</sub>. Reacts strongly alkaline.

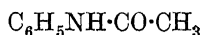
B.HCl: prisms from EtOH. M.p. 166–7°.

B.HNO<sub>3</sub>: needles. M.p. 189°.

NN'-Dimethyl: plates from EtOH. M.p. 218°.

p-Toluenesulphonyl deriv.: m.p. 193°.

Picrate: m.p. 245°.

Dox, *Organic Syntheses*, Collective Vol. I, 5.Barber, Self, B.P., 551,445, (*Chem. Abstracts*, 1944, 38, 1239).**Acetanilide** (*Acetylaniline*, *N-phenylacetamide*, *Antifebrin*)C<sub>8</sub>H<sub>9</sub>ON

MW, 135

Plates from H<sub>2</sub>O. M.p. 113–4°. B.p. 304°. Sol. 189 parts H<sub>2</sub>O at 6°, 5.55% at 100°. Sol. MeOH to 41% at 20°, 107% at 50°. Sol. EtOH to 27% at 20°, 87% at 60°. Sol. CHCl<sub>3</sub> to 12% at 20°, 31% at 50°. Sol. Et<sub>2</sub>O. k (base) = 4.1 × 10<sup>-14</sup> at 40°. D<sub>4</sub><sup>1</sup> 1.21. Heat of comb. 1016.1 Cal. Forms N-Na deriv. Febrifuge and antipyretic.

**Acetanisidide.**

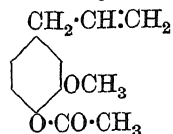
See under Anisidine.

**Acetarsonic.**

See under 2-Aminophenol-4-arsonic Acid.

**Acet-ψ-cumidide.**

See under ψ-Cumidine.

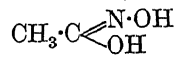
**Aceteugenol** (*Acetylugenol*, *eugenol acetate*, *1-allyl-3-methoxy-4-acetoxybenzene*)C<sub>12</sub>H<sub>14</sub>O<sub>3</sub>

MW, 206

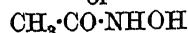
Constituent of oil of cloves. Plates from EtOH. M.p. 30–1°. B.p. 281–2°/752 mm., 163–4°/13 mm., 146°/8 mm. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O, D<sub>4</sub><sup>15</sup> 1.087. n<sub>D</sub><sup>20</sup> 1.52069. Heat of comb. C<sub>p</sub> 1498.5 Cal.

Freyss, *Chem. Zentr.*, 1899, I, 835.Erdmann, *J. prakt. Chem.*, 1897, 56, 146.**Acethydrazide.**

See under Acetic Acid.

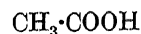
**Acethydroxamic Acid** (*N-Acetylhydroxylamine*, *acethydroxamic acid*)

or

C<sub>2</sub>H<sub>5</sub>O<sub>2</sub>N

MW, 75

M.p. anhyd. 87–8°. Sol. H<sub>2</sub>O, EtOH. Insol. Et<sub>2</sub>O. k = 2.8 × 10<sup>-8</sup> at 25°. Reduces NH<sub>3</sub>.AgNO<sub>3</sub>. FeCl<sub>3</sub> → cherry-red col.

Et ether: C<sub>4</sub>H<sub>9</sub>O<sub>2</sub>N. MW, 103. Needles. M.p. 25–6°. B.p. 59–60°/13 mm. Sol. H<sub>2</sub>O.Acetyl deriv.: diacethydroxamic acid. Needles. M.p. 89°. Sol. H<sub>2</sub>O.Benzoyl deriv.: cryst. from Et<sub>2</sub>O. M.p. 69–70°.Jones, Oesper, *Am. Chem. J.*, 1909, 42, 518.**Acetic Acid**C<sub>2</sub>H<sub>4</sub>O<sub>2</sub>

MW, 60

M.p. 16.7°. B.p. 118.2°, 109°/560 mm., 96°/360 mm., 73°/160 mm., 48°/60 mm., 30°/31 mm. Misc. all proportions with H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, and sol. most org. solvents. Insol. CS<sub>2</sub>. D<sub>4</sub><sup>20</sup> 1.04922. n<sub>D</sub><sup>25</sup> 1.36976. k = 1.845 × 10<sup>5</sup> at 25°. Sp. heat of liq. at 17° 0.480. Latent heat of vaporisation 85 Cal. per kilogramme at 118°. Heat of comb. (liq.) 209.4 Cal. Crit. temp. 321.5°. Molecular f.p. depression 39, molecular b.p. elevation 29.9. Dist. of Ca salt → acetone. Excellent solvent for organic compounds. Also dissolves sulphur, phosphorus, and halogen acids.

Anhydride: see Acetic Anhydride.

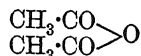
Nitrile: see Acetonitrile.

Anilide: see Acetanilide.

Hydrazide: acethydrazide, acetylhydrazine. Needles from EtOH. M.p. 67°. B.p. 129°/18



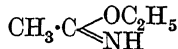
mm. Sol.  $H_2O$ , EtOH. Spar. sol.  $Et_2O$ . Reduces  $NH_3 \cdot AgNO_3$ .

**Acetic Anhydride**

$C_4H_6O_3$  MW, 102

M.p.  $-73^\circ$ . B.p.  $139.55^\circ$ ,  $81^\circ/105$  mm.,  $68^\circ/53$  mm.,  $44^\circ/15$  mm. Sol. to 2.7% in  $H_2O$  at  $15^\circ$ . Sol.  $Et_2O$ ,  $C_6H_6$ ,  $PhNO_2$ .  $D_4^{25}$  1.0850.  $n_D^{20}$  1.39006. Sp. heat 0.434. Latent heat of vap. 66.1 Cal. per kilogramme at  $137^\circ$ . Heat of comb.  $C_p$  460.07 Cal. Aq. sol. reacts neutral and is only very slowly hyd. to acetic acid. Heat of hydration to acetic acid 13.1 Cal. per gm.-mol.

Orshansky, Bograchov, *Chemistry and Industry*, 1944, 382.

**Acetiminioether (Acetimidic acid ethyl ester)**

$C_4H_9ON$  MW, 87

B.p.  $92-5^\circ$ . Unstable.  $D_4^{19}$  0.8729.  $n_D^{20}$  1.40348.

*B.HCl*: felted plates. Decomp. at  $98-100^\circ$ . Hyd. by  $H_2O$  to ethyl acetate +  $NH_4Cl$ . Alc.  $NH_3 \rightarrow$  acetamidine.

Hill, Rabinowitz, *J. Am. Chem. Soc.*, 1926, 48, 734.

McElvain, Nelson, *J. Am. Chem. Soc.*, 1942, 64, 1825.

**Acetin.**

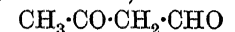
See Monoacetin, Diacetin, and Triacetin.

**Acetiodoamide.**

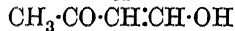
See *N*-Iodoacetamide.

**Acetnaphthalide.**

See under Naphthylamine.

**Acetoacetaldehyde (Acetoacetic aldehyde, formylacetone, butanalone)**

or



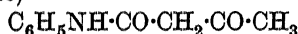
$C_4H_6O_2$  MW, 86

Very unstable. Isolated as Na deriv., sol.  $H_2O$ .  $Cu(C_4H_5O_2)_2$ , light blue needles, sol.  $H_2O$ ,  $Et_2O$ , hot  $C_6H_6$ . Spar. sol. ligroin.

*Benzoyl deriv.*: cryst. from  $C_6H_6$ -ligroin. M.p.  $92-3^\circ$ .

Peck, U.S.P., 2,262,817, (*Chem. Abstracts*, 1942, 36, 1331).

Claisen, Stylos, *Ber.*, 1888, 21, 1144.

**Acetoacetanilide (Acetoacetic anilide, acetoacetylaniline)**

$C_{10}H_{11}O_2N$  MW, 177

Plates from ligroin. M.p.  $86^\circ$ . Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ , ligroin, hot  $C_6H_6$ . Sol. acids and alkalis. Spar. sol.  $H_2O$ .  $FeCl_3 \rightarrow$  violet col. Reduces  $NH_3 \cdot AgNO_3$ . Dist.  $\rightarrow$  diphenylurea.

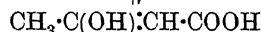
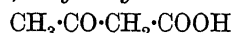
*Oxime*:  $CH_3 \cdot C(N \cdot OH) \cdot CH_2 \cdot CO \cdot NH \cdot C_6H_5$ . Needles from EtOH. M.p.  $125^\circ$ .

*Phenylhydrazone*: plates from EtOH. M.p.  $128^\circ$ .

Pfeiffer, *J. prakt. Chem.*, 1925, 111, 240; 1926, 114, 56.

Fierz-David, Ziegler, *Helv. Chim. Acta*, 1928, 11, 779.

Williams, Krynitsky, *Organic Syntheses*, 1941, XXI, 4.

**Acetoacetic Acid (2-Ketobutyric acid, acetone-carboxylic acid, 2-hydroxycrotonic acid)**

$C_4H_6O_3$  MW, 102

Syrup. Misc.  $H_2O$  all proportions. Unstable. Heat  $\rightarrow$  acetone +  $CO_2$ .  $FeCl_3 \rightarrow$  reddish-violet col.  $HNO_2 \rightarrow$  isonitrosoacetone +  $CO_2$ .

*o*-Chlorophenylhydrazone: cryst. from  $AcOH \cdot H_2O$ . M.p.  $74-7^\circ$ .

*Me ester*:  $C_5H_8O_3$ . MW, 116. Liq. B.p.  $169-70^\circ$ ,  $73-4^\circ/12$  mm. Misc.  $H_2O$ .  $D_{15}^{20}$  1.0809,  $D_{25}^{20}$  1.0724.  $n_D$  1.41964.  $FeCl_3 \rightarrow$  deep red col. Boil.  $H_2O \rightarrow$  acetone +  $CH_3 \cdot OH$  +  $CO_2$ .

*Semicarbazone*: cryst. from MeOH. M.p.  $151-2^\circ$ .

*Et ester*: see Ethyl acetoacetate.

*Isopropyl ester*:  $C_7H_{12}O_3$ . MW, 144. B.p.  $185-7^\circ$ ,  $75-6^\circ/15$  mm. *Cu salt*: green cryst. from abs. EtOH. M.p.  $174^\circ$ . Sol.  $CHCl_3$ .

*Isobutyl ester*:  $C_8H_{14}O_3$ . MW, 158. B.p.  $202-6^\circ$ .  $D^{20}$  0.979,  $D^{25}$  0.932.

*Isoamyl ester*:  $C_9H_{16}O_3$ . MW, 172. B.p.  $223^\circ$ .  $D_{17}^{20}$  0.954.

*Allyl ester*:  $C_7H_{10}O_3$ . MW, 142. B.p.  $66.5^\circ/14$  mm.  $D_{25}^{20}$  1.0366.  $n_D^{25}$  1.4380.

*Benzyl ester*:  $C_{11}H_{12}O_3$ . MW, 192. Oil. B.p.  $270^\circ$ ,  $162-4^\circ/16$  mm. *Cu salt*: green cryst. from  $C_6H_6$ . M.p.  $156^\circ$ .

*Nitrile*: cyanoacetone.  $C_4H_5ON$ . MW, 83. Liq. Readily polymerises  $\rightarrow$  yellow glassy mass, decomp. above  $230^\circ$ . *Phenylhydrazone*: needles from EtOH. M.p.  $101-2^\circ$ . *o*-Tolylhydrazone: needles from EtOH. M.p.  $115^\circ$ . *p*-Tolylhydrazone: yellow plates. M.p.  $123^\circ$ .

*Amide*: acetoacetamide.  $C_4H_7O_2N$ . MW, 101. Cryst. from  $Me_2CO$ -pet. ether. M.p.  $54^\circ$ . Sol.  $H_2O$ , EtOH,  $AcOH$ . Insol.  $Et_2O$ . Forms green cryst. *Cu salt*. *Phenylhydrazone*: m.p.  $128^\circ$ .

*Anilide*: see Acetoacetanilide.

*o*-Chloroanilide: m.p.  $105^\circ$ .

2 : 5-Dichloroanilide: m.p.  $96^\circ$ .

*p*-Nitroanilide: m.p.  $119^\circ$ .

*o*-Toluidide: m.p.  $104^\circ$ .

*p*-Toluidide: m.p.  $95^\circ$ .

*m*-Xylidide: m.p.  $89^\circ$ .

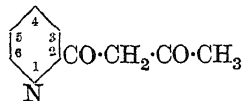
*o*-Anisidide: m.p.  $87^\circ$ .

**Acetoacetic Ester.**

See Ethyl acetoacetate.

**Acetoacetylene.**

See 1-Butyne-3-one.

**2-Acetoacetylpyridine** (*α-Acetoacetylpyridine*) $C_9H_9O_2N$ 

MW, 163

Needles or prisms from pet. ether. M.p. 50°. B.p. 137–43°/15 mm. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, hot ligroin. Insol. H<sub>2</sub>O. FeCl<sub>3</sub> in EtOH sol. → deep red col. Conc. KOH at 100° → picolinic acid + acetone.

*Monoxime*: cryst. from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 78°.

*Dioxime*: red prisms from H<sub>2</sub>O. M.p. 146–7°.

Micko, *Monatsh.*, 1896, 17, 442.**3-Acetoacetylpyridine** (*β-Acetoacetylpyridine*).

Needles from ligroin. M.p. 85°. B.p. 171°/15 mm. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O. FeCl<sub>3</sub> → deep red col. KOH → nicotinic acid + acetone.

*B,HCl*: needles from EtOH-Et<sub>2</sub>O. M.p. 92°.

*B,HgCl<sub>2</sub>*: needles from EtOH. M.p. 107–10°.

*B,HCl.HgCl<sub>2</sub>*: cryst. from dil. HCl. M.p. 123–5° decomp.

*B<sub>2</sub>,H<sub>2</sub>PtCl<sub>6</sub>*: reddish-yellow cryst. from dil. HCl. M.p. 173–5° decomp.

*Dioxime*: cryst. from EtOH. M.p. 79°. Sol. H<sub>2</sub>O.

*Picrate*: m.p. 155°.

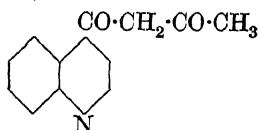
Ferency, *Monatsh.*, 1897, 18, 673.**4-Acetoacetylpyridine** (*γ-Acetoacetylpyridine*).

Needles from ligroin. M.p. 62°. B.p. 145–7°/18 mm. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O. Sol. HCl with greenish-yellow col.

*B<sub>2</sub>,H<sub>2</sub>PtCl<sub>6</sub>*: reddish-brown plates. Decomp. at 228°.

*Monoxime*: cryst. from EtOH. M.p. 165°.

*Monoanil*: yellow plates from ligroin. M.p. 103–4°.

Tscherne, *Monatsh.*, 1901, 22, 616.**4-Acetoacetylquinoline** (*γ-Acetoacetylquinoline*) $C_{13}H_{11}O_2N$ 

MW, 213

Needles from ligroin. M.p. 64–5°. B.p. 205–7°/17 mm. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. cold ligroin.

*B,HCl*: yellow needles from dil. HCl. M.p. 180–1°.

*B<sub>2</sub>,H<sub>2</sub>PtCl<sub>6</sub>*: orange-yellow needles from HCl. M.p. 192–3° decomp.

*B<sub>1</sub>(COOH)<sub>2</sub>*: needles from EtOH. M.p. 166–7°.

*Monoxime*: m.p. 171°.

*Methiodide*: (+1H<sub>2</sub>O), reddish-yellow needles. M.p. 189–91° decomp.

*Monoanil*: yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 129–5°.

Weidel, *Monatsh.*, 1896, 17, 402.**2-Acetoacrylic Acid** $C_5H_6O_3$ 

MW, 114

Needles or plates from CHCl<sub>3</sub> or C<sub>6</sub>H<sub>6</sub>. M.p. 125°. Sol. 15 parts cold H<sub>2</sub>O. Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O, hot CHCl<sub>3</sub>. Insol. CS<sub>2</sub>, ligroin. Sublimes. Red. → levulinic acid. Br → 1:2-dibromolevulinic acid.

*Oxime*: exists in two forms. (i) M.p. 206° decomp. *Acetyl deriv.*: m.p. 155°. (ii) M.p. 189° decomp. Boil. H<sub>2</sub>O → (i). *Acetyl deriv.*: m.p. 143°.

*Phenylhydrazone*: yellow needles from H<sub>2</sub>O. M.p. 169° (158°).

*Me ester*: C<sub>6</sub>H<sub>8</sub>O<sub>3</sub>. MW, 128. Plates. M.p. 60–5°. B.p. 197°, 85°/14 mm. D<sub>4</sub><sup>20</sup> 1.046. n<sub>D</sub><sup>20</sup> 1.43392. *Oxime*: needles from pet. ether. M.p. 100°. *Semicarbazone*: m.p. 196°. *Phenylhydrazone*: yellow cryst. from toluene. M.p. 156°. *p-Nitrophenylhydrazone*: needles. M.p. 227–8°.

*Et ester*: C<sub>7</sub>H<sub>11</sub>O<sub>3</sub>. MW, 142. B.p. 206–7°. D<sup>o</sup> 1.057. *Phenylhydrazone*: yellow plates from EtOH. M.p. 117–5°. *Semicarbazone*: m.p. 205–7°.

Königs, Wagstaffe, *Ber.*, 1893, 26, 555.Rinkes, van Hasselt, *Chem. Zentr.*, 1917, I, 208.**4-Aceto-n-amy Alcohol.**

See 3-Methyl-6-hexanolone-2.

**Acetoanisole.**

See under Hydroxyacetophenone.

**ω-Acetoanisole.**

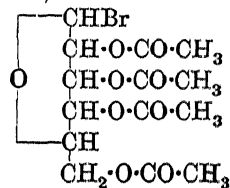
See Phenoxyacetone.

**Acetobenzoic Acid.**

See Acetophenone-carboxylic Acid.

**Acetobromoamide.**

See N-Bromoacetamide.

**Acetobromoglucose** (1-Bromo-2:3:4:6-tetra-acetylglucose) $C_{14}H_{19}O_9Br$ 

MW, 411

*d.*  
 $\alpha$ -Form : prisms from ligroin. M.p. 79–80°.  
 $\beta$ -Form : needles from Et<sub>2</sub>O. M.p. 88–9°.  
 Spar. sol. H<sub>2</sub>O.  $[\alpha]_D^{25} + 198^\circ$  in CHCl<sub>3</sub>. Hyd. by H<sub>2</sub>O. Reduces hot Fehling's.

*l.*  
 Needles from Et<sub>2</sub>O. M.p. 88°.  $[\alpha]_D^{17.5} - 192.7^\circ$  in Et<sub>2</sub>O.

*dl.*  
 Needles from Et<sub>2</sub>O. M.p. 85°.  
 Karrer, Nägeli, Smirnoff, *Helv. Chim. Acta*, 1922, 5, 141.  
 Fischer, Armstrong, *Ber.*, 1901, 34, 2885.  
 Fischer, *Ber.*, 1911, 44, 1898.  
 Redemann, Niemann, *Organic Syntheses*, 1942, XXII, 1.  
 McCloskey, Pyle, Coleman, *J. Am. Chem. Soc.*, 1944, 66, 349–50.  
 Nichols, Smith, *Nature*, 1948, 161, 349.

## 2-Acetobutane.

See Methyl sec.-butyl Ketone.

**Acetobutyl Alcohol** (*Methyl 4-hydroxybutyl ketone, 1-hexanolone-5*)



C<sub>6</sub>H<sub>12</sub>O<sub>2</sub> MW, 116  
 B.p. 227°, 171°/177 mm., 157°/100 mm., 112°/15 mm. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. D<sub>4</sub><sup>15</sup> 0.9895.  $n_D$  1.44937. Spar. volatile in steam.  
*Acetyl*: b.p. 114–16°/12 mm. D<sub>4</sub><sup>15</sup> 1.002.  $n_D^{15}$  1.4336.

Lipp, *Ann.*, 1896, 289, 182.

## Aceto-sec.-n-butyl Alcohol.

See 2-Hexanolone-5 and 3-Hexanolone-5.

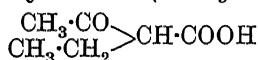
## 4-Acetobutyl bromide.

See Methyl 4-bromobutyl Ketone.

## Acetobutylene.

See Hexenone and Methylpentenone.

## 1-Acetobutyric Acid (1-Ethylacetoacetic acid)



C<sub>6</sub>H<sub>10</sub>O<sub>3</sub> MW, 130  
*Me ester*: C<sub>7</sub>H<sub>12</sub>O<sub>3</sub>. MW, 144. B.p. 190°. D<sub>14</sub> 0.995.

*Et ester*: C<sub>8</sub>H<sub>14</sub>O<sub>3</sub>. MW, 158. B.p. 198°, 95°/16 mm., 83°/12 mm. D<sub>4</sub><sup>25</sup> 0.9754.  $n_D^{19}$  1.42256. Sol. EtOH, Et<sub>2</sub>O. Mod. sol. H<sub>2</sub>O. Gives Na deriv. *Semicarbazone*: cryst. M.p. 154° decomp.

*Isobutyl ester*: C<sub>10</sub>H<sub>18</sub>O<sub>3</sub>. MW, 186. B.p. 211–5°.

*Isoamyl ester*: C<sub>11</sub>H<sub>20</sub>O<sub>3</sub>. MW, 200. B.p. 233–6°. D<sub>18</sub><sup>20</sup> 0.937.

*Amide*: C<sub>6</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 129. Needles from H<sub>2</sub>O. M.p. 95–6°. Sublimes. Sol. H<sub>2</sub>O, MeOH, EtOH. Mod. sol. pet. ether.

*Nitrile*: C<sub>6</sub>H<sub>9</sub>ON. MW, 111. B.p. 80°/13 mm. D<sub>19</sub> 0.9555. Sol. dil. alkalis. *Semicarbazone*: needles from MeOH. M.p. 160°.

*Phenylhydrazone*: prisms from EtOH. M.p. 73–4°.

Robinson, *J. Chem. Soc.*, 1916, 109, 1044.  
 Michael, *J. prakt. Chem.*, 1905, 72, 553.

## 2-Acetobutyric Acid (2-Methyl-levulinic acid)



C<sub>6</sub>H<sub>10</sub>O<sub>3</sub> MW, 130  
 M.p. 31.5°. B.p. 241–2°, 140–1°/14 mm. Sol. H<sub>2</sub>O, EtOH. D<sub>4</sub><sup>17</sup> 1.0932.  $n_D^{17}$  1.4443. Very hygroscopic. Oxidises in air.

*Me ester*: C<sub>7</sub>H<sub>12</sub>O<sub>3</sub>. MW, 144. B.p. 200°, 82–3°/10 mm. D<sub>4</sub><sup>20</sup> 1.022.  $n_D^{23}$  1.4052. *Phenylhydrazone*: m.p. 88°. *p-Nitrophenylhydrazone*: m.p. 147°.

*Et ester*: C<sub>8</sub>H<sub>14</sub>O<sub>3</sub>. MW, 158. Oil. B.p. 206°, 110°/30 mm. D<sub>20</sub> 0.987.

*Semicarbazone*: needles. M.p. 197° decomp. (179°). Spar. sol. H<sub>2</sub>O.

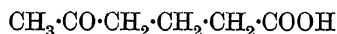
*Phenylhydrazone*: m.p. 125°.

*p-Nitrophenylhydrazone*: m.p. 168–9°.

Pauly, Gilmour, Will, *Ann.*, 1914, 403, 149.

Blaise, *Bull. soc. chim.*, 1900, 23, 920.

## 3-Acetobutyric Acid (4-Ketocaproic acid)



C<sub>6</sub>H<sub>10</sub>O<sub>3</sub> MW, 130

M.p. 13–4°. B.p. 275° slight decomp., 195–200°/65 mm., 180°/20 mm. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Cryst. in prisms from H<sub>2</sub>O, with 1H<sub>2</sub>O, m.p. 38°.  $k = 2.2 \times 10^{-5}$  at 25°. Hot dil. HNO<sub>3</sub> → succinic acid. NaOEt → dihydroresorcinol. Small amount H<sub>2</sub>O → hydrate, m.p. 34–6°.

*Et ester*: C<sub>8</sub>H<sub>14</sub>O<sub>3</sub>. MW, 158. B.p. 222°, 110–5°/12 mm.

*Amide*: C<sub>6</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 129. Cryst. from CHCl<sub>3</sub>. M.p. 114°. Sol. H<sub>2</sub>O, EtOH. Mod. sol. Et<sub>2</sub>O.

*Oxime*: prisms from C<sub>6</sub>H<sub>6</sub>. M.p. 104–5°.  
*Semicarbazone*: plates from H<sub>2</sub>O, with 1H<sub>2</sub>O. M.p. 175° decomp.

*p-Toluidide*: leaflets from H<sub>2</sub>O. M.p. 123°.  
 Bentley, Perkin, *J. Chem. Soc.*, 1896, 69, 1511.

Hopff, Rapp, U.S.P., 2,265,165, (*Chem. Abstracts*, 1942, 36, 1615).

## 5-Acetocaproic Acid.

See 6-Keto-n-caprylic Acid.

## 7-Acetocaprylic Acid.

See 8-Ketocaprylic Acid.

## Acetocatechol.

See 2:3-Dihydroxyacetophenone and 3:4-Dihydroxyacetophenone.

## Acetochloroamide.

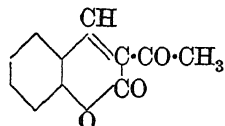
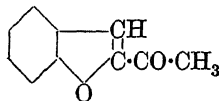
See N-Chloroacetamide.

## Acetochloroanilide.

See N-Chloroacetanilide.

**Acetocinnamone.**

See Benzylideneacetone.

**3-Acetocoumarin** $C_{11}H_8O_3$  MW, 188Needles from EtOH. M.p. 124°. Sol. EtOH, AcOH,  $CHCl_3$ , hot  $C_6H_6$ , hot ligroin. Insol. cold  $H_2O$ .*Oxime*: cryst. from EtOH. M.p. 206°.*Phenylhydrazone*: orange-yellow needles from EtOH. M.p. 186°.*Semicarbazone*: needles from EtOH. M.p. 231°.*Picrate*: yellow needles. M.p. 75°.Knoevenagel, *Ber.*, 1898, 31, 732.**2-Acetocoumarone** $C_{10}H_8O_2$  MW, 160Plates from EtOH.Aq. M.p. 75-6°. Sol. most org. solvents. Mod. sol.  $H_2O$ . Volatile in steam.*Oxime*: m.p. 150°.Störmer, *Ber.*, 1897, 30, 1711.**Acetocresol.**

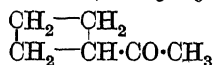
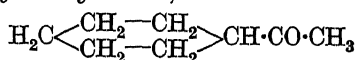
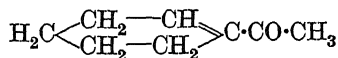
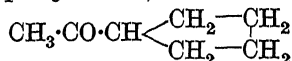
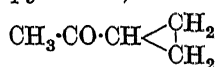
See Hydroxy-methylacetophenone.

**Acetocumene.**

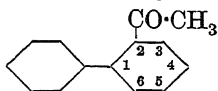
See Isopropylacetophenone.

**5-Aceto- $\psi$ -cumene.**

See 2 : 4 : 5-Trimethylacetophenone.

**Acetocyclobutane (Methyl cyclobutyl ketone)** $C_6H_{10}O$  MW, 98B.p. 137-9°. Spar. sol.  $H_2O$ .  $D_4^{20}$  0.9020.  $n_D^{19.5}$  1.4322. Forms bisulphite comp.*Oxime*: prisms from  $H_2O$ . M.p. 61°. B.p. 194-5°.*Semicarbazone*: m.p. 148-9° corr.Zelinsky, *Gutt. Ber.*, 1908, 41, 2432.Kishner, *Chem. Zentr.*, 1913, II, 2132.**Acetocyclohexane (Hexahydroacetophenone, methyl cyclohexyl ketone)** $C_8H_{14}O$  MW, 126B.p. 180-1°, 72°/25 mm., 68°/12 mm.  $D_4^{18}$  0.9254.  $n_D^{18}$  1.45652. Alk.  $KMnO_4 \rightarrow$  adipic acid. Forms bisulphite comp.*Oxime*: plates from  $Et_2O$ . M.p. 60°. B.p. 145-50°/20 mm.*Semicarbazone*: cryst. from MeOH. M.p. 177°. *p-Nitrophenylhydrazone*: reddish-violet cryst. from EtOH. M.p. 154°.Nenitzescu, Ciorănescu, *Ber.*, 1936, 69, 1821.Hell, Schaal, *Ber.*, 1907, 40, 4163.Darzens, Rost, *Compt. rend.*, 1911, 153, 773.Walker, Hauser, *J. Am. Chem. Soc.*, 1946, 68, 1386.**1-Acetocyclohexene (Tetrahydroacetophenone)** $C_8H_{12}O$  MW, 124B.p. 201-2°.  $D_4^{20}$  0.9655.  $n_D^{20}$  1.4881.*Oxime*: cryst. from  $C_6H_6$ -ligroin. M.p. 99°.*Semicarbazone*: m.p. 221° decomp.Ruzicka, Koolhaas, Wind, *Helv. Chim. Acta*, 1931, 14, 1157.**Acetocyclopentane (Acetylpentamethylene, methyl cyclopentyl ketone)** $C_7H_{12}O$  MW, 112B.p. 158-9.5°, 75-6.5°/20 mm.  $D_4^0$  0.9269.  $D_20^0$  0.918.  $n_D^{20}$  1.444.*Semicarbazone*: cryst. from  $Me_2CO$ . M.p. 145°.Goldsworthy, *J. Chem. Soc.*, 1934, 378.Nenitzescu, Cantuniari, *Ber.*, 1932, 65, 810.Nenitzescu, Ciorănescu, *Ber.*, 1936, 69, 1820.**Acetocyclopropane (Acetyltrimethylene, methyl cyclopropyl ketone)** $C_5H_8O$  MW, 84Oil with camphoraceous odour. B.p. 114°.  $D_4^{20}$  0.89839.  $n_D^{20}$  1.42514. Sol.  $H_2O$ . Polymerises readily.  $KMnO_4 \rightarrow$  cyclopropanecarboxylic acid.*Oxime*: prisms from  $C_6H_6$ . M.p. 50-1°.*Semicarbazone*: plates from MeOH. M.p. 118-20° (110-12°).*Hydrazone*: b.p. 173-5°/752 mm., 63.5°/5-6 mm.*Methylhydrazone*: b.p. 85-7°/25 mm.  $D_4^{20}$  0.9692.  $n_D^{20}$  1.5124.Marshall, Perkin, *J. Chem. Soc.*, 1891, 59, 860.Idzkowska, Wagner, *Chem. Zentr.*, 1898, II, 474.**Acetocymene.**

See Methylisopropylacetophenone.

**2-Acetodiphenyl** (*o*-Phenylacetophenone) $C_{14}H_{12}O$ 

MW, 196

B.p. 104–5°/1 mm.

Semicarbazone: m.p. 197°.

2 : 4-Dinitrophenylhydrazone: m.p. 169–70°.

Campaigne, Reid, *J. Am. Chem. Soc.*, 1946, 68, 1663.**3-Acetodiphenyl** (*m*-Phenylacetophenone).Cryst. from EtOH or Me<sub>2</sub>CO. M.p. 120–1°.

Semicarbazone: m.p. 222–3°.

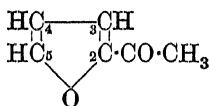
2 : 4-Dinitrophenylhydrazone: m.p. 191–2°.

Campaigne, Reid, *J. Am. Chem. Soc.*, 1946, 68, 1663.**4-Acetodiphenyl** (*p*-Phenylacetophenone).Cryst. from EtOH or Me<sub>2</sub>CO. M.p. 120–1°.B.p. 325–7°.  $KMnO_4 \rightarrow$  diphenyl-4-carboxylic acid. Cu chromite red.  $\rightarrow$  ethylcyclohexylbenzene.

Oxime: m.p. 184–6°.

Gull, Turner, *J. Chem. Soc.*, 1929, 498.Grieve, Hey, *J. Chem. Soc.*, 1933, 970.Long, Henze, *J. Am. Chem. Soc.*, 1941, 63, 1939.**4-Acetodiphenyl Ether.**See under *p*-Hydroxyacetophenone.**Acetoevernone.**

See under 4 : 6-Dihydroxy-2-methylacetophenone.

**2-Acetofurone** (*2*-Acetylfuran, methyl  $\alpha$ -furyl ketone) $C_6H_6O_2$ 

MW, 110

Cryst. from ligroin. M.p. 33° (29°). B.p. 173°, 67°/10 mm.  $D_{20}^{20}$  1.098.  $n_D^{20}$  1.5017.Oxime: prisms from Et<sub>2</sub>O–pet. ether. M.p. 104° (92°). Spar. sol. EtOH. Acetyl: needles from Et<sub>2</sub>O. M.p. 96°. B.p. 135°/10 mm. Benzoyl: needles from MeOH. M.p. 97–8°.

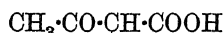
Semicarbazone: plates from MeOH. M.p. 150°.

Phenylhydrazone: yellow plates from EtOH.Aq. M.p. 86.5°.

*p*-Nitrophenylhydrazone: red needles from EtOH.Aq. M.p. 185–6°.Hartough, Kosak, *J. Am. Chem. Soc.*, 1947, 69, 1012.Reichstein, *Helv. Chim. Acta*, 1930, 13, 356.Asahina, Murayama, *Arch. Pharm.*, 1914, 252, 443.**3-Acetofurone** (*3*-Acetylfuran, methyl  $\beta$ -furyl ketone).

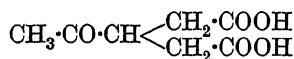
B.p. 84°/21 mm.

Semicarbazone: m.p. 150°.

Gilman, Woolley, Wright, *J. Am. Chem. Soc.*, 1933, 55, 2609.**1-Acetoglutaric Acid** $C_7H_{10}O_5$ 

MW, 174

M.p. anhyd. 102°. B.p. 205°/12 mm.

Di-Et ester:  $C_{11}H_{18}O_5$ . MW, 230. B.p. 271–2° slight decomp., 169–71°/22–25 mm., 162°/11 mm.  $D_4^{20}$  1.07115.Adkins, Isbell, Wojcik, *Organic Syntheses*, 1934, XIV, 39.Küster, Weller, *Z. physiol. Chem.*, 1917, 99, 235.**2-Acetoglutaric Acid** $C_7H_{10}O_5$ 

MW, 174

Leaflets. M.p. 58°. Sol. H<sub>2</sub>O, EtOH. Mod. sol. Et<sub>2</sub>O, CHCl<sub>3</sub>. Insol. ligroin. Easily forms anhydride.Me ester:  $C_8H_{12}O_5$ . MW, 188. Needles. M.p. 99°.Di-Me ester:  $C_9H_{14}O_5$ . MW, 202. B.p. 144°/12 mm.  $D_4^{20}$  1.441. Phenylhydrazone: needles from dil. AcOH. M.p. 83°.Di-Et ester:  $C_{11}H_{18}O_5$ . MW, 230. B.p. 154°/12 mm.  $D_4^{20}$  1.0798.Mono-amide:  $C_7H_{11}O_4N$ . MW, 173. Needles from EtOH–Et<sub>2</sub>O. M.p. 141–2°. Sol. H<sub>2</sub>O. Spar. sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, ligroin.Fittig, Roth, *Ann.*, 1901, 314, 21.**2-Acetoheptane.**

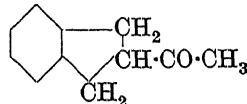
See 3-Methylheptanone-2.

**6-Aceto-*n*-heptylic Acid.**

See 7-Ketopelargonic Acid.

 **$\omega$ -Acetohexahydrostyrene.**

See Hexahydrobenzylideneacetone.

**2-Acetohydrindene** (*Methyl 2-hydrindyl ketone*) $C_{11}H_{12}O$ 

MW, 160

B.p. 175–7°/80 mm., 164–8°/47 mm.  $D_4^{20}$  1.0685.

Oxime: prisms from MeOH. M.p. 125–6°.

Semicarbazone: m.p. 178°.

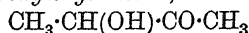
Ssolonina, *Chem. Zentr.*, 1905, I, 343.

**α-Acetohydrocinnamic Acid.**

See 1-Benzylacetoacetic Acid.

**Acetohydroquinone.**

See Quinacetophenone.

**Acetoin** (*Methylacetylcarbinol, dimethylketol, methyl 1-hydroxyethyl ketone, 2-butanolone-3*)C<sub>4</sub>H<sub>8</sub>O<sub>2</sub> MW, 88

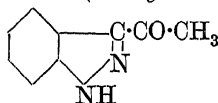
M.p. 15°. B.p. 148° (142°). Misc. H<sub>2</sub>O. Sol. EtOH. Prac. insol. Et<sub>2</sub>O. D<sub>4</sub><sup>17</sup> 0.9972. n<sub>D</sub><sup>17</sup> 1.4190. Forms bisulphite comp. Reduces Fehling's. Dist. → diacetyl. Polymerises to C<sub>8</sub>H<sub>16</sub>O<sub>4</sub>, m.p. 95° (another form has m.p. 85°), depolymerised by heat or treatment with Et<sub>2</sub>O. Catalytic dehydration → methyl vinyl ketone.

Acetyl: b.p. 169–73°. D<sub>4</sub><sup>17</sup> 1.033. n<sub>D</sub><sup>17</sup> 1.4153.

Semicarbazone: plates from EtOH. M.p. 161°.

Benzoyl: b.p. 140–1°/8 mm. D<sup>18</sup> 1.104.Me ether: C<sub>5</sub>H<sub>10</sub>O<sub>2</sub>. MW, 102. B.p. 114°/727 mm. Spar. sol. H<sub>2</sub>O.Et ether: C<sub>6</sub>H<sub>12</sub>O<sub>2</sub>. MW, 116. B.p. 128°/727 mm.Propyl ether: C<sub>7</sub>H<sub>14</sub>O<sub>2</sub>. MW, 130. B.p. 148–9°/727 mm.Phenyl ether: C<sub>10</sub>H<sub>12</sub>O<sub>2</sub>. MW, 164. B.p. 235–40°.

Semicarbazone: m.p. 202° (185°).

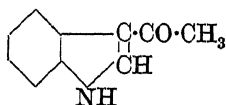
Bergmann, Ludewig, *Ann.*, 1924, 436, 173.Lowry, Baldwin, *J. Chem. Soc.*, 1935, 704.**3-Acetoindazole** (*Methyl 3-indolyl ketone*)C<sub>9</sub>H<sub>9</sub>ON<sub>2</sub> MW, 160

Yellow leaflets from AcOH. M.p. 182°. Sol. EtOH, Et<sub>2</sub>O, AcOH. Spar. sol. H<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, ligroin.

N-Acetyl: needles from AcOH. M.p. 123°.

Oxime: needles from C<sub>6</sub>H<sub>6</sub>-EtOH. M.p. 222°.

2:4-Dinitrophenylhydrazone: red needles from nitrobenzene. Does not melt below 320°.

Meisenheimer, Diedrich, *Ber.*, 1924, 57, 1720.**3-Acetoindole**C<sub>10</sub>H<sub>9</sub>ON MW, 159

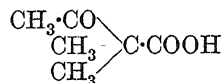
Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 190–1°. Sol. EtOH. Spar. sol. H<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Sublimes.

Oxime: needles from H<sub>2</sub>O. M.p. 144–7°.N-Acetyl: needles from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 151°. Sol. hot H<sub>2</sub>O. Sublimes.

Picrate: yellow cryst. from pet. ether. M.p. 183°.

Oddo, Sessa, *Gazz. chim. ital.*, 1911, 41, I, 237.Zatti, *Ber.*, 1889, 22, 662.**3-Acetoisobutylene.**

See 2-Methyl-1-pentenone-4.

**1-Acetoisobutyric Acid** (1:1-Dimethylacetoacetic acid)C<sub>6</sub>H<sub>10</sub>O<sub>3</sub> MW, 130

Very hygroscopic. Decomp. readily at ord. temps. to methyl isopropyl ketone and CO<sub>2</sub>.

Me ester: C<sub>7</sub>H<sub>12</sub>O<sub>3</sub>. MW, 144. B.p. 175–6°, 74°/15 mm. D<sub>4</sub><sup>14</sup> 1.0002. n<sub>D</sub><sup>14</sup> 1.418. p-Bromophenylhydrazone: colourless prisms from EtOH. M.p. 90°. Unstable.

Et ester: C<sub>8</sub>H<sub>14</sub>O<sub>3</sub>. MW, 158. Oil. B.p. 184°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O. D<sub>20</sub><sup>20</sup> 0.9773. n<sub>D</sub><sup>19</sup> 1.418. Semicarbazone: cryst. from H<sub>2</sub>O. M.p. 183–7° decomp.

Amide: C<sub>6</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 129. Cryst. from H<sub>2</sub>O. M.p. 121°. Sol. H<sub>2</sub>O. Spar. sol. EtOH, C<sub>6</sub>H<sub>6</sub>. Oxime: prisms from EtOH. M.p. 162–4° decomp.

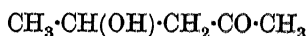
Nitrile: C<sub>6</sub>H<sub>9</sub>ON. MW, 111. Yellow liq. B.p. 163–4°. Insol. H<sub>2</sub>O. D<sup>13</sup> 1.008. Oxime: cryst. from ligroin. M.p. 99–100°. B.p. 230° decomp.

Oxime: cryst. from Et<sub>2</sub>O. M.p. 96–7° decomp. Unstable.

Folkers, Adkins, *J. Am. Chem. Soc.*, 1931, 53, 1416.Meyer, *Monatsh.*, 1906, 27, 1088.**2-Acetoisobutyric Acid** (1-Methyl-levulinic acid)C<sub>6</sub>H<sub>10</sub>O<sub>3</sub> MW, 130

Hygroscopic oil. B.p. 165°/40 mm., 153–6°/3 mm. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. 30% KOH → acetone + pyruvic acid.

2:4-Dinitrophenylhydrazone: m.p. 130°.

Et ester: C<sub>8</sub>H<sub>14</sub>O<sub>3</sub>. MW, 158. B.p. 206–8°. Insol. H<sub>2</sub>O.March, *Compt. rend.*, 1902, 134, 180.Ajello, Cusmano, *Gazz. chim. ital.*, 1940, 70, 755.**Acetoisopropyl Alcohol** (*Methylacetonyl carbinol, methyl 2-hydroxypropyl ketone, 4-pentanolone-2*)C<sub>5</sub>H<sub>10</sub>O<sub>2</sub> MW, 102

B.p. 177°, 77°/28 mm., 62–4°/12 mm. Misc. with H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. D<sub>20</sub><sup>20</sup> 1.0071. n<sub>D</sub><sup>19</sup> 1.44146. Heat to 250°, or with Ac<sub>2</sub>O → ethylideneacetone, CH<sub>3</sub>·CH:CH·CO·CH<sub>3</sub>.

Oxime: b.p. 123–4°/13 mm.

Phenylhydrazone: m.p. 102–3°.

*Acetyl*: b.p. 84°/12 mm. *Phenylhydrazone*: plates from EtOH. M.p. 115° corr.

Claisen, *Ann.*, 1899, 306, 324.

Winthrop Chem. Co., U.S.P., 1,714,378, (*Chem. Abstracts*, 1929, 23, 3477).

 **$\beta$ -Acetoisopropylbenzene.**

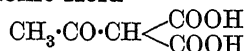
See 2-Phenylpentanone-4.

**3-Acetoisovaleric Acid.**

See 2-Methyl-3-acetobutyric Acid.

**Acetol.**

See Hydroxyacetone.

**Acetomalonic Acid**

$\text{C}_5\text{H}_6\text{O}_5$  MW, 146  
*Mono-Me ester*:  $\text{C}_6\text{H}_8\text{O}_5$ . MW, 160. *Nitrile*: needles from  $\text{Et}_2\text{O}$ . M.p. 46-7°. B.p. 130°/40 mm. Sol. EtOH,  $\text{Et}_2\text{O}$ . Insol.  $\text{H}_2\text{O}$ .  $k = 8.5 \times 10^{-4}$  at 25°.

*Mono-Et ester*:  $\text{C}_7\text{H}_{10}\text{O}_5$ . MW, 174. *Nitrile*: colourless needles. M.p. 26°. B.p. 195-7°, 130-2°/35 mm. Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ ,  $\text{CS}_2$ ,  $\text{C}_6\text{H}_6$ . Spar. sol.  $\text{H}_2\text{O}$ .  $D_4^{20}$  1.1107.  $n_D^{20}$  1.4710.  $k = 6.5 \times 10^{-4}$  at 25°. *Amide*: prisms from AcOH. M.p. 110°. *Anilide*: prisms from EtOH. M.p. 57-8°. Spar. sol.  $\text{H}_2\text{O}$ . *Oxime*: needles from dil. EtOH. M.p. 148°.

*Di-Et ester*:  $\text{C}_9\text{H}_{14}\text{O}_5$ . MW, 202. B.p. 125°/20 mm. Exists as mixture of keto and enol forms, about 64% enol. Sol. dil. alkalis.  $D_4^{20}$  1.099.  $n_D^{20}$  1.4460.  $\text{FeCl}_3 \rightarrow$  dark red col. *Acetyl*: b.p. 154-6°/15 mm.  $D_4^{15}$  1.1161.  $n_D^{15}$  1.451. *Propionyl*: b.p. 154-5°/10 mm.  $D_4^{19}$  1.0984.  $n_D^{19}$  1.452. *Semicarbazone*: m.p. 106-7°. *2:4-Dinitrophenylhydrazone*: m.p. 147°. *Cu comp.*: m.p. 124°.

*Mono-propyl ester*:  $\text{C}_8\text{H}_{12}\text{O}_5$ . MW, 188. *Nitrile*: needles from pet. ether. M.p. 35-6°. B.p. 133°/25 mm.  $k = 6.0 \times 10^{-4}$  at 25°.

*Mono-isobutyl ester*:  $\text{C}_9\text{H}_{14}\text{O}_5$ . MW, 202. *Nitrile*: b.p. 143°/32 mm.  $k = 7.0 \times 10^{-4}$  at 25°.

*Mono-isoamyl ester*:  $\text{C}_{10}\text{H}_{16}\text{O}_5$ . MW, 216. *Nitrile*: b.p. 167°/44 mm.  $D_4^{20}$  1.0328.  $n_D^{20}$  1.4676.  $k = 5.8 \times 10^{-4}$  at 25°.

*Nitrile*:  $\text{C}_5\text{H}_5\text{O}_3\text{N}$ . MW, 127. *Anilide*: needles from EtOH. M.p. 145°. *o-Toluidide*: needles. M.p. 110°. *p-Toluidide*: needles. M.p. 176°.

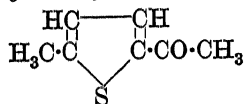
Nef, *Ann.*, 1891, 266, 105.

Guinchant, *Ann. chim.*, 1918, 9, 70.

**Acetomesitylene.**

See 2:4:6-Trimethylacetophenone.

**Acetomethylthienone** (*2-Methyl-5-acetylthiophene, methyl methylthienyl ketone*)



$\text{C}_7\text{H}_8\text{OS}$

MW, 140

M.p. 25°. B.p. 232-3°. Volatile in steam. *Oxime*: m.p. 125°.

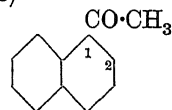
Rinkes, *Rec. trav. chim.*, 1932, 51, 1134.

Demuth, *Ber.*, 1886, 19, 1859.

**Acetonaphthol.**

See Hydroxyacetoneaphthone.

**1-Acetonaphthone** (*Methyl  $\alpha$ -naphthyl ketone, 1-acetylnaphthalene*)



$\text{C}_{12}\text{H}_{10}\text{O}$

MW, 170

M.p. 34°. B.p. 167-70°/13 mm. Sol. common org. solvents. Insol.  $\text{H}_2\text{O}$ .  $D^0$  1.1336.  $n_D^{27}$  1.622.  $\text{KMnO}_4$  (cold)  $\rightarrow$  1-naphthoylformic acid.  $\text{KMnO}_4$  (hot)  $\rightarrow$  1-naphthoic acid.

*Oxime*: cryst. from EtOH.Aq. M.p. 136°.

*Semicarbazone*: m.p. 235-7° (205°).

*Picrate*: yellow needles from EtOH. M.p. 116° (118-19°).

*1:3:5-Trinitrobenzene add. comp.*: yellow needles. M.p. 112°.

Fröschl, Harlass, *Monatsh.*, 1932, 59, 279.

Caille, *Compt. rend.*, 1911, 153, 393.

Nunn, Henze, *J. Org. Chem.*, 1947, 12, 540.

**2-Acetonaphthone** (*Methyl  $\beta$ -naphthyl ketone, 2-acetylnaphthalene*).

Needles from ligroin. M.p. 56°. B.p. 301-3°, 171-3°/17 mm. Dil.  $\text{HNO}_3 \rightarrow$  2-naphthoic acid.

*Oxime*: m.p. 145°.

*Semicarbazone*: m.p. 235-7°.

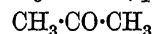
*Phenylhydrazone*: m.p. 176-7°.

*Picrate*: m.p. 85° (82°).

Barbot, *Bull. soc. chim.*, 1930, 47, 1318.

Immediata, Day, *J. Org. Chem.*, 1940, 5, 512.

**Acetone** (*Dimethyl ketone, propanone*)



$\text{C}_3\text{H}_6\text{O}$

MW, 58

M.p. -94°. B.p. 56.2°.  $D_4^0$  0.8186,  $D_4^{20}$  0.7899. Misc.  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ . Salted out from  $\text{H}_2\text{O}$  with  $\text{CaCl}_2$  or  $\text{K}_2\text{CO}_3$ .  $n_D^{15}$  1.36157. Heat of comb. liq.  $\text{C}_v$  426.3 Cal., vapour  $\text{C}_p$  437.25 Cal. Crit. temp. 246.1°. Mol. elevation of b.p. 17.1°. Forms add. comps. at low temps. with HF, HBr, HCl,  $\text{HNO}_3$ . Gives bisulphite comp. Iodine + KOH  $\rightarrow$  iodoform.  $\text{NH}_3 \rightarrow$  di- and tri-acetonamine. H + Ni at 125°  $\rightarrow$  isopropyl alcohol.  $\text{H}_2\text{SO}_4 \rightarrow$  mesityl oxide and phorone.

*Oxime*: acetoxime. M.p. 59° (61°). B.p. 134-5°/730 mm. Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ , ligroin.  $D_4^{20}$  0.97.  $n_D^{20}$  1.41560. *Me ether*: b.p. 73°. Sol.  $\text{H}_2\text{O}$ . *Et ether*: b.p. 91-2°.

*Hydrazone*: oil. B.p. 124–5°.

*Phenylhydrazone*: m.p. 42°. B.p. 140°/16 mm.

*Diphenylhydrazone*: leaflets from ligroin. M.p. 148°.

*Methylphenylhydrazone*: b.p. 215–16°.

*o-Nitrophenylhydrazone*: m.p. 70°.

*p-Nitrophenylhydrazone*: yellow needles from EtOH. M.p. 149°.

*2:4-Dinitrophenylhydrazone*: yellow needles from EtOH. M.p. 128°.

*p-Bromophenylhydrazone*: plates from ligroin. M.p. 98–9° (93°).

*p-Iodophenylhydrazone*: cryst. from EtOH-H<sub>2</sub>O. M.p. 214–15°.

*1-Naphthylhydrazone*: cryst. from ligroin. M.p. 74°.

*2-Naphthylhydrazone*: yellow prisms from ligroin. M.p. 65.5°.

*1-Naphthoylethylhydrazone*: m.p. 145–6°.

*Semicarbazone*: needles from H<sub>2</sub>O or Me<sub>2</sub>CO. M.p. 190–1° decomp.

*2-Phenylsemicarbazone*: needles from EtOH. M.p. 140°.

*4-Phenylsemicarbazone*: needles. M.p. 160–1°.

*4:4-Diphenylsemicarbazone*: needles from Et<sub>2</sub>O. M.p. 119°.

*4-m-Nitrophenylsemicarbazone*: m.p. 210–11°.

*4-p-Nitrophenylsemicarbazone*: m.p. 235–6°.

*4-p-Bromophenylsemicarbazone*: m.p. 174°.

*4-o-Tolylsemicarbazone*: cryst. from EtOH.Aq. M.p. 154–6° decomp. (142–3°).

*4-p-Tolylsemicarbazone*: needles from EtOH. M.p. 174–5°.

*Thiosemicarbazone*: cryst. from H<sub>2</sub>O. M.p. 179°.

*2-Phenylthiosemicarbazone*: needles. M.p. 135°.

*4-Phenylthiosemicarbazone*: m.p. 128°.

*4-o-Tolylthiosemicarbazone*: m.p. 182°.

*4-p-Tolylthiosemicarbazone*: m.p. 142°.

*Semioxamazone*: needles from Me<sub>2</sub>CO. M.p. 147°.

*Cyanhydrin*: see under 1-Hydroxyisobutyric Acid.

*Anil*: isopropylideneaniline. B.p. 227–9°.

*Di-Me acetal*: 2:2-dimethoxypropane. C<sub>5</sub>H<sub>12</sub>O<sub>2</sub>. MW, 104. B.p. 83°.

*Di-Et acetal*: 2:2-diethoxypropane. C<sub>7</sub>H<sub>16</sub>O<sub>2</sub>. MW, 132. B.p. 114°.

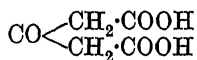
### Acetone-chloroform.

See Chloretone.

### Acetone-diacetic Acid.

See 3-Ketopimelic Acid.

### Acetone-dicarboxylic Acid (2-Ketoglutaric acid)



C<sub>5</sub>H<sub>6</sub>O<sub>5</sub>

MW, 146

Needles from EtOAc. M.p. 135° decomp. Sol. H<sub>2</sub>O, EtOH. Mod. sol. Et<sub>2</sub>O, EtOAc. Insol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, ligroin. Decomp. by hot H<sub>2</sub>O,

acids or alkalis to acetone + CO<sub>2</sub>. FeCl<sub>3</sub> → violet col.  $k = 7.9 \times 10^{-4}$  at 25°. NaHg → 2-hydroxyglutaric acid.

*Di-Me ester*: C<sub>7</sub>H<sub>10</sub>O<sub>5</sub>. MW, 174. B.p. 150°/25 mm., 128°/12 mm.

*Et ester*: C<sub>7</sub>H<sub>10</sub>O<sub>5</sub>. MW, 174. *Amide*: needles. M.p. 86°. Sol. EtOH. Mod. sol. CHCl<sub>3</sub>. Spar. sol. cold H<sub>2</sub>O, EtOH. *Anilide*: needles from H<sub>2</sub>O. M.p. 75–6°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin.

*Di-Et ester*: C<sub>9</sub>H<sub>14</sub>O<sub>5</sub>. MW, 202. Oil. B.p. 250°, 140°/13 mm. D<sub>4</sub><sup>20</sup> 1.113. Misc. EtOH. Spar. sol. H<sub>2</sub>O. *Semicarbazone*: cryst. from EtOH. M.p. 94–5°.

*Di-isobutyl ester*: C<sub>13</sub>H<sub>22</sub>O<sub>5</sub>. MW, 258. B.p. 220°/120 mm.

*Di-anilide*: needles from EtOH. M.p. 155°. Spar. sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

*Oxime*: m.p. 53–4°.

Adams, Chiles, Rassweiler, *Organic Syntheses*, Collective Vol. I, 9.

Jerdan, *J. Chem. Soc.*, 1899, 75, 809.

Ruggli, Doebel, *Helv. Chim. Acta*, 1946, 29, 600.

### Acetone dichloride.

See 2:2-Dichloropropane.

### Acetone diethylsulphone.

See Sulphonal.

### Acetone-dioxalic Acid.

See Triketopimelic Acid.

### Acetone-dipropionic Acid.

See 4-Ketoazelaic Acid.

### Acetone-oxalic Acid.

See Acetopyruvic Acid.

### Acetonic Acid.

See 1-Hydroxyisobutyric Acid.

### Acetonitrile (*Methyl cyanide, cyanomethane*)



C<sub>2</sub>H<sub>3</sub>N

MW, 41

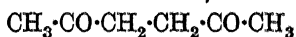
M.p. –44.9°. B.p. 81.6°. D<sub>4</sub><sup>20</sup> 0.7828. Misc. with H<sub>2</sub>O.  $n_D^{20}$  1.34423. Heat of comb. of vapour C<sub>7</sub> 312.14 Cal., liq. 304.0 Cal. Burns with luminous flame. Good solvent for inorg. salts. H<sub>2</sub>O at 100° → acetamide. Red. → ethylamine. H<sub>2</sub>S → thioacetamide. Benzoic acid at 280° → benzonitrile + acetic acid.

Walden, *Ber.*, 1907, 40, 3215.

van Epps, Reid, *J. Am. Chem. Soc.*, 1916, 38, 2130.

Yeo-Sein Gwan, *J. Indian Chem. Soc.*, 1941, 18, 164, (*Chem. Abstracts*, 1946, 40, 2782).

### Acetylacetone (1:2-Diacetylene, hexan-2-one-2:5, 2:5-diketohexane)



C<sub>6</sub>H<sub>10</sub>O<sub>2</sub>

MW, 114

M.p. –9°. B.p. 194°/754 mm., 137°/150



mm.  $D_4^{20}$  0.97370.  $n_D^{20}$  1.449. Misc. all proportions  $H_2O$ ,  $EtOH$ ,  $Et_2O$ .

*Monoxime*: b.p.  $130^\circ/11$  mm.

*Dioxime*: plates from  $C_6H_6$ . M.p.  $137^\circ$ . Sol.  $H_2O$ . Red.  $\rightarrow$  dimethylpyrrolidine.

*Di-phenylhydrazone*: plates from  $EtOH$ . M.p.  $120^\circ$ .

*Di-p-nitrophenylhydrazone*: red needles from  $EtOH$ . M.p.  $210-12^\circ$ .

*Di-2:4-dinitrophenylhydrazone*: m.p.  $257^\circ$ .

*Disemicarbazone*: m.p.  $223-4^\circ$ .

Knorr, *Ber.*, 1900, **33**, 1219.

Justoni, *Gazz. chim. ital.*, 1941, **71**, 375.

### Acetonyl Alcohol.

See Hydroxyacetone.

### Acetonylbenzene.

See Methyl benzyl Ketone.

### Acetonylbenzoic Acid.

See Methyl benzyl ketone carboxylic Acid.

### Acetonylcarbinol.

See 3-Keto-*n*-butyl Alcohol.

### Acetonylfuran.

See Methyl furfuryl Ketone.

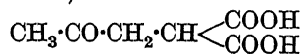
### 2-Acetonylheptane.

See 4-Methylnonanone-2.

### 2-Acetonylhexane.

See 4-Methyloctanone-2.

### Acetonylmalonic Acid (2-Butanone-4:4-dicarboxylic acid)



$C_6H_8O_5$  MW, 160

Plates from  $Et_2O$ . M.p.  $150^\circ$  decomp. Very sol.  $H_2O$ . Spar. sol.  $Et_2O$ . Heat  $\rightarrow$  levulinic acid +  $CO_2$ .

*Semicarbazone*: cryst. from  $H_2O$ . M.p.  $170^\circ$  decomp.

*Me ester nitrile*:  $C_7H_8O_2N$ . MW, 139. B.p.  $159-60^\circ/26$  mm.  $D^{16}$  1.148. *Phenylhydrazone*: needles. M.p.  $137-8^\circ$ .

*Et ester nitrile*:  $C_8H_{11}O_2N$ . MW, 153. B.p.  $161-71^\circ/24$  mm.  $D^{18}$  1.10. *Phenylhydrazone*: needles from  $EtOH$ . M.p.  $144^\circ$ .

Perkin, Simonsen, *J. Chem. Soc.*, 1907, **91**, 821.

### 2-Acetonylpiperidine.

See Isopelletierine.

### N-Acetonylpiperidine.

See Piperidinoacetone.

### Acetonyltoluene.

See Tolyacetone.

### 2-Aceto-octane.

See 3-Methylnonanone-2.

### 1-Aceto-1-octene.

See Methyl 1-octenyl Ketone.

### 8-Acetopelargonic Acid.

See 9-Ketoundecylic Acid.

### 1-Aceto-1:3-pentadiene.

See 2:4-Heptadienone-6.

### 2-Acetopentane.

See 3-Methylhexanone-2.

### 3-Acetopentane.

See 3-Ethylpentanone-2.

### 2-Aceto-3-pentanol.

See 3-Methyl-4-hexanolone-2.

### 1-Aceto-1-pentene.

See 3-Heptenone-2.

### 4-Aceto-1-pentene.

See 4-Methyl-1-hexenone-5.

### 5-Aceto-1-pentene.

See 1-Heptenone-6.

### 1-Aceto-2-pentene.

See 3-Heptenone-6.

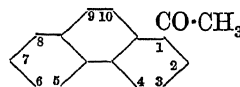
### 2-Aceto-2-pentene.

See 3-Methyl-3-hexenone-2.

### 5-Aceto-2-pentene.

See 2-Heptenone-6.

### 1-Acetophenanthrene



$C_{16}H_{12}O$

MW, 220

Plates from  $EtOH$ . M.p.  $112-3^\circ$ .

Bachmann, Boatner, *J. Am. Chem. Soc.*, 1936, **58**, 857, 2097.

### 2-Acetophenanthrene.

Needles from  $MeOH$ . M.p.  $143^\circ$ . Sol.  $EtOH$ ,  $C_6H_6$ .

*Semicarbazone*: leaflets from  $EtOH$ . M.p.  $260^\circ$ . Solidifies and remelts at  $297-9^\circ$ .

*Phenylhydrazone*: m.p.  $187-8^\circ$ .

Mosettig, Van de Kamp, *J. Am. Chem. Soc.*, 1930, **52**, 3704.

Riegel, Gold, Kubico, *J. Am. Chem. Soc.*, 1942, **64**, 2221.

### 3-Acetophenanthrene.

Needles from  $MeOH$ . M.p.  $72^\circ$ . Sol.  $MeOH$ ,  $EtOH$ ,  $AcOH$ ,  $C_6H_6$ . Spar. sol. pet. ether.

*Oxime*: needles from  $MeOH$ . M.p.  $143-4^\circ$ .

*Semicarbazone*: needles. M.p.  $228-30^\circ$ .

*Phenylhydrazone*: m.p.  $193-4^\circ$ .

*Picrate*: m.p.  $125-6^\circ$ .

Mosettig, van de Kamp, *J. Am. Chem. Soc.*, 1930, **52**, 3704.

### 4-Acetophenanthrene.

Clusters of plates. M.p.  $90^\circ$ .

*Picrate*: yellow needles from  $MeOH$ . M.p.  $129-30^\circ$ .

Fieser, Fieser, Hershberg, *J. Am. Chem. Soc.*, 1936, **58**, 2322.

### 9-Acetophenanthrene.

Needles from  $MeOH$ . M.p.  $74.5^\circ$ .

*Oxime*: needles from  $MeOH$ . M.p.  $154-5^\circ$ .

*Semicarbazone*: plates from  $MeOH$ . M.p.  $199-201^\circ$ .

*Picrate*: yellow needles from MeOH. M.p. 107–8°.

Bachmann, Boatner, *J. Am. Chem. Soc.*, 1936, 58, 2097.

Mosettig, van de Kamp, *J. Am. Chem. Soc.*, 1933, 55, 3442.

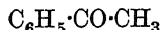
### Acetophenine.

See 2 : 4 : 6-Triphenylpyridine.

### Acetophenol.

See Hydroxyacetophenone.

**Acetophenone** (*Methyl phenyl ketone*, *Hyponone*)



$\text{C}_8\text{H}_8\text{O}$

MW, 120

Plates. M.p. 20.5°. B.p. 202°, 83–5°/12 mm. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O. Sol. conc. H<sub>2</sub>SO<sub>4</sub> with orange col. D<sub>4</sub><sup>25</sup> 1.0236.  $n_D^{20}$  1.53418. Soporific. CrO<sub>3</sub> → benzoic acid. Alk. KMnO<sub>4</sub> → benzoic acid. H<sub>2</sub>O<sub>2</sub> in H<sub>2</sub>SO<sub>4</sub> → benzoylcarbinol. Na + EtOH or Al<sub>2</sub>O<sub>3</sub>/Cu<sub>2</sub>O → methylphenylcarbinol.

*Oxime*: needles from H<sub>2</sub>O. M.p. 60°. B.p. 245°, 119°/20 mm. Mod. volatile in steam. *Me ether*: b.p. 214–16° decomp.

*Hydrazone*: cryst. from pet. ether. M.p. 22°. B.p. 255°. Decomp. by H<sub>2</sub>O.

*Phenylhydrazone*: needles from EtOH. M.p. 106°.

*o*-Nitrophenylhydrazone: m.p. 138°.

*m*-Nitrophenylhydrazone: m.p. 163°.

*p*-Nitrophenylhydrazone: orange-red needles. M.p. 184–5°.

2 : 4-Dinitrophenylhydrazone: m.p. 237°.

*p*-Bromophenylhydrazone: m.p. 111–12°.

*p*-Iodophenylhydrazone: m.p. 212°.

*o*-Tolylhydrazone: m.p. 101°.

*m*-Tolylhydrazone: m.p. 81°. B.p. 214–23°/12 mm.

*p*-Tolylhydrazone: needles from pet. ether. M.p. 125°.

*Methylphenylhydrazone*: m.p. 49–50°.

*Diphenylhydrazone*: cryst. from EtOH. M.p. 97–8°.

$\beta$ -Naphthylhydrazone: needles from EtOH. M.p. 157–8°.

*Semicarbazone*: plates from EtOH. M.p. 203° decomp.

2-Phenylsemicarbazone: cryst. from EtOH. M.p. 122°.

4-Phenylsemicarbazone: needles from EtOH. M.p. 187–8°.

4-*o*-Tolylsemicarbazone: needles from EtOH. M.p. 211–12° decomp.

4-*p*-Tolylsemicarbazone: needles. M.p. 192°.

$\beta$ -Naphthylsemicarbazone: needles from EtOH. M.p. 201–2°.

*Thiosemicarbazone*: cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 108°.

*Anil*: cryst. M.p. 41°. B.p. 310°, 166–7°/12 mm.

*Semioxamazone*: needles from EtOH. M.p. 214°.

*Picrate*: m.p. 53°.

*Di-Et acetal*: b.p. 212–6° part. decomp., 103–4°/23 mm. D<sub>4</sub><sup>0</sup> 0.9266.

Bouveault, *Bull. soc. chim.*, 1897, 17, 1020.

Nencki, Stoeber, *Ber.*, 1897, 30, 1769.

Senderens, *Ann. chim.*, 1913, 28, 312.

Williams, Dickert, Krynitsky, *J. Am. Chem. Soc.*, 1941, 63, 2510.

Berlin, *J. Gen. Chem. U.S.S.R.*, 1944, 14, 1096, (*Chem. Abstracts*, 1946, 40, 4054).

Salmi, Vaikhönen, *Chem. Abstracts*, 1947, 41, 5481.

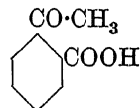
### Acetophenone-acetone.

See Phenacylacetone.

### Acetophenone Alcohol.

See Phenacyl Alcohol.

**Acetophenone-*o*-carboxylic Acid** (*o*-Acetobenzoic acid, *methyl o*-carboxyphenyl ketone)



$\text{C}_9\text{H}_8\text{O}_3$

MW, 164

Cryst. from H<sub>2</sub>O. M.p. 114–15°.

*Et ester*: C<sub>11</sub>H<sub>12</sub>O<sub>3</sub>. MW, 192. B.p. 279°.

*Amide*: C<sub>9</sub>H<sub>8</sub>O<sub>2</sub>N. MW, 163. Prisms from H<sub>2</sub>O. M.p. 116–5°. *N-Et*: plates from H<sub>2</sub>O. M.p. 93–4° decomp. Spar. sol. H<sub>2</sub>O.

Gabriel, Michael, *Ber.*, 1877, 10, 1551.

De Benneville, *J. Org. Chem.*, 1941, 6, 462.

Yalc, *J. Am. Chem. Soc.*, 1947, 69, 1547.

**Acetophenone-*m*-carboxylic Acid** (*m*-Acetobenzoic acid, *methyl m*-carboxyphenyl ketone).

Needles from H<sub>2</sub>O. M.p. 172°. Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O. Spar. sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

*Nitrile*: *m*-cyanoacetophenone. (C<sub>9</sub>H<sub>7</sub>ON. MW, 145. Needles from EtOH. M.p. 98–9°.

Rupe, Majewski, *Ber.*, 1900, 33, 3408.

**Acetophenone-*p*-carboxylic Acid** (*p*-Acetobenzoic acid, *methyl p*-carboxyphenyl ketone).

Needles from H<sub>2</sub>O. M.p. 208°. Sol. hot H<sub>2</sub>O. Spar. sol. EtOH, Et<sub>2</sub>O. Sublimes.

*Phenylhydrazone*: m.p. 234°.

*Semicarbazone*: m.p. 269°.

*Me ester*: C<sub>10</sub>H<sub>10</sub>O<sub>3</sub>. MW, 178. Needles from H<sub>2</sub>O. M.p. 92°. Sublimes.

*Et ester*: C<sub>11</sub>H<sub>12</sub>O<sub>3</sub>. MW, 192. Needles from H<sub>2</sub>O. M.p. 57°.

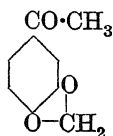
*Nitrile*: *p*-cyanoacetophenone. Needles from EtOH. M.p. 60–1°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. *Oxime*: plates from H<sub>2</sub>O. M.p. 160°.

Meyer, *Ann.*, 1883, 219, 260.

### Acetophenone- $\omega$ -dicarboxylic Acid.

See Benzoylmalonic Acid.

**Acetopiperone** (3 : 4-Methylenedioxyacetophenone)



$C_9H_8O_3$  MW, 164  
Leaflets from EtOH.Aq. M.p. 88°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Insol. pet. ether. Does not give bisulphite comp.

*Oxime* : needles from H<sub>2</sub>O. M.p. 156-7°.

*Phenyldrazone* : plates from EtOH. M.p. 114°.

Mameli, *Gazz. chim. ital.*, 1909, 39, II, 165.

### Acetopivalic Acid.

See Mesitonic Acid.

### 2-Acetopropane.

See Methyl isopropyl Ketone.

### 2-Acetopropionaldehyde.

See Levulinic Aldehyde.

### 1-Acetopropionic Acid.

See 1-Methylacetoacetic Acid.

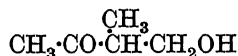
### 2-Acetopropionic Acid.

See Levulinic Acid.

### 1-Acetopropyl Alcohol.

See 3-Pentanolone-2.

### 2-Acetopropyl Alcohol (2-Methyl-1-butanolone-3)



$C_5H_{10}O_2$  MW, 102

B.p. 90-5°/15 mm. H<sub>3</sub>PO<sub>4</sub> dehydration → methyl isopropenyl ketone.

*Oxime* : b.p. 144°/20 mm.

Décombe, *Compt. rend.*, 1936, 202, 1685.

Bayer, D.R.P. 223,207 (*Chem. Zentr.*, 1910, II, 347).

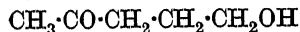
Colemore Adhesives, White, B.P. 551,219, (*Chem. Abstracts*, 1944, 38, 2350).

Dreyfus, Drewitt, U.S.P., 2,378,988, (*Chem. Abstracts*, 1945, 39, 4626).

Lincoln, Drewitt, U.S.P., 2,395,414, (*Chem. Abstracts*, 1946, 40, 3127).

Landau, Irany, *J. Org. Chem.*, 1947, 12, 422.

### 3-Acetopropyl Alcohol (Methyl 3-hydroxypropyl ketone, levulinic alcohol, 1-pentanolone-4)



$C_5H_{10}O_2$  MW, 102

B.p. 208°/730 mm. decomp., 144-5°/100 mm., 116-18°/33 mm. Cyclised by dist. at atm. press. → dihydromethylfuran. Misc. with H<sub>2</sub>O. Sol. EtOH, Et<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 1.0071. n<sub>D</sub><sup>17</sup> 1.4436. Steam volatile. Reduces NH<sub>3</sub>. AgNO<sub>3</sub>. Forms bisulphite comp. CrO<sub>3</sub> → levulinic acid. Electrolytic red. → n-amyl alcohol.

*Acetyl* : b.p. 211-3°, 91°/12 mm. D<sub>4</sub><sup>20</sup> 1.0181. n<sub>D</sub><sup>20</sup> 1.42677.

*Semicarbazone* : m.p. 155-7°.

Dict. of Org. Comp.—I.

*Phenyl ether* : C<sub>11</sub>H<sub>14</sub>O<sub>2</sub>. MW, 178. Plates from pet. ether. M.p. 55°. *Oxime* : m.p. 78°. *Semicarbazone* : plates from EtOH. M.p. 144°.

Possanner, Ehrenthal, *Monatsh.*, 1903, 24, 352.

Paul, *Bull. soc. chim.*, 1933, 53, 417; *Chem. Abstracts*, 1944, 38, 2334.

### γ-Acetopropylbenzene.

See 1-Phenylpentanone-4.

### p-Acetopropylbenzene.

See p-Propylacetophenone.

### Acetopyridine.

See Methyl pyridyl Ketone.

### Acetopyrine.

See under Antipyrine.

### Acetopyrocatechol.

See 3 : 4-Dihydroxyacetophenone.

### 4-Acetopyrogallol.

See Gallacetophenone.

### 5-Acetopyrogallol.

See 3 : 4 : 5-Trihydroxyacetophenone.

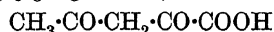
### Acetopyrotartaric Acid.

See Methylacetosuccinic Acid.

### 2-Acetopyrrole.

See Methyl 2-pyrrolyl Ketone.

**Acetopyruvic Acid** (1 : 3-Diketo-n-valeric acid, acetonylglyoxylic acid, acetone-oxalic acid)



$C_5H_6O_4$  MW, 130

Prisms from C<sub>6</sub>H<sub>6</sub>. M.p. 101°. B.p. 130°/37 mm. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, AcOEt, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Insol. pet. ether. Sublimes with part. decomp. Heat with alkalis → acetone + oxalic acid.

*Me ester* : C<sub>6</sub>H<sub>8</sub>O<sub>4</sub>. MW, 144. Cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 63-4°. B.p. 93-7°/12 mm. D<sub>4</sub><sup>20</sup> 1.1536. Enolises.

*Et ester* : C<sub>7</sub>H<sub>10</sub>O<sub>4</sub>. MW, 158. M.p. 18°. B.p. 213-15°, 134-5°/40 mm., 111-12°/16 mm. D<sub>4</sub><sup>17</sup> 1.12879. n<sub>D</sub><sup>17</sup> 1.475699. Enolises.

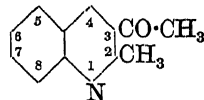
*Amide* : C<sub>5</sub>H<sub>7</sub>O<sub>3</sub>N. MW, 129. Cryst. from EtOH. M.p. 131-2° decomp. Easily sol. H<sub>2</sub>O. Sol. Me<sub>2</sub>CO, AcOH, AcOEt. Spar. sol. Et<sub>2</sub>O. Insol. pet. ether. FeCl<sub>3</sub> → red col.

Mumm, Bergell, *Ber.*, 1912, 45, 3045.

Breusch, Keskin, *Enzymologia*, 1945, 11, 356, (*Chem. Abstracts*, 1946, 40, 5702).

Lehninger, Witzemann, *J. Am. Chem. Soc.*, 1942, 64, 874.

### 3-Acetoquinaldine (2-Methyl-3-acetylquinoline)



$C_{12}H_{11}ON$  MW, 185

Needles from ligroin. M.p. 78-9°. B.p. 306°. Cryst. as hydrate from EtOH.Aq., m.p. 57.5°.

*Oxime* : cryst. + 1½H<sub>2</sub>O from EtOH.Aq. M.p. 118-20°, anhyd. 146°.

*Semicarbazone*: needles from EtOH. M.p. 208°.

*Phenylhydrazone*: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 130°. Unstable.

2:4-Dinitrophenylhydrazone: yellow, m.p. 216-7°.

*Picrate*: yellow, m.p. 233-4°.

Stark, *Ber.*, 1907, 40, 3427.

**6-Acetoquinaldine** (2-Methyl-6-acetylquinoline).

Needles from H<sub>2</sub>O. M.p. 92°. B.p. 318-20°. Spar. sol. cold H<sub>2</sub>O.

*Phenylhydrazone*: reddish-yellow needles from EtOH.Aq. M.p. 193°.

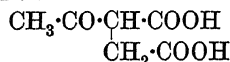
*Picrate*: yellow needles from H<sub>2</sub>O. M.p. 208-11°.

Berend, Thomas, *Ber.*, 1892, 25, 2548.

**Acetoresorcinol.**

See Dihydroxyacetophenone and Resacetophenone.

**Acetosuccinic Acid**

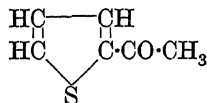


C<sub>6</sub>H<sub>8</sub>O<sub>5</sub> MW, 160

*Di-Et ester*: C<sub>10</sub>H<sub>16</sub>O<sub>5</sub>. MW, 216. B.p. 254-6° decomp., 239-40°/330 mm., 180-3°/50 mm., 140-2°/15 mm. D<sub>4</sub><sup>20</sup> 1.08809. n<sub>D</sub><sup>20</sup> 1.438. Boiling alc. KOH → acetic + succinic acid. Ba(OH)<sub>2</sub> → levulinic acid + CO<sub>2</sub>.

Fittig, Spenser, *Ann.*, 1894, 283, 67.

**2-Acethienone** (Methyl 2-thienyl ketone, 2-acetylthiophene)



C<sub>6</sub>H<sub>6</sub>OS MW, 126

M.p. 9°. B.p. 213-14°, 94.5-6.5°/13 mm. D<sub>24</sub><sup>24</sup> 1.167. n<sub>D</sub><sup>20</sup> 1.5667. KMnO<sub>4</sub> → thiophene-2-carboxylic acid. H<sub>2</sub>SO<sub>4</sub> + isatin → blue col.

C<sub>6</sub>H<sub>6</sub>OS, H<sub>3</sub>PO<sub>4</sub>: cryst. M.p. 92-6°. Mod. sol. Et<sub>2</sub>O.

*Oxime*: m.p. 81°.

*Semicarbazone*: plates from C<sub>6</sub>H<sub>6</sub>. M.p. 190-1°.

*Phenylhydrazone*: yellow needles from EtOH. M.p. 96°.

p-Nitrophenylhydrazone: red cryst. from EtOH. M.p. 181-2°.

*Benzoylhydrazone*: cryst. from toluene. M.p. 187-8°.

Hartough, Kosak, *J. Am. Chem. Soc.*, 1947, 69, 1012.

Johnson, *ibid.*, 150.

Hartough, Kosak, *J. Am. Chem. Soc.*, 1946, 68, 2639.

Mowry, Renoll, Huber, *ibid.*, 1105.

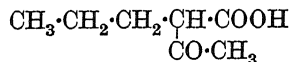
Stadnikoff, Rakowski, *Ber.*, 1928, 61, 268.

Bradley, *Ber.*, 1886, 19, 2115.

**o-Acethiophenol.**

See o-Mercaptoacetophenone.

**1-Aceto-n-valeric Acid** (1-Propylacetoacetic acid)



C<sub>7</sub>H<sub>12</sub>O<sub>3</sub> MW, 144

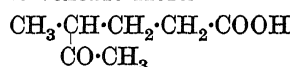
*Et ester*: C<sub>9</sub>H<sub>16</sub>O<sub>3</sub>. MW, 172. B.p. 210-12°/749 mm., 105-7°/13 mm. D<sub>4</sub><sup>20</sup> 0.981.

*Isobutyl ester*: C<sub>11</sub>H<sub>20</sub>O<sub>3</sub>. MW, 200. B.p. 115-16°/13 mm. D<sub>4</sub><sup>20</sup> 0.954.

*Amide*: C<sub>7</sub>H<sub>13</sub>O<sub>2</sub>N. MW, 143. Needles from EtOH-Et<sub>2</sub>O. M.p. 105-6°. Sol. H<sub>2</sub>O. FeCl<sub>3</sub> → blue col.

Burton, *Am. Chem. J.*, 1881, 3, 385.

**3-Aceto-n-valeric Acid**



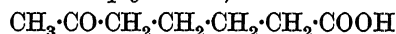
C<sub>7</sub>H<sub>12</sub>O<sub>3</sub> MW, 144

B.p. 168-9°/22 mm. D<sub>4</sub><sup>20</sup> 1.114.

*Et ester*: b.p. 117-18°/23 mm. D<sub>4</sub><sup>20</sup> 1.004.

March, *Ann. chim. phys.*, 1902, 26, 337.

**4-Aceto-n-valeric Acid** (ω-Aceto-n-valeric acid, 5-keto-n-heptylic acid)



C<sub>7</sub>H<sub>12</sub>O<sub>3</sub> MW, 144

M.p. 40-2° (31-2°). B.p. 250-3°/280 mm. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.

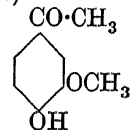
*Et ester*: b.p. 120.5°/11 mm. *Semicarbazone*: cryst. from EtOH. M.p. 107° (100-4°).

*Semicarbazone*: cryst. from AcOH. M.p. 144-6°.

Blaise, Köhler, *Compt. rend.*, 1909, 148, 490.

Polgar, Robinson, *J. Chem. Soc.*, 1945, 389.

**Acetovanillone** (4-Hydroxy-3-methoxyacetophenone, Apocynin)



C<sub>9</sub>H<sub>10</sub>O<sub>3</sub> MW, 166

Prisms from hot H<sub>2</sub>O. M.p. 115°. B.p. 295-300°, 233-5°/15-20 mm. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, hot H<sub>2</sub>O. Spar. sol. ligroin. Spar. volatile in steam. FeCl<sub>3</sub> → bluish-violet col.

*Me ether*: see Acetoveratrone.

*Et ether*: C<sub>11</sub>H<sub>14</sub>O<sub>3</sub>. MW, 194. Needles from EtOH.Aq. M.p. 78°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. *Oxime*: prisms from EtOH.Aq. M.p. 116-18°.

*Acetyl*: needles from EtOH.Aq. M.p. 58°.

*Benzoyl*: needles from EtOH.Aq. M.p. 106°.

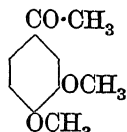
*Oxime*: cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 95°.

*Semicarbazone*: prisms from EtOH.Aq. M.p. 166°.

*Phenylhydrazone*: cryst. from H<sub>2</sub>O. M.p. 125°.

Reichstein, *Helv. Chim. Acta*, 1927, 10, 392.

**Acetoveratrone** (3 : 4-Dimethoxyacetophenone)



C<sub>10</sub>H<sub>12</sub>O<sub>3</sub> MW, 180

Prisms from EtOH.Aq. M.p. 51° (49°). B.p. 286-8°, 205-7°/10-15 mm. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, hot H<sub>2</sub>O. Spar. volatile in steam. HNO<sub>3</sub> + H<sub>2</sub>SO<sub>4</sub> → 6-nitro deriv.

*Oxime*: cryst. from EtOH.Aq. M.p. 140°.

*Semicarbazone*: cryst. from EtOH.Aq. M.p. 218°.

*Phenylhydrazone*: m.p. 131°.

*p-Nitrophenylhydrazone*: m.p. 227°.

Ploeg, *Rec. trav. chim.*, 1926, 45, 342.

**Acetoxime.**

See under Acetone.

**Acetoxyacetic Acid** (*Acetylglcollic acid*)



C<sub>4</sub>H<sub>6</sub>O<sub>4</sub> MW, 118

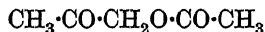
Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 66-8°. B.p. 145°/12 mm. Sol. H<sub>2</sub>O and most org. solvents.

*Et ester*: C<sub>6</sub>H<sub>10</sub>O<sub>4</sub>. MW, 146. B.p. 179°. D<sub>4</sub><sup>17</sup> 1.0993.

*Anilide*: needles from H<sub>2</sub>O. M.p. 89-90°.

Anschütz, Bertram, *Ber.*, 1903, 36, 466.

**Acetoxyacetone** (*Acetol acetate, acetylhydroxyacetone*)



C<sub>5</sub>H<sub>8</sub>O<sub>3</sub> MW, 116

B.p. 174-5°/138°/230 mm., 74°/18 mm., 66°/12 mm. Sol. EtOH, Et<sub>2</sub>O. Hyd. by H<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 1.0749. n<sub>D</sub><sup>20</sup> 1.4150.

*Oxime*: b.p. 144°/20 mm.

*Semicarbazone*: needles from MeOH. M.p. 145°.

*Phenylhydrazone*: plates from Et<sub>2</sub>O. Decomp. at 60°.

*p-Bromophenylhydrazone*: cryst. from EtOH. M.p. 137-8°.

*p-Nitrophenylhydrazone*: yellow cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 144°.

Nef, *Ann.*, 1904, 335, 260.

**Acetoxybenzoic Acid.**

See Acetylsalicylic Acid and under Hydroxybenzoic Acid.

**Acetoxycapric Acid.**

See under Hydroxycapric Acid.

**Acetoxycaprylic Acid.**

See under Hydroxycaprylic Acid.

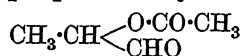
**Aceto-xylene.**

See Dimethylacetophenone.

**α-Acetoxyphenylacetic Acid.**

See under Mandelic Acid.

**1-Acetoxypropionaldehyde**



C<sub>5</sub>H<sub>8</sub>O<sub>3</sub> MW, 116

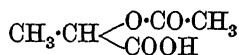
B.p. 52-5°/15 mm.

*Semicarbazone*: m.p. 163°.

Nef, *Ann.*, 1904, 335, 266.

Gresham, Brooks, U.S.P., 2,402,133, (*Chem. Abstracts*, 1946, 40, 6093).

**1-Acetoxypropionic Acid** (*Acetyl-lactic acid*)



C<sub>5</sub>H<sub>8</sub>O<sub>4</sub> MW, 132

M.p. 57-60° (39-40°). B.p. 167-70°/78 mm., 127°/11 mm. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>. Ba salt sol. H<sub>2</sub>O.

*Et ester*: C<sub>7</sub>H<sub>12</sub>O<sub>4</sub>. MW, 160. B.p. 177°/730 mm. Insol. H<sub>2</sub>O. D<sub>4</sub><sup>17</sup> 1.0458.

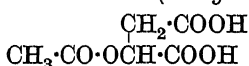
*Chloride*: C<sub>5</sub>H<sub>7</sub>O<sub>3</sub>Cl. MW, 150.5. B.p. 150° part. decomp., 56°/11 mm. D<sub>4</sub><sup>17</sup> 1.1920. n<sub>D</sub><sup>17</sup> 1.4241. Hyd. by H<sub>2</sub>O.

*Nitrile*: C<sub>5</sub>H<sub>7</sub>O<sub>3</sub>N. MW, 113. B.p. 172-3°, 73°/8 mm. Sol. H<sub>2</sub>O to 4%. Sol. EtOH, Et<sub>2</sub>O, AcOH. D<sub>4</sub><sup>14</sup> 1.032.

Auger, *Compt. rend.*, 1905, 140, 938.

Filachione, Fisher, U.S.P. 2,399,395, (*Chem. Abstracts*, 1946, 40, 4394).

**Acetoxysuccinic Acid** (*Acetyl-l-malic acid*)



C<sub>6</sub>H<sub>8</sub>O<sub>6</sub> MW, 176

M.p. 139° (132°). Hyd. by H<sub>2</sub>O. Heat → maleic + acetic acids.

*Di-Me ester*: C<sub>8</sub>H<sub>12</sub>O<sub>6</sub>. MW, 204. B.p. 157°/35 mm., 132°/12 mm. D<sub>4</sub><sup>20</sup> 1.1983. [α]<sub>D</sub><sup>20</sup> -22.9°.

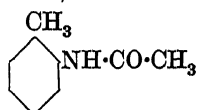
*Di-Et ester*: C<sub>10</sub>H<sub>16</sub>O<sub>6</sub>. MW, 232. B.p. 266°/730 mm., 141°/13 mm. D<sub>4</sub><sup>20</sup> 1.1168. n<sub>D</sub><sup>20</sup> 1.4295. [α]<sub>D</sub><sup>20</sup> -22.5°.

Anschütz, Bennert, *Ann.*, 1889, 254, 165.

**Acetphenetidide.**

See under Phenetidide.

**Acet-o-toluidide** (*Acetyl-o-toluidine, 1-methyl-2-acetylaminobenzene*)



C<sub>9</sub>H<sub>11</sub>ON MW, 149

Needles. M.p. 110°. B.p. 296°. 1000 parts H<sub>2</sub>O dissolve 8.6 parts at 19°. Heat of comb. C<sub>p</sub> 1174.6 Cal. KMnO<sub>4</sub> → *o*-acetylaminobenzoic acid.

*N*-Chloro: m.p. 43°. Sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. At 160° → 5-chloro-acet-*o*-toluidide.

*N*-Bromo: m.p. 100-5°.

*N*-Me: see under *N*-Methyl-*o*-toluidine.

*N*-Et: see under *N*-Ethyl-*o*-toluidine.

Kaufmann, *Ber.*, 1909, 42, 3481.

Ioffe, *Chem. Abstracts*, 1945, 39, 3786.

**Acet-*m*-toluidide** (*Acetyl-m-toluidine*, 1-methyl-3-acetylaminobenzene).

Needles. M.p. 65.5°. B.p. 303°, 182-3°/14 mm. Sol. EtOH, Et<sub>2</sub>O. 1000 parts H<sub>2</sub>O dissolve 4.4 parts at 13°. Heat of comb. C<sub>p</sub> 1174.7 Cal.

*N*-Me: see under *N*-Methyl-*m*-toluidine.

*N*-Et: see under *N*-Ethyl-*m*-toluidine.

Beilstein, Kuhlberg, *Ann.*, 1870, 156, 83.

**Acet-*p*-toluidide** (*Acetyl-p-toluidine*, 1-methyl-4-acetylaminobenzene).

Cryst. from EtOH.Aq. M.p. 155° (146°). B.p. 307°. Spar. sol. H<sub>2</sub>O. Sol. to 10% in EtOH at 25°. D<sub>15</sub> 1.212. Heat of comb. C<sub>p</sub> 1174.3 Cal. KMnO<sub>4</sub> → *p*-acetylaminobenzoic acid. Sublimes.

*N*-Chloro: m.p. 91-2°. Heat → 3-chloro-acet-*p*-toluidide.

*N*-Bromo: m.p. 94-5°. At 95° → 3-bromo-acet-*p*-toluidide.

*N*-Me: see under *N*-Methyl-*p*-toluidine.

Dehn, *J. Am. Chem. Soc.*, 1912, 34, 1405.

Ioffe, *Chem. Abstracts*, 1945, 39, 3786.

Sanford et al., *J. Am. Chem. Soc.*, 1945, 67, 1941.

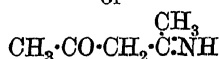
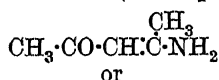
**Aceturic Acid.**

See Acetylglycine.

**Acet-xylidide.**

See under Xylidine.

**Acetylacetone** (*Aminopentenone*)



C<sub>5</sub>H<sub>9</sub>ON

MW, 99

M.p. 43°. B.p. 209°. Sol. H<sub>2</sub>O. Hot H<sub>2</sub>O or dil. acids → acetylacetone + NH<sub>3</sub>.

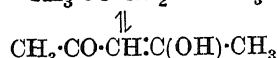
*N*-Benzoyl: prisms from MeOH. M.p. 82°. Sol. EtOH, Me<sub>2</sub>CO, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. Et<sub>2</sub>O, AcOH. Insol. pet. ether. *Phenylhydrazone*: yellow needles from MeOH. M.p. 130°.

*N*-Me: acetylacetone methylimide. C<sub>6</sub>H<sub>11</sub>ON. MW, 113. Plates. M.p. 45°. B.p. 200°.

*N*-Phenyl: see under Acetylacetone.

Combes, Combes, *Bull. soc. chim.*, 1892, 7, 779.

**Acetylacetone** (*Diacetylmethane*, *pentandione-2:4*, 2:4-diketopentane)



MW, 100

M.p. -23°. B.p. 139°/746 mm. Sol. H<sub>2</sub>O to 15% at 30°, 34% at 80°. Sol. dil. HCl. Misc. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub> all proportions. D<sub>4</sub><sup>25</sup> 0.9721. n<sub>D</sub><sup>25</sup> 1.45409. k = 1.5 × 10<sup>-6</sup> at 25°. Heat of comb. C<sub>p</sub> 616.3 Cal. Forms salts with many metals. Ox. → acetic acid. KOH → acetone + acetic acid. FeCl<sub>3</sub> → red col.

*Dioxime*: prisms from Et<sub>2</sub>O. M.p. 149-50°. Reduces Fehling's in cold.

*Monoanil*: *N*-phenylacetylacetoneamine. Plates from ligroin. M.p. 51-3°. B.p. 285-6°.

*Mono-methylphenylhydrazone*: m.p. 98°. B.p. 165°/12 mm.

*Enol form*:

M.p. -9°. n<sub>D</sub><sup>15</sup> 1.4609. Readily passes into equilibrium mixture.

*Me ether*: b.p. 58-9°/10 mm. D<sub>4</sub><sup>16</sup> 0.9740. n<sub>D</sub><sup>16</sup> 1.470.

*Et ether*: b.p. 69-70°/10 mm. D<sub>4</sub><sup>16</sup> 0.9477. n<sub>D</sub><sup>16</sup> 1.466.

*Acetyl*: b.p. 95-6°/20 mm D<sub>4</sub><sup>25</sup> 1.0483. n<sub>D</sub><sup>25</sup> 1.4507.

*Hippuric ester*: plates from CHCl<sub>3</sub>. M.p. 109°.

Knorr, *Ber.*, 1911, 44, 2771.

Claisen, *Ann.*, 1893, 277, 168.

Adams, Hauser, *J. Am. Chem. Soc.*, 1944, 66, 1220.

**Acetylacetonylguanidine.**

See 2-Amino-4:6-dimethylpyrimidine.

**Acetylacetophenone.**

See Diacetobenzene.

**Acetylacetylene.**

See 1-Butyne-3-one.

**Acetyl-*dl*-alanine** (*Inactive acetyl-1-amino-propionic acid*)



C<sub>5</sub>H<sub>9</sub>O<sub>3</sub>N

MW, 131

Needles or plates from H<sub>2</sub>O. M.p. 137-8°. Sol. H<sub>2</sub>O, EtOH. Insol. Et<sub>2</sub>O. Hyd. by acids or alkalis.

*B.HNO<sub>3</sub>*: needles. M.p. 64-5°.

*NH<sub>4</sub> salt*: needles + H<sub>2</sub>O. M.p. 100°.

*Et ester*: C<sub>7</sub>H<sub>13</sub>O<sub>3</sub>N. MW, 159. Needles. M.p. 39-40°.

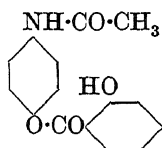
*Amide*: C<sub>5</sub>H<sub>10</sub>O<sub>2</sub>N<sub>2</sub>. MW, 130. Cryst. from H<sub>2</sub>O. M.p. 157-8°.

*Nitrile*: C<sub>5</sub>H<sub>9</sub>ON<sub>2</sub>. MW, 112. Leaflets. M.p. 102°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.

Fischer, Otto, *Ber.*, 1903, 36, 2115.

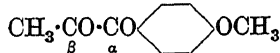
**Acetylamidrazone.**

See Phenylhydrazidine.

**Acetylamino-carbinol.**See *N*-Hydroxymethylacetamide.**Acetylamino-methyl Alcohol.**See *N*-Hydroxymethylacetamide.***p*-Acetylamino-phenyl salicylate (*Salophen*)** $C_{15}H_{13}O_4N$  MW, 271

White leaflets. M.p. 187–8°. Sol. EtOH, Et<sub>2</sub>O, dil. alkalis. Alk. sol. turns blue on warming. FeCl<sub>3</sub> → violet col. Odourless, tasteless. Analgesic and antipyretic. Triboluminescent.

Brewster, *J. Am. Chem. Soc.*, 1918, 40, 1136.

**Acetylanisoyl (*Methyl p*-methoxyphenyl diketone, *methyl-p*-methoxyphenylglyoxal)** $C_{10}H_{10}O_3$  MW, 178

Yellow needles. M.p. 48° (45°). Sol. EtOH, hot H<sub>2</sub>O. Volatile in steam.

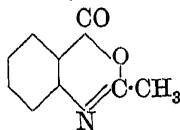
*α*-Oxime: needles from MeOH. M.p. 153°.

*Dioxime*: exists in two forms. (a) Needles from EtOH. M.p. 206°. *Diacetyl*: needles from EtOH. M.p. 104°. (b) Prisms. M.p. 125°.

*Diacetyl*: needles from EtOH. M.p. 89°.

*Disemicarbazone*: m.p. 235–6° decomp. Insol. EtOH.

Borsche, *Ber.*, 1907, 40, 742.

**Acetylanthranil (*Acetantranil*)** $C_9H_7O_2N$  MW, 161

Cryst. from ligroin–EtOH. M.p. 79–80°. B.p. 148–9°/13 mm.  $D_4^{20}$  1.2034.  $n_D^{20}$  1.5686. Hyd. → acetylanthranilic acid.

Bredt, Hof, *Ber.*, 1900, 33, 29.

Lothrop, Goodwin, *J. Am. Chem. Soc.*, 1943, 65, 363.

**Acetylanthranilic Acid (*Acetyl-o*-amino-benzoic acid, *lappaconitic acid*)** $C_9H_9O_3N$  MW, 179

Needles from AcOH. M.p. 185°. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, hot H<sub>2</sub>O, hot EtOH. Easily hyd. by dil. acids.  $k = 2.3 \times 10^{-4}$  at 25°.

*Me ester*:  $C_{10}H_{11}O_3N$ . MW, 193. Needles from EtOH. M.p. 101°.

*Et ester*:  $C_{11}H_{13}O_3N$ . MW, 207. Needles from EtOH. M.p. 64–5°.

*Amide*:  $C_9H_{10}O_2N_2$ . MW, 178. Needles from EtOH. M.p. 177°.

*Methylamide*: prisms from EtOH. M.p. 171–2°.

*Ethylamide*: plates from EtOH. M.p. 140°.

*Anilide*: needles from EtOH. M.p. 167–8°.

*Nitrile*:  $C_9H_8ON_2$ . MW, 160. Needles from H<sub>2</sub>O. M.p. 133°. Volatile in steam.

*N-Me*:  $C_{10}H_{11}O_3N$ . MW, 193. Needles. M.p. 192–3°. *Amide*:  $C_{10}H_{12}O_3N_2$ . MW, 192. Needles from EtOH. M.p. 155°.

*N-Acetyl*: diacetylanthranilic acid. Prisms from EtOH. M.p. 180°.

Kauffmann, *Ber.*, 1909, 42, 3482.

Bedson, *King, J. Chem. Soc.*, 1880, 37, 752.

**Acetylarisan.**

See under 2-Aminophenol-4-arsonic Acid.

**Acetylbenzoyl (*Methyl phenyl diketone, methylphenylglyoxal*)** $C_9H_8O_2$  MW, 148

Yellow oil. B.p. 222° (217–18°), 164°/116 mm., 102°/12 mm.  $D_4^{20}$  1.0065.  $n_D^{20}$  1.537. Sol. in 380 parts H<sub>2</sub>O at 20°. Volatile in steam. Forms bisulphite comp.

*α*-Oxime: *α*-phenyl-*α*-isonitrosoacetone, phenyl acetyl ketoxime. Yellow needles from AcOH. M.p. 166–7°. *Acetyl*: leaflets from EtOH.Aq. M.p. 61–2°. *Benzyl ether*: m.p. 62°.

*β*-Oxime: *α*-isonitrosopropiophenone, methyl benzoyl ketoxime. Needles from H<sub>2</sub>O. M.p. 114–5°.

*Dioxime*: methylphenylglyoxime. Needles from EtOH.Aq. M.p. 238–40°. *α*-Benzyl ether: leaflets. M.p. 157–8°. *Dibenzyl ether*: needles. M.p. 55–6°.

*α*-Phenylhydrazone: yellow needles from EtOH. M.p. 143–5°.

*Osazone*: yellow cryst. M.p. 104–5°.

*Di-p-nitrophenylhydrazone*: m.p. 256–7°.

*α*-Semicarbazone: m.p. 213°.

*Disemicarbazone*: m.p. 229–32°. Spar. sol. most solvents.

Borsche, *Ber.*, 1907, 40, 740.

Hartman, Roll, *Organic Syntheses*, XXIII, 1.

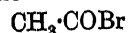
Wegmann, Dahn, *Helv. Chim. Acta*, 1946, 29, 1247.

**Acetylbenzoyl ethane.**

See Phenacylacetone.

**Acetylbenzoyl methane.**

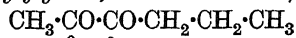
See Benzoylacetone.

**Acetyl bromide** $C_2H_3OBr$  MW, 123

Colourless fuming liq. M.p. — 96°. B.p. 81°, 71°/746 mm.  $D_4^{16}$  1.6625.  $n_D^{16}$  1.45376.

Gal, *Ann.*, 1864, 129, 53.  
Burton, Degering, *J. Am. Chem. Soc.*, 1940, 62, 227.

**Acetylbutyryl** (*Methyl propyl diketone, methylpropylglyoxal, hexandione-2 : 3*)



$\text{C}_6\text{H}_{10}\text{O}_2$  MW, 114

B.p. 128°.  $D_4^{19}$  0.934.

*3-Oxime*: methyl isonitrosobutyl ketone. Cryst. from EtOH. M.p. 60° (49.5°).

*Dioxime*: methylpropylglyoxime. Needles from Et<sub>2</sub>O. M.p. 175°. *Ni deriv.*: orange needles from EtOH or C<sub>6</sub>H<sub>6</sub>. M.p. 159–60° (144°). Sol. EtOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

*2-Phenylhydrazone*: cryst. from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 113–14°.

*3-Phenylhydrazone*: m.p. 108–9°.

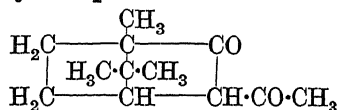
*Osozone*: yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 137–8°.

Dufraise, Moureu, *Bull. soc. chim.*, 1927, 41, 1370.

### Acetylbutyrylmethane.

See Butyrylacetone.

### 3-Acetylcamphor



$\text{C}_{12}\text{H}_{18}\text{O}_2$  MW, 194

Colourless oil, turning yellow in air. B.p. 127–8°/15 mm., 118–19°/11 mm.  $D_4^{19}$  1.0314.  $n_D^{17}$  1.49387. Sol. dil. alkalis. FeCl<sub>3</sub> → bluish-red col.

*Oxime*: needles. M.p. 164°.

*Cu deriv.*: Cu(C<sub>12</sub>H<sub>17</sub>O<sub>2</sub>)<sub>2</sub>. Dark green cryst. M.p. 200–2°. Sol. org. solvents.

Brühl, *Ber.*, 1904, 37, 762.

**Acetylcaproyl** (*Methyl n-amyl diketone, methyl-n-amylglyoxal, octandione-2 : 3, 2 : 3-diketo-octane*)



$\text{C}_8\text{H}_{14}\text{O}_2$  MW, 142

B.p. 172–3°/733 mm.

*2-Oxime*: isonitrosoethyl n-amyl ketone. M.p. 39°. B.p. 139°/16 mm.

*3-Oxime*: methyl isonitrosohexyl ketone. M.p. 59° (54°). B.p. 133°/11 mm.

*Dioxime*: methyl-n-amylglyoxime. Needles from EtOH.Aq. M.p. 173°.

*2-Phenylhydrazone*: plates from EtOH. M.p. 103–4°.

*Osozone*: yellowish-brown prisms from EtOH. M.p. 117–18°.

Ponzio, *Gazz. chim. ital.*, 1901, 31, i, 406.

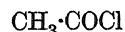
### Acetylcaproylmethane.

See Caproylacetone.

### Acetylcarbinol.

See Hydroxyacetone.

### Acetyl chloride

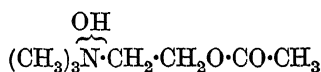


$\text{C}_2\text{H}_3\text{OCl}$  MW, 78.5

Colourless fuming liq. M.p. — 112°. B.p. 51–2°. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>, CS<sub>2</sub>.  $D_4^{20}$  1.1051.  $n_D^{20}$  1.38976. H<sub>2</sub>O → acetic acid + HCl. NH<sub>3</sub>.Aq. → acetamide. K<sub>2</sub>S → diacetyl sulphide. CaI<sub>2</sub> → acetyl iodide. Na acetate → acetic anhydride. Alcohols → acetic esters. C<sub>6</sub>H<sub>6</sub> + AlCl<sub>3</sub> → acetophenone. Aniline → acetanilide.

Aschan, *Ber.*, 1898, 31, 2346.

### Acetylcholine



$\text{C}_7\text{H}_{17}\text{O}_3\text{N}$  MW, 163

Occurs in blood, spleen, ergot, and plants. Present as complex in brain. More sensitive than choline to dil. alkalis. Easily hyd. Physiological activity 1000 times greater than that of choline.

*Bromide*: prisms from EtOH.Aq. M.p. 143°.

$\text{C}_7\text{H}_{16}\text{O}_2\text{NCl}$ ,  $\text{AuCl}_3$ : m.p. 166–8°.

$2\text{C}_7\text{H}_{16}\text{O}_2\text{NCl}$ ,  $\text{PtCl}_4$ : yellow needles from H<sub>2</sub>O. M.p. 242–4°.

Baeyer, *Ann.*, 1867, 143, 325.

Nothnagel, *Arch. Pharm.*, 1894, 232, 266.

Ewins, *Biochem. J.*, 1914, 8, 44.

Fourneau, Page, *Bull. soc. chim.*, 1914, 15, 550.

Dudley, *Biochem. J.*, 1929, 23, 1064.

Gaddum, *Annual Review of Biochemistry*, 1935, 4, 311.

### Acetylcoumaric Acid.

See under Coumaric Acid.

### Acetyl cyanide.

See under Pyruvic Acid.

### Acetyldibenzoylmethane.

See 1 : 1-Dibenzoylacetone.

### Acetyldimethyl Ether.

See Methoxyacetone.

### Acetyl disulphide.

See Diacetyl disulphide.

### Acetylene (*Ethine, ethyne*)



$\text{C}_2\text{H}_2$  MW, 26

Colourless gas. B.p. — 84°. H<sub>2</sub>O diss. 1 vol. at 18°. Me<sub>2</sub>CO diss. 25 vols. at 15° and 760 mm., 300 vols. at 12 atm., 2000 vols. at — 80°. EtOH diss. 6 vols., C<sub>6</sub>H<sub>6</sub> 4 vols., AcOH 6 vols. at 18°. Sol. CHCl<sub>3</sub>. Vapour press. of liq. 11 atm. at — 23°, 22 atm. at 0°, 103 atm. at 31°. Sp. gr. (liq.) at 0°, 0.451; solid at — 75°, 0.73. Heat of form. — 50 Cal. Heat of comb.



$C_p$  312.9 Cal. Crit. temp.  $37^\circ$ . Crit. press. 61.5 atm. Adds halogens to give di- and tetra-halogen comp.  $HOCl \rightarrow CHCl_2 \cdot CHO$ .  $H_2O$  (+ catalyst)  $\rightarrow CH_3 \cdot CHO$ .  $SeO_2 \rightarrow$  glyoxal.

*Na deriv.*:  $C_2HNa$ . Decomp. at  $210-20^\circ$ . Insol.  $Et_2O$ ,  $C_6H_6$ .

*Cu deriv.*:  $Cu_2C_2$ . Explodes at  $120^\circ$ . Insol.  $H_2O$ .

Nieuwland, Vogt, *The Chemistry of Acetylene*, (Am. Chem. Soc. Monograph No. 99).

### Acetylenecarboxylic Acid.

See Propiolic Acid.

**Acetylene chlorobromide** (1-Chloro-2-bromoethylene)



$C_2H_2ClBr$  MW, 141.5

B.p.  $81-2^\circ$ .  $D_4^{20}$  1.8157.

Plimpton, *J. Chem. Soc.*, 1882, 41, 393.

Nesmeyanov, Borisov, *Chem. Abstracts*, 1946, 40, 2123.

**Acetylene chloriodide** (1-Chloro-2-iodoethylene)



$C_2H_2ClI$  MW, 188.5

B.p.  $119^\circ$ .  $D_4^{20}$  2.2298.

Thiele, Haakh, *Ann.*, 1909, 369, 135.

Nesmeyanov, Borisov, *Chem. Abstracts*, 1946, 40, 2123, 3451.

**Acetylene dibromide** (sym.-Dibromoethylene)



$C_2H_2Br_2$  MW, 186

*Cis*:

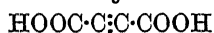
M.p.  $-53^\circ$ . B.p.  $112.5^\circ$ .  $D_4^{17.5}$  2.2846.  $n_D^{17.5}$  1.54312. Reacts with alc. KOH 125 times more rapidly than *trans* isomer  $\rightarrow$  bromoacetylene.

*Trans*:

M.p.  $-6.5^\circ$ . B.p.  $108^\circ$ .  $D_4^{17.5}$  2.2667.  $n_D^{17.5}$  1.55054.

van de Walle, *Bull. soc. chim. Belg.*, 1913, 27, 211.

### Acetylene-dicarboxylic Acid



$C_4H_2O_4$  MW, 114

Cryst. +  $2H_2O$  from aq.  $Et_2O$ . M.p. (anhyd.)  $179^\circ$ . Sol.  $H_2O$ ,  $EtOH$ ,  $Et_2O$ . Very powerful acid. Metallic salts decomp. by hot  $H_2O$ .  $NaHg$ , or  $Zn$  +  $AcOH \rightarrow$  succinic acid.  $I \rightarrow$  di-iodofumaric acid.  $HCl$ ,  $HBr$ ,  $HI \rightarrow$  chloro-, bromo-, and iodo-fumaric acids. Hot  $H_2O \rightarrow$  propiolic acid +  $CO_2$ .

*Di-Me ester*:  $C_6H_6O_4$ . MW, 142. B.p.  $195-8^\circ$  part. decomp.  $98^\circ/20$  mm.  $D_4^{20}$  1.1564.  $n_D^{20}$  1.4434.

*Di-Et ester*:  $C_8H_{10}O_4$ . MW, 170. B.p.  $184^\circ/200$  mm.,  $107-8^\circ/13$  mm.  $n_D^{25}$  1.4405. Heat of comb. C, 5634 Cal.

*Diamide*:  $C_4H_4O_2N_2$ . MW, 112. Microcryst. powder. Decomp. at  $294^\circ$ . Spar. sol.  $H_2O$ ,  $EtOH$ ,  $Et_2O$ ,  $AcOH$ ,  $CHCl_3$ .

*Dinitrile*:  $C_4N_2$ . MW, 76. Needles. M.p.  $21^\circ$ . B.p.  $76^\circ/753$  mm. Sublimes readily.  $D_4^{25}$  0.9703.  $n_D^{25}$  1.46471. Heat of comb. C, 6790 Cal.

Moureu, Bongrand, *Ann. chim.*, 1920, 14, 9.

Musante, *Gazz. chim. ital.*, 1935, 65, 199.

Gilman, Haubein, *J. Am. Chem. Soc.*, 1945, 67, 1420.

**Acetylene dichloride** (sym.-Dichloroethylene Dioform)



$C_2H_2Cl_2$  MW, 97

*Cis*:

M.p.  $-80^\circ$ . B.p.  $60^\circ$ .  $D_4^{15}$  1.2913 (1.2896).  $n_D^{15}$  1.45189. Reacts with KOH 20 times quicker than *trans* isomer  $\rightarrow$  chloroacetylene.

*Trans*:

M.p.  $-50^\circ$ . B.p.  $48^\circ$ .  $D_4^{15}$  1.2651.  $n_D^{15}$  1.44903.

Chavanne, *Compt. rend.*, 1912, 154, 776.

Ott, *Ber.*, 1942, 75, 1517.

**Acetylene di-iodide** (sym.-Di-iodoethylene)



$C_2H_2I_2$  MW, 280

*Cis*:

Colourless liq. M.p.  $-14^\circ$ . B.p.  $188^\circ$  decomp.,  $72.5^\circ/16$  mm.  $D_4^{20}$  3.0625. Reacts with 1% alc. KOH 200 times quicker than *trans* isomer  $\rightarrow$  iodoacetylene. KCN in  $EtOH \rightarrow$  maleic acid.

*Trans*:

Prisms from  $EtOH$ . M.p.  $78^\circ$  ( $73^\circ$ ). B.p.  $192^\circ$ ,  $77^\circ/16$  mm. Sublimes. Volatile in steam.  $D_4^{21}$  3.303. KCN in  $EtOH \rightarrow$  fumaric acid.

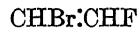
Keiser, *Am. Chem. J.*, 1899, 21, 265.

Gaade, *Rec. trav. chim.*, 1946, 65, 823.

### Acetylenediurene.

See Glycoluril.

**Acetylene fluorobromide** (sym.-Fluorobromoethylene)



$C_2H_2FBr$  MW, 125

B.p.  $36^\circ$ .  $D_4^{16.5}$  1.6939.

Swarts, *Chem. Zentr.*, 1909, II, 1414: *Bull. soc. chim.*, 1919, 25, 153.

**Acetylene fluorochloride** (sym.-Fluorochloroethylene)



$C_2H_2FCl$  MW, 80.5

B.p. 10–11°. Sol. EtOH. Insol. H<sub>2</sub>O.

Swarts, *Chem. Zentr.*, 1903, I, 13; *Bull. soc. chim.*, 1919, 25, 153.

Lamb, Mast, U.S.P., 2,377,297, (*Chem. Abstracts*, 1945, 39, 4081).

### Acetylene tetrabromide.

See sym.-Tetrabromoethane.

### Acetylene tetrachloride.

See sym.-Tetrachloroethane.

### Acetylenylbenzene.

See Phenylacetylene.

### Acetylenylcarbinol.

See Propargyl Alcohol.

### Acetylenylfuran.

See Furylacetylene.

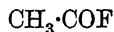
### 2-Acetylenylisobutyric Acid.

See 1-Pentyne-4-carboxylic Acid.

### 1-Acetylenyl-3-propynylethane.

See 1:5-Heptadi-yne.

### Acetyl fluoride



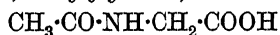
C<sub>2</sub>H<sub>3</sub>OF MW, 62

Colourless liq. B.p. 20–1°. D<sup>0</sup> 1.032. Sol. EtOH, Et<sub>2</sub>O, AcOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. CS<sub>2</sub>. D<sup>15</sup> 1.002. Decomp. by H<sub>2</sub>O. Reacts similarly to CH<sub>3</sub>COCl but less vigorously.

Meslans, *Compt. rend.*, 1892, 114, 1020.

Mashentsev, *J. Applied Chem. U.S.S.R.*, 1941, 14, 816, (*Chem. Abstracts*, 1943, 37, 1990): 1946, 16, 203, (*Chem. Abstracts*, 1947, 41, 706).

### Acetylglycine (*Acetyl aminoacetic acid, aceturic acid, acetylglycolic*)



C<sub>4</sub>H<sub>7</sub>O<sub>3</sub>N MW, 117

Cryst. from H<sub>2</sub>O. M.p. 206°. Sol. H<sub>2</sub>O to 2.7% at 15°. Mod. sol. EtOH. Spar. sol. Me<sub>2</sub>CO, CHCl<sub>3</sub>, AcOH. Insol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Hyd. by acids or alkalis.  $k = 2.3 \times 10^{-4}$  at 25°. Cu, Ag, and Ba salts sol. H<sub>2</sub>O.

*Me ester*: C<sub>5</sub>H<sub>9</sub>O<sub>3</sub>N. MW, 131. M.p. 58–9°. B.p. 254°/712 mm. Sol. H<sub>2</sub>O, EtOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

*Et ester*: C<sub>6</sub>H<sub>11</sub>O<sub>3</sub>N. MW, 145. Leaflets from Et<sub>2</sub>O. M.p. 48°. B.p. 260°/712 mm., 145°/14 mm. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

*Chloride*: C<sub>4</sub>H<sub>6</sub>O<sub>2</sub>NCl. MW, 135.5. Plates from acetyl chloride. Decomp. at 115–18°.

*Amide*: C<sub>4</sub>H<sub>8</sub>O<sub>2</sub>N<sub>2</sub>. MW, 116. Plates from H<sub>2</sub>O. M.p. 137°. Sol. H<sub>2</sub>O, EtOH. Insol. Et<sub>2</sub>O. Hyd. by hot H<sub>2</sub>O.

*Hydrazide*: prisms from EtOH–Et<sub>2</sub>O. M.p. 115°. B, HCl: m.p. 177°.

*N-Phenyl*: see under Phenylglycine.

Radenhausen, *J. prakt. Chem.*, 1895, 52, 437.

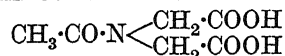
### Acetylglycollic Acid.

See Acetoxyacetic Acid.

### Acetylhydroperoxide.

See Peracetic Acid.

### Acetylaminodiacetic Acid



C<sub>6</sub>H<sub>9</sub>O<sub>5</sub>N MW, 175

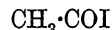
*Di-Me ester*: C<sub>8</sub>H<sub>13</sub>O<sub>5</sub>N. MW, 203. M.p. 84°. B.p. 184°/15 mm.

*Diamide*: C<sub>8</sub>H<sub>11</sub>O<sub>3</sub>N<sub>3</sub>. MW, 173. Needles from MeOH. Decomp. at 203°. Sol. hot H<sub>2</sub>O.

*Di-nitrile*: oil. B.p. 227°/16 mm. Acids or alkalis → acetic + iminodiacetic acids.

Jongkees, *Rec. trav. chim.*, 1908, 27, 310.

### Acetyl iodide



C<sub>2</sub>H<sub>3</sub>OI MW, 170

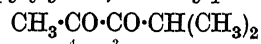
Colourless liq. B.p. 108°, 36°/50 mm. D<sup>17</sup> 1.98. Fumes strongly in air, and turns brown with pptn. of iodine. H<sub>2</sub>O → acetic acid + HI.

Thiele, Haakh, *Ann.*, 1909, 369, 145.

### Acetylisoamylmethane.

See Isoamylacetone.

**Acetylisobutyryl** (*Methyl isopropyl diketone, methylisopropylglyoxal, 2-methylpentandione-3:4*)



C<sub>6</sub>H<sub>10</sub>O<sub>2</sub> MW, 114

Yellow liq. B.p. 115–16°. Spar. sol. H<sub>2</sub>O. D<sup>11</sup> 0.9215.

*3-Oxime*: methyl isonitrosobutyl ketone. Plates from EtOH. M.p. 75°.

*4-Oxime*: isonitrosoethyl isopropyl ketone. Needles from H<sub>2</sub>O. M.p. 94°. Volatile in steam.

*Dioxime*: methylisopropylglyoxime. Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 155–8°.

*Osazone*: yellow needles from EtOH. M.p. 117°.

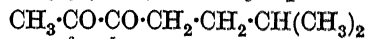
Pauly, Lieck, *Ber.*, 1900, 33, 503.

Adams, Buls, U.S.P., 2,393, 593, (*Chem. Abstracts*, 1946, 40, 2466).

### Acetylisobutyrylmethane.

See Isobutyrylacetone.

**Acetylisocaproyl** (*Methyl isoamyl diketone, methylisoamylglyoxal, 2-methylheptandione-5:6*)



C<sub>8</sub>H<sub>14</sub>O<sub>2</sub> MW, 142

B.p. 163°. D<sup>19</sup> 0.8814.

*5-Oxime*: isonitrosoisoamylacetone. Cryst. from pet. ether. M.p. 32–3°. B.p. 128°/18 mm.

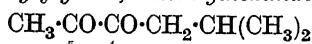
*Dioxime*: methylisoamylglyoxime. Needles from EtOH. Aq. M.p. 172–3° (177–8°).

*5-Phenylhydrazone*: needles from EtOH. M.p. 92–3°.

*6-Phenylhydrazone*: needles from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 99–100°.

*Osazone*: needles from EtOH.Aq. M.p. 114°.  
Otte, v. Pechmann, *Ber.*, 1889, 22, 2123.

**Acetylisovaleryl** (*Methyl isobutyl diketone, methylisobutylglyoxal, 2-methylhexandione-4:5*)



$\text{C}_7\text{H}_{12}\text{O}_2$  MW, 128

B.p. 138°.  $D_4^{20}$  0.908.

*4-Oxime*: methyl isonitrosoisoamyl ketone. Leaflets. M.p. 42°. Sol. EtOH, Et<sub>2</sub>O, alkalis with intense yellow col. Spar. sol. cold H<sub>2</sub>O. Sublimes.

*5-Oxime*: isonitrosoethyl isobutyl ketone. Needles from EtOH.Aq. M.p. 64–5°.

*Dioxime*: methylisobutylglyoxime. Leaflets from EtOH.Aq. M.p. 171–2°. *Ni deriv.*: orange needles. M.p. 160°.

*4-Phenylhydrazone*: yellow needles. M.p. 94°.

*5-Phenylhydrazone*: m.p. 98°.

*Osazone*: needles. M.p. 116–17°.

v. Pechmann, *Ber.*, 1889, 22, 2122.

**Acetylmesityl oxide** (*2-Methylheptene-2-dione-4:6, 4:6-diketo-2-methylheptene-2*)



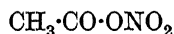
$\text{C}_8\text{H}_{12}\text{O}_2$  MW, 140

B.p. 204–6°. Sol. alkalis. Alc. FeCl<sub>3</sub> → red col.

*Cu deriv.*: olive-green powder. M.p. 123°. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, ligroin, hot EtOH.

Claisen, Ehrhardt, *Ber.*, 1889, 22, 1013.

**Acetyl nitrate**

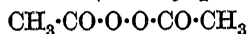


$\text{C}_2\text{H}_3\text{O}_4\text{N}$  MW, 105

Colourless, hygroscopic fuming liq. B.p. 22°/70 mm.  $D_4^{20}$  1.24. Explodes violently if suddenly heated. Hyd. by H<sub>2</sub>O to acetic and nitric acids. Powerful nitrating agent. Toluene → *o*- and some *p*-nitrotoluene. Acetanilide → *o*-nitroacetanilide.

Pictet, Khotinsky, *Ber.*, 1907, 40, 1164.

**Acetyl peroxide** (*Diacetyl peroxide*)



$\text{C}_4\text{H}_6\text{O}_4$  MW, 118

Cryst. M.p. 26.5° (30°). B.p. 63°/21 mm. Exceedingly explosive. Very pungent odour. Aq. sol. slowly evolves O<sub>2</sub>.

Walker, *J. Chem. Soc.*, 1928, 2041.

D'Ans, Friedrich, *Z. anorg. allgem. Chem.*, 1912, 73, 357.

**Acetylphenanthrene.**

See Acetophenanthrene.

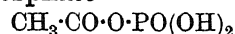
**Acetylphenol.**

See Hydroxyacetophenone.

**Acetylphenylenediamine.**

See Aminoacetanilide.

**Acetyl phosphate**



$\text{C}_2\text{H}_5\text{O}_5\text{P}$  MW, 140

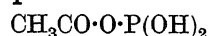
Decomp. in sol. Isolated as Ag salt.

Lynen, *Ber.*, 1940, 73, 367.

Lipmann, Tuttle, *J. Biol. Chem.*, 1944, 153, 571.

Bentley, *J. Am. Chem. Soc.*, 1948, 70, 2183.

**Acetyl phosphite**

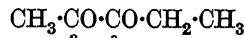


$\text{C}_2\text{H}_5\text{O}_4\text{P}$  MW, 124

Small plates. M.p. approx. 110° decomp. Sol. H<sub>2</sub>O, EtOH.

Wedenski, *J. Russ. Phys. Chem. Soc.*, 1888, 20, 31.

**Acetylpropionyl** (*Methyl ethyl diketone, methylethylglyoxal, 2:3-diketopentane, pentandione-2:3*)



$\text{C}_5\text{H}_8\text{O}_2$  MW, 100

Yellow liq. B.p. 108°. Sol. 15 parts H<sub>2</sub>O at 15°.  $D_4^{20}$  0.9565.  $n_D^{20}$  1.40135. Zn + H<sub>2</sub>SO<sub>4</sub> → methyl ethyl ketol.

*2-Oxime*: isonitrosodiethyl ketone. Leaflets. M.p. 69–71° (60–2°).

*3-Oxime*: methyl isonitrosopropyl ketone. Leaflets. M.p. 58–9° (54–5°). B.p. 183–7° part. decomp. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, alkalis (yellow sols.).

*Di-Me acetal*: b.p. 162–3°.  $D_4^{20}$  0.973.

*Dioxime*: methylethylglyoxime. Needles from EtOH. M.p. 172–3° part. sublimation. Sol. EtOH.

*2-Phenylhydrazone*: m.p. 102–3°.

*3-Phenylhydrazone*: m.p. 116–17°.

*Bis-2:4-dinitrophenylhydrazone*: m.p. 280–1°.

*Osazone*: yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 166–7°.

Manasse, *Ber.*, 1888, 21, 2177.

Adams, Buls, U.S.P., 2,393,532, (*Chem. Abstracts*, 1946, 40, 2466).

Hearne, Adams, Buls, B.P., 586,754, (*Chem. Abstracts*, 1947, 41, 6894).

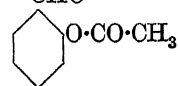
**unsym.-Acetylpropionylethane.**

See Methylpropionylacetone.

**Acetylpropionylmethane.**

See Propionylacetone.

**Acetylsalicylaldehyde**



$\text{C}_9\text{H}_8\text{O}_3$  MW, 164

Needles from pet. ether or EtOH. M.p. 38–9°. B.p. 253°, 142°/18 mm. Sol. Et<sub>2</sub>O, EtOH. FeCl<sub>3</sub> → purple col. Forms bisulphite comp.

*Semicarbazone*: powder from Me<sub>2</sub>CO. M.p. 167°.

*Phenylhydrazone*: plates from EtOH. M.p. 141-2°.

*o-Nitrophenylhydrazone*: red needles from EtOH. M.p. 160°.

*m-Nitrophenylhydrazone*: red needles from EtOH. M.p. 165°.

*p-Nitrophenylhydrazone*: red needles from EtOH or AcOH. Yellow needles + ½ C<sub>6</sub>H<sub>6</sub> from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 185-6°.

*o-Tolylhydrazone*: yellow needles from EtOH.Aq. M.p. 111°.

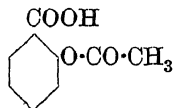
*o-Bromophenylhydrazone*: needles from EtOH. M.p. 114°.

*p-Bromophenylhydrazone*: plates from EtOH, C<sub>6</sub>H<sub>6</sub>, or ligroin. M.p. 137-8°.

Perkin, *Ann.*, 1868, 148, 203.

Rivals, *Compt. rend.*, 1897, 124, 369.

**Acetylsalicylic Acid** (*o*-Acetoxybenzoic acid, *Aspirin*)



C<sub>9</sub>H<sub>8</sub>O<sub>4</sub>

MW, 180

White cryst. M.p. 135° (rapid heat.). Liq. solidifies at 118°. Sol. EtOH to 20%. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>. Sol. 100 parts H<sub>2</sub>O at 37°. Slowly hyd. by H<sub>2</sub>O. Gives no col. with FeCl<sub>3</sub>. *k* = 3.27 × 10<sup>-4</sup> at 25°. Analgesic and antipyretic.

*Me ester*: C<sub>10</sub>H<sub>10</sub>O<sub>4</sub>. MW, 194. Colourless cryst. M.p. 49°. Sol. EtOH. Insol. H<sub>2</sub>O.

*Et ester*: C<sub>11</sub>H<sub>12</sub>O<sub>4</sub>. MW, 208. Colourless liq. B.p. 272°.

*Phenyl ester*: C<sub>15</sub>H<sub>12</sub>O<sub>4</sub>. MW, 256. Acetylsalol. M.p. 97°. B.p. 197-8°/11 mm.

*Benzyl ester*: C<sub>16</sub>H<sub>14</sub>O<sub>4</sub>. MW, 270. Cryst. M.p. 25-6°.

Kaufmann, *Ber.*, 1909, 42, 3482.

Ciusa, Sollazzo, *Chem Zentr.*, 1943, II, 615.

**Acetyl sulphide.**

See Diacetyl sulphide.

**Acetyltartaric Acid.**

See under Tartaric Acid.

**Acetylthiophene.**

See Acetothienone.

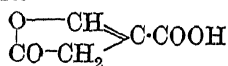
**Acetylvalerylmethane.**

See Octandione-2 : 4.

**Acidol.**

See under Betaine.

**Aconic Acid**



C<sub>5</sub>H<sub>4</sub>O<sub>4</sub>

MW, 128

Cryst. from H<sub>2</sub>O or EtOH. M.p. 164°. Sol. 5-6 parts H<sub>2</sub>O at 15°. Salts are sol. H<sub>2</sub>O. HCl or HBr → chloro- or bromo-itaconic acid.

*Me ester*: C<sub>6</sub>H<sub>6</sub>O<sub>4</sub>. MW, 142. Prisms. M.p. 85°. Sol. EtOH, Et<sub>2</sub>O.

Fittig, *Ann.*, 1883, 216, 91.

**Aconine**

C<sub>21</sub>H<sub>25</sub>O(OCH<sub>3</sub>)<sub>4</sub>(OH)<sub>4</sub>N  
C<sub>25</sub>H<sub>41</sub>O<sub>9</sub>N MW, 499

Hyd. product of aconitine. Amorph. Sol. H<sub>2</sub>O, EtOH, CHCl<sub>3</sub>. Prac. insol. Et<sub>2</sub>O, pet. ether. Dextrorotatory.

*B.HCl, 2H<sub>2</sub>O*: decomp. at 169-70°. [α]<sub>D</sub><sup>20</sup> - 3.70° in H<sub>2</sub>O.

*Tetra-acetyl deriv.*: decomp. at 240-1°. [α]<sub>D</sub><sup>20</sup> - 32.5° in CHCl<sub>3</sub>.

Majima, Suginomé, Morio, *Ber.*, 1924, 57, 1456.

Craig *et al.*, *J. Biol. Chem.*, 1944, 154, 293.

**ψ-Aconine** (*Pseudaconine*)

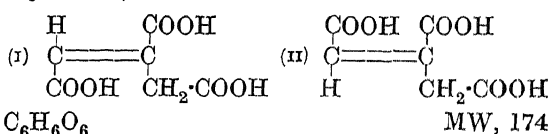
C<sub>20</sub>H<sub>22</sub>(OCH<sub>3</sub>)<sub>4</sub>(OH)<sub>4</sub>NCH<sub>3</sub>  
C<sub>25</sub>H<sub>41</sub>O<sub>8</sub>N MW, 483

Hyd. product of ψ-aconitine. Colourless cryst. + 1Me<sub>2</sub>CO from Me<sub>2</sub>CO. M.p. 93-4°. [α]<sub>D</sub><sup>20</sup> + 38.7° in H<sub>2</sub>O.

*Tetra-acetyl deriv.*: m.p. 228°. [α]<sub>D</sub><sup>20</sup> - 8.1° in EtOH.

Henry, Sharp, *J. Chem. Soc.*, 1928, 1105.

**Aconitic Acid** (*Propylene-1 : 2 : 3-tricarboxylic acid*)



*Trans*- (I):

Leaflets from H<sub>2</sub>O. M.p. 194-5°. Sol. 5.5 parts H<sub>2</sub>O at 13°, 2 parts 88% EtOH at 12°. Spar. sol. Et<sub>2</sub>O. Decomp. at the m.p. or by heat. with H<sub>2</sub>O at 180° to itaconic acid + CO<sub>2</sub>. *k* (first) = 1.58 × 10<sup>-3</sup> at 25° (1.36 × 10<sup>-3</sup> at 25°); *k* (second) = 3.5 × 10<sup>-5</sup> at 25°. Heat of comb. C<sub>v</sub> 481.32 Cal. (476.3), C<sub>p</sub> 475.4 Cal. Na.Hg → tricarballic acid. HBr at 100° → bromotricarballic acid. Brown cherry-red col., changing to fuschin red, with Ac<sub>2</sub>O/Py.

*Me esters*: C<sub>7</sub>H<sub>8</sub>O<sub>6</sub>. MW, 188. The three possible esters have been prepared. α. Prisms from Me<sub>2</sub>CO-C<sub>6</sub>H<sub>6</sub>. M.p. 136-7°. β. Prisms from Me<sub>2</sub>CO-C<sub>6</sub>H<sub>6</sub>. M.p. 144-5°. γ. Prisms from Me<sub>2</sub>CO-C<sub>6</sub>H<sub>6</sub>. M.p. 154-5°.

*Tri-Me ester*: C<sub>9</sub>H<sub>12</sub>O<sub>8</sub>. MW, 216. B.p. 270°, 170-80°/25 mm., 161°/14 mm. Sol. EtOH, Et<sub>2</sub>O.

*Tri-Et ester*: C<sub>12</sub>H<sub>18</sub>O<sub>8</sub>. MW, 258. Oil. B.p. 275° decomp., 250-3°/250 mm., 174-5°/22 mm., 164-5°/12 mm. D<sub>4</sub><sup>20</sup> 1.1064. n<sub>D</sub><sup>20</sup> 1.45562.

*Tripropyl ester*: C<sub>15</sub>H<sub>24</sub>O<sub>6</sub>. MW, 300. B.p. 195°/13 mm.

*Trichloride*:  $C_6H_3O_3Cl_3$ . MW, 229.5. B.p. 155–7°/20 mm.

*Triamide*:  $C_6H_3O_3N_3$ . MW, 171. Needles. Turns brown at 250°. Sinters without melting at about 260°. Sol. hot  $H_2O$ . Insol. EtOH,  $Et_2O$ ,  $CHCl_3$ .

*Anhydride*: m.p. 134–5°.

*Cis*- (II):

M.p. 125°. Heat.  $\rightarrow$  *trans*. Adds Br more easily than *trans*.

*Me esters*:  $\alpha$ . Prisms from  $Me_2CO-C_6H_6$ . M.p. 101–2°.  $\beta$ . Prisms from  $Me_2CO-C_6H_6$ . M.p. 102–4°.  $\gamma$ . Prisms from  $Me_2CO-C_6H_6$ . M.p. 126–7°. Irradiation gives corresponding *trans*-esters.

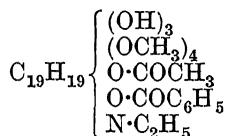
*Anhydride*: m.p. 74°.

*Monoamide*:  $(-CH_2 \cdot CO \cdot NH \cdot C_6H_5)$ . Pale yellow prisms from EtOH. M.p. 170° decomp.

*Dianilide*: may be from I or II. (1) Needles from EtOH. M.p. 188–9°. (2) Needles from EtOH. M.p. 199–200°.

Malachowski, Maslowski, *Ber.*, 1928, 61, 2521, 2525.

### Aconitine



$C_{34}H_{47}O_{11}N$  MW, 647

Principal alkaloid of *Aconitum napellus*, Linn. (monkshood) and other species. Colourless cryst. M.p. 204°.  $[\alpha]_D + 17.3^\circ$  in  $CHCl_3$ . Aq. sol. alk. to litmus.

*B.HCl*: cryst. Decomp. at 170–2°.  $[\alpha]_D - 29.2^\circ$  in  $H_2O$ .

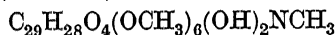
*B.HBr*: m.p. 176–80°.  $[\alpha]_D - 29.1^\circ$  in  $H_2O$ .

*B.HAuCl\_4*: m.p. 157–8°, 136° (air-dried), 151–2° (dried at 100°), 138–40° (from  $Me_2CO$ ), 177° (from  $CHCl_3$ ).

*Styphnate*: m.p. 120°.

Majima, *Proc. Imper. Acad. Tokyo*, 1929, 5, 415.

$\psi$ -Aconitine (*Pseudoaconitine*, *nepaline*, *acetyl veratroyl- $\psi$ -aconine*)



$C_{36}H_{51}O_{12}N$  MW, 689

From *Aconitum deinorrhizum*, Stapf., and *A. Balfourii*, Stapf. Needles from  $Et_2O$ . M.p. 214° slight decomp. Sol. EtOH,  $Et_2O$ . Prac. insol.  $H_2O$ .  $[\alpha]_D + 17.06^\circ$  in EtOH, + 22.75° in  $CHCl_3$ . Hyd.  $\rightarrow$   $\psi$ -aconine + acetic and veratric acids.

*B.HCl, 3H\_2O*: m.p. 179–82°.  $[\alpha]_D^{20} - 18.1^\circ$  in  $H_2O$ .

*B.HBr, 3H\_2O*: m.p. 199°.  $[\alpha]_D^{20} - 18.5^\circ$  in  $H_2O$ .

*B.HI, 1H\_2O*: m.p. 230°.

*B.HNO\_3, 1H\_2O*: m.p. 198°.  $[\alpha]_D^{18} - 17.95^\circ$  in  $H_2O$ .

*B.HAuCl\_4*: m.p. 233°.

*B.HClO\_4*: m.p. 239°.

*Oxalate*: m.p. 216°.

*Picrate*: m.p. 196°.

Henry, Sharp, *J. Chem. Soc.*, 1928, 1105.

Marion, Edwards, *J. Am. Chem. Soc.*, 1946, 68, 2565.

### $\alpha$ - $\psi$ -Aconitine

$C_{36}H_{51}O_{12}N$  MW, 689

From *Aconitum napellus*. Colourless prisms from  $Et_2O$  or MeOH. M.p. 205–6° decomp.  $[\alpha]_D^{25} + 24.7^\circ$  in  $CHCl_3$ . Hyd.  $\rightarrow$   $\psi$ -aconine + acetic and veratric acids.

*B.HI*: needles from MeOH- $Et_2O$ . M.p. 220°.

*B.HClO\_4*: plates from MeOH,  $Me_2CO$ . M.p. 246° decomp.

Marion, Edwards, *J. Am. Chem. Soc.*, 1946, 68, 2565.

### Acorone

$C_{15}H_{24}O_2$  MW, 236

Sesquiterpene diketone present in essential oil of sweetflag (*Acorus calamus*, Linn.). M.p. 100°.  $[\alpha]_D^{15} + 139.5^\circ$  in EtOH.

*Di-semicarbazone*: m.p. 205–7° decomp.  $[\alpha]_D^{17} + 437^\circ$  in Py.

Sörm, Herout, *Chem. Abstracts*, 1949, 43, 3808; 1950, 44, 9384.

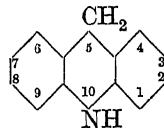
### Acraldehyde.

See Acrolein.

### Acrichine.

See Atebrin.

Acridan (5 : 10-Dihydroacridine, *ms-dihydroacridine*)

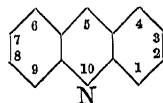


$C_{13}H_{11}N$  MW, 181

Prisms from EtOH. M.p. 169°. Sol.  $Et_2O$ , hot EtOH. Insol.  $H_2O$ . Sublimes. Does not form salts.  $CrO_3 \rightarrow$  acridine.

Graebe, Caro, *Ann.*, 1871, 158, 278.

### Acridine



$C_{13}H_9N$  MW, 179

Needles or prisms. M.p. 111°. Boils above 360°. Sublimes at 100°. Sol. EtOH,  $Et_2O$ ,

CS<sub>2</sub>. Spar. sol. hot H<sub>2</sub>O. Sols. show blue fluor. Volatile in steam. KMnO<sub>4</sub> → acridinic acid. NaHg → acridan.

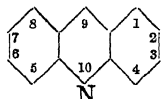
(B,HCl)<sub>2</sub>HgCl<sub>2</sub>: yellow needles. M.p. 235°.

B<sub>2</sub>CH<sub>3</sub>·COCl: yellow needles. M.p. 236°.

Acid oxalate: cryst. from H<sub>2</sub>O. M.p. 162° decomp.

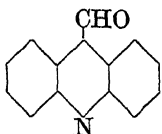
sym. - *Trinitrobenzene add. comp.*: yellow needles from EtOH. M.p. 115°.

*Note.*—The following numbering of the acridine ring is also employed, particularly in German literature:



Meyer, Hofmann, *Monatsh.*, 1916, 37, 698.  
Ullmann, *Ber.*, 1907, 40, 2521.

### Acridine-5-aldehyde



C<sub>14</sub>H<sub>9</sub>ON MW, 207

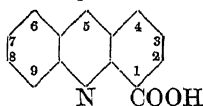
Yellow needles from EtOH. M.p. 139–40°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O.

*o*-Nitrophenylhydrazone: yellow, m.p. 191°.

2:4-Dinitrophenylhydrazone: yellow, m.p. 235°.

Berntsen, Muhlert, *Ber.*, 1887, 20, 1547.

### Acridine-1-carboxylic Acid



C<sub>14</sub>H<sub>9</sub>O<sub>2</sub>N MW, 223

Yellow cryst. from EtOH.Aq. M.p. 189–90°.

Albert, Goldacre, *J. Chem. Soc.*, 1946, 706.

### Acridine-3-carboxylic Acid.

Buff cryst. from aq. cellosolve. Decomp. without melting at 270°.

Albert, Goldacre, *J. Chem. Soc.*, 1946, 706.

### Acridine-5-carboxylic Acid.

Yellow needles. Unchanged at 300°. Sol. EtOH. Spar. sol. H<sub>2</sub>O. Dil. alk. sol. → blue fluor. Heat. above 300° → acridine and CO<sub>2</sub>.

*Me ester*: C<sub>15</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 237. M.p. 127–8°.

Berntsen, Muhlert, *Ber.*, 1887, 20, 1549.

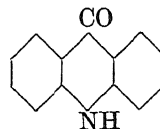
Eisleb, *Chem. Zentr.*, 1937, I, 604.

Braz, Gortinskaya, *Chem. Abstracts*, 1941, 35, 4025.

### Acridinic Acid.

See Quinoline-2:3-dicarboxylic Acid.

### Acridone



C<sub>13</sub>H<sub>9</sub>ON MW, 195

Yellow leaflets from EtOH. M.p. 354°. Sol. hot EtOH, hot AcOH, alc. KOH. Insol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. EtOH sol. fluor. blue. Distils undecomp. Sol. warm conc. H<sub>2</sub>SO<sub>4</sub>, cryst. on cooling, or ppd. unchanged by H<sub>2</sub>O. Insol. aq. alkalis. Zn dust → acridine. PCl<sub>5</sub> → 5-chloroacridine.

*N-Me*: C<sub>14</sub>H<sub>11</sub>ON. MW, 209. Yellow needles from EtOH. M.p. 203·5°. *Anil*: yellow needles from EtOH.Aq. M.p. 162–3°.

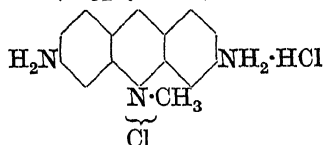
*N-Et*: C<sub>15</sub>H<sub>13</sub>ON. MW, 223. Prisms from EtOH. M.p. 159°.

*N-Phenyl*: C<sub>19</sub>H<sub>13</sub>ON. MW, 271. Cryst. from toluene. M.p. 276°.

Bamberger, *Ber.*, 1909, 42, 1707.

Allen, McKee, *Organic Syntheses*, 1939, XIX, 7.

### Acriflavine (*Trypaflavine*)



C<sub>14</sub>H<sub>15</sub>N<sub>3</sub>Cl<sub>2</sub> MW, 296

Red needles or prisms; orange needles from EtOH. Sol. H<sub>2</sub>O, MeOH, EtOH. Dil. aq. sol. yellow with green fluor. H<sub>2</sub>SO<sub>4</sub> → yellow sol. with blue-green fluor. Used as disinfectant for wounds and has a trypanocidal action in sleeping sickness. Commercial product usually contains a proportion of the unmethylated base (hydrochloride of the 2:8-diaminoacridino).

Benda, *Ber.*, 1912, 45, 1787.

Grandmougin, Simonis, *Ber.*, 1913, 46, 3425.

### Acrifoline (*Alkaloid L27*)

C<sub>18</sub>H<sub>23</sub>O<sub>2</sub>N MW, 261

Alkaloid from *Lycopodium acrifolium*, (Fern.), N. Comb. (*L. annotinum* var. *acrifolium*, Fern.). M.p. 97°.

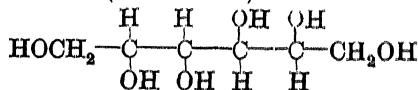
B, HClO<sub>4</sub>: m.p. 266°.

Manske, Marion, *J. Am. Chem. Soc.*, 1947, 69, 2126.

### Acriquine.

See Atebrin.

### $\alpha$ -Acritol (dl-Mannitol)



C<sub>6</sub>H<sub>14</sub>O<sub>6</sub> MW, 182

M.p. 168°. Sol. hot H<sub>2</sub>O. Spar. sol. EtOH.  
Dil. HNO<sub>3</sub> → *dl*-mannose.

Lespieau, Wiemann, *Compt. rend.*, 1932,  
194, 1946.

Fischer, *Ber.*, 1890, 23, 383.

**Acrolein** (*Acrylic aldehyde, acraldehyde, propenal*)



C<sub>3</sub>H<sub>4</sub>O

MW, 56

M.p. — 87°. B.p. 52°. Unstable. Polymerises to disacryl, a white translucent solid. Sol. 2–3 parts H<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 0.8410. n<sub>D</sub><sup>20</sup> 1.39975. Reduces NH<sub>3</sub>·AgNO<sub>3</sub>. HCl → 2-chloropropionaldehyde. PCl<sub>5</sub> → CH<sub>2</sub>:CH·CHCl<sub>2</sub>.

*Di-Et acetal*: b.p. 123–4°. Spar. sol. H<sub>2</sub>O. D<sup>15</sup> 0.8543.

*Cyanhydrin*: vinylglycollic nitrile. B.p. 94°/17 mm. D<sub>4</sub><sup>15</sup> 1.009. Sol. H<sub>2</sub>O. Insol. pet. ether.

*Oxime*: b.p. 35°/9 mm. D<sup>15</sup> 0.996.

*Semicarbazone*: cryst. from EtOH–Et<sub>2</sub>O. M.p. 171°.

*2:4-Dinitrophenylhydrazone*: reddish-orange cryst. from EtOH. M.p. 165°.

*Benzoylhydrazone*: cryst. from EtOH–Et<sub>2</sub>O. M.p. 175–7°.

Doebner, *Ber.*, 1902, 35, 1137.

Bremner, Jones, Beaumont, *J. Chem. Soc.*, 1946, 1018.

Wilson, B.P., 569,625, (*Chem. Abstracts*, 1947, 41, 6275).

### Acrolein dibromide.

See 1: 2-Dibromopropionaldehyde.

### Acronycidine

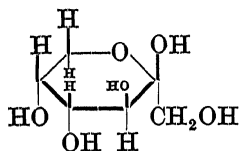
C<sub>15</sub>H<sub>15</sub>O<sub>5</sub>N

MW, 289

Alkaloid from the bark of *Melicope fareana*. Needles. M.p. 136.5–137.5°.

Hughes, Lahey, Price, Webb, *Nature*, 1948, 162, 223.

### α-Acrose (dl-Fructose, methose)



C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>

MW, 180

Syrup. Reduces Fehling's. NaHg → α-acroline.

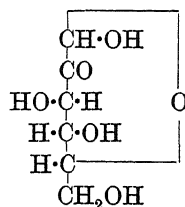
*Osazone*: acrosazone, *dl*-phenylglucosazone. Yellow needles from EtOH.Aq. M.p. 205°. Insol. H<sub>2</sub>O. HCl → glucosone.

Fischer, *Ber.*, 1890, 23, 387.

### β-Acrose.

See Sorbose.

### α-Acrosone (dl-Glucosone)



C<sub>6</sub>H<sub>10</sub>O<sub>6</sub>

MW, 178

Syrup. Sol. hot EtOH. Zn + AcOH → α-acrose. H<sub>2</sub>O at 140° → furfural.

*1-Benzoyl-3:4:6-triacetyl*: cryst. from EtOH. M.p. 116°. [α]<sub>D</sub><sup>19</sup> + 144.3° in CHCl<sub>3</sub>.

*1-Acetyl-3:4:6-tribenzoyl*: cryst. from EtOH. M.p. 131–2°. [α]<sub>D</sub> + 29.5° in Py.

Fischer, Tafel, *Ber.*, 1889, 22, 98.

### Acrylic Acid (*Vinylformic acid*)



C<sub>3</sub>H<sub>4</sub>O<sub>2</sub>

MW, 72

M.p. 13°. B.p. 141°. Misc. with H<sub>2</sub>O all proportions. Polymerises at b.p. D<sub>4</sub><sup>15</sup> 1.0621. n<sub>D</sub><sup>20</sup> 1.4224. k = 5.6 × 10<sup>-5</sup> at 25°. Heat of comb. (solid) 326.6 Cal. Na.Hg or Zn + H<sub>2</sub>SO<sub>4</sub> → propionic acid. HBr, HCl → 2-halogenopropionic acid. KOH fusion → acetic + formic acids.

*Me ester*: C<sub>4</sub>H<sub>6</sub>O<sub>2</sub>. MW, 86. B.p. 85°. D<sup>0</sup> 0.977. n<sub>D</sub><sup>20</sup> 1.3984. Polymerises on long standing.

*Et ester*: C<sub>5</sub>H<sub>8</sub>O<sub>2</sub>. MW, 100. B.p. 101°. D<sup>0</sup> 0.9252.

*Propyl ester*: C<sub>6</sub>H<sub>10</sub>O<sub>2</sub>. MW, 114. B.p. 123°. D<sup>0</sup> 0.92.

*Isopropyl ester*: b.p. 108–12°.

*n-Butyl ester*: C<sub>7</sub>H<sub>12</sub>O<sub>2</sub>. MW, 128. B.p. 39°/10 mm.

*Isobutyl ester*: b.p. 130–4°.

*Allyl ester*: C<sub>6</sub>H<sub>8</sub>O<sub>2</sub>. MW, 112. B.p. 120–4°.

*Phenyl ester*: C<sub>9</sub>H<sub>8</sub>O<sub>2</sub>. MW, 148. B.p. 202–3°, 105°/20 mm.

*Benzyl ester*: C<sub>10</sub>H<sub>10</sub>O<sub>2</sub>. MW, 162. B.p. 228°, 110–18°/8 mm.

*Chloride*: C<sub>3</sub>H<sub>5</sub>OCl. MW, 90.5. B.p. 75°. D<sup>0</sup> 1.14. n<sub>D</sub><sup>20</sup> 1.4343.

*Amide*: C<sub>3</sub>H<sub>5</sub>ON. MW, 71. Leaflets from C<sub>6</sub>H<sub>6</sub>. M.p. 85°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Polymerises on heating.

*Anhydride*: C<sub>6</sub>H<sub>6</sub>O<sub>3</sub>. MW, 126. B.p. 97°/35 mm. D<sup>0</sup> 1.094.

*N-Methylamide*: C<sub>4</sub>H<sub>7</sub>ON. MW, 85. B.p. 220° decomp., 127–9°/30 mm. D<sup>0</sup> 1.018.

*N-Ethylamide*: C<sub>5</sub>H<sub>9</sub>ON. MW, 99. B.p. 128–30°/25 mm. D<sup>0</sup> 0.978.

*N-Diethylamide*: C<sub>7</sub>H<sub>13</sub>ON. MW, 127. B.p. 101–7°/10 mm.

*Nitrile*: vinyl cyanide, cyanoethylene. C<sub>3</sub>H<sub>3</sub>N. MW, 53. B.p. 78°. Sol. H<sub>2</sub>O. Forms constant

boiling mixture with H<sub>2</sub>O, containing 12.5% H<sub>2</sub>O.

*Anilide*: m.p. 104–5°.

*o-Toluidide*: m.p. 109–10°.

*p-Toluidide*: m.p. 141°.

Fisher, Ratchford, Smith, *Ind. Eng. Chem.*, 1944, **36**, 229.

van der Burg, *Rec. trav. chim.*, 1922, **41**, 21.

Wohlk, *J. prakt. Chem.*, 1900, **61**, 212.

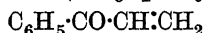
### Acrylic Acid Oxide.

See Glycidic Acid.

### Acrylic Aldehyde.

See Acrolein.

### Acrylophenone (Vinyl phenyl ketone)



C<sub>9</sub>H<sub>8</sub>O

MW, 132

Oil. B.p. 115°/18 mm. Decomp. on heating at atm. press. Volatile in steam. Phenylhydrazine → 1 : 3-diphenylpyrazoline.

Norris, Cough, *J. Am. Chem. Soc.*, 1920, **42**, 2331.

### A.C.T.H. (Adrenocorticotrophin, corticotrophin, adrenocorticotropic hormone).

Hormone of the anterior pituitary gland, used in rheumatoid arthritis therapy. The natural material is, or is closely associated with, a protein, but highly active material of polypeptidic nature can be prepared by controlled hyd. of the protein-like material.

*Protein*. Isolated from pig and sheep pituitaries. MW, 20,000 (from sedimentation and diffusion data). Isoelectric point (by moving boundary electrophoresis), pH 4.65–4.70 (4.7–4.8). Sedimentation rate at 20°, 2.08 × 10<sup>-13</sup> (2.04–2.11 × 10<sup>-13</sup>) cm./sec./dyne. Diffusion const. at 20°, 10.4 × 10<sup>-7</sup> cm.<sup>2</sup>/sec. Dissymmetry const. (f/f<sub>0</sub>), 1.1. Contains no phosphorus, carbohydrate or cysteine. Contains tryptophan (1.0%), tyrosine (4.5%), methionine (1.93%), cystine (7.19%). Very sol. H<sub>2</sub>O. Pptd. by 2.5% trichloroacetic acid, 20% sulphosalicylic acid, 5% lead acetate. Inactivated by CH<sub>2</sub>:C:O, HNO<sub>2</sub>, H·CHO, Ac<sub>2</sub>O, I<sub>2</sub> and esterification. Heat-stable. Inactivated in 30 mins. at 100° by 0.1M/NaOH. Stable for 60 mins. in boiling 0.1M/HCl.

*Low MW material*. Obtained by hyd. of the protein (18% cleavage by trypsin, 50% cleavage by pepsin or 30% cleavage by HCl at 37.4°). Highly active material contains 7–9 amino-acid residues. Very highly active material has MW, 2,500–10,000.

Li, Evans, *Vitamins and Hormones*, 1947, **5**, 198 (*Bibl.*).

Astwood, Tyslowitz, *Federation Proceedings*, 1942, **1** (Pt. 2), 4.

Li, Evans, Simpson, *Science*, 1942, **96**, 450; *J. Biol. Chem.*, 1943, **149**, 413.

Sayers, White, Long, *Proc. Soc. Exptl. Biol. Med.*, 1943, **52**, 199; *J. Biol. Chem.*, 1943, **149**, 425.

Wilhelmi, Sayers, *J. Biol. Chem.*, 1948, **176**, 175.

Burtner, *J. Am. Chem. Soc.*, 1943, **65**, 1238.

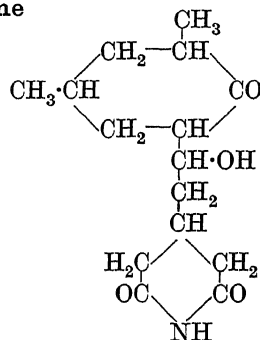
Li, *Federation Proceedings*, 1945, **5** (Pt. 2), 144.

Smith, Brown, Ghosh, Sayers, *J. Biol. Chem.*, 1950, **187**, 631.

Li, *J. Am. Chem. Soc.*, 1951, **73**, 4146.

Hess, Harris, Carpenter, Li, *ibid.*, 5918.

### Actidione



C<sub>15</sub>H<sub>23</sub>O<sub>4</sub>N

MW, 281

Antibiotic from *Streptomyces griseus*. M.p. 119.5–121°. [α]<sub>D</sub><sup>20</sup> – 3.38° in EtOH.

*Acetyl*: m.p. 150–2°.

*p-Nitrobenzoyl*: m.p. 215–20° decomp.

*Semicarbazone*: cryst. + 1H<sub>2</sub>O. M.p. 187–8°.

Kornfeld, Jones, Parke, *J. Am. Chem. Soc.*, 1949, **71**, 150.

Leach, Ford, Whiffen, *J. Am. Chem. Soc.*, 1947, **69**, 474.

### Actiniasterol

C<sub>27</sub>H<sub>44</sub>O

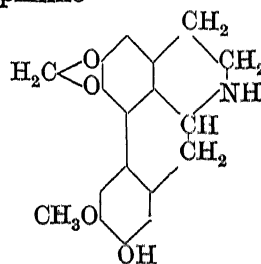
MW, 384

Isolated from non-saponifiable portion of sea-anemones (*Anemonia sulcata*). Leaflets from MeOH. M.p. 145–6°. [α]<sub>D</sub><sup>20</sup> – 42.5°. Contains 2 ethylenic linkages. Gives no m.p. depression with cholesterol.

*Acetyl*: cryst. from MeOH or AcOEt. M.p. 126–7°.

Klenk, Diebold, *Z. physiol. Chem.*, 1935, **236**, 141.

### Actinodaphnine



Suggested structure

C<sub>18</sub>H<sub>17</sub>O<sub>4</sub>N

MW, 311



Constituent of bark of *Actinodaphne hookeri*. Needles from EtOH. M.p. 210–11°. Sol. EtOH, Me<sub>2</sub>CO, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Mod. sol. Et<sub>2</sub>O. Insol. H<sub>2</sub>O.  $[\alpha]_D^{20} + 32.77^\circ$  in EtOH. H<sub>2</sub>SO<sub>4</sub> → red → purple col.

*B,HCl*: needles from EtOH–Et<sub>2</sub>O. M.p. 280–1° decomp.  $[\alpha]_D^{20} + 8.75^\circ$  in H<sub>2</sub>O.

*B,HI*: needles from EtOH. M.p. 264–5° decomp.

*B<sub>2</sub>,H<sub>2</sub>SO<sub>4</sub>*: needles + 3H<sub>2</sub>O from EtOH.Aq. M.p. (anhyd.) 249–50° decomp.

*Methiodide*: cryst. from EtOH–Et<sub>2</sub>O. M.p. 243–4°.

*Acetyl deriv.*: prisms from AcOEt. M.p. 229–30°.

*Benzoyl deriv.*: m.p. 232–3°.

*Picrate*: needles + H<sub>2</sub>O from EtOH.Aq. De-comp. at 220–2°.

Ghose, Krishna, Schlittler, *Helv. Chim. Acta*, 1934, 17, 919.

Krishna, Ghose, *J. Indian Chem. Soc.*, 1932, 9, 429.

### Actinomycin

C<sub>41</sub>H<sub>58</sub>O<sub>11</sub>N<sub>8</sub> MW, 838

Pigment of *Actinomyces*. Red prisms + 5H<sub>2</sub>O from MeOH, EtOH or AcOEt–light petroleum. M.p. 255°.  $[\alpha]_D^{25} - 367^\circ$ . Shows ultraviolet absorption max. at 237–240 (E<sub>1</sub><sup>1</sup> 238) and 442–444 mμ (E<sub>1</sub><sup>1</sup> 161). Very sol. Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>, AcOH. Mod. sol. AcOEt, MeOH, EtOH, *n*-butyl alcohol. Spar. sol. Et<sub>2</sub>O, H<sub>2</sub>O. Insol. light petroleum. Sol. dil. min. acids. Insol. alkalis. EtOH–KOH → sol. with dark violet col. which fades. Hyd. → threonylproline + *l*-threonine + sarcosine + *d*-valine + *l*-methylvaline + *l*-proline.

Dalgleish, Johnson, Todd, Vining, *J. Chem. Soc.*, 1950, 2946.

Loehr, Berger, *Arch. Biochem.*, 1949, 23, 503.

### Actinorhodine

C<sub>23</sub>H<sub>20</sub>O<sub>10</sub> MW, 456

Quinonoid pigment from *Actinomyces*. Red needles. Sol. Py, tetrahydrofuran, dioxan. Sol. alkalis with blue col. H<sub>2</sub>SO<sub>4</sub> → deep blue col., with H<sub>3</sub>BO<sub>3</sub> → reddish-violet col. Absorption max. in butyl alcohol at 571 and 553 mμ.

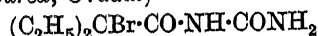
*Triacetyl deriv.*: yellow needles. M.p. 260° decomp.

Brockmann, Pinni, *Naturwiss.*, 1947, 34, 190.

### Activin.

See Chloramine-T.

*Adalin* (1-Bromo-1-ethylbutyrylurea, bromodiethylacetylurea, Uradal)



C<sub>7</sub>H<sub>13</sub>O<sub>2</sub>N<sub>2</sub>Br

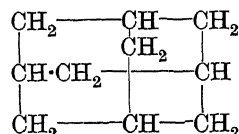
MW, 237

Exists in two crystalline forms, both stable at room temp. Rhombic modification changing to the monoclinic at 70°, m.p. 117°. Cryst. from MeOH, EtOH, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub> or ligroin. M.p. 115–6°. Sol. EtOH, Me<sub>2</sub>CO. Spar. sol. H<sub>2</sub>O. Heat. with H<sub>2</sub>O → diethylhydantoin. Hypnotic and sedative.

Bayer, D.R.Ps., 225,710, 240,353, 243,233, 249,906, 253,189, 271,682.

Beckmann, D.R.P., 262,048.

### Adamantane



C<sub>10</sub>H<sub>16</sub> MW, 136

M.p. 268° (252–3°). D 1.07. n<sub>D</sub> 1.568. Camphor odour.

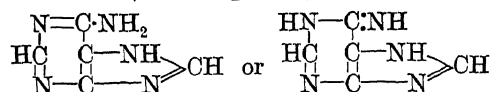
Landa, Machacek, *Chem. Abstracts*, 1933, 27, 2792.

Prelog, Seiwerth, *Ber.*, 1941, 74, 1769.

### Adamsite.

See 10-Chloro-5 : 10-dihydrophenarsazine.

### Adenine (6-Aminopurine)



C<sub>5</sub>H<sub>5</sub>N<sub>5</sub> MW, 135

Needles + 3H<sub>2</sub>O from H<sub>2</sub>O. M.p. (anhyd.) 360–5° decomp. (rapid heat.). Sol. hot H<sub>2</sub>O. Spar. sol. EtOH. Insol. Et<sub>2</sub>O, CHCl<sub>3</sub>. Sublimes at 220°. HNO<sub>2</sub> → hypoxanthine. FeCl<sub>3</sub> → red col.

*Acetyl deriv.*: leaflets from H<sub>2</sub>O. Yellow at 260°.

*Di-acetyl*: m.p. 195° decomp.

*Monochloroacetyl deriv.*: m.p. 163° decomp.

*Monobenzoyl deriv.*: m.p. 234–5°.

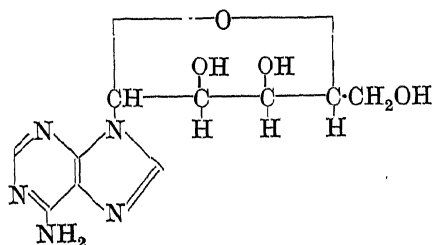
*Picrate*: decomp. 279–81°.

Traube, *Ann.*, 1904, 331, 64.

Todd et al., *J. Chem. Soc.*, 1943, 386.

Hoffer, *Jubilee Vol. Emil Barrell*, 1946, 428, (*Chem. Abstracts*, 1947, 41, 4108).

### Adenosine



C<sub>10</sub>H<sub>13</sub>O<sub>4</sub>N<sub>5</sub>

MW, 267

Occurs in heart muscles, etc. Cryst. from  $H_2O$ . M.p. 229°.  $[\alpha]_D - 63.3^\circ$ .

*Triphenylmethyl ether*: m.p. 259–60°.  $[\alpha]_D^{20} - 8.8^\circ$  in  $CHCl_3$ .

*Picrate*: m.p. 182°.

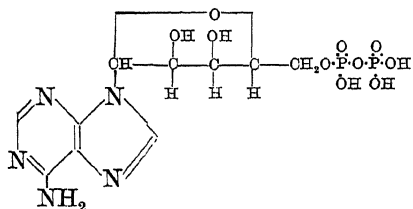
Levene, Tipson, *J. Biol. Chem.*, 1932, **97**, 491.

Szent-Györgyi, Drury, *Journal of Physiology*, 1930, **68**, 213.

Embsden, Zimmermann, *Z. physiol. Chem.*, 1927, **167**, 114.

Davoll, Lythgoe, Todd, *J. Chem. Soc.*, 1948, 967.

**Adenosine diphosphate** (*Adenosine pyrophosphate*)



$C_{10}H_{15}O_{10}N_5P_2$  MW, 427

Degradation product of cozymase and adenosine triphosphate.

*Acridine salt*: yellow prismatic needles. M.p. 215° decomp.

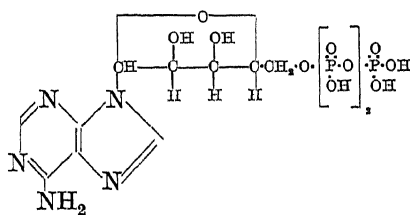
Lohmann, *Biochem. Z.*, 1935, **282**, 109.

Gulland, Walsh, *J. Chem. Soc.*, 1945, 169.

Lythgoe, Todd, *Nature*, 1945, **155**, 693.

Baddiley, Todd, *J. Chem. Soc.*, 1947, 648.

**Adenosine triphosphate** (*A.T.P.*)



$C_{10}H_{16}O_{13}N_5P_3$  MW, 507

Isolated from muscle extracts.

*Tri-acridine salt*: egg-yellow needles. M.p. 208–9° decomp.

*Acridine salt*:  $(ATP)_2$  (acridine) $_5$ : lemon-yellow crystals. M.p. 218°.

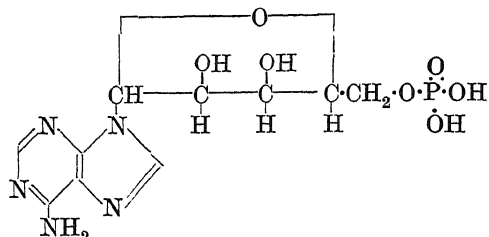
Lohmann, *Naturwiss.*, 1929, **17**, 624;

*Biochem. Z.*, 1931, **233**, 460; 1932, **254**, 381; 1935, **282**, 120.

Fiske, Subbarow, *Science*, 1929, **70**, 381.

Baddiley, Michelson, Todd, *J. Chem. Soc.*, 1949, 582.

**Adenylic Acid** (*Muscle adenylic acid, adenosine 5'-phosphate*)



$C_{10}H_{14}O_7N_5P$  MW, 347

Nucleotide isolated from muscle. Needles from  $H_2O$  or EtOH.Aq. M.p. 195°.  $[\alpha]_D^{20} - 41.78^\circ$  in  $H_2O$ .

Ostern, *Biochem. Z.*, 1932, **254**, 66.

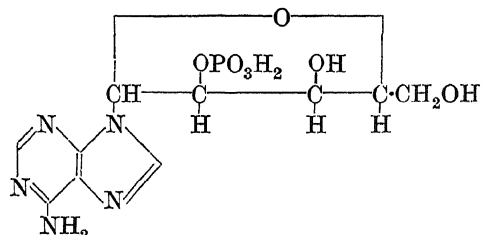
Lohmann, *ibid.*, 381.

Steudel, *Z. physiol. Chem.*, 1933, **216**, 77.

Klimek, Parnas, *Biochem. Z.*, 1932, **252**, 392.

Baddiley, Todd, *J. Chem. Soc.*, 1947, 648.

**Adenylic Acid a** (*Adenosine 2'-phosphate*)



$C_{10}H_{14}O_6N_4P$  MW, 347

Isolated from yeast ribonucleic acid. Amorphous. Turns brown at 170–80°. M.p. 205–15° decomp.

*Di-brucine salt*: needles from  $H_2O$ . M.p. 165–75°.

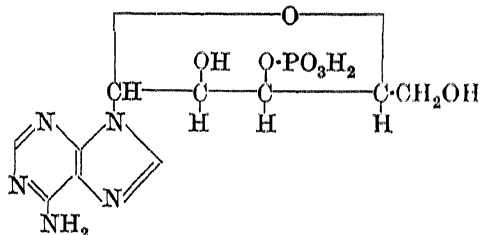
*Acridine salt*: yellow needles from EtOH.Aq. M.p. 215° decomp.

Carter, Cohn, *Federation Proceedings*, 1949, **8**, 190.

Brown, Haynes, Todd, *J. Chem. Soc.*, 1950, 3299.

Brown, Todd, *J. Chem. Soc.*, 1952, 44.

**Adenylic Acid b** (*Yeast adenylic acid, adenosine 3'-phosphate*)



$C_{10}H_{14}O_6N_4P$  MW, 347

Isolated from yeast ribonucleic acid. Rods from hot H<sub>2</sub>O. M.p. 194°.

*Di-brucine salt*: rods from H<sub>2</sub>O. M.p. 177°. Decomp. at 225°.

*Monocridine salt*: yellow needles. M.p. 175° decomp.

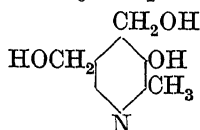
*Di-acridine salt*: m.p. 184°.

Tipson, *J. Biol. Chem.*, 1937, **120**, 621.

Levene, Harris, *J. Biol. Chem.*, 1932, **98**, 9.

Brown, Todd, *J. Chem. Soc.*, 1952, 44.

**Adermin** (*Vitamin B<sub>6</sub>, 2-methyl-3-hydroxy-4:5-di-(hydroxymethyl)-pyridine, pyridoxin, 3-hydroxy-4:5-dimethylol- $\alpha$ -picoline*)



C<sub>8</sub>H<sub>11</sub>O<sub>3</sub>N

MW, 169

Part of vitamin B complex which prevents or cures acrodermatitis-like dermatitis in young rats. Best source is rice husks but cane molasses, yeast, wheat germ and cod liver oils are good sources. Needles from Me<sub>2</sub>CO. M.p. 160°. Sublimes readily. FeCl<sub>3</sub> → reddish-brown col. Silicotungstate and reineckate crystallise well.

*B,HCl*: cryst. from EtOH-Me<sub>2</sub>CO. M.p. 206-8°.

*3-Me ether*: C<sub>9</sub>H<sub>13</sub>O<sub>3</sub>N. MW, 183. Needles from CHCl<sub>3</sub>-pet. ether. M.p. 89.5-90°. *B,HCl*: m.p. 150°.

*4-Et ether*: C<sub>10</sub>H<sub>15</sub>O<sub>3</sub>N. MW, 197. M.p. 134°.

*Triacetyl*: viscous oil. B.p. 145-50°/0.2 mm.

*Tribenzoyl*: m.p. 121-2°.

*Picrate*: m.p. 156°.

Kuhn *et al.*, *Naturwiss.*, 1939, **27**, 469; *Ber.*, 1939, **72**, 305, 309, 310.

Harris, Folkers, *J. Am. Chem. Soc.*, 1939, **61**, 1245, 3307.

Greene, *J. Biol. Chem.*, 1939, **130**, 513.

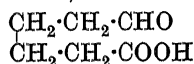
Todd, *J. Chem. Soc.*, 1941, 429.

Mowatt *et al.*, *J. Am. Chem. Soc.*, 1943, **65**, 954.

Hoffer, U.S.P., 2,410,938, (*Chem. Abstracts*, 1947, **41**, 1395).

Szabo, U.S.P., 2,410,531, (*Chem. Abstracts*, 1947, **41**, 1714).

**Adipaldehydic Acid** (*Adipic semialdehyde,  $\delta$ -formylvaleric acid*)



C<sub>6</sub>H<sub>10</sub>O<sub>3</sub>

MW, 130

B.p. 151-3°/20 mm., 144°/8 mm. D<sub>15</sub> 1.15. n<sub>D</sub><sup>25</sup> 1.4489. Polymerises on standing to trimer, m.p. 131°.

*Et ester*: b.p. 97-8°/10 mm. n<sub>D</sub><sup>24</sup> 1.4280.

*Semicarbazone*: m.p. 159-60°.

Dict. of Org. Comp.—I.

*p-Nitrophenylhydrazone*: m.p. 134°.

*2:4-Dinitrophenylhydrazone*: m.p. 140-1°.

Harries, Neymann, *Ber.*, 1908, **41**, 3557.

Treibs, *Ber.*, 1939, **72**, 1194.

Baer, *J. Am. Chem. Soc.*, 1942, **64**, 1416.

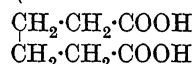
**Adipamic Acid.**

*See under Adipic Acid.*

**Adipamide.**

*See under Adipic Acid.*

**Adipic Acid** (*Butane-1:4-dicarboxylic acid*)



C<sub>6</sub>H<sub>10</sub>O<sub>4</sub>

MW, 146

Monoclinic cryst. from hot HNO<sub>3</sub>. M.p. 149-50° (153°). B.p. 265°/100 mm., 244°/50 mm., 216°/15 mm., 205°/10 mm. Sol. H<sub>2</sub>O to 1.5% at 15°. Sol. EtOH. Spar. sol. Et<sub>2</sub>O. *k* (first) = 3.76 × 10<sup>-5</sup> at 25°; *k* (second) = 2.4 × 10<sup>-6</sup> at 25°. Sublimes. Heat. of comb. C<sub>v</sub> 668.6 Cal. Metallic salts mostly sol. H<sub>2</sub>O. Dist. Ca salt → cyclopentanone.

*Me ester*: C<sub>7</sub>H<sub>12</sub>O<sub>4</sub>. MW, 160. M.p. 3°. B.p. 162°/10 mm.

*Di-Me ester*: C<sub>8</sub>H<sub>14</sub>O<sub>4</sub>. MW, 174. Freezes at 0°. M.p. 8°. B.p. 112°/10 mm.

*Et ester*: C<sub>8</sub>H<sub>14</sub>O<sub>4</sub>. MW, 174. M.p. 28-9°. B.p. 169-70°/17 mm.

*Di-Et ester*: C<sub>10</sub>H<sub>18</sub>O<sub>4</sub>. MW, 202. B.p. 245°, 130°/14 mm.

*Dipentyl ester*: m.p. -14°.

*Dihexyl ester*: m.p. -9° to -7°.

*Diheptyl ester*: m.p. 3.8-4.5°.

*Dioctyl ester*: m.p. 9.5-9.8°.

*Dinonyl ester*: m.p. 21.6°.

*Didecyl ester*: m.p. 27.4°.

*Diundecyl ester*: m.p. 34.7°.

*Didodecyl ester*: m.p. 39.3°.

*Ditridecyl ester*: m.p. 45.9°.

*Ditetradecyl ester*: m.p. 49.4°.

*Dipentadecyl ester*: m.p. 55°.

*Dihexadecyl ester*: m.p. 57.3°.

*Diheptadecyl ester*: m.p. 61.8°.

*Diocitadecyl ester*: m.p. 63.4°.

*Di-phenyl ester*: C<sub>16</sub>H<sub>18</sub>O<sub>4</sub>. MW, 274. Plates from EtOH.Aq. M.p. 105-6°.

*p-Nitrobenzyl ester*: cryst. M.p. 106°.

*Phenacyl ester*: cryst. from EtOH. M.p. 88°.

*p-Bromophenacyl ester*: cryst. from AcOH. M.p. 153°.

*p-Phenylphenacyl ester*: cryst. from Me<sub>2</sub>CO. M.p. 148°.

*Dichloride*: C<sub>6</sub>H<sub>8</sub>O<sub>2</sub>Cl<sub>2</sub>. MW, 183. B.p. 130-2°/18 mm., slight decomp.

*Amide*: adipamic acid. C<sub>6</sub>H<sub>11</sub>O<sub>3</sub>N. MW, 145. Needles from H<sub>2</sub>O. M.p. 125-30°.

*Diamide*: adipamide. C<sub>6</sub>H<sub>12</sub>O<sub>2</sub>N<sub>2</sub>. MW, 144. M.p. 220°. Ac<sub>2</sub>O or P<sub>2</sub>O<sub>5</sub> → dinitrile.

*Di-N-methylamide*: C<sub>8</sub>H<sub>16</sub>O<sub>2</sub>N<sub>2</sub>. M.p. 152-3°.

*Di-N-dimethylamide*: C<sub>10</sub>H<sub>20</sub>O<sub>2</sub>N<sub>2</sub>. Cryst. M.p. 85°.

*Anhydride*:  $C_6H_8O_3$ . MW, 128. M.p. 22°. B.p. 98–100°/0.1 mm. Polymerises with trace of  $H_2O$ .

*Di-nitrile*: 1:4-dicyanobutane.  $C_6H_8N_2$ . MW, 108. M.p. 0–1°. B.p. 295°, 181°/20 mm. Sol. EtOH,  $CHCl_3$ . Insol.  $H_2O$ ,  $CS_2$ ,  $Et_2O$ .  $D_{19}^{20}$  0.951.  $n_D^{20}$  1.4597.

*Anilide*: needles from  $H_2O$ . M.p. 151–3°.

*Di-anilide*: needles from EtOH. M.p. 240–1°.

Mannich, Hancu, *Ber.*, 1908, 41, 575.

Feagan, Copenhaver, *J. Am. Chem. Soc.*, 1940, 62, 869.

du Pont, U.S.P., 2,220,734, (*Chem. Abstracts*, 1940, 34, 6302); B.P., 494,236, (*Chem. Abstracts*, 1939, 33, 2539); U.S.P., 2,196,357, (*Chem. Abstracts*, 1940, 34, 5093).

Aronow, U.S.P., 2,191,786, (*Chem. Abstracts*, 1940, 34, 4394).

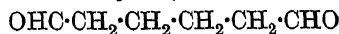
Machinskaya, Veseloskaya, *J. Applied Chem. U.S.S.R.*, 1944, 17, 377, (*Chem. Abstracts*, 1945, 39, 3738).

Korshak, Pakhomov, *Chem. Abstracts*, 1942, 36, 3488.

Henne, Hill, *J. Am. Chem. Soc.*, 1943, 65, 752.

Ellis, *Organic Syntheses*, Collective Vol. I, 2nd. Edition, 18.

### Adipic-dialdehyde (Hexandial-1:6)



$C_6H_{10}O_2$  MW, 114

B.p. 92–4°/9 mm. Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ . Spar. sol.  $H_2O$ . Polymerises on long standing.

*Dioxime*: needles from  $H_2O$ . M.p. 185–6°.

*Di-semicarbazone*: m.p. 206°.

*Di-diethyl acetal*: b.p. 155°/20 mm.

Wohl, Schweitzer, *Ber.*, 1906, 39, 894.

Henne, Perilstein, *J. Am. Chem. Soc.*, 1943, 65, 2183.

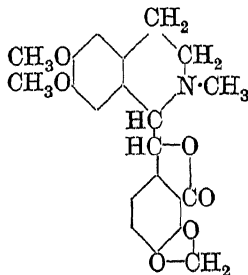
### Adipin Ketone.

See Cyclopentanone.

### Adipoin.

See 2-Cyclohexanolone-1.

### Adlumine

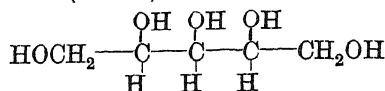


$C_{21}H_{21}O_6N$  MW, 383

Alkaloid from *Adlumia fungosa*, Greene. M.p. 180°.

Manske, *Can. J. Research*, 1933, 8, 210, 404.

### Adonitol (Ribitol)



$C_5H_{12}O_5$

MW, 152

Prisms from  $H_2O$ . M.p. 102°. Sol.  $H_2O$ , hot EtOH. Insol.  $Et_2O$ , ligroin. Does not reduce Fehling's.

*Di-triphenylmethyl ether*: cryst. M.p. 141–5°.

*2:4-Methylene ether*: m.p. 86°.

*1:3:2:4-Dimethylene ether*: m.p. 145°.

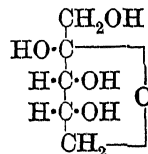
Lespieau, *Compt. rend.*, 3198, 206, 1773; *Advances in Carbohydrate Chemistry*, 1946, 2, 117.

Fischer, *Ber.*, 1893, 26, 633.

Raphael, *J. Chem. Soc.*, 1949, 544.

Hann, Hudson, *J. Am. Chem. Soc.*, 1944, 66, 1906.

### Adonose (Erythro-2-ketopentose, ribulose)



$C_5H_{10}O_5$

MW, 150

*d.*

*o-Nitrophenylhydrazone*: orange needles from EtOH. M.p. 168–169.5°.  $[\alpha]_D^{20} + 48.3^\circ \pm 3^\circ$  in MeOH.

*l.*

Syrup.  $[\alpha]_D^{21} + 15.8^\circ$ . Py.  $\rightarrow$  *l*-arabinose.

*o-Nitrophenylhydrazone*: orange needles from EtOH. M.p. 168–9° decomp.  $[\alpha]_D^{19} - 47.5^\circ$  in MeOH.

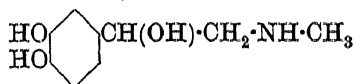
*p-Nitrophenylhydrazone*: cryst. powder from AcOEt. M.p. 121–3°.  $[\alpha]_D^{21} - 48.7^\circ$ .

Glatthaar, Reichstein, *Helv. Chim. Acta*, 1935, 18, 80.

Reichstein, *Helv. Chim. Acta*, 1934, 17, 996.

Levene, Tipson, *J. Biol. Chem.*, 1936, 115, 731.

### Adrenaline (1-[3:4-Dihydroxyphenyl]-2-methylaminoethanol)



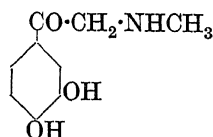
$C_9H_{13}O_3N$

MW, 183

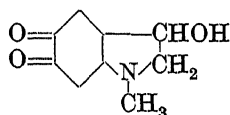
*l.* *Epinephrine*, *Suprarenin*, *Heemisine*.

Active constituent of suprarenal gland. Cryst. M.p. 211–12° (215° rapid heat.). Sol. AcOH, min. acids, caustic alkalis.  $[\alpha]_D - 53^\circ$  in HCl.  $FeCl_3 \rightarrow$  green col. Reduces Fehling's. Weakly alkaline to litmus.

*B,HCl*: m.p. 157°.

*d*-Decomp. at 211–21°.  $[\alpha]_D^{20} + 50.5^\circ$  in HCl.*dl*-Decomp. at 230°. Less physiologically active than *l*-base. 3 : 4-*Diacetyl*: m.p. 163°. *B, HCl*: m.p. 155–6°.Ott, *Ber.*, 1926, 59, 1068.Ciocca, *Chem. Abstracts*, 1934, 28, 4398.Bertrand, *Bull. soc. chim.*, 1904, 31, 1188.Abderhalden, Bergell, *Ber.*, 1904, 37, 2024.**Adrenalone** (3 : 4-*Dihydroxy*- $\beta$ -*methylamino*-*acetophenone*) $C_9H_{11}O_3N$ 

MW, 181

Needles. M.p. 235–6° decomp. (darkens at 200°). Spar. sol.  $H_2O$ , EtOH, Et<sub>2</sub>O. Red  $\rightarrow$  adrenalin.  $FeCl_3 \rightarrow$  emerald col. Similar physiological activity to adrenalin.*B, HCl*: plates +1  $H_2O$  from EtOH. M.p. 240° decomp. (243–4°).*Tribzenzenesulphonyl*: m.p. 106–7°.Höchst, D.R.P., 152,814, (*Chem. Zentr.*, 1904, II, 270).Stolz, *Ber.*, 1904, 37, 4152.Friedmann, *Chem. Zentr.*, 1906, I, 1620.**Adrenochrome**

Suggested structure

 $C_9H_9O_3N$ 

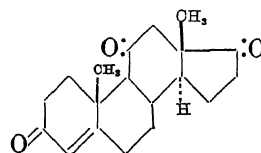
MW, 179

Brick red. M.p. 125–30°. Very sol.  $H_2O$ , EtOH. Unstable in solution (pH 4 at 0° optimum conditions). Red.  $\rightarrow$  leuco-adrenochrome,  $[\alpha]_D^{18} - 79.2^\circ$ .*Oxime*: orange needles +1 $H_2O$ . M.p. 192° decomp., +1½ $H_2O$ , m.p. 278°.*p*-*Nitrophenylhydrazone*: brown needles + 4 $H_2O$  from dioxan, m.p. 200° decomp.Green, Richter, *Biochem. J.*, 1937, 31, 596.Voor, *Rec. trav. chim.*, 1942, 61, 638.Bergel, Morrison, *J. Chem. Soc.*, 1943, 48.MacCarthy, *Chemie et industrie*, 1946, 55, 435.Frankel, Allers, *Biochem. Z.*, 1909, 18, 401; *ibid.*, 22, 131.**Adrenocorticotropic Hormone.**

See A.C.T.H.

**Adrenodiamine** $C_{12}H_{12}O_2N_2$ 

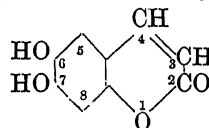
MW, 216

Phenolic base isolated from adrenal glands of cattle. Needles from EtOH. M.p. 219–21° decomp.  $FeCl_3 \rightarrow$  red col. Couples with diazotised *p*-nitroaniline. Millon's reagent  $\rightarrow$  green sol., turning brownish-red on warming. Gibbs' reagent  $\rightarrow$  blue col. Absorption maxima in EtOH at 231, 271 and 300  $m\mu$ .*B, HCl*: rosettes of needles from EtOH-AcOEt. M.p. 215–6° decomp. Loses HCl in vacuo at 110°.*O*-*Monoacetyl*: m.p. 176–7° decomp. No col. with  $FeCl_3$ .Pffiffer, North, *J. Biol. Chem.*, 1940, 132, 461.**Adrenosterone** ( $\Delta^4$ -*Androstene*-3 : 11 : 17-*trione*) $C_{19}H_{24}O_3$ 

MW, 300

Constituent of the adrenal cortex. Leaflets from Et<sub>2</sub>O or EtOH. M.p. 222° (corr.). Sublimes in vacuo.  $[\alpha]_D^{20} + 262^\circ \pm 5^\circ$  in EtOH. Absorption band at about 240  $m\mu$ . No cortical hormone activity, but has male sex hormone activity (½ activity of androsterone).*Disemicarbazone*: cryst. from EtOH. Gradually decomp. at about 270°.Reichstein, *Helv. Chim. Acta*, 1936, 19, 61, 1125; 1937, 20, 979.Sarett, *J. Am. Chem. Soc.*, 1946, 68, 2478.**Adurol.**

See Bromohydroquinone.

**Aegelenine.**See  $\gamma$ -Fagarine.**Aesculetin** (*Esculetin*, 6 : 7-*dihydroxycoumarin*) $C_9H_6O_4$ 

MW, 178

Needles + 1 $H_2O$ . Prisms from AcOH. M.p. 276°. Sol. hot EtOH, dil. alkalis. Spar. sol.  $H_2O$ . Insol. Et<sub>2</sub>O. Reduces Fehling's and  $NH_3 \cdot AgNO_3$ .  $FeCl_3 \rightarrow$  green col.6-*Me ether*: see Scopoletin.7-*Me ether*:  $C_{10}H_8O_4$ . MW, 192. Needles from MeOH. M.p. 184°. *Acetyl*: needles from EtOH.Aq. M.p. 164–6°.7-*Et ether*:  $C_{11}H_{10}O_4$ . MW, 206. M.p. 143°.Di-*Me ether*:  $C_{11}H_{10}O_4$ . MW, 206. Needles from  $H_2O$ . M.p. 144°.

*Di-Et ether*:  $C_{13}H_{14}O_4$ . MW, 234. Plates from EtOH.Aq. M.p. 109°.

*Diacetyl*: prisms from EtOH. M.p. 133-4°.

*Dibenzoyl*: cryst. M.p. 185-6°.

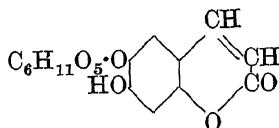
*Di-p-nitrobenzoyl*: cryst. M.p. 207-8°.

Merz, *Arch. Pharm.*, 1932, 270, 476.

Gattermann, Kobner, *Ber.*, 1899, 32, 288.

Bert, *Compt. rend.*, 1942, 214, 230.

**Aesculin** (*Esculin*, 6- $\beta$ -glucosido-7-hydroxy-coumarin)



$C_{15}H_{16}O_9$

MW, 340

Occurs in bark of horse chestnut, *Aesculus hippocastanum*, Linn., and roots of wild jasmin, *Gelsemium sempervirens*, Ait. Prisms +  $2H_2O$ . M.p. 205° decomp. Sol. 670 parts  $H_2O$  at 10°. Sol. 24 parts boiling EtOH. Sol. AcOH, AcOEt, alkalis. Spar. sol.  $Et_2O$ . Aq. sol. fluor. blue.  $[\alpha]_D^{18} - 14.6^\circ$  in MeOH. Min. acids  $\rightarrow$  aesculetin + glucose.

*Me ether*:  $C_{16}H_{18}O_9$ . MW, 354. Needles from  $H_2O$ . M.p. 225°.

*Tetra-acetyl deriv.*: m.p. 181-2°.  $[\alpha]_D^{11} - 21^\circ$  in MeOH.

*Penta-acetyl deriv.*: needles from EtOH. M.p. 130°.

Merz, Hagemann, *Naturwiss.*, 1941, 29, 650; *Chem. Zentr.*, 1942, II, 2038.

Merz, *Arch. Pharm.*, 1932, 270, 476.

Seka, Kallir, *Ber.*, 1931, 64, 622.

Macbeth, *J. Chem. Soc.*, 1931, 1288.

Rochleder, Schwarz, *Ann.*, 1853, 87, 186.

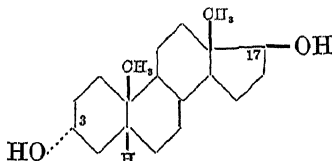
#### Aetioallocholane.

See Androstane.

#### Aetioallocholanone.

See Androstanone.

**Aetiocholane-3 $\alpha$ :17 $\beta$ -diol** (*Testane-3 $\alpha$ :17 $\beta$ -diol*)



$C_{19}H_{32}O_2$

MW, 292

Isolated from male urine. Needles from EtOH.Aq. M.p. 232°.  $[\alpha]_D + 26.5^\circ$  in EtOH. No physiological activity.

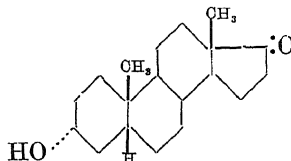
*Diacetyl*: leaflets from EtOH. M.p. 125° corr.

Butenandt, Tscherning, Dannenberg, *Z. physiol. Chem.*, 1937, 248, 205.

Ruzicka, Goldberg, Bosshard, *Helv. Chim. Acta*, 1937, 20, 547.

Hildebrandt, U.S.P., 2,238,936, (*Chem. Abstracts*, 1941, 35, 4920).

**Aetiocholane-3 $\alpha$ -ol-17-one** (*5-Isoandrosterone, testane-3 $\alpha$ -ol-17-one*)



$C_{19}H_{30}O_2$

MW, 290

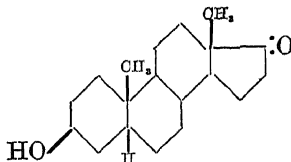
Needles from hexane. M.p. 153° corr., 139.5° (low melting form).  $[\alpha]_D + 105^\circ$ . No physiological activity in 1000  $\gamma$  doses.

*Benzoyl*: m.p. 165-6°.

*Semicarbazone of acetyl deriv.*: cryst. from EtOH. M.p. 254-5°.

Ruzicka, Goldberg, Meyer, Brüngger, Eichenberger, *Helv. Chim. Acta*, 1934, 17, 1405.

**Aetiocholane-3 $\beta$ -ol-17-one** (*Testane-3 $\beta$ -ol-17-one*)



$C_{19}H_{30}O_2$

MW, 290

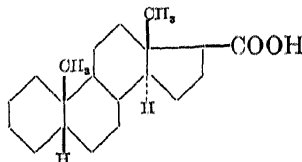
Needles from hexane. M.p. 151-2° corr., 115-17° (low melting form).  $[\alpha]_D - 89^\circ$ . No physiological activity in 1000  $\gamma$  doses.

*Acetyl*: m.p. 157-8°.

*Semicarbazone of acetyl*: cryst. from EtOH. M.p. 244-5°.

Ruzicka, Goldberg, Meyer, Brüngger, Eichenberger, *Helv. Chim. Acta*, 1934, 17, 1406.

#### Aetiocholic Acid



$C_{20}H_{32}O_2$

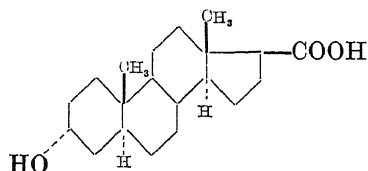
MW, 304

Needles from AcOH. M.p. 227.5-229°.

*Me ester*: needles from MeOH. M.p. 97-100°.

Reichstein et al., *Helv. Chim. Acta*, 1937, 20, 1040; 1938, 21, 828.

## Aetiolithocholic Acid

 $C_{20}H_{32}O_3$ 

MW, 320

Needles from MeOH or Me<sub>2</sub>CO. M.p. 273–5°. Sol. MeOH, Me<sub>2</sub>CO. Spar. sol. Et<sub>2</sub>O.  $[\alpha]_D^{25} + 50^\circ \pm 2^\circ$  in dioxan.

*Me ester*: needles from Et<sub>2</sub>O–pentane. M.p. 141–2°.

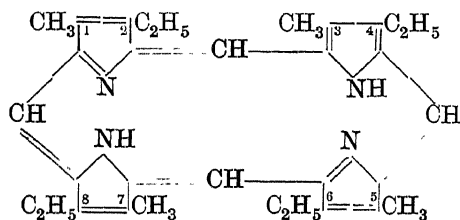
*Acetyl*: cryst. from Et<sub>2</sub>O–pentane. M.p. 225–6°.

Reichstein *et al.*, *Helv. Chim. Acta*, 1937, 20, 952.

## Aetiophyllin.

See under Aetioporphyrin III.

## Aetioporphyrin I (1 : 3 : 5 : 7-Tetramethyl-2 : 4 : 6 : 8-tetraethylporphin)

 $C_{32}H_{38}N_4$ 

MW, 478

Synthetic. Violet prisms from CHCl<sub>3</sub>–MeOH. M.p. 400–5°. Sol. AcOH, Ac<sub>2</sub>O, Py, C<sub>6</sub>H<sub>6</sub>. Sublimes unchanged.

*Ni salt*: C<sub>32</sub>H<sub>36</sub>N<sub>4</sub>Ni. Needles +  $\frac{1}{2}$ Py from Py. M.p. 327°.

*Co salt*: C<sub>32</sub>H<sub>36</sub>N<sub>4</sub>Co. Needles from Py. M.p. 337°.

*Zn salt*: C<sub>32</sub>H<sub>36</sub>N<sub>4</sub>Zn. Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 243°.

*Mg salt*: C<sub>32</sub>H<sub>36</sub>N<sub>4</sub>Mg. Violet prisms from MeOH. M.p. 347–9°.

*Picrate*: C<sub>32</sub>H<sub>38</sub>N<sub>4</sub>·2C<sub>6</sub>H<sub>3</sub>O<sub>7</sub>N<sub>3</sub>. Violet prisms from Me<sub>2</sub>CO–MeOH. M.p. 232°.

*Picolonate*: B<sub>2</sub>C<sub>10</sub>H<sub>8</sub>N<sub>4</sub>O<sub>5</sub>. Reddish-brown needles from CHCl<sub>3</sub>–MeOH. M.p. 262°.

*Styphnate*: B<sub>2</sub>C<sub>6</sub>H<sub>3</sub>O<sub>8</sub>N<sub>3</sub>. Violet prisms from MeOH. M.p. 217–23°.

*Flavianate*: B<sub>2</sub>C<sub>10</sub>H<sub>6</sub>O<sub>8</sub>N<sub>2</sub>S. Purple needles from CHCl<sub>3</sub>–Me<sub>2</sub>CO. M.p. 230°.

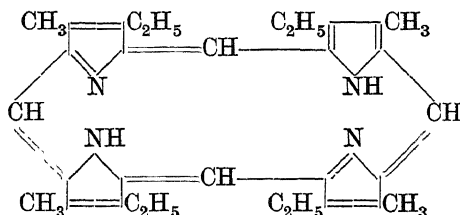
Fischer, Treibs, *Ann.*, 1926, 450, 146.

Fischer, Klarer, *ibid.*, 190.

Fischer, Stangler, *Ann.*, 1927, 459, 91.

Fischer, Orth, *Chemie des Pyrrols* (Leipzig, 1937), II, 191.

Siedel, Winkler, *Ann.*, 1943, 554, 162.

Aetioporphyrin II (*Isoaetioporphyrin*, 1 : 4 : 5 : 8-tetramethyl-2 : 3 : 6 : 7-tetraethylporphin) $C_{32}H_{38}N_4$ 

MW, 478

Synthetic. Black prisms from Py. M.p. 360–6°. Sublimes in vacuum.

*Cu salt*: C<sub>32</sub>H<sub>36</sub>N<sub>4</sub>Cu. Red needles from CHCl<sub>3</sub>–AcOH.

*Fe salt*: C<sub>32</sub>H<sub>36</sub>N<sub>4</sub>FeCl. Brown prisms from CHCl<sub>3</sub>–Et<sub>2</sub>O.

*Mg salt*: C<sub>32</sub>H<sub>36</sub>N<sub>4</sub>Me. Leaflets from Et<sub>2</sub>O.

*Picrate*: B<sub>2</sub>C<sub>6</sub>H<sub>3</sub>O<sub>7</sub>N<sub>3</sub>. Red prisms from Et<sub>2</sub>O. M.p. 223°.

*Picolonate*: B<sub>2</sub>C<sub>10</sub>H<sub>8</sub>O<sub>5</sub>N<sub>4</sub>. Red needles from CHCl<sub>3</sub>–Me<sub>2</sub>CO. M.p. 228°.

*Styphnate*: B<sub>2</sub>C<sub>6</sub>H<sub>3</sub>O<sub>8</sub>N<sub>3</sub>. Reddish-violet leaflets or prisms from MeOH. M.p. 217°.

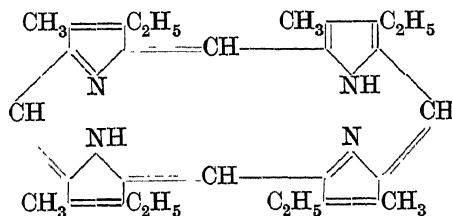
*Flavianate*: B<sub>2</sub>C<sub>10</sub>H<sub>6</sub>O<sub>8</sub>N<sub>2</sub>S. Red prisms from MeOH. M.p. 250°.

Fischer, Halbig, Walach, *Ann.*, 1927, 452, 284.

Fischer, Halbig, *Ann.*, 1926, 450, 158.

Fischer, Orth, *Chemie des Pyrrols* (Leipzig, 1937), II, 199.

## Aetioporphyrin III (1 : 3 : 5 : 8-Tetramethyl-2 : 4 : 6 : 7-tetraethylporphin)

 $C_{32}H_{38}N_4$ 

MW, 478

The above formula represents the nuclear complex of haematin (blood) and of chlorophyll. Aetioporphyrin III is obtained from these substances by degradation, from mesoporphyrin IX by decarboxylation, and it occurs naturally in oil shale, petroleum, mineral wax, amber and various coals. It has been synthesised. Violet needles from Py or CHCl<sub>3</sub>–pet. ether. M.p. 360–3°. Sol. Me<sub>2</sub>CO. Spar. sol. EtOH.

*Mg salt*: C<sub>32</sub>H<sub>36</sub>N<sub>4</sub>Mg. Aetiophyllin (from chlorophyll). Bluish-violet cryst.

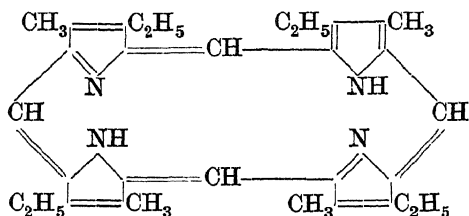
*Cu salt*: C<sub>32</sub>H<sub>36</sub>N<sub>4</sub>Cu. Red needles from Py–AcOH.

*Fe salt*:  $C_{32}H_{36}N_4FeCl$ . Dark red needles from  $CHCl_3-Et_2O$ .

Fischer, Stangler, *Ann.*, 1928, 462, 265; 1928, 459, 76.

Fischer, Orth, *Chemie des Pyrrols* (Leipzig, 1937), II, 199.

**Aetioporphyrin IV (1 : 4 : 6 : 7-Tetramethyl-2 : 3 : 5 : 8-tetraethylporphin)**



$C_{32}H_{38}N_4$  MW, 478

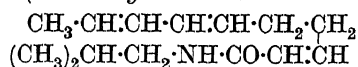
Synthetic. Leaflets from  $CHCl_3-MeOH$  or  $Py$ . M.p. 355-7°.

*Cu salt*:  $C_{32}H_{36}N_4Cu$ . Prisms.

Fischer, Stangler, *Ann.*, 1927, 459, 57, 80.

Fischer, Orth, *Chemie des Pyrrols* (Leipzig, 1937), II, 202.

**Affinin (N-Isobutyldeca-1 : 5 : 7-trienoamide)**



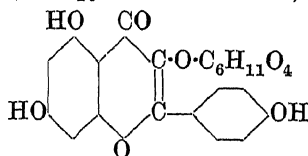
$C_{14}H_{23}ON$  MW, 221

Powerful insecticide occurring in roots of *Heliospis longipes*, (A. Gray) Blake. B.p. 100-162°/0.3 mm.  $n_D^{25}$  1.5128.  $H/Pt \rightarrow$  N-isobutylcapramide.

Jacobson, Acree, Haller, *J. Org. Chem.*, 1947, 12, 731.

Acree, Jacobson, Haller, *J. Org. Chem.*, 1945, 10, 236, 449.

**Afzelin (Kæmpferol-3-rhamnoside)**

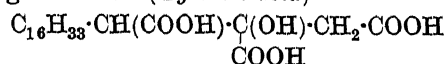


$C_{21}H_{20}O_{10}$  MW, 432

A glycoside obtained from doussié, a timber derived from trees of the genus *Afzelia*. Yellow prisms +  $1\frac{1}{2}H_2O$ . M.p. 172-4°.

King, Acheson, *J. Chem. Soc.*, 1950, 168.

**Agaric Acid (Agaricic acid)**



$C_{22}H_{40}O_7$  MW, 416

Constituent of *Polyporus officinalis*, Vill. Leaflets +  $1\frac{1}{2}H_2O$  from  $EtOH.Aq$ . Anhyd. at

100°. M.p. 142° decomp. Spar. sol.  $EtOH$ ,  $Et_2O$ .  $[\alpha]_D^{19} - 8.84^\circ$  in  $NaOH$ . Alc.  $KOH$  at 160°  $\rightarrow$  stearic acid.  $H_2SO_4 \rightarrow$  methyl heptadecyl ketone.

*Tri-Me ester*:  $C_{25}H_{46}O_7$ . MW, 458. M.p. 63-4°.

*Tri-Et ester*:  $C_{28}H_{52}O_7$ . MW, 500. M.p. 36-7°.

Thoms, Vogelsang, *Ann.*, 1907, 357, 145.

Roberts, *Nature*, 1945, 155, 697.

**Agarobiose**

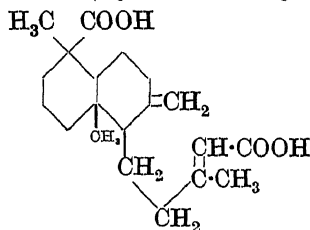
$C_{12}H_{20}O_{10}$  MW, 324

Degradation product of the agar-agar-like component of *Gelidium amansii*.  $[\alpha]_D^{12} - 5.8^\circ$ .

*Hexa-Me*:  $[\alpha]_D^{20} - 4.4^\circ$  in  $H_2O$ . *Di-Me acetal*: b.p. 155-6°/0.052 mm.  $[\alpha]_D^{25} - 11.0^\circ$  in  $H_2O$ .

Araki, *J. Chem. Soc. Japan*, 1944, 65, 533, 627.

**Agathic Acid (Agathic dicarboxylic acid)**



$C_{20}H_{30}O_4$  MW, 334

Present in manila and kauri copals. Cryst. from  $MeOH$ . M.p. 203-4°.  $[\alpha]_D + 56.1^\circ$  in  $EtOH$ . Dist.  $\rightarrow$  noragathic acid +  $CO_2$ . Se dehydrogenation  $\rightarrow$  1 : 2 : 5-trimethylnaphthalene.  $H \cdot COOH \rightarrow$  isoagathic acid by further ring-closure.

*Di-Me ester*:  $C_{22}H_{34}O_4$ . MW, 362.  $D_4^{17}$  1.0777.  $n_D^{17}$  1.5163.  $[\alpha]_D + 55.4^\circ$  in  $EtOH$ .

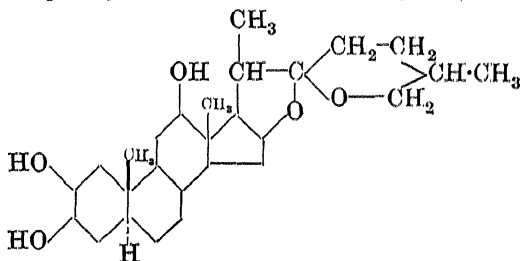
Ruzicka, Jacobs, *Rec. trav. chim.*, 1938, 57, 509.

Hosking, *Chem. Abstracts*, 1940, 34, 6464.

Ruzicka, Hosking, *Helv. Chim. Acta*, 1931, 14, 203; 1930, 13, 1402.

Ruzicka, Bernold, Tallichet, *Helv. Chim. Acta*, 1941, 24, 223.

**Agavogenin (1 : 2-Dihydromanogenin)**



$C_{27}H_{44}O_5$  MW, 448



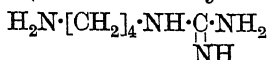
A steroidal sapogenin isolated from *Agave huachucensis*. M.p. 242°.  $\text{CrO}_3 \rightarrow$  hecogenic acid.

*Triacetyl*: m.p. 228°.

Wagner *et al.*, *J. Am. Chem. Soc.*, 1943, 65, 1199.

Wagner, U.S.P., 2,408,835.

**Agmatine (4-Guanidinobutylamine)**



$\text{C}_5\text{H}_{14}\text{N}_4$  MW, 130

Present in ergot, and pollen of *Ambrosia artemisifolia*. Ox.  $\rightarrow$  guanidine + guanidino-butyric acid.

$\text{B}_2\text{H}_2\text{SO}_4$ : needles from MeOH.Aq. M.p. 229°.

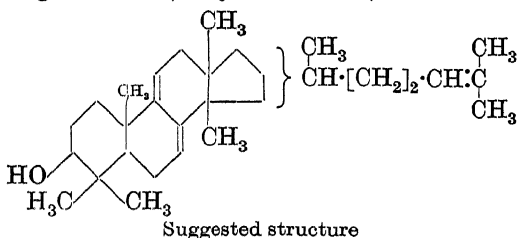
$2\text{H}_2\text{AuCl}_4$ : yellow needles from  $\text{H}_2\text{O}$ . Decomp. at 220–3°.

*Picrate*: m.p. 235–6°.

Kossel, *Z. physiol. Chem.*, 1910, 68, 170; 1910, 66, 257.

Heyl, *J. Am. Chem. Soc.*, 1919, 41, 681.

**Agnosterol (Dehydrolanosterol)**



$\text{C}_{30}\text{H}_{48}\text{O}$  MW, 424

Isolated from wool fat. Needles from EtOH. M.p. 162°.  $[\alpha]_D^{19} + 70.4^\circ$  in  $\text{CHCl}_3$ . Contains 3 ethylenic linkages.

*Acetyl*: needles from AcOEt. M.p. 173–4°.  $[\alpha]_D^{19} + 90.3^\circ$  in  $\text{CHCl}_3$ .

*Bromoacetyl*: leaflets from  $\text{Me}_2\text{CO}$ . M.p. 130–1°.  $[\alpha]_D^{20} + 78.3^\circ$  in  $\text{CHCl}_3$ .

*Benzoyl*: clusters of needles from AcOEt. M.p. 203°.  $[\alpha]_D^{17} + 103.3^\circ$  in  $\text{CHCl}_3$ .

Marker, Whittle, *J. Am. Chem. Soc.*, 1937, 59, 2289.

Marker, Whittle, Nixon, *ibid.*, 1368.

Windaus, Tschesche, *Z. physiol. Chem.*, 1930, 190, 51.

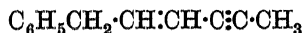
Voser, Günthard, Jeger, Ruzicka, *Helv. Chim. Acta*, 1952, 35, 66.

Voser, Jeger, Ruzicka, *ibid.*, 503.

Cavalla, McGhie, Pradhan, *J. Chem. Soc.*, 1951, 3142.

Barton, Fawcett, Thomas, *ibid.*, 3147.

**Agropyrene**



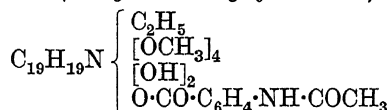
$\text{C}_{12}\text{H}_{12}$

MW, 156

Occurs in roots of couch grass (*Agropyron repens*, *Triticum repens*). B.p. 140–3°/10 mm.  $\text{D}_{20}$  0.9744.  $n_D^{20}$  1.5695. Sweet odour, reminiscent of isochavibetol. Polymerizes at b.p. under atm. press. KOH  $\rightarrow$  brown resin.  $\text{HNO}_3 \rightarrow$  violet col.  $\rightarrow$  deep blue.  $\text{KMnO}_4 \rightarrow$  benzoic acid + oxalic acid. Na in EtOH  $\rightarrow$  3-hexenylbenzene.  $\text{O}_3 \rightarrow$  phenylacetic acid + AcOH. Catalytic hydrogenation  $\rightarrow$  hexylbenzene.

Treibs, *Ber.*, 1947, 80, 97.

**Ajacine (Acetylanthranoyllycoctonine)**



$\text{C}_{34}\text{H}_{46}\text{O}_9\text{N}_2 \cdot 2\text{H}_2\text{O}$  MW, 662

Occurs in *Delphinium ajacis*. Cryst. from Et<sub>2</sub>O. M.p. 154°.  $[\alpha]_D^{22}$  49.5° in EtOH, 30–8° in HCl. Alk. hyd.  $\rightarrow$  lycoctonine + acetyl-anthranilic acid. HCl  $\rightarrow$  anthranoyllycoctonine + AcOH.

Keller, Völker, *Arch. Pharm.*, 1913, 251, 209.

Hunter, *Pharm. J.*, 1943, 150, 82.

Goodson, *J. Chem. Soc.*, 1944, 108; 1945, 245.

**Ajmaline**

$\text{C}_{20}\text{H}_{26}\text{O}_2\text{N}_2$  MW, 326

Alkaloid from *Rauwolfia serpentina*, Benth. Amber rectangular plates +  $3\frac{1}{2}\text{H}_2\text{O}$  from moist AcOEt. Softens at 150°. M.p. 158–60°. Sol. EtOH, AcOEt,  $\text{CHCl}_3$ . Spar. sol. Et<sub>2</sub>O,  $\text{C}_6\text{H}_6$ .  $[\alpha]_D^{23} + 128^\circ$  in  $\text{CHCl}_3$ . Monacid base.

$\text{B}_2\text{HCl}$ : amber prisms +  $2\text{H}_2\text{O}$ . M.p. 133–4°. M.p. anhyd. 253–5°.  $[\alpha]_D^{40} + 84.6^\circ$  in  $\text{H}_2\text{O}$ .

$\text{B}_2\text{H}_2\text{PtCl}_6$ : m.p. 217–18°. *Benzoyl deriv.*: needles from  $\text{C}_6\text{H}_6$ . M.p. 214–16°.

*Picrate*: plates from EtOH. M.p. 126–7°. M.p. anhyd. 223°.

Siddiqui, Siddiqui, *J. Indian Chem. Soc.*, 1935, 12, 37; 1932, 9, 539; 1931, 8, 667.

Mukherji, Robinson, Schlittler, *Experientia*, 1949, 5, 215.

Anet, Mukherji, Robinson, Schlittler, *Chemistry and Industry*, 1952, 20, 442.

**Ajmalinine**

$\text{C}_{20}\text{H}_{26}\text{O}_3\text{N}_2$  MW, 342

Alkaloid from *Rauwolfia serpentina*, Benth. Hexagonal prisms from moist AcOEt. M.p. 180–1°. Sol. EtOH,  $\text{CHCl}_3$ . Spar. sol. Et<sub>2</sub>O,  $\text{C}_6\text{H}_6$ . Insol. pet. ether. Acts on the sympathetic nervous system, producing hypertension.

$\text{B}_2\text{HCl}$ : semicryst. powder from EtOH–Et<sub>2</sub>O. M.p. 240–5° decomp.

*Chloroplatinate*: amorph. M.p. 254–8° decomp.

*Methiodide*: rods from EtOH. M.p. 233–4° decomp.

*Picrate*: yellow powder. M.p. 200–5°.

Siddiqui, Siddiqui, *J. Indian Chem. Soc.*, 1935, 12, 37; 1932, 9, 539; 1931, 8, 667.

**Akuammicine**

$C_{19}H_{20}O_4N_2$  MW, 340

From *Picralima klaineana* Pierre. Leaflets from EtOH. M.p. anhyd. 177·5°.  $[\alpha]_D^{20}$  – 737·7° in  $CHCl_3$ .

*B,HCl*: prisms + 2H<sub>2</sub>O from H<sub>2</sub>O or EtOH. M.p. 144°. M.p. anhyd. 171°.  $[\alpha]_D^{16}$  + 626·6° in EtOH.

*Sulphate*: cubes + H<sub>2</sub>O from H<sub>2</sub>O. M.p. 161°.  $[\alpha]_D^{14}$  – 594° in H<sub>2</sub>O.

*Nitrate*: needles. M.p. 182·5°.

*Methiodide*: yellow prisms from H<sub>2</sub>O. M.p. 252°.

*Picrate*: yellow needles from  $CHCl_3$ -EtOH. M.p. 169°.

Clinquart, Edouard, *J. Pharm. Belg.*, 1927, 9, 187.

Henry, Anderson, Sharp, *J. Chem. Soc.*, 1927, 1950.

Henry, *J. Chem. Soc.*, 1932, 2759.

**Akuamidine**

$C_{21}H_{24}O_3N_2$  MW, 352

From *Picralima klaineana* Pierre. Needles + 1H<sub>2</sub>O. M.p. (air dried) 248·5°.  $[\alpha]_D^{19}$  + 21° in EtOH. Sol. EtOH, Et<sub>2</sub>O,  $CHCl_3$ . Insol. C<sub>6</sub>H<sub>6</sub>.

*B,HI*: prisms + 3H<sub>2</sub>O from EtOH.Aq. M.p. 90°. M.p. anhyd. 238°.

*Perchlorate*: prisms. M.p. anhyd. 110°.

*Methiodide*: prisms from MeOH.Aq. M.p. 195°. M.p. anhyd. 233°.

*Acetyl deriv.*: prisms from  $CHCl_3$ -EtOH. M.p. 272°.

*Benzoyl deriv.*: needles from EtOH. M.p. 219°.

*Picrate*: yellow spheroids from EtOH. M.p. 215°.

Clinquart, Edouard, *J. Pharm. Belg.*, 1927, 9, 187.

Henry, Anderson, Sharp, *J. Chem. Soc.*, 1927, 1950.

Henry, *J. Chem. Soc.*, 1932, 2759.

Hamet, *Compt. rend.*, 1945, 221, 699.

**Akuammigine**

$C_{22}H_{26}O_3N_2$  MW, 366

From *Picralima klaineana* Pierre. Yellow tablets + 1H<sub>2</sub>O from EtOH.Aq. M.p. 125°.  $[\alpha]_D^{20}$  – 44·4° in EtOH.

*B,HCl*: prisms from H<sub>2</sub>O, EtOH, or MeOH.Aq. M.p. 287°.  $[\alpha]_D^{20}$  – 37·8° in MeOH.

*Nitrate*: prisms from EtOH.Aq. M.p. 261°.

*Picrate*: garnet-red prisms. M.p. 240°.

Clinquart, Edouard, *J. Pharm. Belg.*, 1927, 9, 187.

Henry, Anderson, Sharp, *J. Chem. Soc.*, 1927, 1950.

Henry, *J. Chem. Soc.*, 1932, 2759.

Hamet, *Compt. rend.*, 1945, 221, 699.

**Akuammiline**

$C_{22}H_{24}O_4N_2$  MW, 380

From *Picralima klaineana* Pierre. Prisms from EtOH. M.p. 160°.  $[\alpha]_D^{20}$  + 47·9° in EtOH. Sol. Et<sub>2</sub>O,  $CHCl_3$ , warm C<sub>6</sub>H<sub>6</sub>.

*B,HCl*: needles + 1H<sub>2</sub>O from H<sub>2</sub>O or EtOH. M.p. 196°.  $[\alpha]_D^{20}$  – 29·6° in H<sub>2</sub>O.

*B,HI*: fine needles from EtOH.Aq. M.p. 210°.

*Nitrate*: prisms from H<sub>2</sub>O. M.p. 204°.

*Methiodide*: rosettes of needles from H<sub>2</sub>O. M.p. 233°.  $[\alpha]_D^{20}$  – 83·3° in EtOH.

Clinquart, Edouard, *J. Pharm. Belg.*, 1927, 9, 187.

Henry, Anderson, Sharp, *J. Chem. Soc.*, 1927, 1950.

Henry, *J. Chem. Soc.*, 1932, 2759.

**Akuammine**

$C_{22}H_{28}O_4N_2$  MW, 384

Alkaloid from *Picralima klaineana* Pierre. Needles from EtOH. M.p. 255° (295°).  $[\alpha]_D^{20}$  – 73·4° in  $CHCl_3$ . Sol.  $CHCl_3$ . Spar. sol. EtOH, Et<sub>2</sub>O.

*B,HCl*: + H<sub>2</sub>O. M.p. 227°.  $[\alpha]_D^{22}$  – 26·6° in H<sub>2</sub>O.

*B,HBr*: prisms + H<sub>2</sub>O from H<sub>2</sub>O or EtOH. M.p. 228°.  $[\alpha]_D^{20}$  – 26° in H<sub>2</sub>O.

*B,HI*: grey needles + H<sub>2</sub>O. M.p. 226°.

*B,2HNO<sub>3</sub>*: needles from EtOH. M.p. 224°.

*Sulphate*: needles from H<sub>2</sub>O. M.p. 221°.  $[\alpha]_D^{19}$  – 40·3° in H<sub>2</sub>O.

*Acetyl deriv.*: prisms from EtOH. M.p. 226°. *Hydrochloride*: needles. M.p. 236°.

*Methiodide*: prisms from MeOH. M.p. 274°.

*Picrate*: yellow needles from EtOH. M.p. 199°.

*Picolonate*: yellow micro-needles. M.p. 194°.

Clinquart, Edouard, *J. Pharm. Belg.*, 1927, 9, 187.

Henry, Anderson, Sharp, *J. Chem. Soc.*, 1927, 1950.

Henry, *J. Chem. Soc.*, 1932, 2759.

**Alacreatine.**

See 1-Guanidinopropionic Acid.

**Alanine** (1-Aminopropionic acid,  $\alpha$ -alanine)



$C_3H_7O_2N$  MW, 89

*dl*- (Racemic alanine).

Needles or prisms from H<sub>2</sub>O. Yellow cryst. from EtOH. M.p. 295–6°. Sol. 4–5 parts H<sub>2</sub>O

at 17°, 500 parts 80% EtOH in cold. Insol Et<sub>2</sub>O. Heat of form., 135.2 Cal. Heat of comb. C<sub>p</sub> 389.2, C<sub>v</sub> 390.3 Cal. *k* (acid) =  $9 \times 10^{-10}$  at 25°. *k* (base) =  $5.1 \times 10^{-12}$  at 25°. Reacts weakly acid to phenolphthalein and methyl orange.

*Me ester*: C<sub>4</sub>H<sub>9</sub>O<sub>2</sub>N. MW, 103. B.p. 38–42°/15 mm. Sol. H<sub>2</sub>O with alk. reaction. D<sub>4</sub><sup>20</sup> 1.0309. *B, HCl*: m.p. 158°. *N-m-Nitrobenzoyl*: needles from MeOH.Aq. M.p. 110–11°.

*Et ester*: C<sub>5</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 117. B.p. 48°/11 mm. D<sub>4</sub><sup>20</sup> 0.9846. *B, HCl*: m.p. 64–8° (129°). *N-Et*: b.p. 53°/10 mm. *N-Di-Et*: b.p. 74–5°/13 mm. *N-m-Nitrobenzoyl*: needles from EtOH.Aq. M.p. 89°. *Picrate*: m.p. 171°.

*Amide*: C<sub>3</sub>H<sub>8</sub>ON<sub>2</sub>. MW, 88. M.p. 62°. Sol. H<sub>2</sub>O, EtOH. *B, HCl*: m.p. 170°. *N-m-Nitrobenzoyl*: needles from EtOH.Aq. M.p. 189–90°. *Picrate*: m.p. 199.5°.

*Nitrile*: *B, HCl*: m.p. 115–17° (132–8° decomp.). *N-Di-Et*: b.p. 66°/15 mm.

*N-Di-Me*: see Dimethyl-*dl*-alanine.

*N-Et*: C<sub>5</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 117. Cryst. from EtOH. M.p. 211–15°.

*Anhydride*: see Dimethyldiketopiperazine.

*N-Acetyl*: see Acetylalanine.

*N-Benzoyl*: m.p. 165–6°.

*N-o-Nitrobenzoyl*: needles from H<sub>2</sub>O. M.p. 165–6°.

*N-m-Nitrobenzoyl*: needles from H<sub>2</sub>O. M.p. 163–4°. *Picolonate*: m.p. 216° decomp.

*d*-(*d*-Alanine).

Hyd. product of many proteins. Rhombic cryst. M.p. 297° decomp. Sol. 4–5 parts H<sub>2</sub>O. Prac. insol. EtOH.  $[\alpha]_D^{25} + 2.7^\circ$  in H<sub>2</sub>O, + 9.55° in HCl. HNO<sub>2</sub> → *d*-lactic acid.

*B, HCl*: prisms. M.p. 204°.  $[\alpha]_D^{20} + 10.4^\circ$  in H<sub>2</sub>O.

*Me ester*: *N-m-Nitrobenzoyl*: needles from EtOH.Aq. M.p. 126°.  $[\alpha]_{5461}^{20} - 12.7^\circ$  in EtOH.

*Amide*: prisms from CHCl<sub>3</sub>. M.p. 72°. Sol. H<sub>2</sub>O, EtOH. Hygroscopic. *N-m-Nitrobenzoyl*: leaflets from EtOH. M.p. 193–4°.  $[\alpha]_{5461}^{20} + 24.2^\circ$  in EtOH.

*N-Acetyl*: cryst. from AcOEt–C<sub>6</sub>H<sub>6</sub>. M.p. 116°.  $[\alpha]_D^{20} - 45.6^\circ$  in H<sub>2</sub>O.

*N-Bromoacetyl*: m.p. 96–7°.

*N-Benzoyl*: m.p. 152–4°.  $[\alpha]_D^{20} + 37.13^\circ$  in alkali.

*N-m-Nitrobenzoyl*: needles from H<sub>2</sub>O. M.p. 158°.

*Picolonate*: m.p. 215° decomp.  $[\alpha]_D^{20} + 11.8^\circ$  in H<sub>2</sub>O.

*l*-(*l*-Alanine).

Prisms from EtOH.Aq. Decomp. at 297°. Sol. hot H<sub>2</sub>O.  $[\alpha]_D - 9.68^\circ$  in HCl.

*B, HCl*: sol. H<sub>2</sub>O.  $[\alpha]_D^{20} - 10.3^\circ$  in H<sub>2</sub>O.

*Et ester*: *N-m-Nitrobenzoyl*: needles from EtOH.Aq. M.p. 104–5°.  $[\alpha]_D^{20} + 6.91^\circ$  in EtOH.

*N-Benzoyl*: m.p. 151°.  $[\alpha]_D - 37.3^\circ$  in alkali.

*N-m-Nitrobenzoyl*: needles from H<sub>2</sub>O. M.p. 158°.  $[\alpha]_D + 5.87^\circ$  in EtOH.

*N-Phenyl*: see *l*-Anilinopropionic Acid.

Billmann, Parker, *J. Am. Chem. Soc.*, 1943, 65, 2455.

Hamlin, Hartung, *J. Biol. Chem.*, 1942, 145, 349.

Sisler, Cheronis, *J. Org. Chem.*, 1941, 6, 467.

Kendall, Mackenzie, *Organic Syntheses*, Collective Vol. I, 20.

Skita, Wulff, *Ann.*, 1927, 453, 199.

Colles, Gibson, *J. Chem. Soc.*, 1931, 279.

Zelinsky, Stradnikoff, *Ber.*, 1908, 41, 2061.

Fischer, *Ber.*, 1907, 40, 491; 1906, 49, 462.

### β-Alanine.

See 2-Aminopropionic Acid.

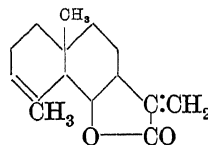
### Alanocyamine.

See 1-Guanidinopropionic Acid.

### Alantic Acid.

See Alantolic Acid.

### Alantolactone (*Helvenine*)



C<sub>15</sub>H<sub>20</sub>O<sub>2</sub>

MW, 232

Lactone or anhydride of alantolic acid. Constituent of oil of elecampane. Needles. M.p. 76°. B.p. 275°, 197°/10 mm. Spar. sol. H<sub>2</sub>O. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, ligroin, alkalis. Volatile in steam.

*Hydrochloride*: needles from EtOH.Aq. M.p. 117°.

*Hydrobromide*: cryst. from EtOH. M.p. 106°.

*Dihydrochloride*: needles or leaflets from EtOH. M.p. 134° decomp.

*Dihydrobromide*: m.p. 117°.

Ruzicka *et al.*, *Helv. Chim. Acta*, 1933, 16, 268.

Bredt, Posth, *Ann.*, 1895, 285, 358.

### Alantolic Acid (*Alantic acid*)

C<sub>15</sub>H<sub>22</sub>O<sub>3</sub>

MW, 250

In oil of elecampane. Needles. M.p. 94°.

*Me ester*: C<sub>16</sub>H<sub>24</sub>O<sub>3</sub>. MW, 264. M.p. 83°.

*Et ester*: C<sub>17</sub>H<sub>26</sub>O<sub>3</sub>. MW, 278. M.p. 80°.

*Amide*: C<sub>15</sub>H<sub>23</sub>O<sub>2</sub>N. MW, 249. Cryst. from EtOH. M.p. 197° (210°) decomp. *N-Acetyl*: m.p. 179° decomp.

*Anhydride*: see Alantolactone.

Bredt, Posth, *Ann.*, 1895, **285**, 358.

**d-Alanyl-d-alanine**



$\text{C}_6\text{H}_{12}\text{O}_3\text{N}_2$  MW, 160

Prisms. M.p. 298° (rapid heat.).  $[\alpha]_D^{20} - 21.6^\circ$  in  $\text{H}_2\text{O}$ .

Fischer, Raske, *Ber.*, 1906, **39**, 3981.

**l-Alanyl-d-alanine.**

Leaflets. M.p. 269–70° decomp. Sol.  $\text{H}_2\text{O}$ . Spar. sol. EtOH. Insol.  $\text{Et}_2\text{O}$ .  $[\alpha]_D^{20} - 68.5^\circ$ .

Fischer, Raske, *Ber.*, 1906, **39**, 3981.

**d-Alanyl-l-alanine.**

M.p. 275–6° decomp.  $[\alpha]_D^{20} + 68.7^\circ$  in  $\text{H}_2\text{O}$ , + 65.96° in HCl.

Fischer, Raske, *Ber.*, 1906, **39**, 3981.

**dl-Alanylalanine.**

Needles. M.p. 276° decomp. Sol.  $\text{H}_2\text{O}$ . Insol. EtOH.

Fischer, Raske, *Ber.*, 1906, **39**, 3981.

Herbst, Shemin, *J. Biol. Chem.*, 1943, **147**, 541.

**d-Alanylglycine**



$\text{C}_5\text{H}_{10}\text{O}_3\text{N}_2$  MW, 146

Needles from EtOH.Aq. M.p. 235° decomp.  $[\alpha]_D^{20} + 50.2^\circ$  in  $\text{H}_2\text{O}$ .

Fischer, *Ber.*, 1908, **41**, 852.

**l-Alanylglycine.**

Cryst. from EtOH.Aq. M.p. 256° decomp. Sol.  $\text{H}_2\text{O}$ .  $[\alpha]_D^{20} - 48.6^\circ$  in  $\text{H}_2\text{O}$ .

Fischer, Warburg, *Ann.*, 1905, **340**, 166.

**dl-Alanylglycine.**

Needles. M.p. 235° decomp. Sol.  $\text{H}_2\text{O}$ . Insol. EtOH,  $\text{Et}_2\text{O}$ .

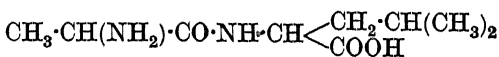
Fischer, Axhausen, *Ann.*, 1905, **340**, 130.

Schönheimer, *Z. physiol. Chem.*, 1926, **154**, 203.

**Alanylhistidine.**

See Carnosine.

**d-Alanyl-d-leucine**



$\text{C}_9\text{H}_{18}\text{O}_3\text{N}_2$  MW, 202

M.p. 254–5° decomp. Cryst. with 1 mol.  $\text{H}_2\text{O}$  which is lost over  $\text{P}_2\text{O}_5$  at 100° in vacuo.

Smith, Brown, *J. Am. Chem. Soc.*, 1941, **63**, 2605.

**d-Alanyl-l-leucine.**

Leaflets from EtOH. M.p. 255–6° (rapid heat.). Sol.  $\text{H}_2\text{O}$ . Spar. sol. EtOH. Insol.  $\text{Et}_2\text{O}$ ,  $\text{Me}_2\text{CO}$ ,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ .  $[\alpha]_D^{20} - 17.2^\circ$  in  $\text{H}_2\text{O}$ .

Fischer, *Ber.*, 1907, **40**, 1766.

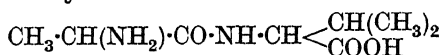
Schönheimer, *Z. physiol. Chem.*, 1926, **154**, 203.

**dl-Alanyl-leucine.**

Two forms. M.p. 248°. Sol.  $\text{H}_2\text{O}$ . Spar. sol. EtOH.

Fischer, Warburg, *Ann.*, 1905, **340**, 154.

**d-Alanyl-d-valine**



$\text{C}_8\text{H}_{16}\text{O}_3\text{N}_2$  MW, 188

Needles or prisms from EtOH.Aq. M.p. 265° (rapid heat.). Sol.  $\text{H}_2\text{O}$ , MeOH. Spar. sol. EtOH.  $[\alpha]_D^{20} - 5.9^\circ$  in  $\text{H}_2\text{O}$ , – 1.9° in HCl.

Fischer, Scheibler, *Ann.*, 1908, **363**, 148.

**Alsapogenin.**

See Gypsogenin.

**Alcapton**

See Homogentisic Acid.

**Aldehyde-ammonia.**

See 1-Aminoethyl Alcohol.

**Aldehydecollidine.**

See 6-Methyl-3-ethylpyridine.

**Aldehydoacetic Acid.**

See Formylacetic Acid.

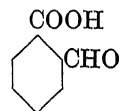
**ω-Aldehydoanisole.**

See Phenoxyacetaldehyde.

**4-Aldehydoantipyrine.**

See Antipyrinaldehyde.

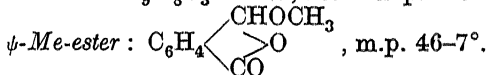
**o-Aldehydobenzoic Acid** (*o-Phthalaldehydic acid, benzaldehyde-o-carboxylic acid*)



$\text{C}_8\text{H}_6\text{O}_3$  MW, 150

Leaflets from  $\text{H}_2\text{O}$ . M.p. 98–9°. Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ . At 240–50° → anhydride. Reduces  $\text{NH}_3 \cdot \text{AgNO}_3$ .  $k = 3.6 \times 10^{-5}$  at 25°.

*Me ester*:  $\text{C}_9\text{H}_8\text{O}_3$ . MW, 164. B.p. 220–2°.



*Et ester*:  $\text{C}_{10}\text{H}_{10}\text{O}_3$ . MW, 178. B.p. 240–3°.

*Anhydride*: diphtalide ether.  $\text{C}_{10}\text{H}_{10}\text{O}_5$ . M.p. 221°. Insol.  $\text{H}_2\text{O}$ . Does not reduce  $\text{NH}_3 \cdot \text{AgNO}_3$ .

*Oxime*: needles from  $\text{H}_2\text{O}$ . M.p. 120° (rapid heat.) → phthalimide.

*Anil*: m.p. 174°.

*Semicarbazone*: m.p. 202°.

*Phenylhydrazone*: yellow needles from EtOH.Aq. M.p. 106°.

Shriner, Wolf, *Organic Syntheses*, 1943, XXIII, 74.

Gardner, Naylor, *Organic Syntheses*, 1936, XVI, 68.

Fuson, *J. Am. Chem. Soc.*, 1926, **48**, 1093.

Auwers, Heinze, *Ber.*, 1919, **52**, 596.

**m-Aldehydobenzoic Acid** (*Isophthalaldehydic acid, benzaldehyde-m-carboxylic acid*).

Needles from H<sub>2</sub>O. M.p. 175°.

*Me ester*: m.p. 53°. *Oxime*: m.p. 104°.

*Et ester*: b.p. 278°. D<sup>18</sup> 1.093.

*Chloride*: C<sub>8</sub>H<sub>5</sub>O<sub>2</sub>Cl. MW, 158.5. B.p. 130°/20 mm.

*Amide*: C<sub>8</sub>H<sub>7</sub>O<sub>2</sub>N. MW, 149. Prisms. M.p. 190° decomp.

*Nitrile*: C<sub>8</sub>H<sub>5</sub>ON. MW, 131. Needles from Et<sub>2</sub>O. M.p. 79–81°. Volatile in steam. *Oxime*: powder from H<sub>2</sub>O. M.p. 99–101°.

*Oxime*: m.p. 188° decomp. → isophthalamic acid.

*Anil*: m.p. 156°.

*Semicarbazone*: m.p. 265°.

*Phenylhydrazone*: m.p. 164°.

Simonis, *Ber.*, 1912, **45**, 1585.

Davies, Perkin, *J. Chem. Soc.*, 1922, **121**, 2215.

**p-Aldehydobenzoic Acid** (*Terephthalaldehydic acid, benzaldehyde-p-carboxylic acid*).

Needles from H<sub>2</sub>O. M.p. 256°. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O, CHCl<sub>3</sub>. Sublimes.

*Me ester*: needles from H<sub>2</sub>O or petrol. M.p. 63°. B.p. 265°. *Phenylhydrazone*: m.p. 144–6°.

*Chloride*: m.p. 48°. B.p. 258°.

*Nitrile*: needles from H<sub>2</sub>O. Prisms from Et<sub>2</sub>O or EtOH.Aq. M.p. 92°. B.p. 133°/12 mm.

*Oxime*: m.p. 208–10°.

*Phenylhydrazone*: m.p. 226°.

*Anil*: m.p. 222°.

Simonis, *Ber.*, 1912, **45**, 1588.

Davies, Perkin, *J. Chem. Soc.*, 1922, **121**, 2215.

**Aldehydobenzophenone.**

See Benzoylbenzaldehyde.

**p-Aldehydobenzyl Alcohol.**

See p-Hydroxymethyl-benzaldehyde.

**β-Aldehydobutyrophenone.**

See 1-Benzoylbutyraldehyde.

**Aldehydocamphor.**

See 3-Hydroxymethylenecamphor.

**Aldehydocaprylic Acid.**

See Azelaic Semi-aldehyde.

**Aldehydocarvacrol.**

See Hydroxy-4-isopropyl-m-toluic Aldehyde.

**4-Aldehydocinnamic Acid** (*p-Formylcinnamic acid*)



C<sub>10</sub>H<sub>8</sub>O<sub>3</sub> MW, 176

Prisms or needles. M.p. 247°. Sublimes. Sol. hot AcOH. Spar. sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, hot H<sub>2</sub>O.

*Me ester*: C<sub>11</sub>H<sub>10</sub>O<sub>3</sub>. MW, 190. Cryst. from Et<sub>2</sub>O. M.p. 82–3°.

Low, *Ann.*, 1885, **231**, 375.

Ephraim, *Ber.*, 1901, **34**, 2784.

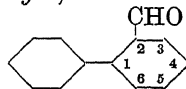
**ω-Aldehydocresol.**

See Hydroxyphenylacetaldehyde.

**Aldehydo-ψ-cumene.**

See Trimethylbenzaldehyde.

**2-Aldehydodiphenyl** (*Diphenyl-2-aldehyde, o-phenylbenzaldehyde*)



C<sub>13</sub>H<sub>10</sub>O MW, 182

B.p. 150°/7 mm.

*Phenylhydrazone*: yellow, m.p. 139°.

Zaheer, Faseeh, *J. Indian Chem. Soc.*, 1944, **21**, 381.

**4-Aldehydodiphenyl** (*Diphenyl-4-aldehyde, p-phenylbenzaldehyde*).

Pale yellow flakes from ligroin. M.p. 60°. KMnO<sub>4</sub> → diphenyl-4-carboxylic acid. HI + P → 4-methyldiphenyl.

*Oxime*: m.p. 149–50°.

*Semicarbazone*: plates from EtOH. M.p. 243° decomp.

*Phenylhydrazone*: m.p. 188–9° decomp.

2:4-Dinitrophenylhydrazone: scarlet plates from xylene. M.p. 239° decomp.

Gattermann, *Ann.*, 1906, **347**, 381.

Hey, *J. Chem. Soc.*, 1931, 2477.

**4-Aldehydodiphenyl Ether.**

See under p-Hydroxybenzaldehyde.

**Aldehydoformic Acid.**

See Glyoxylic Acid.

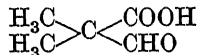
**Aldehydohemimellitene.**

See Trimethylbenzaldehyde.

**Aldehydohydrindene.**

See Hydrindene-aldehyde.

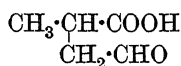
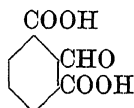
**1-Aldehydoisobutyric Acid** (*α-Formylisobutyric acid*)



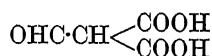
C<sub>5</sub>H<sub>8</sub>O<sub>3</sub> MW, 116

*Et ester*: C<sub>7</sub>H<sub>12</sub>O<sub>3</sub>. MW, 144. Liq. B.p. 163–4°/746 mm., 65–6°/20 mm. D<sub>4</sub><sup>20</sup> 0.9834. Dil. H<sub>2</sub>SO<sub>4</sub> → isobutyraldehyde. *Semicarbazone*: needles from EtOH. M.p. 161–2°.

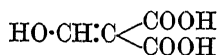
Blaise, Marcilly, *Bull. soc. chim.*, 1904, **31**, 161.

**2-Aldehydoisobutyric Acid** (*β-Formylisobutyric acid*)C<sub>5</sub>H<sub>8</sub>O<sub>3</sub> MW, 116Oil. B.p. 139–40°/12.5 mm. Miscible with H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Reduces NH<sub>3</sub>, AgNO<sub>3</sub>.*Et ester*: C<sub>7</sub>H<sub>12</sub>O<sub>3</sub>. MW, 144. Liq. B.p. 82–4°/11 mm. *Oxime*: C<sub>7</sub>H<sub>13</sub>O<sub>3</sub>N. MW, 159. B.p. 137–8°/16 mm. *Semicarbazone*: m.p. 110–5°. *p-Nitrophenylhydrazone*: m.p. 89°.*Oxime*: m.p. 77°.*Semicarbazone*: m.p. 195°.*Phenylhydrazone*: m.p. 71–2°.*p-Nitrophenylhydrazone*: m.p. 198°.Perkin, Sprankling, *J. Chem. Soc.*, 1899, 75, 19.Blaise, *Compt. rend.*, 1911, 153, 71.**2-Aldehydoisophthalic Acid** (*Benzaldehyde-2:6-dicarboxylic acid*)C<sub>9</sub>H<sub>6</sub>O<sub>5</sub> MW, 194M.p. 175–8°. Sol. EtOH, Et<sub>2</sub>O.*Anhydride*: C<sub>9</sub>H<sub>4</sub>O<sub>4</sub>. M.p. above 340°. Insol. H<sub>2</sub>O. Spar. sol. EtOH.*Phenylhydrazone*: cryst. from EtOH. M.p. 86–90°.Liebermann, *Ber.*, 1897, 30, 697.**Aldehydoisoquinoline.**

See Isoquinaldinic Aldehyde.

**Aldehydomalonic Acid** (*Formylmalonic acid, hydroxymethylenemalonic acid*)

or

C<sub>4</sub>H<sub>4</sub>O<sub>5</sub> MW, 132

The free acid has not been isolated.

*Di-Et ester*: C<sub>8</sub>H<sub>12</sub>O<sub>5</sub>. MW, 188. B.p. 217–19°, 107–09°/12 mm. D<sub>4</sub><sup>20</sup> 1.127. n<sub>D</sub><sup>20</sup> 1.456. FeCl<sub>3</sub> on EtOH sol. → orange-red col. Hyd. by alkalis → formic + malonic acids. *Di-Et acetal*: b.p. 126–9°/7 mm. n<sub>D</sub><sup>20</sup> 1.4220. *Ba deriv.*: (C<sub>8</sub>H<sub>11</sub>O<sub>5</sub>)<sub>2</sub>Ba. M.p. 119° (138° anhyd.).Auwers, *Ann.*, 1918, 415, 222.Fuson, Parham, Reed, *J. Org. Chem.*, 1946, 11, 194.**Aldehydomesitylene.**

See Trimethylbenzaldehyde.

**Aldehydonaphthoic Acid.**

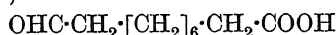
See Naphthaldehydic Acid.

**Aldehydonaphthol.**

See Hydroxynaphthaldehyde.

**Aldehydopelargonic Acid.**

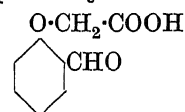
See Aldehydononoic Acid.

**8-Aldehydononoic Acid** (*8-Aldehydopelargonic acid*)C<sub>10</sub>H<sub>18</sub>O<sub>3</sub> MW, 186*Me ester*: C<sub>11</sub>H<sub>20</sub>O<sub>3</sub>. MW, 200. B.p. 120–1°/3 mm. D<sub>4</sub><sup>20</sup> 0.9663. n<sub>D</sub><sup>20</sup> 1.4410. *Semicarbazone*: m.p. 98–100°.Noller, Adams, *J. Am. Chem. Soc.*, 1926, 48, 1074.**7-Aldehydo-octoic Acid.**

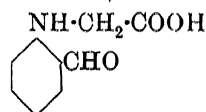
See Azelaic Semi-aldehyde.

**4-Aldehydo-orsellinic Acid.**

See Hæmatommic Acid.

**o-Aldehydophenoxyacetic Acid**C<sub>9</sub>H<sub>8</sub>O<sub>4</sub> MW, 180Yellow leaflets. M.p. 132°. Sol. hot H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Spar. sol. C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Sublimes. Reduces Fehling's in warm. Forms bisulphite comp.*Me ester*: C<sub>10</sub>H<sub>10</sub>O<sub>4</sub>. MW, 194. Needles. M.p. 55°.*Et ester*: C<sub>11</sub>H<sub>12</sub>O<sub>4</sub>. MW, 208. Needles. M.p. 47°. B.p. 195–7°/23 mm. *Semicarbazone*: needles from EtOH. M.p. 178°.*Oxime*: m.p. 138°.*Phenylhydrazone*: m.p. 105° (softens at 60°).Robertson, *J. Chem. Soc.*, 1933, 492.Cajar, *Ber.*, 1898, 31, 2809.**m-Aldehydophenoxyacetic Acid.**

Needles. M.p. 148°.

*Et ester*: cryst. mass. M.p. 120°.*Oxime*: m.p. 145°.Elkan, *Ber.*, 1886, 19, 3042.**p-Aldehydophenoxyacetic Acid.**Leaflets. M.p. 198°. Sol. AcOH. Mod. sol. EtOH, Et<sub>2</sub>O.*Et ester*: m.p. 155° decomp.*Oxime*: m.p. 168°.Elkan, *Ber.*, 1886, 19, 3042.**o-Aldehydophenylglycine** (*o-Aldehydophenylaminoacetic acid*)C<sub>9</sub>H<sub>9</sub>O<sub>3</sub>N MW, 179Plates. M.p. 176–7°. Sol. H<sub>2</sub>O, EtOH. Spar. sol. C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>.

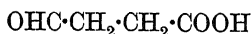
*Oxime*: m.p. 134° decomp. Sol. hot H<sub>2</sub>O.

Glued, *J. Chem. Soc.*, 1913, 103, 1251.

### Aldehydopiperidine.

See Piperidine-aldehyde.

**2-Aldehydopropionic Acid** (*Succinic semi-aldehyde*,  $\beta$ -formylpropionic acid, succinaldehydic acid)



C<sub>4</sub>H<sub>6</sub>O<sub>3</sub>

MW, 102

Oil with rancid odour which solidifies at low temps. B.p. 134–6°/14 mm. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. D<sub>4</sub><sup>20</sup> 1.2568. n<sub>D</sub><sup>20</sup> 1.4487. Volatile in steam. Reduces Fehling's and NH<sub>3</sub>.AgNO<sub>3</sub>. Dimerises on standing.

*Dimer*: C<sub>8</sub>H<sub>12</sub>O<sub>6</sub>. MW, 204. Prisms. M.p. 147°. B.p. 234–6°, 134–6°/14 mm. → monomolecular acid.

*Et ester*: C<sub>6</sub>H<sub>10</sub>O<sub>3</sub>. MW, 130. B.p. 84°/12 mm. *Oxime*: b.p. 139°/14 mm. *Semicarbazone*: cryst. M.p. 161–2° decomp. *Phenylhydrazone*: needles from MeOH. M.p. 188–9°. *p-Nitrophenylhydrazone*: brown cryst. from EtOH. M.p. 80–1°. *Anil*: cryst. from EtOH. M.p. 118°.

*Nitrile*: C<sub>4</sub>H<sub>5</sub>ON. MW, 83. B.p. 77°. D<sup>15</sup> 0.89.

*Oxime*: cryst. from EtOH. M.p. 102–3° (155°).

*Semicarbazone*: prisms or needles from H<sub>2</sub>O. M.p. 177–8° decomp.

*p-Nitrophenylhydrazone*: reddish-violet needles. M.p. 185–7°.

*2:4-Dinitrophenylhydrazone*: yellow cryst. M.p. 201°.

Perkin, Sprankling, *J. Chem. Soc.*, 1899, 75, 16.

Wislicenus, Bökler, Reuthe, *Ann.*, 1908, 363, 353.

Carrière, *Ann. chim.*, 1921, 17, 38.

### Aldehydopyromucic Acid.

See Furfural-5-carboxylic Acid.

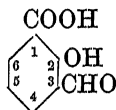
### Aldehydoquinaldine.

See Quinaldine-aldehyde.

### Aldehydoquinoline.

See Quinoline-aldehyde.

**3-Aldehydosalicylic Acid** (*m-Aldehydosalicylic acid*, *2-hydroxy-3-aldehydobenzoic acid*, *o-hydroxybenzaldehyde-m-carboxylic acid*)



C<sub>8</sub>H<sub>6</sub>O<sub>4</sub>

MW, 166

Needles + 1H<sub>2</sub>O from H<sub>2</sub>O. Anhyd. at 100°. M.p. 179°. Sol. EtOH, hot H<sub>2</sub>O. EtOH sol. weak blue fluor. FeCl<sub>3</sub> → red col. Sublimes.

Heat with CaO → salicylaldehyde. KOH fusion → 2-hydroxyisophthalic acid.

*Me ester*: C<sub>9</sub>H<sub>8</sub>O<sub>4</sub>. MW, 180. Needles from EtOH. M.p. 87°.

*Et ester*: C<sub>10</sub>H<sub>10</sub>O<sub>4</sub>. MW, 194. Needles from EtOH. M.p. 66–7°.

*Oxime*: yellow needles from H<sub>2</sub>O. M.p. 193°.

*Phenylhydrazone*: prisms from EtOH. M.p. 188°.

Wayne, Cohen, *J. Chem. Soc.*, 1922, 121, 1022.

Remfry, *J. Chem. Soc.*, 1911, 99, 286.

**5-Aldehydosalicylic Acid** (*2-Hydroxy-5-aldehydobenzoic acid*, *p-hydroxybenzaldehyde-m-carboxylic acid*, *6-hydroxyisophthalaldehydic acid*).

Needles. M.p. 248–9°. Sol. hot EtOH, Et<sub>2</sub>O. Spar. sol. hot H<sub>2</sub>O. Insol. CHCl<sub>3</sub>. FeCl<sub>3</sub> → red col. Heat with CaO → *p*-hydroxybenzaldehyde. KOH fusion → 4-hydroxyisophthalic acid.

*Me ester*: needles from EtOH. M.p. 82–3°.

*Acetate*: needles from EtOH. M.p. 81–2°.

*Benzoate*: prisms from EtOH. M.p. 99–101°.

*Oxime*: needles from EtOH.Aq. M.p. 147–8°.

*Semicarbazone*: prisms from Py. M.p. 215–16°.

*Phenylhydrazone*: prisms from EtOH. M.p. 120–1°.

*p-Nitrophenylhydrazone*: red prisms from Py. M.p. 265–7°.

*Et ester*: prisms from EtOH. M.p. 75°.

*Phenylhydrazone*: prisms from EtOH. M.p. 135–6°.

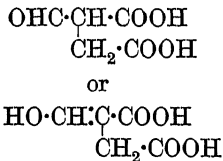
*Oxime*: m.p. 179°.

*Phenylhydrazone*: needles from EtOH. M.p. 219°.

Wayne, Cohen, *J. Chem. Soc.*, 1922, 121, 1022.

Remfry, *J. Chem. Soc.*, 1911, 99, 286.

**Aldehydosuccinic Acid** (*Formylsuccinic acid*, *hydroxymethylenesuccinic acid*)



C<sub>5</sub>H<sub>6</sub>O<sub>5</sub>

MW, 146

The free acid has not been isolated.

*Di-Me ester*: C<sub>7</sub>H<sub>10</sub>O<sub>5</sub>. MW, 174. B.p. 112–15°/12 mm. *Cu salt*: (C<sub>7</sub>H<sub>9</sub>O<sub>5</sub>)<sub>2</sub>Cu.1H<sub>2</sub>O.

Needles from MeOH. M.p. 133–5°.

*Di-Et ester*: C<sub>9</sub>H<sub>14</sub>O<sub>5</sub>. MW, 202. *Aldo-*

*form*: b.p. 134–40°/19 mm. *Enol-form*: b.p.

145–51°/19 mm. *Equilibrium mixture*: b.p.

128–48°/15 mm. FeCl<sub>3</sub> on EtOH sol. →

cherry-red col. Acids or alkalis → C<sub>2</sub>H<sub>5</sub>OH +

formic + succinic acids. *Semicarbazone*: m.p.

126°. *p-Nitrophenylhydrazone*: m.p. 100°. *Cu*

*salt*: (C<sub>9</sub>H<sub>13</sub>O<sub>5</sub>)<sub>2</sub>Cu. Needles from EtOH. M.p.

132–3°. *Ni salt*:  $(C_9H_{13}O_5)_2Ni$ . Needles from EtOH. M.p. 219–20°.

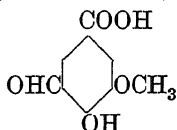
Carrière, *Ann. chim.*, 1922, 17, 41.

Johnson, Peck, Ambler, *J. Am. Chem. Soc.*, 1911, 33, 761.

### Aldehydothymol.

See Thymotinic Aldehyde.

**5-Aldehydovanillic Acid** (4-Hydroxy-3-methoxy-5-aldehydobenzoic acid)



$C_9H_8O_5$  MW, 196

Needles from  $H_2O$ . M.p. 221–2°. Spar. sol. cold  $H_2O$ . Sol. EtOH,  $Et_2O$ . Sol. NaOH to deep yellow sol.  $FeCl_3 \rightarrow$  violet col.

*Me ester*:  $C_{10}H_{10}O_5$ . MW, 210. Yellow needles. M.p. 134–5°.

*Me ether*: see Iso-opianic Acid.

Tiemann, Mendelsohn, *Ber.*, 1877, 10, 396.

### Aldehydo-xyleneol.

See Hydroxydimethylbenzaldehyde.

**Aldol** (2-Hydroxybutyraldehyde, 2-butanolal-3, acetaldol)



$C_4H_8O_2$  MW, 88

Colourless syrupy liq. B.p. 83°/20 mm., 77°/16 mm. At 85° decomp. to crotonaldehyde +  $H_2O$ . Misc. with  $H_2O$  and EtOH.  $D^{20}$  1.1094. Heat of comb. (liq.), 547 Cal. Reduces  $NH_3 \cdot AgNO_3$ . Polymerises to paralldol.

*Mono-acetyl*: b.p. 87–9°/18 mm.

*Tri-acetyl*: b.p. 138–40°/12 mm.

*Di-Et acetal*: b.p. 190–5°, 75–81°/12 mm. Sol. 5 parts  $H_2O$ .

*p-Bromophenylhydrazone*: leaflets. M.p. 127–8°.

*p-Nitrophenylhydrazone*: yellow, m.p. 115–6°.

*Oxime*: b.p. 110–20°.

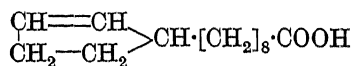
*Anil*: glassy mass. M.p. 73–5°.

Kyriakides, *J. Am. Chem. Soc.*, 1914, 36, 532.

Claisen, *Ann.*, 1899, 306, 323.

Grignard, Reif, *Bull. soc. chim.*, 1907, 1, 114.

### Alepric Acid



$C_{14}H_{24}O_2$  MW, 224

Occurs in *Hydnocarpus wightiana* oil. Needles from MeOH–pct. ether. M.p. 48°. B.p. 165–8°/1 mm.  $[\alpha]_D^{25}$  77.1°. Iodine no. 113.4.

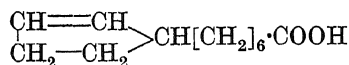
*Et ester*: b.p. 174°/10 mm.  $n_D^{25}$  1.4562.  $D_{25}^{25}$  0.915.  $[\alpha]_D^{25}$  66.5°. Iodine no. 100.7.

Cole, Cardoso, *J. Am. Chem. Soc.*, 1939, 61, 2349.

### Aleprolic Acid.

See Cyclopentene-3-carboxylic Acid.

### Aleprylic Acid



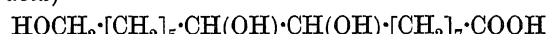
$C_{12}H_{20}O_2$  MW, 196.

Occurs in *Hydnocarpus wightiana* oil. M.p. 32°.  $[\alpha]_D^{25}$  90.8°. Iodine no. 129.7.

*Et ester*: b.p. 148°/10 mm.  $n_D^{25}$  1.4550.  $D_{25}^{25}$  0.925.  $[\alpha]_D^{25}$  79.1°. Iodine no. 113.4.

Cole, Cardoso, *J. Am. Chem. Soc.*, 1939, 61, 2349.

**Aleuritic Acid** (8 : 9 : 15-Trihydroxypalmitic acid)



$C_{16}H_{35}O_5$  MW, 307

Constituent of shellac resin. Leaflets from EtOH.Aq., needles from  $H_2O$ . M.p. 102°. HI  $\rightarrow$  palmitic acid. Ox.  $\rightarrow$  azelaic acid +  $HOCH_2 \cdot [CH_2]_5 \cdot COOH$ .

*Me ester*:  $C_{17}H_{37}O_5$ . MW, 321. M.p. 63–4° (73°). *Triacetyl*: b.p. 232–4°/0.15 mm.

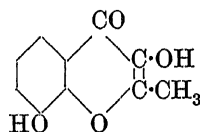
*Hydrazide*: m.p. 139–40°.

*Azide*: needles from EtOH. Decomp. at 50°.

Nagel, *Chem. Zentr.*, 1931, II, 557.

Schaeffer, Gardner, *Ind. Eng. Chem.*, 1938, 30, 333.

### Alginetin



Suggested structure

$C_{10}H_8O_4$  MW, 192

Obtained by heating alginic acid at 160° for 3 hrs. Needles. M.p. 235°. Sol. hot  $H_2O$ , hot EtOH. Insol. ligroin.  $FeCl_3 \rightarrow$  violet col.  $H_2O_2 \rightarrow$  2 : 3-dihydroxybenzoic acid.

*Diacetyl*: m.p. 125°.

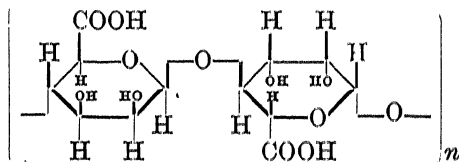
*Dibenzoyl*: m.p. 187°.

*Me ether*: m.p. 215°.

*Acetyl-Me ether*: m.p. 171°.

Kiyoshi, Aso, *Chem. Abstracts*, 1935, 29, 1067.

### Alginic Acid



$[C_6H_8O_6]_n$



Occurs both free and as Ca salt in many seaweeds (*Laminaria*, *Fucus*, etc.). Insol. org. solvents. Sol. aq. alkalis. Forms insol. Ca, Cu, Th salts. Forms a Me ester. Boiling MeOH-HCl  $\rightarrow$  degraded alginic acid + methyl *d*-mannuronoside. Hyd.  $\rightarrow$  mannuronic acid. Na salt employed as stabilizer for ice cream and cheese. Alginates have applications in some branches of the textile and allied industries.

Hirst, Jones, Jones, *J. Chem. Soc.*, 1939, 1882.

Kelco, U.S.P., 2,036,922, (*Chem. Abstracts*, 1936, 30, 3442).

Barry, Dillon, *Sci. Proc. Roy. Dublin Soc.*, 1936, 21, 285, 289.

Lunde, Heen Öy, *Kolloid. Zeit.*, 1938, 83, 196.

Tseng, *Colloid Chemistry*, 1946, 6, 629.

### Alginine

$C_{23}H_{39}O_3N$  MW, 377

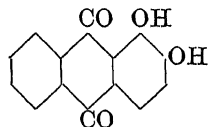
Alkaloid isolated from *Fritillaria sewerzowii*. M.p. 271–2°.  $[\alpha]_D^{20} + 108.5^\circ$  in EtOH.

*B, HCl*: m.p. 323–5°.

*B, MeI*: m.p. 310–11°.

Konovałova, Orékhov, *J. Gen. Chem. U.S.S.R.*, 1939, 9, 1911.

### Alizarin (1 : 2-Dihydroxyanthraquinone)



$C_{14}H_8O_4$  MW, 240

Occurs naturally in madder root (*Rubia tinctoria*, Linn.) as glucoside, ruberythric acid. Orange or red needles or prisms from EtOH or by sublimation. M.p. 290°. B.p. 430°. Sol.  $H_2O$  to 0.034% at 100°. Sol. in  $H_2O$  by addn. of Na salt of naphthalenesulphonic acid. Mod. sol. EtOH,  $Et_2O$ , AcOH,  $C_6H_6$ ,  $PhNO_2$ ,  $CS_2$ . Sol. caustic alkalis, carbonates and  $NH_3$  to violet sols. Sol. conc.  $H_2SO_4$  to reddish-brown col. Sublimes. Heat of comb.  $C_p$  and  $C_v$  1453.1 Cal.  $HNO_3 \rightarrow$  phthalic acid.  $H_2SO_4 + MnO_2 \rightarrow$  purpurin. Zn dust  $\rightarrow$  anthracene. Zn +  $NH_3 \rightarrow$  3 : 4-dihydroxyanthrone.

1-*Me ether*:  $C_{15}H_{10}O_4$ . MW, 254. Orange needles. M.p. 179°. *Acetyl*: yellow needles from EtOH. M.p. 209–10°.

2-*Me ether*: yellow needles from EtOH. M.p. 232–3°. Sol. conc.  $H_2SO_4$  to violet-red sol. *Acetyl*: yellow needles from EtOH. M.p. 204–6°.

*Di-Me ether*:  $C_{16}H_{12}O_4$ . MW, 268. Golden-yellow needles. M.p. 215°. Red sols. in  $H_2SO_4$  and  $H_2SO_4$  + boric acid.

2-*Et ether*:  $C_{16}H_{12}O_4$ . MW, 268. Orange needles. M.p. 189°. *Acetyl*: yellow needles from EtOH. M.p. 141°.

1-*Et*, 2-*Me ether*:  $C_{17}H_{14}O_4$ . MW, 282. Cryst. from EtOH. M.p. 169–70°.

*Di-Et ether*:  $C_{18}H_{16}O_4$ . MW, 296. Yellow needles. M.p. 162°.

2-*Acetyl*: orange leaflets from EtOH. M.p. 198–201°.

*Diacetyl*: yellow cryst. from EtOH. M.p. 184°.

2-*Benzoyl*: needles from EtOH. M.p. 214–6°.

*Dibenzoyl*: 2 forms. Unstable cryst. from  $PhNO_2$ . M.p. 160°. On standing  $\rightarrow$  stable form. Prisms from  $PhNO_2$ . M.p. 187°.

2-*Phenylacetyl*: greenish-yellow needles from  $C_6H_6$ . M.p. 165°.

2-*p-Bromobenzoyl*: yellow needles from  $C_6H_6$ . M.p. 195°.

Vorozhtsov, Aleksandrov, *Chem. Abstracts*, 1941, 35, 4375.

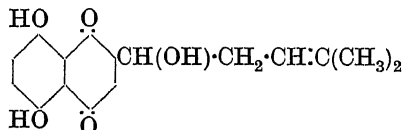
Green, *J. Chem. Soc.*, 1927, 2930.

Badische, D.R.P., 287,270, (*Chem. Zentr.*, 1915, II, 935).

### Alkaloid L27.

See Acrifoline.

### Alkannin



$C_{16}H_{16}O_5$  MW, 288

Red pigment of *Alkanna tinctoria* and *Onosma echinodes*. Bronze spears from  $Et_2O$ -EtOH. M.p. 149°.  $[\alpha]_{Ca}^{20} - 157^\circ$  ( $C_6H_6$ ). Optical antipode of shikonin. Sublimes at 140°/0.001 mm. Dry dist.  $\rightarrow$  1-methylquinizarin. Zn dist.  $\rightarrow$  2-methylantracene. Red  $\rightarrow$  alkannan.  $O_3 \rightarrow$  acetone.

*Triacetyl*: yellow. M.p. 132°.  $[\alpha]_{Ca}^{20} - 110^\circ$  in  $C_6H_6$ .

*Dibenzoyl*: yellow. M.p. 174–5°.

*Me ether*: brownish red. M.p. 105°. Identical with shikonin methyl ether.

*Et ether*: brown red. M.p. 83°.

*Propyl ether*: red. M.p. 57–8°.

Brockmann, Roth, *Naturwiss.*, 1935, 23, 246.

Brockmann, *Ann.*, 1935, 521, 1.

Raudnitz, Stein, *Ber.*, 1934, 67, 1955; 1935, 68, 1479.

Carnelutti, Nasini, *Ber.*, 1880, 13, 1514.

Liebermann, Romer, *Ber.*, 1887, 20, 2428.

Dieterle, Salomon, Nosseck, *Ber.*, 1931, 64, 2086.

### d-Alkannin.

See Shikonin.

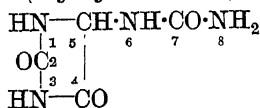
**Alkathene.**

See Ethylene.

**Allantoic Acid** (*Diureidoacetic acid*)C<sub>4</sub>H<sub>8</sub>O<sub>4</sub>N<sub>4</sub> MW, 176

Needles. Sinters at 168°. M.p. 173° decomp. Spar. sol. cold H<sub>2</sub>O, org. sols. and dil. acids. Hot H<sub>2</sub>O → glyoxylic acid + urea.

*Et ester*: C<sub>6</sub>H<sub>12</sub>O<sub>4</sub>N<sub>4</sub>, MW, 204. Needles. Decomp. about 200°. Sol. EtOH, hot H<sub>2</sub>O.

Behrend, Schultz, *Ann.*, 1909, 365, 21.**Allantoin** (*Glyoxylic diureide*)C<sub>4</sub>H<sub>6</sub>O<sub>3</sub>N<sub>4</sub> MW, 158

Occurs in allantoin fluid of cow. Monoclinic prisms from H<sub>2</sub>O. M.p. 238–40°. Sol. EtOH, hot H<sub>2</sub>O.  $k = 1.1 \times 10^{-9}$  at 25°. Heat of form. 170.4 Cal. Heat of comb. C<sub>p</sub>, 413.9 Cal., C<sub>v</sub> 415.1 Cal.

1-*Me*: see 1-Methylallantoin.3-*Me*: see 3-Methylallantoin.

3-*Et*: C<sub>6</sub>H<sub>10</sub>O<sub>3</sub>N<sub>4</sub>, MW, 186. Prisms from MeOH. M.p. 189–90°.

1:3-*Di-Me*: C<sub>6</sub>H<sub>10</sub>O<sub>3</sub>N<sub>4</sub>, MW, 186. Prisms from EtOH. M.p. 214°.

1:6-*Di-Me*: needles from AcOH. M.p. 226–7° decomp.

1:8-*Di-Me*: prisms from H<sub>2</sub>O. M.p. 220–3°.3:8-*Di-Me*: prisms from H<sub>2</sub>O. M.p. 222–3°.1:3:6-*Tri-Me*: see Caffoline.

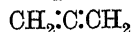
1:3:8-*Tri-Me*: C<sub>7</sub>H<sub>12</sub>O<sub>3</sub>N<sub>4</sub>, MW, 200. Prisms from AcOEt. M.p. 152°.

1-*Acetyl*: leaflets from AcOH. M.p. 236° decomp.

1:3-*Diacetyl*: prisms from AcOH. M.p. 247° decomp.

Biltz, Giesler, *Ber.*, 1913, 46, 3410.Biltz, Max, *Ber.*, 1921, 54, 2451.Hartmann, Moffett, Dickey, *Organic Syntheses*, XIII, 1.**Allantoxanic Acid.**

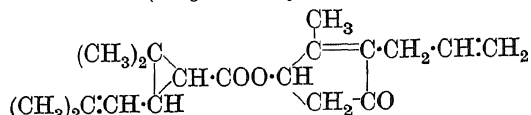
See Oxonic Acid.

**Allene** (*Isoallylene, propadiene*)C<sub>3</sub>H<sub>4</sub> MW, 40

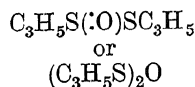
Gas. M.p. –146°. B.p. –32°. Dist. of H<sub>2</sub>SO<sub>4</sub> sol. → Me<sub>2</sub>CO. Gives no Cu or Hg ppt. Bromine → tetrabromide. Readily isomerises on heating → CH<sub>3</sub>C≡CH.

*Tetrabromide*: see 1:2:2:3-Tetrabromopropane.

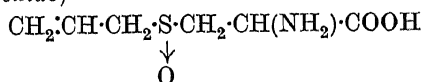
*Nitrosite*: cryst. from Et<sub>2</sub>O. M.p. 89° decomp.

Vaubel, *Ber.*, 1891, 24, 1685.**Allethrin** (*Allylrethronyl chrysanthemate*)C<sub>19</sub>H<sub>26</sub>O<sub>3</sub> MW, 302

Viscous oil. B.p. 127°/0.002 mm., 100–102°/0.001 mm.  $n_D^{20}$  1.505. Synthetic analogue of pyrethrin. Insecticide.

Schechter, Green, LaForge, *J. Am. Chem. Soc.*, 1949, 71, 3165.Gersdorff, *Journal of Economic Entomology*, 1949, 42, 532.Harper et al., *J. Chem. Soc.*, 1950, 3561.**Allicin**C<sub>6</sub>H<sub>10</sub>OS<sub>2</sub> MW, 162

Antibacterial principle of *Allium sativum*. D<sub>20</sub> 1.112.  $n_D^{20}$  1.561. Sol. 2.5 gm./100 c.c. H<sub>2</sub>O at 10°. Alkalis → SO<sub>2</sub>.

Cavallito, Bailey, *J. Am. Chem. Soc.*, 1944, 66, 1950.Raghunandana Rao et al., *J. Sci. Ind. Research*, 1946, 1B, 31.**Alliin** (*β-Allylsulphenylalanine, S-allylcysteine sulphoxide*)C<sub>6</sub>H<sub>11</sub>O<sub>3</sub>NS MW, 177

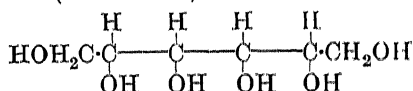
Occurs in garlic oil (from *Allium sativum*, *A. ursinum* and *A. triquetrum*). Fine needles from H<sub>2</sub>O–Me<sub>2</sub>CO. M.p. 163.5° decomp.  $[\alpha]_D^{25}$  +62.7° in H<sub>2</sub>O. Alloxan → red col. Gives positive ninhydrin reaction. Heat with Na<sub>2</sub>Fe(CN)<sub>5</sub>NO → red. col. Alliinase → alliin + pyruvic acid + NH<sub>3</sub>.

*N-Acetyl*: *brucine salt*, m.p. 188–98° decomp.  $[\alpha]_D^{25}$  –29.0°.

*N-Benzoyl*: m.p. 152–3.5° decomp.  $[\alpha]_D^{20}$  –6.0° in MeOH.

*N-p-Nitrobenzoyl*: m.p. 180–2° decomp.  $[\alpha]_D^{20}$  –9.0° in MeOH. *Me ester*: m.p. 140–3°.

*Anilanoformyl deriv.*: m.p. 141–3° decomp.  $[\alpha]_D^{21}$  +76.0° in MeOH.

Stoll, Seebeck, *Helv. Chim. Acta*, 1949, 32, 197; 1948, 31, 189.**Allitol** (*Allodulcitol*)C<sub>6</sub>H<sub>14</sub>O<sub>6</sub> MW, 182

M.p. 150°.

*Dibenzylidene deriv.*: m.p. 249°.

2:4:3:5-Dimethylene: m.p. 256°.

Steiger, Reichstein, *Helv. Chim. Acta*, 1936, 19, 184.

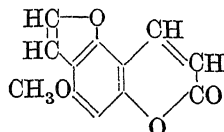
Lespieau, Wiemann, *Bull. soc. chim.*, 1933, 53, 1107.

Wolfrom, Lew, Goepp, *J. Am. Chem. Soc.*, 1946, 68, 1443.

### Allobarbitone.

See 5:5-Diallylbarbituric Acid.

### Allobergaptene



$C_{12}H_8O_4$

MW, 216

Cryst. from MeOH. M.p. 207°.  $H_2O_2 \rightarrow$  furan-2:3-dicarboxylic acid. Red  $\rightarrow$  tetrahydro deriv.

Spáth, Wessely, Kubiczek, *Ber.*, 1937, 70, 243.

Foster, Howell, Robertson, *J. Chem. Soc.*, 1939, 930.

### Allobetulin.

See Betulin.

### Allobromocinnamic Acid.

See Bromocinnamic Acid.

### Allocaffeine.

See under Caffolide.

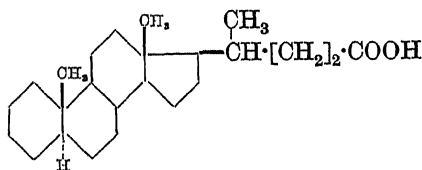
### Allocaffuric Acid.

See under Caffuric Acid.

### Allochlorocinnamic Acid.

See Chlorocinnamic Acid.

### Allocholanic Acid



$C_{24}H_{40}O_2$

MW, 360

Plates from AcOH. M.p. 170°.

*Me ester*:  $C_{25}H_{42}O_2$ . MW, 374. Needles.

M.p. 91°.

*Et ester*:  $C_{26}H_{44}O_2$ . MW, 388. M.p. 84°.

*Propyl ester*:  $C_{27}H_{46}O_2$ . MW, 402. M.p. 103-4°.

*Butyl ester*:  $C_{28}H_{48}O_2$ . MW, 416. M.p. 87°.

Windaus, Bohne, *Ann.*, 1923, 433, 284.

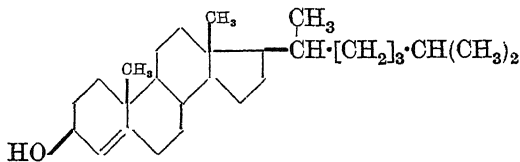
Windaus, Neukirchen, *Ber.*, 1919, 52, 1918.

Hofmann, Stoll, Helfenstein, *Helv. Chim. Acta*, 1935, 18, 644.

Wieland, Dane, Martius, *Z. physiol. Chem.*, 1933, 215, 15.

Dict. of Org. Comp.—I.

### Allocholesterol ( $\Delta^4$ -Cholestenol)



$C_{27}H_{46}O$

MW, 386

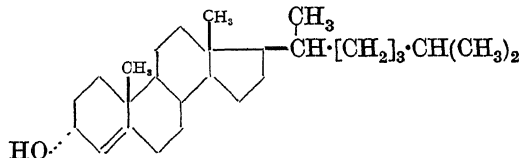
Needles from  $Et_2O$ -MeOH. M.p. 132° (115-8°). Sol. most org. solvents.  $[\alpha]_D^{25} + 43.7^\circ$ . Pptd by digitonin. HCl in EtOH  $\rightarrow \Delta^2:4$ -cholestadiene.

*Acetyl*: needles from MeOH.Aq. M.p. 85°.

*Chloride*: M.p. 95°.

Schoenheimer, Evans, *J. Biol. Chem.*, 1936, 114, 567.

### epiAllocholesterol ( $\Delta^4$ -epiCholestenol)



$C_{27}H_{46}O$

MW, 386

M.p. 84°. Sol. most org. solvents.  $[\alpha]_D^{24} + 120.8^\circ$ . Not pptd. by digitonin. HCl in EtOH  $\rightarrow \Delta^2:4$ -cholestadiene.

*Acetyl*: needles. M.p. 82.5°.

Schoenheimer, Evans, *J. Biol. Chem.*, 1936, 114, 567.

### Allochrysoketone.

See 3:4-Benzfluorenone.

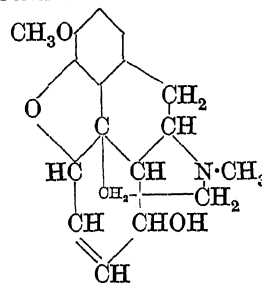
### Allocinchonine.

See Apocinchonine.

### Allocinnamic Acid.

See Cinnamic Acid.

### Allo- $\psi$ -codeine



$C_{18}H_{21}O_3N$

MW, 299

Needles from AcOH. M.p. 116-17°.  $[\alpha]_D^{25} - 235.4^\circ$ .

*B, HCl*: m.p. 256-8° decomp.  $[\alpha]_D^{25} - 202^\circ$ .

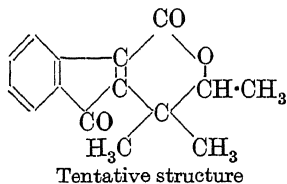
*Salicyloyl deriv.*: m.p. 202°.  $[\alpha]_D^{25} - 145^\circ$ .

Speyer, Krauss, *Ann.*, 1923, 432, 233.

Lutz, Small, *J. Am. Chem. Soc.*, 1934, 56, 2466.

**Allocrotonic Acid.**

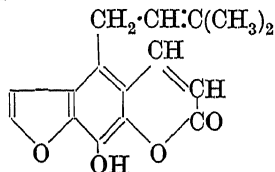
See Isocrotonic Acid.

 **$\alpha$ -Allocryptopine.**See  $\beta$ -Homochelidonine. **$\beta$ -Allocryptopine.**See  $\gamma$ -Homochelidonine.**Allodunnione** $C_{15}H_{14}O_3$  MW, 242Obtained by heating dunnione with alkali. Yellow needles. M.p. 161–2°.  $[\alpha]_D^{25}$  10.2° in  $CHCl_3$ .  $CrO_3 \rightarrow$  acetone.

2 : 4-Dinitrophenylhydrazine: yellowish orange. M.p. 315° decomp.

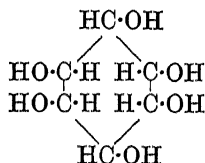
Price, Robinson, *J. Chem. Soc.*, 1939, 1522; 1940, 1493.**Alloemicymarin.**

See 17-Isoemicymarin.

**Alloglaucoctoxigenin** $C_{23}H_{32}O_6$  MW, 404Aglycone from *Coronilla glauca*. M.p. 235° decomp.  $[\alpha]_D^{20} +27^\circ$ . No cardiac activity.Diacetyl deriv.: cryst. +5H<sub>2</sub>O. M.p. 192–3°.  $[\alpha]_D^{20} -8.8^\circ$ . Oxime: m.p. 265°.  $[\alpha]_D^{20} -5.9^\circ \pm 1^\circ$ .Stoll, Pereira, Lenz, *Helv. Chim. Acta*, 1949, 32, 293.**Alloimperatorin** $C_{16}H_{14}O_4$  MW, 270

Obtained by dist. of imperatorin. Yellow. M.p. 233° (235–6°). Sublimes at 205–15° (bath temp.)/0.001 mm. Sol. in alkalis.

Me ether: m.p. 113–5°. B.p. 185–195°/0.01 mm.

Späth, Holzen, *Ber.*, 1933, 66, 1137.  
Späth et al., *Ber.*, 1937, 70, 1021.**Alloinositol** $C_6H_{12}O_6$  MW, 180

M.p. 270–5°.

Dangschat, Fischer, *Naturwiss.*, 1939, 27, 756.**Alloisorubijervine** $C_{27}H_{43}O_2N$  MW, 413Cryst. from EtOH–Et<sub>2</sub>O as rhombic platelets. M.p. 250–1°.  $[\alpha]_D^{25}$  63° in  $CHCl_3$ . Trichloroacetic acid  $\rightarrow$  deep purple col.Jacobs, Craig, *J. Biol. Chem.*, 1945, 159, 617.**Allolupeol** $C_{30}H_{50}O$  MW, 426

Obtained by heating lupeol with formic acid and saponifying. Three forms:

 $\alpha$ -.

Needles. M.p. 191°.

Formyl: m.p. 229°.

Acetyl: m.p. 199° (195–6°).

Benzoyl: m.p. 256°.

 $\beta$ -.

M.p. 151°.

Formyl: amorphous. M.p. 180–3°.

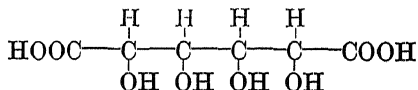
Acetyl: m.p. 196°.

Benzoyl: m.p. 228°.

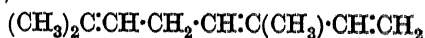
 $\gamma$ -.

Leaflets. M.p. 176–7°.

Acetyl: leaflets. M.p. 268–9°.

Nöjd, *Arch. Pharm.*, 1927, 265, 381.Biedebach, *Arch. Pharm.*, 1943, 281, 49.**Allomucic Acid (Tetrahydroxyadipic acid)** $C_6H_{10}O_8$  MW, 210Needles from H<sub>2</sub>O. M.p. 176° decomp. Heat of comb. C<sub>v</sub> 495.3 Cal. Sol. hot H<sub>2</sub>O, which distinguishes it from mucic acid. Spar. sol. EtOH.Di-Et ester:  $C_{10}H_{18}O_8$ . MW, 266. Cryst. from EtOH. M.p. 139–41°.Amide:  $C_6H_{11}O_7N$ . MW, 209. Cryst. from H<sub>2</sub>O. M.p. 175–6°.Diamide:  $C_6H_{12}O_6N_2$ . MW, 208. Cryst. from H<sub>2</sub>O. M.p. 209° decomp.

Phenylhydrazide: cryst. from EtOH. M.p. 218° decomp.

Butler, Cretcher, *J. Am. Chem. Soc.*, 1929, 51, 2167.Fischer, *Ber.*, 1891, 24, 2137.**Allo-ocimene (2 : 6-Dimethyl-2 : 5 : 7-octatriene)** $C_{10}H_{16}$  MW, 136

B.p. 188°/750 mm., 95°/24 mm., 81°/12 mm.  
D<sup>15</sup> 0.8133.  $n_D^{21}$  1.5447.

Lozac'h, *Bull. soc. chim.*, 1941, 8, 519.  
Nikitin, *J. Applied Chem. U.S.S.R.*, 1946,  
19, 890, (*Chem. Abstracts*, 1947, 41,  
6550).

Arbusow, *Ber.*, 1934, 67, 563.  
Enklaar, *Rec. trav. chim.*, 1907, 26, 175.

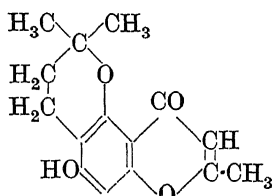
**Alloperiplocyarin.**

See 17-Isoperiplocyarin.

**Alloperiplogenin.**

See 17-Isoperiplogenin.

**Allopeucenin**



Suggested structure

C<sub>15</sub>H<sub>16</sub>O<sub>4</sub> MW, 260

Obtained from peucenin by heating with H<sub>2</sub>SO<sub>4</sub>. M.p. 303-4° decomp.

Me ether: m.p. 170-1°.

Späth, Eiter, *Ber.*, 1941, 74, 1851.

**Allophanamide.**

See Biuret.

**Allophanic Acid** (*Ureidoformic acid*, *N-carboxyurea*, *carbamylicarbamic acid*)



C<sub>2</sub>H<sub>4</sub>O<sub>3</sub>N<sub>2</sub> MW, 104

Not known in free state. Decomp. to CO<sub>2</sub> and urea when liberated from its salts. Salts are unstable, being hyd. by H<sub>2</sub>O to CO<sub>2</sub>, urea and carbonate.

Me ester: C<sub>3</sub>H<sub>6</sub>O<sub>3</sub>N<sub>2</sub>. MW, 118. Needles from H<sub>2</sub>O. M.p. 208° decomp. Sol. EtOH, hot H<sub>2</sub>O.

Et ester: C<sub>4</sub>H<sub>8</sub>O<sub>3</sub>N<sub>2</sub>. MW, 132. Needles from H<sub>2</sub>O. M.p. 195°. Sol. EtOH, hot H<sub>2</sub>O. Spar. sol. EtOH. Dist. → cyanuric acid + EtOH. Acetyl deriv.: m.p. 107°.

Propyl ester: C<sub>5</sub>H<sub>10</sub>O<sub>3</sub>N<sub>2</sub>. MW, 146. Leaflets. M.p. 150-60°. Sol. EtOH, hot H<sub>2</sub>O.

Isoamyl ester: C<sub>7</sub>H<sub>14</sub>O<sub>3</sub>N<sub>2</sub>. MW, 174. M.p. 162°. Sol. EtOH, hot H<sub>2</sub>O. Volatile in steam.

Octyl ester: C<sub>10</sub>H<sub>20</sub>O<sub>3</sub>N<sub>2</sub>. MW, 216. Needles from EtOH. M.p. 155-6°.

Cetyl ester: C<sub>18</sub>H<sub>36</sub>O<sub>3</sub>N<sub>2</sub>. MW, 328. Leaflets from EtOH. M.p. 70°.

Mono-glycol ester: C<sub>4</sub>H<sub>8</sub>O<sub>4</sub>N<sub>2</sub>. MW, 148. M.p. 160°. Sol. H<sub>2</sub>O, EtOH.

Mono-glyceryl ester: C<sub>5</sub>H<sub>10</sub>O<sub>5</sub>N<sub>2</sub>. MW, 178. M.p. 160°. Sol. hot EtOH.

Phenyl ester: C<sub>8</sub>H<sub>8</sub>O<sub>3</sub>N<sub>2</sub>. MW, 180. M.p. 194°.

Benzyl ester: C<sub>9</sub>H<sub>10</sub>O<sub>3</sub>N<sub>2</sub>. MW, 194. M.p. 191-5°.

Amide: see Biuret.

Methylamide: see under Biuret.

Ethylamide: see under Biuret.

Anilide: see ω-Phenylbiuret.

o-Toluidide: m.p. 180°.

m-Toluidide: m.p. 165°.

p-Toluidide: m.p. 215°.

Nitroanilide: see ω-Nitrophenylbiuret.

Bougault, Leboucq, *Bull. soc. chim.*, 1930, 47, 594.

Gattermann, *Ann.*, 1888, 244, 40.

Béhal, *Compt. rend.*, 1919, 168, 945.

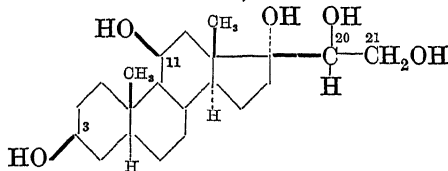
**Allophanylacetic Acid.**

See Malonic Acid.

**Allophanylaniline.**

See ω-Phenylbiuret.

**Allopregnane 3 $\beta$ :11 $\beta$ :17 $\alpha$ :20 $\beta$ :21-pentol**  
(*Reichstein's Substance A*)



C<sub>21</sub>H<sub>36</sub>O<sub>5</sub> MW, 368

Isolated from adrenal cortical extracts. M.p. 222°. [α]<sub>D</sub><sup>19</sup> + 16° in EtOH. Physiologically inactive.

Triacetyl: m.p. 220°. [α]<sub>D</sub> + 74°.

Wintersteiner, Pfiffner, *J. Biol. Chem.*, 1935, 111, 599.

Reichstein, *Helv. Chim. Acta*, 1936, 19, 29; 1937, 20, 978.

Mason, Myers, Kendall, *J. Biol. Chem.*, 1936, 114, 613.

Shoppee, *Helv. Chim. Acta*, 1940, 23, 740.

Reichstein, von Euw, *Helv. Chim. Acta*, 1941, 24, 247E.

**Allopregnane-3 $\beta$ :17 $\alpha$ :20 $\beta$ :21-tetrol**  
(*Reichstein's Substance K*)

C<sub>21</sub>H<sub>36</sub>O<sub>4</sub> MW, 352

Isolated from adrenal cortical extracts. M.p. 200°. [α]<sub>D</sub> -1° in EtOH. Physiologically inactive.

Triacetyl: m.p. 179°. [α]<sub>D</sub> + 53°.

Steiger, Reichstein, *Helv. Chim. Acta*, 1938, 21, 546.

Serini, Logemann, Hildebrand, *Ber.*, 1939, 72, 391.

**Allopregnane-3 $\alpha$ :11 $\beta$ :17 $\alpha$ :21-tetrol-20-one**  
(*Reichstein's Substance C*)

C<sub>21</sub>H<sub>34</sub>O<sub>5</sub> MW, 366

Isolated from adrenal cortical extracts. M.p. 276°. [α]<sub>D</sub> + 73° in EtOH. Physiologically inactive.

*Diacetyl*: m.p. 205°. [ $\alpha$ ]<sub>D</sub> + 74°.

Wintersteiner, Piffner, *J. Biol. Chem.*, 1935, **111**, 599.

Reichstein, *Helv. Chim. Acta*, 1936, **19**, 29.

Mason, Hoehn, Kendall, *J. Biol. Chem.*, 1938, **124**, 459.

Kuizenga, Cartland, *Endocrinology*, 1939, **24**, 526.

Allopregnane-3 $\beta$ :11 $\beta$ :17 $\alpha$ :21-tetrol-20-one (Reichstein's Substance V)

C<sub>21</sub>H<sub>34</sub>O<sub>5</sub> MW, 366

Isolated from adrenal cortical extracts. M.p. 225°. [ $\alpha$ ]<sub>D</sub> + 51° in EtOH. Physiologically inactive.

*Diacetyl*: m.p. 227°. [ $\alpha$ ]<sub>D</sub> + 63°.

Von Euw, Reichstein, *Helv. Chim. Acta*, 1942, **25**, 988.

Allopregnane-3 $\beta$ :17 $\alpha$ :20 $\alpha$ -triol (Reichstein's Substance O)

C<sub>21</sub>H<sub>36</sub>O<sub>3</sub> MW, 336

Isolated from adrenal cortical extracts. M.p. 223°. [ $\alpha$ ]<sub>D</sub> - 13° in EtOH. Physiologically inactive.

*Diacetyl*: m.p. 250°. [ $\alpha$ ]<sub>D</sub> - 30°.

Steiger, Reichstein, *Helv. Chim. Acta*, 1938, **21**, 546.

Reich, Sutter, Reichstein, *Helv. Chim. Acta*, 1940, **23**, 170.

Allopregnane-3 $\beta$ :17 $\alpha$ :20 $\beta$ -triol (Reichstein's Substance J)

C<sub>21</sub>H<sub>36</sub>O<sub>3</sub> MW, 336

Isolated from adrenal cortical extracts. M.p. 217°. [ $\alpha$ ]<sub>D</sub> - 8°. Physiologically inactive.

*Diacetyl*: m.p. 160°. [ $\alpha$ ]<sub>D</sub> + 25°.

Reichstein, *Helv. Chim. Acta*, 1936, **19**, 1107.

Reich, Sutter, Reichstein, *Helv. Chim. Acta*, 1940, **23**, 170.

Allopregnane-3 $\beta$ :17 $\alpha$ :21-triol-11:20-dione (Reichstein's Substance D)

C<sub>21</sub>H<sub>32</sub>O<sub>5</sub> MW, 364

Isolated from adrenal cortical extracts. M.p. 242°. [ $\alpha$ ]<sub>D</sub> + 62° in EtOH. Physiologically inactive.

*Diacetyl*: m.p. 224°. [ $\alpha$ ]<sub>D</sub> + 72°.

Wintersteiner, Piffner, *J. Biol. Chem.*, 1935, **111**, 599.

Mason, Hoehn, Kendall, *J. Biol. Chem.*, 1938, **124**, 459.

Kuizenga, Cartland, *Endocrinology*, 1939, **24**, 526.

von Euw, Reichstein, *Helv. Chim. Acta*, 1942, **25**, 988.

Allopregnane-3 $\beta$ :11 $\beta$ :21-triol-20-one (Reichstein's Substance R)

C<sub>21</sub>H<sub>34</sub>O<sub>4</sub> MW, 350

Isolated from adrenal cortical extracts. M.p. 204°. Physiologically inactive.

*Diacetyl*: m.p. 174°. [ $\alpha$ ]<sub>D</sub> + 84°.

Reichstein, *Helv. Chim. Acta*, 1938, **21**, 1490.

Allopregnane-3 $\beta$ :17 $\alpha$ :21-triol-20-one (Reichstein's Substance P)

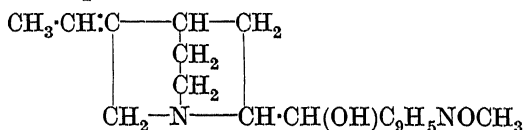
C<sub>21</sub>H<sub>34</sub>O<sub>4</sub> MW, 350

Isolated from adrenal cortical extracts. M.p. 239°. [ $\alpha$ ]<sub>D</sub> + 48° in EtOH. Physiologically inactive.

*Diacetyl*: m.p. 209°. [ $\alpha$ ]<sub>D</sub> + 38°.

Reichstein, Gätzi, *Helv. Chim. Acta*, 1938, **21**, 1185.

Alloquinidine



C<sub>20</sub>H<sub>24</sub>O<sub>2</sub>N<sub>2</sub> MW, 324

Obtained by heating quinaldine with H<sub>2</sub>SO<sub>4</sub>. M.p. 249-50°. [ $\alpha$ ]<sub>D</sub><sup>20</sup> 230°. AcOH  $\rightarrow$  allo-quinotoxin.

*B,HI*: m.p. 265-6° decomp. [ $\alpha$ ]<sub>D</sub><sup>20</sup> 185°.

*B,H<sub>2</sub>SO<sub>4</sub>*: m.p. 244-5° decomp. [ $\alpha$ ]<sub>D</sub><sup>20</sup> 185°.

*Methiodide*: m.p. 252-3°. [ $\alpha$ ]<sub>D</sub><sup>20</sup> 185°.

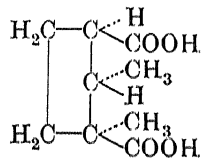
*Di-Methiodide*: m.p. 227°. [ $\alpha$ ]<sub>D</sub><sup>20</sup> 179°.

*Acetyl*: m.p. 166-7°. [ $\alpha$ ]<sub>D</sub><sup>20</sup> 193°.

*Benzoyl*: m.p. 113-5°. [ $\alpha$ ]<sub>D</sub><sup>20</sup> -59°.

Lubwiczak, Susko, *Chem. Abstracts*, 1937, **31**, 1816.

Allosantenic Acid (1:2-Dimethylcyclopentane-1:3-dicarboxylic acid)



C<sub>9</sub>H<sub>14</sub>O<sub>4</sub> MW, 186

Geometrical isomer of santenic acid.

*Cis*-.

M.p. 151-2°. AcOH-HCl  $\rightarrow$  trans form.

*Anhydride*: needles. M.p. 92°.

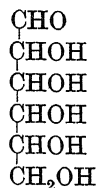
*Trans*-.

M.p. 166-7°.

Enkvist, *Chem. Abstracts*, 1933, **27**, 715.

Chakravarti, *J. Indian Chem. Soc.*, 1943, **20**, 243.

## Allose



$\text{C}_6\text{H}_{12}\text{O}_6$  MW, 180

*dl.*-

*Osazone*: m.p. 186–8° decomp.

*d.*-

Cryst. from  $\text{H}_2\text{O}$ . M.p. 128–128.5°.  $[\alpha]_D^{20} + 0.58^\circ$ .

*Osazone*: m.p. 173–4° decomp.  $[\alpha]_D^{20} - 19.2^\circ \pm 4^\circ$ .

*l.*-

Prisms from EtOH.Aq. M.p. 128–9°.  $[\alpha]_D^{20} - 1.9^\circ$ .

*Phenylosazone*: yellow cryst. from EtOH.Aq. M.p. 165°.

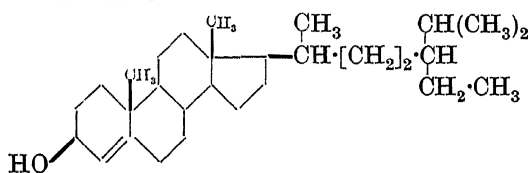
*p*-Bromophenylhydrazone: m.p. 141–5°.  $[\alpha]_D^{20} + 6.4^\circ$  in EtOH.

Reichstein, Steiger, *Helv. Chim. Acta*, 1936, 19, 184.

Phelps, Bates, *J. Am. Chem. Soc.*, 1934, 56, 1250.

Austin, Humoller, *J. Am. Chem. Soc.*, 1934, 56, 1153; 1933, 55, 2167.

## Allositosterol



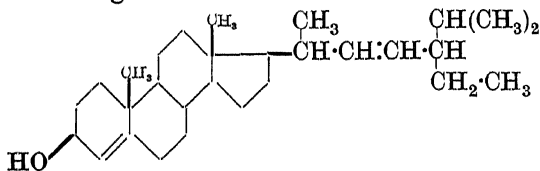
$\text{C}_{29}\text{H}_{50}\text{O}$  MW, 414

M.p. 158°.

*Acetyl*: m.p. 88°.

Marker, Oakwood, *J. Am. Chem. Soc.*, 1937, 59, 2708.

## Allostigmasterol



$\text{C}_{29}\text{H}_{48}\text{O}$  MW, 412

M.p. 137°.

*Acetyl*: m.p. 132°.

Marker, Oakwood, *J. Am. Chem. Soc.*, 1937, 59, 2708.

## Allostrophanthidin.

See 17-Isostrophanthidin.

## Allotephrosin.

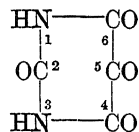
See Tephrosin.

## Allothreonine.

See under 2-Hydroxy-1-aminobutyric Acid.

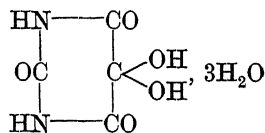
## Allouzarigenin.

See 17-Isouzarigenin.

Alloxan (*Mesoxalyurea*)

$\text{C}_4\text{H}_2\text{O}_4\text{N}_2$  MW, 142

Rhombic prisms from  $\text{H}_2\text{O}$ , having constitution



Effloresces losing  $3\text{H}_2\text{O}$ . At  $150^\circ > \text{C}(\text{OH})_2 \rightarrow > \text{CO} + \text{H}_2\text{O}$ . Decomp. at  $170^\circ$ . Sol.  $\text{H}_2\text{O}$ , EtOH. Aq. sol. reacts acid. Forms bisulphite comp. Heat of comb.  $\text{C}_p$  276.6 Cal.  $k = 2.3 \times 10^{-7}$  at  $25^\circ$ .  $\text{HNO}_3 \rightarrow$  parabanic acid. Red.  $\rightarrow$  alloxantin. Alk. hyd.  $\rightarrow$  alloxanic acid  $\rightarrow$  mesoxalic acid + urea. Fe salts  $\rightarrow$  deep blue col.

*5-Oxime*: see Violuric Acid.

*5:6-Dioxime*: yellow cryst. from EtOH.

M.p.  $242^\circ$  decomp.

*5-Phenylhydrazone*: m.p.  $298^\circ$  decomp. *6-Oxime*: yellow cryst. from EtOH. M.p.  $268^\circ$ .

*6-Phenylhydrazone*: cryst. from EtOH. M.p.  $260^\circ$ .

*o*-Nitrophenylhydrazone: m.p.  $310^\circ$ .

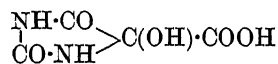
*p*-Nitrophenylhydrazone: m.p.  $300^\circ$ .

$\alpha$ -Naphthylhydrazone: red cryst. from AcOH. M.p.  $264^\circ$ .

Biltz, Heyn, *Ann.*, 1917, 413, 60.

Hartman, Sheppard, *Organic Syntheses*, 1943, XXIII, 3.

## Alloxanic Acid



$\text{C}_4\text{H}_4\text{O}_5\text{N}_2$  MW, 160

Prisms from  $\text{Et}_2\text{O}$ . Decomp. at  $162\text{--}3^\circ$ . Sol.  $\text{H}_2\text{O}$ . Mod. sol. EtOH. Spar. sol.  $\text{Et}_2\text{O}$ .

*Me ester*:  $\text{C}_5\text{H}_6\text{O}_5\text{N}_2$ . MW, 174. Prisms from AcOEt. Needles from  $\text{Me}_2\text{CO}\text{--}\text{CHCl}_3$ . M.p.  $171^\circ$ .

*Et ester*:  $\text{C}_6\text{H}_8\text{O}_5\text{N}_2$ . MW, 188. Cryst. from  $\text{Me}_2\text{CO}\text{--}\text{CHCl}_3$ . M.p.  $115^\circ$ .

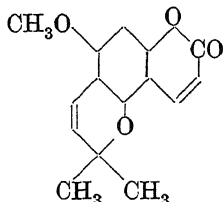
*Amide*:  $\text{C}_4\text{H}_5\text{O}_4\text{N}_3$ . MW, 159. Prisms from  $\text{H}_2\text{O}$ . M.p.  $191^\circ$ .

*Et amide*:  $\text{C}_6\text{H}_7\text{O}_4\text{N}_3$ . MW, 187. Needles from EtOH. Decomp. at  $136^\circ$ .

*Phenyl amide*:  $C_{10}H_9O_4N_3$ . MW, 234. Cryst. from  $Et_2O$ . M.p.  $99^\circ$ .

Biltz, Lachmann, *J. prakt. Chem.*, 1926, 113, 309, 333.

## Alloxanthoxyletin



$C_{15}H_{14}O_4$

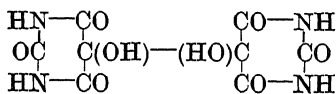
MW, 258

Isolated from bark of *Xanthoxylum americanum*. Pale yellow elongated thick prisms from petrol. M.p.  $115.5^\circ$ . Easily sol.  $C_6H_6$ ,  $Et_2O$ . Spar. sol. cold  $EtOH$ . Orange sol. in conc.  $H_2SO_4$  changing to orange-red in about 1 min., to bright-red on warming to  $100^\circ$ , finally becoming colourless.

*Dihydro deriv.*: thick colourless prisms from petrol. M.p.  $155^\circ$  after sintering at  $153^\circ$ .

Robertson, Subramaniam, *J. Chem. Soc.*, 1937, 1545.

## Alloxantin



$C_8H_6O_8N_4$

MW, 286

Rhombic prisms +  $2H_2O$  from  $H_2O$ . Yellow at  $225^\circ$ . Decomp. at  $253-5^\circ$ . Spar. sol. cold  $H_2O$ . Aq. sol. reacts acid. Reduces Ag salts.  $Ba(OH)_2 \rightarrow$  blue ppt. Heat of comb.  $C_p$  584.7 Cal. Ox.  $\rightarrow$  alloxan. Red.  $\rightarrow$  dialuric acid.

*Acetyl deriv.*: leaflets +  $1H_2O$  from  $H_2O$ . M.p.  $263-5^\circ$  decomp.

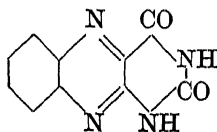
*Benzoyl deriv.*: leaflets from  $H_2O$ . M.p.  $253-5^\circ$ .

Hantzsch, *Ber.*, 1921, 54, 1267.

Denigès, *Chem. Abstracts*, 1929, 23, 4160.

Nightingale, *Organic Syntheses*, 1943, XXXII, 6.

## Alloxazine



$C_{10}H_6O_2N_4$

MW, 214

Greyish-green powder. Decomp. above  $300^\circ$ . Sol. alkalis or alkali carbonates. Very spar. sol.

$EtOH$ . Insol.  $H_2O$ ,  $Et_2O$ . Na salt. cryst. in yellow needles. Red.  $\rightarrow$  red free radical.

Kühling, *Ber.*, 1891, 24, 2364.

Möhlau, Litter, *J. prakt. Chem.*, 1906, 73, 449.

Kuhn, Bär, *Ber.*, 1934, 67, 898.

Tishler, Wellman, Ladenburg, *J. Am. Chem. Soc.*, 1945, 67, 2165.

## Allulose.

See Psicose.

## Allyl acetaldehyde.

See 4-Pentenal.

## Allyl acetate



$C_5H_8O_2$

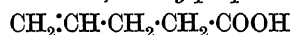
MW, 100

B.p.  $103-4^\circ$ .  $D_4^{20}$  0.938.  $n_D^{20}$  1.40488. Readily polymerised in the presence of alkaline earths.

Deulofeu, *Chem. Abstracts*, 1928, 22, 4104.

Zinin, *Ann.*, 1855, 96, 361.

**Allyl acetic Acid** (1-Butylene-4-carboxylic acid, 3-pentenic acid, 2-vinylpropionic acid)



$C_5H_8O_2$

MW, 100

B.p.  $188-9^\circ$ . Spar. sol.  $H_2O$ .  $D_4^{18}$  0.9843.  $n_D^{18}$  1.4341.  $k = 2.1 \times 10^{-5}$  at  $25^\circ$ . Br  $\rightarrow$  3 : 4-dibromo-*n*-valeric acid.  $KMnO_4 \rightarrow$  3 : 4-dihydroxy-*n*-valeric + succinic acids.

*Et ester*:  $C_7H_{12}O_2$ . MW, 128. B.p.  $144-6^\circ$ .

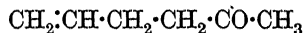
*Chloride*:  $C_5H_7OCl$ . MW, 118.5. B.p.  $128^\circ$ .  $D_4^{18}$  1.0739.

*Amide*:  $C_5H_9ON$ . MW, 99. M.p.  $94^\circ$ . B.p.  $230^\circ$ . Sol.  $H_2O$ .

*Nitrile*:  $C_5H_7N$ . MW, 81. B.p.  $140^\circ$ ,  $60-1^\circ/40$  mm. Insol.  $H_2O$ .  $D_{16}^{25}$  0.848.  $n_D^{25}$  1.4213.

Fittig, Messerschmidt, *Ann.*, 1881, 208, 92.

**Allyl acetone** (1-Hexenone-5, methyl  $\gamma$ -butenyl ketone)



$C_8H_{10}O$

MW, 98

B.p.  $129.6^\circ$ .  $D_{17.5}^{27}$  0.834.  $CrO_3 \rightarrow$  acetic and oxalic acids and  $CO_2$ .  $KMnO_4 \rightarrow$  levulinic acid.

*Oxime*: b.p.  $190^\circ$ . Sol.  $EtOH$ ,  $Et_2O$ . Insol.  $H_2O$ .

*Semicarbazone*: m.p.  $100-2^\circ$ .

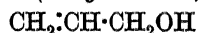
2 : 4-Dinitrophenylhydrazone: orange cryst. from  $EtOH$ . M.p.  $104^\circ$ .

Merling, *Ann.*, 1891, 264, 323.

## Allyl acetylacetone.

See Diacetobutylene.

## Allyl Alcohol (Vinylcarbinol, 1-propenol-3)



$C_3H_6O$

MW, 58

Colourless liq. B.p.  $96-7^\circ$ . Freezes at  $-50^\circ$ . Misc. with  $H_2O$  in all proportions. 72.3% allyl



alcohol + 27.7% H<sub>2</sub>O constant-boiling mixture, b.p. 87.5°. D<sub>20</sub><sup>15</sup> 0.8573. n<sub>D</sub><sup>20</sup> 1.41345. Crit. temp. 271.9°. CrO<sub>3</sub> → acraldehyde + H·CO<sub>2</sub>H. KMnO<sub>4</sub> → acraldehyde + glycerol + H·COOH. HNO<sub>3</sub> → oxalic + formic acids. Ag catalyst → acrolein. Red. → n-propyl alcohol.

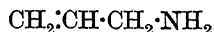
3 : 5-Dinitrobenzoate : m.p. 48°.

Shokal, Evans, B.P., 577,992, (*Chem. Abstracts*, 1947, 41, 2067).

Delaby, Dubois, *Compt. rend.*, 1929, 188, 710.

Nef, *Ann.*, 1904, 335, 228.

**Allylamine** (3-Amino-1-propylene, 3-amino-propene-1)



C<sub>3</sub>H<sub>7</sub>N

MW, 57

Colourless liq. with ammoniacal odour. B.p. 58°. Misc. with H<sub>2</sub>O in all proportions. D<sub>20</sub><sup>20</sup> 0.7436. n<sub>D</sub><sup>20</sup> 1.41943. Heat. of comb. C<sub>p</sub> 526.8 Cal. k = 5.7 × 10<sup>-5</sup> at 25°. HNO<sub>2</sub> → allyl alcohol. MeI → methylallylamine. Br in acid sol. → 2 : 3-dibromopropylamine.

B, HCl : cryst. from H<sub>2</sub>O. M.p. 105–110°.

N-Me : see Methylallylamine.

N-Di-Me : C<sub>5</sub>H<sub>11</sub>N. MW, 85. B.p. 64°/743 mm. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.

N-Et : see Ethylallylamine.

N-Di-Et : see Diethylallylamine.

N-Propyl : see Propylallylamine.

N-Phenyl : allylaniline. See under Aniline.

N-Formyl : see under Formamide.

N-Acetyl : see under Acetamide.

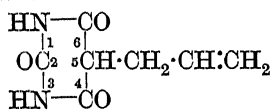
N-Diacetyl : N-allyldiacetamide. B.p. 88–90°/14 mm.

Picrate : m.p. 140–1°.

Gabriel, Eschenbach, *Ber.*, 1897, 30, 1124.

Brown, Jones, *J. Chem. Soc.*, 1946, 781.

**5-Allylbarbituric Acid**



C<sub>7</sub>H<sub>8</sub>O<sub>3</sub>N<sub>2</sub>

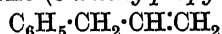
MW, 168

Plates from EtOH. M.p. 167°. Sol. hot H<sub>2</sub>O. Insol. C<sub>6</sub>H<sub>6</sub>. Conc. KOH at 140° → allylmalonic acid.

Johnson, Hill, *Am. Chem. J.*, 1911, 46, 540.

S.C.I., D.R.P., 268,158, (*Chem. Zentr.*, 1914, I, 201).

**Allylbenzene** (3-Phenylpropylene)



C<sub>9</sub>H<sub>10</sub>

MW, 118

B.p. 156–7°. D<sub>15</sub><sup>15</sup> 0.9012. n<sub>D</sub><sup>22</sup> 1.5110.

Klages, *Ber.*, 1906, 39, 2590.

Kharasch, U.S.P., 2,404,235, (*Chem. Abstracts*, 1946, 40, 6503).

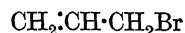
**Allylbenzylamine.**

See under Benzylamine.

**Allyl benzyl Ether.**

See under Benzyl Alcohol.

**Allyl bromide** (3-Bromopropylene, 3-bromopropene-1)



C<sub>3</sub>H<sub>5</sub>Br

MW, 121

B.p. 70–1°. D<sub>4</sub><sup>20</sup> 1.398. n<sub>D</sub><sup>20</sup> 1.46545.

Kamm, Marvel, *Organic Syntheses*, Collective Vol. I, 24.

**1-Allyl-1 : 3-butadiene.**

See 1 : 3 : 6-Heptatriene.

**3-Allyl-1-butylene.**

See 3-Methyl-1 : 5-hexadiene.

**Allylcarbinol** (1-Butenol-4)



C<sub>4</sub>H<sub>8</sub>O

MW, 72

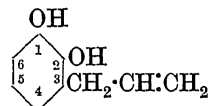
B.p. 112.5–113.5°(corr.)/755 mm. D<sub>4</sub><sup>17.5</sup> 0.8379. n<sub>D</sub><sup>17.5</sup> 1.4146.

Phenylurethane : m.p. 23.5–24.5°.

Pariselle, *Compt. rend.*, 1909, 148, 849.

Grishkevitch-Trochimovski, *J. Chem. Soc.*, 1917, 112, 154.

**3-Allylcatechol** (2 : 3-Dihydroxy-1-allylbenzene)



C<sub>9</sub>H<sub>10</sub>O<sub>2</sub>

MW, 150

B.p. 141–55°/16 mm. D<sub>4</sub><sup>20</sup> 1.1241. n<sub>D</sub><sup>20</sup> 1.5656. Diacetyl : m.p. 65°.

Kawai, *Sci. Papers Inst. Phys. Chem. Research, Tokyo*, 1925, 3, 263 (*Chem. Abstracts*, 1926, 20, 1798).

**4-Allylcatechol** (3 : 4-Dihydroxy-1-allylbenzene).

Constituent of betel-leaf oil. Needles from petrol or C<sub>6</sub>H<sub>6</sub>-petrol. M.p. 48–9°. B.p. 139°/4 mm. Sol. H<sub>2</sub>O. FeCl<sub>3</sub> → green col. Ox. → veratric acid.

2-Me ether : see Eugenol.

1-Et : 2-Me ether : see under Eugenol.

Di-Me ether : see under Eugenol.

Di-Et ether : C<sub>13</sub>H<sub>18</sub>O<sub>2</sub>. MW, 206. B.p. 125°/13 mm. D<sub>4</sub><sup>25</sup> 0.9836. n<sub>D</sub><sup>25</sup> 1.5132.

Dibenzoyl : m.p. 71–2°.

Schimmel, *Chem. Zentr.*, 1907, II, 1741.

Schöpf et al., *Ann.*, 1940, 544, 30.

**Allyl chloride** (3-Chloropropylene, 3-chloropropene-1)



C<sub>3</sub>H<sub>5</sub>Cl

MW, 76.5

B.p. 45°.  $D_4^{20}$  0.9379.  $n_D^{20}$  1.41538.

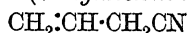
Dewael, *Chem. Abstracts*, 1930, 24, 2717.  
Coffey, Ward, *J. Chem. Soc.*, 1921, 119, 1301.

I.G., B.P., 495,900, (*Chem. Abstracts*, 1939, 33, 2912); B.P., 502,611, (*Chem. Abstracts*, 1939, 33, 7318).

**Allylcyanamide.**

See Triallyl tricyanamide.

**Allyl cyanide (Vinylacetoneitrile)**



$\text{C}_4\text{H}_5\text{N}$

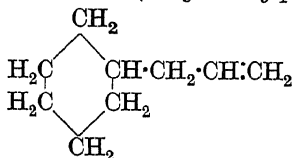
MW, 67

Constituent of some mustard oils. B.p. 119°.  $D^{15}$  0.8351.  $n_D^{20}$  1.40602. Ox.  $\rightarrow$  AcOH. Conc. HCl at 60°  $\rightarrow$  2-chlorobutyric acid. Alc. KOH  $\rightarrow$  crotonic acid.

Supniewski, Salzberg, *Organic Syntheses*, Collective Vol. I, 38.

Smith, Snyder, *Organic Syntheses*, 1944, XXIV, 96.

**Allylcyclohexane (3-Cyclohexylpropylene)**



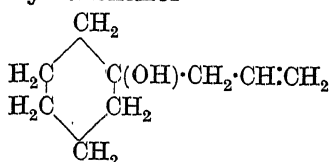
$\text{C}_9\text{H}_{16}$

MW, 124

B.p. 150-1°.  $D^{13}$  0.8196.  $n_D^{13}$  1.4536.

v. Braun, Deutsch, Schmalloch, *Ber.*, 1912, 45, 1255.

**1-Allylcyclohexanol**



$\text{C}_9\text{H}_{16}\text{O}$

MW, 140

B.p. 188-92°, 95-7°/27.5 mm.  $D^{22}$  0.9341.  $n_D^{22}$  1.4756.

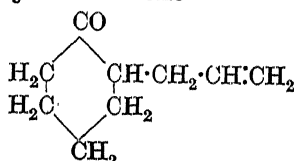
3 : 5-Dinitrobenzoyl : needles from pct. ether. M.p. 101-3°.

Saizew, *Chem. Zentr.*, 1913, I, 23; 1909, I, 1402.

Mazurewitsch, *Chem. Zentr.*, 1911, II, 1922.

Aldersley, Burkhardt, Gillam, Hindley, *J. Chem. Soc.*, 1940, 14.

**2-Allylcyclohexanone**



$\text{C}_9\text{H}_{14}\text{O}$

MW, 138

Liq. with odour of menthol. B.p. 94°/16 mm.  $n_D^{25}$  1.4666.

Oxime : needles. M.p. 71°.

2 : 4-Dinitrophenylhydrazone : m.p. 145-6°.

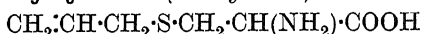
Cope et al., *J. Am. Chem. Soc.*, 1941, 63, 1842.

Cornubert, *Compt. rend.*, 1914, 158, 1901.

**5-Allyl-5- $\Delta^2$ -cyclohexenylthiobarbituric Acid.**

See Kemithal.

**S-Allylcysteine (Deoxyalliin)**



$\text{C}_6\text{H}_{11}\text{O}_2\text{NS}$

MW, 161

Cryst. M.p. 218-19°.  $[\alpha]_D^{21}$  -16.0° in  $\text{H}_2\text{O}$ .

N-Acetyl : m.p. 120-2°.  $[\alpha]_D^{21}$  -34.0° in MeOH.

S-Oxide : cryst. +  $\frac{1}{2}\text{H}_2\text{O}$ . M.p. 146-8° decomp.  $[\alpha]_D^{20}$  -12.0° in  $\text{H}_2\text{O}$ . Synthetic material is not identical with natural alliin.

Stoll, Seebeck, *Helv. Chim. Acta*, 1949, 31, 189.

**Allyldiacetamide.**

See under Allylamine.

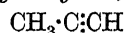
**$\alpha$ -Allyldiethyl Ketone.**

See 4-Methyl-1-heptenone-5.

**Allyl disulphide.**

See Diallyl disulphide.

**Allylene (Methylacetylene, propyne)**



$\text{C}_3\text{H}_4$

MW, 40

Gas. Freezes at -110°. M.p. -105°. B.p. -27.5° (-24°). Sol. EtOH,  $\text{Et}_2\text{O}$ . Mod. sol.  $\text{H}_2\text{O}$ .  $D_4^{13}$  0.66. Heat of comb.  $\dot{C}_p$  467.55 Cal. Gives many metallic comps., e.g., Ag, Cu, Na, Hg. Conc. HCl  $\rightarrow$   $\text{CH}_3\cdot\text{CCl}_2\cdot\text{CH}_3$ . HOBr  $\rightarrow$   $\text{CH}_3\cdot\text{CO}\cdot\text{CHBr}_2$ . Pptes Cu and Hg comps. from  $\text{NH}_3$  solutions. Isomerises to  $\text{CH}_2=\text{C}=\text{CH}_2$ . Red. (Na/liq.  $\text{NH}_3$ )  $\rightarrow$   $\text{CH}_3\text{CH}=\text{CH}_2$ .

Tetrabromide : see 1 : 1 : 2 : 2-Tetrabromopropene.

Bodroux, *Compt. rend.*, 1939, 208, 1022.

Lossen, *Ann.*, 1905, 342, 171.

**Allylene-1-aldehyde.**

See Tetrolaldehyde.

**Allylene-1-carboxylic Acid.**

See Tetrolic Acid.

**Allylene dibromide.**

See 1 : 2-Dibromopropylene.

**Allylene-1 : 3-dicarboxylic Acid.**

See Glutinic Acid.

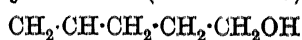
**Allylene dichloride.**

See 1 : 2-Dichloropropylene.

**Allylene di-iodide.**

See 1 : 2-Di-iodopropylene.

**Allylethyl Alcohol (1-Pentenol-5)**



$\text{C}_5\text{H}_{10}\text{O}$

MW, 86

B.p. 140–2°.  $D_4^{20}$  0.863.  $\text{KMnO}_4 \rightarrow$  succinic acid.

*Me ether*:  $\text{C}_6\text{H}_{12}\text{O}$ . MW, 100. B.p. 96–8°.  $D_{15}^{17}$  0.787.

*Acetyl*: b.p. 150–1°.  $D_{15}^{19}$  0.907.

*Phenylurethane*: b.p. 184–5°/16 mm.  $D^{15}$  1.068.

*Allophanate*: cryst. M.p. 148°.

Bouveault, Blanc, *Bull. soc. chim.*, 1904, 31, 1215.

Paul, *Compt. rend.*, 1932, 195, 1289.

Paul, Normant, *Bull. soc. chim.*, 1943, 10, 484.

Kharasch, Fuchs, *J. Org. Chem.*, 1944, 9, 359.

### Allylethylene.

See 1 : 4-Pentadiene.

### Allyl fluoride

$\text{C}_3\text{H}_5\text{F}$   $\text{CH}_2\text{:CH}\cdot\text{CH}_2\text{F}$  MW, 60

Gas with garlic odour. Liq. at –3°. Sol. to 2.8% in  $\text{H}_2\text{O}$ , 60% in EtOH, 90% in  $\text{Et}_2\text{O}$ .

Meslans, *Compt. rend.*, 1890, 111, 882.

### Allylguaiacol.

See Eugenol, *o*-Eugenol and Chavibetol.

### Allylidene chloride.

See 3 : 3-Dichloropropylene.

### Allyl iodide (3-Iodopropylene)

$\text{C}_3\text{H}_5\text{I}$   $\text{CH}_2\text{:CH}\cdot\text{CH}_2\text{I}$  MW, 168

B.p. 101–2°/734 mm.  $D_{15}^{20}$  1.848. Heat of comb.  $C_v$  476.9 Cal.,  $C_p$  478.33 Cal.  $\text{Na} \rightarrow$  diallyl.

Norris, Watt, Thomas, *J. Am. Chem. Soc.*, 1916, 38, 1076.

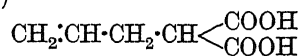
### Allyl isothiocyanate (*Allyl Mustard Oil*)

$\text{C}_4\text{H}_5\text{NS}$   $\text{CH}_2\text{:CH}\cdot\text{CH}_2\text{NCS}$  MW, 99

Chief constituent of natural mustard oil. Colourless oil. Freezes at –80°. B.p. 151°, 85°/93 mm., 66°/37 mm., 56°/22 mm., 44°/12 mm., 31°/5 mm. Sol.  $\text{H}_2\text{O}$  to 0.2%. Sol. 70% EtOH to 7–10%. Sol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ , pet. ether.  $D_4^{15}$  1.0155.  $n_D^{25}$  1.52212. Heat of comb.  $C_v$  731.2 Cal. Heat of comb. of vapour  $C_p$  675.4 Cal. Diss. P and S when hot. Alc.  $\text{NH}_3 \rightarrow$  allylthiourea. Adds Br. Alkali hydrosulphides  $\rightarrow$  salts of *N*-allyldithiocarbamic acid. Long standing with  $\text{H}_2\text{O} \rightarrow$  allyl cyanide + S. Hydrazine  $\rightarrow$  allylthiosemicarbazide.  $\text{Ba}(\text{OH})_2 \rightarrow$  *NN'*-diallylurea.  $\text{Ac}_2\text{O}$  at 180°  $\rightarrow$  diacetyllallylamine. Phthalic anhydride  $\rightarrow$  *N*-allylphthalimide.

Tollens, *Ann.*, 1870, 156, 158.

### Allylmalonic Acid (1-Butylene-4 : 4-dicarboxylic acid)



$\text{C}_6\text{H}_8\text{O}_4$  MW, 144

Cryst. from  $\text{Et}_2\text{O}$ . M.p. 105°. Sol.  $\text{H}_2\text{O}$ ,  $\text{Et}_2\text{O}$ , EtOH, hot  $\text{C}_6\text{H}_6$ . Heat of comb.  $C_p$  and  $C_v$  638.4 Cal.  $k = 1.54 \times 10^{-3}$  at 25°. Heat. at 180°  $\rightarrow$  allylacetic acid. Conc. HBr  $\rightarrow$  3-bromopropylmalonic acid.

*Ag salt*: m.p. 60° decomp. Insol.  $\text{H}_2\text{O}$ .

*Di-Et ester*:  $\text{C}_{10}\text{H}_{16}\text{O}_4$ . MW, 200. B.p. 222–3°, 193–4°/330 mm., 93°/6 mm.  $D_{15}^{15}$  1.014.

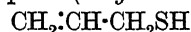
*p*-Nitrobenzyl ester: cryst. from EtOH. M.p. 46°.

*Nitrile*: *Et ester*: b.p. 223°. *Amide*: m.p. 98°. B.p. 289°.

*Di-nitrile*: f.p. –12°. B.p. 217–18°.  $D^{19}$  1.0231.

Conrad, Bischoff, *Ann.*, 1880, 204, 168.

### Allyl Mercaptan (*Allyl thioalcohol*)



$\text{C}_3\text{H}_6\text{S}$  MW, 74

B.p. 67–8°.  $D_4^{23}$  0.925.

Braun, Murjahn, Hahn, *Ber.*, 1926, 59, 1202.

### Allyl Mustard Oil.

See Allyl isothiocyanate.

### 1-Allylnaphthalene (3- $\alpha$ -Naphthylpropylene)



$\text{C}_{13}\text{H}_{12}$  MW, 168

B.p. 265–7°, 129–30°/10 mm.  $D_4^{20}$  1.0228.  $n_D^{20}$  1.6140. Isomerised by heated  $\text{Al}_2\text{O}_3$  to 1-propenylnaphthalene.

*Picrate*: m.p. 69°.

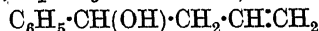
Levina et al., *Chem. Abstracts*, 1941, 35, 2479.

Tiffeneau, Daudel, *Compt. rend.*, 1908, 147, 678.

### *p*-Allylphenol.

See Chavicol.

### Allylphenylcarbinol (4-Hydroxy-4-phenylbutylene-1, 4-phenyl-1-butenol-4)



$\text{C}_{10}\text{H}_{12}\text{O}$  MW, 148

B.p. 228–9°, 100–1°/4 mm.  $D^{18}$  1.004.

*Acetyl*: b.p. 239–40°.  $D^{18}$  1.015.

Fournier, *Bull. soc. chim.*, 1893, 9, 600.

### Allyl phenyl Ether

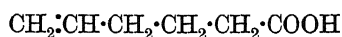


$\text{C}_9\text{H}_{10}\text{O}$  MW, 134

B.p. 192–5°. Insol.  $\text{H}_2\text{O}$ .  $D_{15}^{15}$  0.9856. Volatile in steam.

Perkin, *J. Chem. Soc.*, 1896, 69, 1225.

**2-Allylpropionic Acid** (1-Amylene-5-carboxylic acid, 1-pentene-5-carboxylic acid, 4-hexenic acid)



$\text{C}_6\text{H}_{10}\text{O}_2$  MW, 114

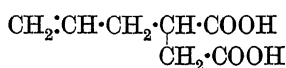
B.p. 203°.  $D_{20}^{20}$  0.9639.  $n_D^{20}$  1.4375.  $k = 1.91 \times 10^{-5}$  at 25°.

Wallach, *Ann.*, 1905, 343, 48.

**N-Allylpyrrole.**

See under Pyrrole.

**Allylsuccinic Acid** (1-Amylene-4 : 5-dicarboxylic acid)



$\text{C}_7\text{H}_{10}\text{O}_4$  MW, 158

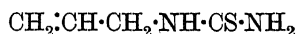
Leaflets from EtOH. M.p. 93-4°.  $k = 1.09 \times 10^{-4}$  at 25°.

Hjelt, *Ber.*, 1883, 16, 334.

**Allyl sulphide.**

See Diallyl sulphide.

**Allylthiourea** (Allylthiocarbamide, Thiosinamine)



$\text{C}_4\text{H}_8\text{N}_2\text{S}$  MW, 116

Monoclinic or rhombic prisms. M.p. 78°. Sol.  $\text{H}_2\text{O}$ , EtOH. Spar. sol.  $\text{Et}_2\text{O}$ . Insol.  $\text{C}_6\text{H}_6$ .  $D_{20}^{20}$  1.219.  $n_D^{20}$  1.59362.  $n_D^{75}$  1.63454. Heat of comb.  $\text{C}_p$  790.4,  $\text{C}_p$  781.8 Cal. PbO or HgO  $\rightarrow$  allylcyanamide.

Gadamer, *J. Chem. Soc.*, 1896, 70, 414.

Kofler, *Arch. Pharm.*, 1943, 281, 8, (*Chem. Zentr.*, 1943, I, 1796).

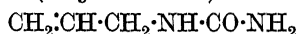
**N-Allyltoluidine.**

See under Toluidine.

**Allyl tolyl Ether.**

See under Cresol.

**Allylurea** (Allylcarbamide)



$\text{C}_4\text{H}_8\text{ON}_2$  MW, 100

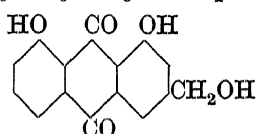
Needles from EtOH. M.p. 85°. Sol.  $\text{H}_2\text{O}$ , EtOH. Spar. sol.  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ . Insol. pet. ether, toluene,  $\text{CS}_2$ .

Andreasch, *Monatsh.*, 1884, 5, 37.

**4-Allylveratrol.**

See under Eugenol.

**Aloe-emodin** (3-Hydroxymethylchrysozin, 4 : 5-dihydroxyanthraquinonylcarbinol-2, 4 : 5-dihydroxy-2-hydroxymethylanthraquinone)



$\text{C}_{15}\text{H}_{10}\text{O}_5$

MW, 270

From most varieties of aloes and from senna leaves (*Cassia acutifolia*, Delile; *C. augustifolia*, Vahl). Orange-yellow needles from hot EtOH. M.p. 223°. Sol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ , hot EtOH. Sol. dil.  $\text{NH}_3$  and conc.  $\text{H}_2\text{SO}_4$  to cherry-red sols. Sublimes in  $\text{CO}_2$ . Ox.  $\rightarrow$  rhein. Red.  $\rightarrow$  chrysophanic acid. Zn dust  $\rightarrow$  2-methylanthracene. Purgative.

*Diacetyl deriv.*: cryst. from AcOH. M.p. 177-8°.

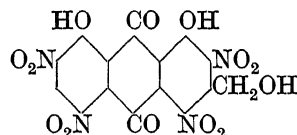
*Tribenzoyl*: greenish-yellow needles from AcOEt. M.p. 235°.

*Tri-Me ether*:  $\text{C}_{18}\text{H}_{16}\text{O}_5$ . MW, 312. Red needles from  $\text{Me}_2\text{CO}$ . M.p. 163°. Sol.  $\text{Me}_2\text{CO}$ , AcOH,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ , Py.

Cahn, Simonsen, *J. Chem. Soc.*, 1932, 2573.

Mitter, Banerjee, *J. Indian Chem. Soc.*, 1932, 9, 375.

**Aloetic Acid** (2 : 4 : 5 : 7-Tetranitro-aloe-emodin)

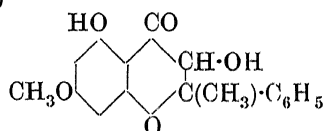


$\text{C}_{15}\text{H}_6\text{O}_{13}\text{N}_4$  MW, 450

Golden-yellow cryst. +  $1\text{H}_2\text{O}$ . Softens at 285°. Decomp. explosively on heating. Mod. sol. hot  $\text{H}_2\text{O}$   $\rightarrow$  violet-red sol. Sol. EtOH,  $\text{NH}_3\text{Aq}$ .  $\rightarrow$  violet sol.

Leger, *Ann. chim.*, 1916, 6, 353, 361, 364.

**Alpinone** (3 : 5-Dihydroxy-7-methoxy-2-methylflavanone)



$\text{C}_{17}\text{H}_{16}\text{O}_5$  MW, 300

Isolated from the Japanese drug "Izususukasya," prepared from the seeds of *Alpina japonica*. M.p. 178°.  $[\alpha]_D^{20}$  79-11° in  $\text{C}_5\text{H}_5\text{N}$ . Conc.  $\text{HNO}_3$   $\rightarrow$  indigo blue col. Mg + HCl  $\rightarrow$  yellow col. Heating with HCl  $\rightarrow$  noralpinone,  $\text{C}_{16}\text{H}_{14}\text{O}_5$ , m.p. 136-7°. Warm with 10-20% KOH in  $\text{H}_2$   $\rightarrow$  apocalpinone,  $\text{C}_{16}\text{H}_{14}\text{O}_5$ , light yellow, m.p. 148°.

*Diacetyl*: m.p. 118°.

*Dibenzoyl*: m.p. 208-9°.

*Di-Me ether*: m.p. 115°.

*Oxime*: m.p. 203-4°.

*Semicarbazone anhydride*:  $\text{C}_{18}\text{H}_{17}\text{N}_3\text{O}_4$ , m.p. 200-1°.

Kimura, Hoshi, *Proc. Imp. Acad. Tokyo*, 1936, 12, 285, (*Chem. Abstracts*, 1937, 31, 1807).

**Alstoniline**

$\text{C}_{22}\text{H}_{18}\text{O}_3\text{N}_2$

MW, 358

Alkaloid from bark of *Alstonia constricta*. Cryst. from MeOH, decomp. sharply at 372°.

$B, HCl, H_2O$ : fine red needles. Decomp. over wide range without melting.

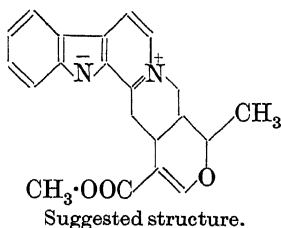
$B_2, H_2SO_4$ : m.p. 260–4°, decomp.

$B, H_2O$ : m.p. 356° (sharp decomp.).

$B, H_2O$  picrate: red needles, m.p. 294° decomp.

Hawkins, Elderfield, *J. Org. Chem.*, 1942, 7, 573.

### Alstonine



$C_{21}H_{20}O_3N_2$  MW, 348

Alkaloid from *Alstonia constricta*. M.p. 205–10° decomp.

$B, H_2SO_4, 2H_2O$ : m.p. 195–6, foams at 208°.  $[\alpha]_D^{25}$  127°.

$B, H_2SO_4, 4H_2O$ : m.p. 203–4°.  $[\alpha]_D^{25}$  120°.

$B, H_2SO_4$ : m.p. 243–4° decomp.  $[\alpha]_D^{25}$  120°.

$B_2, H_2PtCl_6, H_2O$ : m.p. 220–1° decomp.

$B, HCl$ : m.p. 278–9° decomp.  $[\alpha]_D^{25}$  141°.

$B, HNO_3$ : m.p. 252–4° decomp.

$B, HI$ : m.p. 270° decomp.

$B, HClO_4$ : m.p. 239–40°.  $[\alpha]_D^{20} + 154^\circ \pm 4^\circ$  in  $Me_2CO$ .

Leonard, Elderfield, *J. Org. Chem.*, 1942, 7, 556.

Raymond-Hamet, *Compt. rend.*, 1948, 227, 344.

Elderfield, Gray, *J. Org. Chem.*, 1951, 16, 506.

Schlitter, Schwarz, Bader, *Helv. Chim. Acta*, 1952, 35, 271.

### Alstyrene

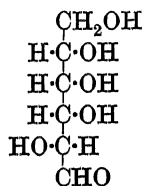
$C_{18}H_{20}N_2(C_{18}H_{22}N_2)$  MW, 264(278)

Prepared from alstonine by heating with Se at 300° for 10 min. Pale yellow. M.p. 113°. Unchanged on heating with conc. HCl at 130° for 15 hrs. or on boiling with 50%  $NH_4OH/KOH$  for 2 hrs.

Picrate: m.p. 215–16°.

Sharp, *J. Chem. Soc.*, 1938, 1353.

### Altrose



$C_6H_{12}O_6$

MW, 180

*d.*

Prisms from MeOH-EtOH. M.p. 103–5°.  $[\alpha]_D^{20} + 32.6^\circ$  in  $H_2O$ .

2:3:4-Triacetyl: m.p. 100–1°.  $[\alpha]_D^{20} - 172^\circ$  in  $CHCl_3$ .

$\beta$ -2:3:4:6-Tetra-acetyl: m.p. 85–90°  $[\alpha]_D^{20} - 6^\circ$  in  $CHCl_3$ .

$\alpha$ -Penta-acetyl: m.p. 118–9°.  $[\alpha]_D^{20} + 63^\circ$  in  $CHCl_3$ .

Oxime: m.p. 143–4°.  $[\alpha]_D^{25} - 9.8^\circ$  in  $H_2O$ .

*l.*

Prisms from EtOH or AcOH. M.p. 107–109.5°.  $[\alpha]_D^{20} - 32.3^\circ$  in  $H_2O$ . Hydrogenation  $\rightarrow$  *l*-talitol.

Phenylosazone: m.p. 165°.

Benzylphenylhydrazone: m.p. 147–8°.

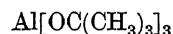
Richtmyer, Hudson, *J. Am. Chem. Soc.*, 1935, 57, 1720; 1941, 63, 1727.

Hockett, Chandler, *J. Am. Chem. Soc.*, 1944, 66, 627.

Austin, Humoller, *J. Am. Chem. Soc.*, 1934, 56, 1153.

Richtmyer, *Advances in Carbohydrate Chemistry*, Vol. I, 37.

### Aluminium tert.-butoxide



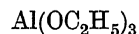
$C_{12}H_{27}O_3Al$  MW, 246

White powder. Sublimes in high vac. Readily sol.  $C_6H_6$ . Used as condensing agent and also in the oxidation of alcohols to carbonyl compounds. (For mechanism, see Adkins *et al*, *J. Am. Chem. Soc.*, 1938, 60, 1158; 1939, 61, 3364; 1940, 62, 3305).

Oppenauer, *Rec. trav. chim.*, 1937, 56, 137.

Wayne, Adkins, *Organic Syntheses*, 1941, XXI, 39.

### Aluminium ethoxide



$C_6H_{15}O_3Al$  MW, 162

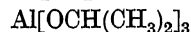
Colourless liq. B.p. 200°/6–8 mm., 175–80°/3 mm. Slowly solidifies to white solid, m.p. 140°. Employed for reduction of carbonyl compounds to alcohols. Catalyst for preparation of esters from aldehydes and alcoholysis of diketones.

Adkins, *J. Am. Chem. Soc.*, 1922, 44, 2178.

Meerwein, Schmidt, *Ann.*, 1925, 444, 232.

Sumiya, Yamaba, Tajima, *Chem. Abstracts*, 1932, 26, 3481.

### Aluminium isopropoxide



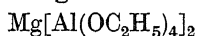
$C_9H_{21}O_3Al$  MW, 204

Colourless liq. B.p. 145–50°/5 mm. Slowly solidifies to white solid, m.p. 118°. Condensing agent and also used in reduction of carbonyl compounds to alcohols. Can be employed, like

aluminium *tert.*-butoxide, for oxidation of alcohols.

- Adkins, *J. Am. Chem. Soc.*, 1922, **44**, 2178.  
Lund, *Ber.*, 1937, **70**, 1521.  
Young, Hartung, Crossley, *J. Am. Chem. Soc.*, 1936, **58**, 101.

### Aluminium magnesium ethoxide

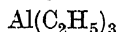


$\text{C}_{16}\text{H}_{40}\text{O}_8\text{Al}_2\text{Mg}$  MW, 438

Ice blue cryst., m.p. 129°. Distils in vacuo without decomp. B.p. 220–8°/4 mm. (chiefly at 225°). Easily sol. benzene, chlorobenzene, petrol. Insol.  $\text{CHCl}_3$ ,  $\text{Et}_2\text{O}$ . Used as catalyst for trans-esterification of alkyl silicates.

- Meerwein, Bersin, *Ann.*, 1929, **476**, 113.  
Peppard, Brown, Johnson, *J. Am. Chem. Soc.*, 1946, **68**, 77.

### Aluminium triethyl

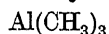


$\text{C}_6\text{H}_{15}\text{Al}$  MW, 114

M.p. –52.5°. B.p. 194°.  $n_D^{20}$  1.480. Takes fire in air. Explodes with  $\text{H}_2\text{O}$ .

- Cahours, *Ann.*, 1860, **114**, 242.  
Laubengayer *et al.*, *J. Am. Chem. Soc.*, 1941, **63**, 559.

### Aluminium trimethyl

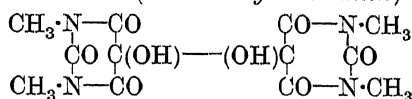


$\text{C}_3\text{H}_9\text{Al}$  MW, 72

M.p. 15°. B.p. 130°.  $D_4^{20}$  0.752.  $n_D^{20}$  1.432. Inflames in air. Exists as a dimer at 70°.

- Buckton, Odling, *Ann.*, 1866, Suppl., **4**, 112.  
Laubengayer *et al.*, *J. Am. Chem. Soc.*, 1941, **63**, 559.  
Levi, Newitt, *J. Chem. Soc.*, 1946, 468.

### Amalic Acid (*Tetramethyl-alloxantin*)



$\text{C}_{12}\text{H}_{14}\text{O}_8\text{N}_4$  MW, 342

Cryst. from  $\text{H}_2\text{O}$ .

- Billmann, Berg, *Ber.*, 1930, **63**, 2188.  
Cope *et al.*, *J. Am. Chem. Soc.*, 1941, **63**, 356.

### $\alpha$ -Amantine ( $\alpha$ -*Amanitine*).

Isolated, together with  $\beta$ -amantine and phalloidine, from *Amanita phalloides*. Very poisonous (fatal dose, 2.5  $\gamma$  per mouse). Induces hypoglycemia. Colourless needles. M.p. 254–5° decomp. [ $\alpha$ ] $_D^{20}$  +191° in  $\text{H}_2\text{O}$ . Gives positive Hopkins–Cole, Xanthoprotein, and Millon–

Pauly reactions. Buirot reaction is weak. Probably contains peptide bonds.

- Wieland, Hallermeyer, Zilg, *Ann.*, 1941, **548**, 1.  
Wieland *et al.*, *Ann.*, 1949, **564**, 152.

### $\beta$ -Amantine ( $\beta$ -*Amanitine*).

Isolated from *Amanita phalloides*. Very poisonous (fatal dose 8–10  $\gamma$  per mouse). Needles from MeOH. Decomp. above 300°. Easily sol. MeOH, EtOH,  $\text{H}_2\text{O}$ . Gives positive Folin and Hopkins–Cole reactions.

- Wieland *et al.*, *Ann.*, 1949, **564**, 152.

### Amarbeline

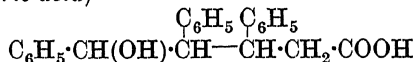
$\text{C}_{18}\text{H}_{16}\text{O}_7\cdot\text{H}_2\text{O}$  MW, 362

Colouring matter from seeds of *Cuscuta reflexa*. Lemon yellow needles, m.p. 234°.

- Diacetyl*: m.p. 152°.  
*Dibenzoyl*: m.p. 166° decomp.

- Agarival, *J. Indian Chem. Soc.*, 1936, **13**, 531.

### Amaric Acid (4-*Hydroxy*-2 : 3 : 4-*triphenyl n-valeric acid*)



$\text{C}_{23}\text{H}_{22}\text{O}_3$  MW, 346

#### $\alpha$ -Form.

Needles +  $\text{H}_2\text{O}$  from EtOH.Aq. M.p. 140–5°. Heat  $\rightarrow$  lactone: m.p. 141°.

#### $\beta$ -Form.

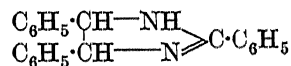
Needles from 50% EtOH. M.p. 156°. Heat  $\rightarrow$  lactone: m.p. 168°.

#### $\gamma$ -Form.

M.p. 173°. Heat  $\rightarrow$  lactone: m.p. 171–2°.

- Meerwein, *J. prakt. Chem.*, 1918, **97**, 225.

### Amarin (2 : 4 : 5-*Triphenyldihydroglyoxaline, triphenyliminazoline*)



$\text{C}_{21}\text{H}_{18}\text{N}_2$  MW, 298

Prisms +  $\frac{1}{2}\text{H}_2\text{O}$  from EtOH.Aq. M.p. 106°. Prisms from dry  $\text{Et}_2\text{O}$ . M.p. 136°. Sol. EtOH,  $\text{Et}_2\text{O}$ . Insol.  $\text{H}_2\text{O}$ .

*B,HCl*: cryst. from EtOH. M.p. 302°.

*B,HBr*: cryst. from EtOH. M.p. 288°.

*B,HNO*<sub>3</sub>: prisms from EtOH. M.p. 165°.

*N-Me*:  $\text{C}_{22}\text{H}_{20}\text{N}_2$ . MW, 312. Cryst. from  $\text{Et}_2\text{O}$ . M.p. 184°. Very sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ .

*N-Et*:  $\text{C}_{23}\text{H}_{22}\text{N}_2$ . MW, 326. Leaflets from  $\text{Et}_2\text{O}$ . M.p. 163°. Sol. EtOH,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ . Spar. sol.  $\text{Et}_2\text{O}$ .

*N-Benzyl*:  $\text{C}_{28}\text{H}_{24}\text{N}_2$ . MW, 388. Needles from EtOH. M.p. 123–4°. Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ .

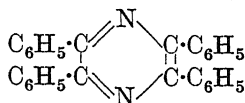
*N-Benzoyl*: prisms from Et<sub>2</sub>O. M.p. 180°.

Japp, Moir, *J. Chem. Soc.*, 1900, **77**, 611.

Delépine, *Compt. rend.*, 1898, **127**, 623.

Claus, Scherbel, *Ber.*, 1885, **18**, 3079.

### Amaron (*Tetraphenylpyrazine*)



C<sub>28</sub>H<sub>20</sub>N<sub>2</sub>

MW, 384

Needles from AcOH. M.p. 246°. Sol. CHCl<sub>3</sub>, hot C<sub>6</sub>H<sub>6</sub>. Spar. sol. Et<sub>2</sub>O, hot EtOH. Sublimes. Sol. conc. H<sub>2</sub>SO<sub>4</sub> → blood-red sol.

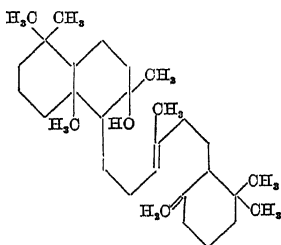
Japp, Wilson, *J. Chem. Soc.*, 1886, **49**, 826.

Japp, Davidson, *J. Chem. Soc.*, 1895, **67**, 35.

### Amasatin.

See under Isamic Acid.

### Ambrein



C<sub>30</sub>H<sub>52</sub>O

MW, 428

Isolated from EtOH soluble portion of ambergris. M.p. 82-3°. [ $\alpha$ ]<sub>D</sub> 14.1° (c, 1.0 in C<sub>6</sub>H<sub>6</sub>). Gives strong yellow col. with tetranitromethane.

Ruzicka, Lardon, *Helv. Chim. Acta*, 1946, **29**, 912.

Ruzicka, Gutmann, Jeger, Lederer, *Helv. Chim. Acta*, 1948, **31**, 1746.

Dürst, Jeger, Ruzicka, *Helv. Chim. Acta*, 1949, **32**, 46.

**Ambrettolic Acid** (16-*Hydroxy-6-hexadecenoic acid*)



C<sub>16</sub>H<sub>30</sub>O<sub>3</sub>

MW, 270

Obtained from musk seed oil.

$\alpha$ -Isomer: m.p. 53-5°.

$\beta$ -Isomer: m.p. 26-7°.

Lactone: see Ambrettolide.

Baudart, *Compt. rend.*, 1945, **221**, 205.

Stoll, Gardner, *Helv. Chim. Acta*, 1934, **17**, 1609.

### Ambrettolide

C<sub>16</sub>H<sub>28</sub>O<sub>2</sub>

MW, 252

Lactone of ambrettolic acid. Strong musk-like odour. B.p. 154-6°/1 mm. D<sub>4</sub><sup>20</sup> 0.9580. n<sub>D</sub><sup>20</sup> 1.4815.

Baudart, *Compt. rend.*, 1945, **221**, 205.

Stoll, Gardner, *Helv. Chim. Acta*, 1934, **17**, 1609.

### Ameliaroside.

See Piceoside.

### Amethocaine.

See Decicaine.

### Amido-G Acid.

See 2-Naphthylamine-6 : 8-disulphonic Acid.

### Amidodicyanic Acid.

See Cyanourea.

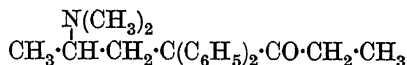
### Amido-R Acid.

See 2-Naphthylamine-3 : 6-disulphonic Acid.

### Amidol.

See under 2 : 4-Diaminophenol.

**Amidone** (6-Dimethylamino-4 : 4-diphenylheptanone-3)



C<sub>21</sub>H<sub>27</sub>ON

MW, 309

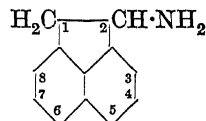
Powerful analgesic equalling morphine in potency.

*B, HCl*: white cryst. M.p. 236-6.5°. Sol. H<sub>2</sub>O, EtOH. Insol. Et<sub>2</sub>O.

Scott, Chen, *J. Pharmacol.*, 1946, **87**, 63.

Kleiderer, Rice, Conquest, Williams, *Report No. 981, Office of Publication Board, Dept. of Commerce, Washington, U.S.A.*

### 2-Aminoacenaphthene



C<sub>12</sub>H<sub>11</sub>N

MW, 169

M.p. 135°.

*B, HCl*: decomp. at 270°.

*Picrate*: yellow prisms from Et<sub>2</sub>O. M.p. 260° decomp.

Morgan, Stanley, *J. Soc. Chem. Ind.*, 1925, **44**, 493r.

### 3-Aminoacenaphthene.

Buff plates from EtOH, needles from pet. ether. M.p. 81.5°. Sol. usual org. solvents. Turns pink in air. Alc. FeCl<sub>3</sub> → bluish-violet col.

*N-Formyl*: needles from EtOH. M.p. 151-2°. Sol. EtOH, Me<sub>2</sub>CO, AcOH. Less sol. C<sub>6</sub>H<sub>6</sub>, pet. ether.

*N-Acetyl*: needles from EtOH. M.p. 192-3°.

*N-Benzoyl*: needles from EtOH. M.p. 209-10°.

*Picrate*: yellow needles from  $\text{Me}_2\text{CO}$ . Decomp. at  $221^\circ$ .

Morgan, Harrison, *J. Soc. Chem. Ind.*, 1930, 49, 415t.

#### 4-Aminoacenaphthene.

Needles from hot  $\text{H}_2\text{O}$ . M.p.  $87^\circ$ . Very sol. volatile org. solvents.

*N-Acetyl*: prisms from  $\text{EtOH.Aq.}$  or  $\text{AcOH}$ . M.p.  $175-6^\circ$ . Sol.  $\text{Me}_2\text{CO}$ ,  $\text{CHCl}_3$ . Insol.  $\text{H}_2\text{O}$ .

*N-Benzoyl*: prismatic needles from 90%  $\text{AcOH}$ . M.p.  $196^\circ$ .

*Picrate*: yellow needles from  $\text{EtOH}$  or  $\text{Me}_2\text{CO}$ . Decomp. at  $190-200^\circ$ .

Morgan, Stanley, *J. Soc. Chem. Ind.*, 1924, 43, 345t.

#### 5-Aminoacenaphthene.

Needles from pet. ether. M.p.  $108^\circ$ . Volatile in steam.  $\text{FeCl}_3 \rightarrow$  blue col.

*N-Formyl*: needles from  $\text{EtOH.Aq.}$  M.p.  $172^\circ$ .

*N-Acetyl*: plates from  $\text{EtOH}$ . M.p.  $238^\circ$ .

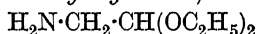
*N-Diacetyl*: plates from  $\text{EtOH}$ . M.p.  $122^\circ$ .

*N-Benzoyl*: needles from  $\text{EtOH}$ . M.p.  $210^\circ$  ( $199^\circ$ ).

*Picrate*: yellow needles from  $\text{EtOH}$ . Decomp. at  $190-200^\circ$ .

Morgan, Stanley, *J. Soc. Chem. Ind.*, 1924, 43, 345t.

**Aminoacetal** (*Aminoacetaldehyde diethyl acetal*, 2 : 2-diethoxyethylamine)



$\text{C}_6\text{H}_{15}\text{O}_2\text{N}$  MW, 133

B.p.  $163^\circ$ .  $D^{25}$  0.9159.  $n_D^{25}$  1.4123. Sol.  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ . Volatile in steam. Reacts alkaline. Conc.  $\text{HCl} \rightarrow$  aminoacetaldehyde.

*N-Me*: see under Methylaminoacetaldehyde.

*Picrate*: m.p.  $143^\circ$ .

Allen, Clark, *Organic Syntheses*, 1944, XXIV, 3.

Woodward, Doering, *J. Am. Chem. Soc.*, 1945, 67, 860.

Richmond, Wright, *Can. J. Research*, 1945, 23B, 158.

Buck, Wrenn, *J. Am. Chem. Soc.*, 1929, 51, 3612.

**Aminoacetaldehyde** (*Glycine aldehyde*)



$\text{C}_2\text{H}_5\text{ON}$  MW, 59

Stable in conc. acid solutions. Readily polymerises. Reduces Fehling's.  $\text{Br} \rightarrow$  glycine.  $\text{HBr} \rightarrow$  dihydroxypiperazine.

$\text{B}_2, \text{H}_2\text{PtCl}_6$ : prisms or plates from  $\text{H}_2\text{O}$ . M.p.  $125^\circ$ .

*N-Caproyl*: see Amylpenilloaldehyde.

*N-3-Hexenoyl*: see Penilloaldehyde-F.

*N-p-Hydroxyphenylacetyl*: see Penilloaldehyde-X.

*N-Octanoyl*: see Penilloaldehyde-K.

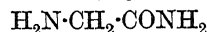
*N-Phenylacetyl*: see Penilloaldehyde-G.

*N-Benzoyl*: see Hippuric Aldehyde.

Fischer, *Ber.*, 1908, 41, 1021.

Curtius, *J. prakt. Chem.*, 1917, 95, 212.

**Aminoacetamide** (*Glycine amide*)



$\text{C}_2\text{H}_6\text{ON}_2$  MW, 74

Needles. M.p.  $65-7^\circ$ . Sol.  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ ,  $\text{MeOH}$ . Mod. sol.  $\text{Me}_2\text{CO}$ ,  $\text{CHCl}_3$ ,  $\text{AcOEt}$ . Spar. sol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Reacts strongly alkaline. Absorbs  $\text{CO}_2$ . Hot  $\text{H}_2\text{O} \rightarrow$  glycine +  $\text{NH}_3$ .

*B,HCl*: m.p.  $186-9^\circ$ .

*B,H AuCl\_4*: needles. M.p.  $197-8^\circ$ .

Königs, Mylo, *Ber.*, 1908, 41, 4429.

Bergell, v. Wülfig, *Z. physiol. Chem.*, 1910, 64, 354.

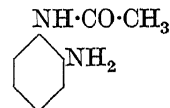
Yang, Rising, *J. Am. Chem. Soc.*, 1931, 53, 3183.

Cook, Heilbron, Levy, *J. Chem. Soc.*, 1948, 201.

$\omega$ -Aminoacetanilide.

See under Glycine.

**o-Aminoacetanilide** (*Acetyl-o-phenylenediamine*)



$\text{C}_8\text{H}_{10}\text{ON}_2$  MW, 150

Plates from  $\text{C}_6\text{H}_6$ . M.p.  $132^\circ$ . Sol.  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ , hot  $\text{C}_6\text{H}_6$ . Less sol.  $\text{Et}_2\text{O}$ .

Bell, Kenyon, *J. Chem. Soc.*, 1926, 954.

Levitz, Bogert, *J. Org. Chem.*, 1945, 10, 341.

**m-Aminoacetanilide** (*Acetyl-m-phenylene diamine*).

Needles or plates from  $\text{C}_6\text{H}_6$ . M.p.  $87-9^\circ$ . Very sol. cold  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ ,  $\text{Me}_2\text{CO}$ . Spar. sol.  $\text{C}_6\text{H}_6$ .

*B,HCl*: plates from 95%  $\text{EtOH}$ . Sinters at  $248-51^\circ$ , entirely liquid at  $280^\circ$ . Sol.  $\text{H}_2\text{O}$ .

*N-p-Toluenesulphonyl*: needles from  $\text{EtOH}$ . M.p.  $241^\circ$ .

Wallach, Schulze, *Ber.*, 1882, 15, 3020.

Jacobs, Heidelberger, *J. Am. Chem. Soc.*, 1917, 39, 1448.

**p-Aminoacetanilide** (*Acetyl-p-phenylenediamine*).

Needles from  $\text{H}_2\text{O}$ . Darkens in air. M.p.  $162-3^\circ$  ( $159-60^\circ$ ). Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ . Spar. sol. cold  $\text{H}_2\text{O}$ . Hyd. by conc.  $\text{HCl}$ .

*B,H\_2SO\_4*: m.p.  $285^\circ$  decomp.

Sachs, Goldmann, *Ber.*, 1902, 35, 3341.

**Aminoacetylhydrazide.**

See under Glycine.

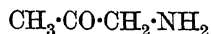


**Aminoacetic Acid.**

See Glycine.

**1-Aminoacetoacetic Ester.**

See Ethyl 1-aminoacetoacetate.

**Aminoacetone**C<sub>3</sub>H<sub>7</sub>ON

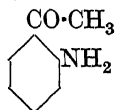
MW, 73

Not isolated in free state. Reduces Fehling's. Ox. → 2 : 5-dimethylpyrazine.

*B, HCl*: plates from EtOH-Et<sub>2</sub>O. M.p. 75°. Very hygroscopic.*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: orange-yellow needles from EtOH. M.p. 188-9°. Very sol. H<sub>2</sub>O.Gabriel, Colman, *Ber.*, 1902, 35, 3805.Neber, Huh, *Ann.*, 1935, 515, 293.**Aminoacetoneitrile** (*Glycine nitrile, cyanomethylamine*)C<sub>2</sub>H<sub>4</sub>N<sub>2</sub>

MW, 56

B.p. 58°/15 mm., part decomp. HCl → glycine hydrochloride.

*B, HCl*: m.p. 165° decomp. Spar. sol. EtOH, Et<sub>2</sub>O. Hygroscopic.*B, H<sub>2</sub>SO<sub>4</sub>*: m.p. 101°. Sol. H<sub>2</sub>O. Insol. Et<sub>2</sub>O.*B, H<sub>2</sub>SO<sub>4</sub>*: m.p. 165° decomp.*Picrate*: m.p. 165° decomp.Klages, *Ber.*, 1903, 36, 1511.Gesellschaft für Kohlentechnik, m.b.H., B.P., 436,692, (*Chem. Abstracts*, 1936, 30, 2201).Anslow, King, *Organic Syntheses*, Collective Vol. I, 298.Cook, Heilbron, Levy, *J. Chem. Soc.*, 1948, 201.**o-Aminoacetophenone**C<sub>8</sub>H<sub>9</sub>ON

MW, 135

Cryst. M.p. 20°. B.p. 250-2° slight decomp., 130.5°/14 mm., 124°/10 mm. Volatile in steam.

*B, HCl*: prisms. Decomp. at 168°. Sol. EtOH.*B, HI*: m.p. 150° decomp.*N-Formyl*: needles. M.p. 79°.*N-Acetyl*: needles from ligroin. M.p. 76-7°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. cold H<sub>2</sub>O. *Oxime*: needles from H<sub>2</sub>O. M.p. 149-50°.*N-Propionyl*: plates from Et<sub>2</sub>O. M.p. 69°.*N-Butyryl*: prisms from ligroin. M.p. 52°.*N-Isobutyryl*: prisms from Et<sub>2</sub>O. M.p. 50°.*N-Benzoyl*: needles from Et<sub>2</sub>O. M.p. 98°.*N-p-Toluenesulphonyl*: plates from EtOH. M.p. 148°.*Oxime*: needles from H<sub>2</sub>O. M.p. 109°. Sublimes.*Semicarbazone*: plates from EtOH. M.p. 290° decomp.*Phenylhydrazone*: needles from EtOH. M.p. 108°.Skita, Meyer, *Ber.*, 1912, 45, 3587.Elson, Gibson, Johnson, *J. Chem. Soc.*, 1930, 1131.Simpson *et al.*, *J. Chem. Soc.*, 1945, 646.Leonard, Boyd, *J. Org. Chem.*, 1946, 11, 405.**m-Aminoacetophenone.**

Pale yellow plates from EtOH. M.p. 98-9° (92-3°). Part. volatile in steam. Weak base.

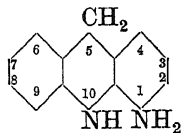
*N-Acetyl*: needles from EtOH.Aq. M.p. 128-9°. *Oxime*: needles from EtOH.Aq. M.p. 192-4°.*N-Chloroacetyl*: prisms from EtOH. M.p. 114°.*N-p-Toluenesulphonyl*: needles from EtOH. M.p. 130°.*Semicarbazone*: prisms from H<sub>2</sub>O. M.p. 196° decomp.*Hydrazone*: cryst. from EtOH or C<sub>6</sub>H<sub>6</sub>. M.p. 98°.Cobb, *Chem. Abstracts*, 1946, 40, 7180.Simpson *et al.*, *J. Chem. Soc.*, 1945, 646.Marvel *et al.*, *J. Am. Chem. Soc.*, 1946, 68, 1088.Leonard, Boyd, *J. Org. Chem.*, 1946, 11, 405.Elson, Gibson, Johnson, *J. Chem. Soc.*, 1930, 1130.Camps, *Arch. Pharm.*, 1902, 240, 15.Rupe, Braun, v. Zembruzski, *Ber.*, 1901, 34, 3522.**p-Aminoacetophenone.**Cryst. from H<sub>2</sub>O. M.p. 106°. B.p. 293-5°. Sol. boiling H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Spar. sol. C<sub>6</sub>H<sub>6</sub>, pet. ether.*N-Acetyl*: needles from H<sub>2</sub>O. M.p. 166-7°.*N-Propionyl*: prisms from EtOH. M.p. 136°.*N-Benzoyl*: plates from EtOH or CHCl<sub>3</sub>. M.p. 205°.*Oxime*: needles from EtOH. M.p. 147-8°.*Semicarbazone*: yellowish cryst. from EtOH. M.p. 250°.

2 : 4-Dinitrophenylhydrazone: dark red. M.p. 263°.

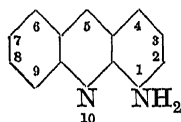
Kunckell, *Ber.*, 1900, 33, 2641; D.R.P., 105,199, (*Chem. Zentr.*, 1900, I, 240).Klingel, *Ber.*, 1885, 18, 2691.Chattaway, *J. Chem. Soc.*, 1904, 85, 388.Florence, *Chem. Abstracts*, 1933, 27, 4225.Kursanov, *Chem. Abstracts*, 1944, 38, 959.Leonard, Boyd, *J. Org. Chem.*, 1946, 11, 405.

$\omega$ -Aminoacetophenone.

See Phenacylamine.

**1-Aminoacridan** (1-Amino-5:10-dihydroacridine) $C_{13}H_{12}N_2$  MW, 196Needles from pet. ether. M.p. 114°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, AcOH, dil. HCl. Conc. H<sub>2</sub>SO<sub>4</sub> → deep yellow sol.

N-Acetyl deriv.: plates from MeOH. M.p. 177°.

Clemo, Perkin, Robinson, *J. Chem. Soc.*, 1924, 1785.**2-Aminoacridan** (2-Amino-5:10-dihydroacridine).Leaflets from EtOH.Aq. M.p. 193–6°, 206–7° (sealed tube). Spar. sol. Me<sub>2</sub>CO, xylene. Insol. Et<sub>2</sub>O. Red sols. in conc. HCl and H<sub>2</sub>SO<sub>4</sub>. Oxidises in air, particularly in presence of alkalis.Scherlin, Bras, Jakubowitsch, Worobjowa, Ssergejew, *Ann.*, 1935, 516, 223.**3-Aminoacridan** (3-Amino-5:10-dihydroacridine).Yellow needles from MeOH. M.p. 191–2°. Insol. H<sub>2</sub>O. Dark red sol. in dil. HCl. Oxidises in air.Scherlin, Bras, Jakubowitsch, Worobjowa, Ssergejew, *Ann.*, 1935, 516, 226.**1-Aminoacridine** $C_{13}H_{10}N_2$  MW, 194Reddish-brown needles from pet. ether. M.p. 108°. Very sol. EtOH to yellow sol. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin. Yellow in H<sub>2</sub>SO<sub>4</sub> with greenish-blue fluor. Brownish-red in dil. HCl. Spar. sol. 50% H<sub>2</sub>SO<sub>4</sub>. K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> to H<sub>2</sub>SO<sub>4</sub> sol. → violet col.

B.HCl: yellow needles from EtOH.Aq. M.p. 234° decomp.

N-Acetyl: yellow needles from pet. ether. M.p. 117°.

N-p-Toluenesulphonyl: plates from EtOH. M.p. 169–70°.

Monopicrate: purplish-black plates. M.p. 220° (206°).

N-Me: C<sub>14</sub>H<sub>12</sub>N<sub>2</sub>. MW, 208. Orange prisms from pet. ether. M.p. 75°.N-Et: C<sub>15</sub>H<sub>14</sub>N<sub>2</sub>. MW, 222. Orange-red

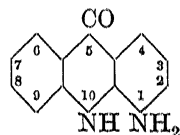
plates from pet. ether. M.p. 65°. Acetyl: plates from pet. ether. M.p. 95°.

Clemo, Perkin, Robinson, *J. Chem. Soc.*, 1924, 125, 1786.Ullmann, Maag, *Ber.*, 1907, 40, 2522.Albert, Ritchie, *J. Soc. Chem. Ind.*, 1941, 60, 122r.**2-Aminoacridine.**Yellowish-orange needles from EtOH.Aq. M.p. 224° corr., after drying. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>. Mod. sol. Me<sub>2</sub>CO, xylene. Alc. and aq. sols. show yellow fluor.Scherlin, Bras, Jakubowitsch, Worobjowa, Ssergejew, *Ann.*, 1935, 516, 224.Albert, Linnell, *J. Chem. Soc.*, 1936, 1616.Albert, Ritchie, *J. Soc. Chem. Ind.*, 1941, 60, 122r.**3-Aminoacridine.**Yellow needles + C<sub>2</sub>H<sub>5</sub>OH from EtOH. M.p. 213–4°. Sols. fluor. yellowish-green.Albert, Ritchie, *J. Soc. Chem. Ind.*, 1941, 60, 122r.Albert, Australian P. 115,480, (*Chem. Abstracts*, 1946, 40, 3479).**4-Aminoacridine.**Yellow needles + H<sub>2</sub>O from 50% EtOH. M.p. 183° corr. after drying.Albert, Ritchie, *J. Soc. Chem. Ind.*, 1941, 60, 122r.**5-Aminoacridine.**Yellow needles from EtOH or Me<sub>2</sub>CO. M.p. 236–7° (241° corr., after drying).

Carbethoxyl: m.p. 188–94°.

N-Acetyl: cryst. from EtOH. M.p. 268–9°.

N-Diacetyl: cryst. from EtOH. M.p. 148–9°.

M. L. B., *Chem. Abstracts*, 1924, 18, 1131.Drozdov, Cherntzov, *Chem. Abstracts*, 1936, 30, 3433.Albert, Ritchie, *J. Soc. Chem. Ind.*, 1941, 60, 123r.**1-Aminoacridone** $C_{13}H_{10}ON_2$  MW, 210Dark yellow needles from EtOH. M.p. 340–2°. Sol. hot AcOH, PhNO<sub>2</sub>, aniline. Spar. sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Prac. insol. ligroin. H<sub>2</sub>SO<sub>4</sub> → greenish-yellow sol. with blue fluor.Ullmann, *Ann.*, 1907, 355, 329.Lehmstedt, *Ber.*, 1937, 70, 1535.**2-Aminoacridone.**

Pale yellow needles from EtOH.Aq. M.p.

301–3° corr. Sol. in EtOH exhibits violet fluor. → yellowish-green with trace of acid. Sol. in AcOH → green fluor.

Albert, Linnell, *J. Chem. Soc.*, 1936, 1618.

### 3-Aminoacridone.

Yellow needles from EtOH. M.p. 298°. Sol. boiling EtOH, Me<sub>2</sub>CO. Spar. sol. C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O, ligroin. Conc. H<sub>2</sub>SO<sub>4</sub> → bluish-green fluor.

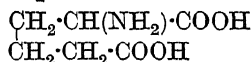
Ullmann, *Ann.*, 1907, 355, 329.

### 4-Aminoacridone.

Yellow needles from EtOH. M.p. 285°. Sol. EtOH, AcOH, Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Insol. ligroin. Conc. H<sub>2</sub>SO<sub>4</sub> → bluish-green fluor.

Ullmann, *Ann.*, 1907, 355, 329.  
Lehmstedt, *Ber.*, 1937, 70, 1535.

### 1-Amino adipic Acid

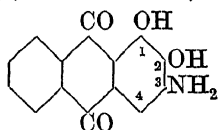


C<sub>6</sub>H<sub>11</sub>O<sub>4</sub>N MW, 161

Cryst. M.p. anhyd. 206°. Sol. 450 parts H<sub>2</sub>O at 40°. Spar. sol. EtOH, Et<sub>2</sub>O. FeCl<sub>3</sub> → reddish-brown col. Heat → α-piperidone-α'-carboxylic acid.

Dieckmann, *Ber.*, 1905, 38, 1656.  
Waalkes, Fones, White, *J. Am. Chem. Soc.*, 1950, 72, 5760.

### 3-Aminoalizarin (1:2-Dihydroxy-3-aminoanthraquinone, β-aminoalizarin)



C<sub>14</sub>H<sub>9</sub>O<sub>4</sub>N MW, 255

Dark red prisms from AcOH. M.p. above 300°. Sol. KOH.Aq. with blue col. NaOH.Aq. or NH<sub>3</sub>.Aq. → brown sols.

*Acetyl deriv.*: yellowish-brown cryst. M.p. 238–40°. Sol. C<sub>6</sub>H<sub>6</sub>. Sublimes.

*Diacetyl deriv.*: reddish-brown cryst. M.p. 268–71°. Sol. EtOH.

*Benzoyl deriv.*: dark yellow needles. M.p. 275°. Sol. EtOH. Spar. sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

*Dibenzoyl deriv.*: yellow leaflets. M.p. 252°.

Roemer, *Ber.*, 1885, 18, 1666.

### 4-Aminoalizarin (1:2-Dihydroxy-4-aminoanthraquinone, α-aminoalizarin).

Greenish-black cryst. from EtOH. Sol. EtOH. Sol. alkalis to carmine-red sols. Sol. Ac<sub>2</sub>O with reddish-violet col. Forms two diacetyl comps.: (a) with excess Ac<sub>2</sub>O. Reddish-brown leaflets. M.p. 245°. Sol. AcOH, Ac<sub>2</sub>O, toluene.

Dict. of Org. Comp.—I.

Conc. H<sub>2</sub>SO<sub>4</sub> → red sol. Boiling EtOH → isomeric diacetyl (below).

(b) With Ac<sub>2</sub>O + AcONa. M.p. 205°. Hot Ac<sub>2</sub>O → isomeric comp. (above).

*Di-Me ether*: C<sub>16</sub>H<sub>13</sub>O<sub>4</sub>N. MW, 283. Dark red cryst. from Py.Aq. M.p. 182–3°. Spar. sol. EtOH, Et<sub>2</sub>O, ligroin. Conc. H<sub>2</sub>SO<sub>4</sub> → blood-red sol.

*Benzoyl deriv.*: reddish-brown needles. M.p. above 310°.

*Dibenzoyl deriv.*: light brown needles. M.p. 255°.

Schultz, Erber, *Ber.*, 1902, 35, 906.

Seer, Karl, *Monatsh.*, 1913, 34, 640.

Turski, B.P., 564,610, (*Chem. Abstracts*, 1946, 40, 4080).

### Aminoallylene.

See Propargylamine.

### Amino-amyl Alcohol.

See Aminopentanol.

### ω-Amino-n-amylbenzene.

See 5-Phenyl-n-amylamine.

### 3-Amino-Δ<sup>16</sup>-androstene

C<sub>19</sub>H<sub>20</sub>ON MW, 287

Cryst. from MeOH. M.p. 163–5° corr.

Prelog, Ruzicka, Meister, Wieland, *Helv. Chim. Acta*, 1945, 28, 618.

### Aminoanilinobenzoic Acid.

See Aminodiphenylamine-carboxylic Acid.

### Aminoanilinoformic Ester.

See Aminophenylurethane.

### Aminoanisic Acid.

See under Hydroxyaminobenzoic Acid and Hydroxyanthranilic Acid.

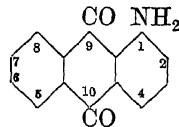
### Aminoanisole.

See Anisidine.

### Aminoanthracene.

See Anthramine.

### 1-Aminoanthraquinone (α-Aminoanthraquinone)



C<sub>14</sub>H<sub>9</sub>O<sub>2</sub>N MW, 223

Orange to brick-red cryst. M.p. 252° (243°). Sol. hot PhNO<sub>2</sub>, toluene, xylene, Et<sub>2</sub>O, AcOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. cold EtOH. Insol. H<sub>2</sub>O. Conc. H<sub>2</sub>SO<sub>4</sub> → pale yellow sol. HSO<sub>3</sub>-Cl → 2-sulphonic acid. Weak base. Salts with HCl and H<sub>2</sub>SO<sub>4</sub> easily hydrolysed.

*N-Acetyl*: yellow or orange-red needles. M.p. 218°.

*N-Benzoyl*: olive-green cryst. M.p. 255°. Insol. EtOH. Conc. H<sub>2</sub>SO<sub>4</sub> → orange sol.

*N-p-Toluenesulphonyl*: m.p. 228–9°.

N-Oxalyl: anthraquinone-1-oxamic acid, (-NH-CO-COOH). M.p. 226°.

Reverdin, *Helv. Chim. Acta*, 1918, 1, 209.  
I.G., D.R.P., 575,580, (*Chem. Abstracts*, 1933, 27, 4819).

**2-Aminoanthraquinone** ( $\beta$ -Aminoanthraquinone).

Red needles from EtOH. M.p. 303-6°. Spar. sol. EtOH. Insol. H<sub>2</sub>O. Weak base. Salts hyd. by H<sub>2</sub>O. Conc. H<sub>2</sub>SO<sub>4</sub> → pale yellow sol.

N-Acetyl: yellow cryst. M.p. 262°.

N-Diacetyl: yellow cryst. from AcOH. M.p. 258°.

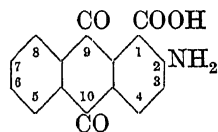
N-Benzoyl: yellow cryst. from AcOH. M.p. 227-8°.

Groggins, Stirton, Newton, *Ind. Eng. Chem.*, 1931, 23, 893.

Groggins, Stirton, *Ind. Eng. Chem.*, 1933, 25, 42.

Newport Chem. Corporation, B.P., 370,724, (*Chem. Abstracts*, 1933, 27, 2967).

**2 - Aminoanthraquinone - 1 - carboxylic Acid**



C<sub>15</sub>H<sub>9</sub>O<sub>4</sub>N MW, 267

Salmon-pink needles. M.p. 250-2°.

Amide: C<sub>15</sub>H<sub>10</sub>O<sub>3</sub>N<sub>2</sub>. MW, 266. Orange cryst. from PhNO<sub>2</sub>. M.p. about 300°.

Nitrile: C<sub>15</sub>H<sub>8</sub>O<sub>2</sub>N<sub>2</sub>. MW, 248. Brownish-yellow needles from PhNO<sub>2</sub>.

Perkin, Spencer, *J. Chem. Soc.*, 1922, 121, 481.

Schaarschmidt, *Ann.*, 1914, 405, 116.

**4 - Aminoanthraquinone - 1 - carboxylic Acid.**

Dark brown needles from AcOH. M.p. 246-8° decomp.

Gattermann, *Ann.*, 1912, 393, 176.

**5 - Aminoanthraquinone - 1 - carboxylic Acid.**

Red leaflets from AcOH. M.p. 277° decomp. (265°). Sol. Me<sub>2</sub>CO, Py. Spar. sol. EtOH, toluene. Insol. Et<sub>2</sub>O, ligroin.

Nitrile: red leaflets from EtOH.

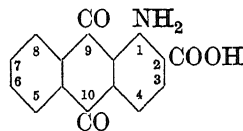
Gattermann, *Ann.*, 1912, 393, 176.

Ullmann, v. der Schalk, *Ann.*, 1912, 388, 210.

**6-Aminoanthraquinone-1-carboxylic Acid.**  
Brown needles from dil. AcOH. M.p. 247-9°.

Pritchard, Simonsen, *J. Chem. Soc.*, 1938, 2047.

**1 - Aminoanthraquinone - 2 - carboxylic Acid**



C<sub>15</sub>H<sub>9</sub>O<sub>4</sub>N MW, 267

Reddish-brown needles from PhNO<sub>2</sub>. M.p. 295-6° (286°). Sol. PhNO<sub>2</sub>, aniline. Spar. sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O, ligroin. Conc. H<sub>2</sub>SO<sub>4</sub> → yellowish-brown sol.

Me ester: C<sub>16</sub>H<sub>11</sub>O<sub>4</sub>N. MW, 281. M.p. 228°.

Et ester: C<sub>17</sub>H<sub>13</sub>O<sub>4</sub>N. MW, 295. M.p. 198°.

Phenyl ester: C<sub>21</sub>H<sub>13</sub>O<sub>4</sub>N. MW, 343. M.p. 198°.

Benzyl ester: C<sub>22</sub>H<sub>15</sub>O<sub>4</sub>N. MW, 357. M.p. 182°.

Amide: C<sub>15</sub>H<sub>10</sub>O<sub>3</sub>N. MW, 266. Red needles from PhNO<sub>2</sub>. M.p. 279-81°.

Nitrile: C<sub>15</sub>H<sub>8</sub>O<sub>2</sub>N<sub>2</sub>. MW, 248. Orange-brown cryst. from chlorobenzene.

N-Acetyl: brown leaflets from AcOH. M.p. 214-15°.

Terres, *Ber.*, 1913, 46, 1634.

General Aniline Works, U.S.P., 1,929,863, (*Chem. Abstracts*, 1934, 28, 338).

I.G., B.P., 314,020, (*Chem. Abstracts*, 1930, 24, 1123).

M. L. B., D.R.P., 275,517, (*Chem. Zentr.*, 1914, II, 279).

**3 - Aminoanthraquinone - 2 - carboxylic Acid.**

Orange-yellow needles from PhNO<sub>2</sub>. M.p. 362-3°. Sol. hot Py, PhNO<sub>2</sub>. Spar. sol. AcOH. Insol. H<sub>2</sub>O, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

N-Acetyl: yellow needles from EtOH. M.p. 248°.

N-Chloroacetyl: orange-red cryst. from PhNO<sub>2</sub>. M.p. 350°.

N-p-Toluenesulphonyl: yellow needles from AcOH.

I.G., D.R.P., 479,355, (*Chem. Zentr.*, 1930, I, 588).

Ullmann, Dasgupta, *Ber.*, 1914, 47, 562.

Willgerodt, Maffezzoli, *J. prakt. Chem.*, 1910, 82, 213.

**5 - Aminoanthraquinone - 2 - carboxylic Acid.**

Brownish-red needles from AcOH.Aq. M.p. 338°. Sol. Me<sub>2</sub>CO, AcOH.

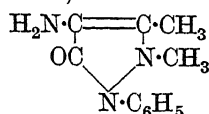
Eckert, *Monatsh.*, 1914, 35, 295.

**4-Aminoanthrarufin.**

du Pont, U.S.P., 1,957,936, (*Chem. Zentr.*, 1934, II, 3184).

**Aminoanthrol.**

See Hydroxyanthramine.

**4-Aminoantipyrine** (4-Amino-2:3-dimethyl-1-phenylpyrazolone-5) $C_{11}H_{13}ON_3$ 

MW, 203

Pale yellow cryst. from  $C_6H_6$ . M.p.  $109^\circ$ . Sol.  $H_2O$ , EtOH,  $C_6H_6$ . Spar. sol.  $Et_2O$ .

$B, HCl$ : m.p. about  $231^\circ$  decomp.

$B, H_2SO_4$ : m.p. about  $215^\circ$ . Sol.  $H_2O$ .

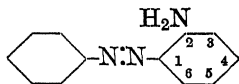
$N$ -Acetyl: m.p.  $199^\circ$ . Sol.  $H_2O$ , EtOH. Mod. sol. hot AcOEt,  $CHCl_3$ . Spar. sol.  $C_6H_6$ . Insol. ligroin.  $FeCl_3 \rightarrow$  faint reddish col.

Picrate: m.p.  $144^\circ$ .

Waser, *Helv. Chim. Acta*, 1925, 8, 121.

Freedman, Sherndal, U.S.P., 1,877,166, (*Chem. Abstracts*, 1933, 27, 103).

Turpeinen, Kallro, *Chem. Abstracts*, 1942, 36, 426.

**o-Aminoazobenzene** (2-Aminoazobenzene) $C_{12}H_{11}N_3$ 

MW, 197

Red prisms from EtOH. M.p.  $59^\circ$ . Very sol. usual org. solvents.  $SnCl_2 + HCl \rightarrow$  aniline + o-phenylenediamine.

$N$ -Acetyl: reddish-yellow needles from AcOH. M.p.  $126^\circ$ .

$N$ -Benzoyl: reddish-yellow needles from AcOH or MeOH. M.p.  $122^\circ$ .

Witt, *Ber.*, 1912, 45, 2383.

**m-Aminoazobenzene** (3-Aminoazobenzene).

Obtained in 2 cryst. forms by regeneration from the sulphate (m.p.  $190-2^\circ$ ). (1) Orange yellow needles, m.p.  $69-70^\circ$ . (2) Brownish red spears, m.p.  $90-1^\circ$ . Sol. EtOH,  $Et_2O$ ,  $Me_2CO$ ,  $CHCl_3$ ,  $C_6H_6$ .

$N$ -Acetyl: both cryst. forms give same deriv. Golden yellow needles from AcOH. M.p.  $130-1^\circ$ . Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ . Insol. pet. ether.  $Fe + dil. AcOH \rightarrow m$ -aminoacetanilide + aniline.

Benzylidene deriv.: yellowish orange. M.p.  $73-4^\circ$ .

Mills, *J. Chem. Soc.*, 1895, 67, 928.

Ruggli, Wüst, *Helv. Chim. Acta*, 1945, 28, 781.

**p-Aminoazobenzene** (4-Aminoazobenzene).

Orange needles with blue cast from EtOH. M.p.  $126^\circ$ . Boils undecomp. above  $360^\circ$ . Sol.  $Et_2O$ , hot EtOH. Spar. sol.  $H_2O$ . Reduces alc.  $NH_3$ .  $AgNO_3$ ,  $k = 9.5 \times 10^{-13}$  at  $25^\circ$ . Red. or boil with conc.  $HCl \rightarrow$  aniline + p-phenylenediamine. Ox.  $\rightarrow$  benzoquinone.

$B, HCl$ : reddish-blue needles.

$B, HBr$ : dark violet needles. M.p.  $206-7^\circ$ . Spar. sol. EtOH,  $Et_2O$ ,  $C_6H_6$ .

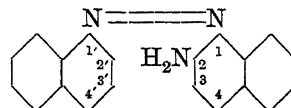
$B, HgCl_2$ : orange cryst. M.p.  $170^\circ$ . Sol.  $Me_2CO$ .

$N$ -Acetyl: golden needles from EtOH. M.p.  $144-6^\circ$ .

$N$ -Propionyl: orange-red plates from EtOH. M.p.  $170^\circ$ .

$N$ -Benzoyl: orange cryst. from EtOH. M.p.  $211^\circ$  ( $205^\circ$ ). Sol. AcOH.

Städel, Bauer, *Ber.*, 1886, 19, 1954.

**2-Amino-1:1'-azonaphthalene** $C_{20}H_{15}N_3$ 

MW, 297

Red needles with green lustre. M.p.  $154^\circ$ . Sol. EtOH,  $CHCl_3$ . Spar. sol. pet. ether, ligroin.

Conc.  $H_2SO_4 \rightarrow$  red col.

$Ni$  comp.:  $(C_{20}H_{14}N_3)_2Ni$ . M.p.  $271^\circ$ .

$Co$  comp.:  $(C_{10}H_{14}N_3)_2Co$ . M.p.  $250^\circ$ .

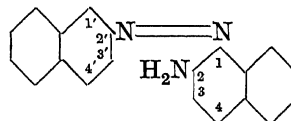
Elter, *Gazz. chim. ital.*, 1915, 45, II, 315.

Crippa, *Gazz. chim. ital.*, 1927, 57, 20.

**4-Amino-1:1'-azonaphthalene.**

Reddish-brown needles with green lustre. M.p.  $175^\circ$  ( $183^\circ$  corr.). Spar. sol. EtOH,  $Et_2O$ ,  $C_6H_6$ .  $Sn + HCl \rightarrow$  1-naphthylamine + 1:4-naphthylenediamine.

Michaelis, Erdmann, *Ber.*, 1895, 28, 2198.

**2-Amino-1:2'-azonaphthalene** $C_{20}H_{15}N_3$ 

MW, 297

Red needles from aniline or xylene. M.p.  $156^\circ$ . Sol. conc.  $H_2SO_4$  to violet sol.

Nietzki, Goll, *Ber.*, 1886, 19, 1281.

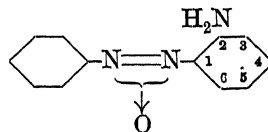
**4-Amino-1:2'-azonaphthalene.**

Brownish-yellow needles from EtOH. M.p.  $152^\circ$ . Sol. conc.  $H_2SO_4$  to violet sol.

Nietzki, Göttig, *Ber.*, 1887, 20, 612.

**Aminoazotoluene.**

See Aminodimethylazobenzene.

**o-Aminoazoxybenzene** (2-Aminoazoxybenzene) $C_{12}H_{11}ON_3$ 

MW, 213

Prisms from EtOH.Aq. M.p. about 98°.  
N-Acetyl: yellow needles from AcOH. M.p. 156°.

Cusmano, Della Nave, *Gazz. chim. ital.*, 1921, 51, i, 69.

**p-Aminoazoxybenzene** (4-Aminoazoxybenzene).

Exists in two isomeric forms.

*α-Form.*

Orange prismatic leaflets. M.p. 138°. Conc. H<sub>2</sub>SO<sub>4</sub> → brown sol.

N-Acetyl: yellow needles from MeOH.Aq. M.p. 151°.

*β-Form.*

Pale yellow cryst. M.p. 136°. Conc. H<sub>2</sub>SO<sub>4</sub> → brown sol.

N-Acetyl: yellow prisms from MeOH.Aq. or EtOH. M.p. 172°.

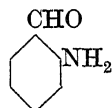
Vorländer, Schuster, *J. prakt. Chem.*, 1934, 140, 193.

Bigiavi, Albanese, *Gazz. chim. ital.*, 1934, 64, 897.

**Aminoazo-xylene.**

See Aminotetramethylazobenzene.

**o-Aminobenzaldehyde** (*Anthranilaldehyde*)



C<sub>7</sub>H<sub>7</sub>ON

MW, 121

Silvery leaflets. M.p. 39–40°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. cold H<sub>2</sub>O. Insol. ligroin. Volatile in steam. Gives bisulphite comp. Forms add. comp. with HgCl<sub>2</sub>. Min. acids → H<sub>2</sub>N·C<sub>6</sub>H<sub>4</sub>·CH·N·C<sub>6</sub>H<sub>4</sub>·CHO (so-called anhydride). Tris-anhydro comp., C<sub>21</sub>H<sub>17</sub>ON<sub>3</sub>, cryst. from EtOH. M.p. 234°. Red. (H<sub>2</sub>/Raney Ni) → o-aminobenzyl alcohol. Heat → polymer. Ac<sub>2</sub>O + AcONa → carbostyryl.

*Oxime*: o-aminobenzaldoxime. Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 134–5°. Sol. EtOH, Et<sub>2</sub>O, AcOH, CS<sub>2</sub>, acids and alkalis. Spar. sol. cold H<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, ligroin. Sublimes. N-Acetyl: m.p. 194°. Sol. hot EtOH.

*Hydrazone*: yellowish leaflets from ligroin. M.p. 62°. *Dipicrate*: m.p. 188°.

p-Nitrophenylhydrazone: m.p. 218–20°.

Semicarbazone: yellow. M.p. 247°.

N-Acetyl: o-aldehydroacetanilide. Needles from H<sub>2</sub>O. M.p. 70–1°. *Oxime*: see above.

N-Benzoyl: o-aldehydobenzanilide. Needles from ligroin. M.p. 73–4°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

Di-Me acetal: b.p. 137–8°/25 mm. Very unstable.

Ruggli, Schmid, *Helv. Chim. Acta*, 1935, 18, 1235.

Bamberger, *Ber.*, 1927, 60, 319.

**m-Aminobenzaldehyde.**

Yellow amorphous powder. Sol. Et<sub>2</sub>O, min. acids.

*Oxime*: m-aminobenzaldoxime. M.p. 195°.

N-Acetyl: colourless cryst. M.p. 122°.

Semicarbazone: yellow needles. Decomp. above 280°.

p-Nitrophenylhydrazone: m.p. 225–6°.

Woodward, *Organic Syntheses*, 1945, XXV, 55.

Rupe, Vogler, *Helv. Chim. Acta*, 1925, 8, 832.

Bissell, U.S.P., 1,499,761, (*Chem. Abstracts*, 1924, 18, 2716).

**p-Aminobenzaldehyde.**

Leaflets. M.p. 70–2°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, min. acids. Undergoes change to red insol. isomer.

*Oxime*: p-aminobenzaldoxime. Yellow cryst. M.p. 124°. Sol. EtOH, Et<sub>2</sub>O, conc. alkalis, min. acids. N-Acetyl: m.p. 205–6°.

Semicarbazone: yellow platelets + ½H<sub>2</sub>O from H<sub>2</sub>O. M.p. 173°.

Phenylhydrazone: leaflets from EtOH. M.p. 156° (175°). Turns yellow in air.

N-Dibenzyl: pale yellow needles from EtOH. M.p. 88–90°.

N-Acetyl: needles from hot H<sub>2</sub>O. M.p. 153°.

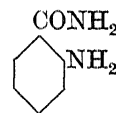
Phenylhydrazone: m.p. 209°. Thiosemicarbazone: Thiacetazone. Yellow hexagonal plates from conc. AcOH. M.p. 228° (234°) decomp. *Oxime*: see above.

Beard et al., *J. Chem. Soc.*, 1944, 4.

Vilsmeier, Haack, *Ber.*, 1927, 60, 121.

Janse, *Rec. trav. chim.*, 1921, 40, 286.

**o-Aminobenzamide** (*Anthranilic acid amide*)



C<sub>7</sub>H<sub>9</sub>ON<sub>2</sub>

MW, 136

Leaflets. M.p. 109–111.5°. Sol. EtOH, hot H<sub>2</sub>O. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Hyd. by HCl.

N-Benzoyl: decomp. at 214–15°.

B<sub>2</sub> + oxalic Et ester: m.p. 87–9°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.

N-Acetyl: see under Acetylanthranilic Acid.

Jacobs, Heidelberger, *J. Am. Chem. Soc.*, 1917, 39, 1437.

Heilbron et al., *J. Chem. Soc.*, 1945, 861.

**m-Aminobenzamide.**

Yellow needles + 1H<sub>2</sub>O from H<sub>2</sub>O. M.p. 113–14° corr. Sol. Et<sub>2</sub>O. Spar. sol. cold CHCl<sub>3</sub>, cold C<sub>6</sub>H<sub>6</sub>.

Hydrate: m.p. 79–80°.

Jacobs, Heidelberger, *J. Am. Chem. Soc.*, 1917, 39, 1437.

***p*-Aminobenzamide.**

Yellow cryst. +  $\frac{1}{2}$ H<sub>2</sub>O. M.p. 183°. Spar. sol. H<sub>2</sub>O.

*N*-Acetyl: prisms from EtOH.Aq. M.p. 274.5°.

*N*-Chloroacetyl: needles from EtOH. M.p. 241-3°.

Beilstein, Reichenbach, *Ann.*, 1864, 132, 144.

**Aminobenzanilide.**

See under Anthranilic Acid and *m*-Aminobenzoic Acid.

**Aminobenzdioxole.**

See Methylenedioxyaniline.

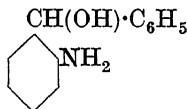
**Aminobenzenesulphonamide.**

See Sulphanilamide and under *o*- and *m*-Aniline-sulphonic Acids.

**Aminobenzenesulphonic Acid.**

See Aniline-sulphonic Acid.

***o*-Aminobenzhydrol** (*o*-Aminodiphenylcarbinol)



C<sub>13</sub>H<sub>13</sub>ON MW, 199

Prisms from EtOH. M.p. 120°. Sol. most org. solvents.

*N*-Acetyl: needles from EtOH. M.p. 118°.

Gabriel, Stelzner, *Ber.*, 1896, 29, 1304.

***m*-Aminobenzhydrol** (*m*-Aminodiphenylcarbinol).

Needles from EtOH.Aq. M.p. 78°. A second form (probably a hydrate) softens at 64°, m.p. 76-7°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, AcOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Insol. cold H<sub>2</sub>O.

Esselen, Clarke, *J. Am. Chem. Soc.*, 1914, 36, 308.

***p*-Aminobenzhydrol** (*p*-Aminodiphenylcarbinol).

Needles from C<sub>6</sub>H<sub>6</sub>, or hot H<sub>2</sub>O. M.p. 121°. Sol. EtOH, MeOH, AcOEt. Spar. sol. Et<sub>2</sub>O, ligroin.

*B*,*HCl*: m.p. 270-3° decomp.

*Benzoyl*: needles from EtOH. M.p. 145°.

Kippenberg, *Ber.*, 1897, 30, 1136.

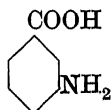
**2-Aminobenzidine.**

See 2 : 4 : 4'-Triaminodiphenyl.

***o*-Aminobenzoic Acid.**

See Anthranilic Acid.

***m*-Aminobenzoic Acid**



C<sub>7</sub>H<sub>7</sub>O<sub>2</sub>N

MW, 137

M.p. 174°. Very sol. hot H<sub>2</sub>O. Spar. sol. cold H<sub>2</sub>O. Sol. EtOH, Et<sub>2</sub>O. Aq. sols. turn brown in air. D<sup>4</sup> 1.5105. Sublimes with some decomp. Forms sol. salts with min. acids. NaHg, or HI at 180° → benzoic acid + NH<sub>3</sub>. Br → tribromo deriv. HCl + KClO<sub>3</sub> → chloranil. *k*(acid) = 1.63 × 10<sup>-5</sup> at 25°. *k*(base) = 1.2 × 10<sup>-11</sup> at 25°.

*N*-Acetyl: *m*-acetylaminobenzoic acid. Small needles. M.p. 248° decomp. Sol. hot EtOH. Spar. sol. hot H<sub>2</sub>O. Sublimes. *k* = 8.5 × 10<sup>-5</sup> at 25°.

*B*<sub>2</sub>,*H*<sub>2</sub>*S*O<sub>4</sub>: needles + H<sub>2</sub>O. M.p. 225°, (anhyd.) 230°. Sol. hot H<sub>2</sub>O.

*Me ester*: C<sub>8</sub>H<sub>9</sub>O<sub>2</sub>N. MW, 151. Cryst. M.p. 36-8°. B.p. 152-3°/11 mm. Very sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. pet. ether. *B*,*HCl*: m.p. 201-2°. *Acetyl*: m.p. 136-7°.

*Et ester*: C<sub>9</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 165. Oil. B.p. 294°. Mod. sol. H<sub>2</sub>O. *B*,*HCl*: m.p. 185°.

*n*-Butyl ester: C<sub>11</sub>H<sub>15</sub>O<sub>2</sub>N. MW, 193. M.p. below 0°. B.p. 245°. *B*,*HCl*: plates. M.p. 128°.

*d*-Amyl ester: C<sub>12</sub>H<sub>17</sub>O<sub>2</sub>N. MW, 207. B.p. 184-7°/35 mm. D<sup>15</sup> 1.051. *n*<sub>D</sub> 1.5351. [α]<sub>D</sub><sup>15</sup> + 6.46°.

*l*-Menthyl ester: b.p. 168°/1.8 mm.

*Benzyl ester*: pale yellow liq. B.p. 308°.

*p*-Nitrobenzyl ester: m.p. 201°.

*Amide*: see *m*-Aminobenzamide.

*Nitrile*: see *m*-Aminobenzonitrile.

*Anilide*: *m*-aminobenzanilide. C<sub>13</sub>H<sub>12</sub>ON<sub>2</sub>. MW, 212. Needles from H<sub>2</sub>O. M.p. 140°. Sol. H<sub>2</sub>O.

*p*-Iodophenylurea deriv.: m.p. 220-1°.

Brill, *J. Am. Chem. Soc.*, 1921, 43, 1320.

Popov, *Chem. Abstracts*, 1934, 28, 1671.

Holleman, Voerman, *Rec. trav. chim.*, 1902, 21, 58.

***p*-Aminobenzoic Acid.**

Yellowish-red cryst. M.p. 186-7°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. *k*(acid) = 1.21 × 10<sup>-5</sup> at 25°. *k*(base) = 2.3 × 10<sup>-12</sup> at 25°. Br → dibromo deriv. HCl + KClO<sub>3</sub> → chloranil. HCl at 180° → aniline + CO<sub>2</sub>. Alkylaminoalkyl esters used extensively as local anæsthetics.

*Me ester*: C<sub>8</sub>H<sub>9</sub>O<sub>2</sub>N. MW, 151. Leaflets from MeOH.Aq. M.p. 112°.

*Et ester*: see Benzocaine.

*Propyl ester*: see Propaesin.

*Isopropyl ester*: cryst. from EtOH. M.p. 79°. *B*,*HCl*: needles. M.p. 184°.

*n*-Butyl ester: see Butesin.

*Isobutyl ester*: see Cycloform.

*Allyl ester*: C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 177. Cryst. from EtOH. M.p. 52°. *B*,*HCl*: plates. M.p. 180°.

*n*-Amyl ester: C<sub>12</sub>H<sub>17</sub>O<sub>2</sub>N. MW, 207. Needles from ligroin. M.p. 56.8°.

*d*-Amyl ester: m.p. 27-30°. B.p. 215°/35 mm. D<sup>15</sup> 1.050. *n*<sub>D</sub><sup>15</sup> 1.5369. [α]<sub>D</sub><sup>15</sup> + 5.47°.

*Menthyl ester*: m.p. 89°. B.p. 175°/0.2 mm. slight decomp. *B,HCl*: m.p. about 200°.

*Benzyl ester*: needles. M.p. 90°. *B,HCl*: m.p. 184°.

*p-Nitrobenzyl ester*: m.p. above 248°.

*β-Naphthyl ester*: needles from EtOH. M.p. 171°. Sol. Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>. Mod. sol. CHCl<sub>3</sub>, Et<sub>2</sub>O, CS<sub>2</sub>.

*β-Diethylaminoethyl ester*: see Novocaine.  
2 : 2-Dimethyl-3-diethylaminopropyl ester hydrochloride: see Larocaine.

*Amide*: see *p*-Aminobenzamide.

*Nitrile*: see *p*-Aminobenzonitrile.

*N-Formyl*: needles from EtOH. M.p. 268° decomp.

*N-Acetyl*: *p*-acetylaminobenzoic acid. Needles. M.p. 250° decomp. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O. Hyd. by hot HCl.  $k = 5.2 \times 10^{-5}$  at 25°.

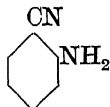
*N-Benzoyl*: needles from EtOH. M.p. 278°. Sol. EtOH, Et<sub>2</sub>O, AcOH. Spar. sol. H<sub>2</sub>O.

*p-Iodophenylurea deriv.*: m.p. 231-2°.

Popov, *Chem. Abstracts*, 1934, **28**, 1671.

Brill, *J. Am. Chem. Soc.*, 1921, **43**, 1320.

**o-Aminobenzonitrile** (*Anthranilic acid nitrile, o-cyanoaniline*)



C<sub>7</sub>H<sub>6</sub>N<sub>2</sub>

MW, 118

Yellow prisms from CS<sub>2</sub>, needles from pet. ether. M.p. 51°. B.p. 267-8°/777 mm. Sol. EtOH, MeOH, Me<sub>2</sub>CO, Et<sub>2</sub>O, CHCl<sub>3</sub>, Py, CS<sub>2</sub>. Spar. sol. H<sub>2</sub>O.

Kalle, D.R.P., 212,207, (*Chem. Zentr.*, 1909, II, 486).

Reissert, Grube, *Ber.*, 1909, **42**, 3712.

**m-Aminobenzonitrile** (*m-Cyanoaniline*).

Needles from EtOH.Aq. M.p. 53-4°. B.p. 288-90°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, AcOEt. Spar. sol. H<sub>2</sub>O. Fe + AcOH → benzonitrile + NH<sub>3</sub>.

Fricke, *Ber.*, 1874, **7**, 1321.

I.G., D.R.P., 523,273, (*Chem. Abstracts*, 1931, **25**, 3359).

**p-Aminobenzonitrile** (*p-Cyanoaniline*).

Prisms. M.p. 86°. Very sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, AcOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, boiling H<sub>2</sub>O. Spar. sol. CS<sub>2</sub>, ligroin. Alk. H<sub>2</sub>O<sub>2</sub> → *p*-aminobenzamide.

*Picrate*: golden yellow needles from EtOH.Aq. M.p. 150°.

*N-Formyl*: cryst. from H<sub>2</sub>O. M.p. 188-9°.

*N-Acetyl*: needles from H<sub>2</sub>O. M.p. 205.5°.

*N-Propionyl*: cryst. from H<sub>2</sub>O. M.p. 169°.

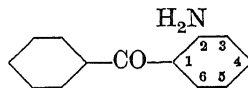
*N-Benzoyl*: cryst. from EtOH.Aq. M.p. 170°.

Bogert, Wise, *J. Am. Chem. Soc.*, 1912, **34**, 693.

I.G., D.R.P., 523,273, (*Chem. Abstracts*, 1931, **25**, 3359).

Ashley *et al.*, *J. Chem. Soc.*, 1942, 103.

**o-Aminobenzophenone** (*o-Aminodiphenyl ketone*)



C<sub>13</sub>H<sub>11</sub>ON

MW, 197

Pale yellow cryst. from EtOH. M.p. 105-6°. PbO at 320° → acridone. Na.Hg → *o*-aminobenzhydrol. ZnCl<sub>2</sub> → aniline + benzoic acid.

*B,HCl*: m.p. 179-80° decomp.

*Oximes*: alkali-stable, m.p. 156°. Acid-stable, m.p. 127°.

*N-Acetyl*: needles from EtOH.Aq. M.p. 72° (89°). *Oxime*: leaflets from EtOH. M.p. 180°.

*N-Propionyl*: needles from EtOH.Aq. M.p. 78.5°.

*N-Butyryl*: cryst. from EtOH. M.p. 56°.

*N-Benzoyl*: needles from EtOH.Aq. M.p. 80.5°. Sol. hot EtOH, C<sub>6</sub>H<sub>6</sub>.

Gabriel, Stelzner, *Ber.*, 1896, **29**, 1303.

Hayashi, Namikawa, Morikawa, *J. Chem. Soc. Japan*, 1935, **56**, 1106.

Simpson *et al.*, *J. Chem. Soc.*, 1945, 646.

**m-Aminobenzophenone**.

Yellow needles from hot H<sub>2</sub>O. M.p. 87°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O. Na.Hg → *m*-aminobenzhydrol.

*B,HCl*: needles from dil. HCl. M.p. 187°.

Geigy, Königs, *Ber.*, 1885, **18**, 2401.

**p-Aminobenzophenone**.

Leaflets from EtOH.Aq. M.p. 124°. Sol. EtOH, Et<sub>2</sub>O, AcOH. Mod. sol. hot H<sub>2</sub>O.

*Oxime*: exists in two forms. (i) Prisms from EtOH. M.p. 168°. (ii) Needles from EtOH.Aq. M.p. 126°.

*Hydrazone*: yellow needles from EtOH. M.p. 139-40°.

*N-Acetyl*: needles from EtOH.Aq. M.p. 153°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>, AcOH. Insol. H<sub>2</sub>O.

*N-Benzoyl*: leaflets from EtOH. M.p. 152°. Sol. C<sub>6</sub>H<sub>6</sub>, AcOH, hot AcOH. Insol. H<sub>2</sub>O.

*N-Propionyl*: plates from EtOH. M.p. 139°.

Döbner, *Ann.*, 1881, **210**, 268.

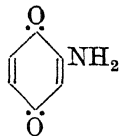
Clarke, Esselen, *J. Am. Chem. Soc.*, 1911, **33**, 1138.

Montagne, *Rec. trav. chim.*, 1923, **42**, 506.

**Aminobenzophenone-carboxylic Acid.**

See Aminobenzoylbenzoic Acid.



**Amino-*p*-benzoquinone** (*Aminoquinone*) $C_6H_5O_2N$ 

MW, 123

*N*-Acetyl: reddish-yellow needles or prisms from  $C_6H_6$ . M.p.  $142^\circ$ . Sol. most ord. org. solvents.

*Dianil*:  $C_6H_5N \cdot C_6H_3(NH_2) \cdot NC_6H_5 \cdot C_{18}H_{15}N_3$ . Red prisms. M.p.  $167^\circ$ . Sol.  $Et_2O$ ,  $Me_2CO$ ,  $CHCl_3$ ,  $C_6H_6$ ,  $CS_2$ . Spar. sol. EtOH.

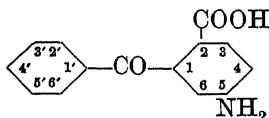
Orlov, *Chem. Abstracts*, 1929, **23**, 1125.

 **$\beta$ -*o*-Aminobenzoylalanine.**

See Kynurenine.

***o*-Aminobenzoylanthranilic Acid.**

See Anthranoylanthranilic Acid.

**4-Amino-*o*-benzoylbenzoic Acid** (5-*Aminobenzophenone-2-carboxylic acid*) $C_{14}H_{11}O_3N$ 

MW, 241

Colourless needles from  $H_2O$ . Yellow prisms + 1EtOH from EtOH. M.p.  $195^\circ$  decomp.

Kliegl, *Ber.*, 1905, **38**, 296.

**5-Amino-*o*-benzoylbenzoic Acid** (4-*Aminobenzophenone-2-carboxylic acid*).

Yellow cryst. from  $H_2O$ . M.p.  $193-4^\circ$  decomp. Sol. warm MeOH. Insol.  $Et_2O$ , AcOEt,  $CHCl_3$ , ligroin.

Rainer, *Monatsh.*, 1908, **29**, 437.

**3'-Amino-*o*-benzoylbenzoic Acid** (3'-*Aminobenzophenone-2-carboxylic acid*).

Yellow cryst. M.p.  $174-5^\circ$ .

Rainer, *Monatsh.*, 1908, **29**, 180; 1905, **26**, 974.

**3'-Amino-*p*-benzoylbenzoic Acid** (3'-*Aminobenzophenone-4-carboxylic acid*).

Cryst. +  $1H_2O$  from EtOH.Aq. M.p.  $145^\circ$ . Sol. EtOH, hot  $H_2O$ . Insol.  $Et_2O$ .

*B*, *HCl*: needles. M.p. above  $250^\circ$ .

Limpricht, *Lenz, Ann.*, 1895, **286**, 318.

**4'-Amino-*p*-benzoylbenzoic Acid** (4'-*Aminobenzophenone-4-carboxylic acid*).

Pale yellow needles from  $H_2O$ . M.p.  $211^\circ$ . Sol. EtOH.

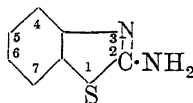
Limpricht, *Samietz, Ann.*, 1895, **286**, 331.

***p*-Aminobenzoylcarbinol.**

See *p*-Aminophenacyl Alcohol.

***o*-Aminobenzoylformic Acid.**

See Isatic Acid.

**2-Aminobenzthiazole** ( $\mu$ -*Aminobenzthiazole*) $C_7H_6N_2S$ 

MW, 150

Leaflets. M.p.  $132^\circ$  ( $129^\circ$ ). Sol. conc. HCl. Very stable and distils undecomp.

*B*, *HCl*: m.p.  $236-7^\circ$ .

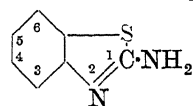
*N*-Phenyl: 2-anilinobenzthiazole.  $C_{13}H_{10}N_2S$ . MW, 226. Needles. M.p.  $159^\circ$ . *Picrate*: m.p.  $222^\circ$ . *N*-Acetyl: m.p.  $158^\circ$ .

*N*-Acetyl: prisms from EtOH. M.p.  $186^\circ$ .

*N*-Benzoyl: prisms from EtOH. M.p.  $186^\circ$ .

*Picrate*: m.p.  $256^\circ$ .

Note.—Alternative numbering:



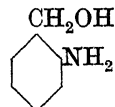
Hunter, *J. Chem. Soc.*, 1925, **127**, 2023; 1926, 1385.

I.G., D.R.P., 615,526, (*Chem. Abstracts*, 1935, **29**, 8003); B.P., 345,735, (*Chem. Abstracts*, 1932, **26**, 1944).

**4-Aminobenzthiazole.**

Leaflets from  $C_6H_6$ -pet. ether. M.p.  $94^\circ$ .

Erlenmeyer, Ueberwasser, *Helv. Chim. Acta*, 1940, **23**, 328.

***o*-Aminobenzyl Alcohol** (*o*-*Aminophenyl*-carbinol) $C_7H_9ON$ 

MW, 123

Needles from  $C_6H_6$ . M.p.  $82^\circ$ . B.p.  $270-80^\circ$  part. decomp.,  $160^\circ/5-10$  mm. Sol. EtOH, AcOH,  $CHCl_3$ ,  $C_6H_6$ . Mod. sol.  $H_2O$ ,  $Et_2O$ . Spar. volatile in steam.

*Me ether*: methyl *o*-aminobenzyl ether.  $C_8H_{11}ON$ . MW, 137. Colourless oil. B.p.  $227^\circ$  with part. resinification,  $124^\circ/30$  mm.  $D_4^{20}$  1.05. Darkens in air. Resinified by acids. *Oxalate*: m.p.  $124^\circ$ .

*Et ether*: ethyl *o*-aminobenzyl ether.  $C_9H_{13}ON$ . MW, 151. Yellow oil. B.p.  $123-9^\circ/25$  mm. Resinified by acids and when dist. at ord. press. *B*, *HCl*: m.p.  $81-2^\circ$ . *Oxalate*: m.p.  $136^\circ$ .

*Phenyl ether*: phenyl *o*-aminobenzyl ether.  $C_{13}H_{13}ON$ . MW, 199. Cryst. from EtOH. M.p.  $81-2^\circ$ . Sol. hot EtOH.

*O*-Acetyl: oil. *B*, *HCl*: needles. M.p.  $116^\circ$ .

*N*-Acetyl: needles from  $C_6H_6$ . M.p.  $114^\circ$ .

*O*-Benzoyl: cryst. from EtOH- $Et_2O$ . M.p.  $198-9^\circ$ .

*B, HCl*: m.p. 108°.

*B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>*: m.p. 114°.

*Oxalate*: m.p. 130°. Sol. H<sub>2</sub>O, hot EtOH.

*Picrate*: m.p. 110°.

Gabriel, Posner, *Ber.*, 1894, 27, 3512.

Reissert, Crämer, *Ber.*, 1928, 61, 2555.

Coleman, Johnson, *Organic Syntheses*, 1941, XXI, 10.

**m-Aminobenzyl Alcohol** (*m-Aminophenylcarbinol*).

Plates from C<sub>6</sub>H<sub>6</sub>. M.p. 97°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, hot H<sub>2</sub>O. Mod. sol. C<sub>6</sub>H<sub>6</sub>.

*N-Acetyl*: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 106-7°. Sol. EtOH.

*N-Benzoyl*: needles from EtOH.Aq. M.p. 115°. Sol. EtOH, Et<sub>2</sub>O, AcOH.

*O-Benzoyl*: cryst. from CHCl<sub>3</sub>-pet. ether. M.p. 144-5°.

*ON-Dibenzoyl*: needles from EtOH. M.p. 113-14°.

Shima, *Chem. Abstracts*, 1928, 22, 3884.

Lutter, *Ber.*, 1897, 30, 1065.

**p-Aminobenzyl Alcohol** (*p-Aminophenylcarbinol*).

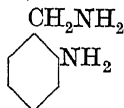
Plates and leaflets from C<sub>6</sub>H<sub>6</sub>. M.p. 65°. Very sol. H<sub>2</sub>O. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*ON-Diacetyl*: needles from EtOH.Aq. M.p. 188°. Sol. EtOH, AcOH.

*N-Benzoyl*: cryst. from H<sub>2</sub>O. M.p. 150-1°.

Thiele, Dimroth, *Ann.*, 1899, 305, 119.

**o-Aminobenzylamine** ( *$\alpha$ -Amino-o-toluidine*,  $\alpha$ : 2-diaminotoluene)



C<sub>7</sub>H<sub>10</sub>N<sub>2</sub> MW, 122

Sol. H<sub>2</sub>O. Mod. volatile in steam. Decomp. on dist. with evolution of NH<sub>3</sub>. Absorbs CO<sub>2</sub>.

*Benzoate*: C<sub>7</sub>H<sub>10</sub>N<sub>2</sub>·C<sub>7</sub>H<sub>6</sub>O<sub>2</sub>. Leaflets. M.p. 167°. Sol. H<sub>2</sub>O, EtOH.

*$\alpha$ N-Acetyl*: needles from hot H<sub>2</sub>O. M.p. 113°.

*$\alpha$ N-Phenyl*: *o*-aminobenzylaniline. C<sub>13</sub>H<sub>14</sub>N<sub>2</sub>. MW, 198. Needles from EtOH. M.p. 86-7°. Sol. most org. solvents except ligroin.

*$\alpha$ N-Di-Me*: *o*-aminobenzylidimethylamine. C<sub>9</sub>H<sub>14</sub>N<sub>2</sub>. MW, 150. M.p. 36-7°. B.p. 107°/14 mm. *B, 2HCl*: prisms from EtOH. M.p. 205°.

*$\alpha$ N-Di-Et*: *o*-aminobenzylidethylamine. C<sub>11</sub>H<sub>18</sub>N<sub>2</sub>. MW, 178. B.p. 153-5°/42 mm.

*Monopicrate*: orange yellow. M.p. 143-4°.

*Dipicrate*: yellow cryst. M.p. 135°.

Gabriel, Colman, *Ber.*, 1904, 37, 3644.

Busch, *J. prakt. Chem.*, 1895, 51, 261.

Noelting, Kregczy, *Bull. soc. chim.*, 1916, 19, 339.

Stedman, *J. Chem. Soc.*, 1927, 130, 1904.

**m-Aminobenzylamine** ( *$\alpha$ -Amino-m-toluidine*,  $\alpha$ : 3-diaminotoluene).

*$\alpha$ N-Di-Me*: *m*-aminobenzylidimethylamine. C<sub>9</sub>H<sub>14</sub>N<sub>2</sub>. MW, 150. M.p. 46°. B.p. 129°/13 mm. *B, 2HCl*: prisms from EtOH. M.p. 225°.

*$\alpha$ N-Di-Et*: *m*-aminobenzylidethylamine. C<sub>11</sub>H<sub>18</sub>N<sub>2</sub>. MW, 178. B.p. 167-8°/42 mm. *Picrate*: orange red. M.p. 142°. *Dipicrate*: yellow. M.p. 148°.

*$\alpha$ N-Phenyl*: *m*-aminobenzylaniline. C<sub>13</sub>H<sub>14</sub>N<sub>2</sub>. MW, 198. Needles. M.p. 60°. *B, 2HCl*: m.p. 161°.

Purgotti, Monti, *Gazz. chim. ital.*, 1900, 30, ii, 258.

Stedman, *J. Chem. Soc.*, 1927, 1906.

Noelting, Kregczy, *Bull. soc. chim.*, 1916, 19, 339.

**p-Aminobenzylamine** ( *$\alpha$ -Amino-p-toluidine*,  $\alpha$ : 4-diaminotoluene).

B.p. 268-70°. Sol. EtOH. Mod. sol. H<sub>2</sub>O. Insol. Et<sub>2</sub>O. D<sup>20</sup> 1.08. Absorbs CO<sub>2</sub>.

*$\alpha$ N-Di-Me*: *p*-aminobenzylidimethylamine. C<sub>9</sub>H<sub>14</sub>N<sub>2</sub>. MW, 150. B.p. 133°/16 mm. *B, 2HCl*: needles from EtOH. M.p. 216°.

*$\alpha$ N-Di-Et*: *p*-aminobenzylidethylamine. C<sub>11</sub>H<sub>18</sub>N<sub>2</sub>. MW, 178. B.p. 165-6°/42 mm. *Monopicrate*: red. M.p. 109-10°. *Dipicrate*: yellow. M.p. 130°.

*$\alpha$ N-Phenyl*: *p*-aminobenzylaniline. C<sub>13</sub>H<sub>14</sub>N<sub>2</sub>. MW, 198. M.p. 49-50°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Dil. HCl  $\rightarrow$  4:4'-diaminodiphenylmethane.

Salkowski, *Ber.*, 1889, 22, 2142.

Paal, Sprenger, *Ber.*, 1897, 30, 70.

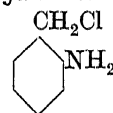
Stedman, *J. Chem. Soc.*, 1927, 1906.

Noelting, Kregczy, *Bull. soc. chim.*, 1916, 19, 339.

**Aminobenzylaniline.**

See under Aminobenzylamine.

**o-Aminobenzyl chloride**



C<sub>7</sub>H<sub>8</sub>NCl MW, 141.5

*N-Acetyl*: cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 114°.

*N-Benzoyl*: needles. M.p. 124-5°.

Gabriel, Posner, *Ber.*, 1894, 27, 3513.

**m-Aminobenzyl chloride.**

*N-Acetyl*: needles from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 89°.

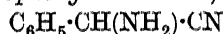
Kühn, *Ber.*, 1900, 33, 2903.

**p-Aminobenzyl chloride.**

*N-Acetyl*: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 155°.

Kühn, *Ber.*, 1900, 33, 2903.

**$\alpha$ -Aminobenzyl cyanide** ( *$\alpha$ -Cyanobenzylamine*,  $\alpha$ -aminophenylacetonitrile)



C<sub>8</sub>H<sub>8</sub>N<sub>2</sub>

MW, 132

l.

Tartrate:  $[\alpha]_D + 41.1^\circ$ .

N-Acetyl: needles from AcOEt-pet ether. M.p. 130-8°.

N-Benzoyl: m.p. 151°.

dl.

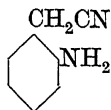
Leaflets from ligroin. M.p. 55°.

B,HCl: needles. M.p. 173° decomp.

Picrate: yellow needles. M.p. 160-1° decomp.

N-Benzoyl: needles from H<sub>2</sub>O. M.p. 159-60°.Dubsky, Wensink, Gränacher, *Ber.*, 1919, 52, 232.Ruggeri, Rigoli, *Gazz. chim. ital.*, 1924, 54, 554.Reihlen, Weinbrenner, v. Hessling, *Ann.*, 1932, 494, 156.

## o-Aminobenzyl cyanide (o-Aminophenyl-acetonitrile)

C<sub>8</sub>H<sub>8</sub>N<sub>2</sub> MW, 132Leaflets from EtOH.Aq. M.p. 72°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O. Na + EtOH → 2-aminoindole.

N-Acetyl: m.p. 120°.

Pschorr, Hoppe, *Ber.*, 1910, 43, 2543.

## m-Aminobenzyl cyanide (m-Aminophenyl-acetonitrile).

B.p. 183-7°/13 mm.

N-Acetyl: m.p. 100-2°.

Picrate: m.p. 200° decomp.

Koelsch, *J. Am. Chem. Soc.*, 1943, 65, 437.Salkowski, *Ber.*, 1910, 43, 2543.

## p-Aminobenzyl cyanide (p-Aminophenyl-acetonitrile).

Leaflets from H<sub>2</sub>O. M.p. 46°. B.p. 312°, 177°/11 mm. Spar. sol. CS<sub>2</sub>, hot H<sub>2</sub>O. Sol. most other org. solvents. Spar. volatile in steam.

B,HCl: m.p. 217-20°.

Picrate: m.p. 185°.

N-Formyl: cryst. from H<sub>2</sub>O. M.p. 135°.

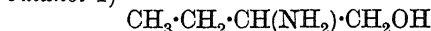
N-Benzoyl: m.p. 176-7°.

N-Acetyl: needles from H<sub>2</sub>O. M.p. 97°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, AcOH. Spar. sol. C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>. Distills undecomp.N-Diacetyl: needles. M.p. 152-3°. Sol. CHCl<sub>3</sub>, hot H<sub>2</sub>O. Mod. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, AcOH, CS<sub>2</sub>.v. Braun, Blessing, *Ber.*, 1923, 56, 2156.I.G., D.R.P., 523,273, (*Chem. Abstracts*, 1931, 25, 3359).

## Aminobutane.

See Butylamine.

## 2-Amino-n-butyl Alcohol (2-Aminobutanol-1)

C<sub>4</sub>H<sub>11</sub>ON MW, 89

B.p. 172-4°.

B<sub>2</sub>(COOH)<sub>2</sub>: m.p. 176°.B<sub>2</sub>,H<sub>2</sub>PtCl<sub>6</sub>: yellow leaflets. M.p. 189-90°.

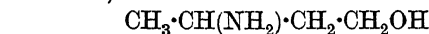
d.

B.p. 80°/11 mm. D<sup>20</sup> 0.947.  $[\alpha]_D^{20} + 9.8^\circ$  in H<sub>2</sub>O.Oxalate: m.p. 190-2°.  $[\alpha]_D^{20} + 11.3^\circ$  in H<sub>2</sub>O.

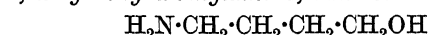
l.

Oxalate:  $[\alpha]_D^{20} - 11.3^\circ$  in H<sub>2</sub>O.Stiénon, *Chem. Zentr.*, 1902, I, 717.Blaise, Picard, *Ann. chim. phys.*, 1912, 26, 273.Stoll, Hofmann, *Helv. Chim. Acta*, 1943, 26, 922.Johnson, Degering, *J. Org. Chem.*, 1943, 8, 7.

## 3-Amino-n-butyl Alcohol (3-Aminobutanol-1)

C<sub>4</sub>H<sub>11</sub>ON MW, 89B.p. 82-5°/19 mm. Sol. H<sub>2</sub>O.Bayer, D.R.P., 247,144, (*Chem. Zentr.*, 1912, II, 159).Schnider, *Jubilee Vol. Emil Barrell*, 1946, 85, (*Chem. Abstracts*, 1947, 41, 6199).

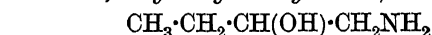
## 4-Amino-n-butyl Alcohol (4-Aminobutanol-1, 4-hydroxy-n-butylamine, butanolamine)

C<sub>4</sub>H<sub>11</sub>ON MW, 89B.p. 206°/776 mm., 148°/148 mm., 125°/34 mm. Sol. EtOH. Insol. Et<sub>2</sub>O. D<sup>20</sup> 0.967.Forms a hydrate in H<sub>2</sub>O. Absorbs CO<sub>2</sub> and H<sub>2</sub>O.Me ether: C<sub>5</sub>H<sub>13</sub>ON. MW, 103. B.p. 142-5°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.Et ether: C<sub>6</sub>H<sub>15</sub>ON. MW, 117. B.p. 153-4°/746 mm. Sol. H<sub>2</sub>O. D<sup>20</sup> 0.864.

N-Chloroacetyl: m.p. 30°. B.p. 165-7°/0.7 mm.

Henry, *Ber.*, 1900, 33, 3170.

## 1-Amino-sec.-n-butyl Alcohol (1-Aminobutanol-2, 2-hydroxy-n-butylamine)

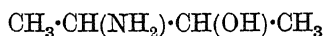
C<sub>4</sub>H<sub>11</sub>ON MW, 89

B.p. 168-70°, 75-7°/12 mm.

Et ether: C<sub>6</sub>H<sub>15</sub>ON. MW, 117. B.p. 139-41°. Picrate: needles. M.p. 156°.B<sub>2</sub>(COOH)<sub>2</sub>: m.p. 193°.

Picrolonate: yellow needles from EtOH. M.p. 154°.

Bookman, *Ber.*, 1895, 28, 3117.Montmollin, Ackermann, *Helv. Chim. Acta*, 1929, 12, 874.

**3-Amino-sec.-n-butyl Alcohol** (3-Aminobutanol-2)

$\text{C}_4\text{H}_{11}\text{ON}$  MW, 89

B.p. 159–60°/745 mm., 78–80°/20 mm. Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ .  $D_{20}^{20}$  0.9416.  $n_D^{25}$  1.4445.

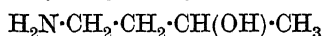
$B_2(\text{COOH})_2$ : leaflets from EtOH. M.p. 208° decomp. (211–12°).

$B_1(\text{COOH})_2$ : cryst. from EtOH. M.p. 164–5°.

N-Chloroacetyl: cryst. M.p. 38–9°. B.p. 119°/0.3 mm. Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{CHCl}_3$ .

Batalin, Ugryumov, *Chem. Abstracts*, 1936, 30, 6701.

Wieland, Bossert, *Ann.*, 1934, 509, 12.

**4-Amino-sec.-n-butyl Alcohol** (4-Aminobutanol-2, 3-hydroxy-n-butylamine)

$\text{C}_4\text{H}_{11}\text{ON}$  MW, 89

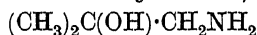
B.p. 172°/755 mm.

$B_2, \text{H}_2\text{PtCl}_6$ : orange-yellow plates from MeOH. M.p. 206° decomp.

Picrate: yellow prisms EtOH. M.p. 122°.

Et ether:  $\text{C}_6\text{H}_{15}\text{ON}$ . MW, 117. B.p. 148°.  $D^{20}$  0.8468.  $B_2, \text{H}_2\text{PtCl}_6$ : m.p. 19°.  $B_2(\text{COOH})_2$ : m.p. 198–200°.

Robinson, Sugimoto, *J. Chem. Soc.*, 1932, 307.

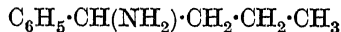
**Amino-tert.-butyl Alcohol** (2-Hydroxyisobutylamine, aminotrimethylcarbinol)

$\text{C}_4\text{H}_{11}\text{ON}$  MW, 89

B.p. 151°.  $D_4^{20}$  0.95.

N-Di-Me:  $\text{C}_6\text{H}_{15}\text{ON}$ . MW, 117. B.p. 60°/48 mm.

Krassusky, *Compt. rend.*, 1908, 146, 238.

 **$\alpha$ -Amino-n-butylbenzene** (1-Phenyl-n-butylamine)

$\text{C}_{10}\text{H}_{15}\text{N}$  MW, 149

B.p. 220°/748 mm., 107–9°/16 mm.  $D_4^{20}$  0.9367. Very sol. EtOH. Spar. sol.  $\text{Et}_2\text{O}$ .

$B, \text{HCl}$ : needles from  $\text{H}_2\text{O}$ . M.p. 288°.

$B_2, \text{H}_2\text{PtCl}_6$ : golden-yellow cryst. M.p. 184°.

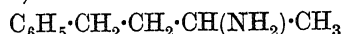
N-Phenyl:  $\alpha$ -anilinobutylbenzene. B.p. 200°/20 mm.  $B, \text{HCl}$ : needles from EtOH– $\text{Et}_2\text{O}$ . M.p. 205°.  $B, \text{HNO}_3$ : cryst. from dil.  $\text{HNO}_3$ . M.p. 168°.

N-Benzoyl: needles. M.p. 128°.

Busch, Leefhelm, *J. prakt. Chem.*, 1908, 77, 11.

Konowalow, *Ber.*, 1895, 28, 1857.

Busch, Rinck, *Ber.*, 1905, 37, 1765.

 **$\gamma$ -Amino-n-butylbenzene** (4-Phenyl-sec.-n-butylamine)

$\text{C}_{10}\text{H}_{15}\text{N}$  MW, 149

Oil with weak ammoniacal aromatic odour. B.p. 221–2°/750 mm., 101–2°/14 mm.  $D_4^{20}$  0.9289.  $n_D^{20}$  1.51520. Spar. sol.  $\text{H}_2\text{O}$ . Absorbs  $\text{CO}_2$ .

$B, \text{HCl}$ : needles from EtOH– $\text{Et}_2\text{O}$ . M.p. 144°.

Neutral sulphate: m.p. 255° decomp.

$B, \text{H}_2\text{PO}_4$ : m.p. 172°.

$B_2, \text{H}_2\text{PtCl}_6$ : yellow leaflets from  $\text{H}_2\text{O}$ . Decomp. at 220°.

N-Benzoyl: needles from EtOH or ligroin. M.p. 108°.

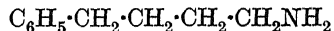
N-Me:  $\text{C}_{11}\text{H}_{17}\text{N}$ . MW, 163. B.p. 112–14°/14 mm. Volatile in steam.  $B, \text{HCl}$ : needles from EtOH– $\text{Et}_2\text{O}$ . M.p. 94–6°.  $B_2, \text{H}_2\text{PtCl}_6$ : orange-red needles. M.p. 169°.

N-Di-Me:  $\text{C}_{12}\text{H}_{19}\text{N}$ . MW, 177. B.p. 124–5°/20 mm. Volatile in steam.  $B, \text{HCl}$ : m.p. 127–9°.  $B_2, \text{H}_2\text{PtCl}_6$ : m.p. 173°. Picrate: needles. M.p. 113–14°.

v. Braun, Neumann, *Ber.*, 1917, 50, 53.

Harries, de Osa, *Ber.*, 1903, 36, 2999.

Schlenk, *J. prakt. Chem.*, 1908, 78, 58.

 **$\delta$ -Amino-n-butylbenzene** (4-Phenyl-n-butylamine)

$\text{C}_{10}\text{H}_{15}\text{N}$  MW, 149

B.p. 123–4°/17 mm. Insol.  $\text{H}_2\text{O}$ .

$B_2, \text{H}_2\text{PtCl}_6$ : cryst. from  $\text{H}_2\text{O}$ . Decomp. at 205°.

Picrate: yellow leaflets from  $\text{Et}_2\text{O}$ . M.p. 125°.

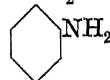
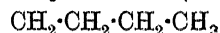
N-Benzoyl: needles from EtOH. M.p. 83–5°.

N-p-Toluenesulphonyl: m.p. 53.5–53.9°.

N-Me:  $\text{C}_{11}\text{H}_{17}\text{N}$ . MW, 163. B.p. 95.0–95.4°/5 mm.  $D_4^{25}$  0.9126.  $n_D^{25}$  1.50350.  $B, \text{HCl}$ : m.p. 126.2–6.8°. N-p-Toluenesulphonyl: m.p. 60.5–61.1°. B.p. 241–5°/2 mm.

v. Braun, *Ber.*, 1910, 43, 2844.

Cope, McElvain, *J. Am. Chem. Soc.*, 1931, 53, 1587.

**o-Amino-n-butylbenzene** (o-n-Butylaniline)

$\text{C}_{10}\text{H}_{15}\text{N}$  MW, 149

Yellow oil. B.p. 122–5°/12 mm.  $D_4^{20}$  0.953.

$B, \text{HCl}$ : scales from  $\text{C}_6\text{H}_6$ . M.p. 137°.

N-Acetyl: needles from MeOH.Aq. M.p. 100°.

Read, Mullin, *J. Am. Chem. Soc.*, 1928, 50, 1764.

Reilly, Hickinbottom, *J. Chem. Soc.*, 1920, 117, 116.

***m*-Amino-*n*-butylbenzene** (*m-n*-Butylaniline).

Pale yellow oil.

*N*-Benzoyl: needles from EtOH. M.p. 68°.

Reilly, Hickinbottom, *J. Chem. Soc.*, 1920, 117, 119.

***p*-Amino-*n*-butylbenzene** (*p-n*-Butylaniline).

B.p. 258-60°/750 mm., 133-4°/14 mm.  $D_4^{20}$  0.945.

$B_2, H_2PtCl_6$ : needles from MeOH. Decomp. at 200-2°.

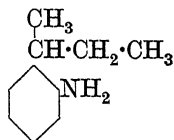
*N*-Acetyl: plates from EtOH. M.p. 105°.

*N*-Benzoyl: needles from EtOH. M.p. 126°.

Reilly, Hickinbottom, *J. Chem. Soc.*, 1920, 117, 119.

Read, Mullin, *J. Am. Chem. Soc.*, 1928, 50, 1764.

***o*-Amino-*sec*-*n*-butylbenzene** (*o-sec-n*-Butylaniline)



$C_{10}H_{15}N$  MW, 149

B.p. 120-2°/16 mm.  $D_4^{20}$  0.957.

Read, Hewitt, Pike, *J. Am. Chem. Soc.*, 1932, 54, 1194.

***m*-Amino-*sec*-*n*-butylbenzene** (*m-sec-n*-Butylaniline).

B.p. 120°/18 mm.

Read, Hewitt, Pike, *J. Am. Chem. Soc.*, 1932, 54, 1194.

***p*-Amino-*sec*-*n*-butylbenzene** (*p-sec-n*-Butylaniline).

*d*-.

B.p. 114°/12 mm.  $D_4^{20}$  0.945.  $[\alpha]_{5461}^{20} + 39.8$  in  $\text{CHCl}_3$ .

*dl*-.

B.p. 238°, 130-3°/26 mm., 118°/15 mm.  $D_4^{15}$  0.949.

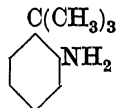
*N*-Acetyl: plates from EtOH. M.p. 125-6° (123°). Sol.  $\text{Et}_2\text{O}$ ,  $\text{Me}_2\text{CO}$ , AcOEt. Spar. sol.  $\text{H}_2\text{O}$ .

*N*-Benzoyl: m.p. 130°.

Harrison, Kenyon, Shepherd, *J. Chem. Soc.*, 1926, 660.

Reilly, Hickinbottom, *J. Chem. Soc.*, 1920, 117, 119.

***o*-Amino-*tert*-*n*-butylbenzene** (*o-tert-n*-Butylaniline)



$C_{10}H_{15}N$

MW, 149

B.p. 233-5°.  $D^{15}$  0.977. Turns red in air. *N*-Acetyl: needles from  $\text{C}_6\text{H}_6$ . M.p. 159-61°.

Craig, *J. Am. Chem. Soc.*, 1935, 57, 195.

***m*-Amino-*tert*-*n*-butylbenzene** (*m-tert-n*-Butylaniline).

B.p. 229°/708 mm. Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ .

*N*-Acetyl: leaflets from  $\text{H}_2\text{O}$ . M.p. 101°.

Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ .

Gelzer, *Ber.*, 1888, 21, 2947.

***p*-Amino-*tert*-*n*-butylbenzene** (*p-tert-n*-Butylaniline)

Cryst. from pet. ether. M.p. 17°. B.p. 228-30°/762 mm., 238-40°/766 mm. Misc. with EtOH,  $\text{Et}_2\text{O}$ . Spar. sol.  $\text{H}_2\text{O}$ . Volatile in steam.

*N*-Formyl: leaflets from pet. ether. M.p. 59°. B.p. 314-6°. Sol. EtOH,  $\text{Et}_2\text{O}$ .

*N*-Acetyl: leaflets from EtOH. M.p. 169-70°.

*N*-Benzoyl: leaflets from EtOH. M.p. 134-6°.

*N-p-Toluenesulphonyl*: plates from EtOH. M.p. 179-80°.

Willgerodt, Rampacher, *Ber.*, 1901, 34, 3667.

Craig, *J. Am. Chem. Soc.*, 1935, 57, 196.

Hickinbottom, Preston, *J. Chem. Soc.*, 1930, 1568.

Malherbe, *Ber.*, 1919, 52, 322.

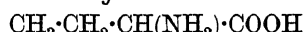
**Aminobutylene.**

See Crotylamine.

**4- $\omega$ -Aminobutylglyoxaline.**

See 4-[4-Iminazolyl]-*n*-butylamine.

**1-Amino-*n*-butyric Acid**



$C_4H_9O_2N$  MW, 103

*d*-.

Found in sperm whale tendon. Leaflets from EtOH.Aq. M.p. about 292° decomp. (303° in sealed tube).  $[\alpha]_D^{20} + 8^\circ$ .

*B.HCl*: needles. Sol.  $\text{H}_2\text{O}$ .  $[\alpha]_D^{20} + 14.51^\circ$ .

*N*-Formyl: cryst. from EtOH. M.p. 126°.  $[\alpha]_D^{20} + 27.74^\circ$  in  $\text{H}_2\text{O}$ .

*N*-Chloroacetyl: needles from AcOEt-pet. ether. M.p. 119°.  $[\alpha]_D^{20} - 61.94^\circ$  in  $\text{H}_2\text{O}$ .

*l*-.

Leaflets from EtOH.Aq. M.p. about 292° decomp.  $[\alpha]_D^{20} - 7.86^\circ$  in  $\text{H}_2\text{O}$ .

*N*-Formyl: cryst. from EtOH. M.p. 126°.  $[\alpha]_D^{20} + 27.98^\circ$  in  $\text{H}_2\text{O}$ .

*N*-Chloroacetyl: needles from AcOEt-pet. ether. M.p. 119°.  $[\alpha]_D^{20} + 19^\circ$  in  $\text{H}_2\text{O}$ .

*dl*-.

M.p. 304° (307° in sealed tube). Sol.  $\text{H}_2\text{O}$ . Spar. sol. EtOH. Insol.  $\text{Et}_2\text{O}$ . Sublimes above 300°.

*Me ester*:  $C_5H_{11}O_2N$ . MW, 117. *B.HCl*: m.p. 139°. Sol.  $\text{H}_2\text{O}$ , EtOH. Insol.  $\text{Et}_2\text{O}$ .

*Et ester*:  $C_6H_{13}O_2N$ . MW, 131. Oil. B.p.

61–2°/11 mm. (58°/16 mm.). Sol. H<sub>2</sub>O, most org. solvents. *B, HCl*: m.p. 130–1°. *Picrate*: m.p. 127°.

*Amide*: C<sub>4</sub>H<sub>10</sub>ON<sub>2</sub>. MW, 102. Prisms. M.p. 74–5°. Sol. H<sub>2</sub>O, EtOH. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, ligroin.

*N-Formyl*: needles from EtOH. M.p. 153°.

*N-Chloroacetyl*: leaflets from AcOEt–pet. ether. M.p. 130°.

*N-Benzoyl*: m.p. 145–6°.

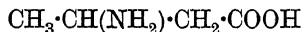
Cocker, Lapworth, *J. Chem. Soc.*, 1931, 1399.

Knoop, Oesterlin, *Z. physiol. Chem.*, 1925, 148, 294.

Oikawa, *Chem. Abstracts*, 1926, 20, 1672. Abderhalden, Chang, Wurms, *Z. physiol. Chem.*, 1911, 72, 28.

Fischer, Mouneyrat, *Ber.*, 1900, 33, 2388.

### 2-Amino-*n*-butyric Acid



C<sub>4</sub>H<sub>9</sub>O<sub>2</sub>N MW, 103

*d.*

Prisms from MeOH. Decomp. at 220°.  $[\alpha]_D^{20} + 35.3^\circ$  in H<sub>2</sub>O.

*Me ester*: C<sub>5</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 117. B.p. 54–5°/13 mm.  $[\alpha]_D^{20} + 8.91^\circ$ .

*l.*

Prisms from MeOH. Decomp. at 220°.  $[\alpha]_D^{20} - 35.2^\circ$  in H<sub>2</sub>O.

*Me ester*: C<sub>5</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 117. B.p. 54–5°/11 mm.  $D^{19} 0.991$ .  $[\alpha]_D^{19} - 6.97^\circ$ .

*dl.*

Cryst. M.p. 193–4°. Sol. 1 part H<sub>2</sub>O. Insol. EtOH, Et<sub>2</sub>O. Tasteless.

*B, HCl*: very hygroscopic. M.p. 109.5–10.5°.

*Me ester*: C<sub>5</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 117. B.p. 54–5°/13 mm.  $D^{20} 0.993$ . Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, ligroin.

*Et ester*: C<sub>6</sub>H<sub>13</sub>O<sub>2</sub>N. MW, 131. B.p. 60–1°/14 mm. Misc. with H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, ligroin. *B<sub>2</sub>, (COOH)<sub>2</sub>*: m.p. 88–90°. *Picrate*: m.p. 147–8°. *N-Acetyl*: b.p. 158°/12 mm.

*N-Benzoyl*: m.p. 154°.

Fischer, Scheibler, *Ann.*, 1911, 383, 339.

Skita, Wulff, *Ann.*, 1927, 453, 206.

### 3-Amino-*n*-butyric Acid (*Piperidinic acid*)



C<sub>4</sub>H<sub>9</sub>O<sub>2</sub>N MW, 103

Widely distributed in higher plants. Prisms from EtOH. M.p. 203° decomp. (193°). Sol. H<sub>2</sub>O. Insol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. *k*(acid) = 3.7 × 10<sup>-11</sup>. *k*(base) = 1.7 × 10<sup>-10</sup>. Heat → pyrrolidone.

*B, HCl*: m.p. 135–6°.

*Et ester*: C<sub>6</sub>H<sub>13</sub>O<sub>2</sub>N. MW, 131. B.p. 75–7°/12 mm. *B, HCl*: m.p. 65–72°. Hygroscopic.

*Lactam*: see Pyrrolidone.

Tafel, Stern, *Ber.*, 1900, 33, 2230.

Curtius, Hechtenberg, *J. prakt. Chem.*, 1923, 105, 319.

Hulme, Arthington, *Nature*, 1950, 165, 716.

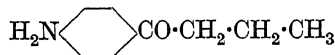
Westall, *ibid.*, 717.

Synge, *Biochem. J.*, 1951, 48, 429.

### 3-Aminobutyrolactam.

See Pyrrolidone.

### 4-Aminobutyrophenone



C<sub>10</sub>H<sub>13</sub>ON MW, 163

Cryst. from H<sub>2</sub>O. M.p. 84°. Sol. EtOH.

*B, HCl*: needles. M.p. 178°.

*B<sub>2</sub>, H<sub>2</sub>SO<sub>4</sub>*: m.p. 216°.

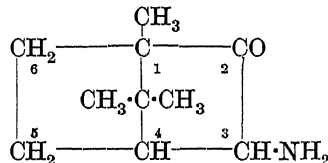
*N-Acetyl*: needles from H<sub>2</sub>O. M.p. 142°.

Kunckell, *Ber.*, 1900, 33, 2643.

### Aminocamphane.

See Bornylamine.

### 3-Aminocamphor ( $\alpha$ -Aminocamphor)



C<sub>10</sub>H<sub>17</sub>ON MW, 167

M.p. about 110–115° decomp. Changes on standing or by heating at 100° to anhydrobisaminocamphor, C<sub>20</sub>H<sub>30</sub>N<sub>2</sub>. Na + EtOH → 2-aminoborneol.

*N-Formyl*: cryst. from H<sub>2</sub>O. M.p. 87°.

*N-Acetyl*: m.p. 121°.

*N-Benzoyl*: m.p. 141°.

*Oxime*: aminocamphoroxime. Cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 145°. Mod. sol. EtOH, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Insol. cold H<sub>2</sub>O, ligroin.  $[\alpha]_D^{18} + 65.5^\circ$  in EtOH, + 36.7° in dil. HCl. Sublimes if carefully heated.

*Hydrazone*: needles from pet. ether. M.p. 105°.

*B, HI*: needles. M.p. 252–3° decomp.

*B<sub>2</sub>, (COOH)<sub>2</sub>*: leaflets. M.p. 194°.

*Picrate*: decomp. at 191°.

Rupe, Buxtorf, *Helv. Chim. Acta*, 1930, 13, 447.

Duden, Pritzkow, *Ber.*, 1899, 32, 1539.

### 4-Aminocamphor.

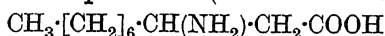
Cryst. from pet. ether. M.p. 230–2°. Sol. H<sub>2</sub>O, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, toluene. Mod. sol. pet. ether. Aq. sol. reacts alkaline to litmus.

*N-Acetyl*: cryst. from toluene. M.p. 122–3°. Sol. H<sub>2</sub>O, Et<sub>2</sub>O, CHCl<sub>3</sub>. Spar. sol. pet. ether.

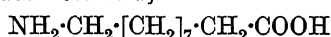
Houben, Pfankuch, *Ann.*, 1931, 489, 217.

**1-Aminocaproic Acid** (1-Aminodecanoic acid)
 $\text{C}_{10}\text{H}_{21}\text{O}_2\text{N}$  MW, 187
M.p. 264°. Spar. sol.  $\text{H}_2\text{O}$ .

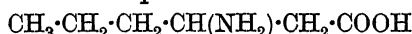
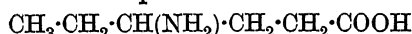
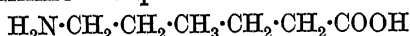
N-Benzoyl: m.p. 130°.

Albertson, *J. Am. Chem. Soc.*, 1946, **68**, 450.**2-Aminocaproic Acid** (2-Aminodecanoic acid)
 $\text{C}_{10}\text{H}_{21}\text{O}_2\text{N}$  MW, 187

M.p. 205–6°.

Lang, Adickes, *Z. physiol. Chem.*, 1941, **269**, 236.**9-Aminocaproic Acid** ( $\omega$ -Aminocaproic acid, 10-aminodecanoic acid)
 $\text{C}_{10}\text{H}_{21}\text{O}_2\text{N}$  MW, 187
M.p. 187–8°. Sol. hot  $\text{H}_2\text{O}$ .Blaise, Honillon, *Compt. rend.*, 1906, **143**, 362.**1-Amino-*n*-caproic Acid.**

See Norleucine.

**2-Amino-*n*-caproic Acid**
 $\text{C}_6\text{H}_{13}\text{O}_2\text{N}$  MW, 131
*Et ester*:  $\text{C}_8\text{H}_{17}\text{O}_2\text{N}$ . MW, 159. B.p. 102–4°/25 mm. *Oxalate*: m.p. 130° decomp.Décombe, *Ann. chim.*, 1932, **18**, 137.**3-Amino-*n*-caproic Acid**
 $\text{C}_6\text{H}_{13}\text{O}_2\text{N}$  MW, 131
Cryst. from  $\text{Et}_2\text{O}$ . M.p. 205–7° decomp. (180–1°). Heat  $\rightarrow$  lactam.*B, HCl*: m.p. 120–1°. $\text{B}_2, \text{H}_2\text{PtCl}_6$ : reddish-brown cryst. M.p. 190–1° decomp.N-Benzoyl: cryst. from  $\text{H}_2\text{O}$ . M.p. 150–2°.*Lactam*: 5-ethyl-2-pyrrolidone. M.p. 22°. B.p. 256–7°, 130°/8 mm.  $D_4^{25}$  1.026.  $n_D^{20}$  1.4800.  $\text{B}_2, \text{H}_2\text{PtCl}_6$ : reddish-brown cryst. M.p. 125–7°.Späth, Kuffner, Ensfellner, *Ber.*, 1933, **66**, 598.Müller, Feld, *Monatsh.*, 1931, **58**, 22.**5-Amino-*n*-caproic Acid**
 $\text{C}_6\text{H}_{13}\text{O}_2\text{N}$  MW, 131
Leaflets. M.p. 202–3°. Sol.  $\text{H}_2\text{O}$ . Insol. EtOH.*B, HBr*: m.p. 105°.*Et ester*:  $\text{C}_8\text{H}_{17}\text{O}_2\text{N}$ . MW, 159. B.p. 80–2°/1 mm., 60–2°/0.05 mm. N-Benzoyl: m.p. 35°. B.p. 184–6°/0.1 mm.*Lactam*: 2-ketohexamethyleneimine. B.p. 140°/12 mm. N-Benzoyl: m.p. 45–7°. B.p. 150–5° in vacuo.*Amide*: hygroscopic. M.p. 50–1°.

N-Benzoyl: m.p. 75–8°.

Ruzicka, *Helv. Chim. Acta*, 1921, **4**, 477. v. Braun, *Ber.*, 1907, **40**, 1839.**1-Amino-*n*-caprylic Acid**
 $\text{C}_8\text{H}_{17}\text{O}_2\text{N}$  MW, 159
Leaflets from  $\text{H}_2\text{O}$ . M.p. 270° (263–4°). Spar. sol. cold  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ . Sublimes.*Me ester*:  $\text{C}_9\text{H}_{19}\text{O}_2\text{N}$ . MW, 173. *B, HCl*: m.p. 76–7°.*Et ester*:  $\text{C}_{10}\text{H}_{21}\text{O}_2\text{N}$ . MW, 187. B.p. 110°/10 mm.  $n_D^{21}$  1.436. *B, HCl*: m.p. 53–4°.*Amide*:  $\text{C}_8\text{H}_{18}\text{ON}_2$ . MW, 158. Reacts strongly alkaline. Absorbs  $\text{CO}_2$ . Hyd. by dil. HCl.*Nitrile*:  $\text{C}_8\text{H}_{16}\text{N}_2$ . MW, 140. Oil. Freezes at –5°. Sol. EtOH,  $\text{Et}_2\text{O}$ . Insol.  $\text{H}_2\text{O}$ .

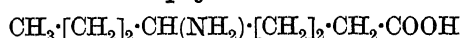
N-Formyl: cryst. from EtOH. M.p. 118°.

N-Chloroacetyl: cryst. from EtOH. M.p. 82–3°.

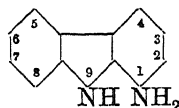
N-Benzoyl: m.p. 128°.

Abderhalden, Goto, *Chem. Abstracts*, 1924, **18**, 3041.Marvel, Noyes, *J. Am. Chem. Soc.*, 1920, **42**, 2275.Erlenmeyer, Sigel, *Ann.*, 1875, **177**, 125.Albertson, *J. Am. Chem. Soc.*, 1946, **68**, 450.**2-Amino-*n*-caprylic Acid**
 $\text{C}_8\text{H}_{17}\text{O}_2\text{N}$  MW, 159

Cryst. from EtOH. M.p. 204–6° decomp.

*Et ester*:  $\text{C}_{10}\text{H}_{21}\text{O}_2\text{N}$ . MW, 187. B.p. 132–3°/25 mm. *Phenylurethane*: m.p. 114°.Décombe, *Ann. chim.*, 1932, **18**, 138.Lang, Adickes, *Z. physiol. Chem.*, 1941, **269**, 236.**4-Amino-*n*-caprylic Acid**
 $\text{C}_8\text{H}_{17}\text{O}_2\text{N}$  MW, 159
Needles. M.p. 158°  $\rightarrow$  anhydride. Sol.  $\text{H}_2\text{O}$ , EtOH. Insol.  $\text{Et}_2\text{O}$ .Baum, *Ber.*, 1886, **19**, 502.**7-Amino-*n*-caprylic Acid**
 $\text{C}_8\text{H}_{17}\text{O}_2\text{N}$  MW, 159
M.p. 172°. Sol. EtOH, hot  $\text{H}_2\text{O}$ .Behrend, *Ber.*, 1896, **29**, 808.

## 1-Aminocarbazole

C<sub>12</sub>H<sub>10</sub>N<sub>2</sub>

MW, 182

Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 193°. Sol. EtOH, AcOH.

N-Diacetyl: cryst. from C<sub>6</sub>H<sub>6</sub> or AcOH. Aq. M.p. 186°.

N-Bromoacetyl: m.p. 188°.

N-Benzoyl: m.p. 242°.

Lindemann, Werther, *Ber.*, 1924, 57, 1316.

I.G., D.R.P., 507,797, (*Chem. Abstracts*, 1931, 25, 716).

Gen. Aniline Works, U.S.P., 1,878,168, (*Chem. Abstracts*, 1933, 27, 313).

## 2-Aminocarbazole.

Needles from H<sub>2</sub>O. M.p. 238°.

Blank, *Ber.*, 1891, 24, 306.

I.G., D.R.P., 542,422, (*Chem. Abstracts*, 1932, 26, 2469).

## 3-Aminocarbazole.

M.p. 254° decomp. after darkening and sintering at 240-3°. Sol. AcOH. Mod. sol. EtOH. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, ligroin.

3-N-Acetyl: needles or leaflets from EtOH. M.p. 217°. Insol. H<sub>2</sub>O.

Diacetyl deriv.: needles from EtOH. M.p. 199.5°.

Triacetyl: needles from EtOH. M.p. 174.5°.

N-Chloroacetyl: m.p. 203°.

3-N-Benzoyl: plates from AcOH. M.p. 250-1°.

N-p-Aminobenzenesulphonyl: m.p. 251° decomp.

Kehrmann, Zweifel, *Helv. Chim. Acta*, 1928, 11, 1215.

Whitner, *J. Am. Chem. Soc.*, 1924, 46, 2326.

## Aminocarbostyryl.

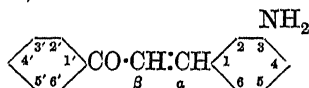
See 2-Hydroxy-5-aminoquinoline, 2-Hydroxy-6-aminoquinoline, 2-Hydroxy-7-aminoquinoline.

## Aminocatechol.

Methyl ether: see Aminoguaiacol.

Methylene ether: see Methylenedioxyaniline.

3-Aminochalkone (ω-[3-Aminobenzylidene]-acetophenone)

C<sub>15</sub>H<sub>13</sub>N

MW, 223

Yellowish-green plates from EtOH or C<sub>6</sub>H<sub>6</sub>. M.p. 159°. Sol. Me<sub>2</sub>CO. Mod. sol. EtOH. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, ligroin.

N-Acetyl: yellow needles from AcOH. M.p. 104°.

Rupe, Porai-Koschitz, *Chem. Zentr.*, 1906, II, 1761.

4-Aminochalkone (ω-[4-Aminobenzylidene]-acetophenone).

Golden plates from EtOH. M.p. 151°. Sol. EtOH, Me<sub>2</sub>CO. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Sol. AcOH → red col.

Oxime: cryst. M.p. 139°.

N-Acetyl: green plates. M.p. 179°.

Rupe, Porai-Koschitz, *Chem. Zentr.*, 1906, II, 1761.

2'-Aminochalkone (2-Amino-ω-benzylidene-acetophenone).

Yellow prisms. M.p. 147°. EtOH sol. of hydrochloride ox. by air → indigo.

N-Acetyl: m.p. 165°.

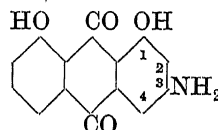
Engler, Dorant, *Ber.*, 1895, 28, 2500.

β-Aminochalkone (ω-Amino-ω-benzylidene-acetophenone).

Needles from EtOH. Aq. M.p. 97°.

Ruhemann, Watson, *J. Chem. Soc.*, 1904, 85, 1181, 1323.

3-Aminochrysazin (1:8-Dihydroxy-3-aminoanthraquinone)

C<sub>14</sub>H<sub>9</sub>O<sub>4</sub>N

MW, 255

Vermilion needles from AcOH. M.p. 258°. Sol. dil. HCl. Dil. alkalis → red col.

Di-Me ether: red prisms with green metallic reflex. M.p. 243°. Sinters at 240°.

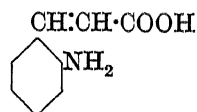
Robinson, Simonsen, *J. Chem. Soc.*, 1909, 95, 1095.

Oesterle, *Chem. Zentr.*, 1912, I, 142.

4-Aminochrysazin (1:8-Dihydroxy-4-aminoanthraquinone).

Bayer, D.R.P., 216,668, (*Chem. Zentr.*, 1910, I, 216.)

## o-Aminocinnamic Acid

C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>N

MW, 163

Yellow needles. M.p. 158-9° decomp. Mod. sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O. Sols. show intense greenish-blue fluor. Heat with HCl → carbostyryl.

Me ester: C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 177. Yellow needles. M.p. 65°. N-Acetyl: needles from.



$C_6H_6$ -ligroin. M.p. 137°. Spar. sol.  $H_2O$ , ligroin. Sol. most other org. solvents. N-Benzoyl: m.p. 176-7°.

*Et ester*:  $C_{11}H_{13}O_2N$ . MW, 191. Pale yellow needles from EtOH.Aq. M.p. 77-8°. Sol. most org. solvents with greenish-yellow fluor. Distils undecomp. HCl at 120° or  $SOCl_2$  in  $C_6H_6$  → carbostyryl. Hyd. by alc. KOH. *Picrate*: m.p. 145°.

*Menthyl ester*: m.p. 85°.

*Nitrile*:  $C_9H_9N_2$ . MW, 144. Cryst. from  $H_2O$ . M.p. 134-5°. Sol.  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ , hot EtOH. Sublimes. N-Acetyl: m.p. 172-4°. Sol. EtOH,  $Et_2O$ , hot  $H_2O$ . Sublimes. *Picrate*: m.p. 192-3°.

N-Acetyl: needles from EtOH. M.p. 250-1°. Sol.  $Me_2CO$ , AcOEt, hot  $H_2O$ . Mod. sol. EtOH, AcOH.

N-Diacetyl: prisms from ligroin. M.p. 158°. Anhydride: leaflets from EtOH. M.p. 156-8°.

N-Benzoyl: needles from EtOH. M.p. 191-3°. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ , AcOH. Anhydride: needles from AcOEt. M.p. 194-5°.

N-Phthalimido: pale yellow. M.p. 233°.

Heller, *Ber.*, 1913, 46, 3982.

Gabriel, *Ber.*, 1882, 15, 2294.

Pschorr, *Ber.*, 1898, 31, 1296.

**m-Aminocinnamic Acid.**

*Cis.*

Yellow cryst. M.p. 193°. Spar. sol. most solvents.

*Trans.*

Pale yellow needles from EtOH. M.p. 181°. Sol. EtOH,  $Et_2O$ . Mod. sol. hot  $H_2O$ .

*Me ester*: m.p. 84°. N-Chloroacetyl: needles from EtOH.Aq. M.p. 122°. N-Benzoyl: m.p. 144-6°.

*Et ester*: prisms. M.p. 64°. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ . Insol.  $H_2O$ , ligroin.

*Menthyl ester*: b.p. 230°/2 mm.

N-Acetyl: cryst. from EtOH. M.p. 237° (235°).

N-Benzoyl: needles from AcOEt. M.p. 229°. Sol. hot EtOH,  $Me_2CO$ , AcOH. Spar. sol.  $C_6H_6$ .

Anhydride: cryst. from  $Me_2CO$ . M.p. 148°.

Amide: N-p-Aminobenzenesulphonyl, m.p. 246°.

Wollring, *Ber.*, 1914, 47, 113.

Gabriel, *Ber.*, 1883, 16, 2038.

Salkowski, *Ber.*, 1895, 28, 1921.

De, *J. Indian Chem. Soc.*, 1928, 5, 30.

**p-Aminocinnamic Acid.**

*Cis.*

Yellow needles. Decomp. at 103-4°.

*Trans.*

Pale yellow needles. M.p. 175-6° decomp. Sol. EtOH,  $Et_2O$ , hot  $H_2O$ .

*Me ester*: yellowish-brown needles from  $C_6H_6$ . M.p. 128-9°. N-Chloroacetyl: needles or leaflets

from EtOH. M.p. 155-6°. N-Benzoyl: m.p. 187-5-8°.

*Et ester*: yellow cryst. from EtOH. M.p. 68-9°. Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ .

*Menthyl ester*: m.p. 122°.

N-Acetyl: m.p. 259-60°. Sol. hot EtOH, hot AcOH. Spar. sol.  $H_2O$ . Insol.  $Et_2O$ ,  $C_6H_6$ , ligroin.

N-Benzoyl: leaflets from AcOH, needles from  $Me_2CO$ . M.p. 274°. Sol. hot AcOH. Spar. sol. most other solvents.

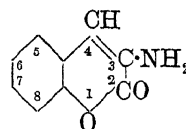
N-Phthalimido: pale yellow. M.p. 320°.

Wollring, *Ber.*, 1914, 47, 114.

Miller, Kinkelin, *Ber.*, 1885, 18, 3234.

Einhorn, Oppenheimer, *Ann.*, 1900, 311, 158.

**3-Aminocoumarin**



$C_9H_7O_2N$

MW, 161

Yellowish needles from  $H_2O$ . M.p. 130°. Sol. ord. org. solvents. Boiling NaOH.Aq. → 3-hydroxycoumarin.

N-Acetyl: needles from EtOH.Aq. M.p. 201-2°. Sol. ord. org. solvents.

N-Benzoyl: m.p. 173°.

Linch, *J. Chem. Soc.*, 1912, 101, 1762.

**6-Aminocoumarin** (Often in literature as 5-aminocoumarin).

Yellow needles. M.p. 168-70°. Sol. EtOH, hot  $H_2O$ .

N-Formyl: cryst. from  $H_2O$ . M.p. 175-6°.

N-Acetyl: m.p. 216-17°.

N-Propionyl: needles from  $H_2O$ . M.p. 186-8°.

N-Benzoyl: m.p. 173°.

N-Benzenesulphonyl: cryst. from  $H_2O$ . M.p. 159°.

N-p-Aminobenzenesulphonyl: m.p. 191°. N<sup>4</sup>-Acetyl: m.p. 230°.

Morgan, Micklethwait, *J. Chem. Soc.*, 1904, 85, 1230.

Kondo, Ui, *J. Chem. Soc.*, 1924, 126, i, 87.

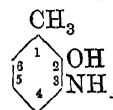
**8-Aminocoumarin.**

Pale yellow prisms from EtOH. M.p. 145-6°. Clayton, *J. Chem. Soc.*, 1910, 97, 1350.

**ω-Aminocresol.**

See Hydroxybenzylamine and Salicylamine.

**3-Amino-o-cresol** (2-Hydroxy-m-toluidine)



$C_7H_9ON$

MW, 123

Plates from  $H_2O$ . M.p.  $89^\circ$ . Sol. MeOH, EtOH,  $Et_2O$ ,  $Me_2CO$ ,  $CHCl_3$ ,  $C_6H_6$ ,  $CCl_4$ , hot  $H_2O$ . Insol. pet. ether.  $FeCl_3 \rightarrow$  red col.

*Me ether*:  $C_8H_{11}ON$ . MW, 137. B.p.  $223^\circ$ . *B,HCl*: cryst. M.p.  $168^\circ$ . *N-Acetyl*: needles from  $H_2O$ . M.p.  $100-1^\circ$ .

*N-Acetyl*: 2-hydroxyacet-*m*-toluidide. Prisms from  $CCl_4$ . M.p.  $78-9^\circ$ . Sol. MeOH, EtOH,  $Et_2O$ ,  $Me_2CO$ ,  $CHCl_3$ ,  $C_6H_6$ , hot  $H_2O$ ,  $CCl_4$ . Insol. pet. ether.  $FeCl_3 \rightarrow$  blue col.

Proskouriakoff, Titherington, *J. Am. Chem. Soc.*, 1930, 52, 3982.

Hofmann, Miller, *Ber.*, 1881, 14, 570.

#### 4-Amino-o-cresol (2-Hydroxy-*p*-toluidine).

Plates from  $H_2O$ . M.p.  $161^\circ$ . Sol. EtOH,  $Et_2O$ . Mod. sol. hot  $H_2O$ . Spar. sol. cold  $H_2O$ . Sublimes when carefully heated.

*Me ether*: cryst. M.p.  $58^\circ$ . B.p.  $250-2^\circ$ . Sol. EtOH,  $C_6H_6$ . *N-Acetyl*: leaflets from  $C_6H_6$ . M.p.  $132^\circ$ .

*Et ether*:  $C_9H_{13}ON$ . MW, 161. B.p.  $249-50^\circ$ . Sol. EtOH,  $Et_2O$ . Volatile in steam. *B,HCl*: needles. M.p.  $245^\circ$ .

*O-p-Toluenesulphonyl*: cryst. from EtOH.Aq. M.p.  $111-12^\circ$ . Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ .

*N-Acetyl*: 2-hydroxyacet-*p*-toluidide. Prisms from EtOH.Aq. M.p.  $225^\circ$ . Sol. EtOH, NaOH.Aq. Sublimes.

*N-Diacetyl*: prisms from  $Et_2O-EtOH$ . M.p.  $132-3^\circ$ .

*N-Chloroacetyl*: plates from AcOH. M.p.  $154-5^\circ$ . Sol. EtOH,  $Me_2CO$ . Spar. sol. hot  $H_2O$ ,  $CHCl_3$ .

Proskouriakoff, Titherington, *J. Am. Chem. Soc.*, 1930, 52, 3981.

Ullmann, Fitzenkam, *Ber.*, 1905, 38, 3791.

#### 5-Amino-o-cresol (6-Hydroxy-*m*-toluidine).

Needles from  $C_6H_6$ . M.p.  $175^\circ$ . Sol. EtOH,  $Et_2O$ . Spar. sol.  $H_2O$ ,  $C_6H_6$ . Sublimes. Ox.  $\rightarrow$  toluquinone.

*Me ether*: cryst. from 50% EtOH. M.p.  $59-9.5^\circ$  ( $92-3^\circ$ ). Sol. EtOH,  $Me_2CO$ ,  $Et_2O$ ,  $C_6H_6$ . Spar. sol. cold  $H_2O$ . *N-Acetyl*: cryst. from EtOH.Aq. M.p.  $103-103.5^\circ$  ( $158^\circ$ ). Sol. EtOH,  $Me_2CO$ ,  $Et_2O$ ,  $CHCl_3$ . Spar. sol.  $H_2O$ ,  $C_6H_6$ . *N-Chloroacetyl*: needles from  $C_6H_6$ -ligroin. M.p.  $90-2^\circ$ .

*Et ether*: oil. Volatile in steam. *B,HCl*: m.p.  $210^\circ$ . *N-Acetyl*: plates from  $H_2O$ . M.p.  $108^\circ$ .

*O-p-Toluenesulphonyl*: needles from  $C_6H_6$ -ligroin. M.p.  $109-10^\circ$ . Sol. EtOH,  $C_6H_6$ . Mod. sol.  $Et_2O$ .

*N-Acetyl*: 6-hydroxyacet-*m*-toluidide. Needles from  $H_2O$ . M.p.  $179^\circ$ .

*ON-Dibenzoyl*: needles from AcOH. M.p.  $194^\circ$ .

Heidelberger, Jacobs, *J. Am. Chem. Soc.*, 1919, 41, 1453.

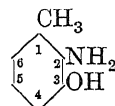
#### 6-Amino-o-cresol (6-Hydroxy-*o*-toluidine).

Needles from  $H_2O$ . M.p.  $129^\circ$ . Spar. sol.  $Et_2O$ , cold  $H_2O$ . Turns brown in air.

*O-p-Toluenesulphonyl*: m.p.  $108^\circ$ .

Ullmann, *Ber.*, 1884, 17, 1962.

#### 2-Amino-m-cresol (3-Hydroxy-*o*-toluidine)



$C_7H_9ON$

MW, 123

Plates. M.p.  $150^\circ$ .

*N-Benzoyl*: m.p.  $189^\circ$ . Spar. sol.  $C_6H_6$ .

Hodgson, Beard, *J. Chem. Soc.*, 1925, 127, 498.

#### 4-Amino-m-cresol (3-Hydroxy-*p*-toluidine).

Prismatic needles from 50% EtOH. M.p.  $162^\circ$  decomp. Sol. hot  $H_2O$ , MeOH, EtOH,  $Et_2O$ ,  $Me_2CO$ ,  $C_6H_6$ . Insol. pet. ether.  $FeCl_3 \rightarrow$  red col.

*Me ether*:  $C_8H_{11}ON$ . MW, 137. B.p.  $237-9^\circ$ .

*N-Acetyl*: 3-hydroxyacet-*p*-toluidide. Plates from 50% EtOH. M.p.  $171^\circ$ . Sol. MeOH, EtOH,  $Me_2CO$ . Mod. sol. hot  $H_2O$ . Spar. sol.  $H_2O$ , pet. ether. Insol.  $CCl_4$ . No col. with  $FeCl_3$ .

*N-Benzoyl*: needles from  $Me_2CO$ -pet. ether. M.p.  $169^\circ$ .

*ON-Dibenzoyl*: needles from MeOH. M.p.  $162-3^\circ$ .

Proskouriakoff, Titherington, *J. Am. Chem. Soc.*, 1930, 52, 3982.

Auwers, Borsche, Weller, *Ber.*, 1921, 54, 1314.

#### 6-Amino-m-cresol (5-Hydroxy-*o*-toluidine).

Prisms from 50% EtOH. M.p.  $179^\circ$ . Ox.  $\rightarrow$  toluquinone.

*Me ether*: cryst. from ligroin. M.p.  $29-30^\circ$  ( $13-14^\circ$ ). B.p.  $146-7^\circ/23$  mm. *N-Acetyl*: needles from  $H_2O$ . M.p.  $134^\circ$ . Sol. EtOH. Spar. sol.  $Et_2O$ , ligroin. *N-Chloroacetyl*: needles from toluene. M.p.  $135^\circ$ . Sol.  $Me_2CO_2$ ,  $CHCl_3$ . Spar. sol. cold EtOH.

*Et ether*:  $C_9H_{13}ON$ . MW, 151. Oil. *N-Acetyl*: needles from  $H_2O$ . M.p.  $114^\circ$ .

*O-Benzoyl*: needles from pet. ether. M.p.  $92^\circ$ . B.p.  $220^\circ/12$  mm. Sol. ord. solvents. Insol. cold pet. ether.

*N-Acetyl*: 5-hydroxyacet-*o*-toluidide. Needles from  $H_2O$ . M.p.  $130^\circ$ .

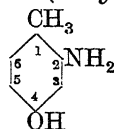
*B,HCl*: needles from conc. HCl. M.p.  $215^\circ$ .

Heidelberger, Jacobs, *J. Am. Chem. Soc.*, 1919, 41, 1454.

Proskouriakoff, Titherington, *J. Am. Chem. Soc.*, 1930, 52, 3983.

Gibson, *J. Chem. Soc.*, 1923, 123, 1276.

A.G.F.A., D.R.P., 295,841, (*Chem. Zentr.*, 1917, I, 295).

**2-Amino-*p*-cresol** (4-*Hydroxy-o*-toluidine)C<sub>7</sub>H<sub>9</sub>ON

MW, 123

M.p. 144°.

*Me ether*: C<sub>8</sub>H<sub>11</sub>ON. MW, 137. Needles from H<sub>2</sub>O. M.p. 47°. B.p. 253°. Sol. Et<sub>2</sub>O. Mod. sol. hot H<sub>2</sub>O. Volatile in steam.

*N-Acetyl*: 4-hydroxyacet-*o*-toluidide. Cryst. from EtOH.Aq. M.p. 178°.

ON-*Diacetyl*: cryst. M.p. 128-9°.

*N-Benzenesulphonyl*: m.p. 183°.

Knecht, *Ann.*, 1882, 215, 91.

**3-Amino-*p*-cresol** (4-*Hydroxy-m*-toluidine).

Cryst. from H<sub>2</sub>O. M.p. 135°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Spar. sol. C<sub>6</sub>H<sub>6</sub>. Insol. cold H<sub>2</sub>O. Ac<sub>2</sub>O + AcONa → 2 : 6-dimethylbenzoxazole.

*Me ether*: cresidine. Needles from pet. ether. M.p. 93-4° (51-2°). B.p. 235°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. hot H<sub>2</sub>O. Intermediate for azo dyestuffs. *N-Formyl*: prisms from EtOH.Aq. M.p. 86°. *N-Acetyl*: leaflets. M.p. 110°.

*Et ether*: C<sub>9</sub>H<sub>13</sub>ON. MW, 151. Needles from H<sub>2</sub>O. M.p. 41°. B.p. 240°. *N-Acetyl*: plates from H<sub>2</sub>O. M.p. 106-5°.

*N-Acetyl*: 4-hydroxyacet-*m*-toluidide. Needles from H<sub>2</sub>O. M.p. 160°. *O-Propionyl*: needles from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 104-5°. *O-Benzoyl*: needles from MeOH. M.p. 146°.

ON-*Diacetyl*: plates. M.p. 145°.

*N-Propionyl*: needles from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 95-6°.

ON-*Dipropionyl*: leaflets from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 91-2°.

*N-Benzoyl*: leaflets from EtOH. M.p. 191°. *O-Acetyl*: leaflets from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 134°.

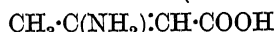
ON-*Dibenzoyl*: leaflets from EtOH. M.p. 190-1°.

Robinson, *J. Chem. Soc.*, 1916, 109, 1088.

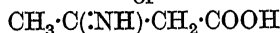
Bradt, Hart, *Chem. Abstracts*, 1931, 25, 4802.

Ashkinazi, Rabinovich, *Chem. Abstracts*, 1935, 29, 2521.

Auwers, Eisenlohr, *Ann.*, 1909, 369, 223.

**2-Aminocrotonic Acid** (2-*Iminobutyric acid*)

or

C<sub>4</sub>H<sub>7</sub>O<sub>2</sub>N

MW, 101

*Me ester*: C<sub>5</sub>H<sub>9</sub>O<sub>2</sub>N. MW, 115. Prisms. M.p. 85°. Sublimes.

*Et ester*: C<sub>6</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 129. Exists in two forms: labile and stable. *Labile*: prisms,

m.p. 20°; *N-acetyl*, m.p. 109-10°, sol. EtOH, insol. H<sub>2</sub>O. *Stable*: prisms, m.p. 33°, b.p. 210-15° decomp., 153-5°/90-100 mm., 105°/15 mm., sol. EtOH, Et<sub>2</sub>O, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>, insol. H<sub>2</sub>O, D<sub>15</sub><sup>D</sup> 1.0273, n<sub>D</sub><sup>20</sup> 1.49882. *N-Acetyl*: m.p. 63°, b.p. 231-3°, sol. EtOH, insol. H<sub>2</sub>O.

*Nitrile*: see Diacetonitrile.

Michaelis, *Ann.*, 1909, 366, 337.

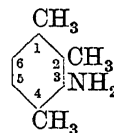
Momm, Gottschaldt, *Ber.*, 1922, 55, 2068.

**Aminocumene.**

See Cumidine, 2-Phenylpropylamine and Phenylisopropylamine.

**ω-Amino-ψ-cumene.**

See 2 : 4-Dimethylbenzylamine.

**3-Amino-ψ-cumene** (3-*Amino-1 : 2 : 4-trimethylbenzene*)C<sub>9</sub>H<sub>13</sub>N

MW, 135

B.p. 235°.

*N-Acetyl*: m.p. 186°.

Huender, *Rec. trav. chim.*, 1915, 34, 10.

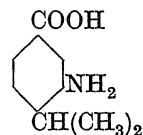
**5-Amino-ψ-cumene.**

See ψ-Cumidine.

**6-Amino-ψ-cumene** (6-*Amino-1 : 2 : 4-trimethylbenzene*).

M.p. 36°. B.p. 233°. Sol. H<sub>2</sub>O. Easily volatile in steam.

Huender, *Rec. trav. chim.*, 1915, 34, 11.

**3-Aminocuminic Acid** (3-*Amino-4-isopropylbenzoic acid*)C<sub>10</sub>H<sub>13</sub>O<sub>2</sub>N

MW, 179

M.p. 129°. Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O. Long heating with H<sub>2</sub>O at 100° → labile form, m.p. 104°.

*Me ester*: C<sub>11</sub>H<sub>15</sub>O<sub>2</sub>N. MW, 193. Prisms or plates from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 51-2°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin. *N-Chloroacetyl*: needles from EtOH.Aq. M.p. 101-2°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O, ligroin.

*Nitrile*: C<sub>10</sub>H<sub>12</sub>N<sub>2</sub>. MW, 160. Needles from H<sub>2</sub>O. M.p. 45°. B.p. 305°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O.

*N-Acetyl*: needles from EtOH. M.p. 248-50°. Sublimes.

Fileti, *Gazz. chim. ital.*, 1880, 10, 12.

Abenius, *J. prakt. chem.*, 1889, 40, 439.

**Aminocyclobutane.**

See Cyclobutylamine.

**Aminocycloheptane.**

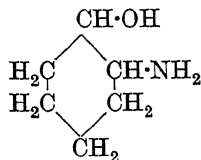
See Cycloheptylamine.

**Aminocyclohexane.**

See Cyclohexylamine.

**Aminocyclohexane-carboxylic Acid.**

See Aminohexahydrobenzoic Acid.

**2-Aminocyclohexanol (Hexahydro-o-aminophenol)** $C_6H_{13}ON$ 

MW, 115

Hygroscopic cryst. with odour of piperidine. M.p. 66°. B.p. 219°. Sol.  $H_2O$  and most org. solvents.

*B,HCl*: needles. M.p. 175°.

*B,HNO\_3*: m.p. 144°.

*N-Me*:  $C_7H_{15}ON$ . MW, 129. B.p. 229°.

*N-Et*:  $C_8H_{17}ON$ . MW, 143. M.p. 44°. B.p. 222°.

*N-Di-Et*:  $C_{10}H_{21}ON$ . MW, 171. B.p. 230°. *Picrate*: yellow. M.p. 94-5°.

*N-Phenyl*:  $C_{13}H_{17}ON$ . MW, 191. M.p. 150-1°.

Brunel, *Compt. rend.*, 1903, 137, 199; *Ann. chim.*, 1905, 6, 253.

**1-Amino-2-cyclohexylpropionic Acid.**See Hexahydrophenyl- $\alpha$ -alanine.**Aminocyclopentane.**

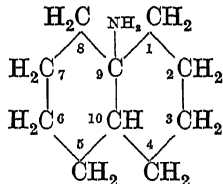
See Cyclopentylamine.

**Aminocyclopropane.**

See Cyclopropylamine.

**Aminocymene.**

See Cymidine and Thymylamine.

**9-Aminodecahydronaphthalene (9-Decalylamine)** $C_{10}H_{19}N$ 

MW, 153

*Cis*-

M.p. -13.5°. B.p. 227.6°/757 mm., 111°/18 mm., 82°/7 mm.  $D_4^{21.2}$  0.9508.  $n_D^{21}$  1.49820.

*N-Formyl*: cryst. from AcOEt. M.p. 165-6°. decomp.

*N-Acetyl*: cryst. from  $Me_2CO$ . M.p. 127°.

*N-Benzoyl*: cryst. from  $Me_2CO$ . M.p. 147°.

*Trans*-

M.p. -25°. B.p. 222.6°/757 mm., 90°/13 mm.  $D_4^{20.2}$  0.9391.  $n_D^{19.9}$  1.49211.

*N-Formyl*: cryst. from AcOEt. M.p. 172° decomp.

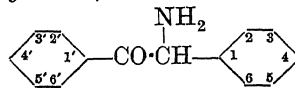
*N-Acetyl*: m.p. 183°.

*N-Benzoyl*: cryst. from  $Me_2CO$ . M.p. 148-9°.

Hückel, Blohm, *Ann.*, 1933, 502, 114.

**Aminodecahydronaphthalene.**

See also Decahydronaphthylamine.

 **$\alpha$ -Aminodeoxybenzoin (ms-Aminodeoxybenzoin, desylamine)** $C_{14}H_{13}ON$ 

MW, 211

Needles from  $Et_2O$ . M.p. 109° corr. Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ ,  $CHCl_3$ .

*B,HCl*: needles from EtOH- $Et_2O$ . M.p. 243°.

*B\_2,H\_2PtCl\_6*: m.p. 192-3° decomp.

*Phenylhydrazone*: yellow needles from AcOH. M.p. 226-7° corr.

Pschorr, Brüggemann, *Ber.*, 1902, 35, 2740.

Braun, *Ber.*, 1889, 22, 557.

Neumann, *Ber.*, 1890, 23, 996.

**4-Aminodeoxybenzoin.**

M.p. 95-6°. Sol. hot EtOH. Spar. sol. hot  $H_2O$ .

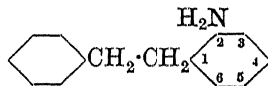
Galubew, *Ber.*, 1878, 11, 1939.

**Aminodibenzfuran.**

See Aminodiphenylene oxide.

 **$\alpha$ -Aminodibenzyl.**

See 1:2-Diphenylethylamine.

**2-Aminodibenzyl (2-Amino-sym.-diphenylethane)** $C_{14}H_{15}N$ 

MW, 197

M.p. 33°. B.p. 173-83°/11 mm.

*B,HCl*: needles from EtOH. M.p. 198°.

*B\_2,H\_2SO\_4*: cryst. from EtOH. M.p. 202°.

*N-Acetyl*: cryst. from EtOH. M.p. 117°.

*N-Benzoyl*: cryst. from EtOH. M.p. 166°.

*Picrate*: yellow needles from EtOH. M.p. 167-8°.

Ruggli, Staub, Schmid, *Helv. Chim. Acta*, 1937, 20, 50.

**3-Aminodibenzyl.**

Plates from 60-80° pet. ether. M.p. 51°. B.p. 180°/6 mm.

*N-Acetyl*: plates. M.p. 128-9°.

Bergmann, Schapiro, *J. Org. Chem.*, 1947, 12, 57.

**4-Aminodibenzyl.**

Plates from  $Et_2O$ -pet. ether. M.p. 48°.

*B,HCl*: plates from dil. HCl. M.p. 210°.

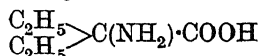
$B_2, H_2PtCl_6$ : m.p. 286–9°. Insol.  $H_2O$ .  
*N*-Benzoyl: m.p. 170–1°. Spar. sol. EtOH,  
 Et<sub>2</sub>O.

v. Braun, Deutsch, Koscielski, *Ber.*, 1913,  
 46, 1514.

### Aminodibenzylaniline.

See *unsym.*-Dibenzylphenylenediamine.

### 1-Aminodiethylacetic Acid



$C_6H_{13}O_2N$  MW, 131

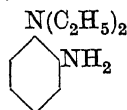
Prisms from  $H_2O$ . Sublimes without melting,  
 but melts in sealed tube at 309°. Sol.  $H_2O$ .  
 Spar. sol. EtOH. Insol. Et<sub>2</sub>O.

*Et ester*:  $C_8H_{17}O_2N$ . MW, 159. Oil. B.p.  
 76°/15 mm. Sol.  $H_2O$ .

*Nitrile*:  $C_8H_{12}N_2$ . MW, 112. B.p. 71°/11  
 mm.  $D_4^{20}$  0.8934. *Hydrochloride*: m.p. 110–  
 13°.

Rosenmund, *Ber.*, 1909, 42, 4472.

### *o*-Aminodiethylaniline (unsym. Diethyl-*o*-phenylenediamine)



$C_{10}H_{16}N_2$  MW, 164

Viscous oil. B.p. 312–13°/744 mm., 127°/25  
 mm.

*Chlorostannate*: silky needles. M.p. 145°.

*N-p-Toluenesulphonyl*: m.p. 64–5°.

*Monopicrate*: orange. M.p. 162°.

*Dipicrate* (?): m.p. 236°.

Weissenberger, *Monatsh.*, 1912, 33, 821.

Hall, Turner, *J. Chem. Soc.*, 1945, 694.

### *m*-Aminodiethylaniline (unsym.-Diethyl-*m*-phenylenediamine).

B.p. 276–8°, 117°/4 mm.

*Picrate*: m.p. 152°.

Moore, *J. Am. Chem. Soc.*, 1910, 32, 382.

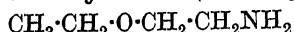
### *p*-Aminodiethylaniline (unsym.-Diethyl-*p*-phenylenediamine).

Pale yellow oil. B.p. 260–2°, 139–40°/10  
 mm. Darkens in air. Easily oxidised by  
 $FeCl_3$ , etc.

*N-Chloroacetyl*: pink needles. M.p. 83–4°.

Lippmann, Fleissner, *Monatsh.*, 1883, 4,  
 297.

### 2-Aminodiethyl Ether (2-Ethoxyethylamine)



$C_4H_{11}ON$  MW, 89

Liq. with strong ammoniacal odour. B.p.  
 108°/758 mm.  $D_4^{20}$  0.8512.  $n_D^{20}$  1.4101. Misc.  
 with  $H_2O$ , EtOH, Et<sub>2</sub>O. Reacts strongly  
 alkaline.

*Picrate*: yellow cryst. M.p. 122°.

*Picrolonate*: yellow cryst. M.p. 204° decomp.  
 Knorr, Meyer, *Ber.*, 1905, 38, 3130.

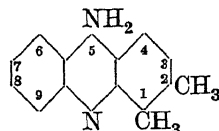
### Aminodi-isobutyl.

See 2-Amino-2:5-dimethyl-*n*-hexane.

### 2-Amino-1:4-dimethoxybenzene.

See under Aminohydroquinone.

### 5-Amino-1:2-dimethylacridine



$C_{15}H_{14}N_2$  MW, 222  
 M.p. 167°.

Albert, Gledhill, *J. Soc. Chem. Ind.*, 1945,  
 64, 169.

### 5-Amino-1:9-dimethylacridine.

Yellow. M.p. 136°.

Albert, Gledhill, *J. Soc. Chem. Ind.*, 1945,  
 64, 169.

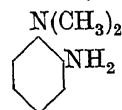
### 2-Amino-3:7-dimethylacridine.

Brownish-yellow cryst. from toluene. M.p.  
 244–5°. Sol. EtOH, Et<sub>2</sub>O, dil. AcOH, with  
 green fluor. Spar. sol.  $C_6H_6$ .

*N-Acetyl*: m.p. 258°. Spar. sol. EtOH.

Fox, Hewitt, *J. Chem. Soc.*, 1904, 85, 531.

### *o*-Aminodimethylaniline (unsym.-Di-*methyl-o*-phenylenediamine)



$C_8H_{12}N_2$  MW, 136

Oil. B.p. 218°/751 mm., 99–101°/20–25 mm.  
 $B_2HCl$ : prisms. Turns red and melts at  
 184–6° decomp.

*N-Acetyl*: needles from pet. ether. M.p.  
 72–3°.

*N-Benzoyl*: needles from MeOH.Aq. M.p. 51°.

*Picrate*: m.p. 138–40° decomp.

Pinnow, *Ber.*, 1899, 32, 1668.

Bamberger, Tschirner, *Ber.*, 1899, 32,  
 1905.

### *m*-Aminodimethylaniline (unsym.-Di-*methyl-m*-phenylenediamine).

B.p. 268–70°/740 mm. (258°), 138°/10 mm.  
 $D_4^{25}$  0.995.

$B_2HCl$ : prisms. M.p. 218°.

*N-Acetyl*: needles from EtOH.Aq. M.p. 87°.

*N-Diacetyl*: cryst. from EtOH. M.p. 69°.

*N-Chloroacetyl*: cryst. from 95% EtOH.

M.p. 101.5–2.5°. Sol.  $Me_2CO$ . Spar. sol. EtOH,  
 Et<sub>2</sub>O.

*N-Benzoyl*: prisms from EtOH. M.p. 163–4°.

Jaubert, *Bull. soc. chim.*, 1899, 21, 20.

Groll, *Ber.*, 1886, 19, 200.

**p-Aminodimethylaniline** (unsym.-*Dimethyl-p-phenylenediamine*).

M.p. 53° (41°, 36°). B.p. 262°, 146-8°/24 mm., 95-100°/1 mm.  $D_4^{20}$  1.036,  $D_4^{20}$  1.0168. Sol. EtOH, Et<sub>2</sub>O, cold H<sub>2</sub>O. Spar. volatile in steam. Ox. → benzoquinone.

*N-Formyl*: leaflets from H<sub>2</sub>O. M.p. 108°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Insol. ligroin. *Picrate*: m.p. 188°.

*N-Acetyl*: needles from H<sub>2</sub>O. M.p. 132-3°. B.p. 355° slight decomp. Very sol. EtOH, CHCl<sub>3</sub>. Sol. AcOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. cold H<sub>2</sub>O. Insol. ligroin.

*N-Diacetyl*: needles from pet. ether. M.p. 68-9°.

*N-Chloroacetyl*: needles from EtOH. M.p. 146-7°. Spar. sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

*N-Benzoyl*: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 228°. Spar. sol. EtOH.

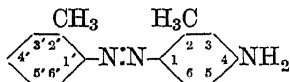
*N-p-Nitrobenzoyl*: bronze needles from EtOH. M.p. 258°.

*Picrate*: m.p. 186° (139°).

Winans, Adkins, *J. Am. Chem. Soc.*, 1932, 54, 311.

Fischer, *Ber.*, 1883, 16, 2235.

**4-Amino-2 : 2'-dimethylazobenzene** (*o-Tolueneazo-m-toluidine*)



C<sub>14</sub>H<sub>15</sub>N<sub>3</sub> MW, 225

Yellow needles from ligroin. M.p. 116-17°.

Mehner, *J. prakt. Chem.*, 1902, 65, 448.

**4-Amino-2 : 3'-dimethylazobenzene** (*m-Tolueneazo-m-toluidine, m-aminoazotoluene*).

Golden-yellow needles from EtOH, yellowish-brown needles from ligroin. M.p. 80°. Sn + HCl → 2 : 5-tolylenediamine.

*N-Di-Me*: C<sub>16</sub>H<sub>19</sub>N<sub>3</sub>. MW, 253. Red cryst. from EtOH. M.p. 73-4°.

Mehner, *J. prakt. Chem.*, 1902, 65, 448.

**4-Amino-2 : 4'-dimethylazobenzene** (*p-Tolueneazo-m-toluidine*).

Yellow plates from EtOH, golden-yellow needles from ligroin. M.p. 127°. Sn + HCl → 2 : 5-tolylenediamine.

*N-Di-Me*: light red needles from EtOH. M.p. 121°. Sol. EtOH, Et<sub>2</sub>O, ligroin. *B,HCl*: cryst. from EtOH. M.p. 121°.

Mehner, *J. prakt. Chem.*, 1902, 65, 448.

**4-Amino-3 : 2'-dimethylazobenzene** (*o-Tolueneazo-o-toluidine, o-aminoazotoluene*).

Yellow leaflets from EtOH. M.p. 100°. Heat of comb C<sub>p</sub> 1894.3 Cal. Sn + SnCl<sub>2</sub> → *o*-toluidine + 2 : 5-tolylenediamine.

*N-Acetyl*: red needles from EtOH. M.p. 185°.

*N-Diacetyl*: exists in two forms. (1) Reddish-

yellow needles from ligroin. M.p. 65°. (2) Red cryst. M.p. 75°. Very sol. most solvents.

*N-Chloroacetyl*: needles from EtOH. M.p. 171-2°.

Willgerodt, Lewino, *J. prakt. Chem.*, 1904, 69, 321.

**4-Amino-3 : 3'-dimethylazobenzene** (*m-Tolueneazo-o-toluidine*).

Yellowish-brown leaflets or needles from ligroin. M.p. 124°.

Mehner, *J. prakt. Chem.*, 1902, 65, 445.

**4-Amino-3 : 4'-dimethylazobenzene** (*p-Tolueneazo-o-toluidine*).

Orange-yellow needles from ligroin. M.p. 128°. Spar. sol. ligroin. Sn + HCl → *p*-toluidine + 2 : 5-tolylenediamine.

Mehner, *J. prakt. Chem.*, 1902, 65, 437.

Nietzki, *Ber.*, 1877, 10, 662.

**6-Amino-3 : 4'-dimethylazobenzene** (*p-Tolueneazo-p-toluidine, p-aminoazotoluene*).

Orange-red prisms from AcOEt. M.p. 118-5°. Very sol. C<sub>6</sub>H<sub>6</sub>. Sol. hot EtOH, AcOEt. Red. → 3 : 4-tolylenediamine + *p*-toluidine. Phthalic anhydride → phthaloyl deriv., m.p. 220°.

*B,HCl*: yellow needles from alc. HCl. M.p. 174°. Easily hyd.

*N-Acetyl*: yellow needles from EtOH-AcOH. M.p. 157°.

*N-Benzoyl*: orange-yellow needles from EtOH. M.p. 135°.

*N-Carboethoxyl*: orange-yellow needles from EtOH. M.p. 94°. Very sol. C<sub>6</sub>H<sub>6</sub>. Sol. EtOH, Et<sub>2</sub>O.

Nölting, Witt, *Ber.*, 1884, 17, 78.

v. Walther, Grieshammer, *J. prakt. Chem.*, 1915, 92, 228.

Morgan, Walls, *J. Chem. Soc.*, 1930, 1506.

**4-Amino-2 : 3-dimethylazobenzene.**

Reddish-yellow cryst. from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 98°.

Menton, *Ann.*, 1891, 263, 333.

**4-Amino-2 : 5-dimethylazobenzene.**

Orange cryst. from C<sub>6</sub>H<sub>6</sub>-ligroin, golden leaflets from EtOH.Aq. M.p. 104-5°.

Troeger, Westerkamp, *Arch. Pharm.*, 1909, 247, 684.

**4-Amino-2 : 6-dimethylazobenzene.**

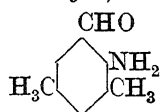
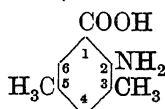
Red needles from pet. ether. M.p. 67°. Sol. most org. solvents.

Auwers, Borsche, *Ber.*, 1915, 48, 1729.

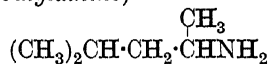
**4-Amino-3 : 5-dimethylazobenzene.**

Brownish needles from pet. ether. M.p. 99-101°. Sol. most org. solvents.

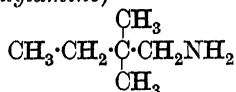
Auwers, Borsche, *Ber.*, 1915, 48, 1729.

**2-Amino-3 : 5-dimethylbenzaldehyde** (4-Aminomesitylenic aldehyde)C<sub>9</sub>H<sub>11</sub>ON MW, 149Yellow needles from pet. ether. M.p. 48–9°. Sol. EtOH. Spar. sol. H<sub>2</sub>O.*Oxime*: needles. M.p. 170–1°.Meisenheimer, Senn, Zimmermann, *Ber.*, 1927, 60, 174.Bamberger, Demuth, *Ber.*, 1901, 34, 1317.**2-Amino-3 : 5-dimethylbenzoic Acid** (4-Aminomesitylenic acid)C<sub>9</sub>H<sub>11</sub>O<sub>2</sub>N MW, 165

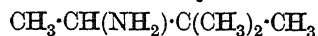
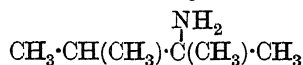
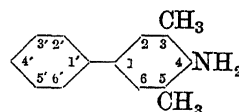
Needles from EtOH. M.p. 191°. EtOH sol. shows bluish-violet fluor. in sunlight.

*Me ester*: C<sub>10</sub>H<sub>13</sub>O<sub>2</sub>N. MW, 179. Cryst. from Me<sub>2</sub>CO. M.p. 39°.*Nitrile*: *N-acetyl*, 2 : 4-dimethyl-6-cyanoacetanilide. Needles. M.p. 196–7°. Sol. EtOH. Boiled with acid or alkali → 2 : 6 : 8-trimethylquinazoline.Wheeler, Hoffmann, *Am. Chem. J.*, 1910, 44, 119.**4-Amino-3 : 5-dimethylbenzoic Acid** (2-Aminomesitylenic acid).Needles from EtOH. M.p. 242° (235°). Spar. sol. H<sub>2</sub>O.*Me ester*: cryst. from MeOH.Aq. M.p. 93°.*Et ester*: C<sub>11</sub>H<sub>15</sub>O<sub>2</sub>N. MW, 193. Plates from pet. ether. M.p. 67°. Spar. sol. hot H<sub>2</sub>O.Wheeler, Hoffmann, *Am. Chem. J.*, 1910, 44, 119.**1-Amino-1 : 3-dimethyl-*n*-butane** (1 : 3-Dimethyl-*n*-butylamine)C<sub>6</sub>H<sub>15</sub>N MW, 101

B.p. 100–3°.

B<sub>2</sub>(COOH)<sub>2</sub>: m.p. 219°.Gulewitsch, Wasmus, *Ber.*, 1906, 39, 1192.**1-Amino-2 : 2-dimethyl-*n*-butane** (2 : 2-Dimethyl-*n*-butylamine)C<sub>6</sub>H<sub>15</sub>N MW, 101B.p. 113–14°. Absorbs CO<sub>2</sub>.

B.HCl: m.p. 225–8°.

Eschert, Freund, *Ber.*, 1893, 26, 2492.**3-Amino-2 : 2-dimethyl-*n*-butane**C<sub>6</sub>H<sub>15</sub>N MW, 101Liq. Freezes at –20°. B.p. 103°. Very sol. cold H<sub>2</sub>O, less sol. hot.*B.HAuCl<sub>4</sub>*: m.p. 186–7° (178°).Markownikow, *Ber.*, 1899, 32, 1448.**2-Amino-2 : 3-dimethyl-*n*-butane**C<sub>6</sub>H<sub>15</sub>N MW, 101B.p. 104–5°. D<sub>4</sub><sup>20</sup> 0.7683. *n*<sub>D</sub><sup>17</sup> 1.4096. Absorbs CO<sub>2</sub>.Konowalow, *Chem. Zentr.*, 1906, I, 737.**4-Amino-3 : 5-dimethyldiphenyl**C<sub>14</sub>H<sub>15</sub>N MW, 197*N-Acetyl*: m.p. 203–4°.I.G., F.P., 739,052, (*Chem. Zentr.*, 1933, II, 1255).**6-Amino-2 : 2'-dimethyldiphenyl.**

Light yellow. M.p. 105°. B.p. 169–70°/20 mm.

*N-p-Nitrobenzoyl*: pale yellow plates. M.p. 122°.Mascarelli, Angeletti, *Gazz. chim. ital.*, 1938, 68, 29.Ritchie, *Chem. Abstracts*, 1946, 40, 879.**4-Amino-3 : 4'-dimethyldiphenyl** (*p*-Amino-*mp'*-ditolyl)

M.p. 42°. B.p. 205–7°/4 mm.

*N-Acetyl*: needles. M.p. 206° (199–200°).Kliegl, Huber, *Ber.*, 1920, 53, 1646.I.G., F.P., 739,052, (*Chem. Zentr.*, 1933, II, 1255).**6-Amino-3 : 4'-dimethyldiphenyl** (*6*-Amino-*mp'*-ditolyl).

B.p. 165–7°/4 mm.

*B.HCl*: needles from EtOH–HCl. Decomp. at 216–26°.*N-Acetyl*: needles from pet. ether. M.p. 104°. Sol. EtOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.Morgan, Walls, *J. Chem. Soc.*, 1930, 1507.**2-Amino-4 : 4'-dimethyldiphenyl** (*o*-Amino-*pp'*-ditolyl).

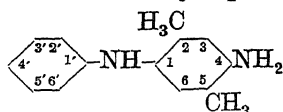
Prisms from EtOH.Aq. M.p. 62–3°.

*N-Acetyl*: needles. M.p. 118–19°.*N-Benzoyl*: needles. M.p. 95–6°.Marler, Turner, *J. Chem. Soc.*, 1932, 2393.

**3-Amino-4 : 4'-dimethyldiphenyl** (m-*Amino-pp'*-*ditolyl*).

Needles from EtOH.Aq. M.p. 104-5°.  
*B,HCl* : needles. M.p. about 230° decomp.  
*N-Acetyl* : needles. M.p. 156-7°.  
*N-Benzoyl* : m.p. 160-1°.

Marler, Turner, *J. Chem. Soc.*, 1932, 2393.

**4-Amino-2 : 5-dimethyldiphenylamine**

$C_{14}H_{16}N_2$  MW, 212  
 M.p. 86-7°.

I.G., F.P., 752,207, (*Chem. Zentr.*, 1934, I, 295).

**4-Amino-3 : 2'-dimethyldiphenylamine** (p-*Amino-o'*m-*ditolylamine*, 5-*N-o-tolyl-2 : 5-tolyl-enediamine*).

Prisms. M.p. 63-4°.

Bamberger, Büsdorf, Sand, *Ber.*, 1898, 31, 1518.

**4-Amino-3 : 4'-dimethyldiphenylamine** (p-*Amino-mp'*-*ditolylamine*).

M.p. 73-4°.

Gen. Aniline Works, U.S.P., 1,900,426, (*Chem. Abstracts*, 1933, 27, 2963).

**6-Amino-3 : 4'-dimethyldiphenylamine** (o-*Amino-mp'*-*ditolylamine*, 3-*N-p-tolyl-3 : 4-tolylenediamine*).

Leaflets from EtOH. M.p. 107°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin.

Biehinger, Busch, *Ber.*, 1903, 36, 341.

**2-Amino-4 : 4'-dimethyldiphenylamine** (o-*Amino-pp'*-*ditolylamine*, 4-*N-p-tolyl-3 : 4-tolylenediamine*).

Cryst. from hot ligroin. M.p. 109°. Conc. H<sub>2</sub>SO<sub>4</sub> → blue sol.

Fischer, Sieder, *Ber.*, 1890, 23, 3798.

**3-Amino-4 : 4'-dimethyldiphenylamine** (m-*Amino-pp'*-*ditolylamine*, 4-*N-p-tolyl-2 : 4-tolylenediamine*).

Prisms from ligroin. M.p. 71°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O.

Jaubert, *Ber.*, 1895, 28, 1649.

**2-Amino-2 : 5-dimethyl-*n*-hexane** (*Amino-di-isobutyl*)

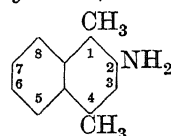
$CH_3 \cdot \overset{NH_2}{\underset{|}{C}}(CH_3) \cdot CH_2 \cdot CH_2 \cdot \overset{CH_3}{\underset{|}{C}}(CH_3) \cdot CH_3$   
 $C_8H_{18}N$  MW, 129

B.p. 144°/750 mm.  $D_4^{20}$  0.7803.

*B,HCl* : needles. M.p. 157-60°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*B,H\_2SO\_4* : m.p. 235°.

Konowalow, *Ber.*, 1895, 28, 1854; *Chem. Zentr.*, 1906, II, 312.

**2-Amino-1 : 4-dimethylnaphthalene** (1 : 4-*Dimethyl-2-naphthylamine*)

$C_{12}H_{13}N$  MW, 171  
 Prisms from Et<sub>2</sub>O. M.p. 75°. B.p. 333°.  
 Sol. EtOH, Et<sub>2</sub>O.

*N-Acetyl* : needles from EtOH. M.p. 219-20°.

Cannizzaro, Andreocci, *Gazz. chim. ital.*, 1896, 26, i, 15.

**1-Amino-2 : 3-dimethylnaphthalene** (2 : 3-*Dimethyl-1-naphthylamine*).

M.p. 42°. B.p. 177°/14 mm.

Willstaedt, *Chem. Zentr.*, 1943, 1, 750.

**1-Amino-2 : 6-dimethylnaphthalene** (2 : 6-*Dimethyl-1-naphthylamine*).

Needles from EtOH. M.p. 91°. Volatile in steam.

*N-Acetyl* : needles from AcOH. M.p. 211°.

*N-Benzoyl* : brown leaflets from xylene. M.p. 219-20°.

Mayer, Alken, *Ber.*, 1922, 55, 2280.

**3-Amino-2 : 6-dimethylnaphthalene** (3 : 7-*Dimethyl-2-naphthylamine*).

Needles from pet. ether. M.p. 129° (134-5°).  
*B,HCl* : plates. M.p. 275° decomp.

*N-Acetyl* : needles from EtOH. M.p. 231° (233-4°).

Coulson, *J. Chem. Soc.*, 1934, 1410.

Vesely, Stursa, *Chem. Zentr.*, 1932, I, 2464.

**4-Amino-2 : 6-dimethylnaphthalene** (3 : 7-*Dimethyl-1-naphthylamine*).

Needles from pet. ether. M.p. 93-4°.

*N-Acetyl* : needles from AcOH. M.p. 207-8°.

Vesely, Stursa, *Chem. Zentr.*, 1932, I, 2464.

**3-Amino-2 : 7-dimethylnaphthalene** (3 : 6-*Dimethyl-2-naphthylamine*).

Plates from pet. ether. M.p. 130°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>.

*B,HCl* : m.p. 283° decomp.

*N-Acetyl* : needles from AcOH or EtOH. M.p. 207°.

Coulson, *J. Chem. Soc.*, 1935, 79.

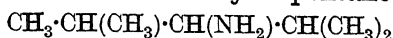
**2-Amino-2 : 4-dimethyl-*n*-pentane**

$CH_3 \cdot \overset{NH_2}{\underset{|}{C}}(CH_3) \cdot CH_2 \cdot \overset{CH_3}{\underset{|}{C}}(CH_3) \cdot CH_3$   
 $C_7H_{17}N$  MW, 115

B.p. 122°.  $D_4^{20}$  0.7720.  $n_D^{20}$  1.4009.

*B,HCl* : needles. M.p. 208-9°. Hygroscopic.  
 Chonin, *Chem. Zentr.*, 1909, II, 587.

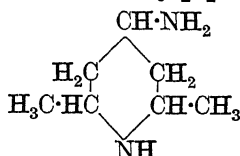
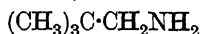


3-Amino-2 : 4-dimethyl-*n*-pentaneC<sub>7</sub>H<sub>17</sub>N MW, 115

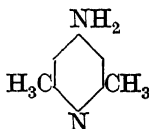
B.p. 125°.

Mailhe, *Bull. soc. chim.*, 1914, 15, 328.

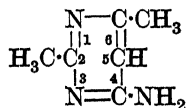
## 4-Amino-2 : 6-dimethylpiperidine

C<sub>7</sub>H<sub>16</sub>N<sub>2</sub> MW, 128B.p. 195–6°. Misc. with H<sub>2</sub>O.*Platinichloride*: orange-red cryst. Decomp. above 250°.*Picrate*: decomp. above 220°.Marckwald, *Ber.*, 1894, 27, 1329.1-Amino-2 : 2-dimethylpropane (2 : 2-Dimethyl-*n*-propylamine)C<sub>5</sub>H<sub>13</sub>N MW, 87B.p. 82–3°. HNO<sub>2</sub> → dimethylethylcarbinol.Freund, *Lenze, Ber.*, 1891, 24, 2156.

## 4-Amino-2 : 6-dimethylpyridine (γ-Amino-α'-lutidine)

C<sub>7</sub>H<sub>10</sub>N<sub>2</sub> MW, 122Needles from H<sub>2</sub>O or C<sub>6</sub>H<sub>6</sub>. M.p. 186°. B.p. 246°. Sol. EtOH, Me<sub>2</sub>CO. Mod. sol. H<sub>2</sub>O. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: reddish-yellow prisms. Decomp. at 250°.*Picrate*: yellow needles. M.p. 194–5°. Spar. sol. H<sub>2</sub>O, EtOH.N-*Acetyl*: m.p. 113°.Marckwald, *Ber.*, 1894, 27, 1325.Tschitschibabin, *Chem. Zentr.*, 1916, I, 1032.

## 4-Amino-2 : 6-dimethylpyrimidine (2 : 6-Dimethyl-4-pyrimidone imide, 6-amino-2 : 4-dimethylpyrimidine, Cyanmethine)

C<sub>6</sub>H<sub>9</sub>N<sub>3</sub> MW, 123Needles from EtOH. M.p. 183°. Sol. to 0.64% in H<sub>2</sub>O at 18°. Sol. to 5.25% in EtOHat 18°. Sublimes. Forms add. comp. with AgNO<sub>3</sub>.*B, HCl*: sublimes without melting.N-*p-Nitrobenzenesulphonyl*: m.p. 188–90° decomp.N-*p-Aminobenzenesulphonyl*: m.p. 236°. N<sup>4</sup>-*Acetyl*: m.p. 310°.N-*Phenyl*: 4-anilino-2 : 6-dimethylpyrimidine, 2 : 6-dimethyl-4-pyrimidone anil. M.p. 104°.*Picrate*: yellow needles. M.p. 214°.Morgan, Reilly, *J. Chem. Soc.*, 1913, 103, 808.

## 2-Amino-4 : 5-dimethylpyrimidine (2-Amino-5 : 6-dimethylpyrimidine, 4 : 5-dimethyl-2-pyrimidone imide).

Needles from H<sub>2</sub>O. M.p. 214–15°. Sol. EtOH, Me<sub>2</sub>CO, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. Et<sub>2</sub>O, ligroin. Sublimes undecomp.*B, HAuCl<sub>4</sub>*: yellow needles. M.p. 112°.*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: reddish-yellow needles. M.p. 227° decomp.N-*p-Aminobenzenesulphonyl*: m.p. 222°.*Picrate*: m.p. 250°.Schlenker, *Ber.*, 1901, 34, 2819.

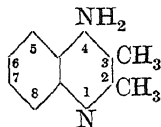
## 6-Amino-4 : 5-dimethylpyrimidine (5 : 6-Dimethyl-4-pyrimidone imide, 4-amino-5 : 6-dimethylpyrimidine).

Cryst. from H<sub>2</sub>O. M.p. 230°. Sol. warm EtOH, Me<sub>2</sub>CO, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. Et<sub>2</sub>O. Insol. ligroin. Aq. sol. turns litmus blue.N-*Phenyl*: 6-anilino-4 : 5-dimethylpyrimidine, 5 : 6-dimethyl-4-pyrimidone anil. Plates from H<sub>2</sub>O. M.p. 152°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin.Schlenker, *Ber.*, 1901, 34, 2823.

## 2-Amino-4 : 6-dimethylpyrimidine (4 : 6-Dimethyl-2-pyrimidone imide, acetylacetonylguanidine).

Cryst. H<sub>2</sub>O from H<sub>2</sub>O, m.p. 197°. Yellow needles from Me<sub>2</sub>CO, m.p. 200° (153°). Sol. CHCl<sub>3</sub>. Mod. sol. H<sub>2</sub>O, EtOH, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>, AcOEt. Insol. Et<sub>2</sub>O, ligroin. Distills undecomp.N-*Me*: prisms from pet. ether. M.p. 98°.N-*Phenyl*: 4 : 6-dimethyl-2-pyrimidone anil. Plates from toluene. M.p. 88–9°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>. *Picrate*: yellow leaflets. M.p. 186°.*B, 2HCl*: needles. M.p. 181°. Sol. H<sub>2</sub>O, EtOH.*B, H<sub>2</sub>PtCl<sub>6</sub>*: yellow prisms. M.p. 225°.N-*p-Nitrobenzenesulphonyl*: pale yellow plates M.p. 220–1°.N-*p-Aminobenzenesulphonyl*: m.p. 177° (198–9°).*Picrate*: yellow leaflets. M.p. 230°.Angerstein, *Ber.*, 1901, 34, 3962.Combes, Combes, *Bull. soc. chim.*, 1892, 7, 788.Hale, Vibrans, *J. Am. Chem. Soc.*, 1918, 40, 1061.

## 4-Amino-2 : 3-dimethylquinoline

 $C_{11}H_{12}N_2$ 

MW, 172

Needles from  $Me_2CO.Aq.$  M.p. 188.5–9.5°.

N-Acetyl: m.p. 216–17°.

Methiodide: needles. M.p. above 310°.

Petrov, *J. Chem. Soc.*, 1945, 18.

## 7(or 5)-Amino-2 : 4-dimethylquinoline.

Needles from ligroin. M.p. 94–100°. B.p. above 300° decomp. Hygroscopic. Liquefies in air and solidifies in yellow needles +  $2H_2O$ .

N-Acetyl: needles from EtOH.Aq. M.p. 212°.

Picrate: yellow needles. M.p. 215–17°.

Marckwald, *Ann.*, 1893, 274, 369.

## 5-Amino-2 : 6-dimethylquinoline.

Needles from EtOH.Aq. M.p. 189–9.5°.

N-Acetyl: needles. M.p. 211–12°.

Price, Velzen, Guthrie, *J. Org. Chem.*, 1947, 12, 203.

## 7-Amino-2 : 8-dimethylquinoline.

Cryst. from  $H_2O$ . M.p. 104°. Sol. most org. solvents.Marckwald, *Ann.*, 1893, 274, 363.

## 8-Amino-5 : 6-dimethylquinoline.

M.p. 78–9°.

Picrate: m.p. 213°.

Manske, Marion, Leger, *Can. J. Research*, 1942, 20B, 133.

## 6-Amino-5 : 7-dimethylquinoline.

Yellow needles from EtOH. M.p. 175°. B.p. above 300°. Sol.  $Et_2O$ ,  $Me_2CO$ ,  $C_6H_6$ ,  $CHCl_3$ . Spar. sol. EtOH. Prac. insol. hot  $H_2O$ , ligroin. Sublimes. Spar. vol. in steam.

N-Acetyl: needles. M.p. 212°.

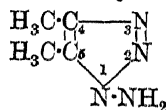
Picrate: orange-red. Sinters at 182°.

Marckwald, *Ber.*, 1890, 23, 1021.

## 5-Amino-6 : 8-dimethylquinoline.

Yellow needles from EtOH.Aq. M.p. 91°. Spar. sol. boiling  $H_2O$ . Sol. most org. solvents.N-Acetyl: needles from  $H_2O$ . M.p. 201°.Noelting, Trautmann, *Ber.*, 1890, 23, 3683.

## 1-Amino-4 : 5-dimethyl-1 : 2 : 3-triazole

 $C_4H_8N_4$ 

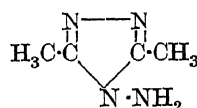
MW, 112

Plates from  $C_6H_6-EtOH$ . M.p. 95°. Distils on careful heat. Explodes on rapid heat. Sol.  $H_2O$ , EtOH. Mod. sol.  $C_6H_6$ ,  $Et_2O$ ,  $CHCl_3$ . Insol. ligroin. Reduces  $NH_3.AgNO_3$  and Fehling's. $B.HCl$ : needles. M.p. 131°. $B_2.AgNO_3$ : prisms. M.p. 188°. $B.HgCl_2$ : needles from  $H_2O$ . M.p. 145°.

Chloroplatinate: decomp. at 215°.

Picrate: yellow prisms from  $H_2O$ . M.p. 124–5°.Stollé, *Ber.*, 1926, 59, 1742.v. Pechmann, Bauer, *Ber.*, 1909, 42, 665; 1900, 33, 645.

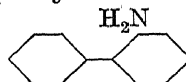
## 1-Amino-2 : 5-dimethyl-1 : 3 : 4-triazole

 $C_4H_8N_4$ 

MW, 112

Prisms from AcOEt. M.p. 199°. Sol. hot  $H_2O$ , EtOH. Prac. insol.  $Et_2O$ ,  $C_6H_6$ ,  $CHCl_3$ , ligroin.  $k = 1.4 \times 10^{-10}$ . $B.HCl$ : needles from EtOH. M.p. 232°. $B_2.H_2SO_4$ : from  $H_2O$ . M.p. 230°. $B_2.H_2PtCl_6.2H_2O$ : m.p. anhyd. 260°.Pellizzari, *Atti accad. Lincei*, 1899, 8, 330; *Gazz. chim. ital.*, 1909, 39, 535.Dedichen, *Ber.*, 1906, 39, 1855.Silberrad, *J. Chem. Soc.*, 1900, 77, 1185.

## o-Aminodiphenyl

 $C_{12}H_{11}N$ 

MW, 169

Cryst. from EtOH.Aq. M.p. 49–50°. B.p. 299°, 170°/15 mm., 145–8°/5 mm. Volatile in steam. Heat with lime  $\rightarrow$  carbazole.N-Formyl: needles from EtOH.Aq. M.p. 75°. Very sol. EtOH,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ . Heat with  $ZnCl_2 \rightarrow$  phenanthridine.N-Acetyl: needles from EtOH.Aq. or pet. ether. M.p. 121°. B.p. 355°. Sol. EtOH,  $Et_2O$ .

N-Acetoacetyl: colourless needles. M.p. 84°.

N-Propionyl: needles from EtOH.Aq. M.p. 65°.

N-Benzoyl: leaflets from EtOH.Aq. M.p. 102° (88°). Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ .N-Me: b.p. 115–16°/2 mm.  $n_D^{20}$  1.6052.

N-Di-Me: m.p. 98–9°.

Chaix, Rochebouët, *Bull. soc. chim.*, 1935, 2, 277.Morgan, Walls, *J. Soc. Chem. Ind.*, 1930, 49, 15r.Scarborough, Waters, *J. Chem. Soc.*, 1927, 91.

**m-Aminodiphenyl.**

Needles. M.p. 30°. B.p. 254°/135 mm., 176-8°/18 mm. Sol. most org. solvents. Turns dark in air. Volatile in steam.

N-Acetyl: needles from EtOH. M.p. 148°.

Fichter, Sulzberger, *Ber.*, 1904, 37, 882.

**p-Aminodiphenyl (Xenylamine).**

Leaflets from EtOH.Aq. M.p. 50-2°. B.p. 302°, 191°/15 mm., 166°/5 mm. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Spar. sol. cold H<sub>2</sub>O. Volatile in steam.

N-Formyl: needles from EtOH.Aq. M.p. 172°. Sol. Et<sub>2</sub>O. Spar. sol. EtOH.

N-Acetyl: cryst. from MeOH.Aq. M.p. 171° (167°). Very sol. MeOH, Me<sub>2</sub>CO. Sol. EtOH.

N-Diacetyl: needles from ligroin. M.p. 120°. Sol. ligroin.

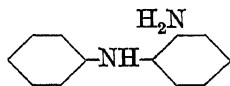
N-Benzoyl: cryst. from EtOH. M.p. 229-30°. Spar. sol. AcOH. Insol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, pet. ether.

N-p-Toluenesulphonyl: m.p. 254-5° (160°).

I.G., B.P., 395,152, (*Chem. Abstracts*, 1934, 28, 340).

Morgan, Walls, *J. Soc. Chem. Ind.*, 1930, 49, 15T.

**o-Aminodiphenylamine (Phenyl-o-phenylenediamine)**



C<sub>12</sub>H<sub>12</sub>N<sub>2</sub>

MW, 184

Needles from H<sub>2</sub>O. M.p. 79-80°. Sol. Me<sub>2</sub>CO, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin. Dist. with PbO → phenazine.

o-N-Acetyl: m.p. 121°. HCl or alc. NaOH → 2-methyl-1-phenylbenzimidazole.

o-N-Benzoyl: m.p. 136°. HCl → 1:2-diphenylbenzimidazole.

Kehrmann, Havas, *Ber.*, 1913, 46, 341.

**m-Aminodiphenylamine (Phenyl-m-phenylenediamine).**

Leaflets from hot H<sub>2</sub>O. M.p. 76-7°. Sol. most org. solvents.

Wieland, Rheinheimer, *Ann.*, 1921, 423, 28.

**p-Aminodiphenylamine (Phenyl-p-phenylenediamine, Diphenyl Black Base P).**

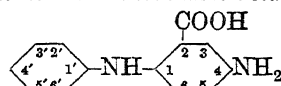
Needles from EtOH. M.p. 66°. Cryst. from ligroin. M.p. 75°. B.p. 354° in H, 155°/0.026 mm. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O. Heat with S → aminothiodiphenylamine. Used in calico printing and in the dyeing of fur.

N-Acetyl: leaflets or needles. M.p. 158°.

I.C.I., F.P., 783,088, (*Chem. Abstracts*, 1935, 29, 6904).

Meyer, *Ber.*, 1920, 53, 1265.

**4 - Aminodiphenylamine - 2 - carboxylic Acid (5-Amino-2-anilinobenzoic acid)**



C<sub>13</sub>H<sub>12</sub>O<sub>2</sub>N<sub>2</sub>

MW, 228

M.p. 233-4° decomp.

B,HCl: needles. Spar. sol. cold H<sub>2</sub>O.

Graebe, Lagodzinski, *Ann.*, 1893, 276, 41.

**2' - Aminodiphenylamine - 2 - carboxylic Acid.**

Plates from EtOH. M.p. 204° decomp. (210°). Prac. insol. boiling C<sub>6</sub>H<sub>6</sub>. Readily oxidised in moist air.

B,HCl: prisms from EtOH. M.p. 260°.

McCombie, Scarborough, Waters, *J. Chem. Soc.*, 1928, 358.

Clemo, Perkin, Robinson, *J. Chem. Soc.*, 1924, 1779.

**3' - Aminodiphenylamine - 2 - carboxylic Acid.**

Needles from toluene. M.p. 166° decomp. Sol. EtOH, AcOH. Spar. sol. C<sub>6</sub>H<sub>6</sub>. Insol. Et<sub>2</sub>O, ligroin.

Ullmann, *Ann.*, 1907, 355, 331.

**4' - Aminodiphenylamine - 2 - carboxylic Acid.**

Needles from xylene. M.p. 205° decomp. Sol. hot EtOH, hot AcOH. Insol. C<sub>6</sub>H<sub>6</sub>, ligroin.

Ullmann, *Ann.*, 1907, 355, 334.

**2 - Aminodiphenylamine - 4 - carboxylic Acid (3-Amino-4-anilinobenzoic acid).**

Needles from hot H<sub>2</sub>O. M.p. 153°. Sol. EtOH, Me<sub>2</sub>CO, CHCl<sub>3</sub>. Mod. sol. C<sub>6</sub>H<sub>6</sub>. Insol. ligroin.

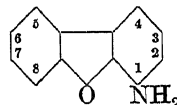
Et ester: C<sub>15</sub>H<sub>16</sub>O<sub>2</sub>N<sub>2</sub>. MW, 256. Plates from EtOH.Aq. M.p. 76-7°.

Schöpf, *Ber.*, 1889, 22, 3286.

**Aminodiphenylcarbinol.**

See Aminobenzhydrol.

**1-Aminodiphenylene oxide (1-Aminodibenzofuran)**



C<sub>12</sub>H<sub>9</sub>ON

MW, 183

M.p. 84.5-85.5°.

N-Acetyl: m.p. 172.5°.

Kirkpatrick, Parker, *J. Am. Chem. Soc.*, 1935, 57, 1126.

Gilman, van Ess, *J. Am. Chem. Soc.*, 1939, 61, 1365.

**2-Aminodiphenylene oxide.**

Cryst. from EtOH.Aq. M.p. 94°.

B,HCl: plates. Decomp. about 220°.

N-Acetyl: m.p. 178°.

N-Diacetyl: needles from EtOH.Aq. M.p. 83°.

N-Benzoyl: m.p. 201°.

N-p-Aminobenzenesulphonyl: m.p. 242-3°.

N-Me: C<sub>13</sub>H<sub>11</sub>ON. MW, 197. M.p. 48-9°.

B.p. 190°/4 mm. B,HCl: m.p. 245-7° decomp.

N-Di-Me: C<sub>14</sub>H<sub>13</sub>ON. MW, 211. M.p. 96°.

B.p. 211-12°/4 mm. B,HCl: m.p. 230-2° decomp.

N-Di-Et: C<sub>16</sub>H<sub>17</sub>ON. MW, 239. B.p. 205°/2 mm. B,HCl: m.p. 203-5° decomp.

Kirkpatrick, Parker, *J. Am. Chem. Soc.*, 1935, 57, 1123.

Cullinane, *J. Chem. Soc.*, 1930, 2267.

Borsche, Schake, *Ber.*, 1923, 56, 2498.

### 3-Aminodiphenylene oxide.

Plates from EtOH.Aq. M.p. 128° (125-6°).

Cullinane, *J. Chem. Soc.*, 1932, 2365.

Gilman *et al.*, *J. Am. Chem. Soc.*, 1934, 56, 2473

### 4-Aminodiphenylene oxide.

Needles from MeOH.Aq. M.p. 74°.

N-Acetyl: m.p. 205°.

Gilman, van Ess, *J. Am. Chem. Soc.*, 1939, 61, 1365.

### Amino-sym.-diphenylethane.

See Aminodibenzyl and 1:2-Diphenylethylamine.

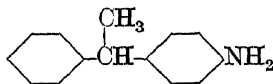
### $\alpha$ -Amino-unsym.-diphenylethane.

See 1:1-Diphenylethylamine.

### $\beta$ -Amino-unsym.-diphenylethane.

See 2:2-Diphenylethylamine.

### 4-Amino-unsym.-diphenylethane



C<sub>14</sub>H<sub>15</sub>N MW, 197

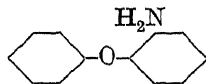
B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>: needles from EtOH. M.p. 206-7°.

Mod. sol. EtOH. Spar. sol. H<sub>2</sub>O.

N-Benzoyl: plates from EtOH. M.p. 128°.

Busch, Rinck, *Ber.*, 1905, 38, 1763.

### o-Aminodiphenyl Ether (o-Aminophenol phenyl ether)



C<sub>12</sub>H<sub>11</sub>ON MW, 185

Cryst. from ligroin. M.p. 42-3°. B.p. 307-8°/728 mm. Very sol. usual solvents.

B,HCl: needles. M.p. 154°. Very sol. H<sub>2</sub>O, EtOH.

N-p-Aminobenzenesulphonyl: m.p. 149°. N<sup>4</sup>-Acetyl: m.p. 162°.

Ullmann, *Ber.*, 1896, 29, 1881.

Jones, Cook, *J. Am. Chem. Soc.*, 1916, 38, 1540.

### m-Aminodiphenyl Ether (m-Aminophenol phenyl ether).

Prisms from ligroin. M.p. 37°. B.p. 315°, 190-1°/14 mm.

B,HCl: leaflets. M.p. 139°. Sol. H<sub>2</sub>O.

N-Acetyl: prisms from ligroin. M.p. 83°.

Ullmann, Sponagel, *Ann.*, 1906, 350, 104.

### p-Aminodiphenyl Ether (p-Aminophenol phenyl ether).

Needles from H<sub>2</sub>O. M.p. 84° (95°). Sol. EtOH, Et<sub>2</sub>O.

B,HCl: plates. M.p. 225-7° decomp. (122°).

N-Acetyl: m.p. 127°.

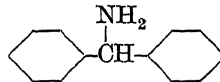
N-p-Aminobenzenesulphonyl: m.p. 177-8°.

N<sup>4</sup>-Acetyl: m.p. 183°.

Ullmann, Sponagel, *Ann.*, 1906, 350, 105

Jones, Cook, *J. Am. Chem. Soc.*, 1916, 38, 1545.

### $\alpha$ -Aminodiphenylmethane (Benzhydrylamine)



C<sub>13</sub>H<sub>13</sub>N MW, 183

B.p. 304-1°/763 mm. (288°), 175-6°/23 mm. D<sub>4</sub><sup>20</sup> 1.0635. n<sub>D</sub><sup>20</sup> 1.59631. Reacts strongly alkaline. Absorbs CO<sub>2</sub> → product m.p. 91°.

Ox. → benzophenone oxime.

B,HCl: needles. M.p. 293° (270°). Spar. sol. cold H<sub>2</sub>O.

B,CH<sub>3</sub>COOH: m.p. 141°.

B<sub>2</sub>(COOH)<sub>2</sub>: m.p. 135-6°.

B,HAuCl<sub>4</sub>: m.p. 152-4°.

N-Formyl: needles from H<sub>2</sub>O. M.p. 132°.

N-Acetyl: needles from EtOH.Aq. M.p. 146-7°.

N-Benzoyl: needles from EtOH. M.p. 172° (166-7°).

Picrate: yellow needles from H<sub>2</sub>O. M.p. 205-6° decomp.

N-Me: C<sub>14</sub>H<sub>15</sub>N. MW, 197. Cryst. from pet. ether. M.p. 40°. B.p. 168°/20 mm. B,HCl: needles. M.p. 238°.

B,HNO<sub>3</sub>: plates from EtOH. M.p. 146°.

N-Et: C<sub>15</sub>H<sub>17</sub>N. MW, 211. Brownish oil. B.p. 175°/20 mm. B,HCl: needles from EtOH. M.p. 248°.

B,HNO<sub>3</sub>: leaflets from EtOH. M.p. 142°.

N-Isopropyl: C<sub>16</sub>H<sub>19</sub>N. MW, 225. Cryst. M.p. 11.5°. B.p. 181.5-82°/25 mm., 173°/19 mm.

D<sub>4</sub><sup>15</sup> 1.001. n<sub>D</sub><sup>15</sup> 1.5602. B,HCl: cryst. + H<sub>2</sub>O from H<sub>2</sub>O. M.p. 213.5-4°. Picrate: yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 189-90°.

N-Phenyl:  $\alpha$ -anilindiphenylmethane. C<sub>19</sub>H<sub>17</sub>N. MW, 259. Needles from EtOH. M.p. 58°. B.p. 232-4°/20 mm., 224-5°/12 mm.

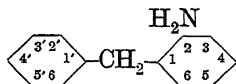
B,HCl: needles from EtOH. M.p. 199°.

Busch, Leefhelm, *J. prakt. Chem.*, 1908, 77, 14.

Biltz, Seydel, *Ber.*, 1911, 44, 411.

Semper, Lichtenstadt, *Ber.*, 1918, 51, 934.

## 2-Aminodiphenylmethane

 $C_{13}H_{13}N$ 

MW, 183

Pale yellow prisms from  $Et_2O$ . M.p.  $52^\circ$ .  
B.p.  $190^\circ/22$  mm.,  $172^\circ/12$  mm.  $PbO \rightarrow$   
acridine.  $HNO_2 \rightarrow$  fluorene.

N-Acetyl: needles from  $EtOH$ . Aq. M.p.  $135^\circ$ .

N-Benzoyl: prisms from  $EtOH$ . Aq. M.p.  $116^\circ$ .

B,  $HCl$ : m.p.  $137^\circ$  decomp. ( $175^\circ$ ).

Carré, *Bull. soc. chim.*, 1909, 5, 120. See  
also *Compt. rend.*, 1909, 148, 101.

Fischer, Schütte, *Ber.*, 1893, 26, 3086.

## 3-Aminodiphenylmethane.

Cryst. from ligroin. M.p.  $46^\circ$ .

N-Acetyl: leaflets from  $C_6H_6$ -pet. ether.  
M.p.  $91^\circ$ .

Becker, *Ber.*, 1882, 15, 2092.

## 4-Aminodiphenylmethane.

Cryst. from ligroin. M.p.  $34-5^\circ$ .

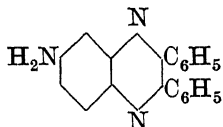
N-p-Nitrophenylacetyl: m.p.  $86^\circ$ .

Basler, *Ber.*, 1883, 16, 2718.

## Aminodiphenylpropane.

See Diphenylpropylamine.

## 6-Amino-2 : 3-diphenylquinoxaline

 $C_{20}H_{15}N_3$ 

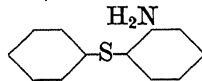
MW, 297

Yellow cryst. from  $EtOH$ . M.p.  $177^\circ$ . Mod.  
sol.  $EtOH$ ,  $Et_2O$  with greenish-yellow fluor.  
Conc.  $H_2SO_4$  gives deep red sol.  $\rightarrow$  green on  
dilution.

N-Acetyl: cryst. from  $CHCl_3$ . M.p.  $252^\circ$ .  
Conc.  $H_2SO_4 \rightarrow$  yellow sol.

Bertels, *Ber.*, 1904, 37, 2277.

## o-Aminodiphenyl sulphide (o-Aminothio-phenol phenyl ether)

 $C_{12}H_{11}NS$ 

MW, 201

Plates from  $EtOH$ . M.p.  $35-6^\circ$ . B.p.  $258^\circ/$   
 $100$  mm.,  $212^\circ/25$  mm.

Bourgeois, Huber, *Rec. trav. chim.*, 1912,  
31, 30.

## p-Aminodiphenyl sulphide (p-Aminothio-phenol phenyl ether).

Cryst. from ligroin. M.p.  $93^\circ$  ( $96^\circ$ ). B.p.  
 $282^\circ/100$  mm.,  $243^\circ/29$  mm.

N-Acetyl: needles from  $EtOH$ . M.p.  $146^\circ$ .

Bourgeois, Huber, *Rec. trav. chim.*, 1912,  
31, 30.

## Aminodithioformic Acid.

See Dithiocarbamic Acid.

## Aminoditoyl.

See Aminodimethyldiphenyl.

## Aminoditolyamine.

See Aminodimethyldiphenylamine.

## 1-Aminododecane.

See Dodecylamine.

 $\omega$ -Aminododecylcyclopentene.

See Homohydnocarpylamine.

## Aminodurene.

See Duridine.

## Aminoethanesulphonic Acid.

See Taurine.

## Aminoethoxybenzoic Acid.

See under Hydroxyaminobenzoic Acid and  
Hydroxyanthranilic Acid.

## 1-Aminoethyl Alcohol (Aldehyde-ammonia, 1-hydroxyethylamine)

 $C_2H_7ON$ 

MW, 61

Rhombic cryst. M.p.  $97^\circ$  ( $70-80^\circ$ ). B.p.  
 $110^\circ$  part decomp. Sol.  $H_2O$ . Spar. sol.  $Et_2O$ .  
Heat of comb.  $C_p$  347 Cal. Dil. acids  $\rightarrow$   
acetaldehyde.

Aschan, *Ber.*, 1915, 48, 874.

Matheson, U.S.P., 1,456,702, (*Chem. Ab-*  
*stracts*, 1923, 17, 2428).

Skirrow, Morrison, U.S.P., 1,551,176,  
(*Chem. Abstracts*, 1926, 20, 210).

## 2-Aminoethyl Alcohol (2-Hydroxyethyl-amine, ethanolamine, colamine)

 $C_2H_7ON$ 

MW, 61

Colourless oil. B.p.  $171^\circ$ . Misc. all propor-  
tions with  $H_2O$ ,  $EtOH$ . Sol.  $CHCl_3$ . Spar. sol.  
 $Et_2O$ ,  $C_6H_6$ , ligroin.  $D_4^{20}$  1.022.  $n_D^{20}$  1.4539.  
Strong base. Volatile in steam. Absorbs  $CO_2$   
and  $H_2O$ .

B,  $HCl$ : m.p.  $100^\circ$ .

B,  $HNO_3$ : m.p.  $52-5^\circ$ . Hygroscopic.

B,  $2HNO_3$ : cryst.

O-Acetyl: 2-aminoethyl acetate. B.p.  $160-$   
 $1^\circ/4$  mm.  $n_D^{20}$  1.4716. B,  $HCl$ : m.p.  $130^\circ$ .

Picrate: m.p.  $158^\circ$ .

Et ether: see 2-Aminodiethyl Ether.

Kawai, *J. Chem. Soc. Japan*, 1923, 44, 303.

Putokhin, *Chem. Abstracts*, 1929, 23, 2938.

I.G., F.P., 650,574, (*Chem. Abstracts*,  
1929, 23, 3232).

Carbide and Carbon Chemical Corp.,  
U.S.P., 1,904,013, (*Chem. Abstracts*,  
1933, 27, 3222).

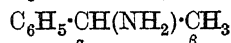
Nobel, D.R.P., 517,832, (*Chem. Abstracts*,  
1931, 25, 2740).

## 2-[\beta-Aminoethylamino]-ethyl Alcohol.

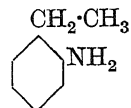
See N-[\beta-Hydroxyethyl]-ethylenediamine.

## Amino-ethylaniline.

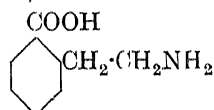
See Ethylphenylenediamine.

$\alpha$ -Aminoethylbenzene (1-Phenylethylamine)C<sub>8</sub>H<sub>11</sub>N MW, 121*d*l-B.p. 187°/760 mm.  $[\alpha]_D^{20} - 10.8^\circ$  in MeOH.*B, HCl*: m.p. 159–60°.

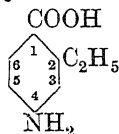
1-Mandelate: plates from EtOH. M.p. 177°.

 $[\alpha]_D^{25} - 60.4^\circ$  in H<sub>2</sub>O.*d*- $\alpha$ -Bromocamphorsulphonate: m.p. 183–6°. $[\alpha]_D^{25} + 63.3^\circ$ .*dl*- $\alpha$ -Bromocamphorsulphonate: prisms from EtOH. M.p. 170°.  $[\alpha]_D^{25} + 1.20^\circ$ .*l*l-B.p. 54°/1 mm.  $[\alpha]_D^{18} - 38^\circ$  in MeOH.*B, HCl*: m.p. 171°.  $[\alpha]_D - 8.27^\circ$  in H<sub>2</sub>O.*d*-Mandelate:  $[\alpha]_D^{25} + 58.9^\circ$  in H<sub>2</sub>O.*d*- $\alpha$ -Bromocamphorsulphonate: prisms fromH<sub>2</sub>O. M.p. 206–7°.  $[\alpha]_D^{19.5} + 77.6^\circ$  in H<sub>2</sub>O.*N*-Acetyl: m.p. 103–4°.*N*-Benzoyl: m.p. 163–3.5°.*dl*l-B.p. 187.5°, 87°/24 mm.  $D^{25} 0.9395$ . Sol. 24 parts H<sub>2</sub>O at 20°. Absorbs CO<sub>2</sub>.*B*<sub>2</sub>·(COOH)<sub>2</sub>: m.p. 238°.*B, HCl*: m.p. 158°.*d*-Mandelate: plates from H<sub>2</sub>O. M.p. 176°.*dl*-Mandelate: plates from H<sub>2</sub>O. M.p. 138°.*dl*- $\alpha$ -Bromocamphorsulphonate: needles from H<sub>2</sub>O. M.p. 155°.*N*-Acetyl: m.p. 57°. B.p. 292–3°. Sol. EtOH. Spar. sol. hot H<sub>2</sub>O.*N*-Benzoyl: needles. M.p. 120°.Ramberg, Hannerz, *Chem. Abstracts*, 1925, 19, 13.André, Vernier, *Compt. rend.*, 1931, 193, 1192.Ingold, Wilson, *J. Chem. Soc.*, 1933, 1502.Kindler, Peschke, Brandt, *Ber.*, 1935, 68, 2241.Robinson, Snyder, *Organic Syntheses*, 1943, XXIII, 68. $\beta$ -Aminoethylbenzene (2-Phenylethylamine).B.p. 197–8°. Sol. EtOH, Et<sub>2</sub>O. Mod. sol. H<sub>2</sub>O.  $D_4^{24} 0.9580$ . Absorbs CO<sub>2</sub>.*B, HCl*: cryst. from EtOH. M.p. 217°.*B*·(COOH)<sub>2</sub>: needles. M.p. 181°.*B*<sub>2</sub>·(COOH)<sub>2</sub>: plates. M.p. 218°.*Picrate*: prisms from EtOH. M.p. 167°.*N*-Formyl: b.p. 210–14°/35 mm., 180–1°/14 mm.*N*-Acetyl: needles. M.p. 51° (42–4°). B.p. 305–6°.*N*-Benzoyl: leaflets from EtOH. M.p. 116°.Erickson, *Ber.*, 1926, 59, 2667.Ing, Manske, *J. Chem. Soc.*, 1926, 2350.Mignonac, F.P., 638,550, (*Chem. Abstracts*, 1929, 23, 154).Kindler, D.R.P., 562,714, (*Chem. Abstracts*, 1933, 27, 995).Robinson, Snyder, *Organic Syntheses*, 1943, XXIII, 71.*o*-Aminoethylbenzene (*o*-Ethylaniline)C<sub>8</sub>H<sub>11</sub>N MW, 121B.p. 215–16°/769 mm. (210–11°).  $D^{22} 0.983$ .  $n_D^{25} 1.5584$ .*B, HCl*: m.p. 191° (172–3°).*N*-Acetyl: *o*-ethylacetanilide. Cryst. M.p. 111–12°. B.p. 304–5°. Sol. hot H<sub>2</sub>O.*N*-Benzoyl: *o*-ethylbenzanilide. C<sub>15</sub>H<sub>15</sub>ON. MW, 225. Leaflets. M.p. 147°.*Picrate*: m.p. 194–5°.Paucksch, *Ber.*, 1884, 17, 2801.*m*-Aminoethylbenzene (*m*-Ethylaniline).B.p. 214–15°. Sol. hot H<sub>2</sub>O.  $D^0 0.990$ .*N*-Me: b.p. 81–5°/1 mm. *Picrate*: m.p. 133–4°.*N*-Acetyl: *m*-ethylacetanilide. M.p. 24–5°.

B.p. 312–13°.

Béhal, Choay, *Bull. soc. chim.*, 1894, 11, 211.*p*-Aminoethylbenzene (*p*-Ethylaniline).M.p. –5°. B.p. 213–14°.  $D^{22} 0.975$ .  $n_D^{25} 1.5529$ .*N*-Acetyl: *p*-ethylacetanilide. Needles from H<sub>2</sub>O. M.p. 94°. B.p. 315–17°. Spar. sol. H<sub>2</sub>O.*N*-Benzoyl: *p*-ethylbenzanilide. C<sub>15</sub>H<sub>15</sub>ON. MW, 225. Needles. M.p. 151°.Willgerodt, Bergdolt, *Ann.*, 1903, 327, 286.*o*- $\beta$ -Aminoethylbenzoic Acid (*o*-Carboxy-2-phenylethylamine)C<sub>9</sub>H<sub>11</sub>O<sub>2</sub>N MW, 165Needles. M.p. 160–5°. Salts sol. H<sub>2</sub>O. Heat  $\rightarrow$  isohydrocarbostyryl.*B, HCl*: plates. M.p. 199–200°.*N*-Benzoyl: cryst. from H<sub>2</sub>O or AcOEt. M.p. 172°.Bamberger, Dieckmann, *Ber.*, 1893, 26, 1217.*p*- $\beta$ -Aminoethylbenzoic Acid (*p*-Carboxy-2-phenylethylamine).*Me ester*: yellow needles. M.p. 178°. *B, HCl*: m.p. 208–11°.*Et ester*: bright yellow needles. M.p. 112°.*B, HCl*: m.p. 178°.*N*-Acetyl: m.p. 173–5°.Slotta, Kethur, *Ber.*, 1938, 71, 59.Blicke, Lilienfeld, *J. Am. Chem. Soc.*, 1943, 65, 2281.

## 4-Amino-2-ethylbenzoic Acid



$C_9H_{11}O_2N$  MW, 165

Needles from  $H_2O$ . M.p.  $179-80^\circ$ .

Gieke, *Ber.*, 1896, 29, 2537.

## 5-Amino-2-ethylbenzoic Acid.

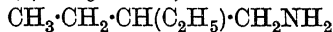
Needles from  $H_2O$ . M.p.  $179-80^\circ$ . Mod. sol. EtOH, Et<sub>2</sub>O. Spar. sol.  $CHCl_3$ ,  $C_6H_6$ , ligroin.

Gieke, *Ber.*, 1896, 29, 2537.

## Aminoethylbromide.

See Bromoethylamine.

**1-Amino-2-ethyl-*n*-butane** (2-Ethyl-*n*-butylamine,  $\psi$ -hexylamine)



$C_6H_{15}N$  MW, 101

B.p.  $125^\circ$ .

*B, HCl*: needles from EtOH. M.p.  $187^\circ$  decomp.

Freund, Herrmann, *Ber.*, 1890, 23, 192.

4-[ $\beta$ -Aminoethyl]-cyclohexanol.

See Hexahydrotyramine.

## Aminoethylene.

See under Ethyleneimine.

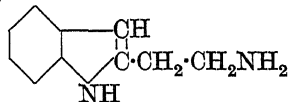
2- $\beta$ -Aminoethylfuran.

See 2-[ $\alpha$ -Furyl]-ethylamine.

4-[ $\omega$ -Aminoethyl]-glyoxaline.

See Histamine.

**2-[ $\omega$ -Aminoethyl]-indole** (2-[2-Indolyl]-ethylamine)



$C_{10}H_{12}N_2$  MW, 160

Prisms from  $C_6H_6$ . M.p.  $120^\circ$ . Fused with KOH  $\rightarrow$  indole-2-carboxylic acid.

*B, HCl*: leaflets. M.p.  $246^\circ$ .

*N-Benzoyl*: m.p.  $173-4^\circ$ .

*Benzylidene deriv.*:  $C_{17}H_{16}N_2$ . Leaflets. M.p.  $122^\circ$ .

Asahina, Mayeda, *Chem. Abstracts*, 1917, 11, 332.

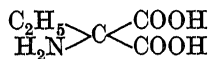
3-[ $\omega$ -Aminoethyl]-indole.

See Tryptamine.

## Aminoethyl iodide.

See 2-Iodoethylamine.

## Aminoethylmalonic Acid



$C_5H_9O_4N$  MW, 147

Cryst. +  $H_2O$ . M.p.  $122^\circ$  decomp. Sol.  $H_2O$ . Mod. sol. EtOH. Insol. Et<sub>2</sub>O. Heat at  $125^\circ \rightarrow$  1-aminobutyric acid.

*Di-Et ester*: *N-acetyl*, m.p.  $83^\circ$ .

Lutz, *Ber.*, 1902, 35, 2553.

## Aminoethyl Mercaptan.

See Mercaptoethylamine.

## Aminoethylnaphthalene.

See Naphthylethylamine.

*p*- $\beta$ -Aminoethylphenol.

See Tyramine.

*p*-Amino- $\alpha$ -ethylphenylacetic Acid.

See 1-*p*-Aminophenylbutyric Acid.

## 1-Aminoethyl phenyl Ketone.

See  $\beta$ -Aminopropiophenone.

## 2-Aminoethyl phenyl Ketone.

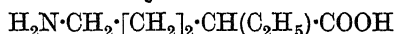
See  $\gamma$ -Aminopropiophenone.

5- $\beta$ -Aminoethylpyrogallol trimethyl Ether.

See Mescaline.

## Aminoethylsulphonic Acid.

See Taurine.

4-Amino-1-ethyl-*n*-valeric Acid

$C_7H_{15}O_2N$  MW, 145

Cryst. from boiling  $H_2O$ . M.p.  $200^\circ$  with effervescence. Sol.  $H_2O$ . Insol. EtOH, Et<sub>2</sub>O.

Aschan, *Ber.*, 1890, 23, 3693.

4-[ $\beta$ -Aminoethyl]-veratrol.

See Homoveratrylamine.

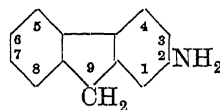
## Aminofenchane.

See Fenchylamine.

*p*-Aminoflavoline.

See Flavaniline.

## 2-Aminofluorene



$C_{13}H_{11}N$  MW, 181

Needles from 50% EtOH. M.p.  $129^\circ$ .

*N-Acetyl*: needles from 50% EtOH. M.p.  $191^\circ$ .

*N-Chloroacetyl*: m.p.  $189^\circ$ .

*N-Valeryl*: fine needles. M.p.  $166^\circ$ .

*N-Isovaleryl*: m.p.  $142^\circ$ .

*N-p-Aminobenzenesulphonyl*: m.p.  $239^\circ$ .

*N-Benzylidene*: m.p.  $152^\circ$ .

*N-Phthalimido*: m.p.  $276^\circ$ .

*Urethane*: prisms. M.p.  $121-2^\circ$ .

Kuhn, *Organic Syntheses*, 1933, XIII, 74.

Cf. Bennett, Noyes, *J. Am. Chem. Soc.*, 1930, 52, 3438.

Buu-Hoi, Royer, *Bull. soc. chim.*, 1946, 379.

## 9-Aminofluorene.

$\alpha$ -.

Cryst. from pet. ether. M.p.  $64^\circ$ . Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO,  $CHCl_3$ ,  $C_6H_6$ . Spar. sol.  $H_2O$ .

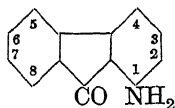
*B, HCl*: cryst. from boiling  $H_2O$ . M.p.  $255^\circ$ .

*N-Acetyl*: m.p.  $262^\circ$ .

N-Benzoyl: needles from EtOH. M.p. 260-1°.  
 γ-.  
 M.p. 46-7°. Unstable.  
 B,HCl: m.p. 216°.  
 N-Acetyl: m.p. 245-6°.

Kuhn, Jacob, *Ber.*, 1925, 58, 1432, 2232.  
 Ingold, Wilson, *J. Chem. Soc.*, 1933, 1499.

## 1-Aminofluorenone



C<sub>13</sub>H<sub>9</sub>ON MW, 195

Yellow needles from EtOH.Aq. M.p. 118-18.5° (110°). Very sol. org. solvents. Mod. sol. boiling H<sub>2</sub>O.

N-Acetyl: yellow. M.p. 138°.  
 N-Benzoyl: yellow. M.p. 149-50°.

Goldschmiedt, *Monatsh.*, 1902, 23, 886.

## 2-Aminofluorenone.

Violet-red prisms from EtOH. M.p. 163°. Mod. sol. EtOH, Et<sub>2</sub>O, AcOH. Spar. sol. pet. ether. Insol. H<sub>2</sub>O.

N-Acetyl: red cryst. M.p. 227-8°. *Hydrazone*: yellow leaflets. M.p. 212-14°.

N-Diacetyl: m.p. 143-4°.

N-Carbethoxyl: reddish-yellow needles from chlorobenzene. M.p. 167-8°.

*Hydrazone*: orange needles. M.p. 209°.

Dids, *Ber.*, 1901, 34, 1764.

## 3-Aminofluorenone.

Cryst. M.p. 158-9°.

N-Acetyl: pale yellow cryst. from AcOH.Aq. M.p. 215°.

Eckert, Langecker, *J. prakt. Chem.*, 1928, 118, 267.

## 4-Aminofluorenone.

Red needles from EtOH. M.p. 138°. Very sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

Courtot, *Ann. chim.*, 1930, 14, 77.

Graebe, Schestakow, *Ann.*, 1895, 284, 311.

## Aminoform.

See Hexamethylenetetramine.

## Aminoformic Acid.

See Carbamic Acid.

## Aminogentisic Acid.

See 2:5-Dihydroxy-3-aminobenzoic Acid.

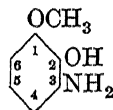
## Aminoglutaric Acid.

See Glutamic Acid.

## Aminogranatanine.

See Granatylamine.

## 3-Aminoguaiacol



C<sub>7</sub>H<sub>9</sub>O<sub>2</sub>N

MW, 139 C<sub>9</sub>H<sub>13</sub>N

Leaflets from pet. ether. M.p. 83.5°. FeCl<sub>3</sub> → wine-red col.

*Triacetyl*: needles from pet. ether. M.p. 122-4°.

Oxford, *J. Chem. Soc.*, 1926, 2007.

## 4-Aminoguaiacol.

M.p. 125-7°.

N-Acetyl: m.p. 116-19°.

ON-Dibenzoyl: m.p. 162-4°.

Jona, Pozzi, *Gazz. chim. ital.*, 1911, 41, i, 722.

## 5-Aminoguaiacol.

Prisms from H<sub>2</sub>O. M.p. 176-7° decomp. (184°).

N-β-Aminopropyl: creamy white prisms. M.p. 156-7°. B,HCl: plates. M.p. 251° decomp. *Picrate*: bright red prisms. M.p. 162°.

N-Acetyl: m.p. 111-13°.

Rupe, *Ber.*, 1897, 30, 2447.

## 6-Aminoguaiacol.

Needles from pet. ether. M.p. 95-6°. FeCl<sub>3</sub> → brown col.

Oxford, *J. Chem. Soc.*, 1926, 2007.

## Aminoguanazole.

See Guanazine.

## Aminoguanidine (Guanylhvdrazine)



CH<sub>6</sub>N<sub>4</sub> MW, 74

Cryst. Sol. H<sub>2</sub>O, EtOH. Insol. Et<sub>2</sub>O. Turns red in air. Strong base. *k* = 1.1 × 10<sup>-3</sup>.

B,HCl: prisms from EtOH.Aq. M.p. 163°. Sol. H<sub>2</sub>O, EtOH. Insol. Et<sub>2</sub>O.

B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>: needles + H<sub>2</sub>O. M.p. 207-8°.

B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>: plates. M.p. 161°.

B,HNO<sub>3</sub>: plates from H<sub>2</sub>O, needles from EtOH. M.p. 146°.

B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>: m.p. 145-6° decomp.

N-p-Aminobenzenesulphonyl: N<sup>4</sup>-acetyl, m.p. 117-118° decomp.

Trojan Powder Co., U.S.P., 1,990,511, (*Chem. Abstracts*, 1935, 29, 1836).

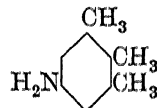
Smith, Anzelmi, *J. Am. Chem. Soc.*, 1935, 57, 2730.

du Pont, U.S.P., 2,033,203, (*Chem. Abstracts*, 1936, 30, 2992).

## 1-Amino-4-guanidinovaleric Acid.

See Arginine.

5-Aminohemimellitene (5-Amino-1:2:3-trimethylbenzene)



MW, 135



Needles. M.p. 75°. B.p. 240°. Insol. cold H<sub>2</sub>O.

*N*-Formyl: m.p. 98.5°.

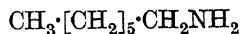
*N*-Acetyl: m.p. 163-4°.

Limpach, *Ber.*, 1888, 21, 643.

### 1-Aminoheptadecane.

See Heptadecylamine.

### 1-Amino-*n*-heptane (*n*-Heptylamine)



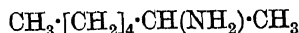
C<sub>7</sub>H<sub>17</sub>N MW, 115

F.p. -23.0°. B.p. 155.25°/760 mm. D<sub>20</sub><sup>4</sup> 0.777. *n*<sub>D</sub><sup>20</sup> 1.41954. Heat of comb. C<sub>p</sub> 1183, C<sub>v</sub> 1181.3 Cal.

*Picrate*: yellow needles. M.p. 120-2°.

Hoogewerff, van Dorp, *Rec. trav. chim.*, 1887, 6, 386.

### 2-Amino-*n*-heptane



C<sub>7</sub>H<sub>17</sub>N MW, 115

B.p. 142°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O. D<sub>4</sub><sup>19</sup> 0.7665. *n*<sub>D</sub><sup>19</sup> 1.41997.

*B*, *HCl*: needles. M.p. 81-3° (133°).

*B*, *HBr*: needles. M.p. 65.7° (163°).

*B*<sub>2</sub>, *H*<sub>2</sub>, *SO*<sub>4</sub>: m.p. 230-40°.

*B*, *H*, *AuCl*<sub>4</sub>: m.p. 82-4° (63-4°). Spar. sol. cold H<sub>2</sub>O.

*B*<sub>2</sub>, (*COOH*)<sub>2</sub>: plates. M.p. 226-8° (204°).

*B*<sub>2</sub>, *H*<sub>2</sub>, *PtCl*<sub>6</sub>: m.p. 225° decomp.

*Benzoate*: m.p. 95-7°.

*Malate*: m.p. 121-3°.

*Maleate*: m.p. 81-3°.

*Gluconate*: m.p. 141-3°.

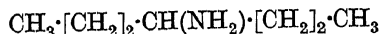
*Succinate*: m.p. 106-8°.

Clarke, *J. Am. Chem. Soc.*, 1899, 21, 1027.

Rohrmann, Shonle, *J. Am. Chem. Soc.*, 1944, 66, 1516.

Robinson, Snyder, *Organic Syntheses*, 1943, XXIII, 68.

### 4-Amino-*n*-heptane



C<sub>7</sub>H<sub>17</sub>N MW, 115

B.p. 139-40°. D<sub>4</sub><sup>20</sup> 0.767. Strong ammoniaical odour.

*B*, *HCl*: needles from H<sub>2</sub>O. M.p. 246-7°. Very sol. EtOH. Sol. cold H<sub>2</sub>O.

*B*<sub>2</sub>, *H*<sub>2</sub>, *PtCl*<sub>6</sub>: plates from H<sub>2</sub>O. Decomp. about 235°.

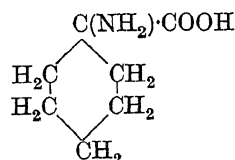
Noyes, *Am. Chem. J.*, 1893, 15, 542.

Pyman, *J. Chem. Soc.*, 1913, 103, 859.

### 1-Aminohexadecane.

See Cetylamine.

### 1-Aminohexahydrobenzoic Acid (1-Aminocyclohexane-1-carboxylic acid)



C<sub>7</sub>H<sub>13</sub>O<sub>2</sub>N MW, 143

Plates from H<sub>2</sub>O. M.p. 350° (320°) in sealed tube. Sol. H<sub>2</sub>O. Spar. sol. hot AcOH. Insol. other org. solvents. Sweet taste.

*B*, *HCl*: cryst. from H<sub>2</sub>O. M.p. 310° decomp.

*Et ester*: C<sub>9</sub>H<sub>17</sub>O<sub>2</sub>N. MW, 171. B.p. 100°/14 mm. D<sub>4</sub><sup>20</sup> 1.0182. *n*<sub>D</sub><sup>20</sup> 1.4614.

*Nitrile*: C<sub>7</sub>H<sub>12</sub>N<sub>2</sub>. MW, 124. Cryst. from Et<sub>2</sub>O. M.p. 26-7°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Reacts alkaline. *B*, *HCl*: plates from EtOH. M.p. 233° decomp.

*Picrate*: yellow needles. M.p. 209-10° decomp.

Zelinsky, Annenkov, Kulikow, *Z. physiol. Chem.*, 1911, 73, 466.

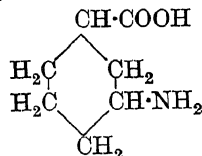
Cocker, Lapworth, Peters, *J. Chem. Soc.*, 1931, 1390.

Bucherer, Brandt, *J. prakt. Chem.*, 1934, 140, 142.

### *o*-Aminohexahydrobenzoic Acid.

See Hexahydroanthranilic Acid.

***m*-Aminohexahydrobenzoic Acid** (*Aminocyclohexane-3-carboxylic acid, cyclohexylamine-3-carboxylic acid*)



C<sub>7</sub>H<sub>13</sub>O<sub>2</sub>N MW, 143

Cryst. from EtOH.Aq. M.p. 268-9°. Sol. H<sub>2</sub>O. Insol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>.

*B*, *HCl*: leaflets from EtOH-Et<sub>2</sub>O. M.p. 156°.

*Et ester*: C<sub>9</sub>H<sub>17</sub>O<sub>2</sub>N. MW, 171. B.p. 123°/11 mm. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, Me<sub>2</sub>CO. Turns yellow in air. *N*-Chloroacetyl: needles from EtOH. M.p. 115°. *N*-Benzoyl: cryst. from ligroin. M.p. 111°.

*B*<sub>2</sub>, *H*<sub>2</sub>, *PtCl*<sub>6</sub>: orange-yellow prisms from H<sub>2</sub>O. M.p. 239°.

Bauer, Einhorn, *Ann.*, 1901, 319, 329.

***p*-Aminohexahydrobenzoic Acid** (*Aminocyclohexane-4-carboxylic acid, cyclohexylamine-4-carboxylic acid*).

*Cis*-

Leaflets from EtOH. M.p. 303-4°. Sol. H<sub>2</sub>O, AcOH. Spar. sol. MeOH, EtOH. Prac.

insol. Et<sub>2</sub>O, ligroin. Sublimes above 330°.  
Heat  $\rightarrow$  lactam, m.p. 196°. Bitter taste.

*B.HCl*: m.p. 217°.

*N-Acetyl*: m.p. 145-6°.

*N-Benzoyl*: m.p. 200°.

*Et ester, HBr*: m.p. 152-5°.

*Trans*-.  
*B.HCl*: m.p. 273°.

*N-Acetyl*: m.p. 234°.

*N-Benzoyl*: m.p. 272°.

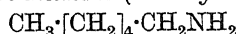
Houben, Pfau, *Ber.*, 1916, 49, 2296.

Ferber, Bruckner, *Ber.*, 1943, 76, 1019.

$\omega$ -Aminohexahydrotoluene.

See Hexahydrobenzylamine.

1-Amino-*n*-hexane (*n*-Hexylamine)



C<sub>6</sub>H<sub>15</sub>N MW, 101

*d*-. F.p. -19°. B.p. 129-30°/742 mm. D<sub>4</sub><sup>20</sup> 0.7855, D<sub>4</sub><sup>25</sup> 0.763. Heat of comb. C<sub>p</sub> 1026.1 Cal.

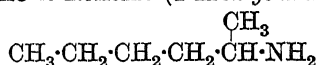
*B.HCl*: leaflets. M.p. 219°.

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: yellow leaflets. M.p. 236-8° decomp.

Frentzel, *Ber.*, 1883, 16, 744.

v. Braun, Sobacki, *Ber.*, 1910, 43, 3599.

2-Amino-*n*-hexane (1-Methyl-*n*-amylamine)



C<sub>6</sub>H<sub>15</sub>N MW, 101

*d*-.  
B.p. 70°/155 mm. D<sub>4</sub><sup>27</sup> 0.755.  $[\alpha]_{\text{D}}^{27} + 4.30^\circ$ .

$[\text{M}]_{\text{D}}^{25} + 4.3^\circ$ .

*B.HCl*: m.p. 102-3°.  $[\alpha]_{\text{D}}^{25} - 5.68^\circ$ .  $[\text{M}]_{\text{D}}^{25} - 7.82^\circ$  in EtOH.

*Benzoyl*: m.p. 86-8°.  $[\alpha]_{\text{D}}^{25} + 14.3^\circ$ .  $[\text{M}]_{\text{D}}^{25} + 29.7^\circ$  in EtOH.

*dl*-.  
B.p. 117-18°. D<sub>0</sub><sup>20</sup> 0.7534.

*B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>, H<sub>2</sub>O*: cryst. Sol. H<sub>2</sub>O. Spar. sol. EtOH. Shows adrenaline-type activity.

Konowalov, *Compt. rend.*, 1892, 114, 27.

Kishner, *Chem. Zentr.*, 1900, I, 957.

Levene, Mardashow, *J. Biol. Chem.*, 1937, 117, 707.

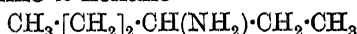
Levene, Rothen, Kuna, *J. Biol. Chem.*, 1937, 120, 759.

Levene, Kuna, *J. Biol. Chem.*, 1938, 122, 291.

Olin, Schwoegler, U.S.P. 2,373,705, (*Chem. Abstracts*, 1945, 39, 3541).

Lilly, B.P. 575,677, (*Chem. Abstracts*, 1947, 41, 6673).

3-Amino-*n*-hexane



C<sub>6</sub>H<sub>15</sub>N MW, 101

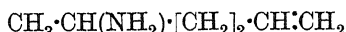
B.p. 130°.

*B.HCl*: m.p. 227-9°.

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 190-200°.

Bewad, *J. prakt. Chem.*, 1901, 63, 230.

5-Amino-1-hexene



C<sub>6</sub>H<sub>13</sub>N MW, 99

B.p. 117-18°. Misc. with H<sub>2</sub>O. D<sup>25</sup> 0.779.

Merling, *Ann.*, 1891, 264, 324.

4-Amino-2-hexene

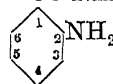


C<sub>6</sub>H<sub>13</sub>N MW, 99

B.p. 135°.

I.G., D.R.P., 487,787, (*Chem. Abstracts*, 1930, 24, 2140).

*o*-Aminohippuric Acid (*o*-Aminobenzoyl-aminoacetic acid, *o*-aminobenzoylglycine)



C<sub>9</sub>H<sub>10</sub>O<sub>3</sub>N<sub>2</sub> MW, 194

*Me ester*: C<sub>10</sub>H<sub>12</sub>O<sub>3</sub>N<sub>2</sub>. MW, 208. Cryst. from Et<sub>2</sub>O-pet. ether. M.p. 87-9°.

Späth, Kuffner, *Ber.*, 1934, 67, 1495.

*m*-Aminohippuric Acid (*m*-Aminobenzoyl-aminoacetic acid, *m*-aminobenzoylglycine).

Leaflets or needles from H<sub>2</sub>O or EtOH. M.p. 194°. Sol. hot H<sub>2</sub>O, hot EtOH, Et<sub>2</sub>O.

Schwanert, *Ann.*, 1859, 112, 70.

*p*-Aminohippuric Acid (*p*-Aminobenzoyl-aminoacetic acid, *p*-aminobenzoylglycine).

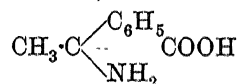
M.p. 198-9°.

Landsteiner, v. der Scheer, *Chem. Abstracts*, 1932, 26, 3293.

Aminohydracrylic Acid.

See Serine.

$\alpha$ -Aminohydratropic Acid ( $\alpha$ -Phenylalanine, 1-amino-1-phenylpropionic acid, amino-methylphenylacetic acid)



C<sub>9</sub>H<sub>11</sub>O<sub>2</sub>N MW, 165

*d*-.  
Prisms from H<sub>2</sub>O. Sublimes at 295°.  $[\alpha]_{\text{D}}^{18} + 70.0^\circ$  in H<sub>2</sub>O. Spar. sol. H<sub>2</sub>O. Insol. org. solvents. Gives deep blue col. with aq. CuSO<sub>4</sub>.

HNO<sub>2</sub>  $\rightarrow$  atrolactic acid.

*N-Formyl*: needles from H<sub>2</sub>O. M.p. 194-5° decomp.  $[\alpha]_{\text{D}}^{18} + 91.9^\circ$  in EtOH.

*l*-.  
Prisms from H<sub>2</sub>O. Sublimes at 295°.  $[\alpha]_{\text{D}}^{20} - 69.5^\circ$  in H<sub>2</sub>O.

*N-Formyl*: needles from H<sub>2</sub>O. M.p. 194-5° decomp.  $[\alpha]_{\text{D}}^{17} - 91.6^\circ$  in EtOH.

*dl.*

Needles from  $H_2O$ . Sublimes at  $260^\circ$ . Very sol.  $H_2O$ . Insol. EtOH,  $Et_2O$ .  $HNO_2 \rightarrow$  atrolactic acid.

*Et ester*:  $C_{11}H_{15}O_2N$ . MW, 193. B.p.  $135-6^\circ/15$  mm.  $n_D^{20}$  1.5135. *B,HCl*: m.p.  $121-3^\circ$ .

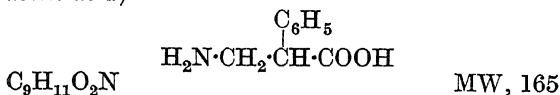
*Amide*: *B,HCl*: prisms. M.p. above  $250^\circ$ . *N-Carbethoxyl*: needles from EtOH.Aq. M.p.  $191^\circ$ .

*Nitrile*: yellow oil. B.p.  $101-4^\circ/12.5$  mm. *B,HCl*: yellowish needles from  $Et_2O$ . M.p.  $96-7^\circ$ .

McKenzie, Myles, *Ber.*, 1932, 65, 212.

McKenzie, Clough, *J. Chem. Soc.*, 1912, 101, 390.

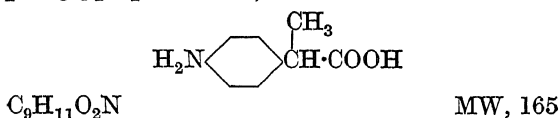
**$\alpha'$ -Aminohydratropic Acid** (*2-Amino-1-phenylpropionic acid*, *1-aminomethyl-1-phenylacetic acid*)

*dl.*

M.p.  $222-4^\circ$  ( $233^\circ$ ). Spar. sol.  $H_2O$ ,  $Et_2O$ ,  $Me_2CO$ ,  $CHCl_3$ ,  $C_6H_6$ ,  $CS_2$ , pet. ether.

McKenzie, Strathern, *J. Chem. Soc.*, 1925, 127, 85.

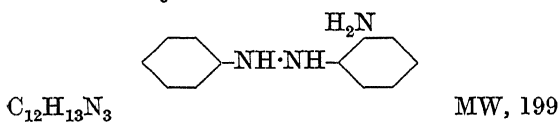
***p*-Aminohydratropic Acid** (*1-[p-Aminophenyl]-propionic acid*)



Yellow leaflets from  $H_2O$ . M.p.  $128^\circ$ . Sol.  $H_2O$ , EtOH,  $Et_2O$ ,  $CS_2$ .

Trinius, *Ann.*, 1885, 227, 267.

***o*-Aminohydrazobenzene**



Colourless prisms. M.p.  $94-5^\circ$ .

*2-N-Acetyl*: m.p.  $167-8^\circ$ .

Ruggli, Holzle, *Helv. Chim. Acta*, 1943, 26, 1190.

***m*-Aminohydrazobenzene.**

Yellow needles. M.p.  $107^\circ$ .

Ruggli, Holzle, *Helv. Chim. Acta*, 1943, 26, 1190.

***p*-Aminohydrazobenzene.**

Cryst. Unstable. Turns yellow at  $50^\circ$ , m.p.  $81-4^\circ$ .

*N-Acetyl*:  $C_{14}H_{15}ON_3$ . MW, 241. Pale yellow leaflets from EtOH.Aq. M.p.  $146^\circ$  decomp. Sol.

Det. of Org. Comp.—I.

EtOH,  $Et_2O$ . Insol.  $H_2O$ .  $SnCl_2 + HCl \rightarrow$  4-acetylamino-4'-aminodiphenylamine.

Schultz, *Ber.*, 1884, 17, 463.

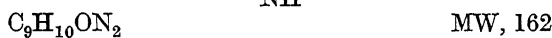
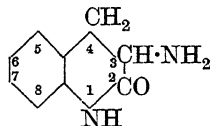
Jacobson, Kunz, *Ann.*, 1898, 303, 362.

Ruggli, Holzle, *Helv. Chim. Acta*, 1943, 26, 1190.

**Aminohydrindene.**

See Hydrindamine.

**3-Aminohydrocarbostyryl** (*3-Aminodihydrocarbostyryl*,  $\alpha$ : *2-diaminohydrocinnamic acid lactam*)



Cryst. from  $Et_2O$ . M.p.  $149-50^\circ$ . Sol.  $H_2O$ , EtOH,  $CHCl_3$ . Mod. sol.  $Et_2O$ ,  $C_6H_6$ . Diazotisation  $\rightarrow$  carbostyryl.

*B,HCl*: cryst. M.p. about  $310^\circ$  decomp.

*Picrate*: yellow leaflets +  $2H_2O$  from  $H_2O$ . M.p.  $214^\circ$  decomp.

*N-Phenyl*:  $C_{15}H_{14}ON_2$ . MW, 238. Cryst. M.p.  $178^\circ$ . Sol. AcOH, hot EtOH. Spar. sol.  $H_2O$ .

*N-Benzoyl*: cryst. from EtOH. M.p.  $205^\circ$ .

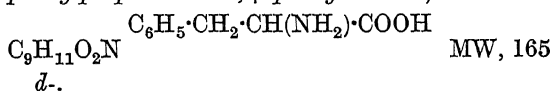
Ueda, *Ber.*, 1928, 61, 148.

**7-Aminohydrocarbostyryl** (*7-Aminodihydrocarbostyryl*,  $2$ : *4-diaminohydrocinnamic acid lactam*).

Needles or prisms. M.p.  $211^\circ$ . Sol. EtOH, hot  $H_2O$ . Spar. sol.  $Et_2O$ . Insol.  $CS_2$ .

Gabriel, Zimmermann, *Ber.*, 1879, 12, 602.

**$\alpha$ -Aminohydrocinnamic Acid** (*1-Amino-2-phenylpropionic acid*,  $\beta$ -phenylalanine)



*d.* Leaflets from  $H_2O$ . M.p.  $283-4^\circ$  decomp. (rapid heat). Sol. 35.5 parts  $H_2O$  at  $16^\circ$ .  $[\alpha]_D^{25} + 35.0^\circ$  in  $H_2O$ . Insol. most org. solvents.

*N-Formyl*: plates from  $H_2O$ . M.p.  $167^\circ$ . Sol. 145 parts  $H_2O$  at  $27^\circ$ .

*N-Benzoyl*: needles from hot  $H_2O$ . M.p.  $146-8^\circ$ .  $[\alpha]_D^{20} - 17.1^\circ$  in KOH.Aq.

*N-p-Toluenesulphonyl*: needles from 50% EtOH. M.p.  $164-5^\circ$ .  $[\alpha]_D^{20} + 2.4^\circ$  in  $Me_2CO$ .

*l.*

Widely distributed in plant proteins. Needles from  $H_2O$ . M.p.  $283^\circ$  decomp. (rapid heat).  $[\alpha]_D^{25} - 35.03^\circ$  in  $H_2O$ .  $k(\text{acid}) = 2.5 \times 10^{-9}$  at  $25^\circ$ .  $k(\text{base}) = 1.3 \times 10^{-12}$  at  $25^\circ$ . Sol. 33 parts  $H_2O$  at  $25^\circ$ .

*Et ester*: *B,HCl*: needles from EtOH- $Et_2O$ .  $[\alpha]_D^{20} - 7.6^\circ$  in  $H_2O$ .

*N-Formyl*: plates from H<sub>2</sub>O. M.p. 167°.  $[\alpha]_D^{20} + 75.2^\circ$  in EtOH.

*N-Chloroacetyl*: cryst. from H<sub>2</sub>O. M.p. 126°.  $[\alpha]_D^{20} + 51.80^\circ$  in H<sub>2</sub>O.

*N-Glycyl*: needles from H<sub>2</sub>O. M.p. 267° decomp.  $[\alpha]_D^{20} + 42.0^\circ$ . Bitter taste.

*Picrolonate*: m.p. 208° decomp.  $[\alpha]_D^{20} + 30.1^\circ$  in EtOH.

*dl.*

Prisms from H<sub>2</sub>O. M.p. 271–3°. Spar. sol. cold H<sub>2</sub>O, EtOH. Insol. Et<sub>2</sub>O. Sublimes part decomp. Sweet taste. Dry dist. → β-aminoethylbenzene.

*Me ester*: C<sub>10</sub>H<sub>13</sub>O<sub>2</sub>N. MW, 179. B.p. 141°/12 mm.  $D_4^{20} 1.096$ .  $n_D^{20} 1.5203$ . *B,HCl*: needles. M.p. 158° decomp. *N-Benzoyl*: cryst. from ligroin. M.p. 87°.

*Et ester*: C<sub>11</sub>H<sub>15</sub>O<sub>2</sub>N. MW, 193. B.p. 143°/10 mm.  $D_4^{20} 1.065$ . *B,HCl*: m.p. 127°. *Picrate*: prisms. M.p. 156.5°. *N-Benzoyl*: needles from ligroin. M.p. 95°.

*Amide*: C<sub>9</sub>H<sub>12</sub>ON<sub>2</sub>. MW, 164. Prisms from CHCl<sub>3</sub>. M.p. 138–40°. Sol. EtOH, hot CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. cold H<sub>2</sub>O. Alk. Cu sol. → violet col. *N-Benzoyl*: needles from CHCl<sub>3</sub>. M.p. 198°.

*N-Formyl*: cryst. from H<sub>2</sub>O. M.p. 163–9°. Sol. EtOH, MeOH. Mod. sol. Me<sub>2</sub>CO, AcOEt. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*N-Chloroacetyl*: plates from H<sub>2</sub>O. M.p. 130–1°. Sol. EtOH, Me<sub>2</sub>CO, CHCl<sub>3</sub>. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*N-Glycyl*: cryst. from hot EtOH. Aq. M.p. about 270°. Sol. H<sub>2</sub>O. Spar. sol. org. solvents.

*N-Benzoyl*: leaflets. M.p. 187–8°.

Fischer, Schoeller, *Ann.*, 1907, 357, 4.  
Curtius, Sieber, *Ber.*, 1922, 55, 1543.  
Bergmann, Stern, Witte, *Ann.*, 1926, 449, 289.

Locquin, Cerchez, *Bull. soc. chim.*, 1930, 47, 1386.

Hoffmann-La Roche, D.R.P., 484,838, (*Chem. Abstracts*, 1930, 24, 1123).

**β-Aminohydrocinnamic Acid (2-Amino-2-phenylpropionic acid)**

C<sub>9</sub>H<sub>11</sub>O<sub>2</sub>N MW, 165

*d.*

Plates from H<sub>2</sub>O. M.p. about 234–5°.  $[\alpha]_D^{20} + 7^\circ$  in H<sub>2</sub>O. Mod. sol. cold H<sub>2</sub>O. Spar. sol. warm EtOH.

*Et ester*: C<sub>11</sub>H<sub>15</sub>O<sub>2</sub>N. MW, 193. B.p. 155°/13 mm.  $D_4^{24} 1.063$ .  $[\alpha]_D^{24} + 13.7^\circ$ .

*N-Formyl*: needles from H<sub>2</sub>O. M.p. 142–3°.  $[\alpha]_D^{20} + 116.4^\circ$  in EtOH.

*l.*

Cryst. from H<sub>2</sub>O. M.p. 234–5°.  $[\alpha]_D^{20} - 7.5^\circ$  in H<sub>2</sub>O. Mod. sol. H<sub>2</sub>O, warm EtOH.

*Et ester*: b.p. 155°/13 mm.  $D_4^{20} 1.063$ .

*N-Formyl*: needles from H<sub>2</sub>O. M.p. 142–3°.  $[\alpha]_D^{20} - 114.4^\circ$  in EtOH.

*dl.*

Cryst. from H<sub>2</sub>O. M.p. 231°. Sol. hot H<sub>2</sub>O. Spar. sol. EtOH. Insol. Et<sub>2</sub>O. Tasteless.

*B,HCl*: prisms from EtOH. M.p. 218°. Sol. H<sub>2</sub>O. Less sol. EtOH.

*N-Formyl*: prisms from H<sub>2</sub>O. M.p. 128–9°. Sol. warm EtOH, Me<sub>2</sub>CO, AcOEt. Mod. sol. H<sub>2</sub>O. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Insol. pet. ether.

*N-Acetyl*: cryst. from EtOH. M.p. 161–2°.

*N-Benzoyl*: cryst. from MeOH. M.p. 194–6°.

Fischer, Scheibler, Groh, *Ber.*, 1910, 43, 2024.

Rodionow, Malewinskaja, *Ber.*, 1926, 59, 2956.

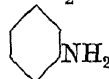
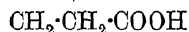
Rodionow, D.R.P., 479,228, (*Chem. Abstracts*, 1929, 23, 4777).

Johnson, Livak, *J. Am. Chem. Soc.*, 1936, 58, 301.

**o-Aminohydrocinnamic Acid.**

See Hydrocarbostyryl.

**m-Aminohydrocinnamic Acid (m-Amino-2-phenylpropionic acid)**



C<sub>9</sub>H<sub>11</sub>O<sub>2</sub>N MW, 165

Cryst. from H<sub>2</sub>O. M.p. 84–5°. Sol. EtOH, Et<sub>2</sub>O, AcOH.

*B,HCl*: needles. M.p. 191°.

*N-Acetyl*: cryst. from AcOH. Aq. M.p. 162°.

De, *J. Indian Chem. Soc.*, 1928, 5, 31.

Slotta, Szyszka, *Ber.*, 1935, 68, 188.

**p-Aminohydrocinnamic Acid (p-Amino-2-phenylpropionic acid).**

Leaflets or prisms from H<sub>2</sub>O. M.p. 132°.

*Et ester*: C<sub>11</sub>H<sub>15</sub>O<sub>2</sub>N. MW, 193. Cryst. from EtOH. M.p. 34°.

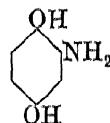
*N-Acetyl*: cryst. + H<sub>2</sub>O from AcOH. Aq. M.p. 124°, anhyd. 143°. Sol. EtOH, Et<sub>2</sub>O, AcOH. Spar. sol. C<sub>6</sub>H<sub>6</sub>.

*N-Benzoyl*: leaflets from 50% AcOH. M.p. 194–5°. Sol. AcOH. Spar. sol. other solvents.

Shoppee, *J. Chem. Soc.*, 1930, 985.

Stöhr, *Ann.*, 1884, 225, 59.

**Aminohydroquinone (2:5-Dihydroxyaniline)**



C<sub>6</sub>H<sub>7</sub>O<sub>2</sub>N MW, 125.

*N-Acetyl*: 2:5-dihydroxyacetanilide. Cryst. from Et<sub>2</sub>O. M.p. 100°. Sol. H<sub>2</sub>O, org. solvents..

*N-Benzoyl*: 4-*Me ether*: needles from EtOH.Aq. M.p. 160°. Sol. hot EtOH, C<sub>6</sub>H<sub>6</sub>. Spar. sol. Et<sub>2</sub>O, ligroin.

*Di-Me ether*: 2-amino-1:4-dimethoxybenzene, 2:5-dimethoxyaniline C<sub>8</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 153. M.p. 81°. B.p. 270° part decomp. Sol. H<sub>2</sub>O, EtOH, hot ligroin. *N-Acetyl*: 2:5-dimethoxyacetanilide. Cryst. from H<sub>2</sub>O. M.p. 91°. Sol. H<sub>2</sub>O, EtOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, ligroin.

*Di-Et ether*: 2-amino-1:4-diethoxybenzene, 2:5-diethoxyaniline. C<sub>10</sub>H<sub>15</sub>O<sub>2</sub>N. MW, 181. White cryst. M.p. 86-7° uncorr. B.p. 138°/1-2 mm.

4-*Benzoyl*: plates from EtOH.Aq. M.p. 161-4°.

Roberts, de Worms, Clark, *J. Chem. Soc.*, 1935, 198.

Bässler, *Ber.*, 1884, 17, 2119.

Kehrmann, Bahatryan, *Ber.*, 1898, 31, 2400.

### Amino- $\omega$ -hydroxyacetophenone.

See Aminophenacyl Alcohol.

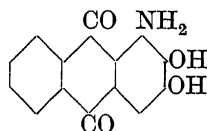
### 1-Amino-2-[4-hydroxycyclohexyl]-propionic Acid.

See Hexahydrotyrosine.

### 2-Aminohypoxanthine.

See Guanine.

### 1-Aminohystazarin (2:3-Dihydroxy-1-aminoanthraquinone)



C<sub>14</sub>H<sub>9</sub>O<sub>4</sub>N MW, 255

Orange-red. Does not melt below 316°.

*Di-Me ether*: C<sub>18</sub>H<sub>13</sub>O<sub>4</sub>N. MW, 283. M.p. 171.5°.

Waldmann, Wider, *J. prakt. Chem.*, 1938, 150, 107.

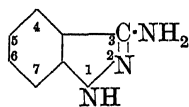
### 1-Amino-2-iminazolylpropionic Acid.

See Histidine.

### Aminoindanol.

See Hydroxyhydrindamine.

### 3-Aminoindazole (3-Aminobenzopyrazole)



C<sub>7</sub>H<sub>7</sub>N<sub>3</sub> MW, 133

Prisms from Et<sub>2</sub>O-C<sub>6</sub>H<sub>6</sub>. M.p. 154°.

B, H<sub>2</sub>SO<sub>4</sub>: needles. M.p. 223-4°.

*Diacetyl deriv.*: needles. M.p. 177-8°.

*Dibenzoyl deriv.*: needles from xylene. M.p. 182°.

3-*N-p-Aminobenzenesulphonyl*: m.p. 225-6°.  
N<sup>4</sup>-*Acetyl*: m.p. 253°.

Bamberger, *Ber.*, 1922, 55, 3371.

### 4-Aminoindazole (4-Aminobenzopyrazole).

Leaflets. M.p. 151°. Sol. Me<sub>2</sub>CO, EtOH, hot H<sub>2</sub>O. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

4-*N-Acetyl*: prisms. M.p. 145-8°.

*N-Diacetyl deriv.*: two forms. Stable, m.p. 202°; labile, m.p. 155-60°. Dil. HCl → 4-acetyl-aminoindazole hydrochloride, m.p. 223-5°.

Auwers, Schwegler, *Ber.*, 1920, 53, 1211.

### 5-Aminoindazole (5-Aminobenzopyrazole).

Needles. M.p. 181°.

5-*N-Acetyl*: cryst. from H<sub>2</sub>O. M.p. 165°.

5-*N-p-Aminobenzenesulphonyl*: m.p. 248°.  
N<sup>4</sup>-*Acetyl*: m.p. 250-2°.

Fries, Tampke, *Ann.*, 1927, 454, 306.

### 6-Aminoindazole (6-Aminobenzopyrazole).

Needles from H<sub>2</sub>O. M.p. 210°. Sol. boiling H<sub>2</sub>O. Mod. sol. EtOH. Sublimes. Strong base.

B, 2HCl: needles. Decomp. at 230°.

6-*N-Acetyl*: needles from EtOH.Aq. M.p. 248°. Sol. EtOH. Distils undecomp.

*Diacetyl deriv.*: needles from EtOH.Aq. M.p. 184-5°.

6-*N-p-Aminobenzenesulphonyl*: m.p. 195-6°.  
N<sup>4</sup>-*Acetyl*: m.p. 245-6°.

Witt, Nölting, Grandmougin, *Ber.*, 1890, 23, 3640.

### 7-Aminoindazole (7-Aminobenzopyrazole).

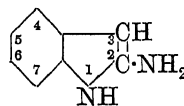
Leaflets from EtOH.Aq. M.p. 155-6°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O, ligroin. Turns red in air. FeCl<sub>3</sub> + HCl → red col. → violet.

*N-Diacetyl deriv.*: needles or prisms from EtOH. M.p. 161°.

7-*N-p-Aminobenzenesulphonyl*: m.p. 254-6°.  
N<sup>4</sup>-*Acetyl*: m.p. 258-60°.

Nölting, *Ber.*, 1904, 37, 2577.

### 2-Aminoindole ( $\alpha$ -Aminoindole, $\alpha$ -indolylamine, 2-indolylamine)



C<sub>8</sub>H<sub>8</sub>N<sub>2</sub> MW, 132

Prisms from EtOH. Sol. EtOH. Mod. sol. hot H<sub>2</sub>O. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Aq. sol. reacts alkaline. Turns violet in air. Na + EtOH → indole.

2-*N-Acetyl*: 2-acetylaminindole. M.p. 167°.

*Diacetyl deriv.*: greenish needles from MeOH. M.p. 142°. Warm K<sub>2</sub>CO<sub>3</sub> → mono-acetyl (above).

Pschorr, Hoppe, *Ber.*, 1910, 43, 2543.

### 3-Aminoindole ( $\beta$ -Aminoindole, $\beta$ -indolylamine, 3-indolylamine).

Leaflets from H<sub>2</sub>O. M.p. 117° decomp.

3-*N-Acetyl*: plates from EtOH. M.p. 162-3° decomp.

Madelung, *Ann.*, 1914, 405, 92.

**6-Aminoindole** (6-Indolylamine).

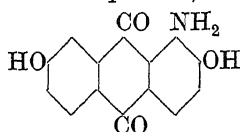
Amorph. ppt. Very unstable.

*B, HCl*: pale yellow needles.Majima, Kotake, *Ber.*, 1930, 63, 2241.**1-Amino-2-[3-indolyl]-propionic Acid.**

See Tryptophan.

**2-Aminoisoamyl Alcohol.**

See Valinol.

**1-Aminoisoanthraflavic Acid** (2:7-Dihydroxy-1-aminoanthraquinone) $C_{14}H_9O_4N$  MW, 255

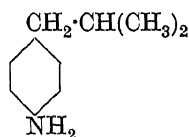
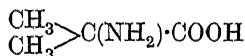
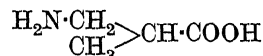
Greenish black cryst. from EtOH. Sol. alkalis with purple col.

Perkin, *J. Chem. Soc.*, 1878, 33, 216.**1-Aminoisobutane.**

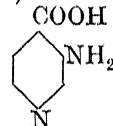
See Isobutylamine.

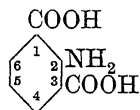
**1-Aminoisobutylic Acid.**

See Leucine.

 **$\alpha$ -Aminoisobutylbenzene** (1-Phenylisobutylamine) $C_{10}H_{15}N$  MW, 149B.p. 214°.  $D_4^{20}$  0.920.  $n_D^{20}$  1.51226.*B, HCl*: m.p. 275-7° decomp. $B_2$ , (COOH) $_2$ : m.p. 120-2° decomp.*Picrate*: yellow needles. M.p. 166-8°.Konowalow, *Ber.*, 1895, 28, 1859.**p-Aminoisobutylbenzene** (p-Isobutylamine) $C_{10}H_{15}N$  MW, 149Pale yellow liq. B.p. 235-6°/762 mm. Misc. with usual org. solvents. Almost insol.  $H_2O$ .*N-Acetyl*: plates from EtOH. M.p. 127-8°.*N-p-Toluenesulphonyl*: prisms from EtOH. M.p. 136-7°. Sol. MeOH, Et $_2O$ , C $_6H_6$ , AcOEt. Spar. sol. CCl $_4$ , pet. ether.Hickinbottom, Preston, *J. Chem. Soc.*, 1930, 1569.**1-Aminoisobutyric Acid** $C_4H_9O_2N$  MW, 103Prisms from  $H_2O$ . Sublimes at 280° without melting. Sol.  $H_2O$ . Spar. sol. EtOH. Insol. Et $_2O$ .  $HNO_2$   $\rightarrow$  1-hydroxyisobutyric acid. Sweet taste.*Me ester*: C $_5H_{11}O_2N$ . MW, 117. B.p. 136°/749 mm., 45°/20 mm.  $D_4^{19}$  0.9787. *B, HCl*: m.p. 183°. Sol.  $H_2O$ , EtOH.*Et ester*: C $_6H_{13}O_2N$ . MW, 131. B.p. 38-5-41°/11 mm.  $D_4^{17}$  1.0974.  $n_D^{17}$  1.4169. *N-Acetyl*: prisms from Et $_2O$ . M.p. 88°.*Nitrile*: C $_4H_8N_2$ . MW, 84. Oil. B.p. 51-2°/15 mm., 49-50°/12 mm.  $D_4^{16}$  0.8899. Sol.  $H_2O$ , EtOH, Et $_2O$ , C $_6H_6$ . Aq. sol. reacts alkaline to litmus. *B, HCl*: needles from EtOH-Et $_2O$ . M.p. 144-6°. *N-Acetyl*: plates or needles from Et $_2O$ . M.p. 106°.*Amide*: C $_4H_{10}ON_2$ . MW, 102. Cryst. from CHCl $_3$ -pet. ether. M.p. 127°. Sol.  $H_2O$ , EtOH. Spar. sol. pet. ether. *B, HBr*: cryst. from EtOH. Aq. M.p. 200-10° decomp.*N-Benzoyl*: m.p. 202° decomp.Dubsky, Wensink, *Ber.*, 1916, 49, 1139.Zelinsky, Stadnikow, *Ber.*, 1906, 39, 1726.Jacobson, *J. Am. Chem. Soc.*, 1946, 68, 2628.**2-Aminoisobutyric Acid** ( $\alpha$ -Methyl- $\beta$ -alanine) $C_4H_9O_2N$  MW, 103White cryst. from  $H_2O$ . M.p. 177° (182°). Found in urine.*Et ester*: b.p. 71°/13 mm., 35-6°/1 mm.*Picrate*: m.p. 108-9°.Clemo, Melrose, *J. Chem. Soc.*, 1942, 424.Pollack, *J. Am. Chem. Soc.*, 1943, 65, 1335.Crumpler *et al.*, *Nature*, 1951, 167, 307.**1-Aminoisocaproic Acid.**

See Leucine.

**Aminohexane.**See 2-Methyl-*n*-amylamine, 4-Amino-2-methyl-*n*-pentane and Isohexylamine.**2-Aminohexyl Alcohol.**See 2-Amino-4-methyl-*n*-amyl Alcohol.**3-Aminoisonicotinic Acid** (3-Aminopyridine-4-carboxylic acid) $C_6H_6O_2N_2$  MW, 138Prisms from  $H_2O$ . M.p. 306-10° (292°) decomp. Sol. boiling  $H_2O$ , EtOH. Sol. acids, bases. Sublimes. Distil with lime  $\rightarrow$  3-aminopyridine.*B, HCl*: prisms. M.p. 244-5° decomp.*B, HNO $_3$* : yellowish needles. M.p. 196-7°.*Me ester*: C $_7H_8O_2N_2$ . MW, 152. Yellow needles from pet. ether. M.p. 86-7°. Aq. sol. deposits a hydrate, m.p. 50° (rapid heat.).Gabriel, Colman, *Ber.*, 1902, 35, 2832.

**Aminoisopentane.**See Amino-2-methyl-*n*-butane.**2-Aminoisophthalic Acid** $C_8H_7O_4N$  MW, 181

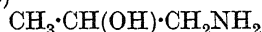
Yellow plates from EtOH. M.p. above 260°.

Sol. EtOH, Et<sub>2</sub>O. Mod. sol. H<sub>2</sub>O.

N-Acetyl: needles from EtOH.Aq. Decomp. at 205-6°.

Noelting, Gachot, *Ber.*, 1906, 39, 74.**4-Aminoisophthalic Acid.**Needles from H<sub>2</sub>O. M.p. 336-7°. Sol. EtOH, hot AcOH. Mod. sol. Et<sub>2</sub>O, Me<sub>2</sub>CO. Spar. sol. H<sub>2</sub>O.1-Me ester: C<sub>9</sub>H<sub>9</sub>O<sub>4</sub>N. MW, 195. Cryst. from EtOH. M.p. 224-5° decomp.  $k = 4.4 \times 10^{-5}$  at 25°. N-Acetyl: m.p. 218-19°.  $k = 6.9 \times 10^{-4}$  at 25°.3-Me ester: cryst. from MeOH. M.p. 228-30° decomp.  $k = 2.67 \times 10^{-5}$  at 25°.Di-Me ester: C<sub>10</sub>H<sub>11</sub>O<sub>4</sub>N. MW, 209. Needles from EtOH. M.p. 131.5°. N-Acetyl: cryst. from MeOH. M.p. 126°. N-Benzoyl: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 132°.1-Et ester: C<sub>10</sub>H<sub>11</sub>O<sub>4</sub>N. MW, 209. Cryst. from EtOH. M.p. 216-18°.  $k = 4.0 \times 10^{-5}$  at 25°. N-Acetyl: cryst. from EtOH. M.p. 193-4°.Di-Et ester: C<sub>12</sub>H<sub>15</sub>O<sub>4</sub>N. MW, 237. Cryst. from EtOH. M.p. 79-80°. N-Acetyl: needles from EtOH. M.p. 109-10°.N-Acetyl: cryst. from H<sub>2</sub>O. M.p. 295-6° decomp.N-Me: C<sub>9</sub>H<sub>9</sub>O<sub>4</sub>N. MW, 195. Cryst. from EtOH. M.p. 298° decomp. Sol. EtOH. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O, xylene. Insol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, ligroin. 1-Me ester: C<sub>10</sub>H<sub>11</sub>O<sub>4</sub>N. MW, 209. Cryst. from MeOH. M.p. 244-5° decomp. Di-Me ester: C<sub>11</sub>H<sub>13</sub>O<sub>4</sub>N. MW, 233. Cryst. from MeOH. M.p. 115°. Volatile in steam. N-Acetyl: needles from H<sub>2</sub>O. M.p. 223° decomp.  $k$  (first) =  $7.2 \times 10^{-4}$ ,  $k$  (second) =  $5.6 \times 10^{-5}$  at 25°.N-Di-Me: C<sub>10</sub>H<sub>11</sub>O<sub>4</sub>N. MW, 209. Cryst. from EtOH. M.p. 285° decomp.  $k = 2.65 \times 10^{-4}$  at 25°. 1-Me ester: C<sub>11</sub>H<sub>13</sub>O<sub>4</sub>N. MW, 223. Prisms from C<sub>6</sub>H<sub>6</sub>. M.p. 180°.  $k = 5.6 \times 10^{-7}$  at 25°. 3-Me ester: plates from C<sub>6</sub>H<sub>6</sub>. M.p. 190°. Di-Me ester: C<sub>12</sub>H<sub>15</sub>O<sub>4</sub>N. MW, 237. Plates from EtOH. M.p. 71°.Ullmann, Uzbachian, *Ber.*, 1903, 36, 1804.Wegscheider, *Monatsh.*, 1916, 37, 219.Wegscheider, Malle, Ehrlich, Skutezky, *Monatsh.*, 1918, 39, 375.**5-Aminoisophthalic Acid.**Prisms from EtOH. M.p. above 300°. Sol. 962 parts H<sub>2</sub>O at 15°, 108 parts at 99°. FeCl<sub>3</sub> → reddish-brown col.N-Acetyl: red needles from H<sub>2</sub>O. Decomp. at 314-15°.

N-Benzoyl: prisms from AcOH. Decomp. above 360°.

Di-Me ester: plates from MeOH. M.p. 176°. Sol. Et<sub>2</sub>O with violet-red fluor. Spar. sol. H<sub>2</sub>O.Di-Et ester: plates from EtOH. M.p. 118°. Sol. Et<sub>2</sub>O with violet-red fluor. Spar. sol. H<sub>2</sub>O.Meyer, Wesche, *Ber.*, 1917, 50, 450.**1-Aminoisopropyl Alcohol (1-Amino-propanol-2, isopropanolamine, 2-hydroxy-n-propylamine)** $C_3H_7ON$  MW, 75

l.

[ $\alpha$ ]<sub>D</sub> about -25.5°.B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>: yellow needles from EtOH. M.p. 198° decomp. [ $\alpha$ ]<sub>D</sub><sup>20</sup> -12.2°.

dl.

B.p. 160-1°/750 mm. D<sub>15</sub><sup>20</sup> 0.973. Sol. H<sub>2</sub>O.

B.HCl: cryst. from EtOH-AcOEt. M.p. 72.5-74°.

B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>: yellow leaflets. M.p. 195°.

N-Chloroacetyl: cryst. M.p. 33-4°. B.p. 131-2°/0.6 mm.

Picrate: yellow cryst. M.p. 142°.

Levene, Kuna, *J. Biol. Chem.*, 1936, 113, 153.Levene, Scheidegger, *J. Biol. Chem.*, 1924, 60, 179.Levene, Walti, *J. Biol. Chem.*, 1927, 71, 461.Brachfeld, Smola, Austrian P., 135,351, (*Chem. Abstracts*, 1934, 28, 1355).Karrer, Klarer, *Helv. Chim. Acta*, 1925, 8, 394.**Aminoisopropylbenzene.**

See Cumidine.

 **$\alpha$ -Aminoisopropylbenzene.**

See 1-Phenylisopropylamine.

 **$\beta$ -Aminoisopropylbenzene.**

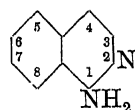
See Phenylpropylamine.

**3-Amino-4-isopropylbenzoic Acid.**

See 3-Aminocuminic Acid.

**Aminoisopropyl Mercaptan.**

See 2-Mercaptopropylamine.

**1-Aminoisoquinoline** $C_9H_8N_2$  MW, 144Plates from H<sub>2</sub>O. M.p. 122-3°. Sol. EtOH. Spar. sol. Et<sub>2</sub>O. HNO<sub>3</sub> → isocarbostyryl.B.HCl: m.p. 233°. Sol. H<sub>2</sub>O, EtOH. Insol. Et<sub>2</sub>O.B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>, 2H<sub>2</sub>O: orange needles. M.p. above 300°. Spar. sol. H<sub>2</sub>O, EtOH, Me<sub>2</sub>CO.

N-Acetyl: m.p. 148-8.5°.

*N*-Dibenzoyl: m.p. 223·5–4·5°.

*N*-*p*-Aminobenzenesulphonyl: m.p. 264–7°.

*N*<sup>4</sup>-Acetyl: m.p. 246–7°.

*Picrate*: yellow cryst. M.p. 290–1°. Spar. sol. H<sub>2</sub>O, EtOH, Me<sub>2</sub>CO.

Bergstrom, *Ann.*, 1934, 515, 34.

Tschitschibabin, Oparina, *Chem. Zentr.*, 1923, III, 1023.

Craig, Cass, *J. Am. Chem. Soc.*, 1942, 64, 783.

#### 4-Aminoisoquinoline.

M.p. 108°.

*N*-Acetyl: m.p. 167–8°.

*N*-Benzoyl: m.p. 188–9°.

*N*-*p*-Aminobenzenesulphonyl: m.p. 211·5–212·5°. *N*<sup>4</sup>-Acetyl: m.p. 304–6° decomp.

Bergstrom, Rodda, *J. Am. Chem. Soc.*, 1940, 62, 3030.

Craig, Cass, *J. Am. Chem. Soc.*, 1942, 64, 783.

#### 5-Aminoisoquinoline.

Needles from pet. ether. M.p. 128°.

*N*-Acetyl: m.p. 166°.

*N*-Benzoyl: m.p. 158–9°.

*N*-*p*-Aminobenzenesulphonyl: m.p. 223–4° decomp. *N*<sup>4</sup>-Acetyl: m.p. 284–8° decomp.

*B*,*HCl*: needles. M.p. 220° decomp.

*Picrate*: yellow cryst. Decomp. above 200°.

*Methochloride*: yellow needles from H<sub>2</sub>O. M.p. 288° decomp.

*Methiodide*: yellow needles from EtOH. M.p. 228°.

*Ethiodide*: yellow needles. M.p. 216°.

Claus, Gutzeit, *J. prakt. Chem.*, 1895, 52, 18.

Tyson, *J. Am. Chem. Soc.*, 1939, 61, 183.

Craig, Cass, *J. Am. Chem. Soc.*, 1942, 64, 783.

#### 8-Aminoisoquinoline.

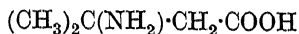
M.p. 174°.

Robinson, *J. Am. Chem. Soc.*, 1947, 69, 1944.

#### 1-Aminoisovaleric Acid.

See Valine.

#### 2-Aminoisovaleric Acid



C<sub>5</sub>H<sub>11</sub>O<sub>2</sub>N MW, 117

Cryst. + H<sub>2</sub>O from EtOH.Aq., needles (anhyd.) from Et<sub>2</sub>O–EtOH. M.p. 217°. Very sol. H<sub>2</sub>O. Spar. sol. EtOH. Insol. Et<sub>2</sub>O. Sweet taste.

*B*,*HCl*: needles + H<sub>2</sub>O. M.p. 120°. Sol. H<sub>2</sub>O, EtOH. Insol. Et<sub>2</sub>O.

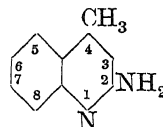
*Et ester*: C<sub>7</sub>H<sub>15</sub>O<sub>2</sub>N. MW, 145. B.p. 170°/760 mm., 75°/22 mm. D<sub>4</sub><sup>20</sup> 0·8165. *B*,*HCl*: m.p. 75°. Very hygroscopic.

Slimmer, *Ber.*, 1902, 35, 408.

#### 2-Aminolactic Acid.

See Isoserine.

#### 2-Aminolepidine (2-Amino-4-methylquinoline)



C<sub>10</sub>H<sub>10</sub>N<sub>2</sub> MW, 158

Cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 133°. B.p. 320°. Sol. EtOH, Et<sub>2</sub>O, AcOH, CHCl<sub>3</sub>, hot C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O. Not volatile in steam.

*Sulphate*: needles from dil. H<sub>2</sub>SO<sub>4</sub>. M.p. 155°.

*B*<sub>2</sub>*H*<sub>2</sub>*PtCl*<sub>6</sub>: orange needles. M.p. 230°.

*Picrate*: yellow needles. M.p. about 250°.

*N*-Phenyl: plates from EtOH. M.p. 129–30°.

Ephraim, *Ber.*, 1892, 25, 2707.

#### 5-Aminolepidine (5-Amino-4-methylquinoline).

Pale yellow. M.p. 82·5–3·5°.

*B*,*HCl*: yellow. M.p. 285–9° decomp.

Krahler, Burger, *J. Am. Chem. Soc.*, 1941, 63, 2367.

#### 6-Aminolepidine (6-Amino-4-methylquinoline).

Needles from H<sub>2</sub>O. M.p. 169–70°. Sol. EtOH, CHCl<sub>3</sub>. Mod. sol. Et<sub>2</sub>O, hot H<sub>2</sub>O.

*Chloroplatinate*: cryst. M.p. above 300°.

Busch, Koenigs, *Ber.*, 1890, 23, 2685.

#### 8-Aminolepidine (8-Amino-4-methylquinoline).

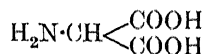
M.p. 84°.

Johnson, Hamilton, *J. Am. Chem. Soc.*, 1941, 63, 2864.

#### Aminolutidine.

See 4-Amino-2:6-dimethylpyridine.

#### Aminomalonic Acid



C<sub>3</sub>H<sub>5</sub>O<sub>4</sub>N MW, 119

Prisms + H<sub>2</sub>O. M.p. 109° with effervescence → glycine + CO<sub>2</sub>. Loses water of cryst. in desiccator. Spar. sol. EtOH. Boiling H<sub>2</sub>O → glycine. *k* = 7·74 × 10<sup>-4</sup> at 25°. Iodine → mesoxalic acid.

*Di-Me ester*: C<sub>5</sub>H<sub>9</sub>O<sub>4</sub>N. MW, 147. *B*,*HCl*: leaflets from MeOH–Et<sub>2</sub>O. M.p. 159°. *N*-Formyl: cryst. from MeOH. M.p. 85°. Spar. sol. Et<sub>2</sub>O.

*Di-Et ester*: C<sub>7</sub>H<sub>13</sub>O<sub>4</sub>N. MW, 175. B.p. 116–18°/12 mm. Sol. H<sub>2</sub>O, org. solvents. Absorbs CO<sub>2</sub>. *B*,*HCl*: needles from Me<sub>2</sub>CO. M.p. 162° decomp. *B*,*(COOH)*<sub>2</sub>: needles. M.p. 138°. Sol. H<sub>2</sub>O, EtOH. Insol. Et<sub>2</sub>O, ligroin.



*N-Formyl*: m.p. 48°. *N-Acetyl*: m.p. 95–6°. *N-Benzoyl*: cryst. from pet. ether. M.p. 61°. *N-Carbethoxyl*: needles from EtOH.Aq. M.p. 163°.

*Diamide*: aminomalonamide.  $C_3H_7O_2N_3$ . MW, 117. Needles from EtOH. M.p. 167° (192°). *N-Formyl*: prisms from EtOH.Aq. M.p. 214° decomp. *N-Carbethoxyl*: leaflets from EtOH. M.p. 178°.

Locquin, Cerchez, *Compt. rend.*, 1928, 186, 1360.

Levene, Schormüller, *J. Biol. Chem.*, 1934, 106, 600.

Johnson, Nicolet, *J. Am. Chem. Soc.*, 1914, 36, 361.

### Aminomenthane.

See Menthylamine.

### $\alpha$ -Amino- $\beta$ -mercaptoisovaleric Acid.

See Penicillamine.

### Aminomercaptopropionic Acid.

See Cysteine and Isocysteine.

### Aminomesitylene.

See Mesidine and 3 : 5-Dimethylbenzylamine.

### Aminomesitylenic Acid.

See Amino-3 : 5-dimethylbenzoic Acid.

### Aminomethoxybenzoic Acid.

See under 4-Hydroxy-*m*-aminobenzoic Acid, 3-, 4-, 5-, and 6-Hydroxyanthranilic Acids, and 3- and 5-Aminosalicyclic Acids.

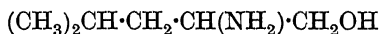
### Amino-*N*-methylacetanilide.

See under *N*-Methylphenylenediamine.

### Amino-methylamino-valeric Acid.

See under Ornithine.

**2-Amino-4-methyl-*n*-amyl Alcohol** (1-Hydroxy-2-amino-4-methyl-*n*-pentane, 2-amino-isoheptyl alcohol, leucinol)



$C_6H_{15}ON$  MW, 117

B.p. 198–200°/768 mm. Sol.  $H_2O$ , EtOH. Spar. sol.  $Et_2O$ .  $D^{13}_4$  0.9173.

*Picrolonate*: yellow cryst. Decomp. at 245–7°.

*d*-.

B.p. 98–9°/11 mm.

*Oxalate*: m.p. 216°.  $[\alpha]^{20}_D - 7.0^\circ$ .

*l*-.

B.p. 98–9°/11 mm.

*Oxalate*: m.p. 216°.  $[\alpha]^{20}_D + 7.0^\circ$ .

*Picrate*: m.p. 120–1°.  $[\alpha]^{25}_D + 5.9^\circ$  in MeOH.

Mousset, *Chem. Zentr.*, 1902, I, 400.

Karrer, Karrer, Thomann, Horlacher, Mäder, *Helv. Chim. Acta*, 1921, 4, 90.

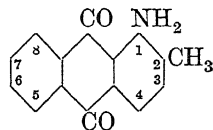
Enz, Leuenberger, *Helv. Chim. Acta*, 1946, 29, 1048.

Adkins, Pavlic, *J. Am. Chem. Soc.*, 1947, 69, 3039.

### Amino-methylaniline.

See Methylphenylenediamine.

### 1-Amino-2-methylanthraquinone



$C_{15}H_{11}O_2N$  MW, 237

Red needles from EtOH or  $PhNO_2$ . M.p. 205°. Sol. EtOH,  $CHCl_3$ ,  $C_6H_6$ , AcOH. Spar. sol.  $Et_2O$ . Insol.  $H_2O$ .

*N-Phenyl*: 1-anilino-2-methylanthraquinone.  $C_{21}H_{15}O_2N$ . MW, 313. Violet needles from AcOH. M.p. 229.5°. Sol.  $C_6H_6$ , toluene.

*N-Acetyl*: light red needles from AcOH. M.p. 176–7°.

*N-Diacetyl*: m.p. 203–6°.

*N-p-Toluenesulphonyl*: yellow prisms from AcOH. M.p. 218°. Sol. AcOH,  $C_6H_6$ . Insol. EtOH,  $Et_2O$ .

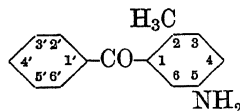
Ullmann, Bincer, *Ber.*, 1916, 49, 742.

### 3-Amino-2-methylanthraquinone.

Orange-red needles from  $PhNO_2$ . M.p. 258–9°.

A.G.F.A., D.R.P., 281,010 (*Chem. Zentr.*, 1915, I, 32).

### 5-Amino-2-methylbenzophenone (Phenyl 5-amino-*o*-tolyl ketone)



$C_{14}H_{13}ON$  MW, 211

*B, HCl*: m.p. 120–50°.

$B_2, H_2SO_4$ : needles +  $\frac{1}{2}H_2O$ . M.p. anhyd. 147–9°.

*N-Benzoyl*: needles from EtOH. M.p. 136–8°.

Hanschke, *Ber.*, 1899, 32, 2029.

### 2'-Amino-2-methylbenzophenone (2-Aminophenyl *o*-tolyl ketone).

Bright yellow needles. M.p. 84°.

*N-Acetyl*: m.p. 104°.

Inagak, *Chem. Abstracts*, 1939, 33, 3791.

Lothrop, Goodwin, *J. Am. Chem. Soc.*, 1943, 65, 363.

### 4-Amino-3-methylbenzophenone (Phenyl 4-amino-*m*-tolyl ketone).

Pale yellow prisms from  $H_2O$ . M.p. 112°. Sol. EtOH. Spar. sol.  $H_2O$ .

*B, HCl*: plates. M.p. 215–20° decomp.

$B_2, H_2SO_4$ : plates. Decomp. at 105–10°.

*N-Acetyl*: plates from EtOH. M.p. 175°.

*N-Propionyl*: needles from EtOH. M.p. 128°.

*N-Benzoyl*: prisms from EtOH. M.p. 158°.

Chattaway; Lewis, *J. Chem. Soc.*, 1904, 85, 590.

**6-Amino-3-methylbenzophenone** (*Phenyl 6-amino-m-tolyl ketone*).

Yellow needles or hexagonal plates. M.p. 66°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, AcOH, CHCl<sub>3</sub>, pet. ether.

*B.HCl*: m.p. 195-7° (179-80°).

*N-Acetyl*: plates from EtOH. M.p. 159°.

*N-Propionyl*: plates from EtOH. M.p. 99°.

*N-Benzoyl*: needles from EtOH. M.p. 118°.

*Picrate*: yellow prisms from EtOH. M.p. 145°.

Hanschke, *Ber.*, 1899, 32, 2023.

Chattaway, Lewis, *J. Chem. Soc.*, 1904, 85, 594.

**2'-Amino-3-methylbenzophenone** (*2-Aminophenyl m-tolyl ketone*).

Yellow needles from MeOH.Aq. M.p. 57°.

Lothrop, Goodwin, *J. Am. Chem. Soc.*, 1943, 65, 363.

**2-Amino-4-methylbenzophenone** (*Phenyl 2-amino-p-tolyl ketone*).

Yellow needles from pet. ether. M.p. 66°.

Ritchie, *Chem. Abstracts*, 1947, 41, 3094.

**3-Amino-4-methylbenzophenone** (*Phenyl 3-amino-p-tolyl ketone*).

Yellow needles from MeOH. M.p. 109°. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>.

*B.HBr*: needles from dil. HBr. M.p. 130°.

*N-Acetyl*: needles from MeOH. M.p. 108°.

Weis, *Monatsh.*, 1928, 50, 109.

**2'-Amino-4-methylbenzophenone** (*o-Aminophenyl p-tolyl ketone*).

Yellow prisms or plates from EtOH. M.p. 96°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Picrate*: m.p. 146°.

Kippenberg, *Ber.*, 1897, 30, 1133.

**3'-Amino-4-methylbenzophenone** (*m-Aminophenyl p-tolyl ketone*).

Prisms from EtOH. M.p. 111°. Sol. EtOH, Et<sub>2</sub>O.

*B.HCl*: needles. M.p. 198°.

*B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>*: needles. M.p. 142°.

*N-Acetyl*: prisms from EtOH. M.p. 139°.

*Oxime*: prisms from EtOH. M.p. 146°.

Limpricht, Lenz, *Ann.*, 1895, 286, 312.

**4'-Amino-4-methylbenzophenone** (*p-Aminophenyl p-tolyl ketone*).

Cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 186-7°. Sol. EtOH, CHCl<sub>3</sub>, CS<sub>2</sub>. Spar. sol. pet. ether.

*B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>*: plates. M.p. 210-16° decomp.

*N-Acetyl*: plates from Et<sub>2</sub>O. M.p. 155°.

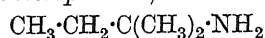
*Phenylhydrazone*: brownish-red cryst. from EtOH. M.p. 163°.

Limpricht, Samietz, *Ann.*, 1895, 286, 325.

Limpricht, Lenz, *Ann.*, 1895, 286, 312.

**1-Amino-2-methylbutane.**

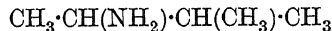
See 2-Methyl-*n*-butylamine.

**2-Amino-2-methyl-*n*-butane** (*tert.-Amylamine, 2-aminoisopentane*)

C<sub>5</sub>H<sub>13</sub>N MW, 87

B.p. 77-8°. Misc. with H<sub>2</sub>O. D<sub>4</sub><sup>0</sup> 0.756, D<sub>4</sub><sup>25</sup> 0.731.

Wyschnegradsky, *Ann.*, 1874, 174, 60.

**3-Amino-2-methyl-*n*-butane** (*3-Aminoisopentane*)

C<sub>5</sub>H<sub>13</sub>N MW, 87

B.p. 84-7°. D<sup>19</sup> 0.7574. HNO<sub>2</sub> → methylisopropylcarbinol.

*B<sub>2</sub>(COOH)<sub>2</sub>*: cryst. M.p. 220°.

Trasciatti, *Gazz. chim. ital.*, 1899, 29, II, 95.

**4-Amino-2-methyl-*n*-butane** (*Isoamylamine, 4-aminoisopentane, isopentylamine*)

C<sub>5</sub>H<sub>13</sub>N MW, 87

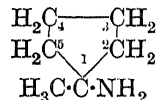
B.p. 95°. Misc. with H<sub>2</sub>O. D<sup>18</sup> 0.751. n<sub>D</sub><sup>18</sup> 1.4096. *k* = 5 × 10<sup>-4</sup> at 25°.

*N-Acetyl*: *N*-isoamylacetamide. B.p. 230-2° (238°).

Erickson, *Ber.*, 1926, 59, 2665.

**1-Amino-1-methyl-*n*-butyric Acid.**

See Isovaline.

**1-Amino-1-methylcyclopentane** (*1-Methylcyclopentylamine*)

C<sub>6</sub>H<sub>13</sub>N MW, 99

B.p. 120-2°. Sol. H<sub>2</sub>O. D<sup>20</sup> 0.8025.

*B.HAuCl<sub>4</sub>*: m.p. 173° decomp.

Markownikow, *Ann.*, 1899, 307, 371.

**2-Amino-1-methylcyclopentane** (*2-Methylcyclopentylamine*).

B.p. 123°. Spar. sol. H<sub>2</sub>O. D<sup>20</sup> 0.801.

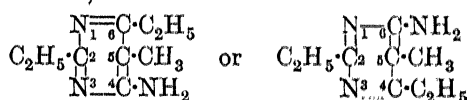
Markownikow, *Ann.*, 1899, 307, 371.

**3-Amino-1-methylcyclopentane** (*3-Methylcyclopentylamine*).

B.p. 124°. Misc. with H<sub>2</sub>O. D<sup>20</sup> 0.8422.

*N-Benzoyl*: needles from EtOll.Aq. M.p. 115-17°. Very sol. EtOH.

Markownikow, *Ann.*, 1899, 307, 349

**4-Amino-5-methyl-2 : 6-diethylpyrimidine** (*6-Amino-5-methyl-2 : 4-diethylpyrimidine, Cyanethine*)

C<sub>9</sub>H<sub>15</sub>N<sub>3</sub> MW, 165

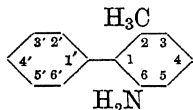
Cryst. from H<sub>2</sub>O or EtOH. M.p. 189°. B.p. 280° decomp. Aq. sol. weakly alkaline. Sol. 18 parts EtOH at 17°. Acid KMnO<sub>4</sub> → formic acid + ammonia. Forms cryst. nitrate and hydrochloride. Gives add. comp. with AgNO<sub>3</sub>.  
N-Acetyl : m.p. 59°.

Meyer, *J. prakt. Chem.*, 1888, 38, 584.

$\alpha$ -Aminomethyl-3 : 4-dihydroxyphenyl-carbinol.

See Arterenol.

6-Amino-2-methyldiphenyl (Phenyl-6-amino-o-tolyl)



C<sub>13</sub>H<sub>13</sub>N MW, 183  
M.p. 43-4°. B.p. 144-5°/2 mm. Sol. most org. solvents.

Sadler, Powell, *J. Am. Chem. Soc.*, 1934, 56, 2652.

4-Amino-3-methyldiphenyl (Phenyl-4-amino-m-tolyl).

M.p. 43°. B.p. 190-1°/15 mm. Misc. with most solvents. FeCl<sub>3</sub> → green col.  
N-Acetyl : cryst. from EtOH. M.p. 165.5° (158°). Sol. most org. solvents. Spar. sol. cold C<sub>6</sub>H<sub>6</sub>; pet. ether.

N-Benzoyl : m.p. 189°.

Benzylidene : yellow leaflets from EtOH. M.p. 108.5°.

I.G., F.P., 739,052, (*Chem. Zentr.*, 1933, II, 1255).

Pummerer, Binapfl, Schuegraf, *Ber.*, 1922, 55, 3099.

2-Amino-4-methyldiphenyl (Phenyl-2-amino-p-tolyl).

B.p. 183°/11 mm.

N-Acetyl : m.p. 150.5-1.5°.

N-Benzoyl : needles. M.p. 92°.

Picrate : golden needles. M.p. 161° decomp.

Petrow, *J. Chem. Soc.*, 1945, 18.

Ritchie, *Chem. Abstracts*, 1946, 40, 880.

2'-Amino-4-methyldiphenyl (2-Amino-phenyl-p-tolyl).

N-Benzoyl : cryst. M.p. 121°.

v. Braun, *Chem. Zentr.*, 1909, II, 1993.

4'-Amino-4-methyldiphenyl (4-Amino-phenyl-p-tolyl).

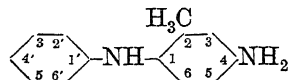
Cryst. from ligroin. M.p. 99°. B.p. 190°/18 mm. Very sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>; AcOH. Spar. sol. CCl<sub>4</sub>, CS<sub>2</sub>, ligroin.

B.HCl : cryst. M.p. 280-3°.

N-Acetyl : cryst. from AcOH. M.p. 221°.

Kliegl, Huber, *Ber.*, 1920, 53, 1650.

4-Amino-2-methyldiphenylamine (o-Anilino-m-toluidine, 2-N-phenyl-2 : 5-tolylenediamine)



C<sub>13</sub>H<sub>14</sub>N<sub>2</sub> MW, 198

Needles from pet. ether. M.p. 49-50°. B.p. 196-9°/4 mm. Sol. most org. solvents. Conc. H<sub>2</sub>SO<sub>4</sub> → reddish-violet col.

B.HCl : m.p. 185-7°.

N-Acetyl : needles from hot H<sub>2</sub>O. M.p. 139-40°.

Joszt, Lésniański, *Chem. Zentr.*, 1930, II, 3275.

5-Amino-2-methyldiphenylamine (o-Anilino-p-toluidine, 2-N-phenyl-2 : 4-tolylenediamine).

Cryst. from H<sub>2</sub>O. M.p. 93-5°.

Weiss, Katz, *Monatsh.*, 1928, 50, 230.

4'-Amino-2-methyldiphenylamine (p-Aminophenyl-o-tolylamine, o-tolyl-p-phenylenediamine).

Leaflets from ligroin. M.p. 58-9°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin. Insol. H<sub>2</sub>O.

Ullmann, Dahmen, *Ber.*, 1908, 41, 3750.

4-Amino-3-methyldiphenylamine (m-Anilino-o-toluidine, 5-N-phenyl-2 : 5-tolylenediamine).

M.p. 77-8° (70-1°).

I. G., D.R.P., 592,201, (*Chem. Abstracts*, 1934, 28, 3419).

Gen. Aniline Works, U.S.P., 1,900,426, (*Chem. Abstracts*, 1933, 27, 2963).

6-Amino-3-methyldiphenylamine (m-Anilino-p-toluidine, 3-N-phenyl-3 : 4-tolylenediamine).

Needles from ligroin. M.p. 87-8°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin.

Schraube, *Ber.*, 1893, 26, 581.

2-Amino-4-methyldiphenylamine (N-4-Phenyl-3 : 4-tolylenediamine, p-anilino-m-toluidine).

Needles from 20% EtOH. M.p. 140°.

B.HCl : needles. M.p. 200-1°.

N-Benzoyl : cryst. from EtOH. M.p. 161°.

Borsche, Feise, *Ber.*, 1907, 40, 384.

3-Amino-4-methyldiphenylamine (p-Anilino-o-toluidine, 4-N-phenyl-2 : 4-tolylenediamine).

Prisms from ligroin. M.p. 76-7°.

Bayer, D.R.P., 80,977.

2'-Amino-4-methyldiphenylamine (o-Aminophenyl-p-tolylamine, p-tolyl-o-phenylenediamine).

Leaflets from ligroin. M.p. 77°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. hot H<sub>2</sub>O. FeCl<sub>3</sub> on HCl sol. → reddish-violet col.

N-Benzoyl: needles. M.p. 143-4°.

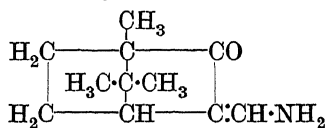
Borsche, Feise, *Ber.*, 1907, 40, 333.

**4'-Amino-4-methyldiphenylamine** (p-Aminophenyl-p-tolylamine, p-tolyl-p-phenylenediamine).

Leaflets from Et<sub>2</sub>O. M.p. 118°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, AcOH. Spar. sol. ligroin.

Ullmann, Dahmen, *Ber.*, 1908, 41, 3751.  
Gen. Aniline Works, U.S.P., 1,900,426,  
(*Chem. Abstracts*, 1933, 27, 2963).

### 3-Aminomethylenecamphor



C<sub>11</sub>H<sub>17</sub>ON MW, 179

*d.*

*Trans* or *α*-form:

Prisms from EtOH. M.p. 157°. Sol. MeOH, EtOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Insol. ligroin. [α]<sub>D</sub><sup>20</sup> + 257.32° in EtOH. Distil at 153-4°/10.5 mm. → β-form.

N-Benzoyl: needles from EtOH. M.p. 208°. Insol. H<sub>2</sub>O, ligroin.

N-p-Nitrobenzoyl: yellow leaflets from C<sub>6</sub>H<sub>6</sub>. M.p. 180-1°.

*Cis* or β-form:

Prisms from EtOH. M.p. 156°. [α]<sub>D</sub><sup>20</sup> + 313.76° in EtOH. More sol. than α-form. Very labile.

N-Benzoyl: cryst. from EtOH. M.p. 112°.

N-p-Nitrobenzoyl: orange needles with violet reflex from EtOH. M.p. 151-2°.

*l.*

Prisms from EtOH. M.p. 152°.

*dl.*

Plates. M.p. 165°. Sol. hot H<sub>2</sub>O, EtOH, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>.

N-Me: m.p. 131°.

N-Et: m.p. 118°.

Singh, Bhadhuri, *J. Indian Chem. Soc.*, 1932, 9, 112.

Rupe, Seiberth, Kussmaul, *Helv. Chim. Acta*, 1920, 3, 50.

### Aminomethylethylacetic Acid.

See Isovaline.

### Aminomethylethylbenzene.

See Ethyltoluidine.

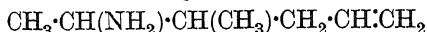
### Aminomethylfuran.

See Furfurylamine.

### 4-Aminomethylglyoxaline.

See 4-Iminazolylmethylamine.

### 5-Amino-4-methyl-1-hexene



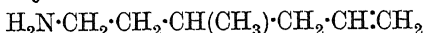
C<sub>7</sub>H<sub>15</sub>N MW, 113

B.p. 133-6°. D<sub>15</sub><sup>0</sup> 0.793.

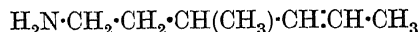
B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>: orange plates. M.p. 157-8° decomp. Sol. H<sub>2</sub>O.

Jacobi, Merling, *Ann.*, 1894, 278, 12.

### 6-Amino-4-methyl-1-hexene or 6-Amino-4-methyl-2-hexene



or



C<sub>7</sub>H<sub>15</sub>N MW, 113

B.p. 145-50°.

B<sub>2</sub>(COOH)<sub>2</sub>: cryst. + ½H<sub>2</sub>O from EtOH. M.p. 150°.

Wohl, Maag, *Ber.*, 1910, 43, 3289.

### Aminomethylhydrindene.

See Methylhydrindamine and Neomethylhydrindamine.

### Aminomethyl hydrogen sulphite



CH<sub>5</sub>O<sub>3</sub>NS MW, 111

Cryst. from H<sub>2</sub>O. Decomp. at 193°. Spar. sol. cold H<sub>2</sub>O. Prac. insol. EtOH. Decomp. by NaOH or boiling H<sub>2</sub>O.

Reinking, Dehnel, Labhardt, *Ber.*, 1905, 38, 1077.

### 3-ω-Aminomethylindole.

See Indolylmethylamine.

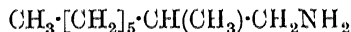
### 1-Aminomethylmalonic Acid.

See Isoaspartic Acid.

### Aminomethylnaphthalene.

See Methyl-naphthylamine and Naphthylmethylamine.

### 1-Amino-2-methyl-*n*-octane



C<sub>9</sub>H<sub>21</sub>N MW, 143

B.p. 185-6°.

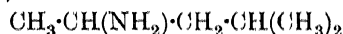
B, HCl: needles. M.p. 130°.

Freund, Schönfeld, *Ber.*, 1891, 24, 3355.

### 1-Amino-2-methylpentane.

See 2-Methyl-*n*-amylamine.

**4-Amino-2-methyl-*n*-pentane** (4-Amino-isohexane)



C<sub>6</sub>H<sub>15</sub>N MW, 101

B.p. 100-3°.

B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>: orange-yellow leaflets from H<sub>2</sub>O. M.p. 205° decomp.

B<sub>2</sub>(COOH)<sub>2</sub>: cryst. M.p. 219°.

Kerp, *Ann.*, 1896, 290, 149.

Gulewitsch, Wasmus, *Ber.*, 1906, 39, 1192.

**5-Amino-2-methyl-*n*-pentane.**

See Isohexylamine.

**1-Amino-3-methylpentane.**

See 3-Methyl-*n*-amylamine.

**2-Amino-2-methylpentanone-4.**

See Diacetoneamine.

**2-Amino-3-methyl-2-pentenone-4.**

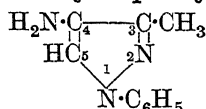
See 2-Imino-3-methylpentanone-4.

**Aminomethylphenanthrene.**

See Phenanthrylmethylamine.

**Aminomethylphenylcarbinol.**

See  $\alpha$ -Hydroxy- $\beta$ -aminoethylbenzene.

**4-Amino-3-methyl-1-phenylpyrazole**

$C_{10}H_{11}N_3$  MW, 173

Needles from  $C_6H_6$ -pet. ether. M.p.  $88^\circ$ . B.p.  $312-13^\circ$ . Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O. Insol. pet. ether. Sol. dil. acids.

*B, HCl*: plates from EtOH-Et<sub>2</sub>O. M.p.  $209^\circ$ . Sol. H<sub>2</sub>O.

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: yellow needles. M.p.  $226^\circ$ .

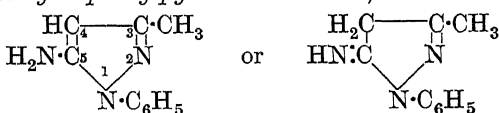
*Picrate*: yellow needles from EtOH. M.p.  $138^\circ$  decomp.

*N-Formyl*: needles + 1H<sub>2</sub>O from EtOH.Aq. M.p.  $81^\circ$ , anhyd.  $112-13^\circ$ .

*N-Acetyl*: needles + 1H<sub>2</sub>O. M.p.  $94-5^\circ$ , anhyd.  $120^\circ$ .

*N-Benzoyl*: needles from  $C_6H_6$ -pet. ether. M.p.  $181^\circ$ .

Michaelis, Schäfer, *Ann.*, 1915, **407**, 238.

**5-Amino-3-methyl-1-phenylpyrazole (3-Methyl-1-phenylpyrazolone-5-imide)**

$C_{10}H_{11}N_3$  MW, 173

Needles or prisms from H<sub>2</sub>O. M.p.  $116^\circ$ . B.p.  $333^\circ$ ,  $197^\circ/16$  mm. Sol. 50 parts boiling H<sub>2</sub>O, 20 parts boiling Et<sub>2</sub>O, 2 parts boiling C<sub>6</sub>H<sub>6</sub>. Sol. acids. Insol. alkalis.

*B, HCl*: m.p.  $199-200^\circ$ . Sol. H<sub>2</sub>O, EtOH.

*B, HAuCl<sub>4</sub>*: m.p.  $90^\circ$ . Sol. EtOH. Insol. H<sub>2</sub>O.

*N-Acetyl*: cryst. M.p.  $110^\circ$ .

*Picrate*: m.p.  $160-2^\circ$ .

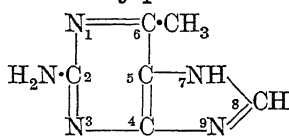
*5-N-Et*:  $C_{12}H_{15}N_3$ . MW, 201. Oil. B.p.  $315^\circ$ .

*5-N-Phenyl*:  $C_{16}H_{15}N_3$ . MW, 249. Needles from EtOH.Aq. M.p.  $124^\circ$ . B.p.  $365-6^\circ$ . *B, HCl.3H<sub>2</sub>O*: m.p.  $67^\circ$ , anhyd.  $118^\circ$ .

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>.5H<sub>2</sub>O*: orange needles. M.p.  $135^\circ$ .

Mohr, *J. prakt. Chem.*, 1909, **79**, 16.

Crippa, Caracci, *Gazz. chim. ital.*, 1940, **70**, 389.

**2-Amino-6-methylpurine**

$C_6H_7N_5$  MW, 149

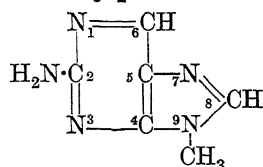
Needles. M.p. above  $300^\circ$  decomp. Sol. hot H<sub>2</sub>O. Spar. sol. hot EtOH.

Gabriel, Colman, *Ber.*, 1901, **34**, 1256.

**2-Amino-7-methylpurine.**

Needles from H<sub>2</sub>O. M.p.  $283^\circ$ . Sol. hot H<sub>2</sub>O. Spar. sol. EtOH, C<sub>6</sub>H<sub>6</sub>.

Fischer, *Ber.*, 1898, **31**, 2555.

**2-Amino-9-methylpurine**

$C_6H_7N_5$  MW, 149

Needles from H<sub>2</sub>O. M.p.  $247^\circ$ . Sublimes. Sol. 2 parts boiling H<sub>2</sub>O, 6-8 parts boiling EtOH. Mod. sol. hot CHCl<sub>3</sub>, hot C<sub>6</sub>H<sub>6</sub>.

*B, HCl*: plates. Sol. H<sub>2</sub>O.

Fischer, *Ber.*, 1898, **31**, 2570.

**6-Amino-methylpurine.**

See Methyladenine.

**8-Amino-9-methylpurine.**

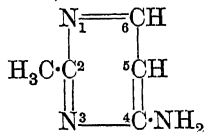
Prisms from H<sub>2</sub>O. Decomp. before melting. Aq. sol. neutral.

*B, HCl*: needles. Sol. H<sub>2</sub>O.

Fischer, *Ber.*, 1897, **30**, 1857.

**Aminomethylpyridine.**

See Aminopicoline.

**4-Amino-2-methylpyrimidine (2-Methylpyrimidone-4-imide)**

$C_5H_7N_3$  MW, 109

Cryst. from Me<sub>2</sub>CO. M.p.  $205^\circ$ . Sol. H<sub>2</sub>O with alk. reaction. Sol. EtOH, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>.

*B, HCl*: pale yellow. M.p.  $230^\circ$ .

*B, HNO<sub>3</sub>*: prisms. Decomp. at  $213-14^\circ$ . Mod. sol. H<sub>2</sub>O.

*B, HAuCl<sub>4</sub>*: needles. M.p.  $203^\circ$  decomp. Sol. hot H<sub>2</sub>O.

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: m.p.  $248-50^\circ$  decomp. Sol. H<sub>2</sub>O.

*N-p-Aminobenzenesulphonyl*: m.p.  $207-8^\circ$ .

Gabriel, *Ber.*, 1904, **37**, 3641.

**2-Amino-4-methylpyrimidine** (*4-Methylpyrimidone-2-imide*)Plates from  $H_2O$ . M.p. 159–60°.N-p-Aminobenzenesulphonyl: m.p. 236–8°.  
N<sup>4</sup>-Acetyl: m.p. 248°.Gabriel, Colman, *Ber.*, 1899, **32**, 2925.Benary, *Ber.*, 1930, **63**, 2601.Northey, U.S.P., 2,378,318, (*Chem. Abstracts*, 1946, **40**, 369).Dvornikoff, U.S.P., 2,391,882, (*Chem. Abstracts*, 1946, **40**, 1889).**5-Amino-4-methylpyrimidine** (*4-Methylpyrimidone-5-imide*).

M.p. 151–1.5°.

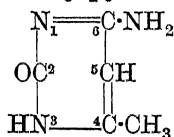
N-p-Aminobenzenesulphonyl: m.p. 233–5.5° decomp. N<sup>4</sup>-Acetyl: m.p. 246–7.5° decomp.Backer, Grevenstuk, *Rec. trav. chim.*, 1942, **61**, 291.**6-Amino-4-methylpyrimidine** (*4-Methylpyrimidone-6-imide*).Prisms from  $H_2O$ . M.p. 197–7.5° (194–5°). Sublimes. Sol.  $H_2O$ .N-Phenyl: needles from  $H_2O$ . M.p. 146°.

N-p-Nitrobenzenesulphonyl: m.p. 204.5–6.5°.

N-p-Aminobenzenesulphonyl: m.p. 209–11°.

Gabriel, Colman, *Ber.*, 1899, **32**, 2928.**2-Amino-5-methylpyrimidine** (*5-Methylpyrimidone-2-imide*).Prisms from  $H_2O$ . M.p. 193.5°. Sol. EtOH. Mod. sol.  $C_6H_6$ , ligroin. Insol.  $Et_2O$ . $B_2H_2PtCl_6$ : plates. Decomp. at 255°.2-N-Me:  $C_6H_9N_3$ . MW, 123. Prisms from ligroin. M.p. 102°. Sublimes above 100°. Sol.  $H_2O$ ,  $Et_2O$ ,  $C_6H_6$ .Gerngross, *Ber.*, 1905, **38**, 3398.**4-Amino-5-methylpyrimidine** (*5-Methylpyrimidone-4-imide*).Plates from EtOH. M.p. 176°. Sol.  $C_6H_6$ . Spar. sol.  $Et_2O$ ,  $CHCl_3$ , ligroin.

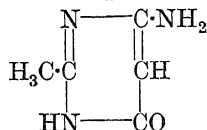
Picrate: needles. M.p. 219–21°.

Gerngross, *Ber.*, 1905, **38**, 3403.**6-Amino-4-methylpyrimidone-2** $C_5H_7ON_3$ 

MW, 125

Prisms from  $H_2O$ . M.p. above 310°. Sol. 250 parts  $H_2O$  at 24°. Sol. AcOH, ammonia.Picrate: yellow needles from  $H_2O$ . Decomp. at 265°.6-N-Me:  $C_6H_9ON_3$ . MW, 139. Cryst. from  $H_2O$ . Decomp. at 290°. Sol. AcOH. Mod. sol. hot  $H_2O$ . Spar. sol. EtOH.6-N-Et:  $C_7H_{11}ON_3$ . MW, 153. Prisms from  $H_2O$ . M.p. 245–50° decomp. Sol. hot EtOH,acids, alkalis. Insol.  $Et_2O$ . Hydrochloride: plates. M.p. 214–15°.Johns, *Am. Chem. J.*, 1908, **40**, 352.**4-Amino-5-methylpyrimidone-2.**

See 5-Methylcytosine.

**6-Amino-2-methylpyrimidone-4** $C_5H_7ON_3$ 

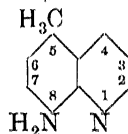
MW, 125

Cryst. from  $H_2O$ . M.p. 298–300° decomp. Sol. AcOH, min. acids, alkalis. Spar. sol.  $H_2O$ , EtOH,  $Et_2O$ ,  $C_6H_6$ .Traube, D.R.P., 135,371, (*Chem. Zentr.*, 1902 II. 1229).**2-Amino-5-methylpyrimidone-4.**Prisms from  $H_2O$ . M.p. 320–1° decomp. Sol. 250 parts  $H_2O$  at 25°. Sol. alkalis. $B_2H_2PtCl_6$ : leaflets +  $2H_2O$ . M.p. 254–5°.2-N-Me:  $C_6H_9ON_3$ . MW, 139. Cryst. +  $1H_2O$  from  $H_2O$ . M.p. 213°. Sol.  $C_6H_6$ , hot EtOH.  $B_2H_2SO_4$ : m.p. 202°. Sol.  $H_2O$ . Insol. EtOH. Picrate: m.p. 240° decomp.Johnson, Clapp, *Am. Chem. J.*, 1904, **32**, 135.Scherp, *J. Am. Chem. Soc.*, 1946, **68**, 912.**2-Amino-6-methylpyrimidone-4.**Needles from  $H_2O$ . M.p. 297–9° decomp. Sol. acids, alkalis. Spar. sol.  $H_2O$ , EtOH,  $CHCl_3$ , pet. ether. Insol.  $Et_2O$ . Aq. sol. reacts alkaline. $B_2HCl$ : needles. M.p. 295°. $B_2H_2SO_4$ : m.p. 180°.2-N-Me: plates from  $H_2O$ . M.p. 202°. Sol. EtOH, acids, alkalis.  $B_2HCl, \frac{1}{3}H_2O$ : m.p. 253°.N-p-Aminobenzenesulphonyl: m.p. 253–4°.  
N<sup>4</sup>-Acetyl: m.p. 273°.Gabriel, Colman, *Ber.*, 1899, **32**, 2924.**Amino-2-methylquinoline.**

See Aminoquinaldine.

**Amino-4-methylquinoline.**

See Aminolepidine.

**8-Amino-5-methylquinoline** $C_{10}H_{10}N_2$ 

MW, 158

M.p. 137–8.5° (46–7°).

Elderfield et al., *J. Am. Chem. Soc.*, 1946, **68**, 1524.**5-Amino-6-methylquinoline.**Yellow needles from  $H_2O$ . M.p. 145°. Sublimes. Sol. common org. solvents. Spar. sol.  $H_2O$ .

*N-Acetyl*: needles from H<sub>2</sub>O. M.p. 160°. Spar. sol. H<sub>2</sub>O.

Noelting, Trautmann, *Ber.*, 1890, **23**, 3657.

### 8-Amino-6-methylquinoline.

Needles. M.p. 73° (62-4°). Sublimes. Sol. H<sub>2</sub>O. Mod. volatile in steam.

*N-Acetyl*: plates from EtOH.Aq. M.p. 91-2°. 1 : 3 : 5-*Trinitrobenzene add. comp.*: red needles from EtOH. M.p. 139°.

Noelting, Trautmann, *Ber.*, 1890, **23**, 3670.

### 4-Amino-7-methylquinoline.

Cryst. from toluene. M.p. 163-4°.

Ramsey, Baldwin, Tipson, *J. Am. Chem. Soc.*, 1947, **69**, 67.

### 8-Amino-7-methylquinoline.

Golden yellow. M.p. (+ 1H<sub>2</sub>O) 41-3° (38-40°), anhyd. 61-2°. Volatile in steam.

*N-Acetyl*: m.p. 155°.

*N-Benzoyl*: m.p. 145-6°.

Elderfield *et al.*, *J. Am. Chem. Soc.*, 1946, **68**, 1524.

Bradford, Elliott, *J. Chem. Soc.*, 1947, 437.

Capps, *J. Am. Chem. Soc.*, 1947, **69**, 179.

### 2-Amino-8-methylquinoline.

Pale yellow needles from H<sub>2</sub>O.

Fischer, *Ber.*, 1902, **35**, 3679.

### 5-Amino-8-methylquinoline.

Yellow needles from H<sub>2</sub>O. M.p. 143°.

*N-Acetyl*: needles from H<sub>2</sub>O. M.p. 187°.

Noelting, Trautmann, *Ber.*, 1890, **23**, 3674.

### 6-Amino-8-methylquinoline.

Needles from benzene. M.p. 129°.

*N-Acetyl*: plates. M.p. 174-4-5°.

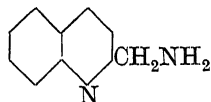
Hutchinson, Kermack, *J. Chem. Soc.*, 1947, 678.

### 7-Amino-8-methylquinoline.

Prisms from EtOH.Aq. M.p. 129°. B.p. 304°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O, ligroin.

Markwald, *Ann.*, 1893, **274**, 360.

### 2-Aminomethyl-quinoline (2-Quinaldylamine)



C<sub>10</sub>H<sub>10</sub>N<sub>2</sub> MW, 158

B.p. 104°/10 mm.

*B,2HCl*: yellow plates from alc. HCl. M.p. 245-6° decomp. (205°).

*Chloroplatinate*: decomp. at 220-5°.

Zimmer, D.R.P., 279,193, (*Chem. Zentr.*, 1914, II, 1174).

Graf, Perattioner, Tatzel, *J. prakt. Chem.*, 1936, 146, 101.

### 4-Aminomethyl-quinoline (4-Quinaldylamine).

B.p. 172°/8 mm. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.

*B,HCl*: cryst. from EtOH. M.p. 206-8° decomp. Sol. H<sub>2</sub>O, EtOH. Insol. Et<sub>2</sub>O.

Zimmer, D.R.P., 279,193, (*Chem. Zentr.*, 1914, II, 1174).

Graf, Perattioner, Tatzel, *J. prakt. Chem.*, 1936, 146, 101.

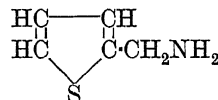
### 1-Amino-1-methylsuccinic Acid.

See Homoaspartic Acid.

### 1-Amino-1-methylsuccinic Monoamide.

See Homoasparagine.

### 2-Aminomethylthiophene (Thenylamine, thienylmethylamine)



C<sub>5</sub>H<sub>7</sub>ONS MW, 129

Liq. B.p. 88°/26 mm., 58°/5 mm. D<sub>4</sub><sup>15</sup> 1.1370. n<sub>D</sub><sup>15</sup> 1.5678, n<sub>D</sub><sup>20</sup> 1.5589.

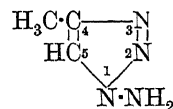
*B,HCl*: m.p. 193-4°.

Blicke, Burckhalter, *J. Am. Chem. Soc.*, 1942, **64**, 477.

Lukasiewicz, Murray, *J. Am. Chem. Soc.*, 1946, **68**, 1389.

Putokhin, Egorova, *Chem. Abstracts*, 1941, **35**, 4377.

### 1-Amino-4-methyl-1 : 2 : 3-triazole (N-Amino-β-methylpyrroldiazole)



C<sub>3</sub>H<sub>6</sub>N<sub>4</sub> MW, 98

*N-Benzoyl*: needles and leaflets from EtOH.Aq. M.p. 202°. Sol. EtOH, hot C<sub>6</sub>H<sub>6</sub>, alkalis and alk. carbonates. Almost insol. H<sub>2</sub>O, Et<sub>2</sub>O.

*N-Dibenzoyl*: needles from EtOH or C<sub>6</sub>H<sub>6</sub>. M.p. 152°. Spar. sol. Et<sub>2</sub>O.

*Benzylidene deriv.*: yellowish leaflets from EtOH.Aq. M.p. 94°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

Stollé, *Ber.*, 1926, **59**, 1746.

### 1-Amino-5-methyl-1 : 2 : 3-triazole (N-Amino-α-methylpyrroldiazole).

Leaflets from C<sub>6</sub>H<sub>6</sub>. M.p. 70°. Sol. H<sub>2</sub>O, EtOH, CHCl<sub>3</sub>. Spar. sol. Et<sub>2</sub>O. Reacts neutral. Does not reduce NH<sub>3</sub>.AgNO<sub>3</sub> or Fehling's.

*B,HCl*: needles from EtOH. M.p. 138° decomp. Aq. sol. reacts acid and reduces Fehling's.

*N-Benzoyl*: cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 158°. Sol. hot EtOH. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

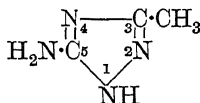
*N-Dibenzoyl*: cryst. from EtOH. M.p. 136°. Sol. hot EtOH. Spar. sol. Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

*Benzylidene deriv.*: cryst. from pet. ether. M.p. 67-8°. *B,HCl*: needles. M.p. 135-40° decomp.

Stollé, *Ber.*, 1926, 59, 1746.

Wolff, *Hall, Ber.*, 1903, 36, 3617.

### 5-Amino-3-methyl-1 : 2 : 4-triazole



C<sub>3</sub>H<sub>6</sub>N<sub>4</sub> MW, 98

Needles from AcOEt. M.p. 148°. Sol. H<sub>2</sub>O, EtOH.

*B,HNO<sub>3</sub>*: m.p. 171°.

*Picrate*: yellow needles. M.p. 225° decomp.

*Acetyl deriv.*: cryst. from H<sub>2</sub>O. M.p. above 270°.

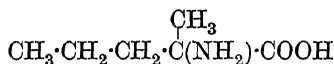
*Benzoyl deriv.*: cryst. from EtOH. M.p. 285-90° decomp.

*N-p-Aminobenzenesulphonyl*: m.p. 244-5°. *N<sup>4</sup>-Acetyl*: m.p. 298°.

Thiele, Heidenreich, *Ber.*, 1893, 26, 2599.

Morgan, Reilly, *J. Chem. Soc.*, 1916, 109, 155.

### 1-Amino-1-methyl-*n*-valeric Acid



C<sub>6</sub>H<sub>13</sub>O<sub>2</sub>N MW, 131

Needles from H<sub>2</sub>O. M.p. 295° (sealed tube). Very sol. H<sub>2</sub>O. Mod. sol. EtOH, MeOH. Insol. Et<sub>2</sub>O, Me<sub>2</sub>CO, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, toluene, ligroin.

*Cu salt*: dark blue. Chars at 200°. Very sol. H<sub>2</sub>O. Mod. sol. MeOH, EtOH, hot amyl alc. Insol. Me<sub>2</sub>CO.

*α-Naphthylurethane*: needles from EtOH. Aq. M.p. 196°.

Kurono, *Biochem. Z.*, 1922, 134, 434.

### 4-Amino-1-methyl-*n*-valeric Acid



C<sub>6</sub>H<sub>13</sub>O<sub>2</sub>N MW, 131

Leaflets from EtOH. M.p. 170-2° → 3-methyl-2-piperidone. Sol. H<sub>2</sub>O. Insol. EtOH, Et<sub>2</sub>O.

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: orange-yellow leaflets from EtOH. M.p. 202-3° decomp. Very sol. H<sub>2</sub>O. Spar. sol. EtOH.

Lipp, Widmann, *Ann.*, 1915, 409, 143.

### 1-Amino-2-methyl-*n*-valeric Acid.

See Isoleucine.

### 1-Aminomyristic Acid



C<sub>14</sub>H<sub>29</sub>O<sub>2</sub>N MW, 243

Cryst. powder from AcOH. M.p. 253°. Insol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, ligroin, dil. acids.

*Me ester*: C<sub>15</sub>H<sub>31</sub>O<sub>2</sub>N. MW, 257. *B,HCl*: m.p. 105°.

*Et ester*: C<sub>16</sub>H<sub>33</sub>O<sub>2</sub>N. MW, 271. *B,HCl*: cryst. from EtOH. M.p. 83°. Sol. H<sub>2</sub>O, EtOH. Spar. sol. Et<sub>2</sub>O. *N-Chloroacetyl*: m.p. 58°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>.

*N-Chloroacetyl*: m.p. 97°.

*N-Glycyl*: m.p. 205°. Spar. sol. H<sub>2</sub>O.

*N-Leucyl*: m.p. 218°. Insol. cold H<sub>2</sub>O, org. solvents.

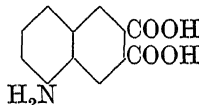
Abderhalden, Tanaka, *Chem. Zentr.*, 1924, I, 551.

Hell, Twerdomeow, *Ber.*, 1889, 22, 1747.

### Aminonaphthalene - 1 : 8 - dicarboxylic Acid.

See Aminonaphthalic Acid.

### 5-Aminonaphthalene - 2 : 3 - dicarboxylic Acid



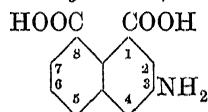
C<sub>12</sub>H<sub>9</sub>O<sub>4</sub>N MW, 231

Needles from 75% AcOH. M.p. above 360°.

*Anhydride*: *N-Acetyl*: needles. M.p. 290°.

Baker, *J. Chem. Soc.*, 1934, 1413.

### 3-Aminonaphthalic Acid (3-Aminonaphthalene-1 : 8-dicarboxylic acid)



C<sub>12</sub>H<sub>9</sub>O<sub>4</sub>N MW, 231

*Anhydride*: C<sub>12</sub>H<sub>7</sub>O<sub>3</sub>N. MW, 213. Yellow cryst. M.p. above 360°. *N-Acetyl*: yellow needles from AcOH. Spar. sol. EtOH, C<sub>6</sub>H<sub>6</sub>.

*Methylimide*: yellow needles from xylene. M.p. 278-80°. *N-Acetyl*: needles from nitrobenzene. M.p. 329-30°.

Francis, Simonsen, *J. Chem. Soc.*, 1935, 496.

I.G., F.P., 743,104, (*Chem. Zentr.*, 1934, I, 1249).

### 4-Aminonaphthalic Acid (4-Aminonaphthalene-1 : 8-dicarboxylic acid).

M.p. 200°. Na salt dist. with CaO → 1-naphthylamine.

*Chlorostannite*: needles. M.p. 274°.

*Chlorostannate*: pale yellow cryst. M.p. 182°.

*NH<sub>4</sub> salt*: m.p. 222° decomp.

*Anhydride*: m.p. above 350°.

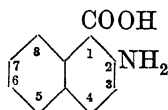


*Imide*: m.p. 325°. Sol. conc. H<sub>2</sub>SO<sub>4</sub> with yellow fluor.

*Methylimide*: m.p. 256–8°.

Graebe, Briones, *Ann.*, 1903, 327, 83.

### 2-Amino-1-naphthoic Acid (2-Amino- $\alpha$ -naphthoic acid)



C<sub>11</sub>H<sub>9</sub>O<sub>2</sub>N MW, 187

Needles from EtOH.Aq. M.p. 126° decomp. Sol. EtOH, Et<sub>2</sub>O, hot C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O. Loses CO<sub>2</sub> on heating alone or with HCl.

*N-Acetyl*: needles from EtOH. M.p. 195–6°. Sol. alkalis.

Friedländer, Littner, *Ber.*, 1915, 48, 328.

M.L.B., B.P., 252,820, (*Chem. Abstracts*, 1927, 21, 2477).

### 3-Amino-1-naphthoic Acid.

Yellowish-brown needles. M.p. 181–2°.

*N-Acetyl*: needles. M.p. 254–5°.

Leuch, Perkins, Whitmore, *J. Am. Chem. Soc.*, 1929, 51, 1834.

### 4-Amino-1-naphthoic Acid.

Needles from hot H<sub>2</sub>O. M.p. 177°. Spar. sol. C<sub>6</sub>H<sub>6</sub>, ligroin, cold H<sub>2</sub>O. Heat with HCl → 1-naphthylamine + CO<sub>2</sub>.

*Et ester*: C<sub>13</sub>H<sub>13</sub>O<sub>2</sub>N. MW, 215. M.p. 80°.

*Amide*: C<sub>11</sub>H<sub>10</sub>ON<sub>2</sub>. MW, 186. Needles. M.p. 175° decomp. Sol. EtOH, ligroin, hot H<sub>2</sub>O. Spar. sol. Et<sub>2</sub>O.

*Nitrile*: C<sub>11</sub>H<sub>8</sub>N<sub>2</sub>. MW, 168. Cryst. from H<sub>2</sub>O. M.p. 174°. Sol. EtOH, CHCl<sub>3</sub>. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*N-Acetyl*: needles from EtOH. M.p. 189°.

Weisberg, *Ber.*, 1895, 28, 1842.

Sergievskaya, Preobrazhenskaya, *J. Gen. Chem. U.S.S.R.*, 1940, 10, 950.

### 5-Amino-1-naphthoic Acid.

Needles from EtOH. M.p. 212°. Mod. sol. EtOH, AcOH. Spar. sol. Et<sub>2</sub>O, hot H<sub>2</sub>O. Sublimes in needles, m.p. 196°. Turns violet when fused.

*Et ester*: m.p. 92°.

*Nitrile*: needles from EtOH. M.p. 139°. Sol. hot EtOH, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O, ligroin.

*N-Acetyl*: needles from EtOH. M.p. above 296°.

Ekstrand, *J. prakt. Chem.*, 1888, 38, 244.

Friedländer, Heilpern, Spielfogel, *Chem. Zentr.*, 1899, I, 289.

### 6-Amino-1-naphthoic Acid.

Pale yellow needles from EtOH. M.p. 205–6°. Sol. AcOH. Green or blue fluor. in sol.

*N-Acetyl*: needles from AcOH. M.p. 170–2° (252–3°).

Harrison, Royle, *J. Chem. Soc.*, 1926, 87.  
Dziewoński, Otto, *Chem. Zentr.*, 1936, II, 78.

### 7-Amino-1-naphthoic Acid.

Light brown prisms from EtOH. M.p. 223–4°. Shows green or blue fluor. in sol.

*N-Acetyl*: needles from EtOH. M.p. 229–30°.

Harrison, Royle, *J. Chem. Soc.*, 1926, 87.

### 8-Amino-1-naphthoic Acid.

Needles. Heat with H<sub>2</sub>O → naphthastyril. *N-p-Toluenesulphonyl*: needles from EtOH. M.p. 158–9°. Sol. boiling EtOH, C<sub>6</sub>H<sub>6</sub>. Spar. sol. Et<sub>2</sub>O. Insol. ligroin.

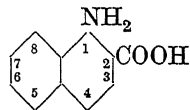
*Lactam*: see Naphthastyril.

Ullmann, Cassirer, *Ber.*, 1910, 43, 441.

Corbellini, F.P., 774,472, (*Chem. Abstracts*, 1935, 29, 2179).

I.G., D.R.P., 531,889, (*Chem. Abstracts*, 1932, 26, 155).

### 1-Amino-2-naphthoic Acid (1-Amino- $\beta$ -naphthoic acid)



C<sub>11</sub>H<sub>9</sub>O<sub>2</sub>N MW, 187

Needles from EtOH.Aq. or AcOH. M.p. 205° (rapid heat.). Loses CO<sub>2</sub> at m.p. Shows blue fluor. in sol. Sol. EtOH, Et<sub>2</sub>O, AcOH. Insol. H<sub>2</sub>O. Heat with conc. HCl → 1-naphthylamine.

*Nitrile*: C<sub>11</sub>H<sub>8</sub>N<sub>2</sub>. MW, 168. Needles from H<sub>2</sub>O or C<sub>6</sub>H<sub>6</sub>. M.p. 191–2°. Sol. EtOH, AcOH. Spar. sol. hot H<sub>2</sub>O, Et<sub>2</sub>O. Stable to alkalis.

Friedländer, Littner, *Ber.*, 1915, 48, 328.

I.G., D.R.P., 622,308, (*Chem. Abstracts*, 1936, 30, 1391).

### 3-Amino-2-naphthoic Acid.

Yellow cryst. from EtOH.Aq. M.p. 214°. Sol. EtOH, Et<sub>2</sub>O to yellow sols. with green fluor. Na salt spar. sol. H<sub>2</sub>O.

*Me ester*: C<sub>12</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 201. M.p. 104–5°.

*Et ester*: C<sub>13</sub>H<sub>13</sub>O<sub>2</sub>N. MW, 215. Yellow needles from EtOH. M.p. 117–18°. Sol. ord. org. solvents.

*Isopropyl ester*: m.p. 85°.

*Butyl ester*: m.p. 100–1°.

*Isobutyl ester*: m.p. 99–100°.

*Phenyl ester*: m.p. 135°.

*Benzyl ester*: m.p. 105–6°.

*Amide*: m.p. 234–6°.

*Hydrazide*: yellowish-green cryst. M.p. 206–10° decomp.

N-Acetyl: prisms from EtOH.Aq. M.p. 238°. Hydrazide: m.p. 225°.

Gen. Aniline Works, U.S.P., 1,903,880, (*Chem. Abstracts*, 1933, 27, 3343); 1,871,990, (*Chem. Abstracts*, 1932, 26, 5971).

I.G., B.P., 315,661, (*Chem. Abstracts*, 1930, 24, 1748).

Fierz, Tobler, *Helv. Chim. Acta*, 1922, 5, 557.

Allen, Bell, *Organic Syntheses*, 1942, XXII, 19.

#### 4-Amino-2-naphthoic Acid.

Needles from EtOH.Aq. M.p. 215–16° (204–6°).

Nitrile:  $C_{11}H_8N_2$ . MW, 168. Needles from EtOH.Aq. M.p. 123–4°.

Butler, Royle, *J. Chem. Soc.*, 1923, 123, 1652.

Cason, *J. Am. Chem. Soc.*, 1941, 63, 828.

#### 5-Amino-2-naphthoic Acid.

Yellow leaflets from EtOH. M.p. 291–2° (232°). Mod. sol. hot EtOH. Prac. insol.  $H_2O$ . Insol.  $Et_2O$ ,  $C_6H_6$ .

Diethylaminoethyl ester: yellow. M.p. 207–8°.

Nitrile: yellow needles. M.p. 142°. Sol.  $Et_2O$ , hot EtOH,  $C_6H_6$ .

N-Acetyl: plates from AcOH. M.p. 291°. Spar. sol. EtOH.

Harrison, Royle, *J. Chem. Soc.*, 1926, 87.

Ekstrand, *J. prakt. Chem.*, 1890, 42, 280.

Cason, *J. Am. Chem. Soc.*, 1941, 63, 828.

#### 6-Amino-2-naphthoic Acid.

Pale yellow needles from EtOH.Aq. M.p. 225°. N-Acetyl: needles from EtOH.Aq. M.p. 230–2°.

Harrison, Royle, *J. Chem. Soc.*, 1926, 87.

#### 7-Amino-2-naphthoic Acid.

Pale yellow leaflets from EtOH. M.p. 245°. Nitrile: yellow leaflets. M.p. 192–5° (186°, 170–1°). Sol. boiling EtOH,  $C_6H_6$ . Spar. sol.  $Et_2O$ .

N-Acetyl: pale yellow cryst. from EtOH.Aq. or AcOH. Mp. 287–90 (200–1° decomp.).

Hopper, Syme, Wilson, *J. Soc. Dyers Colourists*, 1942, 58, 93.

#### 8-Amino-2-naphthoic Acid.

Greenish-yellow needles from AcOH. M.p. 220°. Sol. EtOH. Heat with lime  $\rightarrow$  1-naphthylamine.

$B_2HCl$ : prisms. M.p. 260° decomp.

Nitrile: greenish-yellow leaflets. M.p. 133° (117°). Sol.  $Et_2O$ ,  $C_6H_6$ . Spar. sol.  $H_2O$ .

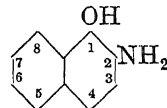
N-Acetyl: needles from EtOH. M.p. 258°. Sol. EtOH.

N-Diacetyl: yellow needles from EtOH. M.p. 181°.

Ekstrand, *J. prakt. Chem.*, 1890, 42, 295.

Harrison, Royle, *J. Chem. Soc.*, 1926, 87.

#### 2-Amino-1-naphthol (1-Hydroxy- $\beta$ -naphthylamine)



$C_{10}H_9ON$  MW, 159

Needles from  $H_2O$ . Spar. sol.  $H_2O$ .  $HNO_2 \rightarrow \beta$ -naphthoquinone.

Me ether:  $C_{11}H_{11}ON$ . MW, 173. Leaflets. M.p. 48–9°. Sol. org. solvents with blue fluor. Spar. sol. warm  $H_2O$ . N-Acetyl: cryst. from EtOH.Aq. M.p. 132°.

Et ether:  $C_{12}H_{13}ON$ . MW, 187. Leaflets. M.p. 48–9°. N-Acetyl: cryst. from EtOH.Aq. M.p. 148–9°.

N-Acetyl: needles from EtOH.Aq. M.p. 128–9°. Sol. EtOH,  $Et_2O$ . Spar. sol. cold ligroin. O-Benzoyl: needles from MeOH. M.p. 185°.

ON-Diacetyl: needles from EtOH.Aq. M.p. 117°.

N-Benzoyl: leaflets from AcOH. M.p. 190°.

ON-Dibenzoyl: needles from EtOH. M.p. 180°.

O-Benzenesulphonyl: prisms from EtOH.Aq. M.p. 118–19°.

Grandmougin, *Ber.*, 1906, 39, 2496; cf.

Auwers, Eckardt, *Ann.*, 1908, 359, 381.

Nölting, Grandmougin, Freimann, *Ber.*, 1909, 42, 1383.

#### 4-Amino-1-naphthol (4-Hydroxy- $\alpha$ -naphthylamine).

Needles. Turns blue in air. Ox.  $\rightarrow$  1:4-naphthoquinone.

Me ether: N-Acetyl: prisms from EtOH. M.p. 180–1°.

Et ether: needles from EtOH. M.p. 96°. Sol. usual org. solvents.  $FeCl_3$  gives indigo-blue ppt. N-Acetyl: naphthacetin. Leaflets from EtOH.Aq. M.p. 192°. Diacetyl: leaflets or prisms. M.p. 138°. N-Benzoyl: needles from EtOH. M.p. 214–15°.

N-Formyl: needles from hot  $H_2O$ . M.p. 168°. Sol. EtOH.

N-Acetyl: naphthacetol. Needles from EtOH. M.p. 187°. Sol. EtOH. Spar. sol.  $H_2O$ .

N-Chloroacetyl: needles from EtOH. M.p. 200–1°. Sol. EtOH,  $Et_2O$ , boiling  $H_2O$ . Spar. sol.  $CHCl_3$ .

N-Benzoyl: needles from EtOH. M.p. 228–9°.

O-Benzoyl: m.p. 107°.  $B_2HCl$ : m.p. 258–63° decomp.

Dibenzoyl deriv.: cryst. from  $C_6H_6$ . M.p. 215°.

*Diacetyl deriv.* : m.p. 158°.

Fieser, Fieser, *J. Am. Chem. Soc.*, 1935, 57, 493.

Conant, Lutz, Corson, *Organic Syntheses*, Collective Vol. I, 41.

**5-Amino-1-naphthol** (5-Hydroxy- $\alpha$ -naphthylamine).

Pink needles from H<sub>2</sub>O. M.p. 192°.

*Dibenzoyl deriv.* : leaflets from AcOH. M.p. 276°. Sol. EtOH, Me<sub>2</sub>CO, AcOH, hot CHCl<sub>3</sub>.

Vorozhtzov, Kulev, *Chem. Abstracts*, 1929, 23, 3697.

**6-Amino-1-naphthol** (5-Hydroxy- $\beta$ -naphthylamine).

*N-Acetyl* : needles from H<sub>2</sub>O. M.p. 100°.

Sander, *Ber.*, 1925, 58, 829.

**7-Amino-1-naphthol** (8-Hydroxy- $\beta$ -naphthylamine).

Plates. M.p. 158°.

*N-Acetyl* : needles. M.p. 210–11°. *Me ether HCl* : needles. M.p. 163–4°.

Friedländer, Zinberg, *Ber.*, 1896, 29, 40.

Mueller, Hamilton, *J. Am. Chem. Soc.*, 1944, 66, 860.

**8-Amino-1-naphthol** (8-Hydroxy- $\alpha$ -naphthylamine).

Needles from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 95–7°. Sol. hot H<sub>2</sub>O. Turns grey in air.

*Me ether* : b.p. 180–5°/14 mm. *N-Acetyl* : needles from EtOH.Aq. M.p. 128°. B.p. 138–40°/14 mm. Sol. EtOH, AcOH. Mod. sol. Et<sub>2</sub>O. *Picrate* : greenish-yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 172°.

*Et ether* : *N-acetyl*. Leaflets from EtOH.Aq. M.p. 154°.

*N-Formyl* : needles from EtOH.Aq. Decomp. at 140–50°.

*N-Acetyl* : needles or plates from EtOH. M.p. 181° (169°). B.p. 170–2°/16 mm. Sol. EtOH, AcOH. Spar. sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

*ON-Diacetyl* : needles from EtOH.Aq. M.p. 118–5°.

*N-Benzoyl* : needles from EtOH.Aq. M.p. 193–4°.

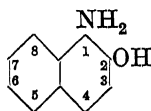
*Dibenzoyl deriv.* : needles from EtOH.Aq. M.p. 206–7°.

*N-p-Toluenesulphonyl* : cryst. from EtOH.Aq. M.p. 189°.

*Picrate* : m.p. 163–4°.

Fichter, Gageur, *Ber.*, 1906, 39, 3331.

**1-Amino-2-naphthol** (2-Hydroxy- $\alpha$ -naphthylamine)



C<sub>10</sub>H<sub>9</sub>ON

MW, 159

Dict. of Org. Comp.—I.

Leaflets from Et<sub>2</sub>O. Spar. sol. boiling H<sub>2</sub>O, Et<sub>2</sub>O. Sol. NH<sub>3</sub>.Aq. to yellow sol. Ox. → 1:2-naphthoquinone.

*Me ether* : C<sub>11</sub>H<sub>11</sub>ON. MW, 173. Needles from H<sub>2</sub>O. M.p. 54°. Turns pink in air. Sol. usual org. solvents. FeCl<sub>3</sub> → blue col. *N-Acetyl* : prisms from EtOH.Aq. M.p. 178°.

*Et ether* : C<sub>12</sub>H<sub>13</sub>ON. MW, 187. Plates from pet. ether. M.p. 51°. B.p. 300–2°. Very sol. org. solvents. FeCl<sub>3</sub> + HCl → blue col. *N-Acetyl* : needles from H<sub>2</sub>O. M.p. 145°.

*Propyl ether* : C<sub>13</sub>H<sub>15</sub>ON. MW, 201. Needles from H<sub>2</sub>O. M.p. 45°. Sol. usual org. solvents.

*Isopropyl ether* : leaflets from H<sub>2</sub>O. M.p. 50°.

*Isobutyl ether* : C<sub>14</sub>H<sub>17</sub>ON. MW, 215. Leaflets from H<sub>2</sub>O. M.p. 61–2°.

*N-Formyl* : needles from EtOH. M.p. 204°. Spar. sol. H<sub>2</sub>O, EtOH.

*N-Acetyl* : leaflets from MeOH. M.p. 235°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>.

*ON-Diacetyl* : prisms from EtOH. M.p. 206°. Sublimes.

*Triacetyl* : m.p. 119–5°.

*N-Chloroacetyl* : yellowish leaflets from EtOH. M.p. 192–3° decomp.

*N-Benzoyl* : leaflets from MeOH. M.p. 248–9°.

*ON-Dibenzoyl* : needles from EtOH. M.p. 235–5° (226°).

Fieser, Fieser, *J. Am. Chem. Soc.*, 1935, 57, 493.

Conant, Corson, *Organic Syntheses*, 1931, XI, 8.

Charrier, Ferreri, *Gazz. chim. ital.*, 1912, 42, ii, 121.

**3-Amino-2-naphthol** (3-Hydroxy- $\beta$ -naphthylamine).

Needles from H<sub>2</sub>O. M.p. 234°. Sol. EtOH, hot H<sub>2</sub>O. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*N-Benzoyl* : leaflets from EtOH. M.p. 233–5°. Sol. Me<sub>2</sub>CO, hot AcOH. Spar. sol. C<sub>6</sub>H<sub>6</sub>.

*ON-Diacetyl* : m.p. 188°.

I.G., B.P., 379,862, (*Chem. Abstracts*, 1933, 27, 4094); F.P., 645,919, (*Chem. Abstracts*, 1929, 23, 2304).

Friedlander, Zakrzewski, *Ber.*, 1894, 27, 763.

**4-Amino-2-naphthol** (3-Hydroxy- $\alpha$ -naphthylamine).

Needles from EtOH. Decomp. at 185°. Sol. EtOH, hot xylene. Spar. sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

*N-Acetyl* : needles. M.p. 179°.

*ON-Dibenzoyl* : yellowish leaflets from AcOH. M.p. 309–10°. Sol. Me<sub>2</sub>CO, hot AcOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

*O-p-Toluenesulphonyl* : pale yellow prisms from EtOH. M.p. 137°. Mod. sol. boiling EtOH.

Challenor, Ingold, *J. Chem. Soc.*, 1923, 123, 2080.

Morgan, Evans, *J. Chem. Soc.*, 1919, 115, 1133.

**5-Amino-2-naphthol** (6-Hydroxy- $\alpha$ -naphthylamine).

Needles from  $H_2O$ . M.p.  $190^\circ$  ( $185^\circ$ ). Sol. usual solvents. Darkens in air. Sol.  $NH_3$ . Aq. with blue fluor.  $FeCl_3 \rightarrow$  violet col.

*B.HCl*: dark red cryst.

*N-Acetyl*: needles from EtOH. Aq. M.p.  $218^\circ$ .

*ON-Diacetyl*: cryst. from AcOH. M.p.  $187^\circ$ .

*N-Benzoyl*: needles from EtOH. Aq. M.p.  $152^\circ$ .

*ON-Dibenzoyl*: needles from EtOH. M.p.  $223^\circ$ .

*Picrate*: yellow needles. M.p.  $170^\circ$  corr. ( $185^\circ$ ).

Brown, Hebden, Withrow, *J. Am. Chem. Soc.*, 1929, 51, 1767.

Sachs, *Ber.*, 1906, 39, 3016.

**6-Amino-2-naphthol** (6-Hydroxy- $\beta$ -naphthylamine).

Brown cryst. from EtOH. Aq. Decomp. at  $212-13^\circ$ .

*Me ether*: m.p.  $78^\circ$ . *N-Acetyl*: m.p.  $183^\circ$ .

*Et ether*: cryst. from pet. ether. M.p.  $91^\circ$ . B.p.  $330^\circ$ . Sol. ord. org. solvents. *N-Acetyl*: needles from EtOH. M.p.  $184-5^\circ$ .

*ON-Dibenzoyl*: cryst. from AcOH. M.p.  $228-30^\circ$ .

Ruggli, Knapp, Merz, Zimmermann, *Helv. Chim. Acta*, 1929, 12, 1046.

**7-Amino-2-naphthol** (7-Hydroxy- $\beta$ -naphthylamine).

Needles from EtOH. M.p.  $201^\circ$ . Sol. EtOH,  $Et_2O$ . Spar. sol.  $H_2O$ .

*N-Acetyl*: plates from EtOH. M.p.  $232^\circ$ . *O-Benzoyl*: needles from EtOH. M.p.  $177^\circ$ .

*ON-Diacetyl*: pale brown leaflets or needles from EtOH. Aq. M.p.  $156^\circ$ .

*N-Benzoyl*: m.p.  $243-6^\circ$ . *O-Acetyl*: cryst. from EtOH. M.p.  $177^\circ$ .

*ON-Dibenzoyl*: needles from AcOH. M.p.  $181^\circ$ .

*N-Phenyl*: 7-anilino-2-naphthol, phenyl-7-hydroxy-2-naphthylamine. Needles. M.p.  $160^\circ$ .

Raiford, Talbot, *J. Am. Chem. Soc.*, 1927, 49, 560.

Franzen, Deibel, *J. prakt. Chem.*, 1908, 78, 155.

**8-Amino-2-naphthol** (7-Hydroxy- $\alpha$ -naphthylamine).

Needles from EtOH or  $H_2O$ . M.p.  $205-7^\circ$ . Sol. hot  $H_2O$ , EtOH. Mod. sol.  $Et_2O$ . Sublimes. Sol. acids and alkalis with blue fluor.  $FeCl_3 \rightarrow$  greenish-blue col.

*Me ether*: prisms. M.p.  $79-80^\circ$ . *N-Acetyl*: needles. M.p.  $161.5-2.5^\circ$ .

*Et ether*: prisms from pet. ether. M.p.  $67^\circ$ . B.p.  $315^\circ$ . Sol. usual org. solvents. *N-Acetyl*: needles from EtOH. Aq. M.p.  $139^\circ$ .

*N-Acetyl*: needles from AcOH. Aq. M.p.  $165^\circ$ . Sol. EtOH. Spar. sol. cold  $H_2O$ .

*N-Benzoyl*: cryst. M.p.  $208-9^\circ$ .

*ON-Dibenzoyl*: cryst. from AcOH. M.p.  $208^\circ$ .

Brown, Hebden, Withrow, *J. Am. Chem. Soc.*, 1929, 51, 1767.

Friedländer, Zinberg, *Ber.*, 1896, 29, 41.

Kehrmann, Engelke, *Ber.*, 1909, 42, 351.

**1-Amino-2-naphthol-3 : 6-disulphonic Acid**

$C_{10}H_8O_7NS_2$

MW, 319

Sols. give dark brown col. with  $FeCl_3$ . Boil aq. sol.  $\rightarrow$  1 : 2-dihydroxynaphthalene-3 : 6-disulphonic acid. Reduces  $NH_3$ ,  $AgNO_3$ . Does not couple with diazo-comps. Mono-Na salt is the developer Diogen.

Witt, *Ber.*, 1888, 21, 3479.

**1-Amino-8-naphthol-2 : 4-disulphonic Acid** (8-Amino-1-naphthol-5 : 7-disulphonic acid, 2*S* Acid).

Easily sol.  $H_2O$ . Sols. give greenish-black col. with  $FeCl_3$ . Alkaline sols. show green fluor.  $HNO_2 \rightarrow$  reddish-yellow sol. diazo-comp. Couples in AcOH or alk. sol. with 1 mol. diazonium salt, in acid with 2 mols. Intermediate for azo dyestuffs.

*Mono-Na salt*: needles +  $1H_2O$ . Easily sol.  $H_2O$ . Ppd. by HCl from aq. sol.

*Ca salt*: mod. sol.

Dressel, Kothe, *Ber.*, 1894, 27, 2141.

Bayer, D.R.P., 80,668.

Vendelshtein, *Chem. Abstracts*, 1932, 26, 4599.

**1-Amino-8-naphthol-3 : 6-disulphonic Acid** (8-Amino-1-naphthol-3 : 6-disulphonic acid, *H* Acid).

Colourless cryst. Spar. sol. cold  $H_2O$ . Sols. give brownish-red col. with  $FeCl_3$ .  $HNO_2 \rightarrow$  sol. yellow diazo-comp. Couples with diazonium salts in acid or alk. sol. Widely used intermediate for mono- and poly-azo dyestuffs.

*Mono-Na salt*: needles +  $1\frac{1}{2}H_2O$ . Spar. sol.

*Ba salt*: needles +  $4\frac{1}{2}H_2O$ . Spar. sol.

*N-Acetyl dichloride*: m.p.  $188-9^\circ$ .

Willard, *Color Trade Journal* (U.S.A.), 1924, 15, 40, (*Chem. Abstracts*, 1924, 18, 3374).

I.G., U.S.P., 1,939,025, (*Chem. Abstracts*, 1934, 28, 1362).

Gubelmann, Tinker, U.S.P., 1,670,406, (*Chem. Abstracts*, 1928, 22, 2378).

**1-Amino-8-naphthol-4 : 6-disulphonic Acid** (8-Amino-1-naphthol-3 : 5-disulphonic acid, *K* Acid).

Sols. give yellowish-green col. with  $\text{FeCl}_3$ .  $\text{HNO}_2$   $\rightarrow$  yellow sol. diazo-comp. Couples with diazonium salts in acid or alk. sol. Intermediate for mono- and poly-azo dyestuffs.

*N-Acetyl dichloride*: yellow cryst. from  $\text{Et}_2\text{O}$ . M.p. 145–7°.

Kalle, D.R.P., 99,164, (*Chem. Zentr.*, 1898, II, 1230).

I.G., U.S.P., 1,939,025, (*Chem. Abstracts*, 1934, 28, 1362).

**2-Amino-8-naphthol-3 : 6-disulphonic Acid** (*7-Amino-1-naphthol-3 : 6-disulphonic acid, 2R Acid*).

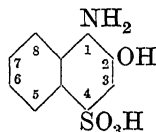
Free acid and alkali salts readily sol.  $\text{H}_2\text{O}$ .  $\text{FeCl}_3$   $\rightarrow$  dark green col. Aq. sols of acid salts fluoresce bluish-violet, addn. of alkalis  $\rightarrow$  bluish-green. Intermediate for azo dyestuffs.

*Dichloride*: yellow cryst. Darkens above 250°.

*N-Phenyl*: 2-anilino-8-naphthol-3 : 6-disulphonic acid. Alkali salts readily sol.  $\text{H}_2\text{O}$ .

Höchst, D.R.P., 52,023; B.P., 15,175/1889.

**1-Amino-2-naphthol-4-sulphonic Acid** (*1 : 2 : 4-Acid*)



$\text{C}_{10}\text{H}_9\text{O}_4\text{NS}$  MW, 239

Fine grey needles turning rose col. on exposure to light. Spar. sol.  $\text{H}_2\text{O}$ . Insol. cold  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Alk. sol. turns brown in air. Ox.  $\rightarrow$  1 : 2-naphthoquinone-4-sulphonic acid. Intermediate for azo dyestuffs.

O : *N-Diacetyl*: *pyridine salt*, m.p. 194–5°.  
*p-Toluidine salt*: m.p. 213–14°.

Fieser, *Organic Syntheses*, 1931, XI, 12.

Bogdanov, *Chem. Abstracts*, 1932, 26, 5297.

Fieser, Fieser, *J. Am. Chem. Soc.*, 1935, 57, 494.

**1-Amino-2-naphthol-6-sulphonic Acid.**

Needles. Spar. sol.  $\text{H}_2\text{O}$ . Prac. insol.  $\text{EtOH}$ . Insol.  $\text{Et}_2\text{O}$ .  $\text{FeCl}_3$   $\rightarrow$  brown col. Couples with diazo-comps. Na salt (+  $2\frac{1}{2}\text{H}_2\text{O}$ ) is the developer Eikonogen. Alk. sols. decomp. by air.

O : *N-Diacetyl*: *p-toluidine salt*, m.p. 209–10°

Witt, *Ber.*, 1888, 21, 3475.

Feldmann, *Chem. Zentr.*, 1926, I, 84.

**1-Amino-5-naphthol-7-sulphonic Acid** (*5-Amino-1-naphthol-3-sulphonic acid, M Acid*).

Leaflets. Spar. sol.  $\text{H}_2\text{O}$ .  $\text{FeCl}_3$   $\rightarrow$  black col.  $\text{HNO}_2$   $\rightarrow$  orange-yellow spar. sol. diazo-comp. Couples in alk. sol. with diazonium salts.

*Na salt*: leaflets. Spar. sol.  $\text{H}_2\text{O}$ .

Badische, D.R.P., 117,471, (*Chem. Zentr.*, 1901, I, 349); D.R.P., 73,276.

Cassella, D.R.Ps., 85,058, 188,505.

**1-Amino-8-naphthol-4-sulphonic Acid** (*8-Amino-1-naphthol-5-sulphonic acid, S Acid*).

Needles. Spar. sol.  $\text{H}_2\text{O}$ .  $\text{FeCl}_3$   $\rightarrow$  emerald-green col.  $\text{HNO}_2$   $\rightarrow$  spar. sol. orange diazo-comp. Couples in acid or alk. sol. with diazonium salts. Intermediate for azo dyestuffs.

*Na salt*: sol.  $\text{H}_2\text{O}$  with bluish-green fluor.

O : *N-Diacetyl*: *pyridine salt*, m.p. 203–4°.

Brandt, *Chem. Abstracts*, 1928, 22, 2665.

Bucherer, *J. prakt. Chem.*, 1904, 70, 349.

**2-Amino-5-naphthol-7-sulphonic Acid** (*6-Amino-1-naphthol-3-sulphonic acid, J Acid*).

Spar. sol.  $\text{H}_2\text{O}$ . Hot sol. with  $\text{FeCl}_3$   $\rightarrow$  brownish-black col.  $\text{HNO}_2$   $\rightarrow$  yellow spar. sol. diazo-comp. Couples in acid or alk. sol. with diazonium salts giving two series of mono-azo dyes. Intermediate for azo dyestuffs.

*Na salt*: easily sol.  $\text{H}_2\text{O}$  with blue fluor.

*N-Acetyl*: *pyridine salt*, m.p. 190–1°.

Battegay, Wolff, *Bull. soc. chim.*, 1923, 33, 1481.

I.G., U.S.P., 1,939,325, (*Chem. Abstracts*, 1934, 28, 1362).

**2-Amino-8-naphthol-6-sulphonic Acid** (*7-Amino-1-naphthol-3-sulphonic acid, Gamma Acid,  $\gamma$ -Acid*).

Needles. Spar. sol.  $\text{H}_2\text{O}$ .  $\text{FeCl}_3$   $\rightarrow$  dirty claret col.  $\text{HNO}_2$   $\rightarrow$  spar. sol. yellow diazo-comp. Couples in acid or alk. sol. with diazonium salts giving two series of mono-azo dyes. Intermediate for many azo dyestuffs.

*Na salt*: easily sol.  $\text{H}_2\text{O}$ .

*Pb salt*: needles. Spar. sol.  $\text{H}_2\text{O}$ .

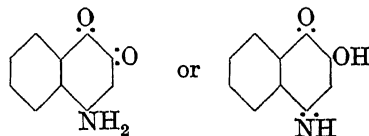
*N-Acetyl chloride*: swells about 180°, but does not melt below 290°.

O : *N-Diacetyl*: *p-toluidine salt*, m.p. 230–1°.

I.G., U.S.P., 1,939,025, (*Chem. Abstracts*, 1934, 28, 1362).

Bucherer, *J. prakt. Chem.*, 1904, 69, 89.

**4-Amino-1 : 2-naphthoquinone** (*4-Amino- $\beta$ -naphthoquinone, 2-hydroxy- $\alpha$ -naphthoquinonimine*)



$\text{C}_{10}\text{H}_7\text{O}_2\text{N}$  MW, 173

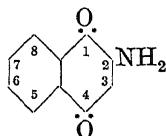
Red needles from  $\text{H}_2\text{O}$ . Decomp. at 270° with charring. Sol.  $\text{EtOH}$ . Spar. sol. hot  $\text{H}_2\text{O}$ . Insol.  $\text{Et}_2\text{O}$ . Red.  $\rightarrow$  3 : 4-dihydroxy-1-

naphthylamine. Conc. alkalis or  $H_2SO_4 \rightarrow$  2-hydroxy-1 : 4-naphthoquinone.

*Acetyl deriv.*: orange-red cryst. Decomp. above  $220^\circ$ . Sol. AcOH, hot EtOH. Insol.  $C_6H_6$ .

Fieser, Hartwell, *J. Am. Chem. Soc.*, 1935, 57, 1483.

**2-Amino-1 : 4-naphthoquinone** (2-Amino- $\alpha$ -naphthoquinone)



$C_{10}H_7O_2N$  MW, 173

Orange-red needles from EtOH,  $Et_2O$ , or AcOH. M.p.  $204-5^\circ$ .

*N-Acetyl*: yellow plates from EtOH. M.p.  $202^\circ$ .

*N-Phenyl*: 2-anilino-1 : 4-naphthoquinone. Red needles. M.p.  $191^\circ$ . Sublimes.

*N-p-Aminobenzenesulphonyl*: m.p.  $226-7^\circ$ .

Fieser, Hartwell, *J. Am. Chem. Soc.*, 1935, 57, 1483.

**5-Amino-1 : 4-naphthoquinone** (5-Amino- $\alpha$ -naphthoquinone).

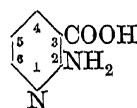
Cryst. from AcOH. M.p.  $180^\circ$  decomp.

*N-Acetyl*: m.p.  $171-2^\circ$  ( $162^\circ$ ).

Friedländer, *Ber.*, 1899, 32, 3530.

Fierz-David, Blangey, von Krannichfeldt, *Helv. Chim. Acta*, 1947, 30, 816.

**2-Aminonicotinic Acid** (2-Aminopyridine-3-carboxylic acid)



$C_6H_6O_2N_2$  MW, 138

Prisms. Sol. hot  $H_2O$ . M.p.  $310^\circ \rightarrow$  2-aminopyridine +  $CO_2$ .

*Me ester*:  $C_7H_8O_2N_2$ . MW, 152. Needles from EtOH.Aq. M.p.  $85^\circ$ . Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ . *N-Acetyl*: yellowish leaflets from ligroin. M.p.  $88^\circ$ . Sol.  $H_2O$ , EtOH,  $Et_2O$ , AcOEt.

*Amide*:  $C_6H_7ON_2$ . MW, 137. Needles from  $H_2O$ . M.p.  $195^\circ$ . *N-p-Aminobenzenesulphonyl*: m.p.  $210^\circ$ .

*Anhydride*: cryst. from  $H_2O$ . M.p.  $384^\circ$ . Sol. hot AcOH. Mod. sol. hot  $H_2O$ . Spar. sol. usual org. solvents.

*N-Benzenesulphonyl*: m.p.  $178^\circ$ .

*N-p-Aminobenzenesulphonyl*: m.p.  $176-9^\circ$ .

*N<sup>4</sup>-Acetyl*: m.p.  $175^\circ$ .

Seide, *Ber.*, 1924, 57, 1807.

Kirpal, *Monatsh.*, 1900, 21, 962.

Philips, *Ann.*, 1895, 288, 259.

**4-Aminonicotinic Acid** (4-Aminopyridine-3-carboxylic acid).

Prisms from  $H_2O$ . Heat at  $340^\circ \rightarrow$  4-aminopyridine +  $CO_2$ .

*B.HCl*: needles. Decomp. at  $270^\circ$ .

*Me ester*: cryst. from  $H_2O$ . M.p.  $173^\circ$ . Sol. EtOH, hot  $CHCl_3$ . Mod. sol.  $Et_2O$ . Hyd. by acids or alkalis.

Kirpal, *Monatsh.*, 1902, 23, 243.

**5-Aminonicotinic Acid** (5-Aminopyridine-3-carboxylic acid).

Leaflets from hot  $H_2O$ . M.p.  $288-90^\circ$  decomp. Mod. sol. hot  $H_2O$ . Spar. sol. cold  $H_2O$ .

*Me ester*: needles from  $H_2O$ . M.p.  $137^\circ$ .

Graf, *J. prakt. Chem.*, 1933, 138, 247.

**6-Aminonicotinic Acid** (6-Aminopyridine-3-carboxylic acid).

Needles +  $2H_2O$  from AcOH.Aq. Decomp. at  $312^\circ \rightarrow$  2-aminopyridine +  $CO_2$ .

*B.HNO<sub>3</sub>*: light brown cryst. M.p.  $242^\circ$ . Sol.  $H_2O$ .

*Amide*: m.p.  $239-40^\circ$  ( $200^\circ$ ).

*Nitrile*:  $C_6H_5N_3$ . MW, 119. Cryst. from  $H_2O$ , MeOH, or  $C_6H_6$ . M.p.  $163-4^\circ$ . B.p.  $240-50^\circ/15$  mm.

*Picrate*: yellow needles. M.p.  $248^\circ$ .

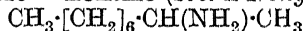
Rath, Prange, *Ann.*, 1928, 467, 4.

Marckwald, *Ber.*, 1894, 27, 1319.

**1-Amino-*n*-nonane.**

See *n*-Nonylamine.

**2-Amino-*n*-nonane** (sec.-*n*-Nonylamine)



$C_9H_{21}N$  MW, 143

Oil. B.p.  $69-9.5^\circ/11$  mm.

$B_2H_2PtCl_6$ : needles from dil. HCl. Decomp. at  $210^\circ$ .

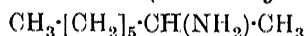
*Picrate*: yellow needles and leaflets from EtOH.Aq. M.p.  $109^\circ$ .

Thoms, Mannich, *Ber.*, 1903, 36, 2555.

**1-Amino-*n*-octane.**

See *n*-Octylamine.

**2-Amino-*n*-octane** (sec.-*n*-Octylamine)



$C_8H_{19}N$  MW, 129

*dl.*

B.p.  $163-5^\circ/760$  mm.,  $58-9^\circ/13$  mm.  $D_4^{20}$  0.7745.  $n_D^{25}$  1.42319.

*d-Camphorsulphonate*: m.p.  $162-5^\circ$ .

*d- $\alpha$ -Bromocamphorsulphonate*: m.p.  $180-5^\circ$ .

*l.*

$[M]_D$   $-8.53^\circ$ .

*B.HCl*: m.p.  $90-1^\circ$ .

*Benzoate*: m.p.  $101-2^\circ$ .

*d.*

B.p.  $70^\circ/25$  mm.  $[M]_D$   $8.62^\circ$ .

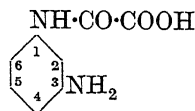
Kishner, *Chem. Zentr.*, 1900, 1, 653.

Mann, Porter, *J. Chem. Soc.*, 1944, 456.

4-Amino-*n*-octane

$\text{CH}_3 \cdot [\text{CH}_2]_3 \cdot \text{CH}(\text{NH}_2) \cdot \text{CH}_2 \cdot \text{CH}_2 \cdot \text{CH}_3$   
 $\text{C}_8\text{H}_{19}\text{N}$  MW, 129  
 B.p. 64–5°/18 mm. Absorbs  $\text{CO}_2$ .  
*B.HCl*: needles from pet. ether. M.p. 194–5°.  
 Freylon, *Ann. chim. phys.*, 1908, 15, 287.

***m*-Amino-oxanilic Acid** (*m*-Aminophenyl-oxamic acid)



$\text{C}_8\text{H}_8\text{O}_3\text{N}_2$  MW, 180  
 Needles +  $\text{H}_2\text{O}$  from  $\text{H}_2\text{O}$ . M.p. anhyd. 245°. Spar. sol.  $\text{H}_2\text{O}$ .

*Amide*:  $\text{C}_8\text{H}_9\text{O}_2\text{N}_3$ . MW, 179. Leaflets from  $\text{H}_2\text{O}$ , needles from EtOH. M.p. 191°. Sol.  $\text{Me}_2\text{CO}$ , hot  $\text{H}_2\text{O}$ . Spar. sol. hot  $\text{CHCl}_3$ . Insol.  $\text{C}_6\text{H}_6$ . *N*-Chloroacetyl: reddish needles from  $\text{H}_2\text{O}$ . Decomp. at 281°. Sol. hot AcOH. Spar. sol.  $\text{H}_2\text{O}$ .

*N*-Acetyl: needles from AcOH.Aq. M.p. 209° decomp. Sol.  $\text{H}_2\text{O}$ , EtOH. Spar. sol.  $\text{Et}_2\text{O}$ .

Jacobs, Heidelberg, *J. Am. Chem. Soc.*, 1917, 39, 1447.

***p*-Amino-oxanilic Acid** (*p*-Aminophenyl-oxamic acid).

Needles from EtOH. Darkens at 250°, but does not melt below 280°. Spar. sol. EtOH,  $\text{H}_2\text{O}$ .

*Me ester*:  $\text{C}_9\text{H}_{10}\text{O}_3\text{N}_2$ . MW, 194. Greenish-yellow needles from  $\text{H}_2\text{O}$ . M.p. 129–30°. Sol. EtOH,  $\text{CHCl}_3$ . Spar. sol.  $\text{H}_2\text{O}$ , cold  $\text{C}_6\text{H}_6$ .

*Et ester*:  $\text{C}_{10}\text{H}_{12}\text{O}_3\text{N}_2$ . MW, 208. *N*-Acetyl: needles. M.p. 193° decomp.

*Amide*: pale violet cryst. from  $\text{H}_2\text{O}$ . M.p. 217–18°. Sol. hot  $\text{H}_2\text{O}$ , EtOH,  $\text{Me}_2\text{CO}$ .  $\text{FeCl}_3$  → purple col. *N*-Chloroacetyl: cryst. from AcOH. M.p. above 280°. Spar. sol. usual solvents.

*Anilide*: prisms from  $\text{C}_6\text{H}_6$ . M.p. 215°. Sol. AcOH, boiling EtOH,  $\text{C}_6\text{H}_6$ . Insol.  $\text{H}_2\text{O}$ .

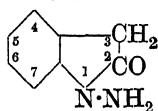
*N*-Acetyl: needles from EtOH.Aq. M.p. above 270°. Sol. EtOH. Spar. sol.  $\text{H}_2\text{O}$ .

*N*-Chloroacetyl: decomp. about 235°. Spar. sol. usual solvents.

Jacobs, Heidelberg, *J. Am. Chem. Soc.*, 1917, 39, 1447.

Koller, *Ber.*, 1903, 36, 413.

## 1-Amino-oxindole



$\text{C}_8\text{H}_8\text{ON}_2$  MW, 148  
 Plates from  $\text{C}_6\text{H}_6$ . M.p. 50°. Very sol. EtOH. Sol. AcOEt,  $\text{C}_6\text{H}_6$ . Spar. sol. pet. ether. Very labile. Lactam ring readily opened on heating with alkali.

*N*-Acetyl: needles +  $\text{H}_2\text{O}$  from  $\text{H}_2\text{O}$ . M.p. 186–7°. Reduces  $\text{AgNO}_3 \cdot \text{NH}_3$  only slowly in cold.

*N*-Benzoyl: plates from EtOH.Aq. M.p. 189°.

Neber, Keppler, *Ber.*, 1924, 57, 778.

Neber, *Ber.*, 1922, 55, 841.

## 3-Amino-oxindole.

Not isolated in free state. Ox. → isatin.

*B.HCl*: cryst. Decomp. at 170°. Decomp. by  $\text{H}_2\text{O}$ .

*N*-Phenyl: 3-anilino-oxindole. Prisms from  $\text{C}_6\text{H}_6$ . M.p. 192°. Very sol.  $\text{Me}_2\text{CO}$ . Sol. EtOH,  $\text{CHCl}_3$ . Spar. sol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Insol. pet. ether.

*Picrate*: yellow. Darkens at 150°.

Baeyer, Knop, *Ann.*, 1866, 140, 37.

Pummerer, Göttler, *Ber.*, 1910, 43, 1380.

## 6-Amino-oxindole.

Needles from  $\text{H}_2\text{O}$ . M.p. about 200°. Sol. hot  $\text{H}_2\text{O}$ , EtOH. Spar. sol.  $\text{C}_6\text{H}_6$ ,  $\text{CS}_2$ .

Gabriel, Meyer, *Ber.*, 1881, 14, 832.

## 1-Aminopalmitic Acid



$\text{C}_{16}\text{H}_{33}\text{O}_2\text{N}$  MW, 271

Cryst. from hot AcOH. Insol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ .

*N*-Phenyl: 1-anilinopalmitic acid. Cryst. from EtOH-AcOEt. M.p. 142–3°.

Hill, Jordanow, *Ber.*, 1891, 24, 941.

## 1-Aminopelargonic Acid



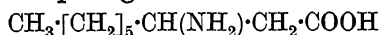
$\text{C}_9\text{H}_{19}\text{O}_2\text{N}$  MW, 173

M.p. 273° decomp. Spar. sol.  $\text{H}_2\text{O}$ .

*N*-Benzoyl: m.p. 128°.

Albertson, *J. Am. Chem. Soc.*, 1946, 68, 450.

## 2-Aminopelargonic Acid



$\text{C}_9\text{H}_{19}\text{O}_2\text{N}$  MW, 173

M.p. 205–5–5°.

*B.HCl*: m.p. 135–5–136°.

*N*-Benzoyl: m.p. 129–5–131°. *Amide*: m.p. 185–6°.

*Urethane*: m.p. 80°.

Rodianov, Zvorykina, *Chem. Abstracts*, 1944, 38, 1473.

## 5-Aminopelargonic Acid



$\text{C}_9\text{H}_{19}\text{O}_2\text{N}$  MW, 173

M.p. 198–5–199°.

McLaren, Pitzl, *J. Am. Chem. Soc.*, 1945, 67, 1625.

**8-Aminopelargonic Acid**

$\text{C}_9\text{H}_{19}\text{O}_2\text{N}$  MW, 173

*B, HCl*: cryst. from  $\text{Me}_2\text{CO}$ . M.p. 115–18°. Sol.  $\text{H}_2\text{O}$ ,  $\text{Me}_2\text{CO}$ .

*N-Carbomethoxyl*: cryst. from EtOH.Aq. M.p. 77°. Sol. usual org. solvents. Spar. sol. cold  $\text{H}_2\text{O}$ . Insol. pet. ether.

*N-Benzenesulphonyl*: prisms from  $\text{H}_2\text{O}$ . M.p. 85°. Mod. sol. warm  $\text{Et}_2\text{O}$ , AcOEt, toluene, hot  $\text{H}_2\text{O}$ . Insol. cold  $\text{H}_2\text{O}$ , pet. ether.

Jegorow, *J. prakt. Chem.*, 1912, **86**, 530.

Flaschenträger, Gebhardt, *Z. physiol. Chem.*, 1930, **192**, 249.

Flaschenträger, Halle, *Z. physiol. Chem.*, 1930, **192**, 253.

**1-Amino-n-pentadecane.**

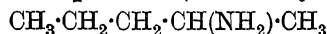
See Pentadecylamine.

**Aminopentamethylbenzene.**

See Pentamethylaniline.

**1-Amino-n-pentane.**

See *n*-Amylamine.

**2-Amino-n-pentane (sec. n-Amylamine)**

$\text{C}_5\text{H}_{13}\text{N}$  MW, 87

B.p. 89.5–91°/752 mm.  $D_4^{20}$  0.7384. Misc. with  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ .

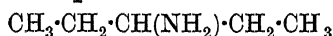
*B, HCl*: needles. M.p. 168°. Sol.  $\text{H}_2\text{O}$ , EtOH.

*B, HAuCl\_4*: leaflets +  $\frac{1}{2}\text{H}_2\text{O}$ . M.p. 82–3°.

*B, (COOH)\_2*: m.p. 226° (131°).

Löffler, *Ber.*, 1910, **43**, 2034.

Sabatier, Mailhe, *Ann. chim.*, 1909, **16**, 105.

**3-Amino-n-pentane**

$\text{C}_5\text{H}_{13}\text{N}$  MW, 87

B.p. 91°.  $D_4^{20}$  0.7487.

*B, HCl*: needles. M.p. 216–17°.

Wallach, *Ann.*, 1905, **343**, 59.

**5-Amino-n-pentanol-1 (5-Hydroxy-n-amylamine, 5-amino-n-amyl alcohol, 5-pentanolamine)**

$\text{C}_5\text{H}_{13}\text{ON}$  MW, 103

Cryst. M.p. 38–9°. B.p. 221–2°, 79–81°/1 mm. Misc. in all proportions with  $\text{H}_2\text{O}$ , EtOH.  $D_4^{27}$  0.9488.  $n_D^{17}$  1.4618. Readily absorbs  $\text{H}_2\text{O}$  and  $\text{CO}_2$  from air.

*B, H\_2SO\_4*: m.p. 102–3°.

Putochin, Lissizin, *Ber.*, 1926, **59**, 629.

Woods, Sanders, *J. Am. Chem. Soc.*, 1946, **68**, 2111.

**3-Amino-n-pentanol-2 (Methyl-1-amino-propylcarbinol, 3-amino-sec. n-amyl alcohol, 2-pentanolamine-3)**

$\text{C}_5\text{H}_{13}\text{ON}$  MW, 103

B.p. 174°/765 mm. Sol. EtOH. Spar. sol.  $\text{H}_2\text{O}$ .  $D^{18}$  0.906.

*B\_2, (COOH)\_2*: m.p. 166°.

*B\_2, (COOH)\_2*: m.p. 204°.

*N-Chloroacetyl*: m.p. 52–60°. B.p. 126–8°/0.3 mm. Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Me}_2\text{CO}$ ,  $\text{CHCl}_3$ . Spar. sol.  $\text{C}_6\text{H}_6$ , ligroin.

Stiénon, *Chem. Zentr.*, 1902, **I**, 717.

Jacobs, Heidelberger, *J. Biol. Chem.*, 1915, **21**, 429.

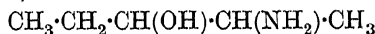
**5-Amino-n-pentanol-2 (5-Amino-sec. n-amyl alcohol, 4-pentanolamine)**

$\text{C}_5\text{H}_{13}\text{ON}$  MW, 103

B.p. 119–21°/8 mm.

*B, HCl*: m.p. 107–10°.

Wojcik, Adkins, *J. Am. Chem. Soc.*, 1934, **56**, 2422.

**2-Amino-n-pentanol-3 (Ethyl-1-aminoethyl-carbinol, 3-pentanolamine-2, 2-aminodiethyl-carbinol)**

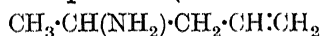
$\text{C}_5\text{H}_{13}\text{ON}$  MW, 103

B.p. 174°/760 mm. Sol.  $\text{H}_2\text{O}$ , EtOH. Spar. sol.  $\text{C}_6\text{H}_6$ . Insol.  $\text{Et}_2\text{O}$ .  $D^{23}$  0.9289.  $n_D$  1.4458.

*B\_2, H\_2PtCl\_6*: yellow cryst. M.p. 154°.

*Picrolonate*: yellow needles. M.p. 215°.

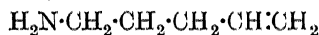
Janecke, *Ber.*, 1899, **32**, 1099.

**4-Amino-1-pentene (4-Amino-1-amylene)**

$\text{C}_5\text{H}_{11}\text{N}$  MW, 85

B.p. 85°. Sol.  $\text{H}_2\text{O}$ , EtOH.

Gal, *Compt. rend.*, 1873, **76**, 1355.

**5-Amino-1-pentene (5-Amino-1-amylene, 4-pentenylamine)**

$\text{C}_5\text{H}_{11}\text{N}$  MW, 85

B.p. 91–4°. Absorbs  $\text{CO}_2$  and  $\text{H}_2\text{O}$ .

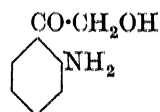
*B, HAuCl\_4*: yellow. M.p. 195°. Sol.  $\text{H}_2\text{O}$ . On warming sol. deposits Au.

*B\_2, H\_2PtCl\_6*: red leaflets from  $\text{H}_2\text{O}$ . M.p. 166° decomp. Sol. hot  $\text{H}_2\text{O}$ .

v. Braun, *Ann.*, 1911, **382**, 43.

**Aminopentenone.**

See Acetylacetoneamine.

**o-Aminophenacyl Alcohol (o-Aminobenzoyl-carbinol, o-amino-ω-hydroxyacetophenone)**

$\text{C}_8\text{H}_9\text{O}_2\text{N}$  MW, 151



Pale yellow cryst. from H<sub>2</sub>O. M.p. 98°. Almost odourless when cold, evolves sweetish odour when heated. Reduces Fehling's immediately. Becomes reddish-violet above m.p.

N-Acetyl: needles from H<sub>2</sub>O. M.p. 141°. Sol. 2N NaOH → indoxyl on heating.

Diacetyl deriv.: cryst. from MeOH. Spar. sol. H<sub>2</sub>O. Gives no indoxyl on heating.

Dibenzoyl deriv.: needles from AcOEt. M.p. 167-8°.

Phenylhydrazone: pale yellow needles from EtOH. M.p. 198°. Turns red in air.

Arndt, Eistert, Partale, *Ber.*, 1928, 61, 1114.

### p-Aminophenacyl Alcohol.

Yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 165°. Sol. EtOH, min. acids. Spar. sol. H<sub>2</sub>O. Reduces AgNO<sub>3</sub> and Fehling's.

N-Acetyl: leaflets. M.p. 176-7°. Sol. EtOH, CHCl<sub>3</sub>. Prac. insol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. O-Benzoyl: needles. M.p. 200-1°. Sol. EtOH. Phenylhydrazone: yellow needles. M.p. 223°.

O-Acetyl: pale yellow prisms from hot H<sub>2</sub>O. M.p. 129-30° (135°). Sol. MeOH, EtOH. Spar. sol. C<sub>6</sub>H<sub>6</sub>. Reduces Fehling's, slowly in cold, rapidly on warming. Readily diazotisable.

ON-Diacetyl: needles from H<sub>2</sub>O. M.p. 162°. Sol. H<sub>2</sub>O, EtOH. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

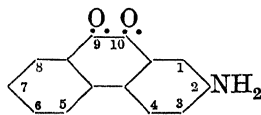
O-Benzoyl: m.p. 188°. Sol. EtOH. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O.

Phenylhydrazone: yellow needles. M.p. 199°.

Kunckell, *Ber.*, 1900, 33, 2646.

Robinson, Robinson, *J. Chem. Soc.*, 1932, 1441.

### 2-Aminophenanthraquinone



C<sub>14</sub>H<sub>9</sub>O<sub>2</sub>N

MW, 223

Dark violet needles from H<sub>2</sub>O. Sinters at 205-10°, does not melt at 300°. Sol. hot EtOH. Spar. sol. H<sub>2</sub>O. Conc. H<sub>2</sub>SO<sub>4</sub> → reddish-brown sol.

N-Acetyl: dark reddish-violet cryst. from PhNO<sub>2</sub>. M.p. 324°. Spar. sol. most solvents. Conc. H<sub>2</sub>SO<sub>4</sub> → yellowish-brown sol.

N-Benzoyl: brownish-red plates from PhNO<sub>2</sub>. M.p. 297-8°. Sol. H<sub>2</sub>SO<sub>4</sub> with greenish-brown col.

McMaster, Wobus, *J. Am. Chem. Soc.*, 1934, 56, 164.

Brass, Ferber, *Ber.*, 1922, 55, 548.

### 3-Aminophenanthraquinone.

Dark reddish-brown needles from EtOH. M.p. 254°.

Monoxime: reddish-brown prisms. M.p. 247° decomp.

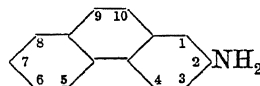
Schmidt, Soll, *Ber.*, 1908, 41, 3694.

### 4-Aminophenanthraquinone.

Black cryst. from EtOH. Softens at 207°, does not melt at 340°. Sol. usual solvents → intense red sols. Conc. H<sub>2</sub>SO<sub>4</sub> → yellowish-olive sol.

Brass, Ferber, *Ber.*, 1922, 55, 551.

### 2-Aminophenanthrene (2-Phenanthrylamine)



C<sub>14</sub>H<sub>11</sub>N

MW, 193

Pale yellow cryst. from ligroin. M.p. 85°.

N-Acetyl: leaflets from xylene. M.p. 225-6°. Sol. EtOH, AcOH, xylene. Spar. sol. ligroin.

N-Benzoyl: needles from xylene. M.p. 216-5°.

Werner, *Ann.*, 1902, 321, 318.

### 3-Aminophenanthrene (3-Phenanthrylamine).

Exists in two forms.

α-

Leaflets from ligroin. M.p. 143°. Labile. Yields β-form on standing.

β-

Cryst. from ligroin. M.p. 87-5°. Sol. EtOH. Spar. sol. H<sub>2</sub>O, xylene. Sols. show violet fluor. Conc. H<sub>2</sub>SO<sub>4</sub> → green sol. → yellow on warming.

B,HI: exists in two forms. 1. Needles from H<sub>2</sub>O. M.p. 244-5°. 2. Cryst. from H<sub>2</sub>O. M.p. 140°. Both yield β-form of base with NaOH.

N-Acetyl: leaflets from xylene. M.p. 200-1°. Sol. 20 parts hot xylene.

N-Benzoyl: needles from EtOH. M.p. 213-14° (211°).

Schmidt, Sauer, *Ber.*, 1911, 44, 3241.

Werner, *Ann.*, 1902, 321, 313.

### 4-Aminophenanthrene (4-Phenanthrylamine).

Grey cryst. from ligroin. M.p. 105°. Very sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin. Sol. conc. H<sub>2</sub>SO<sub>4</sub> with green fluor.

N-Acetyl: cryst. from EtOH. M.p. 190°.

N-Benzoyl: needles from EtOH. M.p. 224°.

Picrate: green needles from EtOH. M.p. 216° decomp.

Picrolonate: needles from EtOH. M.p. 195°.

Schmidt, Heinle, *Ber.*, 1911, 44, 1501.

### 9-Aminophenanthrene (9-Phenanthrylamine).

Exists in two forms. M.p. 137-8° (135-6°, 139°), and cryst. from EtOH, m.p. 104°.

B,HCl: prisms from EtOH — HCl. M.p. 275° decomp.

B,HNO<sub>3</sub>: needles. M.p. 163° decomp.

$B_2, H_2SO_4$ : needles from EtOH- $H_2SO_4$ . M.p. 230°.

$B_2, (COOH)_2$ : yellowish needles from EtOH. M.p. 215°.

*Picrate*: green needles from EtOH. M.p. 190°.

*Picolonate*: m.p. 230-1° decomp.

*N-Acetyl*: needles from EtOH. M.p. 207-8°.

*N-Benzoyl*: needles from EtOH. M.p. 199°.  
Spar. sol. Et<sub>2</sub>O.

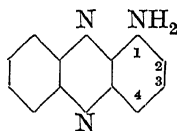
Goldberg, Ordas, Carsch, *J. Am. Chem. Soc.*, 1947, **69**, 260.

Schmidt, Heinle, *Ber.*, 1911, **44**, 1501.

### Aminophenanthrol.

See Hydroxyaminophenanthrene.

### 1-Aminophenazine



$C_{12}H_9N_3$  MW, 195

Red plates from EtOH. M.p. 172°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

Kehrmann, Prunier, *Helv. Chim. Acta*, 1924, **7**, 990.

### 2-Aminophenazine.

Red needles from C<sub>6</sub>H<sub>6</sub> or xylene. M.p. 290-1°. Sublimes. Sol. in C<sub>6</sub>H<sub>6</sub> fluor. green.

*N-Acetyl*: decomp. at 280°.

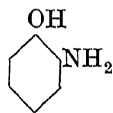
Kehrmann, Mermod, *Helv. Chim. Acta*, 1927, **10**, 65.

Kehrmann, Hoehn, *Helv. Chim. Acta*, 1925, **8**, 218.

### Aminophenetole.

See Phenetidine.

**o-Aminophenol** (*o*-Hydroxyaniline, 1-hydroxy-2-aminobenzene)



$C_6H_7ON$  MW, 109

Needles. M.p. 174°. Sol. 59 parts H<sub>2</sub>O at 0°, 23 parts EtOH. Sol. Et<sub>2</sub>O. Spar. sol. C<sub>6</sub>H<sub>6</sub>.  $k = 2.18 \times 10^{-10}$  at 25°. Sublimes. Turns brown on long standing.

*B, H, COOH*: leaflets. M.p. 119-20°.

*B, CH<sub>3</sub>, COOH*: m.p. 150°. Sol. AcOH.

$B_2, (COOH)_2$ : needles. M.p. 167.5° decomp.

*Me ether*: see *o*-Anisidine.

*Et ether*: see *o*-Phenetidine.

*Phenyl ether*: see *o*-Aminodiphenyl Ether.

*N-Phenyl*: see 2-Hydroxydiphenylamine.

*N-Formyl*: needles from H<sub>2</sub>O. M.p. 129-9.5°. Very sol. EtOH, AcOEt, CHCl<sub>3</sub>, Me<sub>2</sub>CO, hot H<sub>2</sub>O. Sol. Et<sub>2</sub>O. Spar. sol. C<sub>6</sub>H<sub>6</sub>, ligroin.

*N-Acetyl*: see *o*-Hydroxyacetanilide.

*N-Chloroacetyl*: leaflets. M.p. 138-40°.

*N-Benzoyl*: see *o*-Hydroxybenzanilide.

Brown, Warner, *J. Phys. Chem.*, 1923, **27**, 455.

Kirkhof, Spektor, *Russ. P.*, 39, 117, (*Chem. Abstracts*, 1936, **30**, 3339).

Micewicz, *Chem. Abstracts*, 1928, **22**, 4111.

### m-Aminophenol.

Prisms from toluene. M.p. 123°. Very sol. Et<sub>2</sub>O, EtOH. Sol. hot H<sub>2</sub>O. Spar. sol. C<sub>6</sub>H<sub>6</sub>, ligroin. Stable in air.

*B, HCl*: prisms from H<sub>2</sub>O. M.p. 229°.

*B, HBr*: prisms. M.p. 224°.

*B, HI*: prisms. M.p. 209°.

$B, H_2SO_4$ : plates or needles. M.p. 152°.

*Me ether*: see *m*-Anisidine.

*Et ether*: see *m*-Phenetidine.

*Phenyl ether*: see *m*-Aminodiphenyl Ether.

*Benzyl ether*: C<sub>13</sub>H<sub>13</sub>ON. MW, 199. *B, HCl*: plates. M.p. 149°.

*N-Phenyl*: see 3-Hydroxydiphenylamine.

*N-Acetyl*: see *m*-Hydroxyacetanilide.

*Diacetyl deriv.*: plates from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 101°.

*N-Chloroacetyl*: plates from H<sub>2</sub>O. M.p. 135-6° corr.

*N-Benzoyl*: see *m*-Hydroxybenzanilide.

Bantlin, *Ber.*, 1878, **11**, 2101.

Meyer, Sundmacher, *Ber.*, 1899, **32**, 2113.

Ikuta, *Am. Chem. J.*, 1893, **15**, 40.

### p-Aminophenol (*Rodinal*, *Ursol P*).

Plates. M.p. 186°. Sol. 90 parts H<sub>2</sub>O, 22 parts EtOH at 0°. Insol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Sol. alkalis, sols. turning violet rapidly in air. Sublimes part. decomp. Heat of comb. C<sub>p</sub> 763.3 Cal.  $k = 6.6 \times 10^{-9}$  at 15°. CrO<sub>3</sub> → *p*-benzoquinone. Photographic developer.

*B, HCl*: prisms. M.p. 306° decomp.

$B_2, (COOH)_2$ : m.p. 183°.

*Me ether*: see *p*-Anisidine.

*Et ether*: see *p*-Phenetidine.

*Propyl ether*: C<sub>9</sub>H<sub>13</sub>ON. MW, 151. Oil. *B, HCl*: m.p. 171°. *Picrate*: yellow needles from H<sub>2</sub>O. Darkens 162°, m.p. 176°.

*Phenyl ether*: see *p*-Aminodiphenyl Ether.

*Benzyl ether*: C<sub>13</sub>H<sub>13</sub>ON. MW, 199. Plates from H<sub>2</sub>O or EtOH. Aq. M.p. 56°. *B, HCl*: m.p. 222-3°. *Picrate*: yellow needles. M.p. 155° decomp.

*N-Isopropyl*: C<sub>9</sub>H<sub>13</sub>ON. MW, 151. M.p. 155-6°.

*N-sec.-Butyl*: C<sub>10</sub>H<sub>15</sub>ON. MW, 165. Cryst. M.p. 118-19°.

*N-Phenyl*: see 4-Hydroxydiphenylamine.

*N-Formyl*: needles from H<sub>2</sub>O. M.p. 139-40°.

*N-Acetyl*: see *p*-Hydroxyacetanilide.

*N-Diacetyl*: m.p. 118°.

*N-Diacetyl*: see under *p*-Hydroxyacetanilide.

*Dichloroacetyl deriv.*: m.p. 148°.

*Trichloroacetyl deriv.*: m.p. 166°.

*N-Benzoyl*: see *p*-Hydroxybenzanilide.

*O-Benzoyl*: plates. M.p. 153-4°.

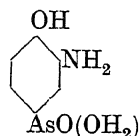
*N-p-Toluenesulphonyl*: m.p. 252-4°.

*O-p-Toluenesulphonyl*: prisms. M.p. 142.5°.

Porai-Koshitz, *Chem.-Ztg.*, 1925, 49, 59.

Bertsch, U.S.P., 2,035,292 (*Chem. Abstracts*, 1936, 30, 2993).

### 2-Aminophenol-4-arsonic Acid



$C_6H_8O_4NAs$  MW, 233

Darkens above 170°. Decomp. about 290°. Spar. sol.  $H_2O$ , most org. solvents. Reduces  $NH_3 \cdot AgNO_3$ . Sol. in alkali +  $NaOCl \rightarrow$  dark olive-green col. Acid sol. +  $K_2Cr_2O_7 \rightarrow$  red col.

*Na salt*: cryst. + 1 or  $2H_2O$ . Spar. sol.  $H_2O$ .

*N-Me*:  $C_7H_{10}O_4NAs$ . MW, 247. Needles +  $\frac{1}{2}H_2O$  from  $H_2O$ . M.p. 263-263.5°. Sol.  $EtOH$ , hot  $AcOH$ . Spar. sol.  $Me_2CO$ . Insol.  $Et_2O$ .

*N:N-Di-Me*:  $C_8H_{12}O_4NAs$ . MW, 261. Cryst. from  $H_2O$ . M.p. 119-21° decomp.

*N-Acetyl*: acetarsone, stovarsol, spiroziod.  $C_8H_{10}O_5NAs$ . MW, 275. M.p. 220-21°. One of the least toxic of the arsenical drugs. Used in syphilis therapy.

*Diethylamine salt*: acetylarsan. Trypanocidal drug.

$\beta$ -*Hydroxyethylamine salt*: solvarsin. Sol.  $H_2O$ . Spar. sol.  $Me_2CO$ ,  $Et_2O$ ,  $C_6H_6$ . Used in syphilis therapy. Toxic, especially to the optic nerve.

Ehrlich, Bertheim, *Ber.*, 1912, 45, 757, 765.

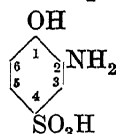
Fargher, *J. Chem. Soc.*, 1919, 115, 991.

Jacobs, Heidelberger, Rolf, *J. Am. Chem. Soc.*, 1918, 40, 1590.

Gaebel, *Archiv. der Pharmazie*, 1911, 249, 242.

Streitwolf et al., U.S.P. 1,859,683, (*Chem. Abstracts*, 1932, 26, 3877).

### 2-Aminophenol-4-sulphonic Acid



$C_6H_7O_4NS$  MW, 189

Rhomboheda +  $\frac{1}{2}H_2O$ . Sol. to 1% in cold  $H_2O$ . Does not melt. (M.p. 155-6°).  $k = 9.41 \times 10^{-5}$ .

*Anilide*: needles from  $EtOH.Aq$ . M.p. 205° (172°).

*O:N-Diacetyl*: *pyridine salt*, m.p. 162°.

*Chloride*: m.p. 143°. *Anilide*: m.p. 205°.

Post, *Ann.*, 1880, 205, 51.

Minevitch, *Chem. Abstracts*, 1922, 16, 2994.

Popov, *Chem. Abstracts*, 1934, 28, 1671; 1936, 30, 7554.

Williams, *J. Chem. Soc.*, 1942, 708.

### 2-Aminophenol-5-sulphonic Acid.

Needles. Mod. sol.  $H_2O$ .

Cassella, D.R.P., 197,496, (*Chem. Zentr.*, 1908, I, 1656).

### 3-Aminophenol-4-sulphonic Acid.

Cryst. from  $H_2O$ . Sol. hot  $H_2O$ .  $FeCl_3 \rightarrow$  red col.  $H_2SO_4$  at 100°  $\rightarrow$  3-aminophenol-6-sulphonic acid.

Oehler, D.R.P., 74,111.

*Colour Trade Journal*, 1921, 9, 240.

### 3-Aminophenol-5-sulphonic Acid.

Needles from  $H_2O$ . Mod. sol.  $H_2O$ .  $FeCl_3 \rightarrow$  brownish-red col. Stable to  $HCl$  at 200°.

Oehler, D.R.P., 79,120.

### 3-Aminophenol-6-sulphonic Acid.

Plates or needles from  $H_2O$ .  $FeCl_3 \rightarrow$  red col.

*Anilide*: m.p. 184°.

*O:N-Diacetyl*: *anilide*, m.p. 213-14°.

*N-Chloroacetyl*: plates and needles. M.p. above 275°.

Jacobs, Heidelberger, Rolf, *J. Am. Chem. Soc.*, 1919, 41, 471.

Bayer, D.R.P., 84,143.

### 4-Aminophenol-2-sulphonic Acid.

Plates or needles +  $H_2O$  from  $H_2O$ . Anhyd. at 100°. Darkens on heating but does not melt below 300°. Spar. sol.  $H_2O$ . Insol.  $EtOH$ ,  $Et_2O$ .  $k = 8.3 \times 10^{-6}$  at 25°. Turns brown in air.  $FeCl_3 \rightarrow$  bluish-violet col. Reduces  $NH_3 \cdot AgNO_3$  and Fehling's.  $FeCl_3 \rightarrow$  *p*-benzoquinone.

*Amide*: m.p. 202° decomp.

*Anilide*: m.p. 159° (98°).

*N-Acetyl*: *amide*, m.p. 215°.

*O:N-Diacetyl*: *pyridine salt*, m.p. 143-4°. *Chloride*: m.p. 148-9°. *Anilide*: m.p. 150° decomp.

Bauer, *Ber.*, 1909, 42, 2107.

Post, *Ann.*, 1880, 205, 49.

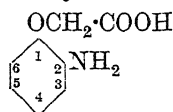
Williams, *J. Chem. Soc.*, 1942, 708.

### 4-Aminophenol-3-sulphonic Acid.

Needles +  $1H_2O$  from hot  $H_2O$ . M.p. 285° decomp. Sol. 50 parts  $H_2O$  at 14°. Insol.  $EtOH$ ,  $Et_2O$ . Reduces  $NH_3 \cdot AgNO_3$ .  $FeCl_3 \rightarrow$  brownish-violet col. Ox.  $\rightarrow$  *p*-benzoquinone.

Schultz, Ståble, *J. prakt. Chem.*, 1904, 69, 334.

## 2-Aminophenoxyacetic Acid



$\text{C}_8\text{H}_9\text{O}_3\text{N}$  MW, 167

*N-Acetyl*: cryst. from xylene. M.p. 153–4°. Heat with HCl  $\rightarrow$  lactam.

*Lactam*: phenmorpholone. Prisms from EtOH. M.p. 173°. Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ , alkalis. Sublimes in needles.

Heidelberger, Jacobs, *J. Am. Chem. Soc.*, 1917, 39, 2188.

Thate, *J. prakt. Chem.*, 1884, 29, 161, 175.

## 3-Aminophenoxyacetic Acid.

Plates from AcOH.Aq. M.p. 207–8° decomp. Spar. sol. common solvents.

*Et ester*: *B,HCl*: m.p. 135–136.5°.

*Amide*:  $\text{C}_8\text{H}_{10}\text{O}_2\text{N}_2$ . MW, 166. Needles from EtOH. M.p. 119–24°. Insol.  $\text{C}_6\text{H}_6$ .

*N-Acetyl*: micro-cryst. M.p. 170–2°.

Heidelberger, Jacobs, *J. Am. Chem. Soc.*, 1917, 39, 2192.

## 4-Aminophenoxyacetic Acid.

Prisms from  $\text{H}_2\text{O}$ . M.p. 220° decomp.

*Me ester*:  $\text{C}_9\text{H}_{11}\text{O}_3\text{N}$ . MW, 181. Needles from  $\text{H}_2\text{O}$ . M.p. 65–6°. Sol. EtOH,  $\text{C}_6\text{H}_6$ . Spar. sol. cold  $\text{H}_2\text{O}$ .  $\text{FeCl}_3 \rightarrow$  reddish-violet col. *B,HCl*: needles from EtOH. M.p. 223–5° decomp.

*Et ester*:  $\text{C}_{10}\text{H}_{13}\text{O}_3\text{N}$ . MW, 195. Prisms from pet. ether. M.p. 58°. Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ .

*Amide*: plates from  $\text{H}_2\text{O}$ . M.p. 128°.

*Me-amide*: needles from toluene. M.p. 110–11°.

*Anilide*: needles from  $\text{C}_6\text{H}_6$ . M.p. 104–5°.

Heidelberger, Jacobs, *J. Am. Chem. Soc.*, 1917, 39, 2196.

 $\alpha$ -Aminophenylacetic Acid (*C-Phenylglycine*,  $\alpha$ -amino- $\alpha$ -toluic acid)

$\text{C}_8\text{H}_9\text{O}_2\text{N}$  MW, 151  
*dl.*

Pearly leaflets. Sublimes without melting at 256°. Spar. sol. most ord. org. solvents. Heat of comb.  $\text{C}_8$  957.8 Cal. Decolorises  $\text{KMnO}_4$  and Br sols. Dist.  $\rightarrow$  benzylamine +  $\text{CO}_2$ .  $\text{HNO}_2 \rightarrow$  mandelic acid.

*Me ester*:  $\text{C}_9\text{H}_{11}\text{O}_2\text{N}$ . MW, 165. Needles from ligroin. M.p. 32°. Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . *B,HCl*: cryst. M.p. 224°.

*Et ester*:  $\text{C}_{10}\text{H}_{13}\text{O}_2\text{N}$ . MW, 179. B.p. 257°, 149°/16 mm., 114–15°/5 mm.  $n_D^{25}$  1.500. *B,HCl*: m.p. 202°. *B,HNO\_2*: needles. M.p. 59°. *N-Acetyl*: m.p. 65–6°.

*Amide*:  $\text{C}_8\text{H}_{10}\text{ON}_2$ . MW, 150. Plates from EtOH- $\text{C}_6\text{H}_6$ . M.p. 132°. Sol.  $\text{H}_2\text{O}$ , EtOH. Spar. sol.  $\text{Et}_2\text{O}$ . Insol.  $\text{C}_6\text{H}_6$ .

*Nitrile*: see  $\alpha$ -Aminobenzyl cyanide.

*N-Phenyl*: see  $\alpha$ -Anilinophenylacetic Acid.

*N-Formyl*: m.p. 180° decomp.

*N-Acetyl*: prisms from  $\text{H}_2\text{O}$ . M.p. 198.5° corr.

*N-Chloroacetyl*: cryst. from  $\text{H}_2\text{O}$  or EtOH. M.p. 170°.

*N-Benzoyl*: see 1-Phenylhippuric Acid.

*l.*

Plates from  $\text{H}_2\text{O}$ , needles from EtOH.Aq. M.p. 305–10°. Spar. sol. EtOH.  $[\alpha]_D - 111.0^\circ$  in  $\text{H}_2\text{O}$ ,  $[\alpha]_D^{20} - 157.8^\circ$  in dil. HCl. Boil. dil. HCl  $\rightarrow dl.$

*B,HCl*: needles from dil. HCl. M.p. 246° decomp.

*Et ester*: *B,HCl*, m.p. 203° decomp. *N-Acetyl*: cryst. from ligroin. M.p. 69–70°.

*Nitrile*: see  $\alpha$ -Aminobenzyl cyanide.

*N-Formyl*: plates from  $\text{H}_2\text{O}$ , needles from EtOH. M.p. 190° decomp.  $[\alpha]_D^{20} - 259.9^\circ$  in EtOH.

*N-Acetyl*: needles from  $\text{H}_2\text{O}$ . M.p. 191° corr.  $[\alpha]_D^{20} + 197.4^\circ$  in  $\text{H}_2\text{O}$ .

*d.*

$[\alpha]_D^{20} + 112.6^\circ$  in  $\text{H}_2\text{O}$ .

*Me ester*: *B,HCl*, m.p. 202°.  $[M]_D - 247^\circ$  in  $\text{H}_2\text{O}$ . *N-Acetyl*: m.p. 114–17°. Hygroscopic.  $[M]_{5893} - 363^\circ$  in MeOH. *N-Benzoyl*: m.p. 101.5°.  $[M]_{5893} + 238^\circ$  in MeOH.

*Amide*: *B,HCl*, decomp. above 150°.  $[M]_{5893}^{20} - 188^\circ$ . *N-Acetyl*: m.p. 175°.  $[M]_D - 465^\circ$  in  $\text{CHCl}_3$ . *N-Benzoyl*: m.p. 217.5°.  $[M]_D - 302^\circ$  in  $\text{CHCl}_3$ .

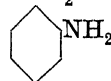
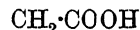
*N-Formyl*:  $[\alpha]_D^{20} + 259.3^\circ$  in EtOH.

*N-Acetyl*: needles from  $\text{H}_2\text{O}$ . M.p. 191° corr.  $[\alpha]_D^{20} + 197.4^\circ$  in  $\text{H}_2\text{O}$ .

Marvel, Noyes, *J. Am. Chem. Soc.*, 1920, 42, 2264.

Fischer, Weichhold, *Ber.*, 1908, 41, 1286.

Zelinsky, Stadnikoff, *Ber.*, 1906, 39, 1725.

 $o$ -Aminophenylacetic Acid ( $o$ -Amino- $\alpha$ -toluic acid)

$\text{C}_8\text{H}_9\text{O}_2\text{N}$  MW, 151

Needles. M.p. 119° decomp. Sol. hot  $\text{H}_2\text{O}$ . Readily forms oxindole. Diazotises and couples.

*Me ester*: *N-acetyl*, powder. M.p. 90°. *N-Benzoyl*: needles from EtOH. M.p. 108°.

*Et ester*: pale red liq. *N-Acetyl*: needles. M.p. 66°. *N-Benzoyl*: needles from EtOH. M.p. 82°.

*Amide*: *N-Acetyl*, needles from  $\text{H}_2\text{O}$ . M.p. 203°.

*Nitrile*: see  $o$ -Aminobenzyl cyanide.

*N-Formyl*: cryst. from EtOH. M.p. 110°. *N-Acetyl*: cryst. M.p. 158° (rapid heat.). *N-Benzoyl*: needles from EtOH. Softens at 170°. M.p. 179°.

Neber, *Ber.*, 1922, 55, 826.

**m-Aminophenylacetic Acid.**

Needles from H<sub>2</sub>O. M.p. 151°. *Me ester*: oil. *B,HCl*: plates from EtOH-Et<sub>2</sub>O. M.p. 167-70° decomp. *Amide*: prisms from H<sub>2</sub>O. Plates from EtOH. M.p. 164-6° corr. *N-Chloroacetyl*: needles from EtOH. Aq. M.p. 187-8°. *Nitrile*: see *m-Aminobenzyl cyanide*.

Jacobs, Heidelberg, *J. Am. Chem. Soc.*, 1917, 39, 2420.

**p-Aminophenylacetic Acid.**

Plates from H<sub>2</sub>O. M.p. 199-200° decomp. Mod. sol. hot H<sub>2</sub>O. *Me ester*: b.p. 140-50°/17 mm. *Et ester*: plates from H<sub>2</sub>O. M.p. 51° corr. *Amide*: m.p. 161-2°. *N-Acetyl*: amorphous. M.p. 235°. *N-Chloroacetyl*: plates from AcOH. M.p. 191-2° corr. *N-Benzoyl*: plates from EtOH. M.p. 248°.

*Nitrile*: see *p-Aminobenzyl cyanide*.

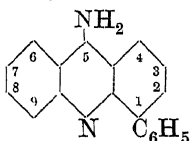
*N-Acetyl*: cryst. M.p. 168-70°.

*N-Chloroacetyl*: needles from H<sub>2</sub>O. Yellow plates from AcOH. M.p. 153-60°.

*N-Benzoyl*: needles from EtOH. M.p. 205-6°.

Robertson, *Organic Syntheses*, Collective Vol. I, 44.

**5-Amino-1-phenylacridine**



C<sub>19</sub>H<sub>14</sub>N<sub>2</sub> MW, 270

Yellow. M.p. 210-11°.

Albert, Gledhill, *J. Soc. Chem. Ind.*, 1945, 64, 169.

**5-Amino-3-phenylacridine.**

Yellow. M.p. 215-16°.

Albert, Gledhill, *J. Soc. Chem. Ind.*, 1945, 64, 169.

**3-Amino-5-phenylacridine.**

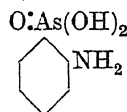
Yellow needles from EtOH. M.p. 204°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>. Mod. sol. EtOH. Spar. sol. ligroin. Insol. H<sub>2</sub>O. Sols. yellow with green fluor. Sol. AcOH → red col. Sol. conc. H<sub>2</sub>SO<sub>4</sub> → yellow sol. with green fluor.

*N-Acetyl*: yellow cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 256°.

*N-Benzoyl*: yellow prisms from EtOH. M.p. 246°.

Kehrmann, Stépanoff, *Ber.*, 1908, 41, 4135.

**o-Aminophenylarsonic Acid** (*o-Amino-phenylarsinic acid*, *o-arsanilic acid*)



C<sub>6</sub>H<sub>8</sub>O<sub>3</sub>NaS MW, 217

Needles. M.p. 153° decomp. Very sol. H<sub>2</sub>O, EtOH. Spar. sol. Et<sub>2</sub>O. Very sol. acids and alkalis. Aq. sol. turns Congo paper violet.

Benda, *Ber.*, 1911, 44, 3307.

Jacobs, Heidelberg, Rolf, *J. Am. Chem. Soc.*, 1918, 40, 1583.

**m-Aminophenylarsonic Acid** (*m-Arsanilic acid*).

Prisms from H<sub>2</sub>O. M.p. 215°. Sol. 50 parts of boiling H<sub>2</sub>O, 200 parts cold. Spar. sol. org. solvents. Very sol. alkalis and alk. carbonates.

*N-Acetyl*: m.p. 208-9°.

Böhringer Sohne, D.R.P., 286,547, (*Chem. Zentr.*, 1915, II, 731).

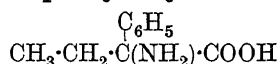
Bertheim, Benda, *Ber.*, 1911, 44, 3299.

Andres, Hamilton, *J. Am. Chem. Soc.*, 1945, 67, 946.

**p-Aminophenylarsonic Acid.**

See *Arsanilic Acid*.

**1-Amino-1-phenylbutyric Acid**



C<sub>10</sub>H<sub>13</sub>O<sub>2</sub>N MW, 179

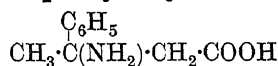
Prisms or needles from H<sub>2</sub>O + a little NH<sub>3</sub>. M.p. 275° (corr.) decomp. Sol. AcOH. Insol. most other solvents.

*B,HCl*: m.p. 271° (corr.) decomp.

Herbst, Johnson, *J. Am. Chem. Soc.*, 1932, 54, 2468.

Jawelow, *Ber.*, 1906, 39, 1199.

**2-Amino-2-phenylbutyric Acid**

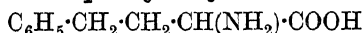


C<sub>10</sub>H<sub>13</sub>O<sub>2</sub>N MW, 179

Cryst. powder from EtOH. M.p. 255° decomp.

Posner, *Ann.*, 1912, 389, 76.

**1-Amino-3-phenylbutyric Acid**



C<sub>10</sub>H<sub>13</sub>O<sub>2</sub>N MW, 179

*d.*

[α]<sub>D</sub> + 33.0° in 20% HCl.

*N-Acetyl*: needles or leaflets from H<sub>2</sub>O. M.p. 178°. [α]<sub>D</sub> + 19.5° in *N*/NaOH.

*l.*

Decomp. at about 305°. [α]<sub>D</sub> - 29.6° in 20% HCl.

*dl*-

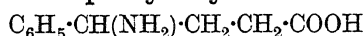
Leaflets or needles from H<sub>2</sub>O. M.p. 293–5° decomp.

*Et ester*: C<sub>15</sub>H<sub>17</sub>O<sub>2</sub>N. MW, 207. B.p. 161–2°/16 mm. *B, HCl*: m.p. 121–3° decomp.

Knoop, Hoessli, *Ber.*, 1906, 39, 1478.

Darapsky, *J. prakt. Chem.*, 1936, 146, 285.

Fischer, Schmitz, *Ber.*, 1906, 39, 2213.

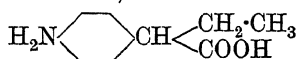
**3-Amino-3-phenylbutyric Acid**

C<sub>10</sub>H<sub>13</sub>O<sub>2</sub>N MW, 179

Prisms from H<sub>2</sub>O. M.p. 216°.

*B, HCl*: prisms. M.p. 180° decomp.

Köhl, *Ber.*, 1903, 36, 174.

**1-*p*-Aminophenylbutyric Acid** (*p*-Amino- $\alpha$ -ethylphenylacetic acid)

C<sub>10</sub>H<sub>13</sub>O<sub>2</sub>N MW, 179

*dl*-

M.p. 138–40°. [ $\alpha$ ]<sub>D</sub><sup>25</sup> + 12.2° in EtOH.

*l*-

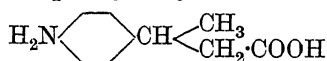
[ $\alpha$ ]<sub>D</sub><sup>25</sup> – 12.4° in EtOH.

*dl*-

Cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 142–3°.

*Et ester*: b.p. 101–2°/0.05 mm.  $n_D^{27}$  1.524.

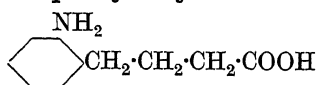
Chu, Marvel, *J. Am. Chem. Soc.*, 1933, 55, 2847.

**2-*p*-Aminophenylbutyric Acid**

C<sub>10</sub>H<sub>13</sub>O<sub>2</sub>N MW, 179

Cryst. from EtOH.Aq. M.p. 176°.

Schroeter, *Ber.*, 1907, 40, 1596.

**3-*o*-Aminophenylbutyric Acid**

C<sub>10</sub>H<sub>13</sub>O<sub>2</sub>N MW, 179

Leaflets from H<sub>2</sub>O or C<sub>6</sub>H<sub>6</sub>. M.p. 125–6°.

*B, HCl*: leaflets from EtOH–Et<sub>2</sub>O. M.p. 201°.

*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: orange cryst. M.p. 208°.

*N-Benzoyl*: cryst. from EtOH.Aq. M.p. 156°.

*N-p-Toluenesulphonyl*: m.p. 177–8°.

*Et ester*: C<sub>12</sub>H<sub>17</sub>O<sub>2</sub>N. MW, 207. Viscous oil. B.p. 191°/10 mm. Not volatile in steam.

*N-Benzoyl*: leaflets from MeOH. M.p. 128°.

*N-p-Toluenesulphonyl*: cryst. from AcOEt. M.p. 115–6°.

Briggs, De Ath, *J. Chem. Soc.*, 1937, 456.

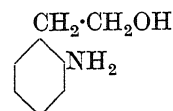
v. Braun, *Ber.*, 1907, 40, 1843.

Schroeter, *Ber.*, 1930, 63, 1324.

**3-*p*-Aminophenylbutyric Acid.**

Plates from H<sub>2</sub>O. M.p. 130–1°. Sol. EtOH, Me<sub>2</sub>CO. Mod. sol. CHCl<sub>3</sub>. Insol. cold H<sub>2</sub>O, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, pet. ether.

van der Scheer, *J. Am. Chem. Soc.*, 1934, 56, 744.

**2-*o*-Aminophenylethyl Alcohol** (*o*-Aminophenethyl alcohol)

C<sub>8</sub>H<sub>11</sub>ON MW, 137

Viscous liq. B.p. 147–8°/3.5 mm.  $n_D^{19}$  1.5849. Sol. cold H<sub>2</sub>O.

*B, HCl*: cryst. from EtOH–Et<sub>2</sub>O. M.p. 126–5°.

*N-Acetyl*: cryst. from C<sub>6</sub>H<sub>6</sub> or CHCl<sub>3</sub>–pet. ether. M.p. 103–5°.

*N-Benzoyl*: m.p. 168°.

*N-Benzenesulphonyl*: prisms. M.p. 89°.

Sabetay, Bléger, de Lestrangé, *Bull. soc. chim.*, 1931, 49, 3.

**2-*p*-Aminophenylethyl Alcohol** (*p*-Aminophenethyl alcohol).

Needles from EtOH. M.p. 108°.

*B, HCl*: cryst. from EtOH–Et<sub>2</sub>O. M.p. 171° (163°).

*Et ether*: m.p. 69–71°. B.p. 164–7°/4 mm. Darkens in air.

*N-Acetyl*: m.p. 105°.

*N-Benzoyl*: plates. M.p. 139–40°.

*N-Benzenesulphonyl*: prisms. M.p. 93°.

*O-Benzoyl*: needles from ligroin. M.p. 59–60°.

*ON-Dibenzoyl*: needles from EtOH.Aq. M.p. 136°.

Ferber, *Ber.*, 1929, 62, 190.

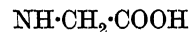
Ehrlich, Distschimuka, *Ber.*, 1912, 45, 2433.

**Aminophenylethyl Alcohol.**

See also Hydroxy-aminoethylbenzene.

**Aminophenylethyl chloride.**

See Chloro-aminoethylbenzene.

***m*-Aminophenylglycine** (*m*-Aminoanilinoacetic acid)

C<sub>8</sub>H<sub>10</sub>O<sub>2</sub>N<sub>2</sub> MW, 166

Light brown cryst. from dil. AcOH. M.p. 193–4° decomp. Sol. hot H<sub>2</sub>O. Spar. sol. most org. solvents. Readily oxidised in aq. sol. FeCl<sub>3</sub> → brown col.

*Me ester*: oil. *B, 2HCl*, cryst. from MeOH–Et<sub>2</sub>O. M.p. 196–7° decomp.

*Amide*: C<sub>8</sub>H<sub>11</sub>ON<sub>3</sub>. MW, 165. Needles from EtOH. M.p. 145.5–146.5° decomp.

Jacobs, Heidelberger, *J. Am. Chem. Soc.*, 1917, 39, 1447.

***p*-Aminophenylglycine.**

Plates + 1H<sub>2</sub>O from dil. AcOH. M.p. 222–3° decomp. Sols. in dil. acids or alkalis turn violet in air. FeCl<sub>3</sub> → green to violet col.

*B,HCl*: turns brown at 200°, decomp. at 250°.

*B,2HCl*: m.p. above 280°.

*Et ester*: *B,2HCl*, m.p. 201–2° decomp. *N-Acetyl*: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 124–5° corr.

*Amide*: brown plates from EtOH. M.p. 161–4°.

*Nitrile*: C<sub>8</sub>H<sub>9</sub>N<sub>3</sub>. MW, 147. Plates. M.p. 168°.

*N-Acetyl*: m.p. 241–2°.

Jacobs, Heidelberger, *J. Am. Chem. Soc.*, 1917, 39, 1447.

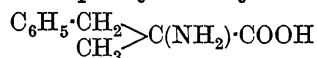
**1-Amino-2-phenylhydracrylic Acid.**

See 2-Hydroxy-1-amino-2-phenylpropionic Acid.

**3-*p*-Aminophenylisobutane.**

See *p*-Isobutylaniline.

**1-Amino-2-phenylisobutyric Acid**



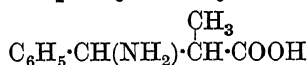
C<sub>10</sub>H<sub>13</sub>O<sub>2</sub>N MW, 179

Needles from H<sub>2</sub>O. M.p. 293–4° (corr.) decomp. Sol. AcOH. Insol. most other org. solvents.

*B,HCl*: m.p. 244–6° (corr.) decomp.

Herbst, Johnson, *J. Am. Chem. Soc.*, 1932, 54, 2468.

**2-Amino-2-phenylisobutyric Acid**



C<sub>10</sub>H<sub>13</sub>O<sub>2</sub>N MW, 179

Cryst. from EtOH.Aq. M.p. 243° decomp. Spar. sol. cold H<sub>2</sub>O, EtOH. Insol. Et<sub>2</sub>O, ligroin, C<sub>6</sub>H<sub>6</sub>.

*B,HCl*: cryst. from EtOH–Et<sub>2</sub>O. M.p. 227° decomp.

*N-Benzoyl*: cryst. from MeOH. M.p. 205°.

Posner, *Ann.*, 1912, 389, 72.

**2-*p*-Aminophenyl-lactic Acid.**

See 1-Hydroxy-2-*p*-aminophenylpropionic Acid.

**2-Amino-2-phenyl-lactic Acid.**

See 1-Hydroxy-2-amino-2-phenylpropionic Acid.

**2-*p*-Aminophenyl-lepidine.**

See Flavaniline.

**Aminophenyl Mercaptan.**

See Aminothiophenol.

**Aminophenyl methyl sulphide.**

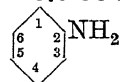
See under Aminothiophenol.

**Aminophenylloxamic Acid.**

See Amino-oxanilic Acid.

***o*-Aminophenylpropionic Acid (*o*-Amino-phenylacetylene-carboxylic acid)**

C:C·COOH



C<sub>9</sub>H<sub>7</sub>O<sub>2</sub>N MW, 161

Yellow needles. M.p. 123° → *o*-aminophenylacetylene + CO<sub>2</sub>. Spar. sol. Et<sub>2</sub>O. Insol. H<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>, pet. ether. Boiling H<sub>2</sub>O → *o*-aminoacetophenone.

*Et ester*: C<sub>11</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 189. Yellow needles from EtOH. M.p. 55°. *N-Formyl*: needles from EtOH. M.p. 83°. *N-Acetyl*: needles. M.p. 124°.

Richter, *Ber.*, 1883, 16, 679.

***m*-Aminophenylpropionic Acid.**

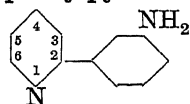
Needles from EtOH.Aq. M.p. 183°.

Reich, *Chem. Abstracts*, 1918, 12, 1876.

**Aminophenylpropionic Acid.**

See Aminohydrocinnamic Acid and Aminohydratropic Acid.

**2-*m*-Aminophenylpyridine**



C<sub>11</sub>H<sub>10</sub>N<sub>2</sub> MW, 170

*B.p.* 213°/20 mm.

*N-Acetyl*: needles. M.p. 141–2°.

Heilbron, Hey, Lambert, *J. Chem. Soc.*, 1940, 1279.

**3-*m*-Aminophenylpyridine.**

Cryst. from CHCl<sub>3</sub>-pet. ether. M.p. 77–8°.

*N-Acetyl*: needles. M.p. 135–6°.

Heilbron, Hey, Lambert, *J. Chem. Soc.*, 1940, 1279.

**4-*m*-Aminophenylpyridine.**

Needles from benzene-pet. ether. M.p. 165–6°.

*N-Acetyl*: needles. M.p. 171–2°.

Heilbron, Hey, Lambert, *J. Chem. Soc.*, 1940, 1279.

**2-*p*-Aminophenylpyridine.**

Prisms from EtOH.Aq. M.p. 97–8°. Sol. EtOH. Spar. sol. Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

*B,2HCl*: cryst. from EtOH–Et<sub>2</sub>O. M.p. above 310°.

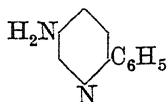
*N-p-Aminobenzenesulphonyl*: m.p. 257.5°.

*N<sup>4</sup>-Acetyl*: m.p. 241°.

*Picrate*: yellow plates from EtOH. M.p. 218–19° decomp.

Forsyth, Pyman, *J. Chem. Soc.*, 1926, 2917.

## 5-Amino-2-phenylpyridine



$C_{11}H_{10}N_2$  MW, 170

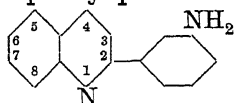
Needles from  $C_6H_6$ -ligroin. M.p. 105–6°. Sol. dil. acids and most org. solvents except ligroin. Insol.  $H_2O$ .

*B,HAcCl*<sub>4</sub>: reddish-brown needles. M.p. 169° decomp.

*N-Acetyl*: needles from EtOH.Aq. M.p. 148–9°.

*N-Benzoyl*: cryst. from EtOH.Aq. M.p. 201°.

Nienburg, *Ber.*, 1934, 67, 877.

2-*m*-Aminophenylquinoline

$C_{15}H_{12}N_2$  MW, 220

Needles from  $H_2O$ . M.p. 120°. Sol. MeOH,  $Et_2O$ ,  $C_6H_6$ . Spar. sol.  $H_2O$ , ligroin.

Miller, Kinkelin, *Ber.*, 1885, 18, 1904.

2-*p*-Aminophenylquinoline.

Needles from  $H_2O$ . M.p. 138°. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ .

*Methiodide*: orange micro-needles. M.p. 220° decomp.

*N-Formyl*: cryst. M.p. 160°.

*N-Acetyl*: plates from EtOH. M.p. 189°.

*N-Diacetyl*: cryst. from MeOH. M.p. 153–5°.

*N-Benzoyl*: plates from toluene. M.p. 234°.

*N-Me*:  $C_{16}H_{14}N_2$ . MW, 234. M.p. 82°.

*Picrate*: needles from EtOH. M.p. 183°.

*N-Et*:  $C_{17}H_{16}N_2$ . MW, 248. Yellow needles from pet. ether. M.p. 110°.

*Picrate*: m.p. 194–5°.

John, *J. prakt. Chem.*, 1934, 139, 183.

Claus, *Ber.*, 1881, 14, 1940.

4-*m*-Aminophenylquinoline.

Prisms from EtOH. M.p. 198°. Mod. sol.  $CHCl_3$ . Spar. sol. EtOH,  $C_6H_6$ . Prac. insol.  $Et_2O$  with bluish-violet fluor.

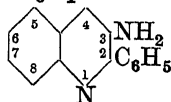
Koenigs, Nef, *Ber.*, 1887, 20, 628.

4-*p*-Aminophenylquinoline.

Plates from EtOH. M.p. 150°. Sol.  $CHCl_3$ ,  $C_6H_6$ . Spar. sol.  $Et_2O$  with bluish-violet fluor.

Koenigs, Nef, *Ber.*, 1887, 20, 627.

## 3-Amino-2-phenylquinoline



$C_{15}H_{12}N_2$  MW, 220

M.p. 115–16° (120–1°). B.p. 223–5°/3 mm.

*B,HCl*: yellow cryst. M.p. 280–300°.

*Methiodide*: needles from EtOH. M.p. 238°.

*Ethiodide*: orange-yellow prisms. M.p. 202°.

*N-Acetyl*: m.p. 124°.

*N-Diacetyl*: prisms. M.p. 173°. *Methochloride*: pale yellow. M.p. 230° decomp.

*Methiodide*: m.p. 221° decomp. *Methosulphate*: pale yellow. M.p. 200–1°.

*N-Benzoyl*: m.p. 179–80°.

*N-p-Nitrobenzoyl*: pale yellow. M.p. 223°.

*N-Phenyl*:  $C_{21}H_{18}N_2$ . MW, 296. M.p. 137°.

*Picrate*: cryst. from EtOH. M.p. 194–5°.

John, Ottawa, *J. prakt. Chem.*, 1931, 131, 346.

## 4-Amino-2-phenylquinoline.

Needles from  $C_6H_6$ . M.p. 168°. Sol. MeOH, EtOH, AcOH,  $Me_2CO$ , AcOEt,  $CHCl_3$ ,  $C_6H_6$ ,  $C_6H_5Cl$ , toluene. Mod. sol.  $Et_2O$ ,  $CCl_4$ . Insol. petrol.

*B,HCl*: needles. M.p. 272°.

*Nitrate*: m.p. 206°.

*Methiodide*: cryst. from MeOH. M.p. 274°.

*Ethiodide*: prisms from EtOH. M.p. 244°.

*N-Formyl*: cryst. from  $C_6H_6$ . M.p. 275° decomp.

*N-Acetyl*: prisms from EtOH. M.p. 108°.

*N-Diacetyl*: cryst. from EtOH. M.p. 117°.

*N-Benzoyl*: needles from  $C_6H_6$ . M.p. 182°.

*N-p-Aminobenzenesulphonyl*: *N*<sup>4</sup>-*acetyl*, m.p. 269–70°.

*N-Phenyl*: cryst. from  $C_6H_6$ . M.p. 190°.

*B,HCl*: yellow cryst. from AcOH. M.p. 265–6°.

*Nitrate*: yellow cryst. from EtOH. M.p. 195°

decomp. *N-Acetyl*: m.p. 160°. *Picrate*: m.p. 235–6°.

Bergström, *J. Org. Chem.*, 1938, 3, 429.

John, *Ber.*, 1926, 59, 1447.

Dziewoński, Moszew, *Chem. Abstracts*, 1933, 27, 3937.

## 6-Amino-2-phenylquinoline.

Cryst. from EtOH.Aq. M.p. 122–3°.

Chem. Fabr. Schering, D.R.P., 312,098, (*Chem. Zentr.*, 1919, II, 852).

## 7-Amino-2-phenylquinoline.

Yellow needles. M.p. 134°.

Borsche, Weigner-Roemmich, *Ann.*, 1940, 544, 287.

## 8-Amino-2-phenylquinoline.

Cryst. from EtOH.Aq. M.p. 111–11.5°.

Elderfield *et al.*, *J. Am. Chem. Soc.*, 1946, 68, 1589.

## 2-Amino-3-phenylquinoline.

Cryst. from EtOH. M.p. 155–6°. Sol. EtOH,  $Et_2O$ ,  $Me_2CO$ , AcOH, AcOEt,  $CHCl_3$ ,  $C_6H_6$ . Spar. sol.  $H_2O$ , ligroin.

*N-Acetyl*: m.p. 107–8°.

*N-Benzoyl*: m.p. 124°.

*Picrate*: needles from EtOH. M.p. 234°.

Pschorr, *Ber.*, 1898, 31, 1293.



**6-Amino-4-phenylquinoline.**

Needles from  $\text{CHCl}_3$ . M.p.  $205^\circ$ . Sol. EtOH with bluish-green fluor. Sol.  $\text{Et}_2\text{O}$  with blue fluor.

*Picrate*: yellow needles. M.p.  $233-4^\circ$ .

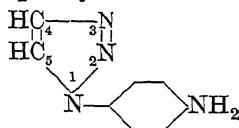
Koenigs, Meimberg, *Ber.*, 1895, **28**, 1044.

**Aminophenyltolylamine.**

See Aminomethyldiphenylamine.

**Aminophenyl tolyl Ketone.**

See Aminomethylbenzophenone.

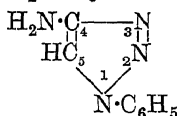
**1-*p*-Aminophenyl-1 : 2 : 3-triazole**

$\text{C}_8\text{H}_8\text{N}_4$  MW, 160

Cryst. from  $\text{H}_2\text{O}$ . M.p.  $138-9^\circ$ . Sol. hot

$\text{C}_6\text{H}_6$ . Spar. sol. hot EtOH, AcOEt.

Michael, Luehn, Higbee, *Am. Chem. J.*, 1898, **20**, 392.

**4-Amino-1-phenyl-1 : 2 : 3-triazole**

$\text{C}_8\text{H}_8\text{N}_4$  MW, 160

Cryst. from EtOH. M.p.  $110^\circ$ .

*N-Acetyl*: cryst. from EtOH. M.p.  $143^\circ$ .

Kleinfeller, Bönig, *J. prakt. Chem.*, 1931, **132**, 196.

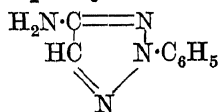
**5-Amino-1-phenyl-1 : 2 : 3-triazole.**

Needles from  $\text{H}_2\text{O}$ . M.p.  $110^\circ$ . Sol. EtOH. Spar. sol.  $\text{Et}_2\text{O}$ . Insol. ligroin.

*5-N-Me*:  $\text{C}_9\text{H}_{10}\text{N}_4$ . MW, 174. Prisms from  $\text{C}_6\text{H}_6$ . M.p.  $102^\circ$ .

*5-N-Phenyl*:  $\text{C}_{14}\text{H}_{12}\text{N}_4$ . MW, 236. Plates from EtOH. M.p.  $142^\circ$ .

Dimroth, *Ann.*, 1909, **364**, 211.

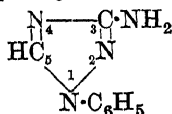
**4-Amino-2-phenyl-1 : 2 : 3-triazole**

$\text{C}_8\text{H}_8\text{N}_4$  MW, 160

Needles from  $\text{H}_2\text{O}$ . M.p.  $70^\circ$ . Sol. EtOH,  $\text{C}_6\text{H}_6$ ,  $\text{CHCl}_3$ .

*4-N-Acetyl*: needles. M.p.  $166^\circ$ .

Thiele, Schlaussner, *Ann.*, 1897, **295**, 157.

**3-Amino-1-phenyl-1 : 2 : 4-triazole**

$\text{C}_8\text{H}_8\text{N}_4$  MW, 160

Needles from  $\text{H}_2\text{O}$ . M.p.  $150^\circ$ . Sol. EtOH,  $\text{Et}_2\text{O}$ .

*B,HCl*: needles +  $1\text{H}_2\text{O}$  from dil. HCl. M.p.  $187^\circ$ .

*B,HNO3*: needles from  $\text{H}_2\text{O}$ . M.p.  $181^\circ$ .

*Picrate*: yellow needles from  $\text{H}_2\text{O}$ . M.p.  $220^\circ$ .

*3-N-Acetyl*: cryst. from EtOH. M.p.  $168^\circ$ .

*3-N-Diacetyl*: needles. M.p.  $118^\circ$ .

Cuneo, *Gazz. chim. ital.*, 1899, **29**, 16.

**5-Amino-1-phenyl-1 : 2 : 4-triazole.**

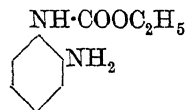
Needles. M.p.  $157^\circ$ . Sol. EtOH. Spar. sol.  $\text{H}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ .

*B2,H2PcCl6*: cryst. M.p.  $197^\circ$ .

*Picrate*: yellow needles from  $\text{H}_2\text{O}$ . M.p.  $175^\circ$ .

Pellizzari, Roncaglione, *Gazz. chim. ital.*, 1901, **31**, 524.

***o*-Aminophenylurethane** (*Carbethoxy-o-phenylenediamine, o-aminoanilinoformic ethyl ester*)



$\text{C}_9\text{H}_{12}\text{O}_2\text{N}_2$  MW, 180

Needles from  $\text{Et}_2\text{O}$ -ligroin. M.p.  $86^\circ$ .

Karrer, Schöpp, Benz, Pfaehler, *Helv. Chim. Acta*, 1935, **18**, 69.

Rudolph, *Ber.*, 1879, **12**, 1295.

***p*-Aminophenylurethane** (*Carbethoxy-p-phenylenediamine, p-aminoanilinoformic ethyl ester*).

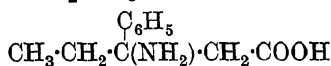
Needles from  $\text{H}_2\text{O}$ . M.p.  $73-4^\circ$ . Spar. sol.  $\text{H}_2\text{O}$ .

*B,HCl*: needles. M.p.  $242-4^\circ$  decomp.

*p-N-Acetyl*: prisms from EtOH. M.p.  $202-5^\circ$  ( $181^\circ$ ).

*p-N-Benzoyl*: violet needles from EtOH. M.p.  $230^\circ$ .

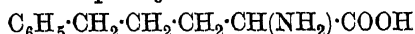
Schiff, Ostrogovich, *Ann.*, 1896, **293**, 375.

**2-Amino-2-phenyl-*n*-valeric Acid**

$\text{C}_{11}\text{H}_{15}\text{O}_2\text{N}$  MW, 193

Needles +  $1\frac{1}{2}\text{H}_2\text{O}$  from  $\text{H}_2\text{O}$ . Sinters at  $95^\circ$ , m.p. anhyd.  $217^\circ$  decomp. Mod. sol. cold EtOH.

Posner, *Ann.*, 1912, **389**, 87.

**1-Amino-4-phenyl-*n*-valeric Acid**

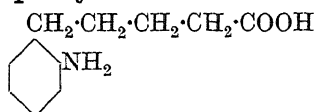
$\text{C}_{11}\text{H}_{15}\text{O}_2\text{N}$  MW, 193

Leaflets from  $\text{H}_2\text{O}$ . M.p.  $203-6^\circ$ . Mod. sol. EtOH. Very spar. sol. cold  $\text{H}_2\text{O}$ .

N- $\beta$ -Naphthalenesulphonyl: cryst. from EtOH.Aq. M.p. 83°.

v. Braun, Kruber, *Ber.*, 1912, 45, 389.

#### 4-*o*-Aminophenylvaleric Acid



C<sub>11</sub>H<sub>15</sub>O<sub>2</sub>N MW, 193

Needles from EtOH.Aq. M.p. 60-2°.

N-Acetyl: m.p. 126-8°.

N-Benzoyl: cryst. from very dil. EtOH.

M.p. 127°. Nitrile: cryst. from EtOH.Aq.

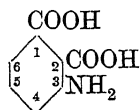
M.p. 114°.

v. Braun, Bartsch, *Ber.*, 1912, 45, 3386.

v. Braun, *Ber.*, 1907, 40, 1841.

Diehl, Einhorn, *Ber.*, 1887, 20, 385.

#### 3-Aminophthalic Acid



C<sub>8</sub>H<sub>7</sub>O<sub>4</sub>N MW, 181

Cryst. M.p. 231-2° (191-2° decomp.). Spar. sol. EtOH, Et<sub>2</sub>O, cold H<sub>2</sub>O. Insol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, ligroin.

Mono-NH<sub>4</sub> salt: cryst. from EtOH.Aq. M.p. 117-18° decomp.

Di-Hg salt: decomp. at 200°. Spar. sol. H<sub>2</sub>O.

B,HCl: m.p. 225° decomp.

1-Me ester: B,HCl, cryst. from conc. HCl. M.p. 153° decomp.

Di-Me ester: B,HCl: needles. M.p. 172-4° decomp. N-Acetyl: cryst. from AcOH.Aq. M.p. 92-3°.

Imide: 3-aminophthalimide. Yellow needles from H<sub>2</sub>O or EtOH. M.p. 266-7°. Spar. sol. most solvents → fluor. sols. Hydrochloride: m.p. 268° decomp. 3-N-Acetyl: needles from H<sub>2</sub>O. M.p. 242°. N-Di-acetyl: prisms from EtOH. M.p. 152-4°.

Phenylimide: yellow needles from EtOH. M.p. 186-8°. N-Acetyl: needles from EtOH. M.p. 195-5°.

*o*-Tolylimide: yellow prisms from MeOH. M.p. 214-15°.

N-Benzoyl: m.p. 186-7° decomp.

Kenner, Mathews, *J. Chem. Soc.*, 1914, 105, 2477.

Scott, Cohen, *J. Chem. Soc.*, 1921, 664.

Gisvold, *J. Am. Pharm. Assoc.*, 1942, 31, 202.

#### 4-Aminophthalic Acid.

Cryst. from AcOH.Aq.

B<sub>2</sub>H<sub>2</sub>SnCl<sub>4</sub>: needles. M.p. 274°.

B<sub>2</sub>H<sub>2</sub>SnCl<sub>6</sub>: yellow cryst. M.p. 182°.

1-Me ester: C<sub>9</sub>H<sub>9</sub>O<sub>4</sub>N. MW, 195. Yellow. Decomp. at 140°.

Di-Me ester: C<sub>10</sub>H<sub>11</sub>O<sub>4</sub>N. MW, 209. Plates from EtOH or C<sub>6</sub>H<sub>6</sub>. M.p. 84°. Sol. CHCl<sub>3</sub>, Py. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O, pet. ether. N-Acetyl: plates from EtOH.Aq. M.p. 136-5°. N-Propionyl: needles from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 110-5°. N-Benzoyl: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 132°. N-m-Nitrobenzoyl: m.p. 147°. N-p-Nitrobenzoyl: yellow cryst. from EtOH. M.p. 202°.

Di-Et ester: C<sub>12</sub>H<sub>15</sub>O<sub>4</sub>N. MW, 237. Prisms from EtOH. M.p. 95°. Insol. H<sub>2</sub>O. N-Acetyl: plates from H<sub>2</sub>O or EtOH. M.p. 122°.

Imide: 4-aminophthalimide. Yellow needles from H<sub>2</sub>O. M.p. 294°. Sublimes. Sol. EtOH, Me<sub>2</sub>CO. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O, CHCl<sub>3</sub>.

Me-imide: yellow cryst. M.p. 242-3°.

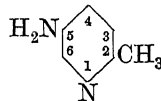
Phenylimide: yellow needles from EtOH or AcOH. M.p. 205-5°.

Bogert, Renshaw, *J. Am. Chem. Soc.*, 1908, 30, 1136.

#### Aminophthalimide.

See under Aminophthalic Acid.

5-Amino- $\alpha$ -picoline (5-Amino-2-methylpyridine)



C<sub>6</sub>H<sub>8</sub>N<sub>2</sub> MW, 108

Cryst. from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 96°. Spar. sol. H<sub>2</sub>O.

B,2HCl: needles from EtOH-Et<sub>2</sub>O. M.p. 215-18°.

Picrate: m.p. 201°.

N-Acetyl: needles from CHCl<sub>3</sub>-pet. ether. M.p. 126° (122-3°).

N-Benzoyl: needles from EtOH.Aq. M.p. 110-11°.

Graf, *J. prakt. Chem.*, 1932, 133, 19.

6-Amino- $\alpha$ -picoline (6-Amino-2-methylpyridine).

M.p. 41°. B.p. 208-9°. Very sol. H<sub>2</sub>O. Sol. common org. solvents except ligroin.

B,HCl: m.p. 155°.

B,HBr: m.p. 149-50°.

B,HI: m.p. 162°.

B,HNO<sub>3</sub>: m.p. 168°.

B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>: orange cryst. from dil. HNO<sub>3</sub>. M.p. 218° decomp. (209°).

Picrate: m.p. 202°.

N-Acetyl: m.p. 90° (88°).

N-Benzoyl: m.p. 90°.

N-p-Aminobenzenesulphonyl: m.p. 219°. B,HCl: m.p. 220°. N<sup>4</sup>-Acetyl: m.p. 215-17°.

Meyer, *Rec. trav. chim.*, 1925, 44, 323.

Seide, *Chem. Zentr.*, 1923, III, 1022.

Schering A.G., D.R.P., 663,891, (*Chem. Zentr.*, 1938, II, 2843).

**2-Amino- $\beta$ -picoline** (2-Amino-3-methylpyridine).

M.p. 26–26.4°. B.p. 222°/748 mm., 102–3°/11 mm. (corr.), 95°/8 mm. Sol. H<sub>2</sub>O, org. solvents.

*B, HCl, H<sub>2</sub>O*: needles from EtOH–Et<sub>2</sub>O. M.p. 68–75°.

*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: orange prisms from H<sub>2</sub>O. M.p. 209° decomp.

*Picrate*: yellow prisms from Me<sub>2</sub>CO. M.p. 229°.

*N-Formyl*: m.p. 138°. *Picrate*: bright yellow. M.p. 167–8°.

*N-Acetyl*: rhombic cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 64°. *Picrate*: bright yellow. M.p. 157–9°.

*N-Benzoyl*: needles from EtOH. M.p. 220°.

Seide, *Ber.*, 1925, 58, 1733; 1924, 57, 1803.

**2-Amino- $\gamma$ -picoline** (2-Amino-4-methylpyridine).

Leaflets from ligroin. M.p. 98°. B.p. 200–250°. Sublimes. Sol. H<sub>2</sub>O, most org. solvents.

*B, HCl*: prisms from EtOH. M.p. 176–7° (sealed tube).

*B, HNO<sub>3</sub>*: leaflets from EtOH. M.p. 139°.

*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: orange cryst. from H<sub>2</sub>O. M.p. 208°.

*Picrate*: yellow needles from Me<sub>2</sub>CO or AcOH. M.p. 227° decomp.

*N-Acetyl*: prisms from C<sub>6</sub>H<sub>6</sub>. M.p. 102–3°.

*N-Benzoyl*: prisms from ligroin. M.p. 114°.

*N-Dibenzoyl*: needles from EtOH.Aq. M.p. 182–3°.

*N-p-Aminobenzenesulphonyl*: m.p. 225–6°.

Seide, *Ber.*, 1924, 57, 791.

**3-Amino- $\gamma$ -picoline** (3-Amino-4-methylpyridine).

Prisms from C<sub>6</sub>H<sub>6</sub>–pet. ether. M.p. 106°. B.p. 254°/735 mm. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>. Insol. ligroin. Volatile in steam.

*B, HCl*: prisms. M.p. 180°.

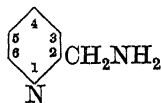
*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: orange prisms from HCl. M.p. 227°.

*Picrate*: yellow prisms from EtOH. M.p. 179–80°.

*N-Acetyl*: leaflets from Me<sub>2</sub>CO–ligroin. M.p. 84°. *Picrate*: m.p. 194°.

*N-Benzoyl*: plates from Me<sub>2</sub>CO–ligroin. M.p. 81°. *Picrate*: needles. M.p. 164°.

Koenigs, Fulde, *Ber.*, 1927, 60, 2109.

 **$\omega$ -Amino- $\alpha$ -picoline** (2-Aminomethylpyridine, 2-pyridylmethylamine,  $\alpha$ -picolylamine)

C<sub>6</sub>H<sub>8</sub>N<sub>2</sub> MW, 108

B.p. 91°/15 mm., 82°/12 mm. Sol. H<sub>2</sub>O.

*B, 2HBr*: m.p. 234°.

Dict. of Org. Comp.—I.

*B, H<sub>2</sub>PtCl<sub>6</sub>, 3H<sub>2</sub>O*: golden leaflets. M.p. 245° decomp.

*B, 2AuCl<sub>3</sub>*: yellow cryst. M.p. 186° (204°).

*Picrate*: needles from EtOH. M.p. 162° decomp.

*N-Benzoyl*: rosettes from pet. ether. M.p. 53°. B.p. 235°/15 mm.

*N-p-Nitrobenzoyl*: pale yellow needles from EtOH. M.p. 136°.

*N-p-Aminobenzenesulphonyl*: m.p. 131°. *N<sup>4</sup>-Acetyl*: m.p. 124°.

Craig, Hixon, *J. Am. Chem. Soc.*, 1931, 53, 4368.

Graf, Perathoner, Tatzel, *J. prakt. Chem.*, 1936, 146, 88.

Kolloff, Hunter, *J. Am. Chem. Soc.*, 1941, 63, 490.

 **$\omega$ -Amino- $\beta$ -picoline** (3-Aminomethylpyridine, 3-pyridylmethylamine,  $\beta$ -picolylamine).

B.p. 112°/18 mm., 102–3°/14 mm. Misc. with H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.

*B, 2HCl*: m.p. 224° (219–20°).

*B, H<sub>2</sub>PtCl<sub>6</sub>*: cryst. from very dil. HCl. M.p. above 320° (decomp. at 280°).

*B, 2HAuCl<sub>4</sub>, H<sub>2</sub>O*: golden leaflets. M.p. 201–2° decomp.

*Picrate*: plates from EtOH. M.p. 211° (193°).

*N-p-Nitrobenzoyl*: needles from EtOH. M.p. 188–9°.

*N-p-Aminobenzenesulphonyl*: m.p. 133°. *N<sup>4</sup>-Acetyl*: m.p. 181°.

Craig, Hixon, *J. Am. Chem. Soc.*, 1931, 53, 4369.

Erlenmeyer, Epprecht, *Helv. Chim. Acta*, 1937, 20, 690.

Graf, Perathoner, Tatzel, *J. prakt. Chem.*, 1936, 146, 88.

Adkins, Wolff, Pavlic, Hutchinson, *J. Am. Chem. Soc.*, 1944, 66, 1293.

 **$\omega$ -Amino- $\gamma$ -picoline** (4-Aminomethylpyridine, 4-pyridylmethylamine,  $\gamma$ -picolylamine).

B.p. 103°/11 mm.

*B, HBr*: m.p. 240° decomp.

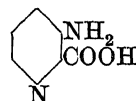
*B, 2HBr*: m.p. 253° decomp.

*B, 2HAuCl<sub>4</sub>*: yellow cryst. powder. M.p. 190°.

*N-Benzoyl*: rosettes from CHCl<sub>3</sub>. M.p. 108°. B.p. 240°/12 mm.

*N-p-Aminobenzenesulphonyl*: m.p. 183°. *N<sup>4</sup>-Acetyl*: m.p. 196°.

Graf, Perathoner, Tatzel, *J. prakt. Chem.*, 1936, 146, 88.

**3-Aminopicolinic Acid** (3-Aminopyridine-2-carboxylic acid)

C<sub>6</sub>H<sub>6</sub>O<sub>2</sub>N<sub>2</sub>

MW, 138

Faintly coloured plates +  $\frac{1}{2}$ H<sub>2</sub>O. M.p. 210° decomp. Heat above m.p. → 3-aminopyridine.

Sucharda, *Ber.*, 1925, 58, 1727.

### 5-Aminoprehnitene.

See Prehnidine.

### Aminopropane.

See Propylamine and Isopropylamine.

### Aminopropanol.

See Aminopropyl Alcohol and Aminoisopropyl Alcohol.

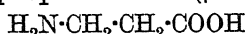
### γ-Aminopropenylbenzene.

See Cinnamylamine.

### 1-Aminopropionic Acid.

See Alanine.

### 2-Aminopropionic Acid (β-Alanine)



C<sub>3</sub>H<sub>7</sub>O<sub>2</sub>N MW, 89

Cryst. from H<sub>2</sub>O. M.p. 200°. Sol. H<sub>2</sub>O. Spar. sol. EtOH. Insol. Et<sub>2</sub>O, Me<sub>2</sub>CO. Heat → acrylic acid.

*B, HCl*: plates. M.p. 123°.

*B, HBr*: needles. M.p. 105–15°.

*B, HI*: needles. M.p. 199°.

*B<sub>2</sub>, H<sub>2</sub>SO<sub>4</sub>*: prisms. M.p. 150° decomp.

*B, H<sub>2</sub>AuCl<sub>4</sub>*: needles. M.p. 144–5°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.

*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: yellow plates from EtOH–HCl. M.p. 210° decomp. Sol. H<sub>2</sub>O. Spar. sol. EtOH.

*Me ester*: C<sub>4</sub>H<sub>9</sub>O<sub>2</sub>N. MW, 103. B.p. 58°/15 mm. Sol. H<sub>2</sub>O. *D*<sub>4</sub><sup>16</sup> 1.0346. *B, HCl*: scales. M.p. 94–5°. *B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: needles. M.p. 192°.

*Et ester*: C<sub>5</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 117. B.p. 58°/14 mm. *B, HCl*: plates from EtOH–Et<sub>2</sub>O. M.p. 69–70°. *B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: needles. M.p. 196°.

*Amide*: C<sub>3</sub>H<sub>8</sub>ON<sub>2</sub>. MW, 88. Needles. M.p. 41°. Spar. sol. Et<sub>2</sub>O. *Hydrochloride*: m.p. 149°. *B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: orange-yellow prisms. M.p. 213° decomp. *Picrate*: m.p. 156°.

*N-Phenyl*: see 2-Anilinopropionic Acid.

*N-Benzyl*: m.p. 181°. *B, HCl*: m.p. 175° decomp.

*N-Benzoyl*: leaflets or prisms from H<sub>2</sub>O. M.p. 120°.

*Lactam*: see β-Propiolactam.

Holm, *J. Chem. Soc.*, 1905, 88, 29.

Ruggli, Bussinger, *Helv. Chim. Acta*, 1942, 25, 35.

Galat, *J. Am. Chem. Soc.*, 1945, 67, 1414.

### β-Aminopropiophenone (1-Aminoethyl phenyl ketone)

C<sub>9</sub>H<sub>11</sub>ON MW, 149

Unstable. (M.p. 112–14°).

*B, HCl*: needles from EtOH–Et<sub>2</sub>O. M.p. 187°.

*B, H<sub>2</sub>AuCl<sub>4</sub>*: m.p. 151°.

*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: orange-red cryst. M.p. 205–6°.

*B<sub>2</sub>, H<sub>2</sub>SnCl<sub>4</sub>*: cryst. from HCl. M.p. 219–20°.

*Picrate*: yellow needles from EtOH. M.p. 164–5°.

*N-Acetyl*: cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 90–1°.

*N-Benzoyl*: prisms from Et<sub>2</sub>O. M.p. 104–5°.

Eberhard, *Arch. pharm.*, 1915, 253, 81.

Gabriel, *Ber.*, 1908, 41, 1127.

### γ-Aminopropiophenone (2-Aminoethyl phenyl ketone)



C<sub>9</sub>H<sub>11</sub>ON MW, 149

*B, HCl*: prisms from EtOH. M.p. 128° decomp.

*B, H<sub>2</sub>AuCl<sub>4</sub>*: m.p. 125° decomp.

*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: yellow needles. M.p. 215° decomp.

*Picrate*: needles. M.p. 155° decomp.

*N-Acetyl*: plates from C<sub>6</sub>H<sub>6</sub>–pet. ether. M.p. 76°.

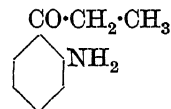
*N-Benzyl*: leaflets. M.p. 67°. *B, HCl*: needles. M.p. 163°.

*N-Benzoyl*: prisms from C<sub>6</sub>H<sub>6</sub>. M.p. 94–5–95–5°.

Hale, Britton, *J. Am. Chem. Soc.*, 1919, 41, 846.

Mannich, Hieronimus, *Ber.*, 1942, 75B, 49.

### o-Aminopropiophenone (Ethyl o-amino phenyl ketone)



C<sub>9</sub>H<sub>11</sub>ON MW, 149

Leaflets from pet. ether. M.p. 47°. B.p. 93°/0.8 mm.

*B, HCl*: m.p. 184–5° (200°) decomp.

*N-Formyl*: m.p. 39–41°.

*N-Acetyl*: plates from EtOH. M.p. 71°.

*N-Propionyl*: cryst. from EtOH. M.p. 51°.

*N-n-Butyryl*: cryst. from EtOH. M.p. 39–40°.

*N-Benzoyl*: needles from EtOH. M.p. 130°.

*N-p-Toluenesulphonyl*: prisms from EtOH. Softens at 125°. Decomp. over range.

*Oxime*: silky needles from H<sub>2</sub>O, stout needles from C<sub>6</sub>H<sub>6</sub>. M.p. 88–9°.

*Semicarbazone*: prisms from EtOH. M.p. 190° decomp.

Auwers, Duesberg, *Ber.*, 1920, 53, 1179.

Elson, Gibson, Johnson, *J. Chem. Soc.*, 1930, 1128.

Wohnlich, *Arch. pharm.*, 1913, 251, 531.

Zenitz, Hartung, *J. Org. Chem.*, 1946, 11, 444.

### m-Aminopropiophenone (Ethyl m-amino phenyl ketone).

Yellow cryst. M.p. 42°. B.p. 168–9°/15 mm.

*B, HCl*: m.p. 198–9° (170°) decomp.

*N-p-Toluenesulphonyl*: needles from EtOH.

M.p. 102-3° (97°).

Oxime: m.p. 112-13°.

Elson, Gibson, Johnson, *J. Chem. Soc.*,  
1930, 1128.**p-Aminopropiophenone** (*Ethyl p-aminophenyl ketone*).Needles from H<sub>2</sub>O. M.p. 140°. Sol. H<sub>2</sub>O, EtOH.

B, HCl: needles. M.p. 225°.

B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>: plates from EtOH. M.p. 225° decomp.N-Acetyl: needles from H<sub>2</sub>O. M.p. 172-3° (161°). Oxime: m.p. 156-7° decomp.N-Propionyl: needles from H<sub>2</sub>O. M.p. 151° corr.

N-Benzoyl: plates from EtOH. M.p. 190°.

Oxime: m.p. 164-5°.

Oxime: needles from EtOH. M.p. 153°.

Kunckell, *Chem. Abstracts*, 1912, 6, 1432;  
*Chem. Zentr.*, 1912, I, 134.**2-Aminopropyl Alcohol** (*2-Hydroxyisopropylamine*, *β-propanolamine*, *2-aminopropanol-1*)C<sub>3</sub>H<sub>9</sub>ON MW, 75d<sub>l</sub>.B.p. 173-6°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.B, HCl: plates from EtOH-Me<sub>2</sub>CO. M.p. 86-87.5° decomp.B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>: brownish-yellow plates. M.p. 198-9° decomp.

N-Benzyl: b.p. 155-7/20° mm. M.p. 70-2°.

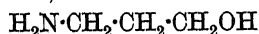
B, HCl: m.p. 111-13°. Picrate: m.p. 135-7°.

Acid oxalate: m.p. 176-8°.

d<sub>l</sub>.B<sub>2</sub>(COOH)<sub>2</sub>: [α]<sub>D</sub><sup>20</sup> -18.8°.N-Benzyl: m.p. 47-9°. [α]<sub>D</sub><sup>20</sup> -44.25°.B, HCl: m.p. 136-8°. [α]<sub>D</sub><sup>20</sup> -14.75°. Picrate: m.p. 73-5°.

Acid oxalate: m.p. 187-9°.

l.

Colourless oil. B.p. 72-3°/11 mm. D<sub>4</sub><sup>20</sup> 0.965.[α]<sub>D</sub><sup>20</sup> +15.8°. B<sub>2</sub>(COOH)<sub>2</sub>: m.p. 171°. [α]<sub>D</sub><sup>20</sup> +18.8°.N-Benzyl: gum. [α]<sub>D</sub><sup>20</sup> +44°.Karrer et al., *Helv. Chim. Acta*, 1921,  
4, 98.Gabriel, *Ber.*, 1916, 49, 2121.Stoll, Peyer, Hofman, *Helv. Chim. Acta*,  
1943, 26, 929.**3-Aminopropyl Alcohol** (*3-Hydroxypropylamine*, *propanolamine*, *γ-propanolamine*, *3-aminopropanol-1*)C<sub>3</sub>H<sub>9</sub>ON MW, 75B.p. 188°. D<sub>4</sub><sup>20</sup> 0.9824. n<sub>D</sub><sup>20</sup> 1.4570.B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>: yellow plates. M.p. 199°.

Picrate: m.p. 222° decomp.

N-Di-Me: C<sub>5</sub>H<sub>13</sub>ON. MW, 103. B.p. 163-4°. Sol. H<sub>2</sub>O. Me ether: C<sub>6</sub>H<sub>15</sub>ON. MW, 117. B.p. 129-30°. D<sub>4</sub><sup>20</sup> 0.8123. Picrate of O:N-Tri-Me: m.p. 203-4°.N-Di-Et: C<sub>7</sub>H<sub>17</sub>ON. MW, 131. B.p. 189-5°, 87/16 mm. Sol. H<sub>2</sub>O. Styphnate: m.p. 103°.

N-Phenyl: see γ-Hydroxypropylaniline.

Putochin, *Chem. Abstracts*, 1929, 23, 2939;  
*Ber.*, 1926, 59, 625.Henry, *Ber.*, 1900, 33, 3169.**ω-Aminopropyl-ω-aminobutyl-amine.**

See Spermidine.

**α-Aminopropylbenzene.**

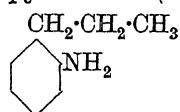
See 1-Phenylpropylamine.

**β-Aminopropylbenzene.**

See 2-Phenylisopropylamine.

**γ-Aminopropylbenzene.**

See 3-Phenylpropylamine.

**o-Aminopropylbenzene** (*o-Propylaniline*)C<sub>9</sub>H<sub>13</sub>N MW, 135

B.p. 222-4°, 116°/15 mm.

B, HCl: m.p. 173°.

Picrate: m.p. 151°.

N-Di-Me: C<sub>11</sub>H<sub>17</sub>N. MW, 163. B.p. 104-5°/17 mm. B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>: red powder from H<sub>2</sub>O.

M.p. 146°. Picrate: m.p. 150°.

N-Acetyl: o-propylacetanilide. Needles from EtOH.Aq. M.p. 104-5°.

N-Benzoyl: needles from EtOH.Aq. M.p. 119°.

Gottlieb, *Ber.*, 1899, 32, 962.**p-Aminopropylbenzene** (*p-Propylaniline*).B.p. 225°. Spar. sol. H<sub>2</sub>O.

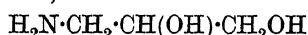
B, HCl: plates. M.p. 203-4°.

B, HBr: plates. M.p. 213°.

N-Di-Me: b.p. 230°.

N-Acetyl: p-propylacetanilide. Plates from EtOH.Aq. M.p. 95-6° (87°).

N-Benzoyl: plates from EtOH. M.p. 115°.

Willgerodt, Seckerl, *Ann.*, 1903, 327, 301.**3-Aminopropylene Glycol** (*2:3-Dihydroxypropylamine*)C<sub>3</sub>H<sub>9</sub>O<sub>2</sub>N MW, 91d<sub>l</sub>.B.p. 264-5°/740 mm. part. decomp. Sol. H<sub>2</sub>O, EtOH. Insol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. D<sub>4</sub><sup>20</sup> 1.1752.n<sub>D</sub><sup>20</sup> 1.49. Hygroscopic. Absorbs CO<sub>2</sub>. HNO<sub>2</sub> → glycerol.B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>: yellow needles. M.p. 185°.N-Me: C<sub>4</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 105. B.p. 239-41°/748 mm. Picrolonate: orange prisms from EtOH. M.p. 212°.

*N-Di-Me*:  $C_5H_{13}O_2N$ . MW, 119. B.p. 216–17°. *Picrolonate*: yellow cryst. from EtOH. M.p. 160°.

*N-Et*:  $C_5H_{13}O_2N$ . MW, 119. B.p. 244–7°/750 mm., 141–2°/18 mm. *Picrolonate*: yellow cryst. from EtOH. M.p. 237° decomp.

*N-Di-Et*:  $C_7H_{17}O_2N$ . MW, 147. B.p. 233–5°. *Picrolonate*: orange yellow needles from EtOH. M.p. 116–18°.

O: *O-Dibenzoyl*: *B,HCl*: needles. M.p. about 203° decomp. *Nitrate*: needles. M.p. 185° decomp. *Nitrite*: needles from EtOH.Aq. Decomp. about 70°. *Picrate*: needles from EtOH.Aq. M.p. 187° decomp.

O: *N-Dibenzoyl deriv.*: hexagonal tables from EtOH.Aq. M.p. 109°.

O: O: *N-Tribenzoyl*: cryst. M.p. 113–14°.

O: O: *O-Di-p-nitrobenzoyl*: hydrochloride, plates or needles from dil. HCl. Decomp. about 216°.

O: *N-Di-p-nitrobenzoyl*: needles. M.p. 139°.

*Picrolonate*: prisms from EtOH. M.p. 219–20° decomp.

*d.*

B.p. 163°/15 mm., 134°/0.1 mm.  $[\alpha]_D^{25} + 2.4^\circ$  in  $H_2O$ , + 17.7° in dil. HCl.

*l.*

B.p. 95–8°/0.003 mm.  $[\alpha]_D - 28.4^\circ$  in dil. HCl, –2.4° in  $H_2O$ .

Knorr, *Ber.*, 1899, 32, 752.

Abderhalden, Eichwald, *Ber.*, 1914, 47, 2880.

Bergmann, Brand, Dreyer, *Ber.*, 1921, 54, 936.

Sowden, Fischer, *J. Am. Chem. Soc.*, 1942, 64, 1291.

#### 4- $\omega$ -Aminopropylglyoxaline.

See 3-[4-Iminazolyl]-*n*-propylamine.

#### 3- $\omega$ -Aminopropylindole.

See 3-[3-Indolyl]-*n*-propylamine.

#### 3-Aminopropyl Mercaptan.

See 3-Mercaptopropylamine.

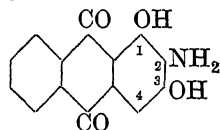
#### Aminoprotocatechnic Acid.

See 3:4-Dihydroxy-2-aminobenzoic Acid, 4:5-Dihydroxy-2-aminobenzoic Acid, and 4:5-Dihydroxy-3-aminobenzoic Acid.

#### 6-Aminopurine.

See Adenine.

**2-Aminopurpuroxanthin** (1:3-Dihydroxy-2-aminoanthraquinone)



$C_{14}H_9O_4N$

MW, 255

Black needles with green lustre, or reddish-brown cryst. powder. Sol. hot Py,  $PhNO_2$ , aniline. Spar. sol. EtOH,  $Et_2O$ , AcOH,  $C_6H_6$ . Sol. alkalis with blue col. HCl  $\rightarrow$  anthragallo.

*N-Benzylidene*: brown prisms from benzaldehyde. M.p. 257–8°.

Böck, *Monatsh.*, 1905, 26, 575.

v. Georgievics, *Monatsh.*, 1885, 6, 755.

**4-Aminopurpuroxanthin** (1:3-Dihydroxy-4-aminoanthraquinone).

Brown needles with metallic reflex from EtOH. Mod. sol. hot  $H_2O$ .

*3-Me ether*:  $C_{15}H_{11}O_4N$ . MW, 269. M.p. 224–6°.

*Di-Me ether*:  $C_{16}H_{13}O_4N$ . MW, 283. Cryst. from AcOH. M.p. 224–6°.

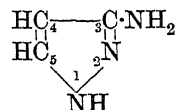
*Di-phenyl ether*: yellow needles from  $C_6H_6$ . M.p. 184°.

Liebermann, *Ann.*, 1876, 183, 211.

Stenhouse, *Ann.*, 1864, 130, 337.

**3-Aminopyrazole** (3-Amino-1:2-diazole).

Note.—The pyrazole ring is sometimes numbered from the other nitrogen atom, in which case the compound is 5-aminopyrazole)



or desmotropic form

$C_3H_5N_3$

MW, 83

Colourless, viscous, hygroscopic oil. B.p. 282°/753 mm., 218°/122 mm. Sol.  $H_2O$ , EtOH. Spar. sol.  $Et_2O$ .

*N-p-Aminobenzenesulphonyl*: m.p. 227–8°.

Knorr, *Ber.*, 1904, 37, 3522.

**4-Aminopyrazole** (4-Amino-1:2-diazole).

M.p. 80–2°. Very sol.  $H_2O$ . Sol. EtOH, AcOEt,  $CHCl_3$ . Spar. sol.  $Et_2O$ ,  $C_6H_6$ , ligroin. Sols. darken in air. Hygroscopic. Sublimes. Forms stable diazo-salts.

*Picrate*: m.p. 193–4°.

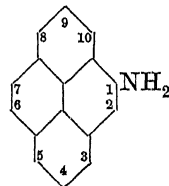
*Picrolonate*: m.p. 242°.

*N-Dibenzoyl deriv.*: needles from EtOH. M.p. 173°.

*N-p-Aminobenzenesulphonyl*: m.p. 185°.

Knorr, *Ber.*, 1904, 37, 3522.

#### 1-Aminopyrene



$C_{16}H_{11}N$

MW, 217

Pale yellow prisms from toluene. M.p. 182°. Conc.  $H_2SO_4 \rightarrow$  yellow sol. with bluish-green fluor.

*N-Acetyl*: needles from  $C_6H_5Cl$ . M.p. 276°.

Vollmann, Becker, Corell, Streeck, *Ann.*, 1937, 531, 155.

**3-Aminopyrene.**

Pale yellow needles from hexane. M.p. 117–18°. Conc.  $H_2SO_4$  → colourless sol. with violet-blue fluor.

N-Acetyl: needles from AcOH. M.p. 260°.

N-Benzylidene: m.p. 122–3°.

N-Me: m.p. 82–3°.

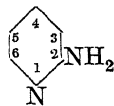
Vollmann, Becker, Corell, Streeck, *Ann.*, 1937, 531, 109.

**4-Aminopyrene.**

Yellow leaflets from xylene. M.p. 207°.

N-Acetyl: yellow needles or plates from AcOH. M.p. 229°.

Vollmann, Becker, Corell, Streeck, *Ann.*, 1937, 531, 138.

**2-Aminopyridine ( $\alpha$ -Pyridylamine)**

$C_5H_6N_2$  MW, 94

Leaflets from ligroin. M.p. 57.5°. B.p. 204°, 104–6°/20 mm. Sol. most org. solvents. Spar. sol. ligroin. Sublimes. Bitter taste. Anæsthetic action.

B,HCl: cryst. + 2 $H_2O$ . M.p. 86°.

Chloroaurate: red needles. M.p. 231°.

$B_2H_2PtCl_6$ : orange prisms. M.p. 231°.

Picrate: yellow needles. M.p. 216–17°.

N-Me:  $C_6H_8N_2$ . MW, 108. Picrate: needles. M.p. 190°.

N-Di-Me:  $C_7H_{10}N_2$ . MW, 122. B.p. 196°.

Picrate: yellow plates. M.p. 182°.

N-Et:  $C_7H_{10}N_2$ . MW, 122. B.p. 79–82°/4 mm.  $B_2H_2SO_4$ : m.p. 111–13°. Chloroaurate: m.p. 125–6°.

N-Phenyl: see 2-Anilinopyridine.

N-Acetyl: prisms from ligroin- $C_6H_6$ . M.p. 71°.

N-Thioacetyl: m.p. 108°.

N-Dibenzoyl: needles from EtOH. M.p. 165°. Picrate: m.p. 146°.

N-p-Nitrobenzoyl: m.p. 244°.

N-p-Aminobenzoyl: m.p. 166–7°.

N-p-Aminobenzenesulphonyl: m.p. 190°.  $N^4$ -Acetyl: m.p. 224–6°.

Fischer, *Ber.*, 1899, 32, 1301.

Tschitschibabin, Seide, *Chem. Zentr.*, 1915, I, 1065.

Blicke, Tsao, *J. Am. Chem. Soc.*, 1946, 68, 905.

Whitmore, Mosher, Goldsmith, Rytina, *J. Am. Chem. Soc.*, 1945, 67, 393.

**3-Aminopyridine ( $\beta$ -Pyridylamine).**

Leaflets from  $C_6H_6$ -ligroin. M.p. 64°. B.p. 250–2°. Sol.  $H_2O$ , EtOH, Et $_2O$ . Insol. ligroin.

B,HCl: hygroscopic plates. M.p. 175°.

B,HAuCl $_4$ : red cryst. M.p. 218°.

$B_2H_2PtCl_6$ : orange-red prisms or plates. Decomp. at 225°.

N-Acetyl: plates from  $C_6H_6$ . M.p. 133°. B.p. 326°. Sol.  $H_2O$ , EtOH,  $CHCl_3$ .

N-Diacetyl: needles from  $C_6H_6$ . M.p. 88°.

N-Benzoyl: leaflets from  $C_6H_6$ . M.p. 119°.

B,HCl: decomp. at 206°.

N-p-Aminobenzenesulphonyl: m.p. 256°.  $N^4$ -Acetyl: m.p. 280°.

Friedl, *Ber.*, 1912, 45, 429.

Binz, Ráth, *Ann.*, 1931, 486, 95.

**4-Aminopyridine ( $\gamma$ -Pyridylamine).**

Needles from  $C_6H_6$ . M.p. 158°. Sol.  $H_2O$ , EtOH. Mod. sol. Et $_2O$ ,  $C_6H_6$ . Spar. sol. ligroin.

B,HCl: m.p. 240°.

B,HAuCl $_4$ : m.p. 283–4°.

$B_2H_2PtCl_6$ : m.p. 251–2°.

Picrate: m.p. 215–16°.

N-Acetyl: needles +  $H_2O$  from  $H_2O$ . M.p. anhyd. 150°.

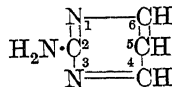
N-Benzoyl: m.p. 202°.

N-p-Aminobenzenesulphonyl: m.p. 240°.  $N^4$ -Acetyl: m.p. 256°.

Koenigs, Kinne, Weiss, *Ber.*, 1924, 57, 1172.

**Aminopyridine-carboxylic Acid.**

See Aminopicolinic, Aminonicotinic and Aminoisonicotinic Acids.

**2-Aminopyrimidine (Pyrimidone-2-imide)**

$C_4H_5N_3$  MW, 95

Cryst. M.p. 127–8°. Sol.  $H_2O$ . Sublimes.

B,HCl: cryst. M.p. 196°.

Chloroplatinate: yellow needles. M.p. 216° decomp.

Picrate: yellow needles. M.p. 237–8°.

N-p-Aminobenzenesulphonyl: m.p. 252°.  $N^4$ -Acetyl: m.p. 255°.

N-p-Nitrobenzoyl: m.p. 206.5–207.5°.

N-p-Aminobenzoyl: m.p. 240–1°.

Büttner, *Ber.*, 1903, 36, 2229.

Dvornikoff, U.S.P., 2,391,822, (*Chem. Abstracts*, 1946, 40, 1888).

Moos, Price, U.S.P., 2,375,735, (*Chem. Abstracts*, 1945, 39, 4633).

**4-Aminopyrimidine (Pyrimidone-4-imide).**

Plates from AcOEt. M.p. 151–2°. Sol.  $H_2O$ , EtOH.

B,HCl: prisms from  $H_2O$ . M.p. 257° decomp.

$B_2H_2SO_4$ : prisms from EtOH. M.p. 143°.

Picrate: yellow needles. M.p. 226°.

Picrolonate: yellow needles from  $H_2O$ . M.p. 261° decomp.

N-Me:  $C_5H_7N_3$ . MW, 109. M.p. 74–5°.

*N*-Phenyl:  $C_{10}H_9N_2$ . MW, 171. M.p. 142–3°.

*N*-Acetyl: needles from  $H_2O$ . M.p. 202°.

Wheeler, *J. Biol. Chem.*, 1907, 3, 189, 290.

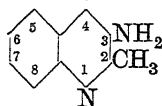
#### 4-Aminopyrimidone-2.

See Cytosine.

#### 2-Aminopyrimidone-4.

See Isocytosine.

#### 3-Aminoquinaldine ( $\beta$ -Aminoquinaldine, 3-amino-2-methylquinoline)



$C_{10}H_{10}N_2$

MW, 158

Yellow needles from  $Et_2O$  or pet. ether. M.p. 159–60°. B.p. 270°, 198°/16 mm. Sol.  $EtOH$ ,  $Me_2CO$ ,  $C_6H_6$ ,  $CHCl_3$ . Spar. sol.  $Et_2O$ , ligroin. Insol.  $H_2O$ . Acid sols. fluoresce.  $KMnO_4 \rightarrow$  acetylanthranilic acid.

*Picrate*: needles from  $H_2O$ . Decomp. about 235°.

*N*-Formyl: needles from  $H_2O$  or  $C_6H_6$ . M.p. 163°.

*N*-Acetyl: needles from  $Et_2O$  or  $C_6H_6$ . M.p. 165°. *Methosulphate*: pale yellow. M.p. 190–1°. *Methochloride*: yellow. M.p. 236° decomp. *Methiodide*: yellow. M.p. 241° decomp.

*N*-Acetoacetyl: m.p. 149°.

*N*-p-Toluenesulphonyl: m.p. 202–3°.

*N*-Di-Me: *methochloride*: yellow. M.p. 230° decomp. *Methiodide*: bright yellow. M.p. 240–1°.

*N*-Benzoyl: needles from  $Me_2CO$ ,  $AcOEt$ ,  $C_6H_6$ , or toluene. M.p. 161°.

Stark, *Ber.*, 1907, 40, 3425.

#### 4-Aminoquinaldine ( $\gamma$ -Aminoquinaldine).

Needles from  $C_6H_6$ -ligroin. M.p. 168°. B.p. 333°. Sol.  $EtOH$ ,  $Et_2O$ ,  $Me_2CO$ , hot  $C_6H_6$ . Prac. insol.  $H_2O$ , ligroin.

$B_2H_2PtCl_6$ : orange cryst. M.p. 223° decomp.

*Picrate*: yellow needles. M.p. 197–9°.

*N*-Acetoacetyl: m.p. 256° decomp.

*N*-Phenyl:  $C_{16}H_{14}N_2$ . MW, 234. Prisms. M.p. 150–1°.

Marcwald, *Ann.*, 1894, 279, 18.

Meyer, *Monatsh.*, 1907, 28, 52.

#### 5-Aminoquinaldine.

Greenish plates or needles +  $1H_2O$  from  $H_2O$ . M.p. anhyd. 117–18°. Sol.  $EtOH$ ,  $C_6H_6$ , hot  $H_2O$ . Spar. sol.  $Et_2O$ .

*N*-Acetyl: m.p. 204·5°. *Methiodide*: orange cryst. M.p. 250–60° decomp. Very sol.  $H_2O$ . Sol.  $EtOH$ .

*N*-Cinnamoyl: yellow prisms. M.p. 257°.

Hamer, *J. Chem. Soc.*, 1921, 119, 1435.

#### 6-Aminoquinaldine.

Pale brown cryst. from  $H_2O$ . M.p. 187–8°. Very sol.  $EtOH$ ,  $CHCl_3$ .

*Chlorostannate*: plates. M.p. 224–5°.

*Chlorostannite*: deliquescent cryst. from  $H_2O$ . Decomp. about 180°.

*N*-Acetyl: m.p. 168–9°. *Methiodide*: yellow cryst. Decomp. at 254°.

*N*-Cinnamoyl: cryst. M.p. 257°.

*N*-p-Aminobenzenesulphonyl: m.p. 252°.

Hamer, *J. Chem. Soc.*, 1921, 119, 1435.

#### 7-Aminoquinaldine.

Needles +  $1H_2O$  from  $H_2O$ . M.p. anhyd. 148°. Sol.  $EtOH$ ,  $C_6H_6$ . Mod. sol. ligroin. Spar. sol.  $Et_2O$  with bluish-green fluor. Volatile in steam.

*Picrate*: yellow needles. M.p. 213–14° decomp.

*N*-Acetyl: yellow needles from  $AcOEt$  or  $EtOH$ - $Et_2O$ . *Methiodide*: yellow cryst. M.p. 267°. Sol.  $EtOH$ , hot  $H_2O$ .

*N*-Benzoyl: needles +  $1H_2O$  from  $EtOH$ . Aq. M.p. 172–3°.

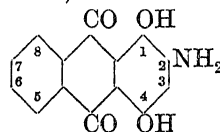
Alber, *J. prakt. Chem.*, 1905, 71, 39.

#### 8-Aminoquinaldine.

Prisms from ligroin. M.p. 56°. Sol.  $EtOH$ ,  $Et_2O$ , hot ligroin. Spar. sol.  $H_2O$ . Volatile in steam.

Döbner, Miller, *Ber.*, 1884, 17, 1701.

#### 2-Aminoquinizarin (1 : 4 - Dihydroxy - 2 - aminoanthraquinone)



$C_{14}H_9O_4N$

MW, 255

Greenish-yellow needles with metallic lustre from  $PhNO_2$ . M.p. 313–4°. Sol.  $H_2SO_4$  with orange-red col. Sol. alkalis with bluish-red col.

*N*-Phenyl: needles from aniline. M.p. 255–6°.

*N*-p-Tolyl: m.p. 220°.

Marschalk, *Bull. soc. chim.*, 1937, 4, 629.

#### 5 - Aminoquinizarin (1 : 4 - Dihydroxy - 5 - aminoanthraquinone).

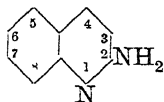
Brownish-red cryst. from toluene. M.p. 212–3°. Sol.  $H_2SO_4$  with red col. Sol. alkalis with reddish-violet sol.

*Di-Me ether*:  $C_{16}H_{13}O_4N$ . MW, 283. Orange-red needles from  $AcOH$ . M.p. 242–3°. *N*-p-Toluenesulphonyl: orange needles from chlorobenzene or  $AcOH$ . M.p. 197°.

*N*-Phenyl: blackish-violet cryst. from toluene. M.p. 223°.

Waldmann, Hartisch, *J. prakt. Chem.*, 1931, 130, 92.



**2-Aminoquinoline** ( $\alpha$ -Aminoquinoline,  $\alpha$ -quinolylamine) $C_9H_8N_2$ 

MW, 144

Leaflets from  $H_2O$ . M.p.  $129^\circ$ . Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ , hot  $H_2O$ . Spar. sol.  $C_6H_6$ , ligroin. Sublimes.

*B, HCl*: m.p.  $225-7^\circ$ .N-p-Nitrobenzoyl: m.p.  $283-5^\circ$ .N-p-Aminobenzoyl: m.p.  $156-8^\circ$ .N-p-Aminobenzenesulphonyl: m.p.  $198^\circ$ .sym.-Trinitrobenzene add. comp.: red needles. M.p.  $186^\circ$ .*Picrate*: cryst. Decomp. at  $255-6^\circ$ .

*Methochloride*: +  $1H_2O$ . M.p.  $268^\circ$ . Sol.  $H_2O$ . Spar. sol. EtOH.  $B_2, H_2PtCl_6$ : m.p.  $268^\circ$ .

*Methiodide*: prisms. M.p.  $247^\circ$ . Sol. EtOH, hot  $H_2O$ . N-Acetyl: m.p.  $213^\circ$ .

*Ethiodide*: m.p.  $232^\circ$ . Sol. EtOH, hot  $H_2O$ .

N-Phenyl:  $C_{15}H_{12}N_2$ . MW, 220. Plates from EtOH. M.p.  $98^\circ$ .

Diepolder, Deurlein, *J. prakt. Chem.*, 1923, 106, 54.

Tschitschibabin, *Ber.*, 1921, 54, 822.

Tschitschibabin, Witkovsky, Lapschin, *Ber.*, 1925, 58, 805.

**3-Aminoquinoline** ( $\beta$ -Aminoquinoline,  $\beta$ -quinolylamine).

Two modifications. (i) Cryst. from toluene, m.p.  $84^\circ$ . (ii) Cryst. from  $H_2O$  or EtOH.Aq., m.p.  $94^\circ$   $\rightarrow$  first mod. Sol.  $Et_2O$ , EtOH,  $CHCl_3$ . Sols. show slight blue fluor., intensified by addition of acids, even  $CO_2$ , and sols. turn yellow. Both forms give same acetyl deriv.

*Picrate*: softens at  $200^\circ$ . M.p.  $210^\circ$  decomp.N-Acetyl: cryst. from  $H_2O$ . M.p.  $166-7^\circ$ .*Methosulphate*: yellow prisms. M.p.  $171^\circ$ .

N-p-Aminobenzenesulphonyl: m.p. 185.

*Methochloride*: yellow. M.p.  $190^\circ$ .*Methiodide*: orange yellow prisms. M.p.  $187^\circ$ .

Mills, Watson, *J. Chem. Soc.*, 1910, 97, 746.

Bargellini, Settimj, *Gazz. chim. ital.*, 1923, 53, 601.

**4-Aminoquinoline** ( $\gamma$ -Aminoquinoline,  $\gamma$ -quinolylamine).

Needles +  $1H_2O$  from  $H_2O$  or EtOH.Aq. M.p.  $70^\circ$ , anhyd.  $154^\circ$ . Sol.  $H_2O$ , EtOH,  $CHCl_3$ , hot  $C_6H_6$ . Spar. sol. ligroin,  $CS_2$ .

*B, HNO\_3*: plates or needles. M.p. anhyd.  $214^\circ$ .

$B_2, H_2PtCl_6$ : orange-yellow needles +  $2H_2O$  from dil. HCl. M.p.  $266-70^\circ$  decomp.

sym.-Trinitrobenzene add. comp.: red prisms. M.p.  $111^\circ$ .

*Picrate*: needles from  $H_2O$ . M.p.  $274^\circ$ .*Methochloride*: m.p.  $310^\circ$ .*Methiodide*: needles from EtOH. M.p.  $224^\circ$ .*Ethiodide*: m.p.  $232^\circ$ .

N-Phenyl: needles. M.p.  $198^\circ$ . *B, HCl*: yellow prisms from EtOH. M.p.  $244^\circ$ .

N-Acetyl: needles +  $1H_2O$  from  $H_2O$ . M.p. anhyd.  $176^\circ$ . *Methiodide*: m.p.  $291^\circ$  decomp.

N-p-Aminobenzenesulphonyl: m.p.  $248^\circ$ .

Claus, Frobenius, *J. prakt. Chem.*, 1897, 56, 181.

Tschitschibabin, Witkovsky, Lapschin, *Ber.*, 1925, 58, 806.

**5-Aminoquinoline** (5-Quinolylamine).

Needles from EtOH. M.p.  $110^\circ$ . B.p.  $310^\circ$ ,  $184^\circ/10$  mm. Sol. EtOH,  $Et_2O$ . Mod. sol.  $C_6H_6$ . Spar. sol. cold  $H_2O$ . Prac. insol. ligroin. Sublimes.

N-Acetyl: needles. M.p.  $178^\circ$ .N-p-Aminobenzenesulphonyl: m.p.  $230^\circ$ .

N-p-Toluenesulphonyl: needles from EtOH. M.p.  $203-4^\circ$ .

Hamer, *J. Chem. Soc.*, 1921, 119, 1436.

Dikshoorn, *Rec. trav. chim.*, 1929, 48, 147.

**6-Aminoquinoline** (6-Quinolylamine).

Cryst. +  $2H_2O$  from  $H_2O$ , prisms from  $Et_2O$ . M.p. anhyd.  $114^\circ$ . B.p.  $146^\circ/0.3$  mm. Sol. EtOH,  $Et_2O$ ,  $NH_3$ . Spar. sol.  $H_2O$ , ligroin. Sublimes.

*B, HCl*: yellow needles from EtOH. M.p.  $109^\circ$ .*B, 2HCl*: prisms. M.p.  $250^\circ$ .*B, SO\_2*: yellow cryst. M.p.  $124^\circ$ .*Methochloride*: lemon-yellow needles. M.p.  $242-3^\circ$ .*Methiodide*: reddish-brown needles from EtOH. M.p.  $199^\circ$ .

N-Di-Me:  $C_{11}H_{12}N_2$ . MW, 172. Yellow cryst. M.p.  $56-8^\circ$ . B.p. about  $335^\circ$ . *Picrate*: reddish-yellow needles from  $H_2O$ . M.p.  $215^\circ$  decomp.

N-Acetyl: needles from  $H_2O$ . M.p.  $138^\circ$ .*Methiodide*: yellow cryst. from  $H_2O$ . M.p.  $317^\circ$  ( $268^\circ$ ).N-Diacetyl: needles. M.p.  $75^\circ$ .

N-Chloroacetyl: prisms from  $C_6H_6$ -toluene. M.p.  $153-5^\circ$ .

N-Benzoyl: leaflets. M.p.  $169^\circ$ .N-p-Nitrobenzoyl: m.p.  $248-50^\circ$ .N-p-Aminobenzoyl: m.p.  $96-8^\circ$ .

N-p-Aminobenzenesulphonyl: m.p.  $208^\circ$  ( $200^\circ$ ). N<sup>4</sup>-Acetyl: m.p.  $283^\circ$  ( $275^\circ$ ).

N-p-Toluenesulphonyl: cryst. from EtOH. M.p.  $193^\circ$ .

Knueppel, *Ann.*, 1900, 310, 75.

Hamer, *J. Chem. Soc.*, 1921, 119, 1436.

**7-Aminoquinoline** (7-Quinolylamine).

Yellow needles +  $H_2O$ . M.p.  $73.5^\circ$ , anhyd.  $93.5-94^\circ$ . Sols. fluoresce.

$B_2H_2PtCl_6$ : yellow cryst. M.p. about 225° decomp.

*N-Acetyl*: m.p. 167.5°. *Methiodide*: yellow prisms. Darkens at 267°. M.p. 295–310°.

*N-Benzoyl*: m.p. 189°.

*N-p-Aminobenzenesulphonyl*: m.p. 206°.

*N-p-Toluenesulphonyl*: m.p. 184–5°.

*N-Cinnamoyl*: m.p. 202°.

Hamer, *J. Chem. Soc.*, 1921, 119, 1436.

### 8-Aminoquinoline (8-Quinolylamine).

Yellow cryst. from EtOH or ligroin. M.p. 70° (65°). B.p. 157–62°/20–4 mm. Sol.  $H_2O$ . Volatile in steam. Forms red salts.

*B,HCl*: dark red. M.p. 208–9°.

*N-Acetyl*: needles from EtOH. M.p. 103°.

*N-Benzoyl*: needles from EtOH. M.p. 98°.

*N-p-Nitrobenzoyl*: m.p. 178–80°.

*N-p-Aminobenzoyle*: m.p. 160–2°.

*N-p-Aminobenzenesulphonyl*: m.p. 195° (188°). *N-Acetyl*: m.p. 194°.

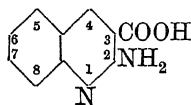
*N-p-Toluenesulphonyl*: needles. M.p. 154–6°.

Seka, *Monatsh.*, 1924, 45, 290.

Dikshoorn, *Rec. trav. chim.*, 1929, 48, 147.

Kaufmann, Zeller, *Ber.*, 1917, 50, 1627.

### 2-Aminoquinoline-3-carboxylic Acid



$C_{10}H_8O_2N_2$  MW, 188

Amorphous. M.p. 290–2° decomp.

*Me ester*:  $C_{11}H_{10}O_2N_2$ . MW, 202. Yellow cryst. M.p. 140–1°.

*Et ester*:  $C_{12}H_{12}O_2N_2$ . MW, 216. Yellow needles from EtOH. M.p. 135°. Sol. EtOH, AcOEt, AcOH,  $C_6H_6$ ,  $CHCl_3$ . Insol.  $H_2O$ ,  $Et_2O$ , ligroin. *N-Benzoyl*: yellow needles from EtOH. M.p. 160°. *Picrate*: golden yellow cryst. from EtOH. M.p. 177°.

Rupe, Heckendorn, *Helv. Chim. Acta*, 1926, 9, 980.

Kollier, Strang, *Monatsh.*, 1928, 50, 144.

### 5-Aminoquinoline-4-carboxylic Acid (5-Aminocinchoninic acid).

Ruby-red needles from  $H_2O$ . Ag and Ba salts are yellow.

*Lactam*:  $C_{10}H_8ON_2$ . MW, 170. Yellow needles from EtOH. M.p. 254–5°.

Koenigs, Lossow, *Ber.*, 1899, 32, 719.

### 5-Aminoquinoline-6-carboxylic Acid.

Cryst. from AcOH.Aq. M.p. 218°. Sol. AcOH, Py. Mod. sol.  $H_2O$ , EtOH,  $Me_2CO$ . Spar. sol.  $C_6H_6$ . Insol.  $Et_2O$ ,  $CHCl_3$ ,  $CCl_4$ , pet. ether.

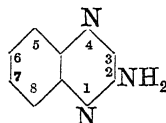
*B,HCl*: red needles. M.p. 265°.

*Me ester*: red needles +  $2H_2O$  from  $H_2O$ . M.p. anhyd. 245° decomp. Sol.  $H_2O$ , EtOH, AcOH.

*N-Acetyl*: yellow needles. M.p. 237° decomp.

Bogert, Fischer, *J. Am. Chem. Soc.*, 1912, 34, 1572.

### 2-Aminoquinoxaline



$C_8H_7N_3$  MW, 145

M.p. 155–6°. Sublimes *in vacuo*.

*N-Acetyl*: yellow. M.p. 192.5–3.5°.

*N-Benzenesulphonyl*: m.p. 259–60°.

*N-p-Aminobenzenesulphonyl*: m.p. 247–8°.

*N-Acetyl*: m.p. 243–4°.

Weijlard, Tishler, Erickson, *J. Am. Chem. Soc.*, 1944, 66, 1957.

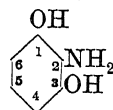
### 6-Aminoquinoxaline.

Yellow needles from  $Et_2O$ . M.p. 159°. Sol.  $H_2O$ , EtOH,  $CHCl_3$ . Mod. sol.  $Et_2O$ ,  $C_6H_6$ .  $Et_2O$  sol. shows greenish-yellow fluor. Sublimes. Conc. min. acids → deep violet sols, changing to reddish-brown on dilution.

*B,HCl*: brownish-red plates with green lustre. Decomp. at 215°.

Hinsberg, *Ann.*, 1887, 237, 345.

### 2-Aminoresorcinol (2 : 6-Dihydroxyaniline)



$C_6H_7O_2N$  MW, 125

Free base unstable. Reduces  $NH_3 \cdot AgNO_3$  and Fehling's.

*Di-Me ether*: 2 : 6-dimethoxyaniline.  $C_8H_{11}O_2N$ . MW, 153. Leaflets from pet. ether. M.p. 75°. B.p. 146°/23 mm. *N-Acetyl*: plates from  $H_2O$  or AcOH. M.p. 81°.

*Di-Et ether*: 2 : 6-diethoxyaniline.  $C_{10}H_{15}O_2N$ . MW, 181. Needles from pet. ether. M.p. 57°.

O : O : *N-Triacetyl*: cryst. from MeOH– $Et_2O$ . M.p. 164–5°.

*N-Benzoyl*: leaflets from EtOH. M.p. 187°.

Turner, *J. Chem. Soc.*, 1915, 107, 469.

Kauffmann, de Pay, *Ber.*, 1906, 39, 323.

Kauffmann, Franck, *Ber.*, 1907, 40, 3999.

### 4-Aminoresorcinol (2 : 4-Dihydroxyaniline).

Unstable. Forms stable hydrochloride with 2 mols.  $H_2O$  of cryst.

*1-Me ether*:  $C_7H_9O_2N$ . MW, 139. Unstable. Reduces  $NH_3 \cdot AgNO_3$ . *B,HCl*: needles from dil. HCl. M.p. 205–6°. *N-Acetyl*: needles from  $H_2O$ . M.p. 164–5°. O : *N-Triacetyl*:

cryst. from  $C_6H_6$ . M.p.  $92^\circ$ . N-Benzoyl: cryst. from  $C_6H_6$ . M.p.  $163^\circ$ .

3-Me ether: reddish-brown needles from toluene. M.p.  $175-80^\circ$ . N-Acetyl: red needles from toluene. M.p.  $150-5^\circ$ . N-Chloroacetyl: plates from AcOEt. M.p.  $166^\circ$ .

Di-Me ether: 2:4-dimethoxyaniline.  $C_8H_{11}O_2N$ . MW, 153. Plates from ligroin. M.p.  $32.5-33.5^\circ$  corr. B,HCl: sublimes at  $110^\circ$ . M.p.  $224^\circ$  decomp. N-Acetyl: cryst. from  $Me_2CO$ . Aq. M.p.  $117^\circ$ . N-Chloroacetyl: needles from EtOH. Aq. M.p.  $90^\circ$  corr. N-Benzoyl: cryst. from EtOH. M.p.  $173^\circ$ .

1-Et ether:  $C_8H_{11}O_2N$ . MW, 153. Needles. M.p.  $148^\circ$ . Spar. sol.  $H_2O$ . O:N-Diacetyl: prisms from ligroin. M.p.  $91-3^\circ$ . N-Benzoyl: cryst. from  $C_6H_6$ . M.p.  $187^\circ$ .

3-Et ether: grey leaflets from  $CS_2$ . Aq. M.p.  $152-4^\circ$ . N-Acetyl: prisms from AcOH. M.p.  $172.5-174.5^\circ$ . N-Chloroacetyl: grey plates from toluene. M.p.  $158.5-161^\circ$ .

Di-Et ether: 2:4-diethoxyaniline.  $C_{10}H_{15}O_2N$ . MW, 181. Brownish-red needles and plates from  $C_6H_6$ -ligroin. M.p.  $34^\circ$  corr. B.p.  $250-2^\circ$ . B,HCl: cryst. M.p.  $198^\circ$ .  $B_2H_2PtCl_6$ : greenish-yellow needles +  $2H_2O$ . M.p.  $169.5^\circ$ . N-Acetyl: needles from EtOH. Aq. M.p.  $117-18^\circ$  ( $121^\circ$ ). N-Chloroacetyl: needles from EtOH. M.p.  $102-3^\circ$ . N-Benzoyl: needles. M.p.  $113.5^\circ$ . N-Dibenzoyl: prisms from AcOH. M.p.  $171^\circ$ .

1-Me-3-Et ether:  $C_9H_{13}O_2N$ . MW, 167. Plates. M.p.  $22.5^\circ$ . B.p.  $144.5/9$  mm. N-Acetyl: red needles from ligroin. M.p.  $100.5-101^\circ$ . N-Chloroacetyl: plates from toluene. M.p.  $126-7^\circ$ .

3-Me-1-Et ether: red cryst. from  $C_6H_6$ -ligroin. M.p.  $27.5-28.5^\circ$  corr. B.p.  $152/12$  mm. N-Acetyl: red plates from  $C_6H_6$ -ligroin. M.p.  $118^\circ$ . N-Chloroacetyl: plates from ligroin. M.p.  $98^\circ$ .

N-Acetyl: m.p.  $164-5^\circ$ .

O:O:N-Triacetyl: m.p.  $113^\circ$ .

O-Benzoyl: m.p.  $177-8^\circ$ .

O:O:N-Tribenzoyl: needles. M.p.  $172^\circ$ .

N-p-Aminobenzenesulphonyl: m.p.  $176^\circ$ .

Heidelberger, Jacobs, *J. Am. Chem. Soc.*, 1919, 41, 1466.

Bechhold, *Ber.*, 1889, 22, 2378.

Henrich, Wagner, *Ber.*, 1902, 35, 4195.

### 5-Aminoresorcinol (3:5-Dihydroxyaniline, phloramine).

Fine needles. M.p.  $146-52^\circ$ . Sol. EtOH. Spar. sol. cold  $H_2O$ . Prac. insol.  $Et_2O$ . Oxidises rapidly in air. Boiling  $H_2O \rightarrow$  phloroglucinol.

Di-Me ether: 3:5-dimethoxyaniline. Cryst. M.p.  $46^\circ$ . B.p.  $177/12$  mm.  $B_2H_2PtCl_6$ : yellow cryst. M.p.  $223^\circ$ . B,HCl: m.p.  $210^\circ$ . Picrate: yellow needles from EtOH. M.p.  $167-70^\circ$  decomp. N-Benzoyl: m.p.  $139^\circ$ .

Triacetyl deriv.: cryst. powder. M.p.  $119-21^\circ$ .

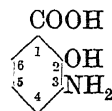
Pollak, *Monatsh.*, 1893, 14, 419.

Seka, Fuchs, *Monatsh.*, 1931, 57, 67.

### Aminoresorcylic Acid.

See 3:5-Dihydroxy-2-aminobenzoic Acid, 4:6-Dihydroxy-3-aminobenzoic Acid, and 3:5-Dihydroxy-4-aminobenzoic Acid.

3-Aminosalicylic Acid (o-Hydroxy-m-aminobenzoic acid)



$C_7H_7O_3N$

MW, 153

M.p.  $235^\circ$  decomp. Prac. insol. EtOH.

B,HCl: needles +  $1H_2O$ . Decomp. at  $150^\circ$ .

Me ester:  $C_8H_9O_3N$ . MW, 167. Needles from  $C_6H_6$ -ligroin. N-Chloroacetyl: needles from EtOH. M.p.  $106^\circ$ .

Et ester:  $C_9H_{11}O_3N$ . MW, 181. Needles from EtOH. Aq. M.p.  $47^\circ$ .

Nitrile: o-hydroxy-m-aminobenzonitrile.  $C_7H_6ON_2$ . MW, 134. Prisms. M.p.  $145^\circ$  decomp. Phototropic. B,HCl: plates from EtOH- $Et_2O$ . Decomp. at  $130^\circ$ .

Me ether:  $C_8H_9O_3N$ . MW, 167. Needles from  $CCl_4$ . M.p.  $82^\circ$ . N-Acetyl: needles +  $\frac{1}{2}H_2O$  from  $H_2O$ . M.p. anhyd.  $137-8^\circ$ .

N-Formyl: needles from  $H_2O$ . Decomp. at  $215^\circ$ .

N-Benzoyl: needles. M.p.  $189^\circ$ .

N-Benzenesulphonyl: cryst. from EtOH- $C_6H_6$ . M.p.  $194^\circ$ .

Zahn, *J. prakt. Chem.*, 1900, 61, 532.

Einhorn, Pfyl, *Ann.*, 1900, 311, 42.

### 4-Aminosalicylic Acid (o-Hydroxy-p-aminobenzoic acid).

Reddish-brown cryst. powder from EtOH- $Et_2O$ . M.p.  $150-1^\circ$  decomp. Sol.  $H_2O$ , EtOH. Mod. sol.  $Et_2O$ .

B,HCl: m.p.  $220^\circ$ .

Nitrile: o-hydroxy-p-aminobenzonitrile.  $C_7H_6ON_2$ . MW, 134. Yellowish needles from AcOEt- $C_6H_6$ . M.p.  $182^\circ$ . O:N-Dibenzoyl: cryst. from EtOH. Aq. M.p.  $198-9^\circ$ .

Siedel, Bittner, *Monatsh.*, 1902, 23, 415.

Borsche, *Ann.*, 1912, 390, 16.

McGhie et al., *J. Soc. Chem. Ind.*, 1949, 68, 328.

### 5-Aminosalicylic Acid (2-Hydroxy-5-aminobenzoic acid).

Needles from  $H_2O$ . M.p.  $283^\circ$  ( $280^\circ$  decomp.). Spar. sol. hot  $H_2O$ . Insol. EtOH.  $FeCl_3 \rightarrow$  red col. Dist.  $\rightarrow$  p-aminophenol +  $CO_2$ .

$B_2H_2SnCl_6$ : brown prisms. M.p.  $128^\circ$ . Me ester:  $C_8H_9O_3N$ . MW, 167. Needles from  $C_6H_6$ . M.p.  $96^\circ$ . N-Acetyl: needles from

EtOH. M.p. 147° (102°). B.p. 169–70°/2 mm. N-*Chloroacetyl*: cryst. from EtOH. M.p. 157°. O-*Benzoyl*: prisms or plates from EtOH. M.p. 180°.

*Et ester*: C<sub>9</sub>H<sub>11</sub>O<sub>3</sub>N. MW, 181. Needles from EtOH. M.p. 145°. N-*Chloroacetyl*: needles from EtOH. M.p. 131–5°.

*Amide*: C<sub>7</sub>H<sub>8</sub>O<sub>2</sub>N<sub>2</sub>. MW, 152. Needles from dil. NH<sub>3</sub>. M.p. 194–7° decomp. N-*Acetyl*: m.p. 204–6°. N-*Chloroacetyl*: plates from EtOH.Aq. M.p. 225–7°.

*Nitrile*: 2-hydroxy-5-aminobenzonitrile. C<sub>7</sub>H<sub>6</sub>ON<sub>2</sub>. MW, 134. Needles. M.p. 158–60° decomp. Phototropic. B, HCl: prisms from EtOH–Et<sub>2</sub>O. Decomp. at 180°.

*Me ether*: C<sub>8</sub>H<sub>9</sub>O<sub>3</sub>N. MW, 167. Prisms from H<sub>2</sub>O. M.p. 153–4°. B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>: plates from EtOH. Decomp. at 242°. N-*Acetyl*: plates from AcOH. M.p. 208–9°.

*Et ether*: N-*acetyl*, needles from H<sub>2</sub>O. M.p. 189–90°.

N-*Acetyl*: cryst. + ½H<sub>2</sub>O from EtOH.Aq. M.p. 218°.

N-*Chloroacetyl*: cryst. + 1H<sub>2</sub>O from AcOH. M.p. 233–4° decomp.

*Diacetyl deriv.*: m.p. 184°.

N-*Benzoyl*: amorphous. M.p. 252°.

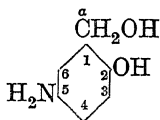
N-p-*Aminobenzenesulphonyl*: m.p. 224°. N<sup>4</sup>-*Acetyl*: m.p. 242–5°.

Weil, Traun, Marcel, *Ber.*, 1922, 55, 2664.  
Norris, Cummings, *Ind. Eng. Chem.*, 1925, 17, 305.

### 6-Aminosalicylic Acid.

See 6-Hydroxyanthranilic Acid.

5-Aminosaligenin (2-Hydroxy-5-amino-benzyl alcohol, 5-aminosaligenol)



C<sub>7</sub>H<sub>9</sub>O<sub>2</sub>N MW, 139

Cryst. M.p. 139°. Sol. hot H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Decomp. in air when moist. Hydrochloride is the developer Edinol.

$\alpha$ -*Me ether*: C<sub>8</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 153. Cryst. M.p. 124–6°. Sol. hot H<sub>2</sub>O, EtOH. Spar. sol. Et<sub>2</sub>O.

$\alpha$ -*Et ether*: C<sub>9</sub>H<sub>13</sub>O<sub>2</sub>N. MW, 167. Cryst. M.p. 76–8°.

$\alpha$ -*Acetyl*: cryst. M.p. 136–7°.

*Tribenzoyl deriv.*: m.p. 187°.

Bayer, *Chem. Zentr.*, 1904, I, 699.

### 1-Aminostearic Acid



C<sub>18</sub>H<sub>37</sub>O<sub>2</sub>N MW, 299

Cryst. powder from hot AcOH. M.p. 222°. Insol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Me ester*: C<sub>19</sub>H<sub>39</sub>O<sub>2</sub>N. MW, 313. B, HCl: needles from AcOEt. M.p. 112° corr. N-*Chloroacetyl*: needles from pet. ether. M.p. 78° corr.

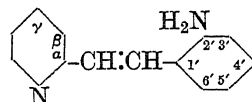
*Et ester*: C<sub>20</sub>H<sub>41</sub>O<sub>2</sub>N. MW, 327. B, HCl: needles from AcOEt. M.p. 89° corr. N-*Chloroacetyl*: needles from pet. ether. M.p. 68° corr.

N-*Chloroacetyl*: needles from Et<sub>2</sub>O–pet. ether. M.p. 103–7°.

Hell, Sadomsky, *Ber.*, 1891, 24, 2395.

Fischer, Kropp, *Ann.*, 1908, 362, 339.

2'-Amino- $\alpha$ -stilbazole (2-[2-Aminostyryl]-pyridine)



C<sub>13</sub>H<sub>12</sub>N<sub>2</sub> MW, 196

B, 2HCl: needles from EtOH–HCl. M.p. 250–4°.

N-*Diacetyl*: m.p. 111–12°.

Feist, *Arch. pharm.*, 1902, 240, 256.

Simpson, *J. Chem. Soc.*, 1946, 673.

3'-Amino- $\alpha$ -stilbazole (2-[3-Aminostyryl]-pyridine).

Needles + H<sub>2</sub>O. M.p. 85°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Prac. insol. cold H<sub>2</sub>O.

B, 2HCl: cryst. + 2H<sub>2</sub>O. M.p. 240°. Turns red in air.

Feist, *Arch. pharm.*, 1902, 240, 254.

Schuftan, *Ber.*, 1890, 23, 2717.

4'-Amino- $\alpha$ -stilbazole (2-[4-Aminostyryl]-pyridine).

Pale yellow needles from EtOH.Aq. M.p. 138–9°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Insol. H<sub>2</sub>O.

B, 2HCl: cryst. from dil. HCl. M.p. above 260°.

B, H<sub>2</sub>Sn<sub>2</sub>Cl<sub>6</sub>: m.p. 198–9°.

N-*Acetyl*: needles from EtOH.Aq. M.p. 170–1°.

Feist, *Arch. pharm.*, 1902, 240, 251.

Baumert, *Ber.*, 1906, 39, 2972.

2'-Amino- $\gamma$ -stilbazole (4-[2-Aminostyryl]-pyridine).

B, 2HCl: needles. M.p. 205°.

*Sulphate*: from H<sub>2</sub>O. M.p. 140°.

B, H<sub>2</sub>Sn<sub>2</sub>Cl<sub>6</sub>: from H<sub>2</sub>O. M.p. 155°.

B, H<sub>2</sub>PtCl<sub>6</sub>: m.p. 238°.

B, CO<sub>2</sub>, H<sub>2</sub>O: m.p. 76°.

Löwensohn, *Ber.*, 1907, 40, 4861.

4'-Amino- $\gamma$ -stilbazole (4-[4-Aminostyryl]-pyridine).

M.p. 275° (138–9°). Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Prac. insol. H<sub>2</sub>O.

B, 2HCl: cryst. from EtOH–HCl. M.p. 257–8° decomp.

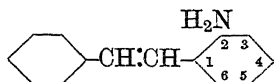
$B_2H_2Sn_2Cl_6$ : m.p. 198–9°.

$B_2H_2PtCl_6$ : m.p. above 300°.

Baumert, *Ber.*, 1906, 39, 2973.

Royer, *J. Chem. Soc.*, 1947, 560.

### 2-Aminostilbene



$C_{14}H_{13}N$  MW, 195

Plates from EtOH.Aq. M.p. 106°. Sols. exhibit blue fluor.

*N-Acetyl*: needles from EtOH. M.p. 140°.

Sachs, Hilpert, *Ber.*, 1906, 39, 904.

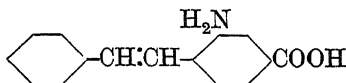
### 3-Aminostilbene.

Blocks from butyl acetate. M.p. 119–20°.

*N-Acetyl*: tablets. M.p. 191–2°.

Bergmann, Schapiro, *J. Org. Chem.*, 1947, 12, 57.

### 2-Aminostilbene-4-carboxylic Acid



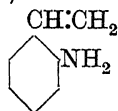
$C_{15}H_{13}O_2N$  MW, 239

Yellow cryst. powder from xylene-ligroin. M.p. 197–8°. Sol. EtOH, Et<sub>2</sub>O, AcOH. Spar. sol. C<sub>6</sub>H<sub>6</sub>. Sols. exhibit bluish-green fluor.

*Nitrile*:  $C_{15}H_{12}N_2$ . MW, 220. Yellow nodules from EtOH-ligroin. M.p. 123°. 2-*N-Acetyl*: needles. M.p. 220°.

Ullmann, Gschwind, *Ber.*, 1908, 41, 2295.

***o*-Aminostyrene** (*o*-Aminophenylethylene, *o*-aminovinylbenzene)



$C_8H_9N$  MW, 119

Colourless oil. B.p. 97–8°/8 mm.  $D_{20}^{21}$  1.015.  $n_D^{21}$  1.6130. Polymerises readily. Turns yellow in air.

*N-Acetyl*: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 129°.

Sabetay, Mintsou, *Bull. soc. chim.*, 1929, 45, 842.

Komppa, *Ber.*, 1893, 26, 677 (*Ref.*).

### *m*-Aminostyrene.

Yellow oil. B.p. 112–15°/12 mm.  $D_{20}^{20}$  1.0216. Readily polymerises.

*B,HCl*: needles. M.p. 144–5°. Prisms + 1H<sub>2</sub>O from EtOH.Aq. M.p. 181°.

*N-Acetyl*: needles from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 74–5°.

*N-Benzoyl*: leaflets from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 90–1°. Plates + 1H<sub>2</sub>O from EtOH.Aq. M.p. 126–7°.

Tutin, Caton, Hann, *J. Chem. Soc.*, 1909, 95, 2125.

Komppa, *Ber.*, 1893, 26, 677 (*Ref.*).

***p*-Aminostyrene** (*p*-Aminophenylethylene, *p*-aminovinylbenzene).

M.p. 23–5°. B.p. 98–100°/4 mm.  $D_{21}^{21}$  1.012.  $n_D^{21}$  1.6250. Turns yellow in air. Polymerises to product, m.p. 81°.

*B,HCl*: needles from dil. HCl. Darkens at 170°.

*N-Acetyl*: plates from C<sub>6</sub>H<sub>6</sub>. M.p. 142°.

*N-Benzoyl*: cryst. from EtOH. M.p. 160–1°.

Sabetay, Minton, *Bull. soc. chim.*, 1929, 45, 842.

Komppa, *Ber.*, 1893, 26, 677 (*Ref.*).

***o*-Aminostyryl chloride.**

See  $\beta$ -Chloro-*o*-aminostyrene.

**Aminostyrylpyridine.**

See Aminostilbazole.

**Aminosuccinic Acid.**

See Aspartic Acid.

**Amino-sulphopropionic Acid.**

See Cysteic Acid and Isocysteic Acid.

**Aminoterephthalic Acid** (2-Aminobenzene-1:4-dicarboxylic acid)



$C_8H_7O_4N$  MW, 181

Yellowish cryst. from H<sub>2</sub>O. M.p. 324–5° decomp. (corr.). Spar. sol. cold H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Insol. Me<sub>2</sub>CO, AcOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, pet. ether. Sols. show blue fluor.  $k = 2.65 \times 10^{-4}$  at 25°.

1-*Me ester*:  $C_9H_9O_4N$ . MW, 195. Yellow cryst. from MeOH. M.p. 216–17° corr. Sols. show violet-blue fluor. *N-Acetyl*: cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 254–5° decomp. (corr.).

4-*Me ester*: colourless needles from MeOH.Aq. M.p. 217° corr. *N-Acetyl*: needles from MeOH. M.p. 207–8° corr.

*Di-Me ester*:  $C_{10}H_{11}O_4N$ . MW, 209. Cryst. from EtOH. M.p. 134°. Volatile in steam. *N-Acetyl*: cryst. from C<sub>6</sub>H<sub>6</sub> or MeOH. M.p. 167° corr. *N-Diacetyl*: tablets from MeOH. M.p. 74–6°.

*Dibenzyl ester*:  $C_{22}H_{19}O_4N$ . MW, 361. Needles from Et<sub>2</sub>O-pet. ether. M.p. 99–101°.

*N-Me*:  $C_9H_9O_4N$ . MW, 195. Yellow cryst. from EtOH. M.p. 271–2° corr. 1-*Me ester*: yellow plates from C<sub>6</sub>H<sub>6</sub>. M.p. 208–9° corr. 4-*Me ester*: yellow needles from MeOH or C<sub>6</sub>H<sub>6</sub>. M.p. 187°. *Di-Me ester*: cryst. from MeOH, EtOH, or C<sub>6</sub>H<sub>6</sub>. M.p. 93°. Volatile in steam. *N-Acetyl*: cryst. from AcOH. M.p. 217° decomp.

*N-Di-Me*:  $C_{10}H_{11}O_4N$ . MW, 209. Needles from H<sub>2</sub>O. M.p. 281° corr. 1-*Me ester*: yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 132–3°. 4-*Me ester*: cryst. from MeOH or C<sub>6</sub>H<sub>6</sub>. M.p. 178–9°. *Di-Me ester*: yellow plates from MeOH. M.p. 70–5°.

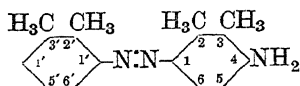
*N*-Acetyl: cryst. from EtOH. Decomp. at 272° corr.

Cahn-Speyer, *Monatsh.*, 1907, 28, 803.  
Wegscheider *et al.*, *Monatsh.*, 1912, 33, 194, 143; 1910, 31, 1299.

### 1-Aminotetradecane.

See Tetradecylamine.

**4-Amino-2:3:2':3'-tetramethylazobenzene** (*o*-Xyleneazo-*o*-3-xylidine, *o*-3-aminoazoxylene)



$C_{16}H_{19}N_3$  MW, 253

Yellow leaflets from  $C_6H_6$ . M.p. 110–11°.  $Sn + HCl \rightarrow o$ -3-xylidine + 3:6-diamino-*o*-xylene.

Nölting, Forel, *Ber.*, 1885, 18, 2684.

**4-Amino-2:5:2':5'-tetramethylazobenzene** (*p*-Xyleneazo-*p*-xylidine, *p*-aminoazoxylene).

Red leaflets from EtOH. M.p. 150°.  $Sn + HCl \rightarrow p$ -xylidine + 2:5-diamino-*p*-xylene.

Nölting, Forel, *Ber.*, 1885, 18, 2685.

**4-Amino-2:6:3':5'-tetramethylazobenzene** (*m*-Xyleneazo-*m*-5-xylidine, *m*-5-aminoazoxylene).

Yellow leaflets from EtOH. M.p. 95°.  $Sn + HCl \rightarrow m$ -5-xylidine + 2:5-diamino-*m*-xylene.

Nölting, Forel, *Ber.*, 1885, 18, 2684.

**6-Amino-3:4:3':4'-tetramethylazobenzene** (*o*-Xyleneazo-*o*-4-xylidine, *o*-4-aminoazoxylene).

Yellow leaflets from EtOH. M.p. 179°.

Nölting, Forel, *Ber.*, 1885, 18, 2685.

**2-Amino-3:5:2':4'-tetramethylazobenzene** (*m*-Xyleneazo-*m*-4-xylidine, *m*-4-aminoazoxylene).

Orange-yellow leaflets. M.p. 78°. Spar. sol. cold EtOH, Sol.  $C_6H_6$ .  $Sn + HCl \rightarrow m$ -4-xylidine + 4:5-diamino-*m*-xylene.

Nölting, Forel, *Ber.*, 1885, 18, 2682.

**4-Amino-3:5:2':6'-tetramethylazobenzene.**

Yellow plates from EtOH.Aq. M.p. 77.5°. Sol. EtOH,  $C_6H_6$ .

Nölting, Forel, *Ber.*, 1885, 18, 2684.

**4-Amino-3:6:2':4'-tetramethylazobenzene** (*m*-Xyleneazo-*p*-xylidine).

Dark orange leaflets. M.p. 110–11°. Sol. EtOH,  $Et_2O$ .  $Sn + HCl \rightarrow m$ -4-xylidine + 2:5-diamino-*p*-xylene.

Nölting, Forel, *Ber.*, 1885, 18, 2684.

**5-Amino-1:2:3:4-tetramethylbenzene.**  
See Prehnidine.

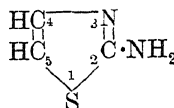
**4-Amino-1:2:3:5-tetramethylbenzene.**  
See Isoduridine.

**3-Amino-1:2:4:5-tetramethylbenzene.**  
See Duridine.

$\omega$ -Aminotetramethylbenzene.

See Trimethylbenzylamine.

**2-Aminothiazole** (*Abadole*)



$C_3H_4N_2S$  MW, 100

Yellow tablets from EtOH. M.p. 90°. Spar. sol.  $H_2O$ , EtOH,  $Et_2O$ . Decomp. on dist.

*N*-Acetyl: needles from  $H_2O$ . M.p. 203°.

Traumann, *Ann.*, 1888, 249, 36.

Britton, Harding, U.S.P., 2,387,212, (*Chem. Abstracts*, 1946, 40, 1179).

Short, Kelly, B.P., 558,956, (*Chem. Abstracts*, 1945, 39, 4632).

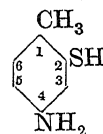
Morren, Dupont, *Chem. Abstracts*, 1944, 38, 3284.

**5-Aminothiazole.**

*N*-Acetyl: anhyd. needles from  $H_2O$ , EtOH, or  $C_6H_6$  or as plates containing solvent of cryst. M.p. 162°.

Helsing, *Ber.*, 1903, 36, 3550.

**4-Amino-*o*-thiocresol** (*o*-Mercapto-*p*-toluidine, 4-amino-*o*-tolyl mercaptan)



$C_7H_9NS$  MW, 139

Needles from  $C_6H_6$ -pet. ether. M.p. 47°. Slowly volatile in steam. Sol. EtOH,  $Et_2O$ .

*S*-Me: methyl *p*-amino-*o*-tolyl sulphide.  $C_8H_{11}NS$ . MW, 153. Plates from ligroin. M.p. 47°. *N*-Acetyl: needles from  $C_6H_6$ . M.p. 126°.

*N*:*S*-Tri-Me:  $C_{10}H_{15}NS$ . MW, 181. Yellow oil. B.p. 159°/17 mm. Volatile in steam. *Methiodide*: plates from  $H_2O$  or EtOH. M.p. 200–2° decomp.

*N*-Acetyl: needles from EtOH. M.p. 95°.

*N*:*S*-Diacetyl: yellow cryst. from  $C_6H_6$ -pet. ether. M.p. 125°.

Zincke, Rollhäuser, *Ber.*, 1912, 45, 1500.

**4-Amino-*m*-thiocresol** (*m*-Mercapto-*p*-toluidine, 4-amino-*m*-tolyl mercaptan).

Thick oil. Formic acid  $\rightarrow$  6-methylbenzthiazole.

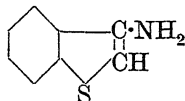
Hess, *Ber.*, 1881, 14, 492.

**2-Amino-p-thiocresol** (*p*-Mercapto-*o*-toluidine, 2-amino-*p*-tolyl mercaptan).

*S*-Me: methyl *o*-amino-*p*-tolyl sulphide. Needles. B.p. 130°/20 mm. *N*-Acetyl: needles from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 114°.

Fichter, Bernoulli, *Ber.*, 1909, 42, 4310.  
Zincke, Röse, *Ann.*, 1914, 406, 135.

**3-Aminothiophene** ( $\beta$ -Aminothiophene)



C<sub>6</sub>H<sub>7</sub>NS MW, 149

Oil. Resinifies in air. Sol. dil. min. acids. Volatile in steam. Boiling H<sub>2</sub>O  $\rightarrow$  thioindoxyl.

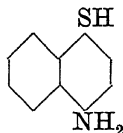
*Zn* salt: greyish-brown needles from C<sub>6</sub>H<sub>6</sub>-EtOH. M.p. 204°.

*N*-Acetyl: tablets from H<sub>2</sub>O or MeOH. M.p. 169°.

*N*-Benzoyl: cryst. from EtOH. M.p. 132°.

Komppa, *J. prakt. Chem.*, 1929, 122, 324.

**4-Amino-1-thionaphthol** (4-Amino-1-mercaptanaphthalene, 4-mercapto-1-naphthylamine)



C<sub>10</sub>H<sub>9</sub>NS MW, 175

Yellow needles from EtOH. M.p. 91-3°. Sol. EtOH, Et<sub>2</sub>O, AcOH, CHCl<sub>3</sub>. Mod. sol. C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin. Vac. dist.  $\rightarrow$  1-naphthylamine.

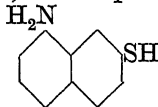
*S*-Me: C<sub>11</sub>H<sub>11</sub>NS. MW, 189. Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 54°. *N*-Acetyl: needles from AcOH. M.p. 193°.

*S*-*p*-Nitrophenyl: ochre needles from EtOH. M.p. 168°.

*N*-Acetyl: needles from AcOH. M.p. 173°.

Zincke, Schütz, *Ber.*, 1912, 45, 473.

**8-Amino-2-thionaphthol** (8-Amino-2-mercaptanaphthalene, 7-mercapto-1-naphthylamine)

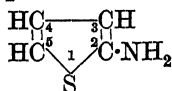


C<sub>10</sub>H<sub>9</sub>NS MW, 175

Needles + 1/2 EtOH from EtOH. M.p. 127°.

Cleve, *Ber.*, 1888, 21, 3267.

**2-Aminothiophene** (2-Thiophenine)



C<sub>4</sub>H<sub>5</sub>NS

MW, 99

Pale yellow liq. B.p. 77-9°/11 mm., 61-2°/1 mm. Rapidly oxidises and polymerises.

*N*-Me: C<sub>5</sub>H<sub>7</sub>NS. MW, 113. B.p. 88-92°/15 mm. *N*-Acetyl: leaflets from H<sub>2</sub>O. M.p. 60°.

*N*-Et: C<sub>7</sub>H<sub>9</sub>NS. MW, 127. B.p. 85-9°/2-3 mm.

*N*-Acetyl: leaflets. M.p. 161-2°.

*N*-Propionyl: plates from H<sub>2</sub>O. M.p. 111°.

*N*-Benzoyl: needles from EtOH.Aq. M.p. 172-3°.

*N*-*o*-Toluenesulphonyl: cryst. from EtOH. M.p. 183-4°.

Steinkopf, *Ann.*, 1913, 403, 17.

Seemann, Lucas, *Can. J. Research*, 1941, 19, 291.

**3-Aminothiophene** (3-Thiophenine).

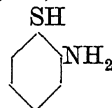
Free base is unstable.

*N*-Acetyl: leaflets from H<sub>2</sub>O. Needles from C<sub>6</sub>H<sub>6</sub>-CHCl<sub>3</sub>. M.p. 145-8°.

*N*-Benzoyl: leaflets from C<sub>6</sub>H<sub>6</sub>-CHCl<sub>3</sub>. M.p. 153-5°.

Steinkopf, Höpner, *Ann.*, 1933, 501, 183.

***o*-Aminothiophenol** (*o*-Mercaptoaniline, *o*-aminophenyl mercaptan)



C<sub>6</sub>H<sub>7</sub>NS MW, 125

Needles. M.p. 26°. B.p. 234°, 125-7°/6 mm. HI  $\rightarrow$  aniline + H<sub>2</sub>S. Ox.  $\rightarrow$  2:2'-diaminodiphenyl disulphide.

*B*.HCl: cryst. M.p. 217° decomp.

*S*-Me: methyl *o*-aminophenyl sulphide, *o*-thioanisidine. C<sub>7</sub>H<sub>9</sub>NS. MW, 139. B.p. 234° part. decomp., 133-4°/15 mm. *N*-Formyl: prisms from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 53-4°. *N*-Acetyl: leaflets from EtOH. M.p. 102-3°.

*N*-Benzoyl: needles from EtOH. M.p. 96°.

*Tri*-Me: C<sub>9</sub>H<sub>13</sub>NS. MW, 167. B.p. 130°/20 mm. *Methiodide*: prisms from H<sub>2</sub>O. M.p. 162-3° decomp.

*S*-Phenyl: see *o*-Aminodiphenyl sulphide.

*N*:*S*-Diacetyl: prisms from EtOH. M.p. 135°.

*N*:*S*-Dibenzoyl: needles from EtOH. M.p. 154-5°.

Hofmann, *Ber.*, 1887, 20, 2260.

Zincke, Siebert, *Ber.*, 1915, 48, 1242.

Claasz, *Ber.*, 1912, 45, 1030.

Kiprianoo *et al.*, *Chem. Abstracts*, 1946, 40, 1829.

Gardner, B.P., 558,887, (*Chem. Abstracts*, 1946, 40, 7237).

***m*-Aminothiophenol** (*m*-Mercaptoaniline, *m*-aminophenyl mercaptan).

Pale yellow oil. B.p. 180-90°/16 mm. Sol. H<sub>2</sub>O, EtOH. Insol. Et<sub>2</sub>O, pet. ether. Easily oxidised. FeCl<sub>3</sub>  $\rightarrow$  3:3'-diaminodiphenyl disulphide.

*B.HCl*: cryst. M.p. 232°.

*S-Me*: methyl *m*-aminophenyl sulphide, *m*-thioanisidine. Pale yellow oil. B.p. 163–5°/16 mm. *N-Acetyl*: needles from H<sub>2</sub>O. M.p. 75°.

*Tri-Me*: yellow oil. B.p. 165–7°/16 mm. *Methiodide*: cryst. from H<sub>2</sub>O. M.p. 183–5° decomp.

*N:S-Diacetyl*: cryst. from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 97°.

Zincke, Muller, *Ber.*, 1913, 46, 775.

**p-Aminothiophenol** (*p*-Mercaptoaniline, *p*-aminophenyl mercaptan).

White cryst. mass. M.p. 46°. B.p. 140–5°/16 mm. Sol. H<sub>2</sub>O. Volatile in steam. Readily ox. → 4:4'-diaminodiphenyl disulphide.

*S-Me*: methyl *p*-aminophenyl sulphide, *p*-thioanisidine. B.p. 272–3°, 140°/15 mm. *D*<sub>25</sub><sup>25</sup> 1.1425. Volatile in steam. *N-Acetyl*: needles from H<sub>2</sub>O. M.p. 130–5° (128°).

*Tri-Me*: leaflets from MeOH.Aq. M.p. 23°. *Methiodide*: leaflets from H<sub>2</sub>O. M.p. 180–4° decomp.

*S-Et*: ethyl *p*-aminophenyl sulphide, *p*-thiophenetidine. C<sub>8</sub>H<sub>11</sub>NS. MW, 153. Yellow oil. B.p. 280–1°, 165°/12 mm. *D*<sub>25</sub><sup>25</sup> 1.1010. *B.HCl*: cryst. M.p. 188° decomp. *N-Acetyl*: cryst. from H<sub>2</sub>O or EtOH.Aq. M.p. 116–17°. *N-Benzoyl*: leaflets from EtOH. M.p. 145°.

*S-Phenyl*: see *p*-Aminodiphenyl sulphide.

*N-Acetyl*: two forms. (i) White scales. (ii) Yellow leaflets. Both forms, m.p. 154° (150°). (i) → (ii) at about 137° in sunlight.

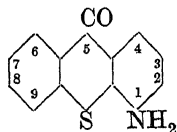
*N:S-Diacetyl*: two forms. (i) Leaflets. M.p. 144°. (ii) M.p. 132°. (i) → (ii) at 155–66°.

*N-Benzoyl*: two forms. (i) Colourless. Sinters at 165°, m.p. 180°. (ii) Yellow needles. M.p. 182°. (i) → (ii) on heat. or by recryst. from EtOH.

Hinsberg, *Ber.*, 1906, 39, 2427.

Zincke, Jörg, *Ber.*, 1909, 42, 3362.

### 1-Aminothioxanthone



C<sub>13</sub>H<sub>9</sub>ONS

MW, 227

Plates from C<sub>6</sub>H<sub>6</sub>. M.p. 202–3°. Green fluor. in H<sub>2</sub>SO<sub>4</sub>.

*N-Acetyl*: cryst. from AcOH. M.p. 233–4°.

Mayer, *Ber.*, 1909, 42, 3063.

### 2-Aminothioxanthone.

Cryst. from AcOH. M.p. 246°.

*N-Acetyl*: m.p. 267°.

Mayer, *Ber.*, 1909, 42, 3067.

### 3-Aminothioxanthone.

Yellowish-brown needles from PhNO<sub>2</sub>. M.p. 221–2°. Sol. CHCl<sub>3</sub>, AcOH. Less sol. C<sub>6</sub>H<sub>6</sub>. Spar. sol. EtOH. Green fluor. in H<sub>2</sub>SO<sub>4</sub>.

*B.HCl*: hygroscopic needles. Decomp. at 230°.

*N-Acetyl*: plates from Ac<sub>2</sub>O. M.p. 236–7°.

Mayer, *Ber.*, 1909, 42, 3056.

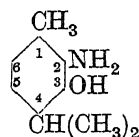
### 4-Aminothioxanthone.

Greyish-brown needles. M.p. 249–50°. Green fluor. in H<sub>2</sub>SO<sub>4</sub>.

*N-Acetyl*: needles from AcOH. M.p. 273°.

Mayer, *Ber.*, 1909, 42, 3065.

**2-Aminothymol** (3-Hydroxy-2-amino-1-methyl-4-isopropylbenzene)



C<sub>10</sub>H<sub>15</sub>ON

MW, 165

Free base not known.

*Et ether*: *B.HCl*: needles from dil. HCl. M.p. about 204° decomp. *B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: reddish-yellow needles. M.p. 169–70° decomp. *N-Acetyl*: needles from EtOH.Aq. M.p. 109°. *N-Benzoyl*: leaflets from EtOH.Aq. M.p. 144°.

Gaebel, *Ber.*, 1902, 35, 2798.

### 6-Aminothymol.

Scales from C<sub>6</sub>H<sub>6</sub>. M.p. 178–9°. Ox. in acid sol. → thymoquinone.

*B.HCl*: cryst. M.p. 255°.

*Me ether*: *B.HCl*: m.p. 250° decomp. *N-Acetyl*: cryst. from EtOH. M.p. 139°.

*Et ether*: C<sub>12</sub>H<sub>19</sub>ON. MW, 193. Unstable oil. *B.HCl*: needles from dil. HCl. M.p. 227–30° decomp. *N-Acetyl*: thymacetin. Needles from EtOH. M.p. 136°. *N-Chloroacetyl*: cryst. from EtOH. M.p. 154°. *N-Bromoacetyl*: m.p. 145°. *N-Benzoyl*: needles from EtOH.Aq. M.p. 151–2°.

*N-Acetyl*: m.p. 174.5°.

*Triacetyl*: leaflets from EtOH. M.p. 91°.

*N-Benzoyl*: needles from EtOH.Aq. M.p. 178–9°.

O: *N-Dibenzoyl*: needles from EtOH.Aq. M.p. 166–7°.

Wallach, Neumann, *Ber.*, 1895, 28, 1663.

Kremers, Wakeman, Hixon, *Organic Syntheses*, Collective Vol. I, 498.

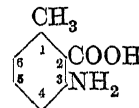
### α-Aminotoluene-*p*-sulphonic Acid.

See 4-Homosulphanilic Acid.

### ω-Aminotoluic Acid.

See Benzylamine-carboxylic Acid.

### 3-Amino-o-toluic Acid



C<sub>8</sub>H<sub>9</sub>O<sub>2</sub>N

MW, 151



Needles. M.p. 125–6° decomp.  
*Nitrile*:  $C_8H_8N_2$ . MW, 132. Cryst. from  $H_2O$ . M.p. 127–8°.

Gabriel, Thieme, *Ber.*, 1919, 52, 1079.

#### 4-Amino-*o*-toluic Acid.

Prisms from  $H_2O$ . M.p. 196°. Sol. hot  $H_2O$ , hot EtOH.

*Nitrile*: needles from pet. ether. M.p. 88°. Spar. sol. hot  $H_2O$ . *B,HCl*: needles from EtOH. M.p. about 220°. *Picrate*: needles from EtOH. M.p. 178–9°.

*N-Acetyl*: needles from EtOH. M.p. 177°.

Landsberger, *Ber.*, 1898, 31, 2881.

#### 5-Amino-*o*-toluic Acid.

Needles from EtOH. M.p. 165° decomp. (153°). Sublimes. Heat.  $\rightarrow$  *m*-toluidine.

*Nitrile*: rhombic cryst. from EtOH. M.p. 90°.

*N-Acetyl*: reddish-yellow cryst. from  $H_2O$ . M.p. 243°.

Gabriel, Thieme, *Ber.*, 1919, 52, 1079.

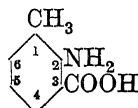
#### 6-Amino-*o*-toluic Acid.

M.p. 191°.

*Nitrile*: needles from  $H_2O$ . M.p. 95.5°.

Nölting, *Ber.*, 1904, 37, 1025.

#### 2-Amino-*m*-toluic Acid



$C_8H_9O_2N$  MW, 151

Prisms from  $H_2O$ . M.p. 172°. Heat. at 200°  $\rightarrow$  *o*-toluidine.

*Amide*:  $C_8H_{10}ON_2$ . MW, 150. Cryst. from  $H_2O$ . M.p. 149°.

*Nitrile*:  $C_8H_8N_2$ . MW, 132. Cryst. M.p. 39°. Volatile in steam.

*N-Et*:  $C_{10}H_{13}O_2N$ . MW, 179. Prisms from ligroin. M.p. 71–2°.

*N-Acetyl*: needles from  $H_2O$ . M.p. 194°.

*N-Benzoyl*: m.p. 178°.

Findelee, *Ber.*, 1905, 38, 3553.

Gabriel, Thieme, *Ber.*, 1919, 52, 1091.

#### 4-Amino-*m*-toluic Acid.

Leaflets from EtOH. M.p. 175°. Sol. Et<sub>2</sub>O. Mod. sol. hot  $H_2O$ .

*Me ester*:  $C_9H_{11}O_2N$ . MW, 165. Columns from  $H_2O$ . M.p. 62°.

*Amide*: prisms from  $CHCl_3$ . M.p. 179°.

*Nitrile*: cryst. from EtOH.Aq. M.p. 63°.

*Anilide*: tablets from EtOH. M.p. 240°.

*N-Me*:  $C_9H_{11}O_2N$ . MW, 165. Cryst. from pet. ether. M.p. about 128°.

*N-Di-Me*: *B,HCl*: m.p. 202°. *B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: yellow cryst. M.p. 217–18°.

*N-Et*: yellow leaflets from  $H_2O$ . M.p. 191°.

*N-Acetyl*: needles from EtOH.Aq. M.p. 193–4°.

Findelee, *Ber.*, 1905, 38, 3553.

#### 5-Amino-*m*-toluic Acid

Needles from  $C_6H_6$ . M.p. 183°. Dist. with  $CaO \rightarrow$  *m*-toluidine.

*Nitrile*: needles from ligroin. M.p. 75°.

Müller, *Ber.*, 1909, 42, 433.

Gabriel, Thieme, *Ber.*, 1919, 52, 1091.

#### 6-Amino-*m*-toluic Acid.

Needles from  $H_2O$ . M.p. 169°. Dist. with  $CaO \rightarrow$  *o*-toluidine.

*Me ester*: prisms from EtOH. M.p. 118°.

*Et ester*: needles from EtOH.Aq. M.p. 79°.

*Amide*: cryst. +  $H_2O$  from  $H_2O$ . M.p. anhyd. 115°.

*Nitrile*: needles from  $H_2O$ . M.p. 95°.

*N-Me*: needles from  $H_2O$ . M.p. 201°.

*N-Et*: needles from  $H_2O$ . M.p. 169–70°.

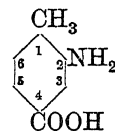
*N-Acetyl*: cryst. from  $H_2O$ . M.p. 228°.

*N-Benzoyl*: yellow needles from Et<sub>2</sub>O. M.p. about 100°.

Müller, *Ber.*, 1909, 42, 433.

Gabriel, Thieme, *Ber.*, 1919, 52, 1091.

#### 2-Amino-*p*-toluic Acid



$C_8H_9O_2N$  MW, 151

Needles. M.p. 165°. Mod. sol.  $H_2O$ .

*Nitrile*:  $C_8H_8N_2$ . MW, 132. Prisms from EtOH. M.p. 81–2°. Spar. sol.  $H_2O$ . Intense sweet taste.

*N-Acetyl*: needles from AcOH. Cryst. from Et<sub>2</sub>O. M.p. 279–81° corr.

Banse, *Ber.*, 1894, 27, 2163.

Ahrens, *Z. Chem.*, 1869, 104.

#### 3-Amino-*p*-toluic Acid (*Homoanthranilic acid*).

Needles from EtOH. M.p. 177° decomp. Sol. Et<sub>2</sub>O,  $C_6H_6$ , hot EtOH. Spar. sol. ligroin,  $CS_2$ , hot  $H_2O$ .

*Amide*:  $C_8H_{10}ON_2$ . MW, 150. Leaflets. M.p. 146–7°.

*Nitrile*: leaflets from EtOH.Aq. M.p. 94°. Sol. EtOH,  $Me_2CO$ ,  $CHCl_3$ ,  $C_6H_6$ . Volatile in steam.

*N-Acetyl*: needles from EtOH. M.p. 133°. *N-Benzoyl*: needles from  $C_6H_6$ . M.p. 145° corr.

*N-Formyl*: needles from EtOH. M.p. 186–7° decomp.

*N-Acetyl*: needles. M.p. 183°.

Niementowski, *J. prakt. Chem.*, 1889, 40, 1.

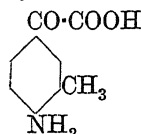
α-Aminotoluidine.

See Aminobenzylamine.

2-Amino-*m*-toluylformic Acid.

See 3-Methylisatic Acid.

4-Amino-*m*-toluylformic Acid (4-Amino-3-methylphenylglyoxylic acid)



C<sub>9</sub>H<sub>9</sub>O<sub>3</sub>N MW, 179

Yellow needles from H<sub>2</sub>O. M.p. 163-4° decomp. Sol. EtOH, Me<sub>2</sub>CO, AcOH. Spar. sol. CHCl<sub>3</sub>, Et<sub>2</sub>O.

N-Et: C<sub>11</sub>H<sub>13</sub>O<sub>3</sub>N. MW, 207. Yellow prisms from H<sub>2</sub>O. M.p. 132-4° decomp.

Phenylhydrazine deriv.: m.p. 179° decomp.

Boehringer, D.R.P., 117,021, (Chem. Zentr., 1901, I, 237).

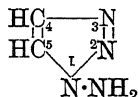
6-Amino-*m*-toluylformic Acid.

See 5-Methylisatic Acid.

Aminotolyl Mercaptan.

See Aminothiocresol.

1-Amino-1 : 2 : 3-triazole



C<sub>2</sub>H<sub>4</sub>N<sub>4</sub> MW, 84

Hygroscopic cryst. from EtOH-Et<sub>2</sub>O or CHCl<sub>3</sub>-ligroin. M.p. 51°.

B,HCl: yellow plates. M.p. 114° decomp.

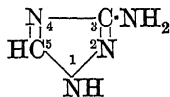
N-Benzoyl: needles from H<sub>2</sub>O. M.p. 151°.

Picrate: m.p. 130° decomp.

Pechmann, Bauer, Ber., 1909, 42, 669.

Stollé, Ber., 1926, 59, 1743.

3-Amino-1 : 2 : 4-triazole



C<sub>2</sub>H<sub>4</sub>N<sub>4</sub> MW, 84

Cryst. from H<sub>2</sub>O, EtOH or AcOEt. M.p. 159°. Sol. H<sub>2</sub>O, EtOH, CHCl<sub>3</sub>. Spar. sol. AcOEt. Insol. Et<sub>2</sub>O, Me<sub>2</sub>CO. Reacts neutral.

B,HCl: cryst. from EtOH. M.p. 153°.

B,HNO<sub>3</sub>: m.p. 174° decomp.

N-Monoacetyl: m.p. 295-300° decomp.

N-Diacetyl: cryst. from EtOH or toluene. M.p. 190-1°.

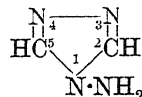
Picrate: yellow needles from H<sub>2</sub>O. M.p. 231° decomp.

Thiele, Manchot, Ann., 1898, 303, 33.

Darapsky, Müller, Ber., 1907, 40, 818.

Allen, Bell, Organic Syntheses, 1946, XXVI, 11.

1-Amino-1 : 3 : 4-triazole



C<sub>2</sub>H<sub>4</sub>N<sub>4</sub> MW, 84

Hygroscopic needles from EtOH or CHCl<sub>3</sub>. M.p. 82-3°. Sol. EtOH. Spar. sol. CHCl<sub>3</sub>, pet. ether. Reacts slightly acid.

B,HCl: leaflets from EtOH. M.p. 153°.

B,HBr: leaflets or needles from EtOH. M.p. 136° slight decomp.

B,HI: needles from EtOH. M.p. 134-5° decomp.

B,HAuCl<sub>4</sub>: cryst. + 1H<sub>2</sub>O. M.p. 120°, anhyd. 170°.

B<sub>2</sub>,H<sub>2</sub>PtCl<sub>6</sub>: orange-red cryst. powder from HCl. M.p. 230° decomp.

N-Formyl: cryst. from EtOH-Et<sub>2</sub>O. M.p. 117°.

Picrate: yellow needles. M.p. 194-5° decomp.

Curtius, Darapsky, Müller, Ber., 1907, 40, 835, 1196.

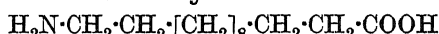
Bülow, Ber., 1909, 42, 2715.

Allen, Bell, Organic Syntheses, 1944, XXIV, 12.

1-Aminotridecane.

See Tridecylamine.

12-Aminotridecylic Acid



C<sub>13</sub>H<sub>27</sub>O<sub>2</sub>N MW, 229

Cryst. powder. M.p. 177° decomp. Sol. EtOH, hot H<sub>2</sub>O. Insol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

B,HCl: m.p. about 151°.

Et ester: C<sub>15</sub>H<sub>31</sub>O<sub>2</sub>N. MW, 257. Cryst. from EtOH.Aq. M.p. 73°. B,HCl: needles from EtOH. M.p. 145°.

N-Benzoyl: cryst. from EtOH.Aq. M.p. 111° (105°).

N-Benzenesulphonyl: prisms from EtOH.Aq. M.p. 102°.

Chloroplatinate: yellow leaflets. M.p. about 207° decomp.

Müller, Krauss, Ber., 1932, 65, 1357.

Baruch, Ber., 1893, 26, 1870.

5-Amino-1 : 2 : 3-trimethylbenzene.

See 5-Aminohemimellitene.

ω-Amino-1 : 2 : 4-trimethylbenzene.

See 2 : 4-Dimethylbenzylamine.

3-Amino-1 : 2 : 4-trimethylbenzene.

See 3-Amino-ψ-cumene.

5-Amino-1 : 2 : 4-trimethylbenzene.

See ψ-Cumidine.

6-Amino-1 : 2 : 4-trimethylbenzene.

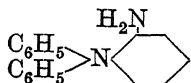
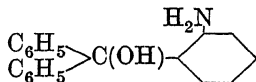
See 6-Amino-ψ-cumene.

ω-Amino-1 : 3 : 5-trimethylbenzene.

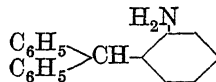
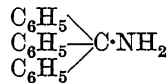
See 3 : 5-Dimethylbenzylamine.

**Aminotrimethylcarbinol.**See Amino-*tert.*-butyl Alcohol.**Aminotrimethylene.**

See Cyclopropylamine.

***o*-Aminotriphenylamine** (*N-Diphenyl-o-phenylenediamine*) $C_{18}H_{16}N_2$  MW, 260Plates from EtOH. M.p. 145°. Sol. EtOH,  $C_6H_6$ . Mod. sol.  $Et_2O$ , ligroin.N-*Acetyl*: needles. M.p. 130°.Piccard, Brewster, *J. Am. Chem. Soc.*, 1921, 43, 2630.***m*-Aminotriphenylamine** (*N-Diphenyl-m-phenylenediamine*).M.p. 116°. Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ .N-*Acetyl*: m.p. 167°.Piccard, Brewster, *J. Am. Chem. Soc.*, 1921, 43, 2630.***p*-Aminotriphenylamine** (*N-Diphenyl-p-phenylenediamine*).Needles from EtOH. M.p. 145–8°. Sol.  $Me_2CO$ ,  $C_6H_6$ . Mod. sol. EtOH, MeOH,  $CCl_4$ . Spar. sol. ligroin.N-*Acetyl*: silvery plates. M.p. 195°.Gambarjan, *Ber.*, 1908, 41, 3507.***o*-Aminotriphenylcarbinol** $C_{19}H_{17}ON$  MW, 275Plates from  $Et_2O$ . M.p. 121.5°. Sol.  $C_6H_6$ , EtOH. Spar. sol.  $Et_2O$ , ligroin. Heat. above m.p.  $\rightarrow$  9-phenylacridine.*B.HCl*: needles +  $\frac{1}{2}H_2O$ . Turns brown at 140°, m.p. 164° decomp.N-*Di-Me*:  $C_{21}H_{21}ON$ . MW, 303. Prisms from EtOH or ligroin. M.p. 156–60°. *B.HCl*: prisms +  $1H_2O$ . M.p. (anhyd.) 187° decomp.N-*Phenyl*:  $C_{25}H_{25}ON$ . MW, 351. Prisms from ligroin. M.p. 127–8°.N-*Acetyl*: prisms. M.p. 192° decomp.*Picrate*: yellow plates +  $\frac{1}{2}C_6H_6$  from  $C_6H_6$ . M.p. 122–3° decomp.Baeyer, Villiger, *Ber.*, 1904, 37, 3193.***m*-Aminotriphenylcarbinol.**Cryst. from  $Et_2O$ . M.p. 155°.N-*Di-Me*: tablets from  $Et_2O$  or ligroin. M.p. 110°. *B.HCl*: leaflets from  $H_2O$ . M.p. 181°.O: N-*Tri-Me*:  $C_{25}H_{25}ON$ . MW, 317. Tablets and prisms from ligroin. M.p. 81°.N-*Acetyl*: leaflets from  $Et_2O$ . M.p. 164°.Tschacher, *Ber.*, 1888, 21, 190.

Dict. of Org. Comp.—I.

***p*-Aminotriphenylcarbinol.**Cryst. from toluene or  $Et_2O$ -ligroin. M.p. 116°. Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ . Spar. sol. ligroin.N-*Di-Me*: needles from  $Et_2O$ -ligroin. M.p. 92–3°.N-*Acetyl*: needles from  $C_6H_6$ -ligroin. M.p. 176°.Baeyer, Löhr, *Ber.*, 1890, 23, 1625.Baeyer, Villiger, *Ber.*, 1904, 37, 599.***o*-Aminotriphenylmethane** $C_{19}H_{17}N$  MW, 259Leaflets from  $Et_2O$ . M.p. 129°. Cryst. +  $1C_6H_6$  from  $C_6H_6$ . M.p. 94–5°.N-*Me*:  $C_{20}H_{19}N$ . MW, 273. Cryst. from  $C_6H_6$ . M.p. 130–2°. *B.HCl*: prisms. M.p. 210° decomp. N-*Acetyl*: prisms from AcOEt. M.p. 147–8°.N-*Acetyl*: prisms from AcOEt. M.p. 154–5°.Baeyer, Villiger, *Ber.*, 1904, 37, 3198.***m*-Aminotriphenylmethane.**Needles from  $Et_2O$ . M.p. 120°.N-*Acetyl*: pearly scales from  $Et_2O$ . M.p. 115°.Tschacher, *Ber.*, 1888, 21, 189.***p*-Aminotriphenylmethane.**Prisms or leaflets from  $Et_2O$  or ligroin. Prisms +  $1C_6H_6$  from  $C_6H_6$ . M.p. 84°. B.p. about 248°/12 mm.*Sulphate*: needles or plates from  $H_2O$ . M.p. 211°.N-*Di-Me*:  $C_{21}H_{21}N$ . MW, 287. Needles from EtOH. M.p. 132°.  $B_2H_2PtCl_6$ : yellow needles. Decomp. at 186–7° corr. *Methiodide*: leaflets from  $H_2O$ . M.p. 184–5°.N-*Acetyl*: needles from EtOH. M.p. 168°.N-*Benzoyl*: needles from  $C_6H_6$ . M.p. 198°.Busch, Rinck, *Ber.*, 1905, 38, 1768.Baeyer, Löhr, *Ber.*, 1890, 23, 1623. **$\alpha$ -Aminotriphenylmethane** (*Triphenyl-methylamine*) $C_{19}H_{17}N$  MW, 259Needles from EtOH. M.p. 105°. B.p. 223°/14 mm. Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ . Insol.  $H_2O$ .*B.HCl*: needles. M.p. 244°.N-*Me*:  $C_{20}H_{19}N$ . MW, 273. Prisms from ligroin. M.p. 73°. *B.HCl*: m.p. 216°.N-*Di-Me*:  $C_{21}H_{21}N$ . MW, 287. Cryst. from ligroin. M.p. 97°.N-*Et*:  $C_{21}H_{21}N$ . MW, 287. Cryst. powder from AcOEt. M.p. 75–7°.

*N*-Phenyl:  $C_{25}H_{21}N$ . MW, 335. Prisms from  $Et_2O-EtOH$ . M.p. 149–50° (146°).

*N*-Benzyl:  $C_{28}H_{23}N$ . MW, 349. Prisms. M.p. 110°. *B, HCl*: needles. M.p. 249°.

*N*-Acetyl: needles from  $EtOH$ . M.p. 207–8°.

*N*-Chloroacetyl: cryst. from toluene. M.p. 201–2° corr.

*N*-Benzoyl: cryst. from  $EtOH$ . M.p. 160–2°.

Elbs, *Ber.*, 1884, 17, 702.

Hemilian, Silberstein, *Ber.*, 1884, 17, 745.

## 2-Aminotropane.

See Isotropyamine.

## 3-Aminotropane.

See Tropylamine.

## 3-Amino- $\psi$ -tropane.

See  $\psi$ -Tropylamine.

## 1-Aminoundecane.

See *n*-Undecylamine.

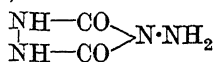
## 2-Aminoundecane.

See *sec.*-*n*-Undecylamine.

## Aminoundecylene.

See Undecenylamine.

**Aminourazole** (4-Amino-3:5-diketodihydro-1:2:4-triazole)



$C_2H_4O_2N_4$  MW, 116

Prisms from  $H_2O$ . M.p. 270°. Spar. sol.  $EtOH$ . Insol.  $Et_2O$ . Reduces  $NH_3 \cdot AgNO_3$ .

$B_2N_2H_4$ : prisms. M.p. 197°.

*Monocacetyl deriv.*: leaflets. Decomp. at 235°.

*Dihydrazone*: needles from  $EtOH \cdot Aq$ . M.p. 207° decomp.

*Dibenzoyl deriv.*: needles. M.p. 201°.

*Tribenzoyl deriv.*: needles. M.p. 234°.

Curtius, *J. prakt. Chem.*, 1895, 52, 481.

Stollé, Krauch, *Ber.*, 1912, 45, 3307.

Stollé, *J. prakt. Chem.*, 1907, 75, 416.

## 1-Amino-4-ureido-*n*-valeric Acid.

See Citrulline.

## 1-Amino-*n*-valeric Acid.

See Norvaline.

## 2-Amino-*n*-valeric Acid



$C_5H_{11}O_2N$  MW, 117

Needles from  $EtOH$  or  $Et_2O$ . M.p. 160–5° decomp., (178–9°). Very sol.  $H_2O$ .

*Cu salt*: cryst. +  $2H_2O$ . M.p. anhyd. 235–6° decomp.

*Et ester*:  $C_7H_{15}O_2N$ . MW, 145. B.p. 82–4°/12 mm.

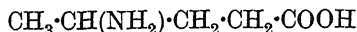
*N*-Benzoyl: m.p. 145–6°.

*N*- $\beta$ -Naphthalenesulphonyl: m.p. 134–5°.

Dakin, *J. Biol. Chem.*, 1933, 99, 531.

Rodionov, *Chem. Abstracts*, 1946, 40, 1785.

## 3-Amino-*n*-valeric Acid



$C_5H_{11}O_2N$  MW, 117

*d*-.  
Cryst. from  $EtOH \cdot Aq$ . M.p. 214° corr.  $[\alpha]_D^{20} + 12 \cdot 0^\circ$  in  $H_2O$ .

*N*-Benzoyl:  $[\alpha]_D^{20} + 16 \cdot 5^\circ$  in  $EtOH$ .

*l*-.  
 $[\alpha]_D^{20} - 10 \cdot 7^\circ$ .

*N*-Benzoyl: needles from  $H_2O$ . M.p. 133° corr.  $[\alpha]_D^{20} - 21 \cdot 9^\circ$  in  $EtOH$ .

*dl*-.  
Cryst. M.p. 199° (214° corr.). Sol.  $H_2O$ . Prac. insol.  $EtOH$ . Insol.  $Et_2O$ ,  $C_6H_6$ , ligroin. Dist.  $\rightarrow$  2-methylpyrrolidone-5.

*B, HCl*: prisms from  $EtOH$ . M.p. 154°.

*Et ester*: *B, HCl*, plates from  $EtOH-Et_2O$ . M.p. 92°.

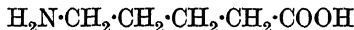
*N*-*Di*-*Et*: *Et ester*, b.p. 96°/8 mm. *Picrate of Et ester*: yellow cryst. from  $EtOH$ . M.p. 90–1°.

*N*-Benzoyl: cryst. M.p. 132°.

Fischer, Groh, *Ann.*, 1911, 383, 370.

Tafel, *Ber.*, 1889, 22, 1861.

## 4-Amino-*n*-valeric Acid



$C_5H_{11}O_2N$  MW, 117

Leaflets. M.p. 157–8°  $\rightarrow$  piperidone +  $H_2O$ . Sol.  $H_2O$ . Prac. insol.  $EtOH$ . Insol.  $Et_2O$ .  $HNO_2 \rightarrow$  allylacetic acid.

*K salt*: from  $EtOH-Et_2O$ . M.p. 228–9°.

*B, HCl*: from  $CHCl_3$ . M.p. 84–6°.

*B, H AuCl\_4*: yellow cryst. +  $1H_2O$ . M.p. 106°.

*Et ester*: *N*-Benzoyl, cryst. M.p. 26°.

*Amide*: *N*-Benzoyl, cryst. from  $H_2O$ . M.p. 181–5°.

*N*-*Me*:  $C_6H_{13}O_2N$ . MW, 131. Hygroscopic needles or prisms from  $EtOH-Et_2O$ . M.p. 121–2° corr. *K salt*: m.p. 280°. *B, HCl*: m.p. 93°.

*N*-*Di*-*Me*:  $C_7H_{15}O_2N$ . MW, 145. B.p. 186–9°. *B, H AuCl\_4*: yellow prisms from  $EtOH$ . M.p. 75°. *Methobromide*: tablets from  $EtOH$ . M.p. 184–7°.

*N*-*Et*: *B, HCl*, from  $Me_2CO$ . M.p. 115°.

*N*-*Propyl*: *B, HCl*, from  $EtOH-Et_2O$ . M.p. 118–19°.

*N*-*Isopropyl*: *B, HCl*, from  $EtOH-Et_2O$ . M.p. 123–4°.

*N*-*Butyl*: *B, HCl*, from  $EtOH-Et_2O$ . M.p. 124°.

*N*-*Octyl*: *B, HCl*, from  $EtOH-Et_2O$ . M.p. 139–40°.

*N*-*Benzyl*: *B, HCl*, from  $EtOH-Et_2O$ . M.p. 120°.

*N*-Benzoyl: cryst. from EtOH.Aq. M.p. 105° (94°).

Gabriel, Aschan, *Ber.*, 1891, 24, 1365.

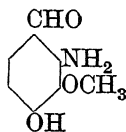
Röth, *Ann.*, 1931, 489, 107.

Schniepp, Marvel, *J. Am. Chem. Soc.*, 1935, 57, 1557.

### 5-Aminovanillic Acid.

See under 4: 5-Dihydroxy-3-aminobenzoic Acid.

### 2-Aminovanillin



$C_8H_9O_3N$  MW, 167

Cryst. from  $C_6H_6$ . M.p. 128-9°. Sol. EtOH,  $Et_2O$ . Spar. sol.  $H_2O$ .

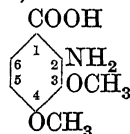
*Oxime*: needles from  $C_6H_6$ . M.p. 151-2°.

*N*-Acetyl: yellow needles from EtOH. M.p. 97°.

*Phenylhydrazone*: yellow needles from EtOH. M.p. 165°.

Sumuleanu, *Chem. Zentr.*, 1903, II, 31.

### 2-Aminoveratric Acid (2-Amino-3:4-dimethoxybenzoic acid)



$C_9H_{11}O_4N$  MW, 197

Needles from  $H_2O$ . M.p. 184°. Sol. EtOH, AcOH,  $Me_2CO$ . Spar. sol. ligroin.

*N*-Acetyl: needles from EtOH. M.p. 188-90°.

Pschorr, Sumuleanu, *Ber.*, 1899, 32, 3410.

Kuhn, *Ber.*, 1895, 23, 810.

Frisch, Bogert, *J. Org. Chem.*, 1944, 9, 338.

### 5-Aminoveratric Acid.

*B*.HCl: decomp. above 235°.

*Me ester*: *N*-Benzoyl, cryst. from EtOH. M.p. 188-90°.

*N*-Acetyl: needles +  $1H_2O$  from  $H_2O$ . M.p. 126°, anhyd. 188°.

Simonsen, Rau, *J. Chem. Soc.*, 1918, 113, 24.

### 6-Aminoveratric Acid.

*Me ester*:  $C_{10}H_{13}O_4N$ . MW, 211. Plates from  $C_6H_6$ . M.p. 133°.

*Et ester*:  $C_{11}H_{15}O_4N$ . MW, 225. M.p. 88-9°. *N*-Acetyl: prisms from AcOH. Decomp. above 228°.

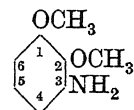
Heidelberger, Jacobs, *J. Am. Chem. Soc.*, 1919, 41, 2142.

Grune, *Ber.*, 1886, 19, 2305.

Tiemann, Matsmoto, *Ber.*, 1876, 9, 942.

Fischer, Bogert, *J. Org. Chem.*, 1939, 4, 71.

### 3-Aminoveratrol



$C_8H_{11}O_2N$  MW, 153

B.p. 137°/10 mm. Darkens in air. Sol.  $H_2O$ . Volatile in steam.

*Picrate*: needles from EtOH. M.p. 173-5°.

Gibson, Simonsen, Rau, *J. Chem. Soc.*, 1917, 111, 79.

### 4-Aminoveratrol.

M.p. 85-6°. B.p. 174-6°. HCl sol. +  $FeCl_3$  → reddish-violet → blue col.

*Platinichloride*: m.p. 227-8°.

*N*-Acetyl: plates from EtOH. M.p. 133°.

*N*-Benzoyl: needles from EtOH. M.p. 177°.

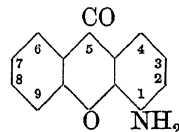
Pollecioff, Robinson, *J. Chem. Soc.*, 1918, 113, 645.

Simonsen, Rau, *ibid.*, 28.

Heinisch, *Monatsh.*, 1894, 15, 232.

Frisch, Bogert, *J. Org. Chem.*, 1943, 8, 331.

### 1-Aminoxanthone



$C_{13}H_9O_2N$  MW, 211

M.p. 201-2°.

Comp. Nationale, F.P., 839,698, (*Chem. Abstracts*, 1939, 33, 8025); 821,275, (*Chem. Abstracts*, 1938, 32, 3628).

### 2-Aminoxanthone.

Bright yellow needles from EtOH or toluene. M.p. 232°. Very sol. EtOH, hot  $C_6H_6$ , hot toluene. Insol. pet. ether. Blue fluor. in EtOH.

Ullmann, Wagner, *Ann.*, 1907, 355, 363.

### 3-Aminoxanthone.

Yellow laminae from EtOH. M.p. 205°.

*N*-Acetyl: needles. M.p. 178°.

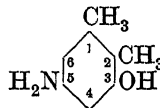
Purgotti, *Gazz. chim. ital.*, 1914, 44, 644.

Comp. Nationale, F.P., 839,698, (*Chem. Abstracts*, 1939, 33, 8025).

### Aminoxylene.

See Xylidine and Xylylamine.

5-Amino-*o*-3-xyleneol (3-Hydroxy-5-amino-*o*-xylene)



$C_8H_{11}ON$

MW, 137

Orange needles from  $\text{CHCl}_3$  or  $\text{C}_6\text{H}_6$ . M.p.  $179^\circ$ . Sol.  $\text{Me}_2\text{CO}$ , warm  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ .

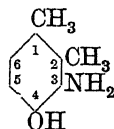
Crossley, *J. Chem. Soc.*, 1913, 103, 2181.

**6-Amino-o-3-xyleneol** (3-Hydroxy-6-amino-o-xylene).

Needles from  $\text{AcOEt}$ . M.p.  $175^\circ$ . Sol.  $\text{EtOH}$ , warm  $\text{H}_2\text{O}$ . Oxidises rapidly in air.

Hinkel, Collins, Ayling, *J. Chem. Soc.*, 1923, 123, 2971.

**3-Amino-o-4-xyleneol** (4-Hydroxy-3-amino-o-xylene)



$\text{C}_8\text{H}_{11}\text{ON}$

MW, 137

Cryst. from  $\text{C}_6\text{H}_6$ . M.p.  $126^\circ$ .

Hinkel, Ayling, Bevan, *J. Chem. Soc.*, 1928, 131, 2531.

**5-Amino-o-4-xyleneol** (4-Hydroxy-5-amino-o-xylene).

Plates from  $\text{Et}_2\text{O}$ . Turns brown at  $165^\circ$ . M.p.  $173-5^\circ$ . Sol.  $\text{EtOH}$ . Spar. sol.  $\text{C}_6\text{H}_6$ . Prac. insol.  $\text{H}_2\text{O}$ , pet. ether. Sublimes. Slowly volatile in steam.  $\text{CrO}_3 \rightarrow$  4:5-dimethyl-o-benzoquinone.

$\text{B, HCl}$ : silky needles from  $\text{H}_2\text{O}$ . M.p.  $250^\circ$  decomp.

$\text{N-Acetyl}$ : plates from  $\text{EtOH}$ . Sinters at  $184^\circ$ . M.p.  $191^\circ$ .

$\text{O}$ :  $\text{N-Diacetyl}$ : needles or prisms from  $\text{EtOH}$ . M.p.  $157^\circ$ .

$\text{Tri-acetyl}$ : tablets from  $\text{EtOH}$ . M.p.  $100-1^\circ$ .

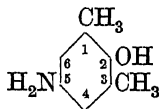
$\text{N-Benzoyl}$ : m.p.  $195-6^\circ$ .

$\text{Dibenzoyl deriv.}$ : needles. M.p.  $152-3^\circ$ .

Crossley, Bartlett, *J. Chem. Soc.*, 1913, 103, 1299.

Hinkel, Collins, Ayling, *J. Chem. Soc.*, 1923, 123, 2973.

**5-Amino-m-2-xyleneol** (2-Hydroxy-5-amino-m-xylene)



$\text{C}_8\text{H}_{11}\text{ON}$

MW, 137

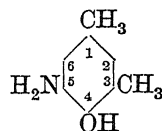
Leaflets from  $\text{H}_2\text{O}$  or  $\text{C}_6\text{H}_6$ . M.p.  $137-8^\circ$  decomp.

$\text{Me ether}$ :  $\text{C}_9\text{H}_{13}\text{ON}$ . MW, 151. Needles from  $\text{H}_2\text{O}$ . M.p.  $66^\circ$ .  $\text{N-Acetyl}$ : prisms from  $\text{EtOH.Aq.}$  M.p.  $136-7^\circ$ .

$\text{Diacetyl deriv.}$ : m.p.  $160^\circ$ .

Rowe, Bannister, Storey, *J. Soc. Chem. Ind.*, 1931, 50, 79.

**5-Amino-m-4-xyleneol** (4-Hydroxy-5-amino-m-xylene)



$\text{C}_8\text{H}_{11}\text{ON}$

MW, 137

Leaflets from  $\text{EtOH}$ . M.p.  $134-5^\circ$ . Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ . Spar. sol.  $\text{C}_6\text{H}_6$ .

$\text{Me ether}$ :  $\text{C}_9\text{H}_{13}\text{ON}$ . MW, 151. B.p.  $239-40^\circ$ .

$\text{Et ether}$ :  $\text{C}_{10}\text{H}_{15}\text{ON}$ . MW, 165. B.p. about  $146/30$  mm.  $\text{N-Acetyl}$ : m.p.  $65-6^\circ$ .

$\text{N-Formyl}$ : needles or prisms from  $\text{EtOH.Aq.}$  M.p.  $68^\circ$ .

$\text{N-Acetyl}$ : cryst. from  $\text{EtOH.Aq.}$  M.p.  $96^\circ$ .

$\text{O}$ :  $\text{N-Dibenzoyl}$ : m.p.  $153-5^\circ$ .

Bamberger, Reber, *Ber.*, 1913, 46, 808.

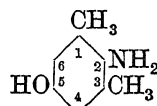
Francke, *Ann.*, 1897, 296, 200.

**6-Amino-m-4-xyleneol** (4-Hydroxy-6-amino-m-xylene).

Needles or plates from  $\text{EtOH}$ . M.p.  $166-7^\circ$ . Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ , hot  $\text{H}_2\text{O}$ . Spar. sol.  $\text{C}_6\text{H}_6$ , ligroin.

Bamberger, Reber, *Ber.*, 1907, 40, 2267.

**2-Amino-m-5-xyleneol** (5-Hydroxy-2-amino-m-xylene)



$\text{C}_8\text{H}_{11}\text{ON}$

MW, 137

Needles from  $\text{H}_2\text{O}$  or  $\text{CHCl}_3$ . M.p.  $181^\circ$ . Sol.  $\text{EtOH}$ . Spar. sol.  $\text{H}_2\text{O}$ ,  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ , ligroin. Boiling dil. min. acids  $\rightarrow$  2:6-dimethylhydroquinone.

$\text{B}_2\text{H}_2\text{SO}_4$ : leaflets, M.p.  $268^\circ$ .

$\text{Me ether}$ :  $\text{C}_9\text{H}_{13}\text{ON}$ . MW, 151. Leaflets from pet. ether. M.p.  $43^\circ$ . Volatile in steam.

$\text{N-Et}$ :  $\text{C}_{10}\text{H}_{15}\text{ON}$ . MW, 165. M.p.  $161-2^\circ$ .

$\text{N-Benzyl}$ :  $\text{C}_{15}\text{H}_{17}\text{ON}$ . MW, 227. M.p.  $104-5^\circ$ .

$\text{N-Acetyl}$ : needles. M.p.  $178-80^\circ$ .

Bamberger, Rising, *Ann.*, 1901, 316, 300.

**4-Amino-m-5-xyleneol** (5-Hydroxy-4-amino-m-xylene).

Needles from  $\text{C}_6\text{H}_6$ . M.p.  $163^\circ$ . Sol.  $\text{EtOH}$ ,  $\text{AcOH}$ , hot  $\text{H}_2\text{O}$ . Reduces  $\text{NH}_3\text{.AgNO}_3$ .

$\text{B, HCl}$ : cryst. from  $\text{H}_2\text{O}$  or dil.  $\text{HCl}$ . M.p.  $270-80^\circ$ .

$\text{Me ether}$ :  $\text{N-Acetyl}$ , prisms from  $\text{C}_6\text{H}_6$ . Needles from  $\text{H}_2\text{O}$ . M.p.  $150-5^\circ$ .  $\text{N-Diacetyl}$ : needles from  $\text{MeOH.Aq.}$ , or  $\text{C}_6\text{H}_6$ . M.p.  $80-1^\circ$ .

$\text{N-Acetyl}$ : scales from  $\text{H}_2\text{O}$ . M.p.  $186-7^\circ$ .

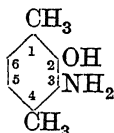
$\text{Diacetyl deriv.}$ : m.p.  $87-8^\circ$ .

$\text{N-Benzoyl}$ : cryst. from  $\text{MeOH}$  or  $\text{EtOH.Aq.}$  M.p.  $211-12^\circ$ .

O : *N*-Dibenzoyl : needles from MeOH. M.p. 148–9°. Alc. KOH → *N*-benzoyl.

Auwers, Borsche, *Ber.*, 1915, 48, 1698.

**3-Amino-*p*-2-xyleneol** (*2-Hydroxy-3-amino-*p*-xylene*)



$C_8H_{11}ON$

MW, 137

Leaflets from  $C_6H_6$ . M.p. 149–50°. Sol. EtOH,  $CHCl_3$ . Spar. sol.  $H_2O$ .

*N*-Benzoyl : needles. M.p. 210–11°.

*Dibenzoyl deriv.* : needles. M.p. 178–9°.

Auwers, Murbe, Sauerwein, Deines, Schornstein, *Chem. Zentr.*, 1924, II, 2269.

**5-Amino-*p*-2-xyleneol** (*2-Hydroxy-5-amino-*p*-xylene*).

Leaflets from EtOH. M.p. 242° decomp.  $FeCl_3$  or  $CrO_3$  → *p*-xyloquinone.

*Et ether* :  $C_{10}H_{15}ON$ . MW, 165. M.p. 69·5°.

*N*-Acetyl : octahedra from EtOH. M.p. 177–9°.

Jacobs, Heidelberger, *J. Am. Chem. Soc.*, 1917, 39, 2204.

Sutkowski, *Ber.*, 1887, 20, 979.

Gattermann, *Ber.*, 1894, 27, 1930.

Smith, Opie, *J. Org. Chem.*, 1941, 6, 427.

**6-Amino-*p*-2-xyleneol** (*2-Hydroxy-6-amino-*p*-xylene*).

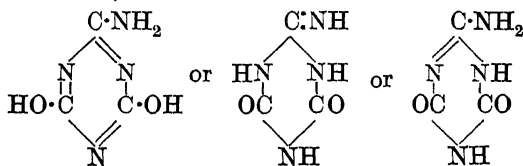
Plates from  $H_2O$ . M.p. 155°.

*Me ether* : *B*, *HCl*, needles +  $1H_2O$  from  $H_2O$ . M.p. anhyd. 250–1° decomp. *Chlorostannate* : needles from dil. *HCl*. Decomp. (anhyd.) about 250°.

Sonn, *Ber.*, 1916, 49, 2590.

Robertson, Stephenson, *J. Chem. Soc.*, 1930, 133, 315.

**Ammelide** (*Melanuric acid, cyanuric acid monoamide*)



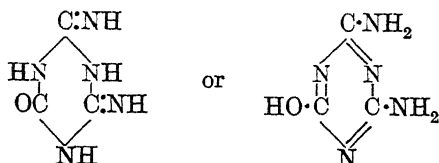
$C_3H_4O_2N_4$

MW, 128

Microscopic prisms from  $H_2O$ . Decomp. at high temps. without melting. Spar. sol. hot  $H_2O$ . Insol. usual org. solvents. Sol. alkalis and min. acids. Hot min. acids → cyanuric acid +  $NH_3$ .

Werner, *J. Chem. Soc.*, 1913, 103, 2275.

**Ammeline** (*Cyanuric acid diamide*)



$C_3H_5ON_5$

MW, 127

Needles from aqueous  $Na_2CO_3$  sol. Prac. insol.  $H_2O$ . Insol. EtOH,  $Et_2O$ , AcOH. Sol. alkalis and min. acids. Warm conc.  $H_2SO_4$  → ammelide +  $NH_3$ . Salts are unstable in presence of  $H_2O$ .

Stollé, Krauch, *Ber.*, 1913, 46, 2337.

**Ammidin.**

*See* Imperatorin.

**Ammodendrine**

$C_{12}H_{20}ON_2 \cdot H_2O$

MW, 226

Alkaloid from *Ammodendron conollyi*, Bge. Prisms from  $Et_2O$ . M.p. 73–4°, anhyd. 50–60°. Sol. EtOH,  $Me_2CO$ ,  $CHCl_3$ . Spar. sol.  $H_2O$ , pet. ether.

*B*, *HI* : cryst. from EtOH. M.p. 218–20°.

*Perchlorate* : cryst. from  $Me_2CO$ . M.p. 199–200°.

*N*-*Me* :  $C_{13}H_{22}ON_2$ . MW, 222. Cryst. from pet. ether. M.p. 65–6°. *B*, *HI* : cryst. from  $Me_2CO$ -EtOH. M.p. 183–5°. *Methiodide* : cryst. from  $Me_2CO$ -EtOH. M.p. 163–5°.

Orékhov, Proskurnina, Lazurevskii, *Ber.*, 1935, 68, 1807.

Orékhov, Proskurnina, *Bull. soc. chim.*, 1938, 5, 29.

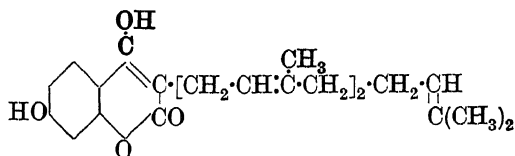
**Ammoidin.**

*See* Xanthotoxin.

**Ammonchelidonic Acid.**

*See* Chelidamic Acid.

**Ammoresinol**



$C_{24}H_{30}O_4$

MW, 382

Isolated from *Dorema ammoniacum*. Cryst. from  $CCl_4$ . M.p. 109°. Sol. dil.  $Na_2CO_3$ . Sol. most org. solvents. Insol.  $H_2O$ . Heat in vacuo → resacetophenone.

*Acetyl deriv.* : cryst. from MeOH.Aq. M.p. 128–9°.

*Diacetyl* : cryst. from AcOH or EtOH. M.p. 102–3°. B.p. 210–25°/0·02 mm.

*Dibenzoyl* : needles from ligroin. M.p. 75°.

*Di-p-chlorobenzoyl*: prisms from MeOH. M.p. 93·5°.

Raudnitz, Petru, Diamant, Neurad, Laner, *Ber.*, 1936, 69, 1956.

Späth, Simon, Lintner, *ibid.*, 1656.

Kunz, Weidle, Fischer, *J. prakt. Chem.*, 1934, 141, 350.

### Amorphigenin

$C_{22}H_{22}O_7$  MW, 398

From *Amorpha fruticosa*. M.p. 191–2° (from MeOH). Contains 2 OMe groups.

Acree, Jacobson, Haller, *J. Org. Chem.*, 1943, 8, 572.

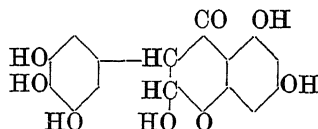
### Amorphin

$C_{33}H_{40}O_{16}$  MW, 692

Glycoside occurring in *Amorpha fruticosa*. M.p. 151–1·5°. Contains 2 OMe groups. Gives positive Durham and orcinol tests.

Acree, Jacobson, Haller, *J. Org. Chem.*, 1943, 8, 572.

### Ampelopsin



$C_{15}H_{12}O_8$  MW, 320

Constituent of "Haku-tya", a drug and condiment used in China. Cryst. +  $2\frac{1}{2}$  H<sub>2</sub>O from H<sub>2</sub>O or EtOH. M.p. 245–6°. Gives violet-red col. with Mg + HCl; with EtOH-FeCl<sub>3</sub> a violet col. which changes to dark orange on standing. AcOH sol. → yellow col. with H<sub>2</sub>SO<sub>4</sub>.

*Tetra-Me*: m.p. 168°.

*Penta-Me*: m.p. 194–5°.

*Hexa-acetyl*: m.p. 174–5°.

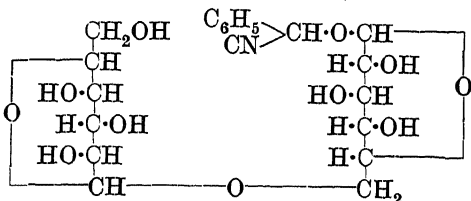
*Hexa-benzoyl*: m.p. 174°.

Kubota, *J. Chem. Soc. Japan*, 1939, 60, 604, (*Chem. Abstracts*, 1942, 36, 4118).

### Amphetamine.

See 2-Phenylisopropylamine.

### Amigdalin (*Mandelonitrile-β-gentiobioside*)



$C_{20}H_{27}O_{11}N$  MW, 457

Glycoside of bitter almonds (3–4%). Also in kernels of cherries (0·8%), peaches (2–2·5%), apricots, and fruits of the *Amygdalaceae* and

*Pomaceae* generally. Cryst. + 3H<sub>2</sub>O from H<sub>2</sub>O. M.p. 214–16°. Sol. hot EtOH. Insol. Et<sub>2</sub>O.  $[\alpha]_D^{25} - 40\text{--}57^\circ$  in H<sub>2</sub>O. Hot dil. HCl → glucose, benzaldehyde and HCN. Emulsin gives same end hyd. products, the amygdalase giving glucose and mandelonitrile-glucoside, and prunase splitting this to aldehyde, HCN and glucose. Bitter taste. Reacts neutral.

*Hepta-acetyl*: prisms from EtOH.Aq. M.p. 169°.  $[\alpha]_D^{18} - 36\text{--}2^\circ$  in AcOEt.

*Hepta-benzoyl*: needles from EtOH-CHCl<sub>3</sub>. M.p. 218°.  $[\alpha]_D^{18} - 10\text{--}5^\circ$ .

*Hepta-p-chlorobenzoyl*: needles from EtOH-CHCl<sub>3</sub>. M.p. 234°.

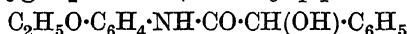
*Hepta-p-bromobenzoyl*: needles from EtOH-CHBr<sub>3</sub>. M.p. 229°.

*Hepta-anisoyl*: amorphous. M.p. 119°.

*Hepta-stearyl*: amorphous. M.p. 92°.  $[\alpha]_D^{18} - 8\text{--}4^\circ$ .

Campbell, Haworth, *J. Chem. Soc.*, 1924, 125, 1337.

### Amygdophenine (*Mandelyl-p-phenetidine*)



$C_{16}H_{17}O_3N$  MW, 271

Leaflets. M.p. 140·5°.

*Acetyl deriv.*: needles from ligroin. M.p. 157°.

Wenghöffer, *Chem.-Ztg.*, 1895, 19, 1753.

Anschütz, Böcker, *Ann.*, 1909, 368, 62.

### n-Amyl acetate

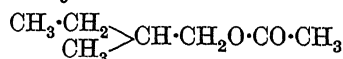


$C_7H_{14}O_2$  MW, 130

F.p. – 70·8°. B.p. 148°/737 mm.  $D_4^{20}$  0·8963,  $D_{20}^{20}$  0·8792.

Lieben, Rossi, *Ann.*, 1871, 159, 74.

### active Amyl acetate



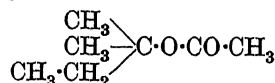
$C_7H_{14}O_2$  MW, 130

B.p. 141–2° (139°).  $D^{12}$  0·8803.  $n_D^{20}$  1·4012.  $[\alpha]_D^{20} + 3\text{--}30^\circ$ .

Hardin, Sikorsky, *Chem. Zentr.*, 1908, I, 2143.

Houtman, Steenis, Heertjes, *Rec. trav. chim.*, 1946, 65, 781.

### tert.-Amyl acetate



$C_7H_{14}O_2$  MW, 130

B.p. 124°.  $D^{19}$  0·8738. Above 125° decomp. gradually to 2-methylbutylene + acetic acid. HCl → acetic acid + tert.-amyl chloride.

Oddo, *Gazz. chim. ital.*, 1911, 41, 289.

Kondakow, *Ber.*, 1893, 26, 1013 (*Ref.*).



**active Amylacetic Acid** (3-Methylcaproic acid, 3-methyl-3-ethylbutyric acid)



$\text{C}_7\text{H}_{14}\text{O}_2$  MW, 130

B.p. 221°. Spar. sol.  $\text{H}_2\text{O}$ .  $D_4^{20}$  0.9149.  $[\alpha]_D^{25}$  + 7.6° in MeOH. (Inactive form, b.p. 217–18°.)  
Me ester:  $\text{C}_8\text{H}_{16}\text{O}_2$ . MW, 144. B.p. 158–64°.  $D_4^{25}$  0.8764.

Et ester:  $\text{C}_9\text{H}_{18}\text{O}_2$ . MW, 158. B.p. 173–9°.  $D_4^{21}$  0.8644.

Welt, *Ann. chim.*, 1895, 6, 132.

### n-Amylacetylene.

See 1-Heptyne.

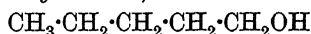
### n-Amylacrylic Acid.

See 1-Octenic Acid.

### Amyl Alcohol (commercial).

Constituent of fusel oil. A mixture of isoamyl alcohol and active amyl alcohol in varying amounts, depending on the source (potatoes, molasses, etc.). That from potato contains 13–22% of the active alcohol, that from molasses 50–60%. B.p. 130–2°.  $D_4^{20}$  0.81. Sol.  $\text{H}_2\text{O}$ , EtOH, Et<sub>2</sub>O.

**n-Amyl Alcohol** (Butylcarbinol, 1-pentanol, primary n-amyl alcohol)



$\text{C}_5\text{H}_{12}\text{O}$  MW, 88

M.p. – 79°. B.p. 137°/740 mm., 49–50°/13 mm. Insol.  $\text{H}_2\text{O}$ .  $D_4^{25}$  0.80915,  $D_4^0$  0.8296.  $n_D^{20}$  1.4101.

Me ether:  $\text{C}_6\text{H}_{14}\text{O}$ . MW, 102. B.p. 99–100°.

Et ether:  $\text{C}_7\text{H}_{16}\text{O}$ . MW, 116. B.p. 119–20°.

n-Amyl ether: see Di-n-amyl Ether.

3 : 5-Dinitrobenzoate: m.p. 46.4°.

Phenylurethane: tablets from pet. ether. M.p. 46°.

p-Nitrophenylurethane: m.p. 86°.

α-Naphthylurethane: m.p. 68°.

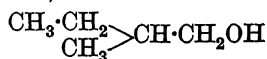
Bouveault, Blanc, *Chem. Zentr.*, 1905, II, 1700.

Scheuble, Löbl, *Monatsh.*, 1904, 25, 1096.

### sec.-n-Amyl Alcohol.

See Methyl-n-propylcarbinol.

**active Amyl Alcohol** (sec.-Butylcarbinol, 2-methylbutanol-1)



$\text{C}_5\text{H}_{12}\text{O}$  MW, 88

l.

B.p. 128°.  $D_4^{20}$  0.816.  $[\alpha]_D^{20}$  – 5.90°.  $\text{CrO}_3$  → methylethylacetic acid. Racemised by Na.

Phenylurethane: cryst. from ligroin. M.p. 30°.  $[\alpha]_D$  + 6.4° in  $\text{CHCl}_3$ .

dl.

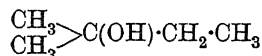
B.p. 128–9°/742 mm.  $D_4^0$  0.8341.  $n_D^{20}$  1.4092. Phenylurethane: m.p. 31°.

Marckwald, *Ber.*, 1904, 37, 1039.

Whitmore, Vlewine, *J. Am. Chem. Soc.*, 1938, 60, 2569.

Houtman, Steenis, Heertjes, *Rec. trav. chim.*, 1946, 65, 781.

**tert.-Amyl Alcohol** (2-Methylbutanol-2, dimethylethylcarbinol, tert.-pentanol, "amylene hydrate")



$\text{C}_5\text{H}_{12}\text{O}$  MW, 88

M.p. – 8.4°. B.p. 102°. Sol. 8 parts  $\text{H}_2\text{O}$ .  $D_4^0$  0.827,  $D_4^{25}$  0.8069.  $n_D^{20}$  1.4052. Mol. b.p. elevation, 24.6.  $\text{CrO}_3$  → acetone + acetic acid. Ni at 230° → unsym.-trimethylethylene. Soporific.

Et ether:  $\text{C}_7\text{H}_{16}\text{O}$ . MW, 116. B.p. 102–3°/742 mm.  $D_4^0$  0.7785.

Phenylurethane: needles. M.p. 44–7°. B.p. 146°/9 mm.

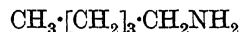
Wischnegradsky, *Ann.*, 1878, 190, 332.

Adams, Kamm, Marvel, *J. Am. Chem. Soc.*, 1918, 40, 1950.

### Amyl Alcohol.

See also Isoamyl Alcohol, Methyl-n-propylcarbinol and Methylisopropylcarbinol.

### n-Amylamine (1-Amino-n-pentane)



$\text{C}_5\text{H}_{13}\text{N}$  MW, 87

F.p. – 55°. B.p. 104°.  $D^{19}$  0.7662.

Picrate: m.p. 138–9°.

Picrolonate: m.p. 198°.

Menschutkin, *Chem. Zentr.*, 1898, I, 702.

Brown, Jones, *J. Chem. Soc.*, 1946, 781.

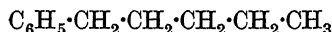
### Amylamine.

See also 2-Amino-n-pentane, Methyl-n-butylamine, 2-Amino-2-methylbutane and 4-Amino-2-methylbutane.

### p-tert.-Amylanisole.

See under p-tert.-Amylphenol.

### n-Amylbenzene (1-Phenylpentane)



$\text{C}_{11}\text{H}_{16}$  MW, 148

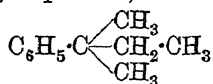
B.p. 201–2°.  $D_{16}^{15}$  0.8664.  $n_D^{15}$  1.4751.

Radcliffe, Simpkin, *J. Soc. Chem. Ind.*, 1921, 40, 119.

Gilman, Robinson, *Organic Syntheses*, 1930, X, 4.

Hennion, Toussaint, U.S.P., 2,390,835, (*Chem. Abstracts*, 1946, 40, 2849).

**tert.-Amylbenzene** (2-Methyl-2-phenylbutane, 2-phenylisopentane)



$\text{C}_{11}\text{H}_{16}$  MW, 148  
B.p. 189–91°, 77°/15 mm.  $D_4^{15}$  0.8736.  $n_D^{25}$  1.49154.

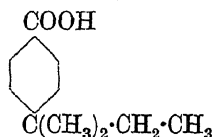
Konowalow, Jegorow, *Chem. Zentr.*, 1899, I, 776.

Anschütz, Beckerhoff, *Ann.*, 1903, 327, 224.

Hennion, Kurtz, *J. Am. Chem. Soc.*, 1943, 65, 1001.

Simons, Hart, *J. Am. Chem. Soc.*, 1944, 66, 1309.

#### 4-tert.-Amylbenzoic Acid



$\text{C}_{12}\text{H}_{16}\text{O}_2$  MW, 192  
Needles. M.p. 158°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O.

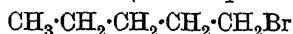
Anschütz, Ranff, *Ann.*, 1903, 327, 202.

Kreysler, *Ber.*, 1885, 18, 1709.

#### Amyl borate.

See Tri-*n*-amyl borate.

#### *n*-Amyl bromide (1-Bromopentane)



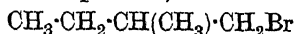
$\text{C}_5\text{H}_{11}\text{Br}$  MW, 151  
M.p. — 95–25°. B.p. 129.7°.  $D_4^{15}$  1.22367,  $D_4^{20}$  1.20456.  $n_D^{20}$  1.4444.

Fournier, *Bull. soc. chim.*, 1906, 35, 623.

#### sec.-*n*-Amyl bromide.

See 2-Bromopentane.

**active Amyl bromide** (1-Bromo-2-methylbutane, 1-bromoisopentane)

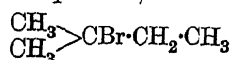


$\text{C}_5\text{H}_{11}\text{Br}$  MW, 151  
B.p. 120–1°.  $D_4^{20}$  1.221.  $[\alpha]_D^{20} + 3.68^\circ$ . (Inactive form, b.p. 117–18°.)

Marchwald, *Ber.*, 1904, 37, 1046.

Jones, *J. Chem. Soc.*, 1905, 87, 138.

**tert.-Amyl bromide** (2-Bromo-2-methylbutane, 2-bromoisopentane)



$\text{C}_5\text{H}_{11}\text{Br}$  MW, 151  
Yellow liq. B.p. 108–9° decomp.  $D_4^0$  1.2439.  $n_D$  1.4421.

Wischnegradsky, *Ann.*, 1878, 190, 337.

#### 2-*n*-Amylbutylene.

See 3-Methyl-2-octene.

#### *n*-Amyl butyrate

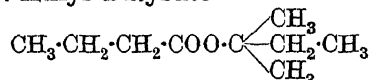
$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-COO-CH}_2\text{-(CH}_2)_3\text{-CH}_3$   
 $\text{C}_9\text{H}_{18}\text{O}_2$  MW, 158  
F.p. — 73.2°. B.p. 185°.  $D_4^0$  0.8832.  
Gartenmeister, *Ann.*, 1886, 233, 269.

#### active Amyl butyrate

$\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-COO-CH}_2\text{-CH}(\text{CH}_3)\text{-CH}_2\text{-CH}_3$   
 $\text{C}_9\text{H}_{18}\text{O}_2$  MW, 158  
B.p. 179°/765 mm. corr., 173–6°/726 mm.  $D_4^{20}$  0.862.  $n_D^{20}$  1.4112.  $[\alpha]_D^{20} + 3.51^\circ$ .

Walden, *Z. physik. Chem.*, 1896, 20, 573.

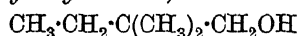
#### tert.-Amyl butyrate



$\text{C}_9\text{H}_{18}\text{O}_2$  MW, 158  
B.p. 164°.  $D^0$  0.8769.

Kondakow, *Ber.*, 1893, 26, 1012 (Ref.).

**tert.-Amylcarbinol** (2:2-Dimethylbutanol-1, 2:2-dimethylbutyl alcohol)

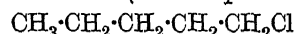


$\text{C}_6\text{H}_{14}\text{O}$  MW, 102  
Liq. with camphoraceous odour. B.p. 135°.  $D_4^0$  0.844.

Phenylurethane: cryst. from EtOH. M.p. 65–6°.

Bouveault, Blanc, *Bull. soc. chim.*, 1879, 31, 749.

#### *n*-Amyl chloride (1-Chloropentane)



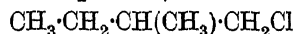
$\text{C}_5\text{H}_{11}\text{Cl}$  MW, 106.5  
M.p. — 99°. B.p. 108.4° (105°/764 mm.).  $D_4^{25}$  0.88657,  $D_4^{30}$  0.87163.  $n_D^{25}$  1.4119.

Lieben, Rossi, *Ann.*, 1871, 159, 72.

#### sec.-*n*-Amyl chloride.

See 2-Chloropentane.

**active Amyl chloride** (1-Chloro-2-methylbutane, 1-chloroisopentane)



$\text{C}_5\text{H}_{11}\text{Cl}$  MW, 106.5  
B.p. 97–9°.  $D_4^{25}$  0.8863.  $n_D^{25}$  1.4126.  $[\alpha]_D^{25} + 1.7^\circ$ . (Inactive form, b.p. 96–9°.  $D_4^{25}$  0.8818.)

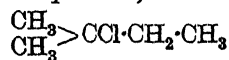
Aschan, *Chem. Zentr.*, 1918, II, 939.

McKenzie, Clough, *J. Chem. Soc.*, 1913, 103, 699.

Hardin, Sikorsky, *Chem. Zentr.*, 1908, I, 2143.

Brown, Groot, *J. Am. Chem. Soc.*, 1942, 64, 2563.

**tert.-Amyl chloride** (2-Chloro-2-methylbutane, 2-chloroisopentane)

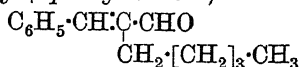


$\text{C}_5\text{H}_{11}\text{Cl}$  MW, 106.5

M.p. - 73°. B.p. 86°.  $D_{15}^{20}$  0.8692.  $n_D^{20}$  1.407.

Brochet, *Ann. chim.*, 1897, 10, 384.

$\alpha$ -*n*-Amylcinnamaldehyde (*Jasmine aldehyde*,  $\alpha$ -*amyl*- $\beta$ -phenylacrolein)



$C_{14}H_{18}O$  MW, 202

Used in perfumery. Pale yellow oil, b.p. 174-5°/20 mm., 140°/5 mm.  $D_{20}^{20}$  0.9711.  $n_D^{20}$  1.5381.

*Oxime*: m.p. 72.5-73°.

*Semicarbazone*: m.p. 117.5-118°.

2:4-Dinitrophenylhydrazone: scarlet. M.p. 164°.

Backès, *Bull. soc. chim.*, 1942, 9, 60.

Rutovskii, Korolev, *J. prakt. Chem.*, 1928, 119, 272.

I.G., Swiss P. 127,159.

**Amylene.**

See 1-Pentene, 2-Pentene, and 2-Methylbutylene.

**Amylene-carboxylic Acid.**

See 2-Allylpropionic Acid, 3-Ethylidenebutyric Acid, Hydrosorbic Acid, and Propylacrylic Acid.

**Amylene dibromide.**

See Dibromopentane and Dibromoisopentane.

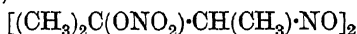
**Amylene Glycol.**

See Dihydroxypentane.

**Amylene hydrate.**

See *tert.*-Amyl Alcohol.

**Amylene nitrosate** (*Bis-trimethylethylene nitrosate*)



$C_{10}H_{20}O_8N_4$  MW, 324

Colourless cryst. M.p. 98-9°. Depolymerises at m.p.  $\rightarrow$  bluish-green liq. Sol.  $Me_2CO$ ,  $C_6H_6$ . Spar. sol. EtOH, AcOH,  $Et_2O$ .

Michael, Carlsons, *J. Am. Chem. Soc.*, 1937, 59, 843.

Klingstedt, *Ber.*, 1925, 58, 2363.

Schmidt, *Ber.*, 1902, 35, 2336.

***n*-Amylethylene.**

See 1-Heptene.

**active Amylethylene.**

See 4-Methyl-1-hexene.

***n*-Amylethylene Glycol.**

See Heptandiol-1:2.

***n*-Amyl fluoride** (*1-Fluoropentane*)

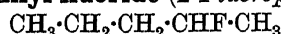


$C_5H_{11}F$  MW, 90

B.p. 63°.  $D_4^{20}$  0.788.

Swarts, *Chem. Zentr.*, 1921, III, 1457.

***sec.*-*n*-Amyl fluoride** (*2-Fluoropentane*)

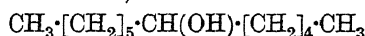


$C_5H_{11}F$  MW, 90

B.p. 48-50°/756 mm.

Bergmann, Polanyi, Szabo, *Trans. Faraday Soc.*, 1936, 32, 843.

***n*-Amyl-*n*-hexylcarbinol** (*1-n-Amylhexanol-1*, *dodecanol-6*)

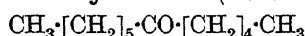


$C_{12}H_{26}O$  MW, 186

Cryst. from pet. ether. M.p. 30°. B.p. 119°/9 mm.

Bouveault, Locquin, *Compt. rend.*, 1905, 140, 1700.

***n*-Amyl *n*-hexyl Ketone** (*Dodecanone-6*)



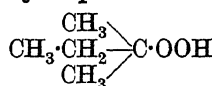
$C_{12}H_{24}O$  MW, 184

M.p. 9°. B.p. 112°/9 mm.

*Oxime*: b.p. 147°/10 mm.

Bouveault, Locquin, *Compt. rend.*, 1905, 140, 1699.

***tert.*-Amyl hydroperoxide**

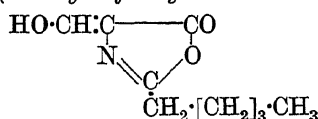


$C_5H_{12}O_2$  MW, 104

B.p. 26°/3.5 mm.  $D^{20}$  0.903.  $n_D$  1.4161.

Milas, Sturgenor, *J. Am. Chem. Soc.*, 1946, 68, 642.

**2-*n*-Amyl-4-hydroxymethylene-5-oxazolone** (*2-Amyl-4-formyl-5-oxazolone*)



$C_9H_{13}O_3N$  MW, 183

Colourless plates. M.p. 145-6° after darkening at 140°. *dl*-Penicillamine  $\rightarrow$  *dl*-amylpenilloic acid.

*Na salt*: needles from  $Me_2O$ . M.p. 228-9°  $\rightarrow$  sodium 2-amylloxazole-4-carboxylate.

*Ag salt*: m.p. 164° decomp.  $EtI \rightarrow$  2-amyl-4-ethoxymethylene-5-oxazolone.

*Me ether*: 2-amyl-4-methoxymethylene-5-oxazolone.  $C_{10}H_{15}O_3N$ . MW, 197. M.p. 22°. B.p. 106-8°/0.15 mm. *d*-Penicillamine methyl ester  $\rightarrow$  methyl *d*-amylpenicillenate.

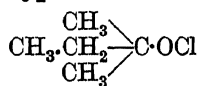
*Et ether*: 2-amyl-4-ethoxymethylene-5-oxazolone.  $C_{11}H_{17}O_3N$ . MW, 211. Colourless oil. B.p. 94°/0.05 mm.  $n_D^{20}$  1.4975.

Brown, Cornforth, *Chemistry of Penicillin*, Princeton University Press, 1949, pp. 522, 804, 808, 824.

**Amyl *p*-hydroxyphenyl sulphide.**

See under Thiohydroquinone.

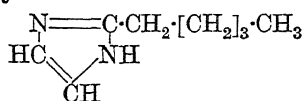
***tert.*-Amyl hypochlorite**



$C_5H_{11}OCl$  MW, 122.5

Yellow liq. B.p. 76°/752 mm. decomp.  $D_4^{25}$  0-8547. Decomp. in sunlight.

Chattaway, Backeberg, *J. Chem. Soc.*, 1923, 123, 2999.

2-*n*-Amyliminazole

$\text{C}_8\text{H}_{14}\text{N}_2$  MW, 138

Needles. M.p. 38°. B.p. 117°/15 mm.

*Picrolonate*: yellow prisms. M.p. 190-1°.

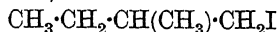
Abraham *et al.*, and Cornforth, *Chemistry of Penicillin*, Princeton University Press, 1949, pp. 50, 705.

*n*-Amyl iodide (1-Iodo-*n*-pentane)

$\text{C}_5\text{H}_{11}\text{I}$  MW, 198

B.p. 155°/740 mm., 62°/20 mm.  $D_4^{20}$  1.517.  $n_D^{20}$  1.4955.

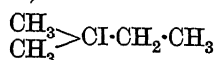
Lieben, Rossi, *Ann.*, 1871, 159, 74.

*active* Amyl iodide (1-Iodo-2-methylbutane, 1-iodoisopentane)

$\text{C}_5\text{H}_{11}\text{I}$  MW, 198

B.p. 148°.  $D_4^{15}$  1.523.  $n_D^{15}$  1.4981.  $[\alpha]_D^{15}$  + 5.78°.

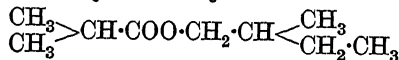
Marckwald, Nolda, *Ber.*, 1909, 42, 1589.  
Klages, Sautter, *Ber.*, 1904, 37, 651.

*tert.*-Amyl iodide (2-Iodo-2-methylbutane, 2-iodoisopentane)

$\text{C}_5\text{H}_{11}\text{I}$  MW, 198

B.p. 128°/737 mm.  $D^0$  1.524.  $\text{H}_2\text{O} \rightarrow$  *tert.*-amyl alcohol.

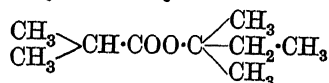
Wischnegradsky, *Ann.*, 1878, 190, 337.

*active* Amyl isobutyrate

$\text{C}_9\text{H}_{18}\text{O}_2$  MW, 158

B.p. 171°/765 mm., 168-70°/730 mm.  $D^{20}$  0.8619.

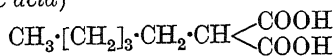
Walden, *Z. physik. Chem.*, 1896, 20, 574.

*tert.*-Amyl isobutyrate

$\text{C}_9\text{H}_{18}\text{O}_2$  MW, 158

B.p. 153-5°.  $D_4^0$  0.8706.

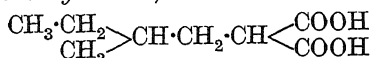
Kondakow, *Ber.*, 1893, 26, 1012.

*n*-Amylmalonic Acid (*Hexane*-1 : 1-dicarboxylic acid)

$\text{C}_8\text{H}_{14}\text{O}_4$  MW, 174

Prisms. M.p. 82°. Sol.  $\text{H}_2\text{O}$ , EtOH, Et<sub>2</sub>O. At 140°  $\rightarrow$  *n*-heptylic acid.

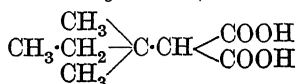
Hell. Schüle, *Ber.*, 1885, 18, 626.

*active* Amylmalonic Acid (3-Methylpentane-1 : 1-dicarboxylic acid)

$\text{C}_8\text{H}_{14}\text{O}_4$  MW, 174

*Di-Et ester*:  $\text{C}_{12}\text{H}_{22}\text{O}_4$ . MW, 230.  $D_4^{20}$  0.9665.

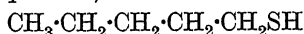
Walden, *Z. physik. Chem.*, 1906, 55, 11.

*tert.*-Amylmalonic Acid (2 : 2-Dimethylbutane-1 : 1-dicarboxylic acid)

$\text{C}_8\text{H}_{14}\text{O}_4$  MW, 174

*Di-Et ester*:  $\text{C}_{12}\text{H}_{22}\text{O}_4$ . MW, 230. B.p. 238°.

Bischoff, *Ber.*, 1895, 28, 2628.

*n*-Amyl Mercaptan (*n*-Thioamyl alcohol, 1-mercapto-*n*-pentane)

$\text{C}_5\text{H}_{12}\text{S}$  MW, 104

B.p. 126°/767 mm.  $D^{20}$  0.857.  $n_D^{20}$  1.44366.

*Hg salt*: m.p. 74-5°.

*PdCl<sub>2</sub> comp.*: m.p. 41°.

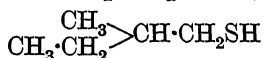
3 : 5-Dinitrobenzoyl chloride comp.: m.p. 39-40°.

3-Nitrophthalic anhydride comp.: m.p. 131-2°.

Pexsters, *Chem. Zentr.*, 1907, I, 1398.

Mann, Purdie, *J. Chem. Soc.*, 1935, 1559.

Wertheim, *J. Am. Chem. Soc.*, 1929, 51, 3661.

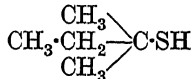
*active* Amyl Mercaptan (2-Methyl-*n*-butyl mercaptan, active thioamyl alcohol, 2-methylbutanthiol-1, 1-mercaptoisopentane)

$\text{C}_5\text{H}_{12}\text{S}$  MW, 104

B.p. 119-21°.  $D^{23}$  0.8415.  $[\alpha]_D^{23}$  + 3.21°.

Votoček, Veselý, *Ber.*, 1914, 47, 1515.

Hardin, Sikorsky, *Chem. Zentr.*, 1908, I, 2143.

*tert.*-Amyl Mercaptan (2-Mercaptoisopentane)

$\text{C}_5\text{H}_{12}\text{S}$  MW, 104

*Hg salt*: m.p. 159–60°.

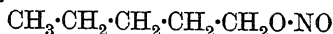
Rheinboldt, Dewald, Diepenbruck, *J. prakt. Chem.*, 1931, **130**, 138.

Backer, *Rec. trav. chim.*, 1935, **54**, 215.

### Amyl *p*-methoxyphenyl sulphide.

See under Thiohydroquinone.

### *n*-Amyl nitrite

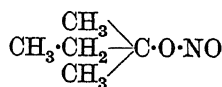


$\text{C}_5\text{H}_{11}\text{O}_2\text{N}$  MW, 117

Yellow liq. B.p. 104°, 51–2°/132 mm.  $D^{20}$  0.8528.  $n_D^{20}$  1.38506. Hyd. by KOH. Inhalation affects heart, blood pressure, etc.

Pexsters, *Chem. Zentr.*, 1907, **I**, 1398.

### *tert.*-Amyl nitrite



$\text{C}_5\text{H}_{11}\text{O}_2\text{N}$  MW, 117

B.p. 93°, 62–3°/345 mm. Sol. EtOH.  $D^{19.5}$  0.8958.  $n^{16.8}$  1.3904.

Bertoni, *Gazz. chim. ital.*, 1886, **16**, 515.

### Amyl nitrite.

See also Isoamyl nitrite.

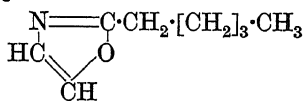
### Amylopectin.

See Starch.

### Amylose.

See Starch.

### 2-*n*-Amyloxazole



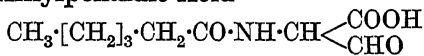
$\text{C}_8\text{H}_{13}\text{ON}$  MW, 139

Sweet-smelling oil. B.p. 172–3°.

*Picrate*: yellow needles. M.p. 84.5–85.8°.

Cornforth, *Chemistry of Penicillin*, Princeton University Press, 1949, p. 703.

### *n*-Amylpencaldic Acid



$\text{C}_9\text{H}_{15}\text{O}_4\text{N}$  MW, 201

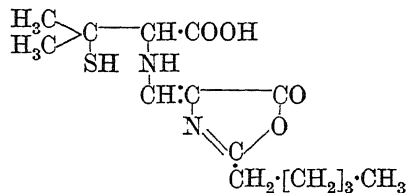
*Me ester*:  $\text{C}_{10}\text{H}_{17}\text{O}_4\text{N}$ . MW, 215. Pale yellow oil. 2 : 4-*Dinitrophenylhydrazone*: cryst. from MeOH. M.p. 153–5°. *d*-Penicillamine  $\rightarrow$   $\alpha$ -methyl amylpenicilloate.

*Et ester*:  $\text{C}_{11}\text{H}_{19}\text{O}_4\text{N}$ . MW, 229. Oil. B.p. 155–60°/4 mm. 2 : 4-*Dinitrophenylhydrazone*: needles from EtOH. M.p. 166–7°. *Anil*: needles from EtOH. M.p. 145–6°. *dl*-Penicillamine  $\rightarrow$   $\alpha$ -ethyl *dl*-amylpenicilloate.

*Di-Et acetal*:  $\text{C}_{13}\text{H}_{25}\text{O}_5\text{N}$ . MW, 275. Cryst. from EtOH. Aq. M.p. 67–8°.

Brown, *The Chemistry of Penicillin*, Princeton University Press, 1949, p. 473.

### *n*-Amylpenicillenic Acid

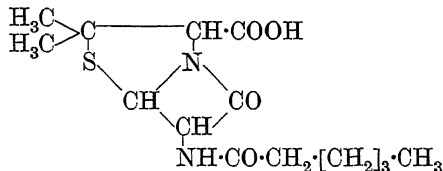


$\text{C}_{14}\text{H}_{22}\text{O}_4\text{N}_2\text{S}$  MW, 314

*Me ester*:  $\text{C}_{15}\text{H}_{24}\text{O}_4\text{N}_2\text{S}$ . MW, 328. Cryst. from  $\text{Me}_2\text{CO} \cdot \text{Et}_2\text{O}$ . M.p. 105–6°. Benzylamine  $\rightarrow$   $\beta$ -methyl amylpenicilloate  $\alpha$ -benzylamide. Shows ultra-violet absorption max. at 317.5  $\mu$  ( $\epsilon$ , 28,000).

Cornforth, *The Chemistry of Penicillin*, Princeton University Press, 1949, p. 831.

### *n*-Amylpenicillin (*Flavacidin*, *gigantic acid*, *dihydropenicillin-F*, *dihydropenicillin-I*)



$\text{C}_{14}\text{H}_{22}\text{O}_4\text{N}_2\text{S}$  MW, 314

Powerful antibiotic elaborated by strains of *Penicillium* and *Aspergillus*.  $[\alpha]_D^{25} + 440^\circ$  in  $\text{H}_2\text{O}$ . Cold min. acids  $\rightarrow$  *n*-amylpenillic acid. Hot min. acids  $\rightarrow$   $\text{CO}_2$  + penicillamine + *n*-amylpenilloaldehyde. Alkalis  $\rightarrow$  *n*-amylpenilaldic acid.

*Ba salt*:  $(\text{C}_{14}\text{H}_{21}\text{O}_4\text{N}_2\text{S})_2\text{Ba} \cdot 2\text{H}_2\text{O}$ .  $[\alpha]_D^{25} + 120^\circ$  in  $\text{H}_2\text{O}$ . Antibiotic activity: 1,000–1,400 penicillin units/mg.

*Procaine salt*: m.p. 113–15°.  $[\alpha]_D^{25} + 175^\circ$  in 50%  $\text{Me}_2\text{CO}$ . Aq. Antibiotic activity: 983 penicillin units/mg.

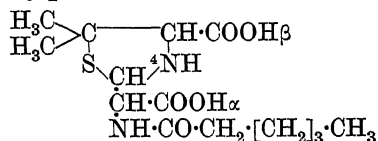
Cook, Heilbron, *The Chemistry of Penicillin*, Princeton University Press, 1949, p. 38.

Wintersteiner, *ibid.*, 103.

Adler, Wintersteiner, *J. Biol. Chem.*, 1948, **176**, 873.

Philpot, *Nature*, 1943, **152**, 725.

### *n*-Amylpenicilloic Acid



$\text{C}_{14}\text{H}_{24}\text{O}_5\text{N}_2\text{S}$  MW, 332

*d*-

Cryst. from  $\text{MeOH} \cdot \text{Et}_2\text{O}$ . M.p. 188–90°.  $\text{HgCl}_2 \rightarrow$  *n*-amylpenilloaldehyde + penicillamine.

*α*-Me ester: C<sub>15</sub>H<sub>26</sub>O<sub>5</sub>N<sub>2</sub>S. MW, 346. Cryst. from MeOH-Et<sub>2</sub>O. M.p. 167–8°. B.HCl: m. p. 170°.

*β*-Me ester: amorphous. *α*-Benzylamide: cryst. from Me<sub>2</sub>CO-Et<sub>2</sub>O. M.p. 142–3°.

*Di*-Me ester: C<sub>16</sub>H<sub>28</sub>O<sub>5</sub>N<sub>2</sub>S. MW, 360. Cryst. from AcOEt. M.p. 128–30°.

*α*-Et ester: C<sub>16</sub>H<sub>28</sub>O<sub>5</sub>N<sub>2</sub>S. MW, 360. B.HCl: cryst. M.p. 167–8°.

*α*-Et *β*-Me ester: C<sub>17</sub>H<sub>30</sub>O<sub>5</sub>N<sub>2</sub>S. MW, 374. Prisms from CHCl<sub>3</sub>-Et<sub>2</sub>O. M.p. 125–7°.

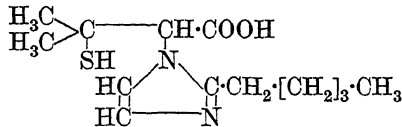
*dl*-.  
*α*-Et ester: prisms from Et<sub>2</sub>O-light petroleum. M.p. 114°.

B.HCl: m.p. 171–2°.

N<sup>4</sup>-Acetyl: cryst. from AcOEt-light petrol. eum. M.p. 125–30°.

Mozingo, Folkers, *The Chemistry of Penicillin*, Princeton University Press, 1949, p. 535.

n-Amylpenillamine



C<sub>13</sub>H<sub>22</sub>O<sub>2</sub>N<sub>2</sub>S MW, 270

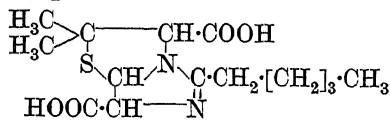
*d*-.  
*B,HCl*: needles. M.p. 170° decomp. Shows ultra-violet absorption max. at 218 mμ (ε 6,750).

*l*-.  
*B,HCl*: needles from Me<sub>2</sub>CO-Et<sub>2</sub>O. M.p. 167–8° decomp. [α]<sub>D</sub><sup>25</sup> + 60.0° in H<sub>2</sub>O.

*dl*-.  
*B,HCl*: prisms from Me<sub>2</sub>CO-MeOH-Et<sub>2</sub>O. M.p. 170°.

Cook, *The Chemistry of Penicillin*, Princeton University Press, 1949, p. 106.

n-Amylpenillic Acid



C<sub>14</sub>H<sub>22</sub>O<sub>4</sub>N<sub>2</sub>S MW, 314

*d*-.  
 Needles or rhombs from H<sub>2</sub>O. M.p. 190° (effervescence). [α]<sub>D</sub><sup>25</sup> + 475°. Shows ultra-violet absorption max. at 240 mμ (ε 2,500). Hyd. → CO<sub>2</sub> + penicillamine + n-amylpenilloaldehyde. HgCl<sub>2</sub> → n-amylpenillamine + CO<sub>2</sub>. Hot H<sub>2</sub>O → n-amylpenilloic acid.

Cook, *The Chemistry of Penicillin*, Princeton University Press, 1949, p. 106.

n-Amylpenilloaldehyde (Caproamidoacetaldehyde)

CH<sub>3</sub>-[CH<sub>2</sub>]<sub>3</sub>-CH<sub>2</sub>-CO-NH-CH<sub>2</sub>-CHO  
 C<sub>8</sub>H<sub>15</sub>O<sub>2</sub>N MW, 157

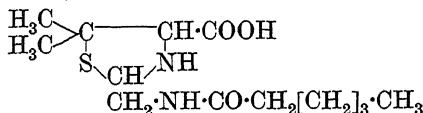
*Di*-Et acetal: C<sub>12</sub>H<sub>25</sub>O<sub>3</sub>N. MW, 231. Oil. B.p. 127–9°/4 mm. Hyd. → caproic acid.

2:4-Dinitrophenylhydrazones: yellow prisms from EtOH. M.p. 191°. Boil with 2:4-dinitrophenylhydrazine hydrochloride → glyoxal osazone.

*Dimedone deriv.*: cryst. from EtOH.Aq. M.p. 143–4°.

Brown, *The Chemistry of Penicillin*, Princeton University Press, 1949, p. 481.

n-Amylpenilloic Acid



C<sub>13</sub>H<sub>24</sub>O<sub>3</sub>N<sub>2</sub>S MW, 288

*d*-.  
*pK*<sub>1</sub> 1.48, *pK*<sub>2</sub> 5.16 in H<sub>2</sub>O at 5°.

*B,HCl*: cryst. M.p. 193–4° decomp. [α]<sub>D</sub><sup>25</sup> + 82.0° in EtOH.

*dl*-.  
*B,HCl*: needles from MeOH-Et<sub>2</sub>O. M.p. 201° decomp. Stable to hot dil. acids.

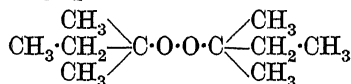
*Me ester*: C<sub>14</sub>H<sub>26</sub>O<sub>3</sub>N<sub>2</sub>S. MW, 302. Plates from Et<sub>2</sub>O-light petroleum. M.p. 100–1°.

*Diketopiperazine*: plates from EtOH.Aq. M.p. 185–6°.

Mozingo, Folkers, *The Chemistry of Penicillin*, Princeton University Press, 1949, p. 535.

Cook, *ibid.*, p. 141.

tert.-Amyl peroxide



C<sub>10</sub>H<sub>22</sub>O<sub>2</sub> MW, 174

B.p. 58.5°/14 mm., 44°/10 mm. *D*<sub>20</sub><sup>4</sup> 0.821. *n*<sub>D</sub><sup>20</sup> 1.4095.

Rust, Dickey, Bell, U.S.P., 2,403,758, (*Chem. Abstracts*, 1946, 40, 6092).

Vaughan, Rust, U.S.P., 2,403,771, (*Chem. Abstracts*, 1946, 40, 5757).

Milas, Surgenor, *J. Am. Chem. Soc.*, 1946, 68, 643.

p-tert.-Amylphenetole.

See under p-tert.-Amylphenol.

p-tert.-Amylphenol (p-Hydroxy-tert.-amylbenzene)



C<sub>11</sub>H<sub>16</sub>O MW, 164

Needles. M.p. 92–3°. B.p. 265–7°, 138°/15 mm.

*Me ether*: *p-tert.*-amylanisole.  $C_{12}H_{18}O$ .  
MW, 178. B.p. 240° (217°).

*Et ether*: *p-tert.*-amyphenetole.  $C_{13}H_{20}O$ .  
MW, 192. B.p. 260°.

*Acetyl*: b.p. 265°.

Anschütz, Beckerhoff, *Ann.*, 1903, 327, 218.

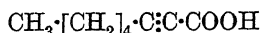
**n-Amylphenylcarbinol.**

See 1-Phenylhexyl Alcohol.

**n-Amyl phenyl Ketone.**

See Caprophenone.

**n-Amylpropionic Acid (1-Heptyne-1-carboxylic acid)**



$C_8H_{12}O_2$  MW, 140

F.p. 2-5°. B.p. 148-9°/19 mm., 133°/10 mm.

Decomp. at 180-220°.  $D_4^{13}$  0.9623.  $n_D^{20}$  1.46335,  $n_D^{20}$  1.4595.

*Me ester*:  $C_9H_{14}O_2$ . MW, 154. B.p. 107°/20 mm., 94°/10 mm.  $D^{20}$  0.926.  $n_D^{20}$  1.4464.

*Et ester*:  $C_{10}H_{16}O_2$ . MW, 168. B.p. 115°/16 mm.

*Propyl ester*:  $C_{11}H_{18}O_2$ . MW, 182. B.p. 134°/17 mm.

*Isopropyl ester*: b.p. 126-7°/22 mm.

*Isobutyl ester*:  $C_{12}H_{20}O_2$ . MW, 196. B.p. 138°/23 mm.

*Isoamyl ester*:  $C_{13}H_{22}O_2$ . MW, 210. B.p. 148-9°/20 mm.

*Allyl ester*:  $C_{11}H_{16}O_2$ . MW, 180. B.p. 124-8°/18 mm.

*Chloride*:  $C_8H_{11}OCl$ . MW, 158.5. B.p. 88-90°/17 mm.

*Amide*:  $C_8H_{13}ON$ . MW, 139. Plates from EtOH. M.p. 91°.

*Nitrile*:  $C_8H_{11}N$ . MW, 121. B.p. 194-6°, 80-1°/13 mm.

*o-Toluidide*: needles from pet. ether. M.p. 60°.

*p-Toluidide*: cryst. from  $C_6H_6$ . M.p. 68°.

*Anisidide*: m.p. 44°.

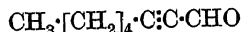
*α-Naphthylamide*: m.p. 113-14°.

Moureu, Delange, *Compt. rend.*, 1903, 136, 553; 1901, 132, 988.

Zoss, Hennion, *J. Am. Chem. Soc.*, 1941, 63, 1152.

Nametkin et al., *Chem. Abstracts*, 1942, 36, 3783.

**Amylpropionic Aldehyde (1-Heptyne-1-aldehyde)**

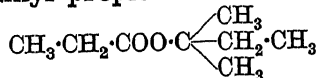


$C_8H_{12}O$  MW, 124

B.p. 185-7°, 89°/26 mm.  $D^0$  0.89. Gives cryst. bisulphite comp.

Moureu, Delange, *Compt. rend.*, 1904, 138, 1341.

**tert.-Amyl propionate**



$C_8H_{16}O_2$

MW, 144

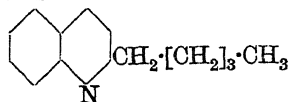
B.p. 143°.  $D^{15}$  0.8545.

Kondakow, *Ber.*, 1893, 26, 1012 (Ref.).

**1-Amylpropionic Acid.**

See 1-Methyl-n-heptylic Acid.

**2-n-Amylquinoline**



$C_{14}H_{17}N$

MW, 199

Constituent of alkaloids of *Cusparia trifoliata*. Colourless oil. B.p. 130-45°/10 mm.

*Picrate*: cryst. from MeOH. M.p. 125-6° (111-12°, 104-5°).

Späth, Pickl, *Ber.*, 1929, 62, 2245; *Monatsh.*, 1930, 55, 352.

Taylor, Hobson, *J. Chem. Soc.*, 1936, 183.

**Amylresorcinol.**

See Olivetol.

**Amyl-β-resorcylic Acid.**

See Olivetol-carboxylic Acid.

**n-Amylsuccinic Acid.**

See Heptane-1 : 2-dicarboxylic Acid.

**n-Amylvinylacetylene.**

See 1-Nonen-3-yne.

**n-Amylvinylcarbinol.**

See 1-Octenol-3.

**α-Amyradiene**

$C_{30}H_{48}$

MW, 408

*l.*

Needles from Et<sub>2</sub>O-EtOH. M.p. 193-4°.  $[\alpha]_D^{20}$  -104° in CHCl<sub>3</sub>.

*d<sup>1</sup>.*

Needles from Et<sub>2</sub>O-EtOH. M.p. 134-5.  $[\alpha]_D^{21}$  +109° in CHCl<sub>3</sub>.

*d<sup>2</sup>.*

M.p. 119-120°.  $[\alpha]$  +137°.

Vesterberg, *Ber.*, 1887, 20, 1245; 1891, 24, 3835.

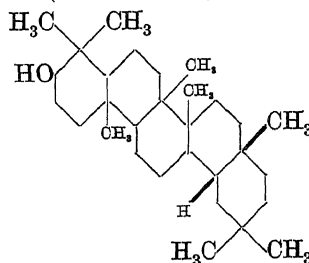
Vesterberg, Westerlind, *Ann.*, 1922, 428, 250.

Winterstein, Stein, *Ann.*, 1933, 502, 223.

Ewen, Gillam, Spring, *J. Chem. Soc.*, 1944, 28.

Noller, Hearst, *J. Am. Chem. Soc.*, 1950, 72, 625.

**β-Amyranol (Oleanan-2β-ol)**



$C_{30}H_{52}O$

MW, 428

Needles from MeOH. M.p. 186.0–6.5°.  $[\alpha]_D^{20} + 18.4^\circ$  in  $\text{CHCl}_3$ . Ox.  $\rightarrow$  amyranone.

Acetyl: plates from  $\text{CHCl}_3$ -MeOH. M.p. 284.5–5.0°.  $[\alpha]_D^{20} + 21^\circ$  in  $\text{CHCl}_3$ .

Ruzicka, Jeger, *Helv. Chim. Acta*, 1941, 24, 1178.

Barton, Holness, *J. Chem. Soc.*, 1952, 78.

 $\alpha$ -Amyrenol.

See  $\alpha$ -Amyrin.

 $\beta$ -Amyrenol.

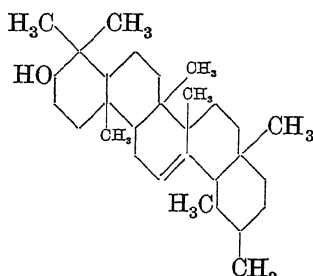
See  $\beta$ -Amyrin.

 $\alpha$ -Amyrenone.

See  $\alpha$ -Amyrone.

 $\beta$ -Amyrenone.

See  $\beta$ -Amyrone.

 $\alpha$ -Amyrin ( *$\alpha$ -Amyrenol*)

Suggested structure

 $\text{C}_{30}\text{H}_{50}\text{O}$ 

MW, 426

Occurs in free state and as acetate in latex of various species of rubber tree. Needles from EtOH. M.p. 186°.  $[\alpha]_D^{17} + 91.6^\circ$  in  $\text{C}_6\text{H}_6$ ,  $+ 83.5^\circ$  in  $\text{CHCl}_3$ .  $\text{CrO}_3 \rightarrow \alpha$ -amyrone.

Formyl: needles from AcOH. M.p. 190°.  $[\alpha]_D^{20} + 80.4^\circ$  in  $\text{C}_6\text{H}_6$ .

Acetyl: leaflets from petrol. Needles from EtOH. M.p. 225–6° corr. More sol. than  $\beta$ -form.  $[\alpha]_D^{18} + 77^\circ$  in  $\text{C}_6\text{H}_6$ .

Benzoyl: needles or prisms from  $\text{C}_6\text{H}_6$ - $\text{Me}_2\text{CO}$ . M.p. 193–4° corr.  $[\alpha]_D^{10} + 94.6^\circ$  in  $\text{CHCl}_3$ .

m-Nitrobenzoyl: cryst. from  $\text{CHCl}_3$ -EtOH. M.p. 233°.  $[\alpha]_D^{20} + 97.6^\circ$  in  $\text{C}_6\text{H}_6$ .

Anisoyl: needles from  $\text{CHCl}_3$ -EtOH. M.p. 193°.  $[\alpha]_D^{20} + 102.2^\circ$  in  $\text{C}_6\text{H}_6$ .

Me ether: m.p. 221–2°.  $[\alpha]_D^{16} + 93^\circ$  in  $\text{CHCl}_3$ .

Ruzicka, Wirz, *Helv. Chim. Acta*, 1939, 22, 948.

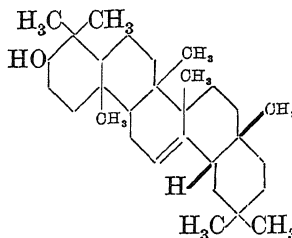
Haworth, *Annual Reports of the Progress of Chemistry* (London), 1937, 34, 338–9. Spring, Vickerstaff, *J. Chem. Soc.*, 1937, 249.

Ruzicka, Schellenberg, Goldberg, *Helv. Chim. Acta*, 1937, 20, 791.

Lederman, *Journal and Proceedings of the Australian Chemical Institute*, 1946, 13, 65 (Review).

Meisels, Jeger, Ruzicka, *Helv. Chim. Acta*, 1949, 32, 1075.

Jeger, *Über die Konstitution der Triterpene, Fortschritte der Chemie Organischer Naturstoffe*, Vol. 7, 1950, 1.

 $\beta$ -Amyrin ( *$\beta$ -Amyrenol, olean-12-en-2 $\beta$ -ol*) $\text{C}_{30}\text{H}_{50}\text{O}$ 

MW, 426

Occurs in free state and as acetate and palmitate in latex of various species of rubber tree. Needles from EtOH. M.p. 197–7.5°. Sol. AcOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$  and hot EtOH. Mod. sol. petrol.  $[\alpha]_D^{20} + 99.8^\circ$  in  $\text{C}_6\text{H}_6$ ,  $+ 88.4^\circ$  in  $\text{CHCl}_3$ .  $\text{CrO}_3 \rightarrow \beta$ -amyrene.

Formyl: leaflets from AcOH. M.p. 240°.  $[\alpha]_D^{20} + 49.8^\circ$  in  $\text{C}_6\text{H}_6$ .

Acetyl: prisms from petrol. Needles from EtOH-Et<sub>2</sub>O. M.p. 236° (238–9°).  $[\alpha]_D^{17} + 78.6^\circ$  in  $\text{C}_6\text{H}_6$ ,  $+ 81.4^\circ$  in  $\text{CHCl}_3$ .

Benzoyl: leaflets from  $\text{Me}_2\text{CO}$ . M.p. 229–30° (233–4°).  $[\alpha]_D^{10} + 100.2^\circ$ .

m-Nitrobenzoyl: needles from  $\text{CHCl}_3$ -EtOH. M.p. 236°.  $[\alpha]_D^{20} + 96.7^\circ$ .

p-Nitrobenzoyl: from 95% EtOH. M.p. 257–8°.  $[\alpha]_D^{25} + 95.6^\circ$  in  $\text{CHCl}_3$ .

Anisoyl: leaflets from  $\text{Me}_2\text{CO}$  or AcOH. M.p. 250°.  $[\alpha]_D^{20} + 97.4^\circ$  in  $\text{C}_6\text{H}_6$ .

Palmitoyl: m.p. 75°.  $[\alpha]_D^{15} + 54.5^\circ$ .

Allophanate: from dioxan-methyl ethyl ketone. M.p. 263–5°.

Toluene-p-sulphonyl: m.p. 132–8° decomp.

Me ether: m.p. 247–8°.  $[\alpha]_D^{16} + 98^\circ$  in  $\text{CHCl}_3$ .

Ruzicka, Marxer, *Helv. Chim. Acta*, 1939, 22, 195.

Horrnann, Firzlafl, *Arch. Pharm.*, 1930, 268, 64.

Vesterberg, *Bull. soc. Chim.*, 1925, 37, 742.

Haworth, *Annual Reports of the Progress of Chemistry*, (London), 1937, 34, 338–9.

King et al., *J. Am. Chem. Soc.*, 1943, 65, 1168.

Lederman, *Journal and Proceedings of the Australian Chemical Institute*, 1946, 13, 65 (Review).

Jeger, *Über die Konstitution der Triterpene, Fortschritte der Chemie Organischer Naturstoffe*, Vol. 7, 1950, 1.

Barton, Holness, *J. Chem. Soc.*, 1952, 78.

Klyne, *J. Chem. Soc.*, 1952, 2916.

epi- $\beta$ -Amyrin.

Cryst. from MeOH. M.p. 225°.  $[\alpha]_D + 73.3^\circ$  in  $\text{CHCl}_3$ .

Acetyl: cryst. from MeOH- $\text{CHCl}_3$ . M.p. 128°.

Ruzicka, Wirz, *Helv. Chim. Acta*, 1941, 24, 248.



$\alpha$ -Amyrone

$C_{30}H_{48}O$  MW, 424

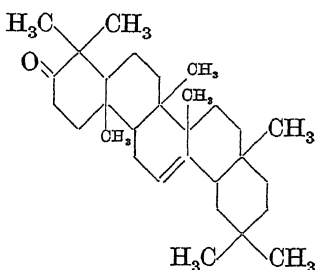
Tablets from MeOH. M.p. 125–6°. Na + EtOH or  $H_2$  + Pt  $\rightarrow$   $\alpha$ -amyrin.

Semicarbazone: cryst. from  $C_6H_6$ -EtOH. M.p. 204–5°.

2 : 4-Dinitrophenylhydrazone: yellowish-red. M.p. 218°.

Dieterle, Brass, Schaal, *Arch. Pharm.*, 1937, 275, 557.

Ruzicka, Muller, Schellenberg, *Helv. Chim. Acta*, 1939, 22, 758.

 $\beta$ -Amyrone

$C_{30}H_{48}O$  MW, 424

Cryst. from MeOH. M.p. 177–9° (174°, 168°).

$[\alpha]_D^{25} +107.2$  in  $CHCl_3$ .

Oxime: m.p. 265–7°.

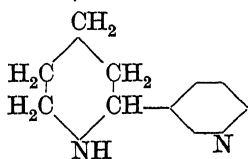
Semicarbazone: m.p. 244–5° decomp. (248–9°).

Rollett, *Monatsh.*, 1923, 43, 413.

Ruzicka, Schellenberg, Goldberg, *Helv. Chim. Acta*, 1937, 20, 791.

Ruzicka, Wirz, *Helv. Chim. Acta*, 1941, 24, 248.

## Anabesine (3-[2-Piperidyl]-pyridine, 2-[3-pyridyl]-piperidine)



$C_{10}H_{14}N_2$  MW, 162

*l.*

Occurs in *Anabasis apylla*. B.p. 276°, 104–5°/2 mm. Sol.  $H_2O$ , EtOH,  $Et_2O$ ,  $C_6H_6$ .  $D_{20}^{25} 1.0455$ .  $n_D^{20} 1.5430$ .  $[\alpha]_D^{20} -82.20^\circ$ .  $KMnO_4 \rightarrow$  nicotinic acid. Boiling with Zn dust  $\rightarrow$  2 : 3'-dipyridyl.

N-Benzoyl: needles. M.p. 82–3°. B.p. 222°/2 mm.  $[\alpha]_D^{20} -127.23^\circ$  in EtOH.

Nitroso deriv.: b.p. 176°/4 mm.  $D_{20}^{20} 1.1777$ .  $n_D^{15} 1.5698$ .  $[\alpha]_D^{20} -155.0^\circ$ .

Dinitrodiphenate: cryst. from MeOH. M.p. 265° in vac.

Dipicrate: m.p. 198–199.5° decomp.

*d.*

Dinitrodiphenate: cryst. from MeOH. M.p. 264–5°.

Dipicrate: m.p. 198–9° decomp.

*dl.* Neonicotine.

B.p. 280–2°/775 mm.

Dipicrate: m.p. 213–14°.

Orechoff, Menschikoff, *Ber.*, 1931, 64, 266; 1932, 65, 232.

Roark, *Chem. Abstracts*, 1941, 35, 3388; 1945, 39, 2373.

Smith, *J. Am. Chem. Soc.*, 1932, 54, 397.

Späth, Keszler, *Ber.*, 1937, 70, 72.

Späth, Mamoli, *Ber.*, 1936, 69, 1084.

## Anacardic Acid

$C_{22}H_{32}O_3$  MW, 344

From cashew nut oil (*Anacardium occidentale*, Linn.). Believed to be a 2-hydroxy-6-pentadecadienylbenzoic acid. M.p. 26° (22–5°, 21°).  $n_D^{25} 1.5164$ . Sol. EtOH,  $Et_2O$ . Insol.  $H_2O$ .  $KMnO_4 \rightarrow$  oxalic and *n*-heptylic acids.  $H_2$  + Pd  $\rightarrow$  2-hydroxy-6-pentadecanylbenzoic acid.

*Me ether*:  $C_{23}H_{34}O_3$ . MW 358.  $n_D^{25} 1.5009$ .

*Me ester*: b.p. 200–5°/0.5 mm.

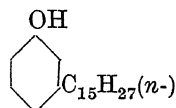
Ruhemann, Skinner, *Ber.*, 1887, 20, 1861.

Pillay, *J. Indian Chem. Soc.*, 1935, 12, 226.

Backer, Haack, *Rec. trav. chim.*, 1941, 60, 661.

Eichbaum, Hauptmann, Rothschild, *Chem. Abstracts*, 1946, 40, 6443.

## Anacardol



$C_{21}H_{32}O$  MW, 300

B.p. 215.2°/14 mm. (220–3°/4 mm.), 186–7°/1 mm.  $D_{20}^{30} 0.9399$ .  $n_D^{30} 1.5107$  ( $n_D^{27} 1.5060$ ). Sol.  $Me_2CO$ ,  $C_6H_6$ , AcOEt, EtOH, ligroin. Insol.  $H_2O$ .  $H$  + Pd  $\rightarrow$  *m*-pentadecylphenol.

*Me ether*:  $C_{22}H_{34}O$ . MW, 314. B.p. 212–14°/5 mm., 188.5°/1 mm.  $n_D^{25} 1.5008$ .

Pillay, *J. Indian Chem. Soc.*, 1935, 12, 226.

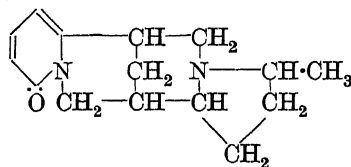
Backer, Haack, *Rec. trav. chim.*, 1941, 60, 661.

Wasserman, Dawson, *Ind. Eng. Chem.*, 1945, 37, 396.

## Anæsthesin.

See Benzocaine.

## Anagyrene (Monolupine, rhombinine)



Suggested structure

$C_{15}H_{20}ON_2$

MW, 244

Alkaloid present in *Anagyris foetida* and *Lupinus laxiflorus* var. *silvicola*. Pale yellow deliquescent glass, darkening on exposure to light. B.p. 210–15°/4 mm., 165–8°/0.3 mm. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Less sol. hot than cold H<sub>2</sub>O. Insol. ligroin.  $[\alpha]_D^{20}$  –165.3° in EtOH. FeCl<sub>3</sub>.Aq. → red col.

*Perchlorate*: needles from H<sub>2</sub>O. Decomp. about 270° without melting (315° decomp.).

*B.HAuCl<sub>4</sub>*: golden needles from dil. HCl. M.p. 167–8°.

*B.H<sub>2</sub>PtCl<sub>6</sub>*: orange cryst. M.p. 278° decomp.

*Picrate*: cryst. from EtOH. M.p. 169.5° (253°).

*Methiodide*: cryst. from MeOH. M.p. 264° decomp. (257°).

Couch, *J. Am. Chem. Soc.*, 1939, 61, 3327.

Ing, *J. Chem. Soc.*, 1933, 504.

Marion, Quillet, *J. Am. Chem. Soc.*, 1948, 70, 3076.

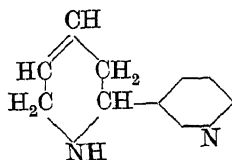
### Analgen.

See under 8-Hydroxy-5-aminoquinoline.

### Analobine.

See Anolobine.

**Anatabine** (*Tetrahydro-2 : 3'-dipyridyl*)



C<sub>10</sub>H<sub>12</sub>N<sub>2</sub>

MW, 160

Alkaloid found in tobacco.

*dl.*

D<sup>20</sup> 1.086.  $n_D^{20}$  1.5655.

*Diperchlorate*: m.p. 129–30°.

*Dipicrate*: m.p. 201.0–1.5°.

*Trinitro-m-cresol add. comp.*: m.p. 140–1°.

*Picrolonate*: m.p. 233–5°.

*l.*

B.p. 145–6°/10 mm. D<sub>4</sub><sup>20</sup> 1.091.  $n_D^{20}$  1.5676.  $[\alpha]_D^{25}$  –177.8°. Pd at 200° → 2 : 3'-dipyridyl.

Pd + H<sub>2</sub> → *l*-anabasine.

*N-Benzoyl*: b.p. 160–170° (bath temp.)/0.01 mm.  $[\alpha]_D^{25}$  –15.4° in MeOH.

*N-p-Nitrobenzoyl*: m.p. 101–2°, solidifies and remelts at 130–1°.  $[\alpha]_D^{25}$  –174.5° in MeOH.

*Dipicrate*: m.p. 191–3°.

*Trinitro-m-cresol add. comp.*: m.p. 191–2°.

*Dinitrodiphenate*: m.p. 238.0–8.5°.

*Picrolonate*: m.p. 234–5° decomp.

*d.*

*N-p-Nitrobenzoyl*: m.p. 101–2°, solidifies and remelts at 129–30°.  $[\alpha]_D$  +168.7° in MeOH.

Späth, Keszler, *Ber.*, 1937, 70, 239, 704.

### Anavenol.

See 2-Hydroxyethyl 2-naphthyl Ether.

### Anchusin

C<sub>30</sub>H<sub>36</sub>O<sub>9</sub> MW, 540

Substituted trihydroxyanthraquinone found in alkanet root. Dark red powder from EtOH. Decomp. above 300°. Dist. with Zn dust → 2-methylanthracene.

*Triacetyl*: cryst. from AcOH. M.p. 212–15° decomp.

*Tribenzoyl*: cryst. from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 226–8° decomp.

*Di-Me ether*: cryst. from AcOH. M.p. 240–2° decomp. *Acetyl*: brown powder. M.p. above 330°.

Majumdar, Chakravarty, *J. Indian Chem. Soc.*, 1940, 17, 272.

### Andogenin

C<sub>27</sub>H<sub>42</sub>O<sub>4</sub> MW, 430

Sapogenin from *Phytolacca abyssinica*. M.p. 276–9°. Sol. EtOH, AcOH, CCl<sub>4</sub>, CHCl<sub>3</sub>, Et<sub>2</sub>O, AcOEt.  $[\alpha]_D^{20}$  +50° in MeOH.

Bachstetz, Cavallini, *Chem. Abstracts*, 1946, 40, 6211.

### Andrographolic Acid

C<sub>20</sub>H<sub>32</sub>O<sub>6</sub> MW, 368

Needles from MeOH. M.p. 188° → andrographolide. Mod. sol. EtOH. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O, Me<sub>2</sub>CO, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.  $[\alpha]_D^{26}$  +14.4° in MeOH. Warm H<sub>2</sub>SO<sub>4</sub>-EtOH → andrographolide.

Gorter, *Rec. trav. chim.*, 1911, 30, 151.

### Andrographolide

C<sub>20</sub>H<sub>30</sub>O<sub>5</sub> MW, 350

Occurs in *Andrographus paniculata*, Nees. Cryst. from MeOH. M.p. 218° decomp. Mod. sol. MeOH, Me<sub>2</sub>CO. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O, CHCl<sub>3</sub>.  $[\alpha]_D^{26}$  –126.0° in AcOH. Warm with alkali → andrographolic acid.

*Triacetyl deriv.*: needles from EtOH. M.p. 129°.

Gorter, *Rec. trav. chim.*, 1914, 33, 239; 1911, 30, 151.

Moktader, Guha-Sircar, *J. Indian Chem. Soc.*, 1939, 16, 333.

### Androl

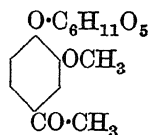
C<sub>10</sub>H<sub>20</sub>O MW, 156

Occurs in oil of water fennel. B.p. 197–8°. D<sup>15</sup> 0.858.  $n_D$  1.44991.  $[\alpha]_D$  –7.2°.

*Phenylurethane*: m.p. 42–3°.

*Diphenylurethane*: m.p. 87–90°.

Schimmel, *Chem. Zentr.*, 1904, II, 1470.

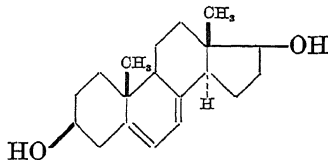
**Androsin** (*Glucoacetovanillone*) $C_{15}H_{20}O_8$ 

MW, 328

Occurs in rhizomes of *Apocynum androsaemifolium*, Linn. Cryst. +  $2H_2O$  from  $H_2O$ . M.p. anhyd.  $223-4^\circ$ . Spar. sol. EtOH, cold  $H_2O$ . Hyd. by emulsin. Boil. dil.  $H_2SO_4 \rightarrow$  acetovanillone.

*Tetra-acetyl deriv.*: cryst. from EtOH. M.p.  $156-7^\circ$ .

Mauthner, *J. prakt. Chem.*, 1925, 110, 123.

 $\Delta^{5:7}$ -Androstadiene-3 $\beta$ :17( $\beta$ )-diol $C_{19}H_{28}O_2$ 

MW, 288

Needles from  $Me_2CO$ . M.p.  $212^\circ$ . One tenth the physiological activity of the corresponding  $\Delta^5$ -androstene-3:17-diol. Absorption maxima at 270 and 280  $m\mu$ .

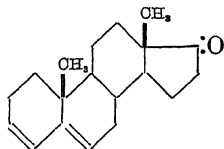
*Diacetyl*: cryst. from EtOH.Aq. M.p.  $132^\circ$ . *Peroxide*: m.p.  $221-1.5^\circ$ .  $[\alpha]_D^{25} -4.8^\circ$  in  $CHCl_3$ .

*Dibenzoyl*: cryst. from  $CHCl_3$ -MeOH. M.p.  $217-18^\circ$ .

Butenandt *et al.*, *Ber.*, 1938, 71, 1316.

Butenandt, Paland, *Ber.*, 1939, 72, 424.

Goldberg *et al.*, *Helv. Chim. Acta*, 1947, 30, 1441.

 $\Delta^{3:5}$ -Androstadiene-17-one $C_{19}H_{26}O$ 

MW, 270

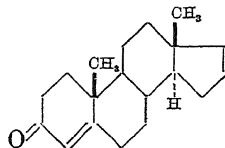
From urine of man with adrenal tumour. Leaflets from MeOH.Aq. M.p.  $88-9^\circ$ .  $[\alpha]_D -31^\circ$  in EtOH. Red.  $\rightarrow$  androstan-17-one.  $350-400 \gamma \equiv 1$  I.U. No cortical hormone activity.

*Oxime*: needles from MeOH. M.p.  $164-70^\circ$ .

*Semicarbazone*: needles from dioxan. M.p.  $291-2^\circ$ .

Burrows, Cook, Roe, Warren, *Biochem. J.*, 1937, 31, 956.

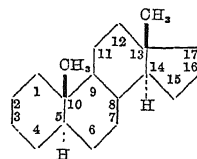
Dict. of Org. Comp.—I.

 $\Delta^4:16$ -Androstadiene-3-one $C_{19}H_{26}O$ 

MW, 270

Purified by sublimation in high vacuum. M.p.  $131.5-3.5^\circ$  corr.  $[\alpha]_D^{16} 123^\circ \pm 3.5^\circ$  (c, 1.03 in  $CHCl_3$ ). Absorption maximum at 240  $m\mu$ . Intense col. in the Kagi-Miescher test (*Helv. Chim. Acta*, 1939, 22, 683).

Prelog, Ruzicka, Meister, Wieland, *Helv. Chim. Acta*, 1945, 28, 618.

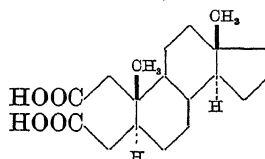
**Androstane** (*Aetioallocholane*) $C_{19}H_{32}$ 

MW, 260

Leaflets from  $Me_2CO$ . M.p.  $50-2^\circ$  ( $50.0-50.5^\circ$ ).  $[\alpha]_D^{16} +2^\circ$  in  $CHCl_3$ .

Butenandt, Tscherning, *Z. physiol. Chem.*, 1934, 229, 190.

*Encyclopedia of Endocrinology*, Section 1, Vol. I. (Franks, Montreal).

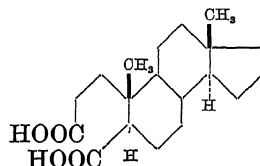
**2//3-Androstane-2:3-dioic Acid** (2:3-sec-Androstane-2:3-dioic acid) $C_{19}H_{30}O_4$ 

MW, 322

Cryst. from  $Et_2O$ -pet. ether. M.p.  $237-8^\circ$  corr.  $[\alpha]_D^{21} -8.3^\circ \pm 2^\circ$  (c, 1.089 in EtOH).

*Di-Me ester*:  $C_{21}H_{34}O_4$ . MW, 350. Cryst. from pet. ether. M.p.  $44-5^\circ$  corr.  $[\alpha]_D^{20} -8.8^\circ \pm 3^\circ$  (c, 1.077 in  $CHCl_3$ ).

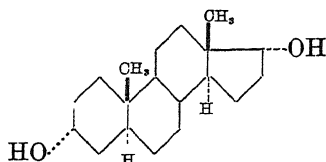
Ruzicka, Prelog, Meister, *Helv. Chim. Acta*, 1945, 28, 1651.

**3//4-Androstane-3:4-dioic Acid** (3:4-sec-Androstane-3:4-dioic acid) $C_{19}H_{30}O_4$ 

MW, 322

Cryst. from Et<sub>2</sub>O. M.p. 242-4° corr.  $[\alpha]_D^{25}$  -21.9° ± 1.5° (c, 1.101 in EtOH).

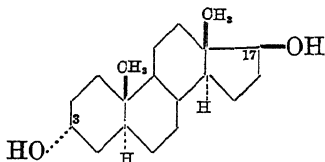
Ruzicka, Prelog, Meister, *Helv. Chim. Acta*, 1945, 28, 1651.

Androstane-3 $\alpha$  : 17 $\alpha$ -diol

C<sub>19</sub>H<sub>32</sub>O<sub>2</sub> MW, 292

Needles from AcOEt. M.p. 227-8° corr. 350  $\gamma$  = 1 I.U.

Ruzicka, Kägi, *Helv. Chim. Acta*, 1937, 20, 1564.

Androstane-3 $\alpha$  : 17 $\beta$ -diol (epi-Androstane-diol)

C<sub>19</sub>H<sub>32</sub>O<sub>2</sub> MW, 292

Needles from Me<sub>2</sub>CO.Aq. or EtOH.Aq. M.p. 221°.  $[\alpha]_D^{25}$  + 12.6°. 20  $\gamma$  = 1 I.U.

3-Acetyl: cryst. from MeOH. M.p. 183-4° corr. 20  $\gamma$  = 1 I.U.

17-Acetyl: cryst. from MeOH.Aq. M.p. 191-2° corr. 20  $\gamma$  = 1 I.U.

Diacetyl: prisms from Me<sub>2</sub>CO.Aq. M.p. 159-60°.  $[\alpha]_D^{25}$  + 12.5°. Physiologically active.

3-Acid-succinyl: m.p. 208° corr.

Di-succinyl: cryst. from Et<sub>2</sub>O. M.p. 139-40° corr.

17-Benzoyl: cryst. from AcOEt. M.p. 203-4° corr. Inactive.

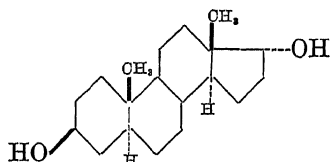
3-Acetyl-17-benzoyl: cryst. from EtOH. M.p. 198-9° corr.

Butenandt, Tscherning, *Z. physiol. Chem.*, 1935, 234, 225.

Ruzicka, Goldberg, Meyer, *Helv. Chim. Acta*, 1935, 18, 210.

Ruzicka, Goldberg, *Helv. Chim. Acta*, 1936, 19, 99.

Ruzicka, Wettstein, *Helv. Chim. Acta*, 1936, 19, 1146.

Androstane-3 $\beta$  : 17 $\alpha$ -diol

C<sub>19</sub>H<sub>32</sub>O<sub>2</sub>

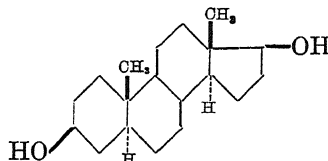
MW, 292

Prisms from MeOH. M.p. 218-20°.

Diacetyl: prisms from di-isopropyl ether. M.p. 146-147.5°.

Ruzicka, Kägi, *Helv. Chim. Acta*, 1936, 19, 847.

Marker, *J. Am. Chem. Soc.*, 1936, 58, 480.

Androstane-3 $\beta$  : 17 $\beta$ -diol

C<sub>19</sub>H<sub>32</sub>O<sub>2</sub> MW, 292

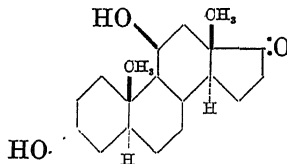
Leaflets from EtOH.Aq. Cryst. from AcOEt. M.p. 164°. Sublimes at 140°/0.01 mm.  $[\alpha]_D^{20}$  + 4.2°. 550  $\gamma$  = 1 I.U.

17-Acetyl: m.p. 148°.

Diacetyl: needles from EtOH.Aq. M.p. 123-4°.

Ruzicka, Goldberg, Rosenberg, *Helv. Chim. Acta*, 1935, 18, 1487.

Butenandt, Tscherning, Hanisch, *Ber.*, 1935, 68, 2098.

Androstane-3 $\alpha$  : 11 $\beta$ -diol-17-one

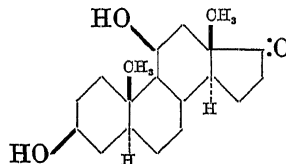
C<sub>19</sub>H<sub>30</sub>O<sub>3</sub> MW, 306

Cryst. from Me<sub>2</sub>CO. M.p. 197-8°.  $[\alpha]_D$  + 96.6° ± 2° (c, 0.590 in EtOH). Isolated from urine, in increased amounts from patients with adrenal cortical tumours.

3-Acetyl: cryst. from Me<sub>2</sub>CO. M.p. 238-40°.

Mason, Kepler, *J. Biol. Chem.*, 1945, 161, 235.

Shoppee, *J. Chem. Soc.*, 1946, 1134.

Androstane-3 $\beta$  : 11 $\beta$ -diol-17-one

C<sub>19</sub>H<sub>30</sub>O<sub>3</sub> MW, 306

Cryst. in needles from Me<sub>2</sub>CO-Et<sub>2</sub>O. M.p. 233-5° corr.

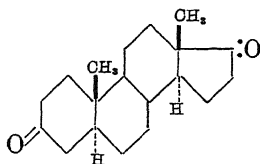
3-Acetyl: purified by sublimation in high vacuum, cryst. in needles from Me<sub>2</sub>CO-Et<sub>2</sub>O. M.p. 228-9° corr.

Reichstein, *Helv. Chim. Acta*, 1936, 19, 402.

Shoppee, *Helv. Chim. Acta*, 1940, 23, 740.

v. Euw, Reichstein, *Helv. Chim. Acta*, 1942, 25, 988.

## Androstane-3 : 17-dione



$C_{19}H_{28}O_2$  MW, 288

Leaflets from  $Me_2CO$  or hexane. M.p. 132–3°.  $[\alpha]_D^{20} + 111^\circ$  in EtOH.  $130 \gamma \equiv 1$  I.U. Bromination  $\rightarrow$  2-monobromide. Clemmensen red.  $\rightarrow$  androstane.

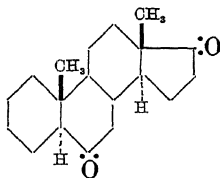
Dioxime : m.p. 255–60°.

Ruzicka, Rosenberg, *Helv. Chim. Acta*, 1936, **19**, 366.

Butenandt, Tscherning, Hanisch, *Ber.*, 1935, **68**, 2102.

Butenandt, Tscherning, *Z. physiol. Chem.*, 1934, **229**, 185.

## Androstane-6 : 17-dione

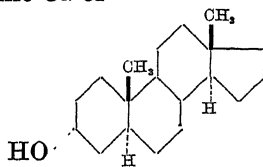


$C_{19}H_{28}O_2$  MW, 288

M.p. 134–5°.

Dioxime : m.p. 288–90°.

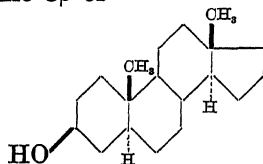
Butenandt, Surányi, *Ber.*, 1942, **75**, 591.

Androstane-3 $\alpha$ -ol

$C_{19}H_{32}O$  MW, 276

M.p. 145–6° corr.  $[\alpha]_D^{17} + 2^\circ \pm 2^\circ$  (c, 1.276 in  $CHCl_3$ ).

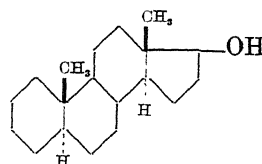
Prelog, Ruzicka, Wieland, *Helv. Chim. Acta*, 1944, **27**, 66.

Androstane-3 $\beta$ -ol

$C_{19}H_{32}O$  MW, 276

M.p. 147.5–148° corr.  $[\alpha]_D^{17} + 0.9^\circ \pm 0.9^\circ$  (c, 2.22 in  $CHCl_3$ ).

Prelog, Ruzicka, Wieland, *Helv. Chim. Acta*, 1944, **27**, 66.

Androstane-17( $\alpha$ )-ol (*Androstane-17-' cis '-ol*)

$C_{19}H_{32}O$  MW, 276

Cryst. in needles from MeOH. M.p. 152–3°. *Hexahydrobenzoyl*:  $C_{26}H_{42}O_2$ . MW, 386. M.p. 138–9°.

Kägi, Miescher, *Helv. Chim. Acta*, 1939, **22**, 683.

See also Goldberg *et al.*, *Helv. Chim. Acta*, 1947, **30**, 1441.

Androstane-17( $\beta$ )-ol (*Androstane-17-' trans '-ol*)

$C_{19}H_{32}O$  MW, 276

Cryst. from  $Et_2O$ -pentane. M.p. 164–6°.  $[\alpha]_D^{20} + 13.1^\circ$  (c, 1.160 in  $CHCl_3$ ).

*Propionyl*: m.p. 80–1°.

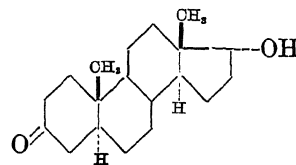
Kägi, Miescher, *Helv. Chim. Acta*, 1939, **22**, 683.

Marker, *J. Am. Chem. Soc.*, 1940, **62**, 2543.

See also Goldberg *et al.*, *Helv. Chim. Acta*, 1947, **30**, 1441.

## Androstane-3-ol-17-one

See Androsterone.

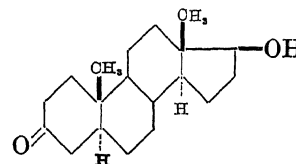
Androstane-17 $\alpha$ -ol-3-one (*epi-Dihydrotestosterone*)

$C_{19}H_{30}O_2$  MW, 290

Needles from MeOH. M.p. 180° corr.  $300 \gamma \equiv 1$  I.U.

*Acetyl*: cryst. from hexane. M.p. 150–1° corr.

Ruzicka, Kägi, *Helv. Chim. Acta*, 1937, **20**, 1563.

Androstane-17 $\beta$ -ol-3-one (*Dihydrotestosterone*)

$C_{19}H_{30}O_2$  MW, 290

Cryst. from AcOEt or Me<sub>2</sub>CO.Aq. M.p. 178° (182°).  $[\alpha]_D^{20} + 32.4^\circ$  in EtOH. Sublimes at 135°/0.01 mm. 20  $\gamma = 1$  I.U. Bromination  $\rightarrow$  2-monobromide.

*Acetyl*: needles from Me<sub>2</sub>CO.Aq. M.p. 157° corr.

*Benzoyl*: cryst. from petrol-AcOEt. M.p. 200-1° corr.

*Oxime*: needles from EtOH.Aq. M.p. 209°.

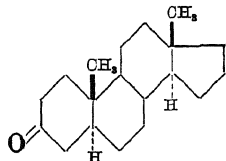
*Semicarbazone*: cryst. from EtOH. M.p. 237-43°.

Butenandt, Tscherning, Hanisch, *Ber.*, 1935, 68, 2100.

Ruzicka, Goldberg, *Helv. Chim. Acta*, 1936, 19, 105.

Ruzicka, Goldberg, Grob, *Helv. Chim. Acta*, 1941, 24, 1151.

## Androstane-3-one

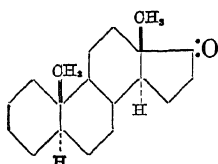
C<sub>19</sub>H<sub>30</sub>O

MW, 274

Purified by sublimation in high vacuum, cryst. from hexane. M.p. 104.5-5.5° corr.  $[\alpha]_D^{20} + 25.4^\circ \pm 3^\circ$  (c, 0.710 in CHCl<sub>3</sub>).

Prelog, Ruzicka, Meister, Wieland, *Helv. Chim. Acta*, 1945, 28, 618.

## Androstane-17-one

C<sub>19</sub>H<sub>30</sub>O

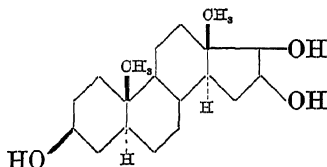
MW, 274

Cryst. from AcOEt-pet. ether. M.p. 122°.  $[\alpha]_D^{15} + 87.8^\circ$  in CHCl<sub>3</sub>.

*Semicarbazone*: m.p. 275° decomp (284-5°).

Fernholz, Chakravorty, *Ber.*, 1935, 68, 353.

Butenandt, Dannenbaum, *Z. physiol. Chem.*, 1934, 229, 192.

Androstane-3 $\beta$ :16( $\alpha$ ):17( $\alpha$ )-triolC<sub>19</sub>H<sub>32</sub>O<sub>3</sub>

MW, 308

Cryst. from EtOH.Aq. M.p. 251-3°.  $[\alpha]_D^{25} + 18^\circ$  (c, 0.53 in 95% EtOH).

Huffman, Lott, *J. Am. Chem. Soc.*, 1949, 71, 719.

See also Goldberg *et al.*, *Helv. Chim. Acta*, 1947, 30, 1441.

Androstane-3 $\beta$ :16( $\beta$ ):17( $\alpha$ )-triolC<sub>19</sub>H<sub>32</sub>O<sub>3</sub>

MW, 308

M.p. 256-60°.

*Triacetyl*: m.p. 175-176.5°.  $[\alpha]_D^{25} - 44^\circ$  (c, 0.45 in EtOH).

Hirschmann, *J. Biol. Chem.*, 1943, 150, 363.

Marrian, Butler, *Nature*, 1944, 154, 19.

Goldberg *et al.*, *Helv. Chim. Acta*, 1947, 30, 1441.

Androstane-3 $\beta$ :16( $\beta$ ):17( $\beta$ )-triolC<sub>19</sub>H<sub>32</sub>O<sub>3</sub>

MW, 308

Purified by sublimation in high vacuum, cryst. from EtOH. M.p. 265-6° corr.  $[\alpha]_D^{15} - 19^\circ \pm 4^\circ$  (c, 0.55 in EtOH).

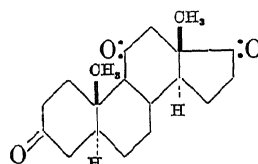
*Triacetyl*: needles from MeOH. M.p. 165° corr. No physiological activity.

Ruzicka, Prelog, Wieland, *Helv. Chim. Acta*, 1945, 28, 1609.

Huffman, Lott, *J. Am. Chem. Soc.*, 1947, 69, 1835; 1949, 71, 719.

Goldberg *et al.*, *Helv. Chim. Acta*, 1947, 30, 1441.

## Androstane-3:11:17-trione

C<sub>19</sub>H<sub>26</sub>O<sub>3</sub>

MW, 302

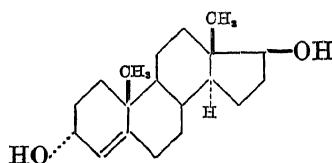
Leaflets from Et<sub>2</sub>O. M.p. 178° corr. (182-3°).  $[\alpha]_D^{12} + 152^\circ$  in Me<sub>2</sub>CO. Sublimes at 165°/0.1 mm. Obtained by ox. of many of the constituents of the adrenal cortex. One-third as active as androsterone.

3:17-*Dioxime*: cryst. from EtOH. M.p. 274-6° corr.

Reichstein, *Helv. Chim. Acta*, 1936, 19, 404.

Euw, Reichstein, *Helv. Chim. Acta*, 1942, 25, 988.

Mason, Kepler, *J. Biol. Chem.*, 1945, 161, 235.

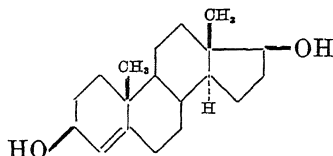
 $\Delta^4$ -Androstene-3 $\alpha$ :17 $\beta$ -diolC<sub>19</sub>H<sub>30</sub>O<sub>2</sub>

MW, 290

Needles from EtOH or AcOEt. M.p. 202-6°.  $[\alpha]_D^{22} + 187.5^\circ$  in Py. 150-200  $\gamma \equiv 1$  I.U.

*Diacetyl*: leaflets from EtOH.Aq. M.p. 121°.

Butenandt, Heusner, *Ber.*, 1938, 71, 202.

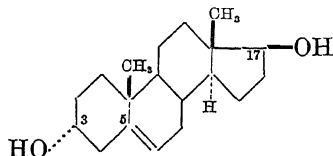
 $\Delta^4$ -Androstene-3 $\beta$  : 17 $\beta$ -diol

$C_{19}H_{30}O_2$  MW, 290

Cryst. from Me<sub>2</sub>CO. M.p. 153-4°.  $[\alpha]_D^{19} + 48.5^\circ$  in EtOH. Pptd by digitonin. 150-200  $\gamma \equiv 1$  I.U.

*Diacetyl*: leaflets from EtOH.Aq. M.p. 101-2°.

Butenandt, Heusner, *Ber.*, 1938, 71, 202.

 $\Delta^5$ -Androstene-3 $\alpha$  : 17 $\beta$ -diol

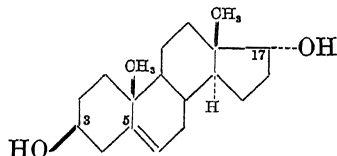
$C_{19}H_{30}O_2$  MW, 290

Prisms from AcOH. M.p. 200°. After sublimation in high vacuum, m.p. 208-9° corr.  $[\alpha]_D - 56^\circ$  in EtOH. 35  $\gamma \equiv 1$  I.U.

*3-Acetyl*: leaflets from MeOH. M.p. 183°.

*Diacetyl*: leaflets from MeOH-pet. ether. M.p. 155° corr.

Ruzicka, Goldberg, Bosshard, *Helv. Chim. Acta*, 1937, 20, 544.

 $\Delta^5$ -Androstene-3 $\beta$  : 17 $\alpha$ -diol

$C_{19}H_{30}O_2$  MW, 290

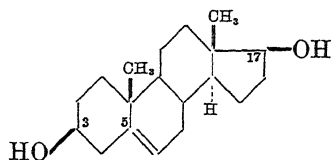
Needles from AcOEt. M.p. 198-198.5° corr. 850-1000  $\gamma \equiv 1$  I.U.

*Diacetyl*: prisms and needles from MeOH. M.p. 170° corr.

*3-Acetyl-17-benzoyl*: needles from EtOH. M.p. 133-4° corr.

*17-Benzoyl*: prisms from di-isopropyl ether. M.p. 150-1° corr.

Ruzicka, Kägi, *Helv. Chim. Acta*, 1936, 19, 842.

 $\Delta^5$ -Androstene-3 $\beta$  : 17 $\beta$ -diol

$C_{19}H_{30}O_2$  MW, 290

Cryst. from MeOH or AcOEt. M.p. 184°.  $[\alpha]_D - 50^\circ$  in EtOH. 500  $\gamma \equiv 1$  I.U. Has oestrogenic properties.

*3-Acetyl*: cryst. from hexane. M.p. 147-8° corr.

*17-Acetyl*: needles from Me<sub>2</sub>CO. M.p. 146.5-148.5° corr.  $[\alpha]_D^{18} - 56.6^\circ$  in EtOH.

*Diacetyl*: leaflets from hexane. M.p. 165-6°.  $[\alpha]_D^{18} - 56.5^\circ$  in EtOH.

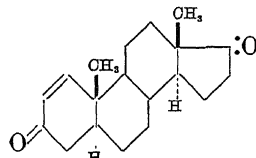
*3-Acetyl-17-benzoyl*: leaflets from EtOH. M.p. 180-2° corr.

*17-Benzoyl*: needles from di-isopropyl ether. M.p. 221-2°.

Butenandt, Hanisch, *Z. physiol. Chem.*, 1935, 237, 89.

Ruzicka, Wettstein, *Helv. Chim. Acta*, 1935, 18, 1264.

Ruzicka, Kägi, *Helv. Chim. Acta*, 1935, 18, 1481.

 $\Delta^1$ -Androstene-3 : 17-dione

$C_{19}H_{26}O_2$  MW, 286

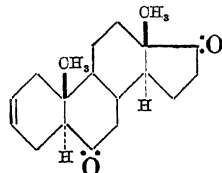
Needles from EtOH.Aq. M.p. 139-40°.  $[\alpha]_D^{20} + 148.5^\circ$  in EtOH. Absorption band at 238  $\mu$ . No male hormone activity but gives positive Allen-Doisy test.

*Dioxime*: cryst. from EtOH.Aq. M.p. 258-64° decomp.

Butenandt *et al.*, *Ber.*, 1939, 72, 1622.

Butenandt, Dannenberg, *Ber.*, 1936, 69, 1161.

Miescher, Wettstein, U.S.P., 2,260,328, (*Chem. Abstracts*, 1942, 36, 873).

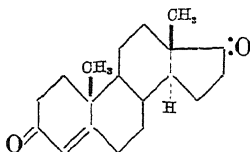
 $\Delta^2$ -Androstene-6 : 17-dione

$C_{19}H_{26}O_2$  MW, 286

Purified by sublimation in high vacuum, cryst. from AcOEt-hexane. M.p. 190-2°.  $[\alpha]_D$

+123°  $\pm$  2° (c, 1.6 in  $\text{CHCl}_3$ ). Yellow col. with  $\text{C}(\text{NO}_2)_4$ .

Blunschy, Hardegger, Simon, *Helv. Chim. Acta*, 1946, 29, 199.

 $\Delta^4$ -Androstene-3 : 17-dione $\text{C}_{19}\text{H}_{26}\text{O}_2$ 

MW, 286

Cryst. from hexane. M.p. 173–4° corr.  $[\alpha]_D^{18} + 185^\circ$  in EtOH, + 199° in  $\text{CHCl}_3$ . Absorption band at 235  $\mu$ . 130  $\gamma \equiv$  1 I.U.

*Dioxime*: cryst. from EtOH. M.p. 143°.

*Enol-acetyl*: needles from MeOH. M.p. 127–9° corr.

*Enol-benzoyl*: cryst. from  $\text{Me}_2\text{CO}$ . M.p. 176–80° corr.

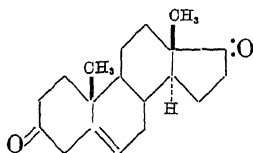
Ruzicka, Wettstein, *Helv. Chim. Acta*, 1935, 18, 993.

Ruzicka, Fischer, *Helv. Chim. Acta*, 1936, 19, 1373.

Butenandt, Kudsus, *Z. physiol. Chem.*, 1935, 237, 85.

Julian *et al.*, *J. Am. Chem. Soc.*, 1945, 67, 1728.

Marker, Wittle, U.S.P.s, 2,397,424–6, (*Chem. Abstracts*, 1946, 40, 3571).

 $\Delta^5$ -Androstene-3 : 17-dione $\text{C}_{19}\text{H}_{26}\text{O}_2$ 

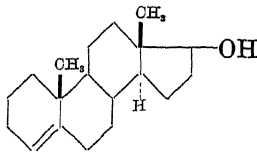
MW, 286

Needles from EtOH. M.p. about 158°. Acids  $\rightarrow$   $\Delta^4$ -androstene-3 : 17-dione. 300  $\gamma \equiv$  1 I.U.

*Dioxime*: cryst. M.p. 180–205°.

Butenandt, Schmidt-Thomé, *Ber.*, 1936, 69, 886.

Oppenauer, *Rec. trav. chim.*, 1937, 56, 137.

 $\Delta^4$ -Androstene-17-ol $\text{C}_{19}\text{H}_{30}\text{O}$ 

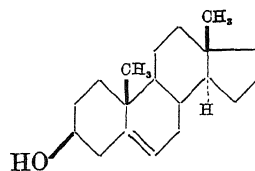
MW, 274

Cryst. from MeOH. M.p. 146–9°.

*Acetyl*: m.p. 97–100°.

Marker, Wittle, Tullar, *J. Am. Chem. Soc.*, 1940, 62, 223.

See also B.P.s, 550,684; 550,478, (*Chem. Abstracts*, 1944, 38, 1611, 1612).

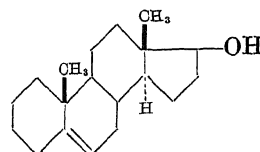
 $\Delta^5$ -Androstene-3 $\beta$ -ol $\text{C}_{19}\text{H}_{30}\text{O}$ 

MW, 274

Purified by sublimation in high vacuum, m.p. 135–136.5° corr.  $[\alpha]_D - 68.3^\circ \pm 2^\circ$  (c, 0.71 in dioxan).

*Acetyl*: purified by sublimation in high vacuum, cryst. from  $\text{Me}_2\text{CO}$ . Aq. in platelets. M.p. 93–4° corr. Yellow. col. with  $\text{C}(\text{NO}_2)_4$ .

Heard, McKay, *J. Biol. Chem.*, 1946, 165, 677.

 $\Delta^5$ -Androstene-17-ol $\text{C}_{19}\text{H}_{30}\text{O}$ 

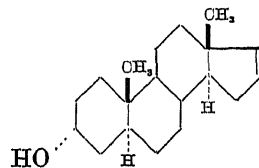
MW, 274

M.p. 163–5° (161–2°).

*Acetyl*: cryst. from MeOH. M.p. 135–6°.

Kuwada, Tutihasi, *J. Pharm. Soc. Japan*, 1939, 59, 352, (*Chem. Abstracts*, 1939, 33, 8209).

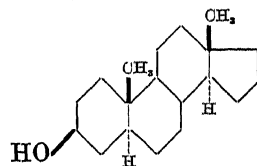
Marker, Wittle, Tullar, *J. Am. Chem. Soc.*, 1940, 62, 223.

 $\Delta^{16}$ -Androstene-3 $\alpha$ -ol $\text{C}_{19}\text{H}_{30}\text{O}$ 

MW, 274

Purified by sublimation in high vacuum, cryst. from  $\text{Me}_2\text{CO}$ . M.p. 143.5–4° corr.  $[\alpha]_D^{18} 13.9^\circ \pm 2^\circ$  (c, 0.936 in  $\text{CHCl}_3$ ). Blue col. in the Kagi-Miescher test (*Helv. Chim. Acta*, 1939, 22, 683).

Prelog, Ruzicka, Wieland, *Helv. Chim. Acta*, 1944, 27, 66.

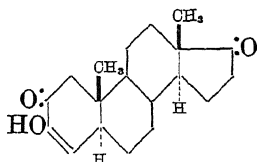
 $\Delta^{16}$ -Androstene-3 $\beta$ -ol $\text{C}_{19}\text{H}_{30}\text{O}$ 

MW, 274



Purified by sublimation in high vacuum, cryst. from Me<sub>2</sub>CO. M.p. 125–7°.  $[\alpha]_D^{25}$  11.2° ± 2.5° (c, 0.761 in CHCl<sub>3</sub>). Blue col. in the K $\ddot{a}$ gi-Miescher test (*Helv. Chim. Acta*, 1939, 22, 683).

Prelog, Ruzicka, Wieland, *Helv. Chim. Acta*, 1944, 27, 66.

 $\Delta^3$ -Androstene-3-ol-2 : 17-dioneC<sub>19</sub>H<sub>26</sub>O<sub>3</sub>

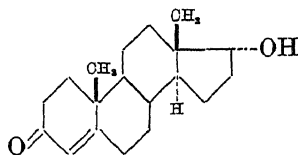
MW, 302

Cryst. from hexane. M.p. 165–75°.  $[\alpha]_D^{20}$  + 149.8°.

*Acetyl*: cryst. from EtOH. M.p. 208–10°.  $[\alpha]_D^{20}$  + 164.5°.

*Toluene-p-sulphonyl*: cryst. from Me<sub>2</sub>CO-hexane. M.p. 206–8°.  $[\alpha]_D^{20}$  + 133.4°.

Djerassi, Yashin, Rosenkranz, *J. Am. Chem. Soc.*, 1950, 72, 5750.

 $\Delta^4$ -Androstene-17 $\alpha$ -ol-3-one (epi-Testosterone)C<sub>19</sub>H<sub>28</sub>O<sub>2</sub>

MW, 288

Pale yellow tablets from AcOEt or Me<sub>2</sub>CO. M.p. 220–1° corr.  $[\alpha]_D$  + 71.7° in EtOH. 25 times less active than testosterone.

*Acetyl*: cryst. from hexane. M.p. 116° corr.

*Benzoyl*: cryst. from EtOH. M.p. 136.5–138° corr.

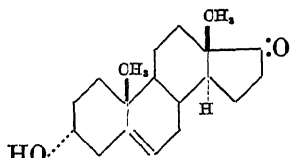
*Oxime*: cryst. from EtOH.Aq. M.p. 220–5° corr.

*Semicarbazone*: cryst. from MeOH. M.p. 221–2° corr. decomp.

Ruzicka, K $\ddot{a}$ gi, *Helv. Chim. Acta*, 1936, 19, 848.

 $\Delta^4$ -Androstene-17 $\beta$ -ol-3-one.

See Testosterone.

 $\Delta^5$ -Androstene-3 $\alpha$ -ol-17-one (Dehydroandrosterone)C<sub>19</sub>H<sub>28</sub>O<sub>2</sub>

MW, 288

Cryst. from AcOEt. M.p. 221° corr. 100  $\gamma$  = 1 I.U.

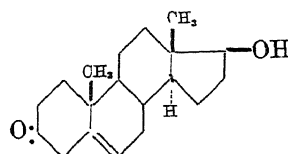
*Acetyl*: cryst. from MeOH. M.p. 173.5–174.5° corr.

*Oxime*: leaflets from MeOH.Aq. M.p. 204–6° corr.

Ruzicka, Goldberg, *Helv. Chim. Acta*, 1936, 19, 1410.

 $\Delta^5$ -Androstene-3 $\beta$ -ol-17-one.

See Dehydro-epiandrosterone.

 $\Delta^5$ -Androstene-17 $\beta$ -ol-3-one ( $\Delta^5$ -Testosterone)C<sub>19</sub>H<sub>28</sub>O<sub>2</sub>

MW, 288

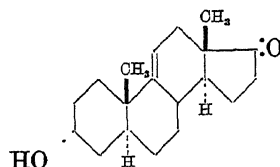
*Acetyl*: leaflets from Me<sub>2</sub>CO.Aq. M.p. 130–47°.  $[\alpha]_D^{20}$  – 30.5° in EtOH. Acids  $\rightarrow$  testosterone acetate. 125  $\gamma$  = 1 I.U.

*Propionyl*: cryst. from pet. ether. M.p. about 135°.  $[\alpha]_D$  – 17° in EtOH.

*Benzoyl*: cryst. from cyclohexane. M.p. 170–80°.  $[\alpha]_D$  + 23° in C<sub>6</sub>H<sub>6</sub>.

Butenandt, Hanisch, *Ber.*, 1936, 69, 2775.

Ruzicka, Goldberg, Bosshard, *Helv. Chim. Acta*, 1937, 20, 541.

 $\Delta^9:11$ -Androstene-3 $\alpha$ -ol-17-oneC<sub>19</sub>H<sub>28</sub>O<sub>2</sub>

MW, 288

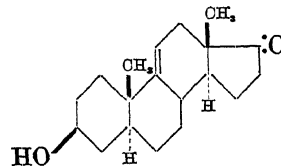
Cryst. from AcOEt. M.p. 189–90°.  $[\alpha]_D^{25}$  140° ± 2°.

*Acetyl*: m.p. 190–2°.  $[\alpha]_D^{25}$  + 135° ± 3°. Isolated from pathological urine.

Mason, Kepler, *J. Biol. Chem.*, 1945, 161, 235.

Shoppee, *J. Chem. Soc.*, 1946, 1134.

Miller, Dorfman, Sevringhaus, *Endocrinology*, 1946, 38, 19.

 $\Delta^9:11$ -Androstene-3 $\beta$ -ol-17-oneC<sub>19</sub>H<sub>28</sub>O<sub>2</sub>

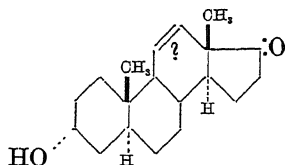
MW, 288

Purified by sublimation in high vacuum, cryst. from MeOH.Aq. M.p. 170–2.5° corr.  $[\alpha]_D^{13}$  + 125.5° ± 2° (c, 0.534 in EtOH).

*Acetyl*: purified by sublimation in high vacuum, cryst. in prisms from pentane. M.p.  $102^\circ$  corr.  $[\alpha]_D^{25} 110.8^\circ \pm 4^\circ$  (c, 1.255 in  $\text{Me}_2\text{CO}$ ). Yellow col. with  $\text{C}(\text{NO}_2)_4$ .

Shoppee, *Helv. Chim. Acta*, 1940, 23, 740; *J. Chem. Soc.*, 1946, 1134.

Reich, Lardon, *Helv. Chim. Acta*, 1947, 30, 329.

 $\Delta^{11}$ ?-Androstene-3 $\alpha$ -ol-17-one

$\text{C}_{19}\text{H}_{28}\text{O}_2$  MW, 288

Purified by sublimation in high vacuum, cryst. from  $\text{MeOH.Aq.}$  M.p.  $181-3^\circ$  corr.  $[\alpha]_D^{25} +122^\circ \pm 2^\circ$  (c, 0.364 in 95% EtOH). Isolated from urine of patient with adrenal cortical tumour.

*Acetyl*: m.p.  $178-80^\circ$  corr.  $[\alpha]_D^{26} +114^\circ \pm 5^\circ$  (c, 0.314 in EtOH).

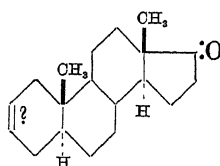
*Benzoyl*: m.p.  $162-4^\circ$  corr.

*Semicarbazone*: m.p.  $279-80^\circ$  decomp.

Wolfe, Fieser, Friedgood, *J. Am. Chem. Soc.*, 1941, 63, 582.

Shoppee, *J. Chem. Soc.*, 1946, 1134.

Lieberman *et al.*, *J. Biol. Chem.*, 1948, 172, 263.

 $\Delta^{2(\text{or } 3)}$ -Androstene-17-one

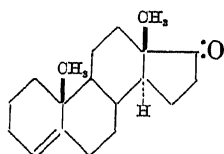
$\text{C}_{19}\text{H}_{28}\text{O}$  MW, 272

Purified by sublimation in high vacuum, cryst. in leaflets from MeOH. M.p.  $104.5-5.5^\circ$  corr. ( $110^\circ$ ,  $111-14^\circ$ ).  $[\alpha]_D^{17} 146^\circ \pm 9^\circ$  (c, 0.40 in EtOH).

Hirschmann, *J. Biol. Chem.*, 1940, 136, 492.

Prelog, Ruzicka, Meister, Wieland, *Helv. Chim. Acta*, 1945, 28, 618.

Lieberman *et al.*, *J. Biol. Chem.*, 1948, 172, 263.

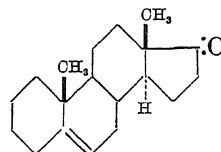
 $\Delta^4$ -Androstene-17-one

$\text{C}_{19}\text{H}_{28}\text{O}$  MW, 272

Purified by sublimation in high vacuum, cryst. from EtOH. M.p.  $78-80^\circ$ .

Marker, Wittle, Tullar, *J. Am. Chem. Soc.*, 1940, 62, 223.

Lee, Stirn, U.S.P., 2,398,185, (*Chem. Abstracts*, 1946, 40, 3569).

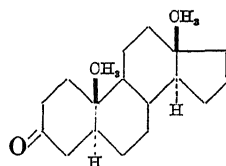
 $\Delta^5$ -Androstene-17-one

$\text{C}_{19}\text{H}_{28}\text{O}$  MW, 272

M.p.  $105-7^\circ$ .

*Semicarbazone*: m.p.  $285-7^\circ$ .

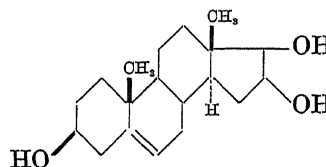
Marker, Wittle, Tullar, *J. Am. Chem. Soc.*, 1940, 62, 223.

 $\Delta^{16}$ -Androstene-3-one

$\text{C}_{19}\text{H}_{28}\text{O}$  MW, 272

Purified by sublimation in high vacuum, cryst. from pentane. M.p.  $140-1^\circ$  corr.  $[\alpha]_D^{17} +38 \pm 1^\circ$  (c, 2.079 in  $\text{CHCl}_3$ ). Intense blue col. in the Kagi-Miescher test (*Helv. Chim. Acta*, 1939, 22, 683).

Prelog, Ruzicka, Wieland, *Helv. Chim. Acta*, 1944, 27, 66.

 $\Delta^5$ -Androstene-3 $\beta$ :16( $\alpha$ ):17( $\alpha$ )-triol

$\text{C}_{19}\text{H}_{30}\text{O}_3$  MW, 306

Needles from Py.Aq. M.p.  $273-5^\circ$ .

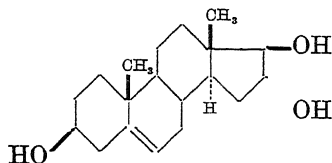
*Acetone condensation product*:  $\text{C}_{22}\text{H}_{34}\text{O}_3$ . MW, 346. Needles from MeOH. M.p.  $163-4^\circ$ .

*Triacetyl*: cryst. from EtOH. M.p.  $208-9.5^\circ$ .

Butenandt, Schmidt-Thomé, Weiss, *Ber.*, 1939, 72, 417.

Huffman, Lott, *J. Am. Chem. Soc.*, 1949, 71, 719.

See also Goldberg *et al.*, *Helv. Chim. Acta*, 1947, 30, 1441.

$\Delta^5$ -Androstene-3 $\beta$  : 16 $\alpha$  : 17 $\beta$ -triol $C_{19}H_{30}O_3$ 

MW, 306

From normal human urine and patient with adrenocarcinoma. Cryst. from EtOH, MeOH. M.p. 265–70° (270°, 257.5–60.5°). Purple col. in Liebermann test.

*Triacetyl*: m.p. 184–5° (187–8.5°).  $[\alpha]_D^{25}$  –102° (c, 1.0 in EtOH).

Hirschmann, *J. Biol. Chem.*, 1943, **150**, 363.

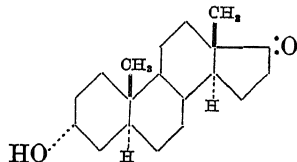
Ruzicka, Prelog, Wieland, *Helv. Chim. Acta*, 1945, **28**, 1609.

Huffman, Lott, *J. Biol. Chem.*, 1946, **164**, 785.

See also Goldberg *et al.*, *Helv. Chim. Acta*, 1947, **30**, 1441.

 $\Delta^4$ -Androstene-3 : 11 : 17-trione.

See Adrenosterone.

Androsterone (*Androstane-3 $\alpha$ -ol-17-one*) $C_{19}H_{30}O_2$ 

MW, 290

Secondary sex hormone isolated from male urine. Leaflets or prismatic needles from EtOH or Me<sub>2</sub>CO. M.p. 178° (184–5° corr.). Sol. prac. all org. solvents. Very spar. sol. H<sub>2</sub>O.  $[\alpha]_D^{25}$  +94.6° in EtOH, +103.5° in MeOH. Produces male sex characteristics in immature animals. Physiologically active in doses of 150–200  $\gamma$  on Butenandt (capon comb) test and 60  $\gamma$  on Tschopp (seminal vesicle) test. 100  $\gamma$  is equivalent to one International Unit (I.U.).

*Acetyl*: prismatic needles from EtOH.Aq. M.p. 160–1°. 100  $\gamma$  = 1 I.U. *Oxime*: needles from EtOH.Aq. M.p. 219–20°. *Semicarbazone*: cryst. from EtOH. M.p. 272–3°.

*Propionyl*: needles from EtOH.Aq. M.p. 145° (151–2°).

*Acid succinyl*: m.p. 184–5° corr.

*Benzoyl*: prisms from C<sub>6</sub>H<sub>6</sub>-ligroin or MeOH. M.p. 178°.

*Oxime*: needles from EtOH.Aq. M.p. 215–16°. 500  $\gamma$  = 1 I.U.

*Semicarbazone*: needles from EtOH. M.p. 276° (260–4°).

*Phenylhydrazone*: m.p. 153–4°.

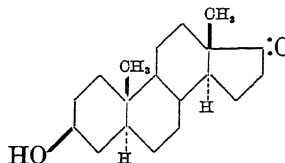
2 : 4-Dinitrophenylhydrazone: yellow cryst. from EtOH.Aq. M.p. 232.5–4.0°.

Ruzicka, *Naturwissenschaften*, 1935, **23**, 44.

Ruzicka, Goldberg, Meyer, Brüngger, Eichenberger, *Helv. Chim. Acta*, 1934, **17**, 1395.

Butenandt, Tscherning, *Z. physiol. Chem.*, 1934, **229**, 167, 185.

Ruzicka, Goldberg, Wirz, *Helv. Chim. Acta*, 1935, **18**, 61.

*epi*-Androsterone (*Androstane-3 $\beta$ -ol-17-one*) $C_{19}H_{30}O_2$ 

MW, 290

Cryst. from EtOH.Aq. M.p. 170–1° (175–6° corr.).  $[\alpha]_D^{25}$  +89° in MeOH. Physiologically active in doses of 1400  $\gamma$  on Butenandt and 500  $\gamma$  on Tschopp tests.

*Acetyl*: cryst. from MeOH.Aq. M.p. 96–7°.

*Semicarbazone*: m.p. 261–2° corr.

*Oxime*: m.p. 185–6° corr.

*Semicarbazone*: m.p. 282–3° corr.

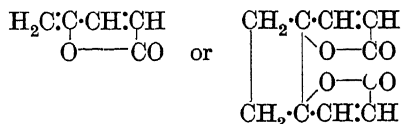
Ruzicka, Goldberg, Brüngger, *Helv. Chim. Acta*, 1934, **17**, 1389.

Ruzicka, Eichenberger, *Helv. Chim. Acta*, 1935, **18**, 430.

Dirscherl, *Z. physiol. Chem.*, 1935, **235**, 1.

Cardwell, Cornforth, Duff, Holtermann, Robinson, *Chemistry and Industry*, 1951, 389.

## Anemonin

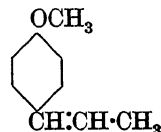
 $C_5H_4O_2$  (C<sub>10</sub>H<sub>8</sub>O<sub>4</sub>)

MW, 96 (192)

Needles or prisms. M.p. 157–8°. Sol. EtOH. Reduces Fehling's and NH<sub>3</sub>.AgNO<sub>3</sub>. Ox. → oxalic and succinic acids.

Asahina, Fujita, *Chem. Abstracts*, 1920, **14**, 1384.

Kipping, *J. Chem. Soc.*, 1935, 1145.

Anethole (*p*-Propenylphenyl methyl ether, *p*-propenylanisole) $C_{10}H_{12}O$ 

MW, 148

From anise and fennel oils. Leaflets from EtOH. M.p. 22-5°. Setting point 21-4°. B.p. 235°, 114°/14 mm. Sol. Et<sub>2</sub>O, Me<sub>2</sub>CO, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Sol. 5 parts 96% EtOH. Very spar. sol. H<sub>2</sub>O. D<sub>15</sub><sup>20</sup> 0.9936. n<sub>D</sub><sup>20</sup> 1.5624. CrO<sub>3</sub> or HNO<sub>3</sub> → anisaldehyde + anisic acid. Red. → *p*-propylanisole. ZnCl<sub>2</sub> → metanethole, C<sub>20</sub>H<sub>24</sub>O<sub>2</sub>, m.p. 133°. Slowly decomp. in sunlight.

*Dibromide*: needles from Et<sub>2</sub>O. M.p. 67°.

*Picrate*: orange-red needles from EtOH. M.p. 70° decomp.

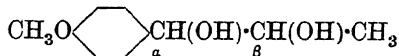
Béhal, Tiffeneau, *Bull. soc. chim.*, 1908, 3, 304.

Cahours, *Ann.*, 1842, 41, 57.

Quelet, *Compt. rend.*, 1936, 202, 956.

Bert, *Compt. rend.*, 1941, 213, 873.

**Anethole Glycol** (*p*-Methoxyphenylpropylene glycol, *p*-α: β-dihydroxypropylanisole)



C<sub>10</sub>H<sub>14</sub>O<sub>3</sub> MW, 182

α-Form:

Cryst. + 3H<sub>2</sub>O. M.p. 31°, anhyd. 63°.

*Diacyl*: b.p. 203°/20 mm. Sol. H<sub>2</sub>O.

β-Form:

M.p. 115-16°.

*Diacyl*: b.p. 210°/41 mm., 187°/12 mm.

Insol. H<sub>2</sub>O.

β-Me ether: C<sub>11</sub>H<sub>16</sub>O<sub>3</sub>. MW, 196. B.p. 171-5°/65-70 mm.

Balbiano, *J. Chem. Soc.*, 1907, 92, i, 522.

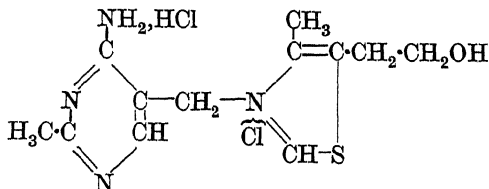
Tiffeneau, Daufresne, *Compt. rend.*, 1907, 144, 1355.

Giuliano, *Chem. Abstracts*, 1941, 35, 2872.

Schulz, Treibs, *Ber.*, 1944, 77, 377.

Doeuvre, Chervet, *Compt. rend.*, 1947, 224, 660.

**Aneurin** (*Vitamin B<sub>1</sub>*, anti-beri-beri or anti-neuritic vitamin, torulin, oryzanin, thiamin)



C<sub>12</sub>H<sub>18</sub>ON<sub>4</sub>Cl<sub>2</sub>S MW, 337

Rice husks are chief source. Variable constituent of yeast, milk, green leaves, roots and tubers. Cryst. from MeOH-Et<sub>2</sub>O, m.p. 233-4°. Plates from MeOH-EtOH or H<sub>2</sub>O-EtOH, m.p. 250°. Very sol. H<sub>2</sub>O. Spar. sol. EtOH, Me<sub>2</sub>CO. Insol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Generally more sol. than lactoflavine. It is also more thermolabile and more

readily decomp. by alkalis than the latter. Sol. in H<sub>2</sub>O or EtOH shows absorption bands at 235 mμ and 267 mμ. Bromide-hydrobromide has equal physiological activity.

*O-Acetyl*: leaflets from EtOH. M.p. 205-7°.

*Picrate*: m.p. 176°.

*Nitrate*: m.p. 164-5°.

*Sulphate*: two forms. M.ps. 203° and 276-8°.

*Picolonate*: m.p. 165° or 229°.

Todd, Bergel, *J. Chem. Soc.*, 1938, 26; 1937, 364.

Williams *et al.*, *J. Am. Chem. Soc.*, 1937, 59, 216; 1936, 58, 1063; 1935, 57, 517, 536, 1093, 1751, 1849, 1856.

Itter, Orent, McCollum, *J. Biol. Chem.*, 1935, 108, 571.

Kinnersley, O'Brien, Peters, *Biochem. J.*, 1935, 29, 701, 716.

Williams, *Ergebnisse der Vitamin-und Hormonforschung* (Akademische Verlag, Leipzig), 1938, I, 213.

Ohdake, *Chem. Zentr.*, 1935, I, 3677.

Windaus *et al.*, *Z. physiol. Chem.*, 1932, 204, 123.

Veen, *Z. physiol. Chem.*, 1932, 208, 125.

Harris, *Vitamins and Vitamin Deficiencies*, Vol. I (Churchill, London, 1938).

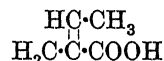
Gravin, *Chem. Abstracts*, 1944, 38, 1239.

Chelintsev, Benevolenskaya, *Chem. Abstracts*, 1946, 40, 4069.

Williams *et al.*, *The Biochemistry of B Vitamins*, (Reinhold Publishing Corporation, New York), 1950.

Robinson, *The Vitamin B Complex*, (Wiley & Sons, Inc., New York), 1951.

**Angelic Acid** (1-Methylcrotonic acid, trans-1:2-dimethylacrylic acid, 1-ethylidenepropionic acid)



C<sub>5</sub>H<sub>8</sub>O<sub>2</sub> MW, 100

Constituent of roots of *Angelica archangelica*, Linn., and Roman cumin oil. Monoclinic prisms. M.p. 45-6°. B.p. 185°, 88-9°/10 mm. Mod. sol. H<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 0.9539. n<sub>D</sub><sup>20</sup> 1.4434. Heat of comb. 635.1 Cal. k = 5.01 × 10<sup>-5</sup> at 25°. Volatile in steam. Isomerises to tiglic acid on boiling, or with conc. H<sub>2</sub>SO<sub>4</sub> at 100°, or with boiling dil. NaOH. KOH fusion → acetic and propionic acids. HI at 180° → methylethylacetic acid.

*Me ester*: C<sub>6</sub>H<sub>10</sub>O<sub>2</sub>. MW, 114. B.p. 127.6-127.8°/764 mm. D<sub>4</sub><sup>20</sup> 0.94130. n<sub>D</sub><sup>20</sup> 1.44620.

*Et ester*: C<sub>7</sub>H<sub>12</sub>O<sub>2</sub>. MW, 128. B.p. 141°, 48-9°/11 mm. D<sub>4</sub><sup>20</sup> 0.9347.

*Isobutyl ester*: C<sub>9</sub>H<sub>16</sub>O<sub>2</sub>. MW, 156. B.p. 177°.

*Isocamyl ester*: C<sub>10</sub>H<sub>18</sub>O<sub>2</sub>. MW, 170. B.p. 200-1°.

*Anilide*: cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 126°.

$\beta$ -Naphthylamide: cryst. from  $C_6H_6$ . M.p. 135°.

Wislicenus, *Ann.*, 1893, 272, 9.

Young, Dillon, Lucas, *J. Am. Chem. Soc.*, 1929, 51, 2532.

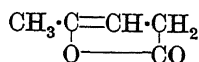
Fittig, Köbig, *Ann.*, 1879, 195, 98.

**Angelica lactone** (*Angelic lactone*)

$C_5H_6O_2$  MW, 98

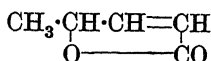
Two forms.

(I)  $\alpha$  or  $\Delta^2$ .



Needles. M.p. 18°. B.p. 55–6°/12 mm. Sol. 20 parts  $H_2O$  at 15°.  $D_4^{20}$  1.084. Volatile. Readily reverts to  $\beta$ -form.  $n_D^{20}$  1.4476.

(II)  $\beta$  or  $\Delta^1$ .

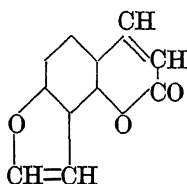


F.p. –17°. B.p. 208–9°/751 mm., 86–5°/10 mm.  $D_4^{20}$  1.076.  $n_D^{20}$  1.4603.  $n_D^{21}$  1.4532.

Auwers, *Ber.*, 1923, 56, 1672.

Haynes, Jones, *J. Chem. Soc.*, 1946, 954.

**Angelicin**



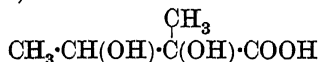
$C_{11}H_{16}O_3$  MW, 186

Constituent of root of *Angelica archangelica*, Linn. Cryst. from MeOH.Aq. M.p. 138–9.5°. Sol.  $Et_2O$ . Spar. sol. petrol.  $H_2O_2 \rightarrow$  furan-2:3-dicarboxylic acid.

Späth, Pailer, *Ber.*, 1934, 67, 1212; 1935, 68, 943.

Späth, Pesta, *Ber.*, 1934, 67, 853.

**Angliceric Acid** (*Anglyceric acid*, 1:2-dimethylglyceric acid, 1:2-dihydroxy-1-methylbutyric acid)

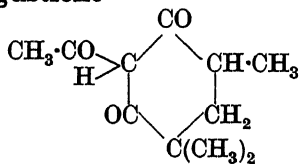


$C_5H_{10}O_4$  MW, 134

Needles. M.p. 111°. Sol.  $H_2O$ ,  $EtOH$ ,  $Me_2CO$ . Spar. sol.  $Et_2O$ . Insol.  $C_6H_6$ ,  $CHCl_3$ , ligroin. Non-volatile in steam. Ca salt sol.  $H_2O$ .

Fittig, Penschuck, *Ann.*, 1894, 283, 114.

**Angustione**



$C_{11}H_{16}O_3$  MW, 196

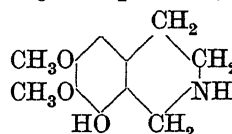
Alkali-soluble constituent of essential oil of *Bachhousia angustifolia*, Muell. Viscous oil with faint unpleasant odour. B.p. 129°/15 mm.  $D_4^{20}$  1.089.  $n_D^{20}$  1.5137.  $[\alpha]_{5461}^{20} - 5.56^\circ$ .  $FeCl_3 \rightarrow$  orange-red col.

*Cu deriv.*: blue prisms. M.p. 192–3°.

Gibson, Penfold, Simonsen, *J. Chem. Soc.*, 1930, 1184.

Birch, *J. Chem. Soc.*, 1951, 3026.

**Anhalamine** (*8-Hydroxy-6:7-dimethoxy-1:2:3:4-tetrahydroisoquinoline*)



$C_{11}H_{15}O_3N$  MW, 209

From Mexican *Anhalonium Lewinii*, Hennings. Spherical aggregates of needles from  $EtOH$ . M.p. 187–8°. Sol.  $H_2O$ , alkalis, hot  $EtOH$ . Spar. sol.  $Et_2O$ ,  $C_6H_6$ ,  $CHCl_3$ , pet. ether.  $FeCl_3 \rightarrow$  blue  $\rightarrow$  green col.

*B.HCl*: m.p. 257–8° (in vacuo).

*Me ether*: see Anhalinine.

*N-Me*: see Anhalidine.

*N-Benzoyl*: m.p. 167–8°.

*Dibenzoyl*: m.p. 128–9°.

*N-m-Nitrobenzoyl*: m.p. 174–5°.

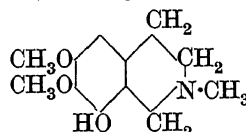
*Picrate*: m.p. 234–6°.

Späth, Becke, *Ber.*, 1934, 67, 2100.

Späth, Röder, *Monatsh.*, 1922, 43, 93.

Heffter, *Ber.*, 1901, 34, 3004.

**Anhalidine** (*N-Methylanhalamine*)



$C_{12}H_{17}O_3N$  MW, 223

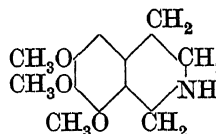
Cactus alkaloid from *Anhalonium Lewinii*, Hennings. Cryst. by sublimation. M.p. 131–3°.

Späth, Becke, *Ber.*, 1935, 68, 944; *Monatsh.*, 1935, 66, 335.

**Anhaline.**

See Hordenine.

**Anhalinine** (*Anhalamine methyl ether*)

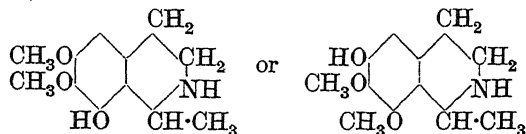


$C_{12}H_{17}O_3N$  MW, 223

Cactus alkaloid from *Anhalonium Lewinii*, Hennings. Cryst. by sublimation. M.p. 61–3°.

Späth, Becke, *Ber.*, 1935, 68, 501; *Monatsh.*, 1935, 66, 327.

**Anhalonidine** (6(8)-Hydroxy-7(6):8(7)-dimethoxy-1-methyl-1:2:3:4-tetrahydroisoquinoline)



$C_{12}H_{17}O_3N$  MW, 223

M.p. 160°. Sol.  $H_2O$ , EtOH,  $CHCl_3$ . Spar. sol.  $Et_2O$ . Insol. petrol.

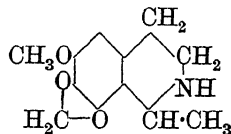
N-Me: see Pelotine.

N-Benzoyl: m.p. 189°.

N-m-Nitrobenzoyl: m.p. 201-2°.

Späth, *Monatsh.*, 1922, 43, 477.

**Anhalonine** (6-Methoxy-7:8-methylenedioxy-1-methyl-1:2:3:4-tetrahydroisoquinoline)



$C_{12}H_{15}O_3N$  MW, 221

M.p. 85°. Sol.  $H_2O$ , EtOH,  $CHCl_3$ ,  $Et_2O$ .

B,HCl:  $[\alpha]_D^{25} - 41.9^\circ$  in  $H_2O$ .

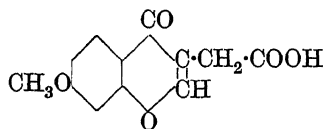
N-Me: lophophorine. Sol. most org. solvents. Insol.  $H_2O$ . B,HCl:  $[\alpha]_D^{25} - 9.47^\circ$  in  $H_2O$ . Methiodide m.p. 238-40° (racemic form, m.p. 242-3°).

Späth, Gangl, *Monatsh.*, 1923, 44, 103.

**Anhydroberberilic Acid.**

See Berberilic Anhydride.

**Anhydrobrazilic Acid**



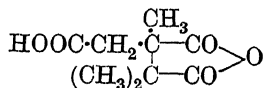
$C_{12}H_{10}O_5$  MW, 234

Cryst. from  $H_2O$ . M.p. 197°. Readily sol. EtOH. Spar. sol.  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ . Insol. pet. ether.

Oxime: needles from  $H_2O$ . M.p. 175-80°.

Perkin, *J. Chem. Soc.*, 1902, 81, 230.

**Anhydrocamphoronic Acid**



$C_9H_{12}O_5$  MW, 200

M.p. 139°. Sol.  $H_2O$ , EtOH,  $Et_2O$ . Sublimes.  $[\alpha]_D^{20} - 5.56^\circ$  in  $CHCl_3$ .

Me ester:  $C_{10}H_{14}O_5$ . MW, 214. Two forms. (α). M.p. 138°. B.p. 166-7°/12 mm. (β). M.p. 45°. B.p. 156°/10 mm.

Chloride:  $C_9H_{11}O_4Cl$ . MW, 218.5. Two forms. (α). M.p. 137-8°. B.p. 164-5°/13 mm., → β-form.  $[\alpha]_D^{20} + 6.25^\circ$  in  $CHCl_3$ . (β). M.p. 38-9°. B.p. 151°/10 mm.  $[\alpha]_D^{20} - 4.21^\circ$  in  $CHCl_3$ .

Anilide: m.p. 202-3°.

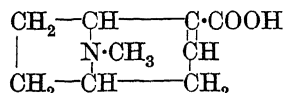
Goebel, Noyes, *J. Am. Chem. Soc.*, 1923, 45, 3064.

Bredt, *Ann.*, 1896, 292, 87.

**Anhydrocarboxyglycine.**

See 2:5-Oxazolidinedione.

**Anhydroecgonine (Ecgonidine)**



$C_9H_{13}O_2N$  MW, 167

dl.

Cryst. +  $1H_2O$ . M.p. 226-30° decomp. Sol.  $H_2O$ . Spar. sol. EtOH.

Me ester: methiodide, m.p. 180°.

l.

Cryst. from MeOH-Et<sub>2</sub>O. M.p. 235° decomp. B,HCl: needles from EtOH. M.p. 240-1°.

Me ester:  $C_{10}H_{15}O_2N$ . MW, 181. B.p. 107°/7 mm. B,HBr: m.p. 147°.

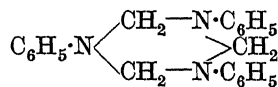
Et ester:  $C_{11}H_{17}O_2N$ . MW, 195. B.p. 136-9°/16 mm. Sol. cold, spar. sol. hot  $H_2O$ . Methiodide: leaflets. M.p. 177°.

$B_2, H_2PtCl_6$ : reddish-yellow prisms. M.p. 223° decomp.

Willstätter, Wolfes, Mäder, *Ann.*, 1923, 434, 137.

Einhoen, *Ber.*, 1890, 23, 1338.

**Anhydroformaldehydeaniline (Methyleneaniline, triphenylhexahydrotriazine)**

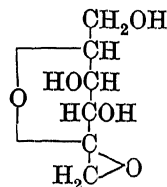


$C_{21}H_{21}N_3$  MW, 315

Silky needles. M.p. 143°. Sol.  $Et_2O$ ,  $C_6H_6$ , toluene,  $CHCl_3$ . Spar. sol. EtOH. Prac. insol.  $H_2O$ . Decomp. by boiling  $H_2O$  or EtOH. Sol. conc. min. acids → reddish-brown sols. HCN → phenylglycine nitrile. Zn + HCl → methylaniline.

Bischoff, *Ber.*, 1898, 31, 3251.

**Anhydrofructose**



$C_6H_{10}O_5$

MW, 162

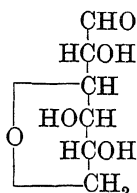
Spheroids from EtOH-Et<sub>2</sub>O. M.p. 143-5°.  $[\alpha]_D + 30.2^\circ$  in H<sub>2</sub>O. Very hygroscopic. Does not reduce Fehling's.

*Tri-acetyl*: needles +  $\frac{1}{2}$ EtOH from EtOH. M.p. 123°.

Schlubach, Elsner, *Ber.*, 1932, **65**, 519.

Irvine, Stevenson, *J. Am. Chem. Soc.*, 1929, **51**, 2197.

## 3 : 6-Anhydrogalactose



C<sub>6</sub>H<sub>10</sub>O<sub>5</sub>

MW, 162

$[\alpha]_D + 24^\circ$  in H<sub>2</sub>O.

*Mono-acetone deriv.*: m.p. 92°.

*Phenylosazone*: yellow needles from MeOH. M.p. 217° (213-4° decomp.).  $[\alpha]_D^{25} + 71^\circ$  in MeOH.

*Di-Me acetal*:  $[\alpha]_D^{25} + 36.5^\circ$  in H<sub>2</sub>O.

Haworth, Jackson, Smith, *J. Chem. Soc.*, 1940, 630.

Ohle, Thiel, *Ber.*, 1933, **66**, 532.

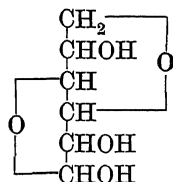
## Anhydrogitalin.

See Gitoxin.

## Anhydroglucochloral.

See  $\beta$ -Glucochloralose.

## 3 : 6-Anhydro-d-glucose



C<sub>6</sub>H<sub>10</sub>O<sub>5</sub>

MW, 162

Needles from AcOEt or EtOH-petrol. M.p. 119°. Sol. H<sub>2</sub>O, Me<sub>2</sub>CO.  $[\alpha]_D^{20} + 55.39^\circ$  in H<sub>2</sub>O.  $[\alpha]_D^{25} + 39.67^\circ \rightarrow 30.8^\circ$  after 10 mins. in Py.

*Tri-Me ether*: C<sub>9</sub>H<sub>16</sub>O<sub>5</sub>. MW, 204. B.p. 111-13°/0.2 mm.  $[\alpha]_D^{14} + 70.6^\circ$  in CHCl<sub>3</sub>.

*5-Acetyl*: syrup.  $[\alpha]_D^{20} + 91.18^\circ$  in CHCl<sub>3</sub>.

*Tri-acetyl*: b.p. 165°/0.2 mm.  $[\alpha]_D^{25} + 178.93^\circ$  in CHCl<sub>3</sub>.

*Mono-acetone deriv.*: needles from Et<sub>2</sub>O-petrol. M.p. 56-7°.  $[\alpha]_D^{20} + 29.33^\circ$  in H<sub>2</sub>O.

*Acetyl deriv.*: needles. M.p. 31°. B.p. 125-30°/0.05 mm.  $[\alpha]_D^{20} + 35.7^\circ$  in CHCl<sub>3</sub>.

*Benzoyl deriv.*: needles from petrol. M.p. 58-9°.  $[\alpha]_D^{20} + 22.28^\circ$  in CHCl<sub>3</sub>. *Toluene-p-sulphonyl*: m.p. 132-4°.

*Phenylosazone*: yellowish-red needles from EtOH.Aq. M.p. 187-8° (198-200°).  $[\alpha]_D^{25} - 150^\circ$  in MeOH.

*o-Tolylosazone*: yellow needles from EtOH. M.p. 168-70°.

*p-Tolylosazone*: yellow needles from acetonitrile. M.p. 202°.

*Phenylhydrazone*: yellow needles from H<sub>2</sub>O. M.p. 157°.

*p-Bromophenylhydrazone*: yellow leaflets from Py-Et<sub>2</sub>O. M.p. 184°.  $[\alpha]_D^{16} - 18.89^\circ \rightarrow -10.86^\circ$  in 6 hours in Py.

Diels, Meyer, Onnen, *Ann.*, 1936, **525**, 94.  
Fischer, Helferich, Ostmann, *Ber.*, 1920, **53**, 880.

Ohle, Vargha, *Ber.*, 1928, **61**, 1208.

Ohle, Euler, *Ber.*, 1930, **63**, 1796.

Kess, Micheel, *Ann.*, 1928, **466**, 100.

Seebeck, Meyer, Reichstein, *Helv. Chim. Acta*, 1944, **27**, 1142.

Haworth, Owen, Smith, *J. Chem. Soc.*, 1941, 88.

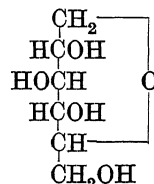
## 1 : 5-Anhydro-D-mannitol.

See Styrcitol.

## 1 : 4-Anhydro-D-sorbitol.

See Sorbitan.

**1 : 5-Anhydro-D-sorbitol** (*Polygalitol, aceritol*)



C<sub>6</sub>H<sub>12</sub>O<sub>5</sub>

MW, 164

Found in *Polygala tenuifolia, vulgaris, amara, senega*. Prisms or plates from MeOH. M.p. 142-3° (140-1°).  $[\alpha]_D^{20} + 42.86^\circ$  in H<sub>2</sub>O. NaOBr + phenylhydrazine  $\rightarrow$  1 : 5-anhydro-fructosazone. H<sub>2</sub>O<sub>2</sub> + phenylhydrazine  $\rightarrow$  glucosazone.

*Tetra-acetyl*: cryst. from ether-isopentane. M.p. 73.6-74.8°.  $[\alpha]_D^{20} + 38.9^\circ$  in CHCl<sub>3</sub>.

*Tetra-Me ether*: b.p. 80° (bath temp.)/2 mm. D 1.0571.  $n_D^{25} 1.4444$ .  $[\alpha]_D^{25} + 67.67^\circ$ .

Picard, *Chem. Abstracts*, 1927, **21**, 3385.

Shinoda, Sato, Sato, *Ber.*, 1932, **65**, 1219.

Carr, Krantz, *J. Am. Pharm. Assoc.*, 1938, **27**, 318, (*Chem. Abstracts*, 1938, **32**, 5785).

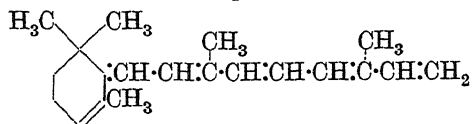
Freudenberg, Rogers, *J. Am. Chem. Soc.*, 1937, **59**, 1602.

Freudenberg, Sheehan, *J. Am. Chem. Soc.*, 1940, **62**, 558.

Richtmeyer, Hudson, *J. Am. Chem. Soc.*, 1943, **65**, 64.

Richtmeyer, Carr, Hudson, *J. Am. Chem. Soc.*, 1943, **65**, 1477.

Fletcher, *J. Am. Chem. Soc.*, 1947, **69**, 706.

Anhydrovitamin A<sub>1</sub>

Suggested structure

C<sub>20</sub>H<sub>28</sub> MW, 268

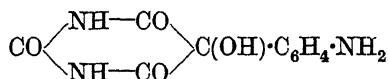
Orange prisms. M.p. 76-7°. Shows max. ultra-violet absorption at 351 (E<sub>1%<sup>1</sup>mm</sub> 2500), 371 (E<sub>1%<sup>1</sup>mm</sub> 3650) and 392 mμ. (E<sub>1%<sup>1</sup>mm</sub> 3180). SbCl<sub>3</sub> → blue col.

Shantz, Cawley, Embree, *J. Am. Chem. Soc.*, 1943, **65**, 9301.

Edisbury, Gillam, Heilbron, Morton, *Biochem. J.*, 1932, **26**, 1164.

Meunier, Dulou, Vinet, *Compt. rend.*, 1943, **216**, 907.

## Anil-alloxan

C<sub>10</sub>H<sub>9</sub>O<sub>4</sub>N<sub>3</sub> MW, 235

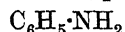
Needles from EtOH. M.p. 248° decomp. Sol. hot. H<sub>2</sub>O. Heat. → CO<sub>2</sub>, NH<sub>3</sub> and *p*-toluidine. Conc. H<sub>2</sub>SO<sub>4</sub> → *p*-aminobenzaldehyde.

Pellizzari, *Gazz. chim. ital.*, 1887, **17**, 412.

## Anil-diacetic Acid.

See Phenyliminodiacetic Acid.

**Aniline** (*Aminobenzene, phenylamine*)

C<sub>6</sub>H<sub>7</sub>N MW, 93

F.p. - 6°. B.p. 184°, 92°/33 mm., 71°/9 mm. Vapour pressures: 600 mm./175°, 500 mm./169°, 400 mm./162°, 300 mm./151°, 200 mm./139°, 100 mm./119°, 50 mm./102°, 15 mm./77°. Misc. in all proportions with EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Sol. most org. solvents. 100 parts H<sub>2</sub>O diss. 3.4 parts at 20°, 6.4 parts at 90°. D<sub>15</sub><sup>20</sup> 1.0268. n<sub>D</sub><sup>20</sup> 1.5863. Sp. heat 0.518 at 20-5°. Latent heat of vap. 113.9 cal./gram. Heat of comb. C<sub>p</sub> 815 Cal. Flash point 76°. *k* = 4.6 × 10<sup>-10</sup> at 25°, 7.6 × 10<sup>-10</sup> at 40°, 1.7 × 10<sup>-9</sup> at 60°. Volatile in steam. Dissolves many metals (K, Na, Mg, Ca, etc.), giving metal anilides, e.g., C<sub>6</sub>H<sub>5</sub>NHNa. Pure aniline is a colourless liq., but turns brown on exposure to air. CrO<sub>3</sub> → *p*-benzoquinone. HNO<sub>2</sub> + min. acid → diazo salt. Alc. KOH + CHCl<sub>3</sub> → phenyl isocyanide (carbylamine reaction). Alc. KOH + CS<sub>2</sub> → thiocarbanilide.

*B.HCl*: known in commerce as aniline salt. White cryst. M.p. 198°. B.p. 245°. Sol. H<sub>2</sub>O, EtOH.

*B.HBr*: m.p. 286°.

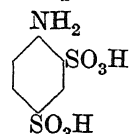
*B.HNO<sub>3</sub>*: b.p. 190° decomp.

*B<sub>2</sub>H<sub>3</sub>AsO<sub>4</sub>*: m.p. 140°.

*N-Allyl*: phenylallylamine. B.p. 217-18°/736 mm. D<sub>25</sub><sup>25</sup> 0.982.

Henke, Brown, *J. Phys. Chem.*, 1922, **26**, 631.  
Wedekind, *Ber.*, 1903, **36**, 3791.

## Aniline-2 : 4-disulphonic Acid

C<sub>6</sub>H<sub>7</sub>O<sub>6</sub>NS<sub>2</sub> MW, 253

Cryst. + 2H<sub>2</sub>O. Decomp. at 120°. Sol. H<sub>2</sub>O, EtOH, alkalis. Insol. Et<sub>2</sub>O.

*Diamide*: C<sub>6</sub>H<sub>9</sub>O<sub>4</sub>N<sub>3</sub>S<sub>2</sub>. MW, 251. Leaflets from H<sub>2</sub>O. M.p. 235°.

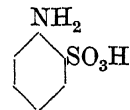
Fischer, *Ber.*, 1891, **24**, 3806.

## Aniline-phthalein.

See Diaminophthalophenone.

## Aniline Salt.

See under Aniline.

Aniline-*o*-sulphonic Acid (*Orthanilic acid*)C<sub>6</sub>H<sub>7</sub>O<sub>3</sub>NS MW, 173

Cryst. + ½H<sub>2</sub>O. Spar. sol. cold H<sub>2</sub>O. *k* = 3.3 × 10<sup>-3</sup> at 25°. Mod. ox. with KMnO<sub>4</sub> → azobenzene-2 : 2'-disulphonic acid. Warm conc. H<sub>2</sub>SO<sub>4</sub> → sulphanilic acid.

*Amide*: C<sub>6</sub>H<sub>8</sub>O<sub>2</sub>N<sub>2</sub>S. MW, 172. Needles. M.p. 153°. *B.HCl*: m.p. 201°. *Benzoyl deriv.*: needles. M.p. 198°.

Wertheim, *Organic Syntheses*, 1935, **XV**, 55.

Gerilowsky, *Ber.*, 1896, **29**, 1075.

Schrader, *J. prakt. Chem.*, 1917, **95**, 392.

Aniline-*m*-sulphonic Acid (*Metanilic acid*).

Prisms + 1½H<sub>2</sub>O, or needles. Sol. 68 parts H<sub>2</sub>O at 15°. *k* = 1.8 × 10<sup>-4</sup> at 25°. KOH fusion → resorcinol.

*Amide*: leaflets or needles. M.p. 142°. Spar. sol. cold H<sub>2</sub>O. *N-Acetyl*: cryst. from 50% EtOH. M.p. 216-19°.

Jacobs, Heidelberger, *J. Am. Chem. Soc.*, 1917, **39**, 2428.

Doolittle, *Chem. Abstracts*, 1924, **18**, 791.

Aniline-*p*-sulphonic Acid (*Sulphanilic acid*).

Rhombic plates or monoclinic cryst. + 2H<sub>2</sub>O. Sol. 166 parts H<sub>2</sub>O at 10°. *k* = 5.81 × 10<sup>-4</sup> at 25°. Ox. → *p*-benzoquinone.

*Amide*: see Sulphanilamide.

*Hydrazide*: m.p. 131° decomp.

*Anilide*: m.p. 200°. *N-Acetyl*: m.p. 214°.

*o-Toluidide*: needles. M.p. 132°.

*m-Toluidide*: needles. M.p. 135°.



*p*-Toluidide: needles. M.p. 109°.

$\alpha$ -Naphthylamide: needles. M.p. 196°.

$\beta$ -Naphthylamide: needles. M.p. 203°.

Gelmo, *J. prakt. Chem.*, 1908, **77**, 369.

Jacobs *et al.*, *Ind. Eng. Chem.*, 1943, **35**, 321.

Turski, U.S.P., 2,401,525, (*Chem. Abstracts*, 1946, **40**, 5451).

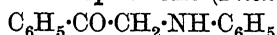
### Aniline- $\omega$ -sulphonic Acid.

See Phenylsulphamic Acid.

### Anilinoacetic Acid.

See Phenylglycine.

### $\omega$ -Anilinoacetophenone (*Phenacylaniline*)

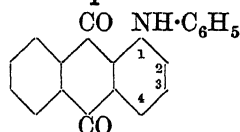


$\text{C}_{14}\text{H}_{13}\text{ON}$  MW, 211

Needles from EtOH. M.p. 93°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>, CS<sub>2</sub>. Insol. cold H<sub>2</sub>O. Volatile in steam. Heat at 100°  $\rightarrow$  3-phenylindole. Conc. min. acids or alkalis in the hot  $\rightarrow$  phenylcarbylamine + aniline.

Bischler, *Ber.*, 1892, **25**, 2860.

### 1-Anilinoanthraquinone



$\text{C}_{20}\text{H}_{13}\text{O}_2\text{N}$  MW, 299

Red plates from EtOH. M.p. 147.5°. Spar. sol. cold EtOH, C<sub>6</sub>H<sub>6</sub>, AcOH, PhNO<sub>2</sub>; more sol. in these when hot. Conc. H<sub>2</sub>SO<sub>4</sub>  $\rightarrow$  yellow sol.

Ulmann, *Ann.*, 1911, **380**, 317.

### 2-Anilinoanthraquinone.

Yellowish-red needles from chlorobenzene. M.p. 234-6°. Conc. H<sub>2</sub>SO<sub>4</sub>  $\rightarrow$  greenish-yellow sol.  $\rightarrow$  bluish-violet on warming.

Badische, D.R.P. 288,464, (*J. Soc. Chem. Ind.*, 1916, **35**, 355).

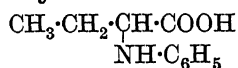
### *p*-Anilinoazobenzene.

See Benzeneazodiphenylamine.

### Anilino benzthiazole.

See under 2-Aminobenzthiazole.

### 1-Anilino butyric Acid



$\text{C}_{10}\text{H}_{13}\text{O}_2\text{N}$  MW, 179

M.p. 141°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. cold H<sub>2</sub>O. Reduces NH<sub>3</sub>·AgNO<sub>3</sub>.  $k = 3.1 \times 10^{-5}$  at 25°.

*Et ester*: C<sub>12</sub>H<sub>17</sub>O<sub>2</sub>N. MW, 207. Cryst. M.p. 26°. B.p. 278°.

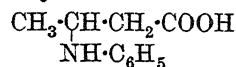
*Amide*: C<sub>10</sub>H<sub>14</sub>ON<sub>2</sub>. MW, 178. Plates from H<sub>2</sub>O, prisms from EtOH. M.p. 123°.

*Nitrile*: C<sub>10</sub>H<sub>12</sub>N<sub>2</sub>. MW, 160. Needles. M.p. 39°. *Anilide*: needles from EtOH. M.p. 92°.

*N-Acetyl*: prisms from C<sub>6</sub>H<sub>6</sub>. M.p. 118°.

Bischoff, *Ber.*, 1897, **30**, 2305, 2313.

### 2-Anilino butyric Acid



$\text{C}_{10}\text{H}_{13}\text{O}_2\text{N}$  MW, 179

Needles. M.p. 128°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. cold H<sub>2</sub>O.

*B*, (COOH)<sub>2</sub>: m.p. 137-9°.

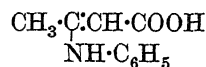
*Anilide*: m.p. 93°. *B, HCl*: leaflets from EtOH. M.p. 206-7°.

Autenrieth, Pretzell, *Ber.*, 1903, **36**, 1266.

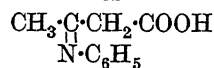
### 3-Anilino-*p*-cresol.

See 5-Hydroxy-3-methyldiphenylamine.

### 2-Anilino crotonic Acid (*Acetoacetic acid* $\beta$ -*anil*)



or



$\text{C}_{10}\text{H}_{11}\text{O}_2\text{N}$  MW, 177

*Me ester*: C<sub>11</sub>H<sub>13</sub>O<sub>2</sub>N. MW, 191. Prisms from MeOH. M.p. 51°.

*Et ester*: C<sub>12</sub>H<sub>15</sub>O<sub>2</sub>N. MW, 205. Decomp. at 240°. Acids or alkalis  $\rightarrow$  aniline + acetoacetic ethyl ester.

*Nitrile*: C<sub>10</sub>H<sub>10</sub>N<sub>2</sub>. MW, 158. Needles from EtOH. M.p. 115°.

Knorr, *Ann.*, 1886, **236**, 73.

Meyer, *Chem. Zentr.*, 1908, **II**, 591.

Conrad, Simpach, *Ber.*, 1888, **21**, 1968.

### Anilino diacetic Acid.

See *N*-Phenyliminodiacetic Acid.

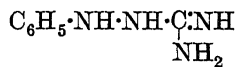
### $\alpha$ -Anilino diphenylmethane.

See under  $\alpha$ -Aminodiphenylmethane.

### 2-Anilino ethyl Alcohol.

See  $\beta$ -Hydroxyethyl aniline.

### Anilino guanidine



$\text{C}_7\text{H}_{10}\text{N}_4$  MW, 150

Very unstable.

*B, HCl*: needles. M.p. 226° decomp.

*B, HBr*: needles. M.p. 210°.

*B, HNO<sub>3</sub>*: needles. M.p. 178°.

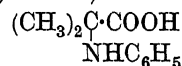
*Acetyl deriv.*: m.p. 195°.

*Picrate*: orange needles. M.p. 193°.

Pellizzari, *Gazz. chim. ital.*, 1911, **41**, 30.

### 1-Anilinoisobutyric Acid

(Note.—*There is some doubt in the literature as to which is the 1-anilino- and which the 2-anilino-isobutyric acid*)



$\text{C}_{10}\text{H}_{13}\text{O}_2\text{N}$  MW, 179

Needles from hot H<sub>2</sub>O. M.p. 184-5°. Sol. EtOH, Et<sub>2</sub>O. Insol. ligroin. Sublimes.  $k = 1.0 \times 10^{-6}$  at 25°.

*Amide*:  $C_{10}H_{14}ON_2$ . MW, 178. Needles. M.p.  $136^\circ$ . Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O.

*Nitrile*:  $C_{10}H_{12}N_2$ . MW, 160. Needles from EtOH, prisms from pet. ether. M.p.  $93-4^\circ$ . Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Anilide*: tablets from EtOH. M.p.  $155^\circ$ .

Mulder, *Rec. trav. chim.*, 1907, 26, 180.

## 2-Anilinoisobutyric Acid

(See note under 1-Anilinoisobutyric Acid, above)



$C_{10}H_{13}O_2N$  MW, 179

Prisms from CHCl<sub>3</sub>. M.p.  $142^\circ$  decomp. Sol hot H<sub>2</sub>O. Spar. sol. CS<sub>2</sub>. Insol. ligroin.  $k = 3.6 \times 10^{-5}$  at  $25^\circ$ . Dist.  $\rightarrow$  isopropylaniline.

*Anilide*: prisms from EtOH.Aq. M.p.  $122^\circ$ .

Bischoff, Mintz, *Ber.*, 1892, 25, 2326.

## 1-Anilinoisovaleric Acid (N-Phenylvaline)



$C_{11}H_{15}O_2N$  MW, 193

Leaflets from H<sub>2</sub>O. M.p.  $135^\circ$ . Sol. to 0.7% in boiling H<sub>2</sub>O. Sol. EtOH, Et<sub>2</sub>O, AcOH, CHCl<sub>3</sub>. Insol. ligroin. Reduces NH<sub>3</sub>.AgNO<sub>3</sub>.

*Et ester*:  $C_{13}H_{19}O_2N$ . MW, 221. B.p.  $275-80^\circ$ .

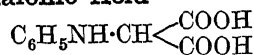
*Amide*:  $C_{11}H_{16}ON_2$ . MW, 192. M.p.  $102-3^\circ$ . Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin.

*Nitrile*:  $C_{11}H_{14}N_2$ . MW, 174. Needles from C<sub>6</sub>H<sub>6</sub>-ligroin. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Anilide*: m.p.  $105-6^\circ$ .

Bischoff, *Ber.*, 1897, 30, 2303.

## Anilomalonic Acid



$C_9H_9O_4N$  MW, 195

Needles from EtOH-ligroin. M.p.  $119^\circ$  decomp.  $\rightarrow$  phenylglycine + CO<sub>2</sub>. Sol. EtOH, Me<sub>2</sub>CO, AcOH, hot H<sub>2</sub>O. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Di-Me ester*:  $C_{11}H_{13}O_4N$ . MW, 223. M.p.  $68^\circ$ .

*Di-Et ester*:  $C_{13}H_{17}O_4N$ . MW, 251. Cryst. from EtOH or ligroin. M.p.  $45^\circ$ .

*Diamide*:  $C_9H_{11}O_2N_3$ . MW, 193. Prisms. M.p.  $156^\circ$ .

*Anilide*: needles from H<sub>2</sub>O. M.p.  $157^\circ$  decomp.

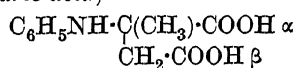
*Di-anilide*: prisms. M.p.  $162^\circ$  (plates from AcOH, m.p.  $246-7^\circ$ ).

Conrad, Reinbach, *Ber.*, 1902, 35, 1813.

## 1-Anilino-2-methylanthraquinone.

See under 1-Amino-2-methylanthraquinone.

*1-Anilino-1-methylsuccinic Acid (Anilino-pyrotartaric acid)*



$C_{11}H_{13}O_4N$  MW, 223

Prisms + 1H<sub>2</sub>O. M.p.  $111^\circ$ , anhyd.  $171^\circ$ . Sol. EtOH, hot H<sub>2</sub>O. Prac. insol. Me<sub>2</sub>CO, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Reduces NH<sub>3</sub>.AgNO<sub>3</sub> and Fehling's when hot.

*α-Amide-β-Et ester*:  $C_{13}H_{18}O_3N_2$ . MW, 250. Plates. M.p.  $109^\circ$ . Sol. H<sub>2</sub>O, EtOH, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Insol. ligroin.

*Imide*: α-anilino-α-methylsuccinimide. Prisms. M.p.  $167^\circ$ . Sol. EtOH, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O. *Acetyl deriv.*: m.p.  $235^\circ$ . *Benzoyl deriv.*: m.p.  $190^\circ$ .

Reissert, *Ber.*, 1888, 21, 1362.

Schroeter, Kirnberger, *Ber.*, 1902, 35, 2078.

## 7-Anilino-2-naphthol.

See under 7-Amino-2-naphthol.

## Anilidonaphthol-sulphonic Acid.

See Phenylaminonaphthol-sulphonic Acid.

## 2-Anilidonaphthoquinone.

See under 2-Amino-1:4-naphthoquinone.

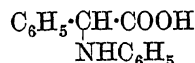
## 1-Anilinpalmitic Acid.

See under 1-Aminopalmitic Acid.

## Anilinophenol.

See Hydroxydiphenylamine.

*α-Anilinophenylacetic Acid (α-Phenylphenylglycine)*



$C_{14}H_{13}O_2N$  MW, 227

*dl.*

Leaflets from EtOH. M.p.  $173-5^\circ$  ( $183^\circ$ ). Sol. EtOH. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O, ligroin.

*Et ester*:  $C_{16}H_{17}O_2N$ . MW, 255. Needles from ligroin. M.p.  $89-90^\circ$ . B.p.  $325-30^\circ$ .

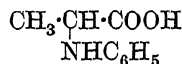
*Nitrile*:  $C_{14}H_{12}N_2$ . MW, 208. Prisms from pet. ether, needles from EtOH. M.p.  $85^\circ$ .

*l.*

M.p.  $188^\circ$ .  $[\alpha]_D - 117.9^\circ$  in Me<sub>2</sub>CO;  $- 111.7^\circ$  in EtOH;  $- 106.8^\circ$  in AcOEt.  $[\alpha]_{5461} - 143.5^\circ$  in Me<sub>2</sub>CO.

McKenzie, Bate, *J. Chem. Soc.*, 1915, 107, 1681.

*1-Anilinopropionic Acid (N-Phenyl-α-alanine)*



$C_9H_{11}O_2N$  MW, 165

Leaflets from H<sub>2</sub>O. M.p.  $162^\circ$ . Sol. EtOH. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Sublimes.  $k = 2.2 \times 10^{-5}$  at  $25^\circ$ .

*Et ester*:  $C_{11}H_{15}O_2N$ . MW, 193. B.p.  $272^\circ$ .  $D_{20}^{25} 1.060$ .

*Amide*:  $C_9H_{12}ON_2$ . MW, 164. M.p.  $144^\circ$ . Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>.

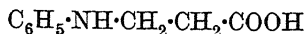
*Nitrile*:  $C_9H_{10}N_2$ . MW, 146. Leaflets from EtOH, Et<sub>2</sub>O or C<sub>6</sub>H<sub>6</sub>. M.p.  $92^\circ$ . Sol. CHCl<sub>3</sub>, hot H<sub>2</sub>O.

*Anilide*: needles from EtOH. M.p.  $127^\circ$ .

*N*-Acetyl: prisms from  $H_2O$ , leaflets from  $C_6H_6$ . M.p.  $143^\circ$ .

Nastvogel, *Ber.*, 1890, 23, 2010.

**2-Anilinopropionic Acid** (*N*-Phenyl- $\beta$ -alanine)



$C_9H_{11}O_2N$  MW, 165

Leaflets from  $CHCl_3$ -ligroin. M.p.  $60^\circ$ . Insol. ligroin.  $k = 4.0 \times 10^{-6}$  at  $25^\circ$ .

*Et ester*:  $C_{11}H_{15}O_2N$ . MW, 193. Yellow oil. B.p.  $175^\circ/18$  mm.

*Anilide*: leaflets from EtOH. M.p.  $92-3^\circ$ .

Autenrieth, Pretzell, *Ber.*, 1903, 36, 1262.

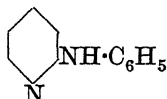
**3-Anilino-*n*-propyl Alcohol.**

See  $\gamma$ -Hydroxypropylaniline.

**$\alpha$ -Anilinopropylbenzene.**

See under 1-Phenylpropylamine.

**2-Anilinyridine** ( $\alpha$ -Anilinyridine, phenyl-2-pyridylamine)



$C_{11}H_{10}N_2$  MW, 170

Leaflets. M.p.  $108^\circ$ . Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ . Spar. sol. pet. ether. Volatile in steam.

$B_2HAuCl_4$ : red leaflets from EtOH. M.p.  $149^\circ$ .

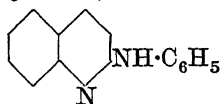
$B_2H_2PtCl_6$ : red needles. M.p.  $202^\circ$ .

*Methiodide*: needles from  $H_2O$ . M.p.  $176-9^\circ$  decomp.

*Picrate*: m.p.  $222^\circ$ .

Fischer, *Ber.*, 1899, 32, 1297.

**2-Anilinoquinoline** ( $\alpha$ -Anilinoquinoline, phenyl-2-quinolylamine)



$C_{15}H_{12}N_2$  MW, 220

Glittering leaflets from EtOH. M.p.  $98^\circ$ .

*Methochloride*: cryst. +  $2H_2O$ . M.p.  $99^\circ$ .

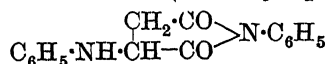
*Methiodide*: yellow cryst. M.p.  $118-19^\circ$ .

Friedländer, Weinberg, *Ber.*, 1885, 18, 1532.

**Anilinosalicylic Acid.**

See Hydroxydiphenylamine-carboxylic Acid.

**Anilinosuccinil** (*N*-Phenylaspartic anil)



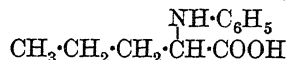
$C_{16}H_{14}O_2N_2$  MW, 266

Needles. M.p.  $211^\circ$ . Sol. AcOH. Spar. sol. cold EtOH. Insol.  $H_2O$ .

Hell, Poliakow, *Ber.*, 1892, 25, 651.

Dict. of Org. Comp.—I.

**1-Anilinovaleric Acid** (*N*-Phenylnorvaline)



$C_{11}H_{15}O_2N$  MW, 193

Cryst. from EtOH.Aq. M.p.  $147-8^\circ$ . Insol.  $H_2O$ .

*Amide*:  $C_{11}H_{16}ON_2$ . MW, 192. Cryst. from  $Et_2O$ -pet. ether. M.p.  $99^\circ$ .

*Nitrile*:  $C_{11}H_{14}N_2$ . MW, 174. Leaflets from pet. ether. M.p.  $51^\circ$ .

Miller, Plöehl, Rampini, *Ber.*, 1892, 25, 2038.

**Anil-pyruvic Acid.**

See under Pyruvic Acid.

**Aniluvitonic Acid.**

See Quinaldine-4-carboxylic Acid.

**Anisacetone.**

See Anisylacetone.

**Anisal-**

See Anisylidene-

**Anisaldehyde** (*p*-Methoxybenzaldehyde)



$C_8H_8O_2$  MW, 136

M.p.  $0^\circ$ . B.p.  $248^\circ$ ,  $199-200^\circ/210$  mm.,  $134-5^\circ/12$  mm.,  $111-14^\circ/4$  mm. Misc. EtOH,  $Et_2O$ .  $D_4^{15}$  1.1191. Volatile in steam. Heat of comb.  $C_p$  967.3 Cal.,  $C_v$  966.7 Cal. Oxidises readily to anisic acid.  $KOH \rightarrow$  anisyl alcohol + anisic acid.  $HNO_3 + H_2SO_4 \rightarrow$  3-nitro and 3:5-dinitro derivs.  $PCl_5 \rightarrow$  anisylidene chloride.  $KCN \rightarrow$  anisoin. Aniline  $\rightarrow$  anisylidene-aniline. Used in perfumery under the name Aubépine.

*anti-Oxime*:  $\alpha$ -anisaldoxime. Two forms. (i) Leaflets. M.p.  $45^\circ$ . (ii) Needles. M.p.  $65^\circ$ . Latter sol. EtOH,  $Et_2O$ ,  $C_6H_6$ .

*syn-Oxime*:  $\beta$ -anisaldoxime. Needles from  $C_6H_6$ . M.p.  $133^\circ$ . Less sol. than  $\alpha$ -form.

*Di-Me-acetal*: b.p.  $253^\circ$ .  $D^{15}$  1.079.

*Cyanhydrin*: see under 4-Hydroxymandelic Acid.

*Semicarbazone*: needles from EtOH, m.p.  $209^\circ$ . Prisms from  $Me_2CO$ , m.p.  $168^\circ$ .

*Phenylsemicarbazone*: needles from EtOH. M.p.  $175-7^\circ$ .

*Hydrazone*: yellow leaflets. M.p.  $167^\circ$ .

*Phenylhydrazone*: needles from EtOH. M.p.  $120-1^\circ$ .

*4-Nitrophenylhydrazone*: m.p.  $161^\circ$ .

*2:4-Dinitrophenylhydrazone*: red leaflets from xylene. M.p.  $254^\circ$ .

*4-Bromophenylhydrazone*: brown leaflets from EtOH. M.p.  $146-7^\circ$ .

*o-Tolylhydrazone*: flakes from EtOH. M.p.  $94^\circ$ .

*m*-Tolylhydrazone: cryst. powder from EtOH. M.p. 111°.

*p*-Tolylhydrazone: yellow leaflets from EtOH. M.p. 136°.

Anil: prisms from EtOH. M.p. 60–2°.

*p*-Bromo-anil: needles from CCl<sub>4</sub>. M.p. 120°.

Tiemann, Herzfeld, *Ber.*, 1877, 10, 63.

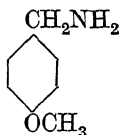
Hinkel, Ayling, Morgan, *J. Chem. Soc.*, 1932, 2795.

Niedzielski, Nord, *J. Am. Chem. Soc.*, 1941, 63, 1462.

### Anisamide.

See under Anisic Acid.

**Anisamine** (*p*-Methoxybenzylamine, anisylamine)



C<sub>8</sub>H<sub>11</sub>ON MW, 137

B.p. 236–7°, 122–4°/14 mm. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Absorbs CO<sub>2</sub> from the air.

*B*, *HCl*: prisms. M.p. 240–1°.

*B*, *HI*: m.p. 183–4°.

*B*, C<sub>6</sub>H<sub>5</sub>COOH: m.p. 135°.

*B*<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>: golden leaflets. M.p. 210°.

*N*-Acetyl: acetanisamine, anisylacetamide. Needles. M.p. 96°.

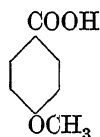
Tiffeneau, *Bull. soc. chim.*, 1911, 9, 819.

Ingold, Shoppee, *J. Chem. Soc.*, 1929, 1202.

### Anise Ketone.

See Anisylacetone.

**Anisic Acid** (*p*-Methoxybenzoic acid)



C<sub>8</sub>H<sub>8</sub>O<sub>3</sub> MW, 152

Needles or prisms. M.p. 184°. B.p. 275–80°. Sol. 2500 parts H<sub>2</sub>O at 18°. Mod. sol. hot H<sub>2</sub>O. Sol. EtOH, Et<sub>2</sub>O. Heat of comb. C<sub>p</sub> 895 Cal., C<sub>v</sub> 894 Cal., *k* = 3.2 × 10<sup>-5</sup> at 25°. Conc. HI → *p*-hydroxybenzoic acid. CaO → anisole.

*Me* ester: C<sub>9</sub>H<sub>10</sub>O<sub>3</sub>. MW, 166. Flakes from EtOH or Et<sub>2</sub>O. M.p. 48°. B.p. 256°.

*Et* ester: C<sub>10</sub>H<sub>12</sub>O<sub>3</sub>. MW, 180. M.p. 7–8°. B.p. 263°.

*n*-Propyl ester: C<sub>11</sub>H<sub>14</sub>O<sub>3</sub>. MW, 194. B.p. 176°/45 mm.

*n*-Butyl ester: C<sub>12</sub>H<sub>16</sub>O<sub>3</sub>. MW, 208. B.p. 183°/40 mm.

*Isobutyl* ester: b.p. 170°/46 mm.

*Isoamyl* ester: C<sub>13</sub>H<sub>18</sub>O<sub>3</sub>. MW, 222. B.p. 188°/30 mm.

*Phenyl* ester: C<sub>14</sub>H<sub>12</sub>O<sub>3</sub>. MW, 228. M.p. 75–6°.

4-Nitrobenzyl ester: C<sub>15</sub>H<sub>13</sub>O<sub>5</sub>N. MW, 287. M.p. 132°.

*Chloride*: anisoyl chloride. C<sub>8</sub>H<sub>7</sub>O<sub>2</sub>Cl. MW, 170.5. M.p. 22°. B.p. 160–4°/35 mm., 145°/14 mm.

*Anhydride*: C<sub>16</sub>H<sub>14</sub>O<sub>5</sub>. MW, 286. M.p. 99°. Sol. EtOH, Et<sub>2</sub>O.

*Amide*: anisamide. C<sub>8</sub>H<sub>9</sub>O<sub>2</sub>N. MW, 151. Needles or tablets from H<sub>2</sub>O. M.p. 163°. B.p. 295°. Spar. sol. Et<sub>2</sub>O.

*Nitrile*: anisonitrile. C<sub>8</sub>H<sub>7</sub>ON. MW, 133. M.p. 61–2°. B.p. 256–7° (240°). Sol. EtOH, Et<sub>2</sub>O. Mod. sol. hot H<sub>2</sub>O.

*Anilide*: leaflets from C<sub>6</sub>H<sub>6</sub>. M.p. 171°.

*Anisidide*: leaflets from EtOH. M.p. 202°.

*p*-Tolylhydrazide: needles from EtOH. M.p. 158°.

Rosel, *Ann.*, 1869, 151, 31.

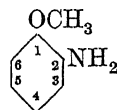
Korczynski, Fandrich, *Chem. Abstracts*, 1927, 21, 77.

Sah, Yuin, *Chem. Abstracts*, 1947, 41, 5869.

### Anisic Ketone.

See Anisylacetone.

***o*-Anisidine** (*o*-Aminophenol methyl ether, *o*-methoxyaniline, *o*-aminoanisole)



C<sub>7</sub>H<sub>9</sub>ON MW, 123

M.p. 5°. B.p. 225°. Volatile in steam. D<sub>4</sub><sup>25</sup> 1.0978. *k* = 1.9 × 10<sup>-10</sup> at 15°.

*N*-Formyl: m.p. 83.5°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, hot H<sub>2</sub>O.

*N*-Acetyl: *o*-acetanisidide. Pearly cryst. M.p. 87–8°. B.p. 303–5°. Sol. hot H<sub>2</sub>O, AcOH. 100 parts EtOH diss. 55 parts at 21°. *k* = 1.9 × 10<sup>-10</sup> at 15°.

*N*-Benzoyl: see under *o*-Hydroxybenzanilide.

Vermeulen, *Rec. trav. chim.*, 1906, 25, 20.

Zuckermann, *Chem. Zentr.*, 1926, I, 3317.

Tcherniac, *Chem. Abstracts*, 1929, 23, 1908.

***m*-Anisidine** (*m*-Aminophenol methyl ether, *m*-methoxyaniline, *m*-aminoanisole).

B.p. 251°.

*N*-Formyl: prisms. M.p. 57°.

*N*-Acetyl: *m*-acetanisidide. M.p. 81°.

*N*-*p*-Toluenesulphonyl: needles. M.p. 68°.

*Picrate*: yellow needles. M.p. 169° decomp.

Reverdin, Luc, *Ber.*, 1914, 47, 1537.

***p*-Anisidine** (*p*-Aminophenol methyl ether, *p*-methoxyaniline, *p*-aminoanisole).

Rhombic plates. M.p. 57°. B.p. 246°. D<sub>4</sub><sup>25</sup> 1.071. *k* = 1.5 × 10<sup>-9</sup> at 25°. Heat of comb.

C<sub>p</sub> 928 Cal., C<sub>v</sub> 927.3 Cal.

*B*<sub>1</sub>(COOH)<sub>2</sub>: m.p. 186°.

*B*<sub>2</sub>(COOH)<sub>2</sub>: m.p. 199°.

$B, (CH_2 \cdot COOH)_2$ : m.p. 125°.

$B, C_6H_5OH$ : prisms from  $Et_2O$ . M.p. 60°.

*N-Formyl*: m.p. 81°.

*N-Acetyl*: *p*-acetanidide, methacetin. Plates from  $H_2O$ . M.p. 130–2°. Sol. EtOH. Spar. sol. cold  $H_2O$ . Antipyretic and antineuralgic.

*N-Benzoyl*: see under *p*-Hydroxybenzanilide.

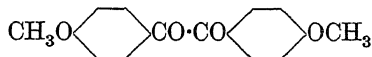
Blanksma, *Rec. trav. chim.*, 1909, 28, 107.

Körner, Wender, *Gazz. chim. ital.*, 1887, 17, 493.

Reverdin, Bucky, *Ber.*, 1906, 39, 2689.

Schwenk *et al.*, *J. Org. Chem.*, 1944, 9, 1.

**Anisil** (*pp'*-Dimethoxybenzil, 4 : 4'-dihydroxy-dibenzoyl dimethyl ether, 4 : 4'-dimethoxydiphenylglyoxal)



$C_{16}H_{14}O_4$  MW, 270

Golden-yellow needles. M.p. 133°. Distils unchanged. Spar. sol. cold EtOH. Alc. KOH → anisilic and anisic acids.

*Monoxime*: m.p. 133°. Sol.  $Et_2O$ ,  $C_6H_6$ .

syn.-*Dioxime*: cryst. powder. M.p. 217°.

Insol. EtOH,  $Et_2O$ ,  $C_6H_6$ . *Diacetyl*: prisms. M.p. 139°.

anti-*Dioxime*: needles from  $C_6H_6$ . M.p. 195°. Sol. EtOH, AcOH. *Diacetyl*: m.p. 130°.

*Disemicarbazone*: leaflets from dil. AcOH. M.p. 254–5°.

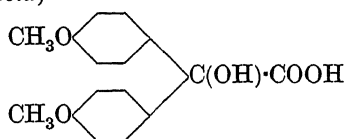
*Dihydrazone*: m.p. 118°.

Staudinger, Schlenker, Goldstein, *Helv.*

*Chim. Acta*, 1921, 4, 341.

Klein, *J. Am. Chem. Soc.*, 1941, 63, 1474.

**Anisilic Acid** (*p* : *p'*-Dimethoxydiphenylglycollic acid)



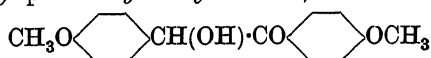
$C_{16}H_{16}O_5$  MW, 288

Needles from EtOH. M.p. 164°. Sol. EtOH. Spar. sol.  $H_2O$ . Ox. → 4 : 4'-dimethoxybenzophenone.

*Me ester*:  $C_{17}H_{18}O_5$ . MW, 302. Cryst. from  $C_6H_6$ -petrol. M.p. 110–11°.

Bösler, *Ber.*, 1881, 14, 327.

**Anisoin** (*pp'*-Dimethoxybenzoin, *p*-methoxyphenyl-*p*-methoxybenzoylcarbinol)



$C_{16}H_{16}O_4$  MW, 272

Prisms. M.p. 113°. Sol. hot EtOH. Spar. sol.  $Et_2O$ , hot  $H_2O$ . Conc.  $H_2SO_4$  → green sol., warm → yellow, then purple. Ox. → anisil.

*Me ether*:  $C_{17}H_{18}O_4$ . MW, 286. Yellow prisms from  $CCl_4$ . M.p. 52–3°. Sol.  $Et_2O$ ,  $Me_2CO$ ,  $C_6H_6$ .

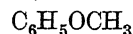
*Et ether*:  $C_{19}H_{20}O_4$ . MW, 300. Cryst. from EtOH.Aq. M.p. 103–4°.

*Acetyl*: m.p. 93·5°.

*Semicarbazone*: prisms from EtOH.Aq. M.p. 185° (rapid heat.) decomp.

Bösler, *Ber.*, 1881, 14, 327.

**Anisole** (*Phenol methyl ether, methyl phenyl ether, methoxybenzene*)



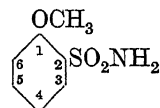
$C_7H_8O$  MW, 108

M.p. – 37·5°. B.p. 155°. Sol. EtOH,  $Et_2O$ . Insol.  $H_2O$ .  $D_{15}^{20}$  0·9988.  $n_D^{20}$  1·51961. Heat of comb.  $C_p$  905·5 Cal.,  $C_v$  904·6 Cal. Mol. b.p. elevation, 45·02. Heat at 400° → phenol + ethylene. HI at 130° → phenol.

*Picrate*: yellow. M.p. 78–81°.

Hiers, Hager, *Organic Syntheses*, Collective Vol. I, 50.

**Anisole-*o*-sulphonamide**



$C_7H_9O_3NS$  MW, 187

Needles from  $H_2O$ . M.p. 171° (169°). Sol. EtOH, hot  $H_2O$ .

Shober, *Am. Chem. J.*, 1896, 18, 860.

**Anisole-*m*-sulphonamide.**

Needles. M.p. 128°.

Shober, Kiefer, *Am. Chem. J.*, 1895, 17, 456.

**Anisole-*p*-sulphonamide.**

Needles from  $H_2O$ . M.p. 113° (116°). Sol. EtOH. Insol. cold  $H_2O$ .

Shober, *Am. Chem. J.*, 1896, 18, 860.

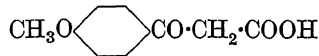
**Anisole-2 : 4 : 6-tricarboxylic Acid.**

See under Hydroxytrimesic Acid.

**Anisonitrile.**

See under Anisic Acid.

**Anisoylactic Acid** (*p*-Methoxybenzoylactic acid)



$C_{10}H_{10}O_4$  MW, 194

M.p. 180° decomp.

*Me ester*:  $C_{11}H_{12}O_4$ . MW, 208. Pale yellow cryst. M.p. 27–8°. B.p. 190–2°/10 mm. *Isonitroso deriv.*: m.p. 154°. *Cu deriv.*: green cryst. M.p. 248–50°.

*Et ester*:  $C_{12}H_{14}O_4$ . MW, 222. Pale yellow liq. B.p. 180–90°/10–12 mm. with part decomp. to anisoyldehydracetic acid (155°/4·5 mm.; 147°/2·5 mm.). Sol. EtOH,  $Et_2O$ . Insol.  $H_2O$ .  $FeCl_3$  → violet col. *Isonitroso deriv.*: m.p.

113–14°. *Cu deriv.*: green cryst. from  $\text{CHCl}_3$ – $\text{EtOH}$ . M.p. 210°.

Wahl, Silberzweig, *Bull. soc. chim.*, 1912, 11, 25.

Wallingford, Homeyer, U.S.P., 2,407,942, (*Chem. Abstracts*, 1947, 41, 1699).

### o-Anisoylbenzoic Acid.

See under 4'-Hydroxybenzophenone-2-carboxylic Acid.

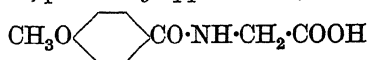
### Anisoylcarbinol.

See under *p*-Hydroxyphenacyl Alcohol.

### Anisoyl chloride.

See under Anisic Acid.

**Anisoylglycine** (*p*-Methoxybenzoylaminoacetic acid, *p*-methoxyhippuric acid, *anisuric acid*)



$\text{C}_{10}\text{H}_{11}\text{O}_4\text{N}$  MW, 209

Prisms from  $\text{H}_2\text{O}$ . M.p. 171°. Sol. hot  $\text{H}_2\text{O}$ . Insol.  $\text{Et}_2\text{O}$ . Heat of comb.  $\text{C}_p$  and  $\text{C}_v$  1136 Cal.

*Et ester*:  $\text{C}_{12}\text{H}_{15}\text{O}_4\text{N}$ . MW, 237. Needles from  $\text{EtOH}$ . M.p. 98–9°. ♂

Matsuo, *J. Biol. Chem.*, 1918, 35, 292.

### $\beta$ -Anisoylstyrene.

See under 4'-Hydroxychalkone.

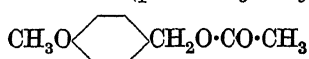
### Anisuric Acid.

See Anisoylglycine.

### Anisylacetamide.

See under Anisamine.

### Anisyl acetate (*p*-Methoxybenzyl acetate)



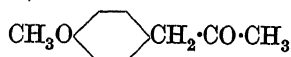
$\text{C}_{10}\text{H}_{12}\text{O}_3$  MW, 180

B.p. 260–5°, 137–9°/12 mm., 115–20°/4 mm.  $D_4^{20}$  1.1014.  $n_D^{20}$  1.515.

Tiffeneau, Fuhrer, *Bull. soc. chim.*, 1914, 15, 169.

Ofuer, *Helv. Chim. Acta*, 1935, 18, 951.

**Anisylacetone** (*Methyl p*-methoxybenzyl ketone, *anisacetone*, *anisic ketone*, *anise ketone*, *p*-acetonylanisole, *methyl anisyl ketone*. Note.—*This is the commonly accepted trivial name for this compound. According to our system of nomenclature it is not anisylacetone but p*-methoxyphenylacetone)



$\text{C}_{10}\text{H}_{12}\text{O}_2$  MW, 164

B.p. 267–9°, 142°/14 mm., 117–22°/5–6 mm. Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ . Spar. sol.  $\text{H}_2\text{O}$ .  $D_{17}^{20}$  1.0707.  $D_4^{15}$  1.067.  $n_D^{15}$  1.5282.  $n_D^{20}$  1.5253. Spar. volatile in steam. Ox.  $\rightarrow$  anisic acid.

*Oxime*: two forms. (i) M.p. 78–9°. Spar. sol. pet. ether. (ii) M.p. 61–2° (63–5°). B.p. 158–62°/6 mm. Sol. pet. ether.

*Semicarbazone*: m.p. 178° (182°).

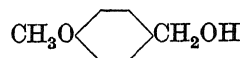
Le Brazidec, *Bull. soc. chim.*, 1922, 31, 255.

Savitskii, Makhnenko, *Chem. Abstracts*, 1941, 35, 4356.

Doeuivre, Chervet, *Compt. rend.*, 1947, 224, 660.

Hoover, Hass, *J. Org. Chem.*, 1947, 12, 501.

**Anisyl Alcohol** (*p*-Methoxybenzyl alcohol, *anisalcohol*)



$\text{C}_8\text{H}_{10}\text{O}_2$  MW, 138

Needles. M.p. 24–5°. B.p. 259°, 127–30°/8 mm.  $D_4^{15}$  1.1129. Heat in air  $\rightarrow$  anisaldehyde. Ox.  $\rightarrow$  anisaldehyde  $\rightarrow$  anisic acid. Esters used in perfumery.

*Me ether*:  $\text{C}_9\text{H}_{12}\text{O}_2$ . MW, 152. B.p. 225–6°. *Benzoyl*: anisyl benzoate. Prisms or needles. M.p. 38°.

*Phenylurethane*: cryst. from  $\text{C}_6\text{H}_6$ . M.p. 93°.

Carothers, Adams, *J. Am. Chem. Soc.*, 1924, 46, 1675.

Sosa, *Ann. chim.*, 1940, 14, 5.

### Anisylamine.

See Anisamine.

**Anisylideneacetone** (*p*-Methoxybenzylideneacetone, *methyl p*-methoxystyryl ketone, *anisalacetone*)



$\text{C}_{11}\text{H}_{12}\text{O}_2$  MW, 176

Leaflets from  $\text{MeOH}$ ,  $\text{Et}_2\text{O}$ , or  $\text{AcOEt}$ . M.p. 73°. Sol.  $\text{C}_6\text{H}_6$ ,  $\text{AcOH}$ . Sol.  $\text{HCl}$  and  $\text{H}_2\text{SO}_4$  to yellow sols. Red.  $\rightarrow$  *p*-methoxybenzylacetone.  $\text{HNO}_3 + \text{H}_2\text{SO}_4 \rightarrow$  3-nitro deriv. Gives add. products with  $\text{HCl}$ ,  $\text{H}_3\text{PO}_4$  and  $\text{H}_2\text{SO}_3$ .

*Oxime*: needles from  $\text{EtOH}$ . M.p. 119–20°.

Baeyer, Villiger, *Ber.*, 1902, 35, 1191.

Kohler, Chadwell, *Organic Syntheses*, 1930, X, 115.

**Anisylideneacetophenone** (*p*-Methoxychalkone, *phenyl p*-methoxystyryl ketone, *anisalacetophenone*)



$\text{C}_{16}\text{H}_{14}\text{O}_2$  MW, 238

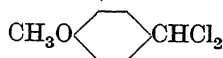
Yellow needles. M.p. 77–8° (74°). B.p. 187.5–188°/19 mm. Sol.  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ , hot  $\text{EtOH}$ . Gives add. products with  $\text{HCl}$ ,  $\text{HClO}_4$ , and  $\text{SnCl}_4$ .

*Picrate*: orange needles. M.p. 87°. Decomp. by  $\text{H}_2\text{O}$ .

*Semicarbazone*: m.p. 215°.

Pond, Shoffstall, *J. Am. Chem. Soc.*, 1900, 22, 666.

**Anisylidene chloride** (*p*-Methoxybenzylidene chloride, *anisal chloride*)



$C_8H_8OCl_2$  MW, 191

M.p. 20°. B.p. 130–2°/13 mm. Darkens and decomp. on standing.  $H_2O$  or alkalis  $\rightarrow$  anisaldehyde.

Schmidt, *Ber.*, 1908, **41**, 2331.

**Anisylidenenitromethane.**

See under  $\beta$ -Nitro-4-hydroxystyrene.

**1-Anisylidenepropionic Acid.**

See under  $\alpha$ -Methyl-*p*-coumaric Acid.

**Annotinine**

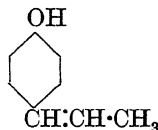
$C_{16}H_{21}O_3N$  MW, 275

Alkaloid found in *Lycopodium annotinum*, Linn. Prisms from  $CHCl_3$ -MeOH. M.p. 232°.

Perchlorate: cryst. from  $H_2O$ . M.p. 267°.

Manske, Marion, *Can. J. Research*, 1943, **21B**, 92.

**Anol** (*p*-Propenylphenol, *p*-hydroxy- $\beta$ -methylstyrene)



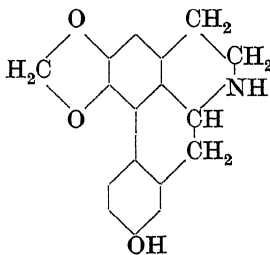
$C_9H_{10}O$  MW, 134

Leaflets from  $H_2O$ . M.p. 93°. B.p. 140°/14 mm. Decomp. on dist. at ord. press. at 250°. Decomp. on standing in air. Sol. most org. solvents. Sol. alkalis.

*Me ether*: see Anethole.

Quelet, *Bull. soc. chim.*, 1929, **45**, 268.

**Anolobine**



$C_{17}H_{15}O_3N$  MW, 281

Alkaloid from bark of *Asimina tribolba*. Cryst. from  $CHCl_3$ -MeOH. M.p. 262°.  $[\alpha]_D^{27}$  -22.5° in  $CHCl_3$ -MeOH.

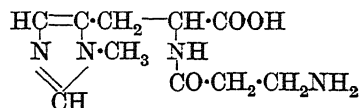
*Me ether*: m.p. 97°.  $[\alpha]_D^{27}$  -27.9° in MeOH.

*Di-Me deriv.*:  $B, HCl$ , m.p. 266° decomp. *Picrate*: prisms from  $Me_2CO$ -MeOH. M.p. 226°. *Methiodide*: prisms from MeOH. M.p. 241°.

Manske, *Can. J. Research*, 1938, **16B**, 76. Govindachari, *Chem. Abstracts*, 1941, **35**, 6963.

Marion, *J. Am. Chem. Soc.*, 1944, **66**, 1125.

**Anserine** ( $\beta$ -Alanylmethylhistidine)



$C_{10}H_{16}O_3N_4$  MW, 240

Constituent of avian musculature. Needles. M.p. 238–9°. Sol.  $H_2O$ . Mod. sol. MeOH. Spar. sol. EtOH.  $[\alpha]_D^{15} + 11.26^\circ$  in  $H_2O$ . Heat with 20%  $H_2SO_4 \rightarrow$  *l*-methylhistidine and  $\beta$ -alanine.

*Cu deriv.*:  $C_{10}H_{16}O_4N_4Cu$ . M.p. 230–2° decomp.

$B, HNO_3$ : m.p. 216–18° decomp.

$B, H_2PtCl_6$ : m.p. 215–20° decomp.

$B, 2HAuCl_4$ : m.p. 90–5°.

*Et ester*:  $B, H_2PtCl_6$ : m.p. 225–30°.

*Monopicrate*: m.p. 205–8° decomp.

Linneweh, Linneweh, *Z. physiol. Chem.*, 1930, **189**, 80.

Eggleton, Eggleton, *Nature*, 1932, **130**, 275.

Ackermann, Timpe, Pollet, *Z. physiol. Chem.*, 1929, **183**, 1.

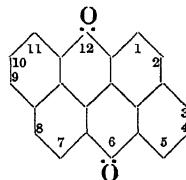
**Antabuse.**

See Tetraethylthiuram disulphide.

**Anthanthrene.**

See Dibenz-[cd, jk]-pyrene.

**Anthanthrone**



$C_{22}H_{10}O_2$  MW, 306

Orange cryst. from  $PhNO_2$ . M.p. 300°. Mod. sol. hot aniline, hot  $PhNO_2$ . Spar. sol.  $Et_2O$ , EtOH, AcOH,  $C_6H_6$ . Sublimes with part. decomp. Green in conc.  $H_2SO_4$  + AcOH.

Kalb, *Ber.*, 1914, **47**, 1724.

Cassella, *B.P.*, 280,217, (*Chem. Zentr.*, 1928, I, 1102.).

**Anthemene**

$C_{30}H_{62}$  MW, 422

Hydrocarbon constituent of *Anthemis nobilis*, Linn. Laminæ from  $Et_2O$ . M.p. 64°. B.p. 440°. Sol.  $Et_2O$ ,  $CS_2$ . Spar. sol. cold EtOH.  $D^{15} 0.942$ .

Klobb, Garnier, Ehrwein, *Bull. soc. chim.*, 1910, **7**, 948.

**Anthemol**

$C_{10}H_{15}OH$

$C_{10}H_{16}O$  MW, 152

Alcohol and esters occur in Roman camomile oil. Syrupy liq. B.p. 214° slight decomp. Dil.  $\text{HNO}_3 \rightarrow$  *p*-toluic and terephthalic acids. Acetyl: b.p. 234-6°.

Köbig, *Ann.*, 1879, 195, 92.

### Antheraxanthin

$\text{C}_{40}\text{H}_{56(58)}\text{O}_3$  MW, 584 (586)

Carotenoid pigment from anthers of *Lilium tigrinum*. Pale yellow leaflets from EtOH. M.p. 207°. Hypophasic. Prac. insol. pet. ether.  $\text{SbCl}_3$  in  $\text{CHCl}_3 \rightarrow$  blue col. (max. 587  $\mu$ ). Absorption maxima in  $\text{CS}_2$ , 512.5, 481, 448  $\mu$ ; in  $\text{CHCl}_3$ , 490.5, 460.5, 428  $\mu$ .

Karrer, Oswald, *Helv. Chim. Acta*, 1935, 18, 1303.

Karrer, Jucker, *Helv. Chim. Acta*, 1945, 28, 300.

### Anthorine

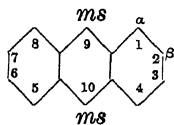
$\text{C}_{22}\text{H}_{31}\text{O}_2\text{N}$  MW, 341

Alkaloid found in *Acconitum anthora*, Linn. Sol.  $\text{Et}_2\text{O}$ .

*B, HCl*: m.p. 335°.  $[\alpha]_D +24.44^\circ$ .

Goris, Métin, *Compt. rend.*, 1925, 180, 968.  
Goris, *Compt. rend.*, 1937, 205, 1007.

### Anthracene



$\text{C}_{14}\text{H}_{10}$  MW, 178

Colourless plates from EtOH. M.p. 216.1°. B.p. 339.9°. 100 parts EtOH dissolve 0.076 part at 16°, 0.83 part at b.p. Sol. to 1.175% in  $\text{Et}_2\text{O}$ , 1.736% in  $\text{CHCl}_3$ , 1.478% in  $\text{CS}_2$ , 0.444% in AcOH, 0.115% in ligroin, 1.296% in  $\text{C}_6\text{H}_6$ , all at 15°. 100 parts toluene dissolve 0.92 part at 16°, 12.94 parts at b.p. Sol.  $\text{PhNO}_2$ . Sol. to 7% in  $\text{C}_6\text{H}_6$  at 80°, to 1.8% in MeOH at 20°, to 0.8% in Py.  $D_{25}^{20}$  1.283. Cryst. and liq. anthracene and its sols. exhibit weak violet fluor. Heat of comb.  $C_p$  1707.6 Cal. Triboluminescent. Sp. heat 0.361 (20-210°). Vapour pressure 0.045 mm./100°, 1.36 mm./150°, 18.6 mm./200°, 43.5 mm./220°, 99.6 mm./250°, 211 mm./280°, 332 mm./300°, 503 mm./320°. Sublimes in vacuo.  $\text{CrO}_3$ ,  $\text{NaClO}_3$ ,  $\text{V}_2\text{O}_5 \rightarrow$  anthraquinone.  $\text{HNO}_3$  in AcOH +  $\text{Ac}_2\text{O} \rightarrow$  *ms*-nitro-, and dinitro-anthracene.  $\text{Na} + \text{EtOH} \rightarrow$  9:10-dihydro deriv.  $\text{Cl}$  at 100°  $\rightarrow$  9:10-dichloro deriv. Br in  $\text{CS}_2$  at 0°  $\rightarrow$  9:10-dibromo deriv. Conc.  $\text{H}_2\text{SO}_4$  at 100°  $\rightarrow$  1:5- and 1:8-disulphonic acids. Polymerises to dianthracene, best by exposing xylene sol. to light.

sym.-*Trinitrobenzene add. comp.*: red needles. M.p. 164°.

*Trinitrotoluene add. comp.*: red needles. M.p. 162°.

*Picrate*: m.p. 138°.

Nanson, *Textile Colorist*, 1926, 48, 605, 678, 751; 1927, 49, 19, 246, 557, 593.

Jaeger, *Ind. Eng. Chem.*, 1928, 20, 1330.

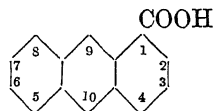
### Anthracene-9-aldehyde.

See Anthraldehyde.

### Anthraceneazine.

See Anthrazine.

**Anthracene-1-carboxylic Acid** (*Anthracene- $\alpha$ -carboxylic acid,  $\alpha$ -anthroic acid*)



$\text{C}_{15}\text{H}_{10}\text{O}_2$  MW, 222

Yellow needles from AcOH. Yellow prisms from EtOH or AcOEt. M.p. 251-2°. Mod. sol. hot EtOH. Spar. sol.  $\text{C}_6\text{H}_6$ ,  $\text{CHCl}_3$ . Insol.  $\text{H}_2\text{O}$ . Sol. alkalis to sols. showing blue fluor. Sublimes.  $\text{CaO} \rightarrow$  anthracene.

*Me ester*:  $\text{C}_{16}\text{H}_{12}\text{O}_2$ . MW, 236. Yellow plates from AcOH. M.p. 108° (101-2°).

*Phenyl ester*:  $\text{C}_{21}\text{H}_{14}\text{O}_2$ . MW, 298. Yellow. M.p. 207-9°.

*Amide*:  $\text{C}_{15}\text{H}_{11}\text{ON}$ . MW, 221. Leaflets or needles from EtOH. M.p. 260°.

*Nitrile*: 1-cyanoanthracene. Glassy yellow leaflets. M.p. 126°. Very sol. EtOH.

Liebermann, Pleus, *Ber.*, 1904, 37, 648.

Coulson, *J. Chem. Soc.*, 1930, 133, 1930.

**Anthracene-2-carboxylic Acid** (*Anthracene- $\beta$ -carboxylic acid,  $\beta$ -anthroic acid*).

Yellow leaflets from EtOH. M.p. 281°. Sol. EtOH and AcOH but less so than the 1-carboxylic acid. Spar. sol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Insol.  $\text{H}_2\text{O}$ . Sol. alkalis to sols. showing blue fluor. Sublimes in leaflets and needles.  $\text{CaO} \rightarrow$  anthracene.

*Et ester*:  $\text{C}_{17}\text{H}_{14}\text{O}_2$ . MW, 250. Leaflets. M.p. 134-5°. Dist. undecomp.

*Amide*: yellow scales from AcOH. Yellow needles from EtOH. M.p. 293-5°. Spar. sol. EtOH.

Barnett, Cook, Grainger, *Ber.*, 1924, 57, 1775.

**Anthracene-9-carboxylic Acid** (*Anthracene-10-carboxylic acid, ms-anthracenecarboxylic acid, ms-anthroic acid*).

Pale yellow needles from EtOH. M.p. 207° decomp. (206°). Sol. EtOH. Spar. sol. hot  $\text{H}_2\text{O}$ . Loses  $\text{CO}_2$  at 150-60°, or with  $\text{CaO} \rightarrow$  anthracene.  $\text{CrO}_3 \rightarrow$  anthraquinone.

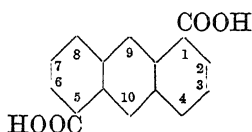


*Me ester* : yellow prisms or tablets. M.p. 111°. *Nitrile* : 9-(10)-cyanoanthracene. Cryst. from ligroin. M.p. 170-2°.

Karrer, Zeller, *Helv. Chim. Acta*, 1919, 2, 482.

Dufraisse, Rigandy, *Compt. rend.*, 1945, 221, 625.

## Anthracene-1 : 5-dicarboxylic Acid



$C_{16}H_{10}O_4$  MW, 266

Yellow needles. M.p. above 360°. Spar. sol. AcOH, hot  $H_2O$ .

*Di-Et ester* :  $C_{20}H_{18}O_4$ . MW, 322. Pale yellow plates from EtOH, AcOH, or  $C_6H_6$ . M.p. 185°.

Coulson, *J. Chem. Soc.*, 1930, 1931.

## Anthracene-1 : 9-dicarboxylic Acid.

Pale yellow cryst. Ox.  $\rightarrow$  anthraquinone-1-carboxylic acid.

*Di-Me ester* :  $C_{18}H_{14}O_4$ . MW, 294. M.p. 149°.

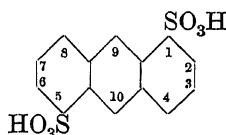
*Anhydride* :  $C_{16}H_8O_3$ . MW, 248. Orange cryst. from AcOH. M.p. 289-90°. Red in conc.  $H_2SO_4$ .

*Imide* :  $C_{16}H_9O_2N$ . MW, 247. Yellow needles from AcOH. M.p. 293-4°. Red in conc.  $H_2SO_4$  with some fluor.

Kardos, *Ber.*, 1913, 46, 2086.

Badische, D.R.P., 280,092, (*Chem. Abstracts*, 1915, 9, 1396).

## Anthracene-1 : 5-disulphonic Acid



$C_{14}H_{10}O_6S_2$  MW, 338

*Dichloride* :  $C_{14}H_8O_4S_2Cl_2$ . MW, 375. Yellow needles from  $C_6H_6$ . M.p. 249°.

*Diamide* :  $C_{14}H_{12}O_4N_2S_2$ . MW, 336. Yellow needles. M.p. above 330°.

*Dianilide* : m.p. 293°.

Lampe, *Ber.*, 1909, 42, 1413.

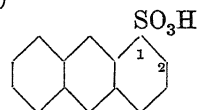
## Anthracene-1 : 8-disulphonic Acid.

*Dichloride* : yellow needles from  $C_6H_6$ . M.p. 225°.

*Diamide* : m.p. 333°.

*Dianilide* : m.p. 224°.

Lampe, *Ber.*, 1909, 42, 1413.

Anthracene-1-sulphonic Acid (*Anthracene- $\alpha$ -sulphonic acid*)

$C_{14}H_{10}O_3S$  MW, 258

*Chloride* :  $C_{14}H_9O_2SCl$ . MW, 276.5. Cryst. M.p. 90°.

*Amide* :  $C_{14}H_{11}O_2NS$ . MW, 257. Cryst. from  $PhNO_2$ . M.p. 205°.

Ferrero, Conzetti, *Helv. Chim. Acta*, 1928, 11, 1153.

Anthracene-2-sulphonic Acid (*Anthracene- $\beta$ -sulphonic acid*).

Sol. hot  $H_2O$ . Spar. sol. EtOH. Insol.  $Et_2O$ ,  $C_6H_6$ ,  $CHCl_3$ . Na salt spar. sol. cold  $H_2O$ .

*Me ester* :  $C_{15}H_{12}O_3S$ . MW, 272. Yellow leaflets. M.p. 157°.

*Et ester* :  $C_{16}H_{14}O_3S$ . MW, 286. M.p. 160°.

*Chloride* : yellow cryst. from toluene. M.p. 122°. Spar. sol. EtOH,  $Et_2O$ , ligroin. Stable to  $H_2O$ .

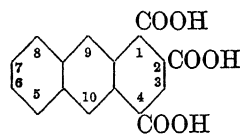
*Amide* : m.p. 261°. Sol.  $PhNO_2$ , phenol. Insol. EtOH,  $Et_2O$ , AcOH,  $C_6H_6$ .

*Anilide* : leaflets. M.p. 201°.

*Phenylhydrazide* : m.p. 210°.

Liebermann, *Ann.*, 1882, 212, 57.

## Anthracene-1 : 2 : 4-tricarboxylic Acid



$C_{17}H_{10}O_6$  MW, 310

Yellow. Indefinite m.p. Sol. EtOH. Spar. sol.  $C_6H_6$ , petrol. Insol.  $H_2O$ .

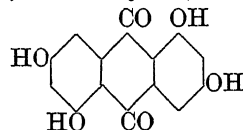
Elbs, *J. prakt. Chem.*, 1890, 41, 129.

## Anthracene-1 : 5 : 9-tricarboxylic Acid.

M.p. about 360°.

I.G., D.R.P., 642,717, (*Chem. Abstracts*, 1937, 31, 6256).

## Anthrachrysin (1 : 3 : 5 : 7-Tetrahydroxy-anthraquinone, anthrachryson)



$C_{14}H_8O_6$  MW, 272

Silky yellow needles +  $2H_2O$ . M.p. above 360°. Sol. AcOH. Mod. sol. EtOH,  $Me_2CO$ . Spar. sol.  $Et_2O$ ,  $C_6H_6$ ,  $CHCl_3$ , ligroin,  $CS_2$ . Insol.  $H_2O$ . Sublimes with part. decomp. Zn dust  $\rightarrow$  anthracene. Yellowish-red in conc.  $H_2SO_4$ .

*Di-Me ether*:  $C_{18}H_{12}O_6$ . MW, 300. Bronze leaflets from aniline. M.p. 280–3°. *Acetyl deriv.*: yellow needles from AcOH–Ac<sub>2</sub>O. M.p. 256°.

*Tri-Me ether*:  $C_{17}H_{14}O_6$ . MW, 314. Yellow needles from AcOH. M.p. 225°. *Acetyl*: yellow needles. M.p. 220°.

*Tetra-Me ether*:  $C_{18}H_{16}O_6$ . MW, 328. Golden prisms from PhNO<sub>2</sub>. M.p. 294°.

*Tetra-acetyl*: needles. M.p. 253°.

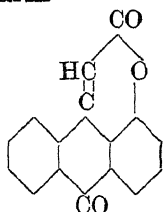
Hirose, *Ber.*, 1912, **45**, 2476.

Hohenemser, *Ber.*, 1902, **35**, 2305.

### Anthrachryson.

See Anthrachrysin.

### Anthracoumarin



$C_{16}H_8O_3$

MW, 248

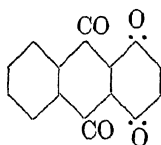
Yellow needles from AcOH. M.p. 260°. Sol.  $C_6H_6$ , hot AcOH. Sol. hot alkalis with yellow col. and green fluor. Spar. sol. EtOH. Sol.  $H_2SO_4$  with green fluor. Sublimes.

Kostanecki, *Ber.*, 1887, **20**, 3141.

### Anthradiamine.

See Diaminoanthracene.

### 1 : 4 : 9 : 10-Anthradiquinone



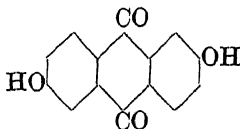
$C_{14}H_6O_4$

MW, 238

Yellow needles from  $C_6H_6$ –ligroin. M.p. 211–13° decomp. (rapid heat.). Sol. EtOH, Me<sub>2</sub>CO, CHCl<sub>3</sub>,  $C_6H_6$ . Spar. sol. ligroin. Unstable. SO<sub>2</sub> → quinizarin. Warm conc.  $H_2SO_4$  → purpurin.

Dimroth, Schultze, *Ann.*, 1916, **411**, 345.

### Anthraflavic Acid (2 : 6-Dihydroxyanthraquinone)



$C_{14}H_8O_4$

MW, 240

Yellow needles from EtOH. M.p. above 330°. Spar. sol. EtOH, AcOH. Insol. Et<sub>2</sub>O,  $C_6H_6$ , CHCl<sub>3</sub>. Sol. conc.  $H_2SO_4$  → yellow sol. Reddish-yellow sols. in alkalis. Conc. KOH → flavopurpurin.

*Di-Me ether*:  $C_{16}H_{12}O_4$ . MW, 268. Yellow needles from  $C_6H_6$ . M.p. 250°. Sol. conc.  $H_2SO_4$  → orange-yellow sol.

*Di-Et ether*:  $C_{18}H_{16}O_4$ . MW, 296. Yellow needles from EtOH. Sol. conc.  $H_2SO_4$  → red sol.

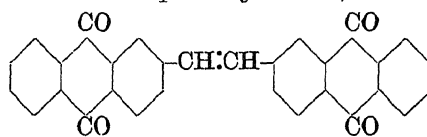
*Diacetyl*: cryst. from AcOH. M.p. 228–9°.

*Dibenzoyl*: needles from AcOH. M.p. 275°.

Schunck, Römer, *Ber.*, 1878, **11**, 969.

M.L.B., D.R.P., 106,505, (*Chem. Zentr.*, 1900, I, 741).

### Anthraflavone (2 : 2'-Dianthraquinonylethylene, 3 : 4 : 3' : 4'-diphthaloylstilbene)



$C_{30}H_{16}O_4$

MW, 440

Golden yellow cryst. from PhNO<sub>2</sub>. M.p. above 360°. Spar. sol.  $C_6H_6$ , EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO. Bluish-red in  $H_2SO_4$ .

*Dibromide*: m.p. above 400°.

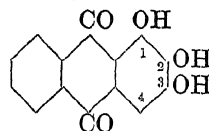
Hepp, Uhlenhuth, Römer, *Ber.*, 1913, **46**, 709.

Ullmann, Klingsberg, *ibid.*, 712.

### Anthragallic Acid.

See Anthragallol.

### Anthragallol (1 : 2 : 3-Trihydroxyanthraquinone, anthragallic acid)



$C_{14}H_8O_5$

MW, 256

M.p. 312–3° (310°). Sublimes at 290°. Sol. EtOH, Et<sub>2</sub>O, AcOH. Spar. sol.  $H_2O$ , CHCl<sub>3</sub>, CS<sub>2</sub>. Sol. conc.  $H_2SO_4$  → reddish-brown sol. Sol. alkalis → green sols.

*1-Me ether*:  $C_{15}H_{10}O_5$ . MW, 270. Yellow rhombic plates + 1MeOH from MeOH. M.p. 248–50°. *Diacetyl*: m.p. 165–6°. *2-p-Toluenesulphonyl*: yellow plates from Me<sub>2</sub>CO. M.p. 289–91°.

*2-Me ether*: m.p. 218–20°. *1-Acetyl*: yellow needles from Me<sub>2</sub>CO. M.p. 205–8°. *3-Acetyl*: flat orange needles from Me<sub>2</sub>CO. M.p. 167–95°. *Diacetyl*: yellow needles from Me<sub>2</sub>CO. M.p. 152–4°.

*3-Me ether*: red needles from Me<sub>2</sub>CO. M.p. 242–3°. *Diacetyl*: greenish-yellow needles. M.p. 204–6°. *2-Benzoyl*: orange needles from Me<sub>2</sub>CO. M.p. 221–3°. *1-Acetyl-2-benzoyl*: leaflets from Me<sub>2</sub>CO. M.p. 195–6°.

*1 : 2-Di-Me ether*:  $C_{16}H_{12}O_5$ . MW, 284. Leaflets from EtOH. M.p. 230–2°. *Acetyl*: yellow needles from Me<sub>2</sub>CO. M.p. 177–9°.

1 : 3-*Di-Me ether* : yellow needles from EtOH. M.p. 212-13°. *Acetyl* : yellow needles from EtOH. M.p. 218-20°. *p-Toluenesulphonyl* : m.p. 175-7°.

2 : 3-*Di-Me ether* : orange needles from EtOH. M.p. 160-2° (166°). *Acetyl* : yellow needles. M.p. 168-70°. *Benzoyl* : greenish-yellow needles from Me<sub>2</sub>CO. M.p. 216-18°.

*Tri-Me ether* : C<sub>17</sub>H<sub>14</sub>O<sub>5</sub>. MW, 298. Greenish-yellow needles from C<sub>6</sub>H<sub>6</sub>-petrol. M.p. 167-9°.

2-*Et ether* : C<sub>16</sub>H<sub>12</sub>O<sub>5</sub>. MW, 284. Red needles from EtOH. M.p. 175°.

3-*Et ether* : red needles from EtOH. M.p. 245°.

2-*Acetyl* : m.p. 219-20°.

3-*Acetyl* : m.p. 206-9°.

2 : 3-*Diacetyl* : m.p. 223-4°.

*Triacetyl* : yellow needles from AcOH-Ac<sub>2</sub>O. M.p. 181-2°.

2-*Benzoyl* : orange needles from EtOH. M.p. 241-3°. 3-*Acetyl* : yellow plates from Me<sub>2</sub>CO. M.p. 203-6°. *Diacetyl* : yellow needles from EtOH-Me<sub>2</sub>CO. M.p. 211-13°.

*Dibenzoyl deriv.* : yellow leaflets from C<sub>6</sub>H<sub>6</sub>. M.p. 204-6°.

*Tribenzoyl* : pale yellow prisms from EtOH-C<sub>6</sub>H<sub>6</sub>. M.p. 213-15°.

2 : 3-*Di-p-toluenesulphonyl* : m.p. 196-8°. *Acetyl* : m.p. 212-15°.

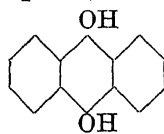
Seuberlich, *Ber.*, 1877, 10, 39.

Simon, D.R.P., 119,755, (*Chem. Zentr.*, 1901, I, 979).

Kubota, Perkin, *J. Chem. Soc.*, 1925, 127, 1889.

Perkin, *J. Chem. Soc.*, 1929, 1399; 1930, 292.

**Anthrahydroquinone** (9 : 10-*Dihydroxy-anthracene, anthraquinol*)



C<sub>14</sub>H<sub>10</sub>O<sub>2</sub>

MW, 210

Enol form of oxanthranol. Yellowish needles. M.p. 180°. Sol. EtOH → green fluorescent sol. Sol. alkalis → deep red col. Very unstable in air. Easily oxidised to anthraquinone.

*Me ether* : C<sub>15</sub>H<sub>12</sub>O<sub>2</sub>. MW, 224. M.p. 164°. *Acetyl* : cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 174°. *Benzoyl* : yellow leaflets from AcOH. M.p. 224°.

*Di-Me ether* : C<sub>16</sub>H<sub>14</sub>O<sub>2</sub>. MW, 238. Colourless tablets with blue fluor. from C<sub>6</sub>H<sub>6</sub>. M.p. 202°.

*Di-Et ether* : C<sub>18</sub>H<sub>18</sub>O<sub>2</sub>. MW, 266. Colourless needles with blue fluor. from EtOH. M.p. 148°.

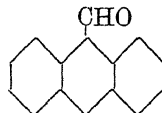
*Diacetyl* : needles from AcOH. M.p. 260° decomp.

*Dibenzoyl* : yellow needles from xylene-CHCl<sub>3</sub>. M.p. 292°.

Grandmougin, *Ber.*, 1906, 39, 3563.

Meyer, *Ann.*, 1911, 379, 37.

**Anthraldehyde** (*Anthracene-9-aldehyde*)



C<sub>15</sub>H<sub>10</sub>O

MW, 206

Orange needles from AcOH. M.p. 104-5°. Decomp. by sunlight. CrO<sub>3</sub> → anthraquinone.

*Aniline comp.* : orange needles from EtOH. M.p. 175°.

*Oxime* : C<sub>15</sub>H<sub>11</sub>ON. MW, 221. Yellow laminae from EtOH. M.p. 186-7°.

*Semicarbazone* : yellow micro-laminae from EtOH. M.p. 291°.

*Azine* : brick red. M.p. 296°.

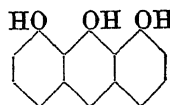
*Hydrazone* : m.p. 125-6° (108-10°).

*Phenylhydrazone* : orange needles from EtOH. M.p. 207°.

I.G., F.P., 648,069, (*Chem. Zentr.*, 1929, I, 2826).

Hinkel, Ayling, Beynon, *J. Chem. Soc.*, 1936, 344.

**Anthralin** (1 : 8 : 9-*Anthratriol*, 1 : 8 : 9-*trihydroxyanthracene, chrysanthranol, cignolin*)



C<sub>14</sub>H<sub>10</sub>O<sub>3</sub>

MW, 226

Yellow plates or needles from ligroin. M.p. 176-7° (178-80°). Sol. EtOH, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>. Used in dermatitis and other skin diseases.

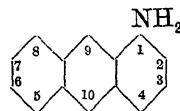
*Triacetyl* : yellow needles. M.p. 209-10°.

Schrobsdorf, *Ber.*, 1902, 35, 2930.

Bayer, D.R.P., 296,091, 305,886, (*Chem. Zentr.*, 1917, I, 351; 1918, II, 238).

Hirosé, *Ber.*, 1912, 45, 2480.

**1-Anthramine** (*α-Anthramine*, 1-*amino-anthracene*)



C<sub>14</sub>H<sub>11</sub>N

MW, 193

Yellow needles from EtOH. M.p. about 130° (119°) (121.5-2.5°). Sol. EtOH with green fluor.

*N-Formyl* : crystals from EtOH. M.p. 193°.

*N-Acetyl* : green needles from AcOH. M.p. 198° (213.5-4.5°). CrO<sub>3</sub> → 1-acetylaminoanthraquinone.

sym.-*Trinitrobenzene add. comp.*: black needles from EtOH. M.p. 206–7°.

Pisovschi, *Ber.*, 1908, 41, 1434.

Fierz-David, Blangey, Streit, *Helv. Chim. Acta*, 1946, 29, 1718.

**2-Anthramine** ( $\beta$ -*Anthramine*, 2-*aminoanthracene*).

Yellow leaflets from EtOH. M.p. 238°. Sol. EtOH with green fluor. Insol. H<sub>2</sub>O. Sublimes.

*N-Formyl*: yellowish-green cryst. M.p. 242°. Sol. hot EtOH with blue fluor.

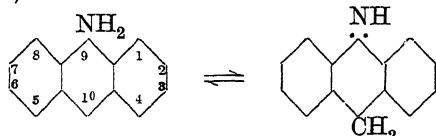
*N-Acetyl*: leaflets. M.p. 240°. Sol. EtOH with blue fluor.

sym.-*Trinitrobenzene add. comp.*: black needles from EtOH. M.p. 168.5–9°.

I.G., D.R.P., 472,825, (*Chem. Abstracts*, 1929, 23, 2987).

Liebermann, Bollert, *Ber.*, 1882, 15, 852.

**9-Anthramine** (*ms-Anthramine*, 9-*aminoanthracene*, 9-*iminoanthracene-dihydrate*, *anthrone-imide*).



C<sub>14</sub>H<sub>11</sub>N MW, 193

Golden leaflets from EtOH, brown cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 145–50°. Unstable. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>. Sol. EtOH  $\rightarrow$  green fluor. Sol. C<sub>6</sub>H<sub>6</sub>  $\rightarrow$  bluish-green fluor. CrO<sub>3</sub>  $\rightarrow$  anthraquinone.

*N-Acetyl*: needles with blue fluor. from EtOH. M.p. 273–4°.

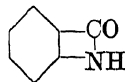
*N-Diacetyl*: tables from EtOH. M.p. 159°.

Kaufler, Suchanek, *Ber.*, 1907, 40, 518.

Mead *et al.*, *J. Biol. Chem.*, 1946, 163, 465.

Singu, *Chem. Abstracts*, 1943, 37, 3083.

### Anthranil



C<sub>7</sub>H<sub>5</sub>ON MW, 119

B.p. 210–15° part. decomp., 99°/13 mm. Sol. EtOH and most org. solvents, and conc. min. acids. Spar. sol. hot H<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 1.1827. n<sub>D</sub><sup>20</sup> 1.5845. Volatile in steam. Gradually resinifies on standing. Reduces NH<sub>3</sub>.AgNO<sub>3</sub>. Alkalis  $\rightarrow$  anthranilic acid. H  $\rightarrow$  *o*-aminobenzaldehyde. Ac<sub>2</sub>O  $\rightarrow$  acetylanthranil. Cl  $\rightarrow$  *N*-dichloro deriv., m.p. 77°. HgCl<sub>2</sub>  $\rightarrow$  mol. comp., m.p. 178°.

*Oxime*: m.p. 135–6°.

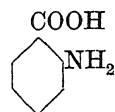
*Acetyl deriv.*: see Acetylanthranil.

Nord, *Ber.*, 1919, 52, 1705.

Auwers, *Ann.*, 1924, 437, 63.

Leuchs, *Ber.*, 1925, 58, 1452.

### Anthranilic Acid (*o*-*Aminobenzoic acid*)



C<sub>7</sub>H<sub>7</sub>O<sub>2</sub>N

MW, 137

Leaflets. M.p. 144–6°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Sublimes. Triboluminescent. Decomp. on dist. to CO<sub>2</sub> + aniline. *k* (acid) = 1.07  $\times$  10<sup>-5</sup> at 25°; *k* (base) = 1.4  $\times$  10<sup>-7</sup> at 25°. NaHg in HCl  $\rightarrow$  *o*-aminobenzyl alcohol (hydrochloride). HNO<sub>3</sub>  $\rightarrow$  salicylic acid.

*B, HF*: m.p. 217–18°.

*B, HCl*: needles. M.p. 193–4°.

*B<sub>2</sub>, H<sub>2</sub>SO<sub>4</sub>*: needles + 2H<sub>2</sub>O. M.p. 188°.

*Me ester*: see Methyl anthranilate.

*Et ester*: C<sub>9</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 165. M.p. 13°.

B.p. 266–8°, 145–7°/15 mm. D<sub>4</sub><sup>20</sup> 1.1174. n<sub>D</sub><sup>20</sup> 1.56455. Sol. EtOH with violet fluor. *B, HCl*:

needles. M.p. 170° (115–20°). *Picrate*: m.p.

116°. *N-Formyl*: prisms from ligroin. M.p.

57°. *N-Chloroacetyl*: cryst. from 95% EtOH.

M.p. 140°. *N-Benzoyl*: needles from EtOH.

M.p. 98°. *N-Benzenesulphonyl*: m.p. 92.5°.

*N-p-Toluenesulphonyl*: m.p. 112°.

*n-Butyl ester*: C<sub>11</sub>H<sub>15</sub>O<sub>2</sub>N. MW, 193. B.p.

182°. *B, HCl*: m.p. 178°.

*Isobutyl ester*: b.p. 156–7°/13 mm.

*Isoamyl ester*: C<sub>12</sub>H<sub>17</sub>O<sub>2</sub>N. MW, 207. B.p.

169–70°/3 mm.

*l-Menthyl ester*: C<sub>17</sub>H<sub>25</sub>O<sub>2</sub>N. MW, 275. M.p.

62.5–63.5°. B.p. 156°/0.33 mm. Sol. EtOH

with violet fluor. *B, HCl*: cryst. from EtOH-

HCl. M.p. 150–70°. Spar. sol. EtOH with

violet fluor.

*Phenyl ester*: C<sub>13</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 213. Needles

from EtOH. M.p. 70°. Sol. EtOH, Et<sub>2</sub>O.

Spar. volatile in steam.

*Phenacyl ester*: cryst. from EtOH. M.p.

181–2°.

*Amide*: see *o*-Aminobenzamide.

*Nitrile*: see *o*-Aminobenzonitrile.

*Anilide*: *o*-aminobenzanilide. C<sub>13</sub>H<sub>12</sub>ON<sub>2</sub>.

MW, 212. Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 131°

(126°). Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, Me<sub>2</sub>CO.

Mod. sol. H<sub>2</sub>O. Spar. sol. C<sub>6</sub>H<sub>6</sub>.

*o-Toluidide*: *o*-aminobenz-*o*-toluidide.

C<sub>14</sub>H<sub>14</sub>ON<sub>2</sub>. MW, 226. Needles from EtOH. Aq.

M.p. 104°.

*m-Toluidide*: *o*-aminobenz-*m*-toluidide.

Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 118°.

*p-Toluidide*: *o*-aminobenz-*p*-toluidide.

Needles from EtOH. Aq. M.p. 151°.

*Hydrazide*: prisms from EtOH, needles from

CHCl<sub>3</sub>. M.p. 121°. Sol. hot H<sub>2</sub>O, EtOH. Mod.

sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*N-Phenyl*: see Diphenylamine-2-carboxylic

Acid.

*N-Tolyl*: see Methyl diphenylamine-2-carb-

oxylic Acid.

*N-Formyl*: needles +  $\frac{1}{2}$ H<sub>2</sub>O. M.p. 169°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. C<sub>6</sub>H<sub>6</sub>.

*N-Chloroacetyl*: needles from EtOH. M.p. 186–8°.

*N-Propionyl*: needles from H<sub>2</sub>O. M.p. 117°.

*N-Butyryl*: prisms from EtOH. M.p. 89°.

*N-Isobutyryl*: needles from EtOH.Aq. M.p. 111°.

*N-Benzoyl*: needles from EtOH. M.p. 80–1°. Sol. EtOH, Et<sub>2</sub>O.

*N-o-Nitrobenzoyl*: cryst. from toluene-EtOH. M.p. 239°.

*N-m-Nitrobenzoyl*: prisms from EtOH. M.p. 233°.

*N-p-Nitrobenzoyl*: needles from EtOH. M.p. 235°.

*N-Benzenesulphonyl*: cryst. from AcOH. M.p. 214°.

*N-p-Toluenesulphonyl*: cryst. from 80% EtOH. M.p. 217°.

Shipley, Calhoun, *Chem. Abstracts*, 1936, 30, 391.

Beall, U.S.P., 1,492,664, (*Chem. Abstracts*, 1924, 18, 2009).

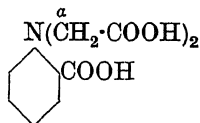
Potter, U.S.P., 1,322,052, (*Chem. Abstracts*, 1920, 14, 287).

Isbell, Henze, *J. Am. Chem. Soc.*, 1944, 66, 2096.

### Anthranilinoacetic Acid.

See Phenylglycine-*o*-carboxylic Acid.

**Anthranilindiacetic Acid** (*o*-Carboxyphenyliminodiacetic acid)



C<sub>11</sub>H<sub>11</sub>O<sub>6</sub>N MW, 253

Plates or leaflets from H<sub>2</sub>O. M.p. 215°.

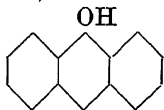
*Tri-Me ester*: C<sub>14</sub>H<sub>17</sub>O<sub>6</sub>N. MW, 295. M.p. 62°.

*α*-Mononitrile: C<sub>11</sub>H<sub>10</sub>O<sub>4</sub>N<sub>2</sub>. MW, 234. Cryst. Decomp. at 140°.

*α*-Dinitrile: C<sub>11</sub>H<sub>9</sub>O<sub>2</sub>N<sub>3</sub>. MW, 215. Prisms from MeOH. M.p. 168–71° decomp.

Badische, D.R.P., 216,748, (*Chem. Zentr.*, 1910, I, 308).

**Anthranol** (*ms-Hydroxyanthracene*, 9-anthrol, 9-hydroxyanthracene)



C<sub>14</sub>H<sub>10</sub>O MW, 194

Enol form of anthrone. Pale yellow needles. M.p. 120° (rapid heat). Sol. AcOH, hot C<sub>6</sub>H<sub>6</sub>, PhNO<sub>2</sub>, alkalis. Slow heat. → anthrone. Ox. → anthraquinone. Easily oxidised (e.g., with FeCl<sub>3</sub>, Br, etc.). Zn dust → anthracene. Glycerol + H<sub>2</sub>SO<sub>4</sub> → benzanthrone. Con-

denses with *p*-nitrosodimethylaniline. Couples with diazo-comps.

*Acetyl*: 9-acetoxyanthracene. Needles from EtOH.Aq. M.p. 134°. Sols. show blue fluor.

Bäckström, Beatty, *J. Phys. Chem.*, 1931, 35, 2530.

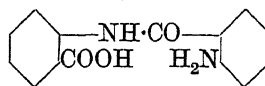
Perkin, B.P., 151,707, (*Chem. Abstracts*, 1921, 15, 690).

Meyer, *Ann.*, 1911, 379, 37.

### Anthranol-carboxylic Acid.

See 10-Hydroxyanthracene-1-carboxylic Acid and 9-Hydroxyanthracene-2-carboxylic Acid.

**Anthranoylanthranilic Acid** (*o*-Aminobenzoylanthranilic acid)



C<sub>14</sub>H<sub>12</sub>O<sub>3</sub>N<sub>2</sub> MW, 256

Pale yellow needles from EtOH.Aq. M.p. 203°. Mod. sol. Et<sub>2</sub>O. Insol. cold H<sub>2</sub>O, CHCl<sub>3</sub>, CS<sub>2</sub>, ligroin. Etheral sols. show blue fluor. Loses CO<sub>2</sub> on prolonged heating.

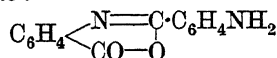
*N-Acetyl*: needles from EtOH. M.p. 226°. *Amide*: prisms or leaflets from EtOH. M.p. 232°.

*N-p-Toluenesulphonyl*: m.p. 217°.

*Me ester*: C<sub>15</sub>H<sub>14</sub>O<sub>3</sub>N<sub>2</sub>. MW, 270. Needles from MeOH. M.p. 118–19°. Spar. sol. MeOH.

*Et ester*: C<sub>16</sub>H<sub>16</sub>O<sub>3</sub>N<sub>2</sub>. MW, 284. Yellowish prisms from EtOH. M.p. 106.5°.

*Anhydride*:



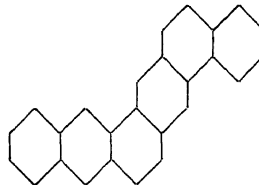
C<sub>14</sub>H<sub>10</sub>O<sub>2</sub>N<sub>2</sub>. MW, 238. M.p. 162°. *Acetyl*: m.p. 211–12°.

Mohr, Köhler, *J. prakt. Chem.*, 1910, 80, 521.

Schroeter, *Ber.*, 1919, 52, 2224.

Simpson *et al.*, *J. Chem. Soc.*, 1945, 646.

### Anthraphenanthrene

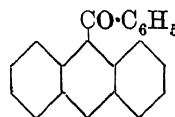


C<sub>26</sub>H<sub>16</sub> MW, 328

Yellow needles. M.p. 281–2° decomp.

Cook, *J. Chem. Soc.*, 1931, 499.

**Anthraphenone** (*ms-Benzoylanthracene*, *phenyl anthranil ketone*, 9-benzoylanthracene)



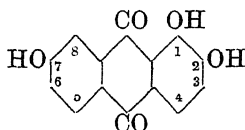
C<sub>21</sub>H<sub>14</sub>O

MW, 282

Yellow needles from  $C_6H_6$  or AcOH. M.p.  $148^\circ$ . Gives fugitive blue col. with  $H_2SO_4$ .  $CrO_3$  in AcOH  $\rightarrow$  anthraquinone + benzoic acid.  $H_2SO_4$  in hot AcOH  $\rightarrow$  anthracene + benzoic acid.  $Zn + AcOH \rightarrow 9:10$ -dihydro deriv.

Cook, *J. Chem. Soc.*, 1926, 1284.

**Anthrapurpurin** (1:2:7-Trihydroxyanthraquinone, isopurpurin)



$C_{14}H_8O_5$  MW, 256

Orange needles from EtOH. M.p.  $369^\circ$ . B.p.  $462^\circ$  part. decomp. Sublimes at  $170^\circ$ . Sol. hot EtOH, hot AcOH, hot  $CHCl_3$ . Spar. sol.  $Et_2O$ . Insol.  $C_6H_6$ . Sol. alkalis to violet sols. Reddish-brown in conc.  $H_2SO_4$ .

1-Me ether:  $C_{15}H_{10}O_5$ . MW, 270. Orange-red needles. M.p.  $299-300^\circ$ . 2:7-Diacetyl: pale yellow leaflets from EtOH. M.p.  $136-7^\circ$ . 2:7-Dicarbethoxyl: yellow needles from MeOH. M.p.  $120-1^\circ$ .

2-Me ether: orange-red needles from EtOH. M.p.  $308-9^\circ$ . 7-Acetyl: orange-yellow needles. M.p.  $207^\circ$ . 1:7-Diacetyl: yellow leaflets from Py. M.p.  $154-5^\circ$ .

1:7-Di-Me ether:  $C_{16}H_{12}O_5$ . MW, 284. Yellow needles. M.p.  $218-19^\circ$ . 2-Acetyl: pale yellow needles. M.p.  $175-6^\circ$ . 2-Benzoyl: yellow leaflets from MeOH. M.p.  $201-3^\circ$ .

2:7-Di-Me ether: orange-yellow needles from MeOH. M.p.  $242-3^\circ$ . 1-Acetyl: pale yellow needles. M.p.  $228-30^\circ$ . 1-Benzoyl: yellow plates from EtOH-AcOH. M.p.  $209-11^\circ$ .

Tri-Me ether:  $C_{17}H_{14}O_5$ . MW, 298. Yellow needles from EtOH. M.p.  $201^\circ$ . Sol.  $CHCl_3$ ,  $C_6H_6$ . Spar. sol. cold EtOH.

2-Acetyl: yellow needles from EtOH. M.p.  $296-8^\circ$ .

2-Benzoyl: yellow plates or prisms from MeOH. M.p.  $272-3^\circ$ . 1:7-Diacetyl: pale yellow plates or leaflets. M.p.  $201-3^\circ$ .

2:7-Diacetyl: yellow needles from EtOH-AcOH. M.p.  $192-3^\circ$ .

2:7-Dicarbethoxyl: golden-yellow needles from EtOH. M.p.  $166-7^\circ$ .

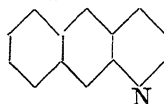
Triacetyl: pale yellow cryst. from AcOH. M.p.  $223^\circ$ . Mod. sol. AcOH. Spar. sol. EtOH.

Wedekind, D.R.P., 137,948, (*Chem. Zentr.*, 1903, I, 267).

Nöling, Wortmann, *Ber.*, 1906, 39, 642. Grandmougin, *Compt. rend.*, 1921, 173, 1176.

Perkin, Storey, *J. Chem. Soc.*, 1928, 229.

$\alpha$ -Anthrapyridine (6:7-Benzquinoline, 2:3-naphthapyridine, naphthazine, 1-azanthracene)



$C_{13}H_9N$  MW, 179

Cryst. M.p.  $114^\circ$ . B.p.  $200-5^\circ/14$  mm. Sol. EtOH,  $Et_2O$ . Less soluble than  $\beta$ -anthrapyridine. Sols. show marked fluor. Sunlight irradiation  $\rightarrow$   $\alpha$ -anthrapyridinequinone.

B,HCl: yellow cryst. from EtOH. M.p.  $196-7^\circ$ . Sinters at  $191^\circ$  (m.p.  $142-3^\circ$ ).

B,HI: red. M.p.  $171-3^\circ$ .

Picrate: m.p.  $258^\circ$ . Darkens at  $229^\circ$ . Spar. sol. EtOH.

Methiodide: yellowish-brown cryst. from  $H_2O$ . M.p.  $225-6^\circ$  ( $219^\circ$ ). Sol. EtOH.

v. Braun, Grüber, *Ber.*, 1922, 55, 1715.

$\beta$ -Anthrapyridine (6:7-Benzisquinoline, 3:4-naphthapyridine, 2-azanthracene)



$C_{13}H_9N$  MW, 179

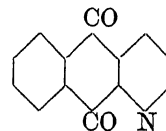
Light reddish leaflets. M.p.  $166^\circ$  ( $174^\circ$ ). Sol. most org. solvents. Spar. sol.  $H_2O$ . Sublimes in yellow leaflets. Sols. show blue to bluish-green fluor. Salts are yellow and their sols. show green fluor. Sunlight irradiation  $\rightarrow$   $\beta$ -anthrapyridinequinone.

Philips, *Ber.*, 1895, 28, 1658.

v. Braun, Nelles, *Ber.*, 1937, 70, 1764.

Étienne, Robert, *Compt. rend.*, 1946, 223, 331.

$\alpha$ -Anthrapyridinequinone (1-Azanthraquinone, 2:3-phthaloylpyridine)



$C_{13}H_7O_2N$  MW, 209

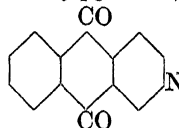
Yellowish-brown needles from  $C_6H_6$ . M.p.  $280^\circ$ . Weak base. Sublimes.  $Zn + NH_3 \rightarrow$   $\alpha$ -anthrapyridine.

v. Braun, Grüber, *Ber.*, 1922, 55, 1716.

I.G., B.P., 427,485, (*Chem. Abstracts*, 1935, 29, 6076).

Clemon, Driver, *J. Chem. Soc.*, 1945, 829.

$\beta$ -Anthrapyridinequinone (2-Azanthraquinone, 3:4-phthaloylpyridine)



$C_{13}H_7O_2N$  MW, 209

Yellow needles from  $C_6H_6$  or  $CCl_4$ . M.p.  $179^\circ$  ( $265-6^\circ$ ). Sublimes. Sol. dil. min. acids. Conc.  $H_2SO_4 \rightarrow$  yellow sol.  $Zn + NH_3 \rightarrow$   $\beta$ -anthrapyridine.

Philips, *Ber.*, 1894, **27**, 1925.

Etienne, Robert, *Compt. rend.*, 1946, **223**, 331.

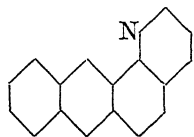
### Anthrapyridone.

See Pyridanthrone.

### Anthraquinol.

See Anthrahydroquinone.

$\alpha$ -Anthraquinoline (1:2-Pyridinoanthracene, 2' : 3' - 7 : 8-naphthaquinoline)

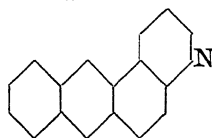


$C_{17}H_{11}N$  MW, 229

Cryst. M.p.  $126.5-128^\circ$ . Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ . Insol.  $H_2O$ . Alc. sol. shows blue fluor. *B.HCl*: yellow needles. Mod. sol. EtOH, hot  $H_2O$ .

Graebe, Pollak, *Chem.-Ztg.*, 1895, **19**, 1229.

$\beta$ -Anthraquinoline (2:1-Pyridinoanthracene, 2' : 3' : 5 : 6-naphthaquinoline)

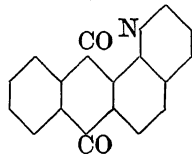


$C_{17}H_{11}N$  MW, 229

Plates or leaflets. M.p.  $170^\circ$ . B.p.  $446^\circ$ . Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ . Insol.  $H_2O$ . Sols. show intense blue fluor. Sublimes readily.  $CrO_3$  in AcOH  $\rightarrow$   $\beta$ -anthraquinolinequinone. Salts are yellow and dissolve in EtOH.Aq. with green fluor.

Graebe, *Ber.*, 1884, **17**, 170.

$\alpha$ -Anthraquinolinequinone ( $\alpha$ -Anthraquinonequinoline, 1 : 2-pyridinoanthraquinone, 7 : 8-phthaloylquinoline)



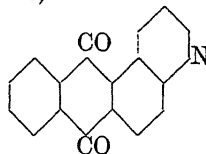
$C_{17}H_9O_2N$  MW, 259

Yellow needles from EtOH.Aq. M.p.  $169^\circ$ . Sol.  $C_6H_6$ , dil. min. acids. Conc.  $H_2SO_4 \rightarrow$  pale yellow sol. Nitration in  $H_2SO_4 \rightarrow$  mononitro deriv., m.p.  $284^\circ$ .

M.L.B., D.R.P., 189,234, (*Chem. Zentr.*, 1908, I, 76).

Badische, D.R.P., 218,476, (*Chem. Zentr.*, 1910, I, 781).

$\beta$ -Anthraquinolinequinone ( $\beta$ -Anthraquinonequinoline, 2 : 1-pyridinoanthraquinone, 5 : 6-phthaloylquinoline)



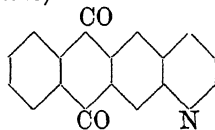
$C_{17}H_9O_2N$  MW, 259

Yellow needles from  $C_6H_6$ . M.p.  $185^\circ$ . Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ . Insol.  $H_2O$ . Sublimes. Zn dust  $\rightarrow$   $\beta$ -anthraquinoline. Nitration in  $H_2SO_4 \rightarrow$  mononitro deriv., m.p.  $258^\circ$ .

Graebe, *Ann.*, 1880, **201**, 333.

Bally, Scholl, *Ber.*, 1911, **44**, 1656.

$\gamma$ -Anthraquinolinequinone ( $\gamma$ -Anthraquinonequinoline, 2 : 3-pyridinoanthraquinone, 6 : 7-phthaloylquinoline)



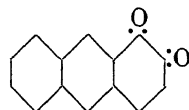
$C_{17}H_9O_2N$  MW, 259

Yellow needles. M.p.  $322^\circ$ . Nitration in  $H_2SO_4 \rightarrow$  mononitro deriv., m.p.  $305^\circ$ .

Badische, D.R.P., 171,939, (*Chem. Zentr.*, 1906, II, 573).

Bally, Scholl, *Ber.*, 1911, **44**, 1656.

### 1 : 2-Anthraquinone



$C_{14}H_8O_2$  MW, 208

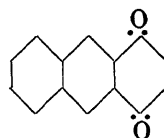
Orange-brown cryst. M.p.  $185-90^\circ$  decomp. Mod. sol. EtOH, hot  $CHCl_3$ , hot AcOH. Spar. sol. hot  $H_2O$ . Sol. conc.  $H_2SO_4$  to violet sol. Red.  $\rightarrow$  1 : 2-dihydroxyanthracene.

1-Oxime : 1-nitroso-2-hydroxyanthracene. Orange-brown needles. Decomp. at  $188^\circ$ . Blue in  $H_2SO_4$ . Red.  $\rightarrow$  1-amino-2-hydroxyanthracene. *Me ether* : m.p.  $130^\circ$ . *Et ether* : m.p.  $143^\circ$ .

2-Oxime : 1-hydroxy-2-nitrosoanthracene. Orange-brown needles. Decomp. at  $200^\circ$ . Reddish-violet in  $H_2SO_4$ . Red.  $\rightarrow$  1-hydroxy-2-aminoanthracene. *Me ether* : m.p.  $134^\circ$ . *Et ether* : m.p.  $144^\circ$ .

Lagodzinski, *Ann.*, 1905, **342**, 80.

### 1 : 4-Anthraquinone



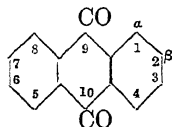
$C_{14}H_8O_2$  MW, 208

Yellow needles. Blackens at 200–10°; m.p. 218° decomp.

*Oxime*: 1-hydroxy-4-nitrosoanthracene. Brown needles. Darkens at 205°; m.p. 233° decomp. Spar. sol. org. solvents. Blue in  $H_2SO_4$ .

Pisovschi, *Ber.*, 1908, 41, 1436.

**9 : 10-Anthraquinone** (*Ordinary anthraquinone*)



$C_{14}H_8O_2$  MW, 208

Yellowish rhombic cryst. M.p. 286°. B.p. 379–81°. Sublimes. Sol. hot  $C_6H_6$ , hot toluene (6% at 100°), and in  $PhNO_2$  and aniline. Mod. sol. EtOH. Spar. sol.  $Et_2O$ . Sol. conc.  $H_2SO_4$ .  $D_4^{20}$  1.419–1.438. Heat of comb.  $C_v$  1547.9 Cal.,  $C_p$  1548.5 Cal. Triboluminescent. Zn dust  $\rightarrow$  anthracene.  $Al + H_2SO_4 \rightarrow$  anthranol.  $Sn + HCl \rightarrow$  anthrone.  $Na_2S_2O_4 \rightarrow$  anthrahydroquinone. Not reduced by  $SO_2$ . Alk. fusion  $\rightarrow$  benzoic acid. Ox.  $\rightarrow$  phthalic acid. Gives no phenylhydrazone and only a monoxime.

*Monoxime*: pale yellow needles. M.p. 224° (rapid heat). *Me ether*: m.p. 147°. *Et ether*: m.p. 97°.

Philips, *Chem. Reviews*, 1929, 6, 157 (Review).

Underwood, Walsh, *Organic Syntheses*, 1936, XVI, 74.

Ilinskii, *Chem. Zentr.*, 1933, I, 125 (Review). I.G., D.R.P., 598,476, (*Chem. Abstracts*, 1934, 28, 5470).

Selden Co., U.S.P., 1,886,023, (*Chem. Abstracts*, 1933, 27, 1366).

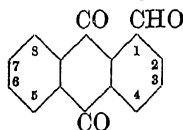
Harding, *Colour Trade Journal*, 1921, 9, 184.

Fedorov, Semenova, *Chem. Abstracts*, 1941, 35, 2138.

Newman, *J. Am. Chem. Soc.*, 1942, 64, 2324.

Houben, *Das Anthracen und die Anthraquinone mit den zugehörigen vielkernigen Systemen*. Ann Arbor, Michigan.

### Anthraquinone-1-aldehyde



$C_{15}H_8O_3$  MW, 236

Cryst. from AcOH or  $C_6H_6$ -EtOH. M.p. 186–8°.

I.G., B.P., 369,902, (*Chem. Abstracts*, 1933, 27, 2159).

Scholl, Donat, *Ber.*, 1931, 64, 320.

### Anthraquinone-2-aldehyde.

Yellowish leaflets or needles from AcOH. M.p. 188–9°. Sol. Py, aniline. Mod. sol.  $Me_2CO$ , AcOH,  $C_6H_6$ . Spar. sol. EtOH, hot  $Et_2O$ , hot ligroin.

*Anil*: yellow cryst. from toluene. M.p. 185°.

*Oxime*: yellow needles. M.p. 238–9°. Sol.  $Et_2O$ , ligroin. Spar. sol. EtOH,  $C_6H_6$ .

*Semicarbazone*: yellow cryst. from  $PhNO_2$ . M.p. 397°. Sol. hot  $PhNO_2$ , aniline. Insol. EtOH,  $Et_2O$ ,  $C_6H_6$ , ligroin.

*Phenylhydrazone*: needles. M.p. 242°.

*p-Nitrophenylhydrazone*: leaflets from  $PhNO_2$ . M.p. 305–6°.

*Azine*: pale yellow needles from  $PhNO_2$ . M.p. 410°.

Ruggli, Disler, *Helv. Chim. Acta*, 1927, 10, 938.

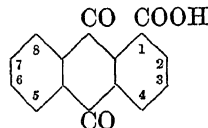
Ullmann, Klingenberg, *Ber.*, 1913, 46, 715.

Jacob, *Helv. Chim. Acta*, 1921, 4, 782.

Chem. Fabr. Griesheim-Elektron, D.R.P., 293,981, (*Chem. Abstracts*, 1917, 11, 2580).

M.L.B., D.R.P., 361,043, (*Chem. Zentr.*, 1923, II, 481).

### Anthraquinone-1-carboxylic Acid



$C_{15}H_8O_4$  MW, 252

Pale yellow needles from AcOH. M.p. 293–4°. Spar. sol. hot  $H_2O$ .  $Zn + NaOH \rightarrow$  blood-red col.  $Zn + NH_3 \rightarrow$  anthracene-1-carboxylic acid.

*Me ester*:  $C_{16}H_{10}O_4$ . MW, 266. Pale yellow cryst. from MeOH. M.p. 189°.

*Et ester*:  $C_{17}H_{12}O_4$ . MW, 280. Yellow needles from EtOH. M.p. 169°. Sol. hot EtOH.

*Amide*:  $C_{15}H_9O_3N$ . MW, 251. Pale yellow cryst. from EtOH. M.p. 280°. Mod. sol. EtOH. Insol. cold  $H_2O$ . Sublimes. Very stable towards alkalis.

*Nitrile*: 1-cyanoanthraquinone.  $C_{15}H_7O_2N$ . MW, 233. Yellow leaflets from AcOH. M.p. 247° (216–17°).

*Anhydride*:  $C_{30}H_{14}O_7$ . MW, 486. Pale yellow cryst. from  $PhNO_2$ .

*Anilide*:  $C_{21}H_{13}O_3N$ . MW, 327. Pale yellow cryst. from EtOH. M.p. 288–9°. Zn dust dist.  $\rightarrow$  anthracene.

Graebe, Blumenfeld, *Ber.*, 1897, 30, 1115. I.G., B.P., 369,902, (*Chem. Abstracts*, 1933, 27, 2159).

Gen. Aniline Works, U.S.P., 1,830,838, (*Chem. Abstracts*, 1932, 26, 737).

Coulson, *J. Chem. Soc.*, 1930, 1932.

Hey, Nicholls, Pritchett, *J. Chem. Soc.*, 1944, 97.



**Anthraquinone-2-carboxylic Acid.**

Yellow needles from AcOH. M.p. 290–2° (285–6°). Sol. Me<sub>2</sub>CO. Spar. sol. EtOH, AcOH. Prac. insol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Sublimes on careful heating. Zn + NH<sub>3</sub> → anthracene-2-carboxylic acid.

*Me ester*: m.p. 170°.

*Et ester*: needles. M.p. 147°. Sol. EtOH.

*Amide*: needles from AcOH–C<sub>6</sub>H<sub>6</sub>. M.p. 280°. Spar. sol. EtOH, C<sub>6</sub>H<sub>6</sub>.

*Chloride*: C<sub>15</sub>H<sub>7</sub>O<sub>3</sub>Cl. MW, 270.5. Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 147°.

*Anilide*: m.p. 258–60°.

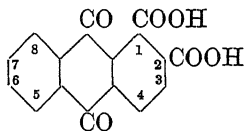
Liebermann, Glock, *Ber.*, 1884, 17, 888.

Whitmore, Carnahan, *J. Am. Chem. Soc.*, 1929, 51, 858.

I.G., B.P., 314,020, (*Chem. Abstracts*, 1930, 24, 1123).

Barnett, Cook, Grainger, *Ber.*, 1924, 57, 1779.

П'inskii, Kazakova, *Chem. Abstracts*, 1941, 35, 5487.

**Anthraquinone-1 : 2-dicarboxylic Acid**

C<sub>16</sub>H<sub>8</sub>O<sub>6</sub> MW, 296

Yellowish needles from AcOH. M.p. 270°. Sol. hot EtOH, AcOH. Insol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Sol. 2200 parts H<sub>2</sub>O at 20°. Heat at 250–300° → anhydride. Conc. H<sub>2</sub>SO<sub>4</sub> → yellow sol., changing to red. Dist. with lime → anthraquinone.

*Di-Me ester*: C<sub>18</sub>H<sub>12</sub>O<sub>6</sub>. MW, 224. Pale yellow needles from AcOEt. M.p. 208°.

*Anhydride*: C<sub>16</sub>H<sub>6</sub>O<sub>5</sub>. MW, 278. Yellow needles. M.p. 319–21°. Sublimes.

*Imide*: yellow needles from AcOH. M.p. 293°.

Scholl, Schwinger, *Ber.*, 1911, 44, 2992.

Whitmore, Carnahan, *J. Am. Chem. Soc.*, 1929, 51, 857.

**Anthraquinone-1 : 3-dicarboxylic Acid.**

Pale yellow needles from EtOH.Aq. Decomp. at 320–5°. Spar. sol. ord. solvents. Zn + NH<sub>3</sub> → anthracene-1 : 3-dicarboxylic acid.

Fieser, Martin, *J. Am. Chem. Soc.*, 1936, 58, 1445.

Scholl, Donat, Böttger, *Ann.*, 1934, 512, 127.

**Anthraquinone-1 : 4-dicarboxylic Acid.**

Yellow cryst. M.p. above 300°. Mod. sol. EtOH. Spar. sol. Me<sub>2</sub>CO, AcOH. Zn + NH<sub>3</sub> → anthracene-1 : 4-dicarboxylic acid.

*Dichloride*: C<sub>16</sub>H<sub>6</sub>O<sub>4</sub>Cl<sub>2</sub>. MW, 333. Pale yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 203–5°.

Elbs, *J. prakt. Chem.*, 1890, 41, 29.

Scholl, Meyer, *Ann.*, 1934, 512, 117.

**Anthraquinone-1 : 5-dicarboxylic Acid.**

Needles. Does not melt below 390°.

*Di-Me ester*: C<sub>18</sub>H<sub>12</sub>O<sub>6</sub>. MW, 324. Leaflets from MeOH. M.p. 236°.

*Di-Et ester*: C<sub>20</sub>H<sub>16</sub>O<sub>6</sub>. MW, 352. Pale yellow needles or prisms from AcOH. M.p. 155°.

*Dichloride*: C<sub>16</sub>H<sub>6</sub>O<sub>4</sub>Cl<sub>2</sub>. MW, 333. M.p. 260–3° decomp.

*Dinitrile*: C<sub>16</sub>H<sub>6</sub>O<sub>2</sub>N<sub>2</sub>. MW, 258. Yellowish-brown needles from benzyl cyanide. Does not melt below 390°. Almost insol. ord. solvents.

*Anhydride*: C<sub>16</sub>H<sub>6</sub>O<sub>5</sub>. MW, 278. Pale yellow. M.p. about 336°. Spar. sol. all ord. org. solvents.

Coulson, *J. Chem. Soc.*, 1930, 1932.

Scholl, Hass, Meyer, *Ber.*, 1929, 62, 109.

**Anthraquinone-1 : 6-dicarboxylic Acid.**

Faintly yellow needles from EtOH. M.p. 336–8°.

Fieser, Martin, *J. Am. Chem. Soc.*, 1936, 58, 1444.

**Anthraquinone-1 : 7-dicarboxylic Acid.**

Pale yellow cryst. from EtOH. M.p. 346–8°.

Fieser, Martin, *J. Am. Chem. Soc.*, 1936, 58, 1444.

**Anthraquinone-1 : 8-dicarboxylic Acid.**

*Dinitrile*: C<sub>16</sub>H<sub>6</sub>O<sub>2</sub>N<sub>2</sub>. MW, 258. Cryst. Does not melt below 400°. Sol. conc. H<sub>2</sub>SO<sub>4</sub> with red col.

I.G., F.P., 624,544, (*Chem. Zentr.*, 1929, II, 935).

**Anthraquinone-2 : 3-dicarboxylic Acid**

Yellow needles from AcOH. M.p. 340–2°. Sol. EtOH. Spar. sol. H<sub>2</sub>O. Zn + NH<sub>3</sub> → anthracene-2 : 3-dicarboxylic acid.

*Di-Me ester*: C<sub>18</sub>H<sub>12</sub>O<sub>6</sub>. MW, 324. M.p. 183–4°.

*Monoamide*: C<sub>16</sub>H<sub>9</sub>O<sub>5</sub>N. MW, 295. Brown leaflets from AcOH. Does not melt below 340°.

*Anhydride*: C<sub>16</sub>H<sub>6</sub>O<sub>5</sub>. MW, 278. M.p. 290°.

Whitmore, Carnahan, *J. Am. Chem. Soc.*, 1929, 51, 859.

Elbs, *J. prakt. Chem.*, 1890, 41, 8.

**Anthraquinone-2 : 6-dicarboxylic Acid.**

Does not melt below 400°. Spar. sol. ord. solvents. Heated with KOH for 6 days → iso- and tere-phthalic acids.

*Dichloride*: C<sub>16</sub>H<sub>6</sub>O<sub>4</sub>Cl<sub>2</sub>. MW, 333. Pale yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 197–8°. Stable to water.

*Diamide*:  $C_{16}H_{10}O_4N_2$ . MW, 294. Needles from AcOH. Does not melt below  $370^\circ$ .

Seer, *Monatsh.*, 1911, 32, 163.

#### Anthraquinone-2 : 7-dicarboxylic Acid.

Pale yellow rhombic plates from AcOH. Does not melt below  $360^\circ$ .

*Dichloride*: pale yellow needles from  $C_6H_6$ .

Morgan, Coulson, *J. Chem. Soc.*, 1929, 2211.

Scholl, Zeigs, *Ber.*, 1934, 67, 1748.

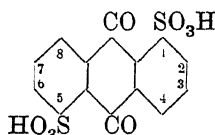
#### Anthraquinone dichloride.

See *ms*-Dichloroanthrone.

#### Anthraquinone-dihydroazine.

See Indanthrone.

#### Anthraquinone-1 : 5-disulphonic Acid



$C_{14}H_8O_6S_2$

MW, 368

Yellowish cryst. +  $4H_2O$ . M.p.  $310-11^\circ$  decomp. Sol.  $H_2O$ , EtOH. Anhyd. acid dissolves in 1.5 parts  $H_2O$  at  $15^\circ$ . Spar. sol.  $Me_2CO$ .

*Na salt*: +  $5H_2O$ . Sol. 7 parts  $H_2O$  at  $100^\circ$ , 54 parts at  $18^\circ$ .

*K salt*: sol. 28 parts  $H_2O$  at  $100^\circ$ , 145 parts at  $18^\circ$ .

*NH<sub>4</sub> salt*: sol. 13 parts  $H_2O$  at  $100^\circ$ , 44 parts at  $18^\circ$ .

*Ca salt*: +  $3H_2O$ . Sol. 108 parts  $H_2O$  at  $18^\circ$  and at  $100^\circ$ .

*Dichloride*:  $C_{14}H_6O_6S_2Cl_2$ . MW, 405. Yellow needles from  $PhNO_2$ . M.p.  $265-70^\circ$  decomp. Sol.  $PhNO_2$ . Spar. sol. AcOH, chlorobenzene.

*Diamide*:  $C_{14}H_{10}O_6N_2S_2$ . MW, 366. Does not melt below  $350^\circ$ . Spar. sol. all solvents.

*Dianilide*: reddish-yellow prisms from  $PhNO_2$ . M.p.  $269-70^\circ$  decomp.

Fierz-David, *Helv. Chim. Acta*, 1927, 10, 202.

Lauer, *J. prakt. Chem.*, 1931, 130, 185.

Rogers, Stowell, U.S.P., 1,721,317, (*Chem. Abstracts*, 1929, 23, 4230).

#### Anthraquinone-1 : 6-disulphonic Acid.

Yellow needles +  $5H_2O$  from HCl, golden prisms +  $5H_2O$  from AcOH. M.p.  $215-17^\circ$ .

*Na salt*: + 3 or  $5H_2O$ . Easily sol.  $H_2O$ .

*K salt*: +  $1\frac{1}{2}H_2O$ . Sol. 7 parts  $H_2O$  at  $100^\circ$ , 95 parts at  $18^\circ$ .

*NH<sub>4</sub> salt*: very sol.  $H_2O$ .

*Ca salt*: +  $5H_2O$ . Sol. 6 parts  $H_2O$  at  $100^\circ$ , 65 parts at  $18^\circ$ .

*Dichloride*:  $C_{14}H_6O_6S_2Cl_2$ . MW, 405. Yellow needles from  $PhNO_2$ . M.p.  $197-8^\circ$  decomp. Sol.  $PhNO_2$ , chlorobenzene.

*Dianilide*: yellow cryst. powder from chlorobenzene or anisole. M.p.  $227-8^\circ$  decomp.

Lauer, *J. prakt. Chem.*, 1931, 130, 185.

Fierz-David, *Helv. Chim. Acta*, 1927, 10, 207.

Wedekind, D.R.P., 202,398, (*Chem. Zentr.*, 1908, II, 1476).

#### Anthraquinone-1 : 7-disulphonic Acid.

Cryst. +  $4H_2O$ . Very sol.  $H_2O$ , EtOH. Sol. AcOH. Melts in its own  $H_2O$  of cryst. at  $120^\circ$ .

*Na salt*: +  $2H_2O$ . Very sol.  $H_2O$ .

*K salt*: +  $2H_2O$ . Very sol.  $H_2O$ .

*NH<sub>4</sub> salt*: +  $2H_2O$ . Very sol.  $H_2O$ .

*Ca salt*: +  $6H_2O$ . Very sol.  $H_2O$ .

*Dichloride*:  $C_{14}H_6O_6S_2Cl_2$ . MW, 405. Brownish-yellow plates from  $PhNO_2$ . M.p.  $231-2^\circ$ .

*Dianilide*: yellow prisms from anisole or chlorobenzene. M.p.  $237-8^\circ$ .

Lauer, *J. prakt. Chem.*, 1931, 130, 185.

Fierz-David, *Helv. Chim. Acta*, 1927, 10, 205.

Wedekind, D.R.P., 202,398, (*Chem. Zentr.*, 1908, II, 1476).

#### Anthraquinone-1 : 8-disulphonic Acid.

Cryst. +  $5H_2O$ . M.p.  $293-4^\circ$  decomp. Anhyd. acid sol. 1.5 parts  $H_2O$  at  $15^\circ$ . Sol. EtOH.

*Na salt*: +  $4H_2O$ . Sol. 8 parts  $H_2O$  at  $100^\circ$ , 95 parts at  $18^\circ$ .

*K salt*: +  $2H_2O$ . Sol. 45 parts  $H_2O$  at  $100^\circ$ , 565 parts at  $18^\circ$ .

*NH<sub>4</sub> salt*: +  $2H_2O$ . Sol. 7 parts  $H_2O$  at  $100^\circ$ , 102 parts at  $18^\circ$ .

*Ca salt*: +  $5\frac{1}{2}H_2O$ . Sol. 88 parts  $H_2O$  at  $100^\circ$ . Spar. sol. cold.

*Dichloride*:  $C_{14}H_6O_6S_2Cl_2$ . MW, 405. Yellow prisms from  $PhNO_2$ . M.p.  $222-3^\circ$  decomp. Sol.  $PhNO_2$ . Mod. sol. chlorobenzene. Spar. sol. AcOH.

*Diamide*:  $C_{14}H_{10}O_6N_2S_2$ . MW, 366. Does not melt below  $340^\circ$ . Spar. sol. most solvents.

*Dianilide*: yellow cryst. powder from  $PhNO_2$  or chlorobenzene. M.p.  $237-8^\circ$  decomp.

Lauer, *J. prakt. Chem.*, 1931, 130, 185.

Fierz-David, *Helv. Chim. Acta*, 1927, 10, 205.

Rogers, Stowell, U.S.P., 1,721,317, (*Chem. Abstracts*, 1929, 23, 4230).

#### Anthraquinone-2 : 6-disulphonic Acid.

Yellowish cryst. +  $6H_2O$ . Easily sol.  $H_2O$ . Sol. EtOH. Insol.  $Et_2O$ ,  $C_6H_6$ .

*Na salt*: yellow cryst. +  $2H_2O$ . Sol. to 18% in  $H_2O$  at  $100^\circ$ , 4% at  $18^\circ$ .

*K salt*: yellow cryst. Sol. to 8% in  $H_2O$  at  $100^\circ$ , 1.5% at  $18^\circ$ .

*NH<sub>4</sub> salt*: yellow cryst. Sol. to 31% in  $H_2O$  at  $100^\circ$ , 5.5% at  $18^\circ$ .

*Ca salt*: pale yellow cryst. +  $5H_2O$ . Sol. to 2.4% in  $H_2O$  at  $100^\circ$ .

*Dichloride*:  $C_{14}H_6O_6S_2Cl_2$ . MW, 405. Yellow leaflets from chlorobenzene. M.p. 250°.

*Dianilide*: m.p. 321°.

Lauer, *J. prakt. Chem.*, 1931, 130, 185.

Fierz-David, *Helv. Chim. Acta*, 1927, 10, 219.

Thümmeler, D.R.P., 214,156, (*Chem. Zentr.*, 1909, II, 1396).

**Anthraquinone-2 : 7-disulphonic Acid.**

Yellow cryst. Very sol.  $H_2O$ . Sol. EtOH. Insol.  $Et_2O$ ,  $C_6H_6$ .

*Na salt*: + 4 $H_2O$ . Very sol.  $H_2O$ .

*NH<sub>4</sub> salt*: + 1 $H_2O$ . Very sol.  $H_2O$ .

*K salt*: + 1 $H_2O$ . Very sol. warm  $H_2O$ .

*Ca salt*: + 2 $H_2O$ . Sol. to 6% in  $H_2O$  at 100°.

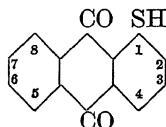
*Dichloride*:  $C_{14}H_6O_6S_2Cl_2$ . MW, 405. Yellow needles from  $CHCl_3$ . M.p. 186°.

*Dianilide*: m.p. 192°.

Lauer, *J. prakt. Chem.*, 1931, 130, 185.

Fierz-David, *Helv. Chim. Acta*, 1927, 10, 219.

**Anthraquinone-1-mercaptan ( $\alpha$ -Mercaptoanthraquinone)**



$C_{14}H_8O_2S$  MW, 240

Orange-yellow prisms or yellow needles from AcOH. M.p. 187°. Sol. AcOH. Spar. sol. EtOH,  $C_6H_6$ . Sol. alc. alkalis to violet sols. Sol. conc.  $H_2SO_4$  with red col. changing to yellow.

*S-Me*:  $C_{15}H_{10}O_2S$ . MW, 254. Yellow needles from EtOH. M.p. 218°. Sol.  $C_6H_6$ . Mod. sol. EtOH. Spar. sol. pet. ether.

*S-Et*:  $C_{16}H_{12}O_2S$ . MW, 268. Yellow prisms from EtOH. M.p. 183°.

*S-Vinyl*:  $C_{16}H_{10}O_2S$ . MW, 266. Brownish-red needles from EtOH. M.p. 163°.

Gattermann, *Ann.*, 1912, 393, 113.

Fries, Schürmann, *Ber.*, 1919, 52, 2170.

M.L.B., D.R.P., 292,457, (*Chem. Zentr.*, 1916, II, 42).

**Anthraquinone-2-mercaptan ( $\beta$ -Mercaptoanthraquinone).**

Yellow needles from AcOH. M.p. 206°. Spar. sol. usual solvents. Sol. alkalis to reddish-violet sols. Red in conc.  $H_2SO_4$ .

*S-Me*: pale yellow needles from EtOH. M.p. 162°.

*S-Et*: golden-yellow needles from EtOH. M.p. 138°.

*S-Vinyl*: golden-yellow needles from EtOH.Aq. M.p. 133°.

*S-Allyl*:  $C_{17}H_{12}O_2S$ . MW, 280. Yellow needles from EtOH. M.p. 126°.

Gattermann, *Ann.*, 1912, 393, 113.

Fries, Schürmann, *Ber.*, 1919, 52, 2170.

M.L.B., D.R.P., 292,457, (*Chem. Zentr.*, 1916, II, 42).

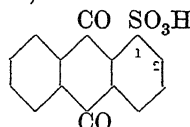
**Anthraquinone-1-oxamic Acid.**

See under 1-Aminoanthraquinone.

**Anthraquinonequinoline.**

See Anthraquinolinequinone.

**Anthraquinone-1-sulphonic Acid ( $\alpha$ -Sulphoanthraquinone)**



$C_{14}H_8O_5S$  MW, 288

Leaflets. M.p. 218°. Very sol.  $H_2O$ . Ppd. by HCl. Cryst. + 3 $H_2O$  from  $H_2O$ . Anhyd. cryst. from AcOH.  $NH_3 \rightarrow$  1-aminoanthraquinone.  $Ca(OH)_2$  under pressure  $\rightarrow$  1-hydroxyanthraquinone.  $NaClO_3 + HCl \rightarrow$  1-chloroanthraquinone.

*Na salt*: yellow pearly leaflets + 1 $H_2O$ . Sol. to 5% in  $H_2O$  at 100°.

*K salt*: yellow pearly leaflets. Sol. to 3.8% in  $H_2O$  at 100°.

*NH<sub>4</sub> salt*: very sol. hot  $H_2O$ .

*Ca salt*: + 3 $H_2O$ . Sol. to 1.8% in  $H_2O$  at 100°.

*Chloride*:  $C_{14}H_7O_4S$ . MW, 306.5. Yellow needles from  $PhNO_2$ . M.p. 216-18°. Hyd. by hot  $H_2O$ . Heat.  $\rightarrow$  1-chloroanthraquinone.

*Anilide*: golden-yellow cryst. M.p. 214°.

Fierz-David, *Helv. Chim. Acta*, 1927, 10, 198.

Lauer, *J. prakt. Chem.*, 1931, 130, 185.

Schwenk, Waldmann, *Z. angew. Chem.*, 1932, 45, 17.

du Pont, U.S.P., 1,881,498, (*Chem. Abstracts*, 1933, 27, 515).

**Anthraquinone-2-sulphonic Acid ( $\beta$ -Sulphoanthraquinone).**

Leaflets + 3 $H_2O$ . Sol.  $H_2O$ , EtOH. Insol.  $Et_2O$ . Ppd. from  $H_2O$  by conc. HCl.

*Na salt*: + 1 $H_2O$ . Sol. to 21% in  $H_2O$  at 100°, 0.8% at 18°. Insol. EtOH,  $Et_2O$ . Known in commerce as "silver salt."

*K salt*: yellow leaflets. Sol. to 12.5% in  $H_2O$  at 100°, 0.9% at 18°.

*NH<sub>4</sub> salt*: sol. to 46% in  $H_2O$  at 100°, 5% at 18°.

*Ca salt*: + 2 $H_2O$ . Sol. to 0.5% in  $H_2O$  at 100°.

*Me ester*:  $C_{15}H_{10}O_5S$ . MW, 302. Cryst. M.p. 123°.

*Et ester*:  $C_{16}H_{12}O_5S$ . MW, 316. White cryst. M.p. 125°.

*Chloride*:  $C_{14}H_7O_4SCl$ . MW, 306.5. Pale yellow needles from  $C_6H_6$  or chlorobenzene. M.p. 197°. Stable to cold  $H_2O$ .

*Amide*:  $C_{14}H_9O_4NS$ . MW, 287. Yellow cryst. from AcOH. M.p. 261°.

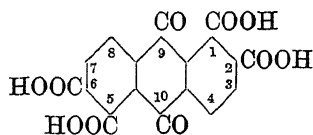
*Anilide*: yellowish-brown cryst. M.p. 193°.

Fierz-David, *Helv. Chim. Acta*, 1927, **10**, 216.

Lauer, *J. prakt. Chem.*, 1931, **130**, 185.

Schwenk, *Z. angew. Chem.*, 1931, **44**, 912. I.G., D.R.P., 576,444, (*Chem. Abstracts*, 1933, **27**, 3722).

**Anthraquinone-1:2:5:6-tetracarboxylic Acid**



$C_{18}H_8O_{10}$  MW, 384

Cream coloured needles from  $H_2O$ . Does not melt below 360°.

*Tetra-Me ester*:  $C_{22}H_{16}O_{10}$ . MW, 440. Powder from xylene. M.p. 292-3°. Spar. sol. most solvents.

Cook, *J. Chem. Soc.*, 1931, 2531.

**Anthraquinone-1:2:6:7-tetracarboxylic Acid.**

*Tetra-Me ester*: cryst. from  $C_6H_6$ . M.p. 188-90°.

Cook, *J. Chem. Soc.*, 1933, 1595.

**Anthraquinone-1:2:7:8-tetracarboxylic Acid.**

*Tetra-Me ester*: yellow rosettes from xylene. M.p. 237-9°.

Cook, *J. Chem. Soc.*, 1933, 1595.

**Anthraquinone-1:3:5:7-tetracarboxylic Acid.**

Yellow needles. Does not melt below 300°. Spar. sol. hot  $PhNO_2$ . Insol. most org. solvents.

*Tetra-chloride*: yellow needles from  $C_6H_6$ .

Scholl, Meyer, Keller, *Ann.*, 1934, **513**, 299.

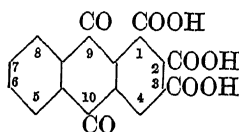
**Anthraquinone-1:4:5:8-tetracarboxylic Acid.**

Yellow prisms from AcOH.

*Tetrachloride*: colourless leaflets from  $C_6H_6$ .

Scholl, Meyer, Keller, *Ann.*, 1934, **513**, 302.

**Anthraquinone - 1 : 2 : 3 - tricarboxylic Acid**



$C_{17}H_8O_8$

MW, 340

*Tri-Me ester*:  $C_{20}H_{14}O_8$ . MW, 382. Cryst. from  $C_6H_6$ -cyclohexane. M.p. 184-5°.

Cook, *J. Chem. Soc.*, 1933, 1595.

**Anthraquinone - 1 : 2 : 4 - tricarboxylic Acid.**

Yellow cryst. from EtOH. Does not melt below 320°. Insol.  $H_2O$ .  $Zn + NH_3 \rightarrow$  anthracene-1:2:4-tricarboxylic acid.

*Tri-Et ester*:  $C_{23}H_{20}O_8$ . MW, 424. Leaflets from EtOH.Aq. M.p. 125°.

Elbs, *J. prakt. Chem.*, 1890, **41**, 126.

**Anthraquinone - 1 : 2 : 5 - tricarboxylic Acid.**

*Tri-Me ester*: cryst. from  $C_6H_6$ . M.p. 212-13°.

Cook, *J. Chem. Soc.*, 1933, 1595.

**Anthraquinone - 1 : 2 : 6 - tricarboxylic Acid.**

*Tri-Me ester*: cryst. from xylene. M.p. 234°.

Cook, *J. Chem. Soc.*, 1933, 1595.

**Anthraquinone - 1 : 2 : 7 - tricarboxylic Acid.**

*Tri-Me ester*: cryst. from  $CHCl_3$ -EtOH. M.p. 204°.

Cook, *J. Chem. Soc.*, 1933, 1595.

**Anthraquinone - 1 : 3 : 6 - tricarboxylic Acid.**

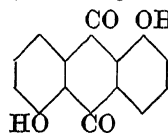
Yellow leaves. Does not melt below 300°. Spar. sol. most org. solvents. Insol.  $H_2O$ .

Elbs, *J. prakt. Chem.*, 1890, **41**, 144.

**Anthrarobin.**

See Deoxyalazarin.

**Anthrarufin (1 : 5-Dihydroxyanthraquinone)**



$C_{14}H_8O_4$

MW, 240

Pale yellow plates from AcOH. M.p. 280°. Sublimes. Sol.  $C_6H_6$ ,  $PhNO_2$ . Spar. sol. EtOH, AcOH, Et<sub>2</sub>O. Sol. KOH. Prac. insol. carbonates and  $NH_3$ . Sol. conc.  $H_2SO_4$  to fluor. crimson sol.  $HNO_3 + H_2SO_4 \rightarrow$  4:8-dinitro deriv.

*Di-Me ether*:  $C_{16}H_{12}O_4$ . MW, 268. Pale yellow needles from EtOH. M.p. 236°. Bluish-red in conc.  $H_2SO_4$ . *Oxime*: brown amorph. powder from EtOH.Aq. M.p. 196°.

*Et ether*:  $C_{16}H_{12}O_4$ . MW, 268. Yellow needles from EtOH.Aq. M.p. 163-4°. *Acetyl*: yellowish leaflets. M.p. 172-3°.

*Di-Et ether*:  $C_{18}H_{16}O_4$ . MW, 296. Yellow needles from EtOH. M.p. 178°.

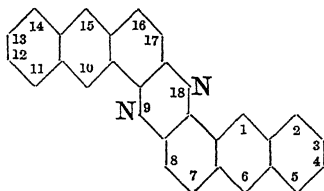
*Diphenyl ether*:  $C_{26}H_{16}O_4$ . MW, 392. Yellow needles from AcOH or  $PhNO_2$ . M.p. 215°. Sol. most org. solvents.

*Diacyl*: yellow needles from AcOH. M.p. 244°. Sol. AcOH. Spar. sol. EtOH. Conc. H<sub>2</sub>SO<sub>4</sub> → red sol. → anthrarufin.

Schwenk, *J. prakt. Chem.*, 1921, 103, 106. National Aniline & Chemical Co., B.P., 181,673, (*Chem. Abstracts*, 1922, 16, 3762).

Gewerkshaff Mathias Stinnes, D.R.P., 605,446, (*Chem. Abstracts*, 1935, 29, 1100).

**Anthrazine** (*Anthracene-1 : 2 : 1' : 2'-azine*)



C<sub>23</sub>H<sub>16</sub>N<sub>2</sub> MW, 380

Yellowish-brown needles from PhNO<sub>2</sub>. M.p. 390°. Sublimes at about 340°. Sol. hot PhNO<sub>2</sub>, anisole. Spar. sol. CHCl<sub>3</sub>, CCl<sub>4</sub>. Insol. other low boiling solvents. Dil. sols. show yellowish-green fluor. Sol. conc. H<sub>2</sub>SO<sub>4</sub>, conc. HNO<sub>3</sub>. Insol. dil. acids, alkalis.

B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>: brownish-red needles. Hyd. by hot H<sub>2</sub>O.

*Picrate*: red needles. Decomp. on warming with EtOH or PhNO<sub>2</sub>.

Scholl, Berblinger, Künzel, *Ber.*, 1907, 40, 933.

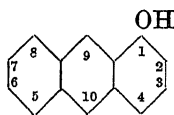
Bayer, D.R.P., 172,684, (*J. Chem. Soc.*, 1906, 90, 868).

Schiedt, *J. prakt. Chem.*, 1941, 157, 203.

**Anthroic Acid.**

See Anthracene-carboxylic Acid.

**1-Anthrol** (*1-Hydroxyanthracene, α-anthrol*)



C<sub>14</sub>H<sub>10</sub>O MW, 194

Brown leaflets or needles from EtOH or AcOH. M.p. 150-3°. Sol. org. solvents with blue fluor. Sol. alkalis to unstable, green fluor. sols. Heat with acetamide → 1-aminoanthracene.

*Me ether*: C<sub>15</sub>H<sub>12</sub>O. MW, 208. Leaflets. M.p. 70°.

*Et ether*: C<sub>16</sub>H<sub>14</sub>O. MW, 222. Needles. M.p. 69°. Sol. EtOH with blue fluor.

*Acetyl*: 1-acetoxyanthracene. Needles from EtOH. Turns brown at 80°, m.p. 130° decomp. Ox. → 1-acetoxyanthraquinone.

Dienel, *Ber.*, 1905, 38, 2863.

Fierz-David, Blangey, Streit, *Helv. Chim. Acta*, 1946, 29, 1718.

**2-Anthrol** (*2-Hydroxyanthracene, β-anthrol*).

Brownish leaflets or needles from EtOH.Aq. Decomp. at 200°. Very sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO. Insol. H<sub>2</sub>O. Sol. KOH, Ba(OH)<sub>2</sub> with green fluor. EtOH sol. shows reddish-violet fluor. Reduces Ag sols. on warming. Alc. FeCl<sub>3</sub> → yellow col.

*Me ether*: m.p. 175-8°.

*Et ether*: needles from EtOH.Aq. M.p. 145-6°. Can be distilled.

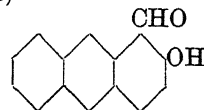
*Acetyl*: 2-acetoxyanthracene. Leaflets from C<sub>6</sub>H<sub>6</sub>. M.p. 198°. Sol. C<sub>6</sub>H<sub>6</sub>. Spar. sol. AcOH. Ox. → 2-acetoxyanthraquinone.

Lagodzinski, *Ann.*, 1905, 342, 67.

**9-Anthrol.**

See Anthranol.

**2-Anthrol-1-aldehyde** (*2-Hydroxy-1-aldehydroanthracene*)



C<sub>15</sub>H<sub>10</sub>O<sub>2</sub> MW, 222

Light yellowish needles from EtOH. M.p. 164°. Sol. EtOH, NaOH. Spar. sol. cold H<sub>2</sub>O. Ethereal sol. shows green fluor. Alc. FeCl<sub>3</sub> → olive-brown col.

*Oxime*: greenish leaflets from C<sub>6</sub>H<sub>6</sub>. M.p. 197° decomp. Spar. sol. cold C<sub>6</sub>H<sub>6</sub>.

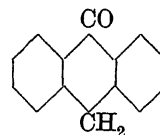
*Azine*: deep red needles. Does not melt below 300°. Spar. sol. usual solvents.

Bezdzik, Friedländer, *Monatsh.*, 1909, 30, 874.

**Anthrol-carboxylic Acid.**

See Hydroxyanthracene-carboxylic Acid.

**Anthrone**

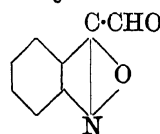


C<sub>14</sub>H<sub>10</sub>O MW, 194

Keto form of anthranol. Needles from AcOH. M.p. 154° (163-70°). Sol. hot C<sub>6</sub>H<sub>6</sub>. Alc. sol. shows blue fluor. In hot caustic alk. sol. → anthranol. Ac<sub>2</sub>O → acetylanthranol (*ms*-acetoxyanthracene). Not oxidised by FeCl<sub>3</sub>, Br, etc. Does not condense with *p*-nitrosodimethylaniline. Does not couple with diazo comps.

Meyer, *Organic Syntheses*, Collective Vol. I, 52.

**Anthroxanaldehyde**



C<sub>8</sub>H<sub>5</sub>O<sub>2</sub>N

MW, 147

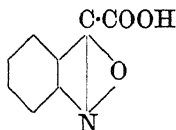
Long, yellowish needles from pet. ether. M.p. 72-5°. Sol. hot H<sub>2</sub>O. Sublimes. Volatile in steam.

*Oxime*: needles. M.p. 172-3°.

Bamberger, *Ber.*, 1909, 42, 1707.

Heller, *Ber.*, 1916, 49, 523.

### Anthroxanic Acid



C<sub>8</sub>H<sub>5</sub>O<sub>3</sub>N MW, 163  
Needles. M.p. 190° (196° decomp., 197-5°).  
Sol. Me<sub>2</sub>CO. Mod. sol. hot H<sub>2</sub>O. Spar. sol.  
AcOH, C<sub>6</sub>H<sub>6</sub>. Insol. cold H<sub>2</sub>O. FeSO<sub>4</sub> +  
NH<sub>3</sub>.Aq. → isatin.

*Brucine salt*: prisms + H<sub>2</sub>O from MeOH.  
M.p. 210-12° decomp.

*Quinine salt*: prismatic needles from MeOH.  
M.p. 198-202° decomp.

*Strychnine salt*: prisms + H<sub>2</sub>O. M.p. 210-  
12° decomp.

*Me ester*: C<sub>9</sub>H<sub>7</sub>O<sub>3</sub>N. MW, 177. M.p. 70°.

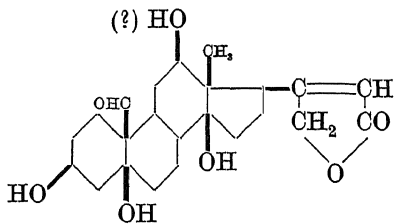
*Et ester*: C<sub>10</sub>H<sub>9</sub>O<sub>3</sub>N. MW, 191. Needles.  
M.p. 64-5°.

*Amide*: C<sub>8</sub>H<sub>6</sub>O<sub>3</sub>N<sub>2</sub>. MW, 162. Needles from  
H<sub>2</sub>O. M.p. 211-12°.

Heller, *Ber.*, 1916, 49, 523.

Leuchs, *Ber.*, 1925, 58, 1452, 2827.

### Antiarigenin



Suggested structure

C<sub>23</sub>H<sub>32</sub>O<sub>7</sub> MW, 420

Cardiac poison. M.p. 242°. [α]<sub>D</sub> + 42°.

*Benzoyl deriv.*: m.p. 307°. [α]<sub>D</sub> + 27°.

*Semicarbazone*: needles from AcOH.Aq.

Does not melt below 250°.

Tschesche, Haupt, *Ber.*, 1936, 69, 1377.

Doebel, Schlittler, Reichstein, *Helv. Chim.*

*Acta*, 1948, 31, 688.

### Antiarin

The name given to two isomeric glycosides  
isolated from the milk sap of *Antiaris toxicaria*.

α-

C<sub>29</sub>H<sub>42</sub>O<sub>11</sub> MW, 566

Tablets from H<sub>2</sub>O. M.p. 220-5°. Hyd. →  
D-gulomethylose + antiarigenin.

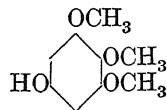
β-

Cryst. from H<sub>2</sub>O. M.p. 225°. Hyd. →  
rhamnose + antiarigenin.

Tschesche, Haupt, *Ber.*, 1936, 69, 1378.

Doebel, Schlittler, Reichstein, *Helv. Chim.*  
*Acta*, 1948, 31, 688.

**Antiarol** (5-Hydroxy-1 : 2 : 3-trimethoxybenz-  
ene)



C<sub>9</sub>H<sub>12</sub>O<sub>4</sub> MW, 184

Occurs in *Antiaris toxicaria*, Lesch. Needles  
from H<sub>2</sub>O. M.p. 148°. Sol. EtOH. Spar. sol.  
Et<sub>2</sub>O. Prac. insol. H<sub>2</sub>O. FeCl<sub>3</sub> → yellowish-  
green col. Ox. → 2 : 6-dimethoxy-*p*-benzo-  
quinone.

*Me ether*: 1 : 3 : 4 : 5-tetramethoxybenzene.  
C<sub>10</sub>H<sub>14</sub>O<sub>4</sub>. MW, 198. Leaflets. M.p. 47°. B.p.  
271°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Acetyl*: prisms from EtOH. M.p. 74°.

Hattori, *Acta Phytochimica*, 1931, 5, 219.

Chapman, Perkin, Robinson, *J. Chem.*  
*Soc.*, 1927, 3028.

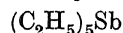
### Antiarose.

See D-Gulomethylose.

**Antifebrin.**

See Acetanilide.

**Antimony pentaethyl**



C<sub>10</sub>H<sub>25</sub>Sb MW, 267

B.p. 100°.

Buckton, *Jahresber. Fortschr. Chem.*, 1860,  
374.

**Antimony triethyl.**

See Triethylstibine.

**Antimony trimethyl.**

See Trimethylstibine.

**Antimony triphenyl.**

See Triphenylstibine.

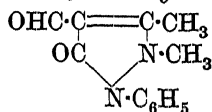
**Antimycin-A**

C<sub>28</sub>H<sub>40</sub>O<sub>9</sub>N<sub>2</sub> MW, 548

Antibiotic antifungal compound from a species  
of *Streptomyces*. M.p. 139-40°. [α]<sub>D</sub><sup>25</sup> + 64-8°  
(c = 10 in CHCl<sub>3</sub>). Sol. EtOH. Insol. H<sub>2</sub>O.  
Weakly acidic.

Dunshee, Leben, Keitt, Strong, *J. Am.*  
*Chem. Soc.*, 1949, 71, 2436.

**Antipyraldehyde** (1-Phenyl-2 : 3-dimethyl-4-  
aldehydopyrazolone-5, 4-aldehydoantipyrine)



C<sub>12</sub>H<sub>12</sub>O<sub>2</sub>N<sub>2</sub>

MW, 216

M.p. 216–17°.

*Oxime*: *syn*-, m.p. 228–30°: *anti*-, m.p. 220–2°.

*Phenylhydrazone*: *syn*-, m.p. 253–5°: *anti*-, m.p. 190–2°.

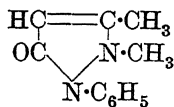
*p*-Nitrophenylhydrazone: *syn*-, m.p. 276–80°: *anti*-, m.p. 240–2°.

*Semicarbazone*: *syn*-, m.p. 249–51°: *anti*-, 204–8°.

Passerini, Losco, *Gazz. chim. ital.*, 1940, 70, 710.

Ridi, *Gazz. chim. ital.*, 1941, 71, 95.

**Antipyrene** (1-Phenyl-2 : 3-dimethylpyrazolone-5, phenazone)



$C_{11}H_{12}ON_2$

MW, 188

Leaflets or scales from  $Et_2O$ ,  $C_6H_6$  or  $H_2O$ . M.p. 114°. B.p. 319°. Sol. to 85% in  $H_2O$ , 75% in EtOH, 2.5% in  $Et_2O$ . Powerful antipyretic. Weak base.  $POCl_3 \rightarrow$  chloride,  $C_{11}H_{12}N_2Cl_2$ , MW, 243: m.p. 137°.  $HNO_2 \rightarrow$  green col. (nitroso-comp.). Acid sol. gives ppt. with Mayer's reagent.

*Picrate*: yellow needles. M.p. 188°.

*Salicylate*: Salipyrene. M.p. 92°. Sol. 200 parts cold  $H_2O$ , mod. sol. hot  $H_2O$ .

*Acetylsalicylate*: Acetopyrene. M.p. 65°.

Thoms, Schnupp, *Ann.*, 1923, 434, 296.

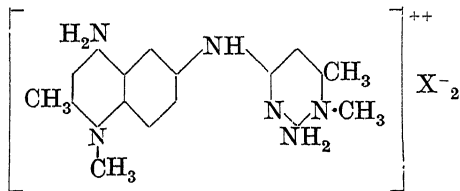
Rodionov, *Bull. soc. chim.*, 1926, 39, 305.

Reuter, U.S.P., 2,005,505, (*Chem. Abstracts*, 1935, 29, 5130).

Soc. des usines chim. Rhône-Poulenc, D.R.P., 581,779, (*Chem. Abstracts*, 1934, 28, 1366).

Klebanskiĭ, Lemke, *Chem. Abstracts*, 1935, 29, 6891.

**Antrycide** (4-Amino-6-[2'-amino-6'-methylpyrimidyl-4'-amino]-quinaldine-1 : 1'-dimetho salts, 4-amino-6-[2'-amino-1' : 6'-dimethylpyrimidinium-4'-amino]-1 : 2-dimethylquinolinium salts)



$C_{17}H_{22}N_6X_2$

MW, 310( $X_2$ )

Antimalarial drug for treatment of animal trypanosomiasis. Administered in the form of a salt, usually the chloride or methosulphate.

*Di-iodide*: m.p. 312–13° decomp.

*Dichloride*: m.p. 316–17° decomp.

*Dibromide*: m.p. 316° decomp.

*Di-methosulphate*: m.p. 265–6°.

Curd, Davey, *Nature*, 1949, 163, 89; *Brit. J. Pharmacol.*, 1950, 5, 25.

Ainley, Curd, I.C.I., B.P. 634,818, (*Chem. Abstracts*, 1950, 44, 7889).

Curd, I.C.I., B.P. 634,531.

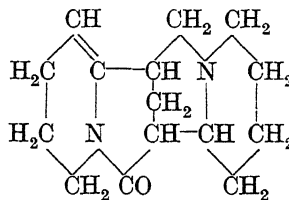
**Antrypol.**

See Bayer 205.

**Aphrodine.**

See Yohimbine.

**Aphyllidene**



Suggested structure

$C_{15}H_{22}ON_2$

MW, 246

Alkaloid from *Anabasis aphylla*. Plates from pet. ether. M.p. 112–13°.  $[\alpha]_D^{18} +5.57^\circ$  in MeOH.

*B.HCl*: cryst. from EtOH M.p. 235–7°.  $[\alpha]_D +30^\circ$  in  $H_2O$ .

*B.HClO4*: prisms from  $H_2O$ . M.p. 212–13°.  $[\alpha]_D +15^\circ$  in MeOH.

*Methiodide*: needles from MeOH. M.p. 223–5°.  $[\alpha]_D +9.8^\circ$  in  $H_2O$ .

*Picrolonate*: yellow prisms from EtOH. M.p. 235–6°.

Orékhov, *Chem. Zentr.*, 1938, I, 2365.

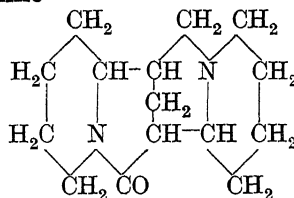
Orékhov, Menschikov, *Ber.*, 1932, 65, 234.

Orékhov, Norkina, Maximova, *Ber.*, 1934, 67, 1976.

Orékhov, Norkina, *Ber.*, 1934, 67, 1845.

Späth *et al.*, *Ber.*, 1942, 75, 805.

**Aphylline**



$C_{15}H_{24}ON_2$

MW, 248

Alkaloid from *Anabasis aphylla*. B.p. 200°/4 mm.  $[\alpha]_D^{20} +10.3^\circ$  in MeOH.

*B.HCl*: prisms. M.p. 207–9°.  $[\alpha]_D +12.91^\circ$ .

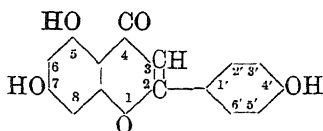
*Methiodide*: needles from MeOH. M.p. 212–13° decomp.

*Picrolonate*: yellow prisms from EtOH. M.p. 230–1° decomp.

Orékhov, *Chem. Zentr.*, 1938, I, 2365.

Orékhov, Menschikov, *Ber.*, 1932, 65, 234; 1931, 64, 266.

Späth *et al.*, *Ber.*, 1942, 75, 805.

**Apigenin** (5 : 7 : 4'-Trihydroxyflavone)

$C_{15}H_{10}O_5$  MW, 270

Constituent of parsley and celery as glycoside, apiin. Occurs in yellow dahlia. Yellow needles from Py.Aq. M.p. 347-8° (352°). Sol. Py. Mod. sol. hot EtOH. Insol.  $H_2O$ . Sol. aq. carbonates to yellow sols. Conc.  $H_2SO_4$  → yellow sol. with weak greenish fluor. Alc.  $FeCl_3$  → brownish-black col.

7-Me ether : see Genkwainin.

4'-Me ether : see Acacetin.

5 : 4'-Di-Me ether :  $C_{17}H_{14}O_5$ . MW, 298. Needles from EtOH.Aq. M.p. 264°. 7-Acetyl : m.p. 204°.

7 : 4'-Di-Me ether :  $C_{17}H_{14}O_5$ . MW, 298. Pale yellow needles. M.p. 171-2°. Spar. sol. EtOH. Conc.  $H_2SO_4$  → pale yellow sol. with greenish fluor. Alk. → *p*-hydroxyacetophenone + phloroglucinol. 5-Acetyl : needles from EtOH. M.p. 195-6° (199-200°).

Tri-Me ether :  $C_{18}H_{16}O_5$ . MW, 312. Needles from EtOH. M.p. 156°. Sol.  $C_6H_6$ . Conc.  $H_2SO_4$  → pale yellow sol. with green fluor.

7 : 4'-Di-Et ether :  $C_{19}H_{18}O_5$ . MW, 326. Yellow needles. M.p. 163-4°. Spar. sol. EtOH. 5-Acetyl : leaflets from  $Me_2CO$ . M.p. 148-149.5°.

Tri-Et ether :  $C_{21}H_{22}O_5$ . MW, 354. M.p. 189-91°.

5 : 7 : 4'-Triacetyl : needles from EtOH. M.p. 181-2° (186°).

5 : 7 : 4'-Tribenzoyl : needles. M.p. 210-12°. Spar. sol. EtOH.

Czajkowski, Kostanecki, Tambor, *Ber.*, 1900, 33, 1988.

Schmid, Waschkau, *Monatsh.*, 1928, 49, 83.

Nakano, *Chem. Abstracts*, 1932, 26, 4334.

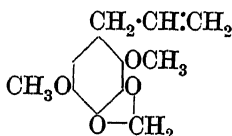
**Apiin**

$C_{26}H_{28}O_{14}$  MW, 564

Apigenin glycoside. Constituent of parsley. Needles +  $1H_2O$ . M.p. 228°. Sol. EtOH, hot  $H_2O$  : ppts from these in gelatinous form. Dil.  $H_2SO_4$  → apigenin + apiose + glucose.

Vongerichten, *Ann.*, 1901, 318, 121.

**Apiol** (2 : 5-Dimethoxy-3 : 4-methylenedioxy-1-allylbenzene : cf. Dill-apiol)



$C_{12}H_{14}O_4$

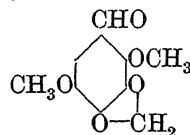
MW, 222

Chief constituent of oil of parsley. Needles. M.p. 30°. B.p. 294°, 179°/33 mm. Sol. EtOH,  $Et_2O$ . Insol.  $H_2O$ .  $D_4^{20}$  1.015.  $n_D^{25}$  1.5380. Volatile in steam. Ox. → apiolic acid. Alc. KOH → isopiolic.

Walmsley, *Quart. J. Pharm. Pharmacol.*, 1929, 1, 388; *Chemist and Druggist*, 1928, 109, 127; *Pharm. J.*, 1928, 121, 89.

Baker, Savage, *J. Chem. Soc.*, 1938, 1602.

**Apiolaldehyde** (*Apiolic aldehyde*, 2 : 5-dimethoxy-3 : 4-methylenedioxybenzaldehyde : cf. Dill-apiolaldehyde)



$C_{10}H_{10}O_5$  MW, 210

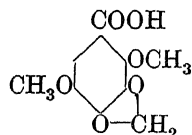
Needles from EtOH. M.p. 102°. B.p. 315°. Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ , AcOH,  $CS_2$ . Spar. sol. pet. ether. Conc.  $H_2SO_4$  → yellow sol. → olive-green on warming. Gives bisulphite comp. Ox. → apiolic acid.

Oxime : needles from EtOH. M.p. 161°. Sol.  $Et_2O$ , AcOH, AcOEt, hot EtOH. Acetyl : prisms from EtOH. M.p. 128-9°.

*p*-Nitrophenylhydrazone : orange-red. M.p. 228-9°.

Fabinyi, Széki, *Ber.*, 1917, 50, 1335.

**Apiolic Acid** (2 : 5-Dimethoxy-3 : 4-methylenedioxybenzoic acid : cf. Dill-apiolic Acid)



$C_{10}H_{10}O_6$  MW, 226

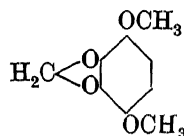
Needles from  $H_2O$ . M.p. 175°. Sol.  $Et_2O$ , hot EtOH, hot AcOH,  $C_6H_6$ , AcOEt. Spar. sol. hot  $H_2O$ , insol. cold.  $k = 8.0 \times 10^{-6}$  at 25°. Dil.  $H_2SO_4$  at 130-40° → apione.

Me ester :  $C_{11}H_{12}O_6$ . MW, 240. Needles from  $H_2O$ . M.p. 71-2°. Sol.  $Et_2O$ , EtOH, AcOH. Spar. sol. hot  $H_2O$ .

Nitrile :  $C_{10}H_9O_4N$ . MW, 207. Cryst. from EtOH.Aq. M.p. 135.5°. Sol. ord. org. solvents. Insol.  $H_2O$ .

Baker, Savage, *J. Chem. Soc.*, 1938, 1606. Ciamician, Silber, *Ber.*, 1888, 21, 1623.

**Apione** (1 : 4-Dimethoxy-2 : 3-methylenedioxybenzene)



$C_9H_{10}O_4$

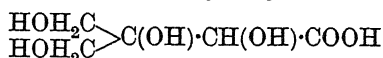
MW, 182



Needles from EtOH.Aq. M.p. 79°. Sol. Et<sub>2</sub>O, AcOH, AcOEt, hot EtOH. Insol. H<sub>2</sub>O. Volatile in steam.

Baker, Savage, *J. Chem. Soc.*, 1938, 1605.  
Ciamician, Silber, *Ber.*, 1888, 21, 1630.

**Apionic Acid** (*Tetrahydroxyisovaleric acid*)



C<sub>5</sub>H<sub>10</sub>O<sub>6</sub> MW, 166

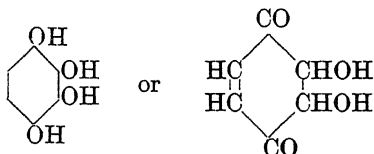
Colourless syrupy liq. HI + P → isovaleric acid.

Ca salt: cryst. + 2H<sub>2</sub>O. [α]<sub>D</sub><sup>20</sup> - 1.34° in H<sub>2</sub>O.  
Phenylhydrazide: m.p. 127°.

Vongerichten, *Ann.*, 1902, 321, 78.

Schmidt, *Ann.*, 1930, 483, 121.

**Apionol** (1 : 2 : 3 : 4 - *Tetrahydroxybenzene*, *phenetetrol*)



C<sub>6</sub>H<sub>6</sub>O<sub>4</sub> MW, 142

Pale pink needles from AcOEt. M.p. 161°. Sol. 400 parts C<sub>6</sub>H<sub>6</sub>. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, AcOH. FeCl<sub>3</sub> → blue col.

1 : 2-*Di-Me ether*: C<sub>8</sub>H<sub>10</sub>O<sub>4</sub>. MW, 170. B.p. 283°. 3 : 4-*Diacetyl*: cryst. from pet. ether. M.p. 85°.

1 : 4-*Di-Me ether*: m.p. 106°. B.p. 298°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, hot H<sub>2</sub>O, alkalis.  
2 : 3-*Diacetyl*: cryst. from EtOH. M.p. 144°.

*Tetra-Me ether*: C<sub>10</sub>H<sub>14</sub>O<sub>4</sub>. MW, 198. Prisms from ligroin. M.p. 89°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>. Volatile in steam.

*Tetra-acetyl*: cryst. from EtOH. M.p. 142° (136°, 139°). Sol. Et<sub>2</sub>O.

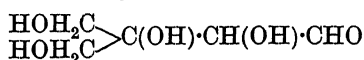
*Tetrabenzoyl*: m.p. 191-2°.

Einhorn, Cobliner, Pfeiffer, *Ber.*, 1904, 37, 119.

Terry, Milas, *J. Am. Chem. Soc.*, 1926, 48, 2647.

Wessely, Lechner, *Monatsh.*, 1932, 60, 160.

**Apiose** (*Tetrahydroxyisovaleraldehyde*)



C<sub>5</sub>H<sub>10</sub>O<sub>5</sub> MW, 150

Clear pale yellow syrup. [α]<sub>D</sub><sup>15</sup> + 5.6° in H<sub>2</sub>O. Br → apionic acid.

p-*Bromophenyllosazone*: m.p. 211-12°.

*Benzylphenylhydrazone*: cryst. from CHCl<sub>3</sub>. M.p. 187-8°. Sol. Py, hot EtOH. Mod. sol.

CHCl<sub>3</sub>, AcOEt. Spar. sol. Et<sub>2</sub>O, CCl<sub>4</sub>, ligroin. [α]<sub>D</sub><sup>20</sup> - 94.0° in Py.

Schmidt, *Ann.*, 1930, 483, 115.

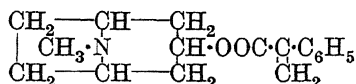
Vongerichten, *Ann.*, 1902, 321, 74.

Hudson, *Advances in Carbohydrate Chemistry*, 1949, 4, 57.

**Aplotaxene**.

See Heptadecatetraene.

**Apotropine** (*Tropine atropic ester*, *atropamine*)



C<sub>17</sub>H<sub>21</sub>O<sub>2</sub>N MW, 271

In belladonna root. Prisms from CHCl<sub>3</sub>. M.p. 60-2°. Very sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>. Mod. sol. ligroin, isoamyl alc. Spar. sol. H<sub>2</sub>O. Optically inactive. Has no mydriatic action. Conc. HCl at 130° → tropine, isotropic and atropic acids. Ba(OH)<sub>2</sub> at 100° → tropine + atropic acid.

*B.HCl*: leaflets. M.p. 237-9°. Mod. sol. hot H<sub>2</sub>O. Spar. sol. EtOH, Me<sub>2</sub>CO. Insol. Et<sub>2</sub>O.

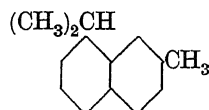
*B.HBr*: leaflets. M.p. 248°.

*B.HAuCl<sub>4</sub>*: yellow needles from H<sub>2</sub>O. M.p. 112°.

*Picrate*: yellow needles. M.p. 166-8°. Spar. sol. cold H<sub>2</sub>O.

Hesse, *Ann.*, 1893, 277, 292.

**Apocadalene** (*2-Methyl-8-isopropyl-naphthalene*)



C<sub>14</sub>H<sub>16</sub> MW, 184

B.p. 282°, 139-41°/12 mm. D<sub>4</sub><sup>20</sup> 0.9833. n<sub>D</sub><sup>20</sup> 1.5884.

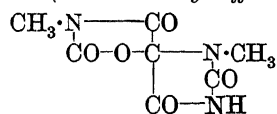
*Picrate*: orange-yellow needles from EtOH. M.p. 102°.

*Styphnate*: yellow needles from EtOH. M.p. 166° (163-4°).

Barnett, Sanders, *J. Chem. Soc.*, 1933, 437.

Ruzicka, Mingazzini, *Helv. Chim. Acta*, 1922, 5, 710.

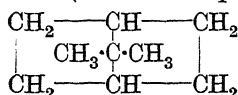
**Apocaffeine** (1 : 7-*Dimethylcaffolide*)



C<sub>7</sub>H<sub>7</sub>O<sub>5</sub>N<sub>3</sub> MW, 213

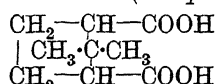
Cryst. from H<sub>2</sub>O. M.p. 154°. Sol. EtOH, MeOH, AcOH, Me<sub>2</sub>CO. Spar. sol. cold H<sub>2</sub>O, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Prac. insol. CS<sub>2</sub>, CCl<sub>4</sub>, ligroin. Boiling H<sub>2</sub>O → caffuric acid.

Biltz, *Ber.*, 1910, 43, 1618.

Apocamphane ( $\alpha$ -Fenchocamphorane) $\text{C}_9\text{H}_{16}$ 

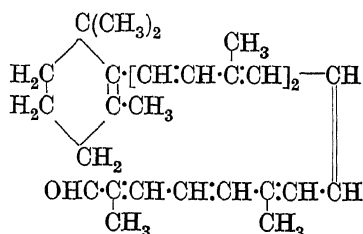
MW, 124

M.p. 86°. B.p. 148°/755 mm.

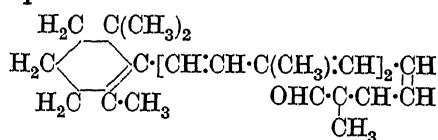
Komppa, Hasselström, *Ann.*, 1932, 496, 164.Apocamphoric Acid (*Camphopyric acid*) $\text{C}_9\text{H}_{14}\text{O}_4$ 

MW, 186

Exists in two stereoisomeric forms.

(I) *Cis*:Cryst. from  $\text{H}_2\text{O}$ , m.p. 204° (209°). Optically inactive. Insol.  $\text{CHCl}_3$ .  $k = 3.5 \times 10^{-5}$  at 18°.*Anhydride*:  $\text{C}_9\text{H}_{12}\text{O}_3$ . MW, 168. Needles from EtOH, prisms from  $\text{CHCl}_3$ -pet. ether. M.p. 178° (174-5°). Sol. EtOH,  $\text{CHCl}_3$ . Spar. sol.  $\text{Et}_2\text{O}$ . Sublimes. Volatile in steam.*Dichloride*:  $\text{C}_9\text{H}_{12}\text{O}_2\text{Cl}_2$ . MW, 223. Colourless liq. B.p. 125-30°/13 mm. Hyd. by hot  $\text{H}_2\text{O}$ .*Mono-anilide*: m.p. 212°.(II) *Trans*:Plates from  $\text{H}_2\text{O}$ . M.p. 190-1°.The *cis-trans* mixture (mesoapocamphoric acid, mesocamphopyric acid) has m.p. 163-70°. Cryst. from  $\text{H}_2\text{O}$ .Wallach, *Ann.*, 1908, 362, 184.Komppa, *Ann.*, 1909, 368, 151.Nametkin, Alexandroff, *Ann.*, 1928, 467, 191. $\beta$ -Apo-2-carotenal $\text{C}_{30}\text{H}_{40}\text{O}$ 

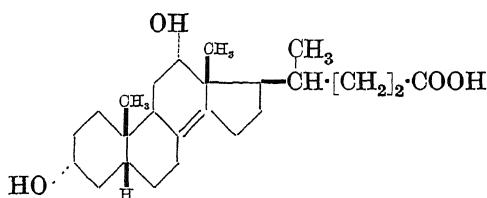
MW, 416

From oxidation of  $\beta$ -carotene. Violet plates from MeOH. M.p. 139°.*Oxime*: violet prisms. M.p. 180°.*Semicarbazone*: m.p. 212°.Karrer, Solmssen, *Helv. Chim. Acta.*, 1937, 20, 682, 1020. $\beta$ -Apo-4-carotenal $\text{C}_{25}\text{H}_{34}\text{O}$ 

MW, 350

From oxidation of  $\beta$ -carotene. Not obtained in cryst. form.*Oxime*: rhombic plates from MeOH. M.p. 165°.*Semicarbazone*: carmine red powder from EtOH. M.p. 217° decomp.Karrer, Solmssen, *Helv. Chim. Acta.*, 1937, 20, 688, 1020.

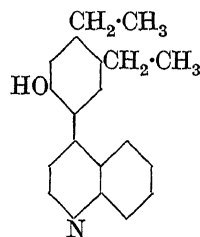
## Apocholic Acid

 $\text{C}_{24}\text{H}_{38}\text{O}_4$ 

MW, 390

M.p. 166-8° (176-7°).  $[\alpha]_D^{20} +49.87^\circ$  in EtOH. Forms addition compounds. $\text{CH}_3\text{COOH}$  add. comp.: prisms from AcOH. M.p. 170-1°.  $[\alpha]_D^{20} +45.35^\circ$  in EtOH. $\text{C}_6\text{H}_6$  add. comp.: needles. M.p. 174-5°.*Me ester*: prisms + 1MeOH, m.p. 83-4°; solvent free, 88-90°.*Hydrazide*: m.p. 191-2°.  $[\alpha]_D^{21} +35.6^\circ$  in EtOH.Devor, Marlow, *J. Am. Chem. Soc.*, 1946, 68, 2101.Barton, *J. Chem. Soc.*, 1946, 1116.Boedecker, *Ber.*, 1920, 53, 1852.

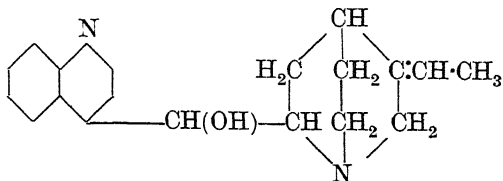
## Apocinchene

 $\text{C}_{19}\text{H}_{19}\text{ON}$ 

MW, 277

Cinchona alkaloid obtained from cinchene with HBr. Cryst. from EtOH. M.p. 209-10°. Sol. acids and alkalis.

*B, HBr*: needles. M.p. 256°.*Me ether*:  $\text{C}_{20}\text{H}_{21}\text{ON}$ . MW, 291. Oil. *Picrate*: m.p. 200° decomp.*Et ether*:  $\text{C}_{21}\text{H}_{23}\text{ON}$ . MW, 305. Prisms from EtOH. Aq. M.p. 70-1°. *Picrate*: m.p. 179-80° decomp.*Acetyl*: cryst. from ligroin. M.p. 118-19°.Kenner, Statham, Jones, *J. Chem. Soc.*, 1935, 299.Comstock, Koenigs, *Ber.*, 1885, 18, 2381.

**Apocinchonine** (*Allocinchonine*) $C_{19}H_{22}ON_2$ 

MW, 294

Prisms from EtOH. M.p. 219° (216°). Sol. 26 parts EtOH at 20°. Mod. sol. hot EtOH. Spar. sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, ligroin. Insol. H<sub>2</sub>O.  $[\alpha]_D^{20} + 167.4^\circ$  in EtOH. Heated with H<sub>2</sub>SO<sub>4</sub> → apocinchonicin.

*B,HCl*: needles + 2H<sub>2</sub>O.  $[\alpha]_D^{15} + 139^\circ$  in H<sub>2</sub>O.

*B,HBr*: needles + 1H<sub>2</sub>O.  $[\alpha]_D^{15} + 126^\circ$  in H<sub>2</sub>O.

*O-Acetyl*: plates from ligroin. M.p. 92–4°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.  $[\alpha]_D^{15} + 71.4^\circ$  in EtOH.

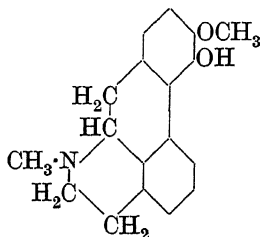
*O-Benzoyl*: needles from Et<sub>2</sub>O. M.p. 118–19°. *B,HCl*: cryst. + 2H<sub>2</sub>O from 50% EtOH. M.p. 223°.

Hesse, *Ann.*, 1880, 205, 330.

v. Peesis, *Monatsh.*, 1902, 23, 444.

Léger, *Compt. rend.*, 1918, 166, 76, 255.

**Apocodeine** (*ψ-Apocodeine*, *apomorphine 3-methyl ether*)

 $C_{18}H_{19}O_2N$ 

MW, 281

Cryst. + 1EtOH from EtOH. M.p. 104.5–106.5°. Loses EtOH at 78°/2 mm. M.p. (solvent-free) 122.5–124.5°.  $[\alpha]_D^{23} - 90^\circ$  in EtOH.

*B,HCl*: cryst. from EtOH–Et<sub>2</sub>O. Softens at 140°, decomp. at 260–3°.  $[\alpha]_D^{22} - 43.3^\circ$  in H<sub>2</sub>O.

Folkers, *J. Am. Chem. Soc.*, 1936, 58, 1814.

**Apoconchinine.**

See Apoquinidine.

**Apoconquinine.**

See Apoquinidine.

**Apocrocetin.**

See Hexadecaheptaene-dioic Acid.

**Apocupreine.**

See Apoquinine.

**Apocynamarin** (*Cyanotoxin*, *cymarigenin*) $C_{23}H_{30}O_5$ 

MW, 386

Occurs in rhizomes of *Apocynum androsaemifolium*, Linn. Cryst. from MeOH. M.p. 170–5°

decomp. Product of hyd. of cymarine by cold HCl. Bitter taste. Reducing agent.

*Benzoate*: m.p. 230°.

Moore, *J. Chem. Soc.*, 1909, 95, 734.

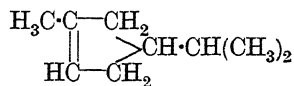
Windaus, *Hermanns, Ber.*, 1915, 48, 979.

Searle, *Journal American Inst. Homeopathy*, 1931, 25, 460 (Review).

**Apocynin.**

See Acetovanillone.

**Apofenchene** (*1-Methyl-4-isopropylcyclopentene*)

 $C_9H_{16}$ 

MW, 124

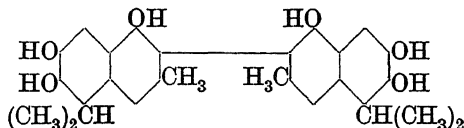
B.p. 142–3°.  $D_4^{21} 0.7945$ .  $n_D^{21} 1.4403$ .  $[\alpha]_D + 66.2^\circ$ .

*Hydrochloride*: b.p. 60°/8 mm.  $D_4^{18} 0.9275$ .  $[\alpha]_D + 1.24^\circ$ .

*Hydrobromide*: b.p. 83°/13 mm.

*Nitroschloride*: cryst. from CHCl<sub>3</sub>. M.p. 115°.  $[\alpha]_D^{15} - 272^\circ$  in CHCl<sub>3</sub>.

Wallach, *Ann.*, 1911, 379, 185; 1909, 369, 83, 95.

**Apogossypol** $C_{28}H_{30}O_6$ 

MW, 462

Degradation product of gossypol. Unstable. Darkens in air.

*Hexa-Me ether*: ppt. from C<sub>6</sub>H<sub>6</sub> with MeOH. M.p. 259°.

*Hexa-Et ether*: ppt. from C<sub>6</sub>H<sub>6</sub> with MeOH. M.p. 176–80°.

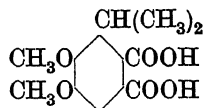
*Hexa-acetyl*: m.p. 291°.

*Tetra-benzoyl*: almost colourless cryst. from MeOH–C<sub>6</sub>H<sub>6</sub>. M.p. 314–16°.

Clark, *J. Biol. Chem.*, 1928, 78, 159.

Adams, Butterbaugh, *J. Am. Chem. Soc.*, 1938, 60, 2174, 2193.

**Apogossypolic Acid** (*4 : 5-Dimethoxy-3-isopropylphthalic acid*)

 $C_{13}H_{16}O_6$ 

MW, 270

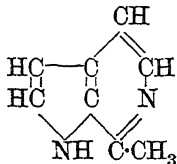
Degradation product of gossypol. Cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 162–5°.

*Di-Me ester*: m.p. 45–6.5°.

*Anhydride*: sublimes. M.p. 93–4°.

Adams, Butterbaugh, *J. Am. Chem. Soc.*, 1938, 60, 2174, 2191.

## Apotharmine

 $C_8H_8N_2$ 

MW, 132

Prisms from  $C_6H_6$ . M.p.  $186^\circ$ . Very sol. MeOH, EtOH,  $CHCl_3$ . Mod. sol.  $H_2O$ . Spar. sol.  $Et_2O$ ,  $C_6H_6$ .  $H_2SO_4$  + trace formaldehyde  $\rightarrow$  green fluor. Basic. Sulphonation  $\rightarrow$  sulphonic acid, m.p. above  $280^\circ$ .

*B.HCl*: needles +  $H_2O$  from MeOH.Aq. Decomp. at  $220^\circ$ .

*B.HAuCl\_4*: pale yellow needles from  $H_2O$ . M.p.  $250^\circ$ .

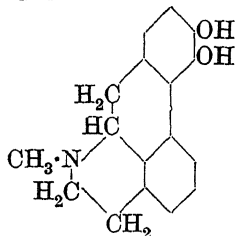
*Picrate*: yellow needles. M.p.  $247^\circ$ .

*N-Me*:  $C_9H_{10}N_2$ . MW, 146. Needles +  $2H_2O$ . M.p.  $64^\circ$ , anhyd.  $183^\circ$ .

Lawson, Perkin, Robinson, *J. Chem. Soc.*, 1924, 125, 626.

Hasenfratz, *Ann. Chim.*, 1927, 7, 151.

## Apomorphine

 $C_{17}H_{17}O_2N$ 

MW, 267

Cryst. from air-free  $Et_2O$  with 1 mol.  $Et_2O$ , which it loses at  $100^\circ$ . White when pure. Turns green in moist air. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ . Slightly sol.  $H_2O$ . Sol. alkalis: sols. turn brown in air. Has no narcotic properties. Powerful emetic.

*B.HCl*: grey cryst. Spar. sol.  $H_2O$ , EtOH.  $[\alpha]_D^{20} - 30.5^\circ$  in  $H_2O$ . Turns green in air.

*3-Me ether*: see Apocodeine.

*Di-Me ether*:  $C_{19}H_{21}O_2N$ . MW, 295. Yellow viscous mass. B.p.  $195-205^\circ$  in cathode ray vacuum.  $[\alpha]_D^{20} - 148^\circ$  in EtOH. *B.HI*: pale yellow cryst. from  $H_2O$ . M.p.  $220^\circ$ . Sol. hot  $H_2O$ .  $[\alpha]_D^{20} - 49^\circ$  in EtOH. *Methiodide*: needles from EtOH. M.p.  $195^\circ$ .  $[\alpha]_D^{21} - 48^\circ$  in EtOH. *Benzoyl deriv.*: m.p.  $165.5^\circ$ .

*O:O-Diacetyl*: needles from AcOEt-pet. ether. M.p.  $129^\circ$ . Sol. most org. solvents. Spar. sol. pet. ether. Insol.  $H_2O$ .  $[\alpha]_D - 47.2^\circ$  in  $Ac_2O$ . *B.HCl*:  $[\alpha]_D - 67.26^\circ$  in  $H_2O$ . *Methiodide*: m.p.  $233^\circ$ .

*Triacetyl deriv.*: m.p.  $137^\circ$ . Optically inactive.

*O:O-Dibenzoyl*: prisms from EtOH. M.p.  $156-8^\circ$ . Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ . Spar. sol. ligroin. Insol.  $H_2O$ .  $[\alpha]_D^{17} + 43^\circ$  in  $CHCl_3$ . *Methiodide*: needles. M.p.  $229-30^\circ$  corr. Mod.

sol. EtOH, AcOH. Spar. sol.  $H_2O$ . Insol.  $Et_2O$ ,  $C_6H_6$ , ligroin.

*Tribenzoyl deriv.*: needles. M.p.  $217-18^\circ$ . Optically inactive.

*Acetyl-dibenzoyl deriv.*: m.p.  $156-8^\circ$ .

*Methobromide*:  $C_{18}H_{20}O_2NBr$ . MW, 362. Needles from MeOH. M.p.  $180^\circ$ . Sol.  $H_2O$ , EtOH. Insol.  $Et_2O$ .

Gulland, Haworth, Virden, Callow, *J. Chem. Soc.*, 1929, 1666.

Späth, Hromatka, *Ber.*, 1929, 62, 325.

Avenarius, Pschorr, *Ber.*, 1929, 62, 321.

Chemnitius, *Pharm. Zentralhalle*, 1929, 70, 101.

Oparina, Karasina, Smirnov, *Chem. Abstracts*, 1935, 29, 1940.

Bick, *Nature*, 1952, 169, 755.

Pschorr, D.R.P. 158,620, (*Chem. Zentr.*, 1905, I, 703).

Riedel, D.R.P. 167,879, (*Chem. Zentr.*, 1906, I, 1067).

## Aponucidine

 $C_{15}H_{22}ON_2$ 

MW, 246

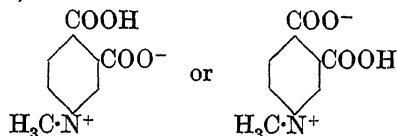
Degradation product of brucidine. M.p.  $122-3^\circ$ .  $[\alpha]_D^{20} - 84^\circ$  in  $H_2O$ .

*B,3H\_2O*: square plates from moist ether.

*N-Acetyl*: prisms from  $H_2O$ . M.p.  $262^\circ$  decomp.

*Dipicrate*: m.p.  $196-8^\circ$ .

Leuchs, Overberg, *Ber.*, 1931, 64, 1007; 1938, 71, 1525.

Apothyllenic Acid (*inchomeronic N-methylbetaine*) $C_8H_7O_4N$ 

MW, 181

Needles or prisms +  $H_2O$  from  $H_2O$ . M.p.  $219^\circ$ , anhyd.  $242^\circ$  decomp. Spar. sol.  $H_2O$ . Insol. EtOH,  $Et_2O$ . Aq. sol. reacts strongly acid. Dry dist.  $\rightarrow$  pyridine. Sn + HCl  $\rightarrow$  hexahydro-*N*-methylcinchomeronic acid. Ba salt sol.  $H_2O$ .

*Me ester*:  $C_9H_9O_4N$ . MW, 195. Prisms from MeOH. Decomp. at  $218^\circ$ . Sol.  $H_2O$ , warm EtOH. Insol.  $Et_2O$ .

*Et ester*:  $C_{10}H_{11}O_4N$ . MW, 209. Needles from EtOH. Decomp. at  $205^\circ$ .

*B\_2, H\_2PtCl\_6*: yellow cryst. +  $H_2O$ . M.p.  $235^\circ$  decomp.

Mumm, Gottschaldt, *Ber.*, 1922, 55, 2075.

Kirpal, Reiter, *Ann.*, 1923, 433, 112.

Apoquinidine (*Apoconquinine, apoconchinine*) $C_{19}H_{22}O_2N_2$ 

MW, 310

Prisms + 1Me<sub>2</sub>CO from Me<sub>2</sub>CO. Loses Me<sub>2</sub>CO at 140°, m.p. 178–80° decomp. Needles or short prisms + 1EtOH from EtOH. Loses EtOH at 160°, m.p. 185–90° decomp.  $[\alpha]_D^{15} + 253.9^\circ$  or  $+ 181.8^\circ$  in EtOH. For base dried at 160°,  $[\alpha]_D^{15} + 291.4^\circ$  or  $208.6^\circ$ .

*B.HCl*: plates or prisms + 1EtOH from EtOH. M.p. 183–5° decomp.  $[\alpha]_D^{15} + 156.3^\circ$  in H<sub>2</sub>O or  $+ 177^\circ$  for EtOH-free salt. Also forms needles + 2H<sub>2</sub>O from H<sub>2</sub>O. M.p. 238–40° decomp.  $[\alpha]_D^{15} + 178.3^\circ$  in H<sub>2</sub>O.

*B.2HBr*: needles + H<sub>2</sub>O from H<sub>2</sub>O. M.p. 280° decomp.  $[\alpha]_D^{15} + 192.5^\circ$  in H<sub>2</sub>O. Spar. sol. EtOH.

*B.2H<sub>2</sub>SO<sub>4</sub>*: needles + 2EtOH from EtOH. M.p. 257–8° decomp. Cryst. + H<sub>2</sub>O from H<sub>2</sub>O. M.p. 260°.  $[\alpha]_D^{15} + 242.4^\circ$ . Spar. sol. H<sub>2</sub>O.

*B.2HCl, ZnCl<sub>2</sub>*: needles from 5% HCl. M.p. 290° decomp.  $[\alpha]_D^{15} + 175.3^\circ$  in H<sub>2</sub>O.

*Me ether*: C<sub>20</sub>H<sub>24</sub>O<sub>2</sub>N<sub>2</sub>. MW, 324. Needles from Et<sub>2</sub>O, prisms from EtOH. M.p. 185° (180–1°).  $[\alpha]_D^{15} + 278.8^\circ$ . *B.HCl*: cryst. + H<sub>2</sub>O from H<sub>2</sub>O or 96% EtOH. M.p. 267°.  $[\alpha]_D^{15} + 174.7^\circ$ . *B.2HBr*: prisms from EtOH. M.p. anhyd. 210–15°.  $[\alpha]_D^{15} + 186.3^\circ$  in H<sub>2</sub>O.

Henry, Solomon, Gibbs, *J. Chem. Soc.* 1935, 969.

See also Thron, Dirscherl, *Ann.*, 1935, 515, 252.

### Apoquinine (*Apocupreine*)

C<sub>19</sub>H<sub>22</sub>O<sub>2</sub>N<sub>2</sub> MW, 310

By heating quinine with acids. Exists in two forms (geometrical isomers?).

$\alpha$ -.

Prisms from Et<sub>2</sub>O. Decomp. at 184°. Sol. MeOH, EtOH. Mod. sol. Et<sub>2</sub>O, Me<sub>2</sub>CO, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>, hot H<sub>2</sub>O. Prac. insol. cold H<sub>2</sub>O. Sol. caustic alkalis.  $[\alpha]_D^{20} - 214.8^\circ$  in EtOH.

*B.HCl*: needles from EtOH.Aq. M.p. 272.5° decomp. Sol. EtOH.Aq. Spar. sol. H<sub>2</sub>O, EtOH.  $[\alpha]_D^{15} - 163.8^\circ$ .

*B.2HCl*: cryst. from EtOH. M.p. 261° decomp.  $[\alpha]_D^{20} - 233^\circ$  in H<sub>2</sub>O.

*B.H<sub>2</sub>SO<sub>4</sub>*: plates from H<sub>2</sub>O. M.p. 203–8° decomp. Spar. sol. H<sub>2</sub>O, MeOH.  $[\alpha]_D^{20} - 224^\circ$  in H<sub>2</sub>O.

$\beta$ -.

M.p. 180–90° decomp.  $[\alpha]_D - 194^\circ$  in EtOH.

*B.HCl*:  $[\alpha]_D - 145^\circ$  in H<sub>2</sub>O.

*B.2HCl*:  $[\alpha]_D - 206^\circ$  in H<sub>2</sub>O.

*B.H<sub>2</sub>SO<sub>4</sub>*:  $[\alpha]_D - 208^\circ$ .

*Unclassified* :—

*B.HBr*: needles from EtOH.Aq. M.p. 284° decomp.

*B.2HBr*: cryst. from EtOH. M.p. 255° decomp.  $[\alpha]_D^{15} - 180.9^\circ$ .

*Sesquioxalate*: pale yellow needles from EtOH. M.p. 224.5–226° decomp. Spar. sol. H<sub>2</sub>O, EtOH.  $[\alpha]_D^{15} - 193.6^\circ$  in H<sub>2</sub>O.

*Me ether*: C<sub>20</sub>H<sub>24</sub>O<sub>2</sub>N<sub>2</sub>. MW, 324. Needles

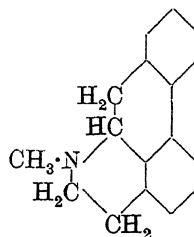
from C<sub>6</sub>H<sub>6</sub>. M.p. 183–5°.  $[\alpha]_D^{15} - 201.2^\circ$  in EtOH. *B.HCl*: needles from EtOH–Me<sub>2</sub>CO–Et<sub>2</sub>O. M.p. 249–51° decomp. Sol. H<sub>2</sub>O, EtOH. Spar. sol. Me<sub>2</sub>CO.  $[\alpha]_D^{15} - 196^\circ$ .

*Et ether*: ethylapoquinine. C<sub>21</sub>H<sub>26</sub>O<sub>2</sub>N<sub>2</sub>. MW, 338. Cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 195–7°.  $[\alpha]_D^{15} - 199.7^\circ$  in EtOH. *B.HCl*: needles from Me<sub>2</sub>CO. M.p. 247–50° decomp.  $[\alpha]_D^{15} - 191.7^\circ$ .

Henry, Solomon, *J. Chem. Soc.*, 1934, 1923.

Cretcher, *et al.*, *J. Am. Chem. Soc.*, 1935, 57, 1083; 1942, 64, 1162.

### Aporphine



C<sub>17</sub>H<sub>17</sub>N

MW, 235

Synthetic alkaloid regarded as the parent of the phenanthrene-isoquinoline series. Froehde's reagent  $\rightarrow$  green. Mandelin's reagent  $\rightarrow$  bluish-red col. "Exhaustive methylation"  $\rightarrow$  1-vinylphenanthrene + N(CH<sub>3</sub>)<sub>3</sub>.

*B.HCl*: decomp. above 250°.

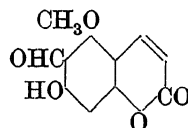
*B.HI*: decomp. at 260°.

*B.HBr*: decomp. at 230°.

*B.HNO<sub>3</sub>*: decomp. at 200–210°.

Gadamer, Oberlin, Schoeler, *Arch. Pharm.*, 1925, 263, 81.

### Apoxanthoxyletin (7-Hydroxy-5-methoxy-6-aldehydocoumarin)



C<sub>11</sub>H<sub>8</sub>O<sub>5</sub>

MW, 220

Ozonolysis product of xanthoxyletin. Needles from EtOH. M.p. 217–18°. Spar. sol. EtOH, AcOH, C<sub>6</sub>H<sub>6</sub>. Sol. hot EtOH. Insol. petrol, NaHCO<sub>3</sub>.Aq. Yellow sol. in NaOH.Aq. Red col. with FeCl<sub>3</sub>. Red with NH<sub>3</sub>·AgNO<sub>3</sub> and Fehling's.

*Phenylhydrazone*: needles from EtOH. M.p. 251° decomp.

Bell, Robertson, Subramaniam, *J. Chem. Soc.*, 1936, 627; 1937, 286.

### Aquaticine

C<sub>18</sub>H<sub>25</sub>O<sub>5</sub>N

MW, 335

Alkaloid of marsh ragwort (*Senecio aquaticus*). Octahedra. M.p. 220° decomp.  $[\alpha]_D^{15} - 83^\circ$ . Toxic.

*Picrate*: cryst. from MeOH. M.p. 182°.

Evans, Evans, *Nature*, 1949, 164, 30.

### Araban

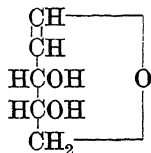
(C<sub>5</sub>H<sub>8</sub>O<sub>4</sub>)<sub>n</sub> MW, (132)<sub>n</sub>

Obtained from peanuts, citrus and apples. Hydrolysis gives L-arabinose.  $[\alpha]_D^{21} - 160^\circ$  in H<sub>2</sub>O. Sol. H<sub>2</sub>O. Insol. Me<sub>2</sub>CO, Et<sub>2</sub>O, EtOH.

*Acetyl deriv.*:  $[\alpha]_D^{20} - 90^\circ$  in Me<sub>2</sub>CO. Sol. Me<sub>2</sub>CO, hot MeOH, hot EtOH. Insol. petrol, H<sub>2</sub>O.

Hirst, Jones, *J. Chem. Soc.*, 1938, 502; 1939, 452, 454, 1865.

### Arabinal (*Ribal*)



C<sub>5</sub>H<sub>8</sub>O<sub>3</sub> MW, 116

*d.*

M.p. 83°.  $[\alpha]_D^{20} + 181.2^\circ$ .

*Diacetyl*: m.p. 99–100°.  $[\alpha]_D^{20} + 262.8^\circ$ .

*l.*

M.p. ca. 90°.  $[\alpha]_D^{19} - 202.8^\circ$  in H<sub>2</sub>O.

*Benzylphenylhydrazone*: m.p. 127–9°.

*Diacetyl*:  $[\alpha]_D^{18} - 266.7^\circ$ .

Gakhokidze, *J. Gen. Chem. U.S.S.R.*, 1945, 15, 539.

Meisenheimer, Jung, *Ber.*, 1927, 60, 1462.

Gehrke, Aichner, *Ber.*, 1927, 60, 918.

### Arabinamine (*Tetrahydroxy-n-amylamine, arabinosamine*)



C<sub>5</sub>H<sub>13</sub>O<sub>4</sub>N MW, 151

Cryst. M.p. 98–9°. Sol. H<sub>2</sub>O. Mod. sol. EtOH.  $[\alpha]_D^{18} - 4.58^\circ$  in H<sub>2</sub>O. Sweet taste. Absorbs CO<sub>2</sub>. HI → *n*-amylamine.

*B, HCl*: leaflets. M.p. 137–8°. Mod. sol. H<sub>2</sub>O. Spar. sol. EtOH.

*B, HI*: leaflets. M.p. 190–1°.

*B<sub>2</sub>, (COOH)<sub>2</sub>*: needles. M.p. 190°. Sol. H<sub>2</sub>O. Spar. sol. EtOH.  $[\alpha]_D^{18} - 13.5^\circ$  in H<sub>2</sub>O.

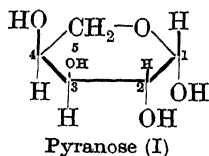
*Picrate*: m.p. 144–5° decomp.

Roux, *Compt. rend.*, 1903, 136, 1079.

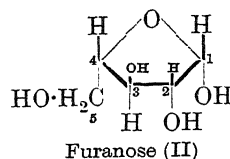
### Arabinosamine.

See Arabinamine.

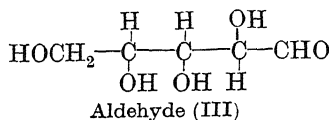
### Arabinose



Pyranose (I)



Furanose (II)



Aldehyde (III)

C<sub>5</sub>H<sub>10</sub>O<sub>5</sub> MW, 150

I. Pyranose Form.

*d.*

Cryst. from MeOH.Aq. M.p. 155.5–56.5°.  $[\alpha]_D^{20} - 108^\circ$  in H<sub>2</sub>O.

*Methylglycoside*: b.p. 165–68°/14 mm., 117–18°/0.1 mm.  $[\alpha]_D^{20} - 15.4^\circ$  in H<sub>2</sub>O.

*2-Me ether*: C<sub>6</sub>H<sub>12</sub>O<sub>5</sub>. MW, 164 Syrup.  $[\alpha]_D^{20} - 102^\circ$  in H<sub>2</sub>O.

*2:4-Di-Me ether*: C<sub>7</sub>H<sub>14</sub>O<sub>5</sub>. MW, 178. B.p. 140° (bath temp.)/0.09 mm.  $n_D^{17} 1.4800$ .  $[\alpha]_D^{17} - 30.8^\circ$  in H<sub>2</sub>O. *Anil*: plates from EtOH. M.p. 142–3°.

*Tetra-acetyl*: m.p. 99–100°.  $[\alpha]_D^{20} - 44.2^\circ$ .

*Oxime*: plates from EtOH.Aq. M.p. 136–7°.  $[\alpha]_D^{20} - 84^\circ \rightarrow -13.5^\circ$ .

*Phenylosazone*: yellow needles from Py.Aq. M.p. 162–3° (171–2°).  $[\alpha]_D^{20} - 60.7^\circ$  in Py–EtOH.

*Benzylphenylhydrazone*: m.p. 173°.

*2:4-Dinitrophenylosazone*: red rhombs from Py. M.p. 259° decomp.

Hockett, Maynard, *J. Am. Chem. Soc.*, 1939, 61, 2111.

Hockett, Hudson, *J. Am. Chem. Soc.*, 1934, 56, 1632.

Neuberg, Collatz, *Chem. Abstracts*, 1937, 31, 2586.

Hockett, Millman, *J. Am. Chem. Soc.*, 1941, 63, 2587.

Wiggins, *J. Chem. Soc.*, 1946, 13.

Reichstein, U.S.P., 2,389,325, (*Chem. Abstracts*, 1946, 40, 1974).

Hirst, Jones, *J. Soc. Dyers Colourists*, 1947, 63, 249.

*l.*

Cryst. from EtOH.Aq. M.p. 158°.  $[\alpha]_{D,20}^{20} + 185^\circ \rightarrow +108^\circ$  in H<sub>2</sub>O. Red. → *l*-arabitol. Ox. → *l*-arabonic acid. HCl → furfural. Reduces Fehling's.

*Methylglycoside*: C<sub>6</sub>H<sub>12</sub>O<sub>5</sub>. MW, 164. *α-Form*: m.p. 165–6°.  $[\alpha]_D^{20} + 246^\circ$  in H<sub>2</sub>O.

*2:3:4-Tri-Me ether*: cryst. from pet. ether. M.p. 44–6°. B.p. 124°/14 mm.  $[\alpha]_D^{20} + 251^\circ$  in H<sub>2</sub>O.

*β-Form*: prisms from AcOEt. M.p. 115–17°.  $[\alpha]_D^{20} + 73^\circ$  in H<sub>2</sub>O. *3-Me ether*: b.p. about 200° (bath temp.)/0.001 mm.  $n_D^{18} 1.4710$ .

$[\alpha]_D^{21} + 46^\circ$  in H<sub>2</sub>O. *2:3-Di-Me ether*: b.p. 115–20° (bath temp.)/0.001 mm.  $n_D^{18.5} 1.4522$ .

$[\alpha]_D^{21} + 14^\circ$  in H<sub>2</sub>O. *2:3:4-Tri-Me ether*: needles. M.p. 46–8°. B.p. 123°/24 mm.  $[\alpha]_D$

+ 46° in H<sub>2</sub>O. 2:3:4-*Triacetyl*: m.p. 85°.  $[\alpha]_D^{25} + 182^\circ$  in CHCl<sub>3</sub>.

3-*Me ether*: syrup.  $n_D^{15} 1.4850$ .  $[\alpha]_D^{20} + 96^\circ$  in H<sub>2</sub>O. *Phenylosazone*: yellow needles from EtOH.Aq. M.p. 163°.

2:3-*Di-Me ether*: syrup.  $n_D^{15} 1.4650$ .  $[\alpha]_D^{15} + 86^\circ \rightarrow + 107^\circ$  in H<sub>2</sub>O. *Anil*: cryst. from Me<sub>2</sub>CO-pet. ether. M.p. 139°.

2:3:4-*Triacetyl*: *phenylosazone*: needles from EtOH.Aq. M.p. 114°.  $[\alpha]_D^{15} + 5^\circ$  in CHCl<sub>3</sub>.

*Tetra-acetyl*:  $\alpha$ -*Form*: cryst. from Et<sub>2</sub>O or H<sub>2</sub>O. M.p. 94-6°.  $[\alpha]_D^{25} + 45^\circ$  in CHCl<sub>3</sub>.  $\beta$ -*Form*: cryst. from H<sub>2</sub>O. M.p. 86°.  $[\alpha]_D^{25} + 147^\circ$  in CHCl<sub>3</sub>.

*Tetra-propionyl*: m.p. 80°. B.p. 200°/0.001 mm.  $[\alpha]_D^{20} + 116^\circ$ .

2:3:4-*Tribenzoyl*: cryst. from MeOH. M.p. 162-3°.  $[\alpha]_D^{30} + 236^\circ$  in CHCl<sub>3</sub>.

*Tetra-benzoyl*:  $\alpha$ -*Form*: cryst. from MeOH. M.p. 160-61°.  $[\alpha]_D^{25} + 112.5^\circ$  in CHCl<sub>3</sub>.  $\beta$ -*Form*: cryst. from MeOH. M.p. 173-4°.  $[\alpha]_D^{26} + 325^\circ$  in CHCl<sub>3</sub>.

*Tetra-p-bromobenzoyl*:  $\alpha$ -*Form*: sinters at 205°. M.p. 210°.  $[\alpha]_D^{20} + 383^\circ$  in CHCl<sub>3</sub>.  $\beta$ -*Form*: sinters at 118°. M.p. 125°.  $[\alpha]_D^{21} + 147^\circ$  in CHCl<sub>3</sub>.

*Oxime*: m.p. 139°.

*Semicarbazone*: m.p. 163° decomp.

*Phenylosazone*: m.p. 164-6° (171-2°).  $[\alpha]_D^{18} + 51^\circ$ ,  $[\alpha]_D^{20} + 60.5^\circ$  in Py-EtOH.

*p-Bromophenylosazone*: sinters at 175°. M.p. 180-85° corr.

*o-Tolylosazone*: m.p. 133°.

*p-Tolylosazone*: m.p. 176-7°.

*p-Bromophenylydrazone*: m.p. 155°.

*o-Nitrophenylydrazone*: reddish-yellow cryst. from EtOH. M.p. 185°.

*m-Nitrophenylydrazone*: reddish-yellow cryst. M.p. 184°.

*p-Nitrophenylydrazone*: m.p. 186.5-188°.  $[\alpha]_D^{21} + 14.9^\circ$ .

*m-Tolylydrazone*: needles from 50% EtOH. M.p. 157°.

*p-Tolylydrazone*: m.p. 160°.

1:2-*Monoacetone deriv.*: + 0.5H<sub>2</sub>O. M.p. 80°.  $[\alpha]_D^{20} + 129^\circ$  in H<sub>2</sub>O.

1:2-3:4-*Diacetone deriv.*: m.p. 42-3°.

*CaCl<sub>2</sub> deriv.*:  $\alpha$ -*Form*: m.p. 112-15°.  $[\alpha]_D^{20} + 36.4^\circ \rightarrow 47.6^\circ$  in H<sub>2</sub>O.

Levene, Compton, *J. Biol. Chem.*, 1936, 116, 189.

Carrington, Haworth, Hirst, *J. Chem. Soc.*, 1934, 1653.

Purdie, Rose, *J. Chem. Soc.*, 1906, 89, 1204.

Hirst, Robinson, *J. Chem. Soc.*, 1925, 127, 358.

Smith, *J. Chem. Soc.*, 1939, 753.

Hirst, Jones, *J. Chem. Soc.*, 1938, 504.

Anderson, Sands, *Organic Syntheses*, Collective Vol. I, 60.

Wolfrom, Christman, *J. Am. Chem. Soc.*, 1936, 58, 41.

Hirst, Jones, Woods, *J. Chem. Soc.*, 1947, 1048.

*dl.* (presumably pyranose form, I).

Prisms from EtOH. M.p. 161-2°.

*Phenylosazone*: yellow needles from H<sub>2</sub>O M.p. 169-70° corr.

*p-Bromophenylosazone*: yellow cryst. from EtOH. M.p. 200-202°.

*Methylphenylosazone*: needles from C<sub>6</sub>H<sub>6</sub>. Softens at 171°. M.p. 175° corr.

*p-Bromophenylydrazone*: needles from H<sub>2</sub>O. M.p. 160°.

Ruff, *Ber.*, 1899, 32, 554.

II. Furanose Form.

*l.*

*Methylglycoside*: mixture of the two forms. B.p. 173-5°/0.15 mm.  $n_D 1.4880$ .  $[\alpha]_D - 47^\circ$  in H<sub>2</sub>O.  $\alpha$ -*Form*: hygroscopic cryst. from Et<sub>2</sub>O.  $[\alpha]_D^{20} - 125^\circ$  in H<sub>2</sub>O. 2:3:5-*Tri-Me ether*: b.p. 85-7°/0.3 mm.  $n_D 1.4355$ .  $[\alpha]_D - 56^\circ$  in H<sub>2</sub>O.

*Ethylglycoside*: C<sub>7</sub>H<sub>14</sub>O<sub>5</sub>. MW, 178. Cryst. from AcOEt. M.p. 48-9°.  $[\alpha]_D^{20} - 116^\circ$  in H<sub>2</sub>O.

2:3:5-*Tri-Me ether*: b.p. 97-9°/0.18 mm.  $n_D^{15} 1.4400$ .  $[\alpha]_D^{20} - 36^\circ$  in H<sub>2</sub>O.

1:2-*Monoacetone deriv.*: cryst. from EtOH. M.p. 117-18°.  $[\alpha]_D^{26} - 29^\circ$  in H<sub>2</sub>O.

*d.*

*Methylglycoside*:  $\alpha$ -*Form*: prisms from AcOEt or Et<sub>2</sub>O. M.p. 65-7°.  $[\alpha]_D + 123^\circ$  in H<sub>2</sub>O. 2:3:5-*Tri-Me ether*: b.p. 135°/15 mm.  $n_D^{15} 1.4350$ .  $[\alpha]_D^{15} + 80^\circ$  in H<sub>2</sub>O.

2:3:5-*Tri-Me ether*: b.p. 95°/0.05 mm.  $n_D^{20} 1.4490$ .  $[\alpha]_D^{14} + 40^\circ$  in MeOH.

Montgomery, Hudson, *J. Am. Chem. Soc.*, 1937, 59, 992.

Green, Pacsu, *J. Am. Chem. Soc.*, 1938, 60, 2056.

Haworth, Peat, Whetstone, *J. Chem. Soc.*, 1938, 1975.

Baker, Haworth, *J. Chem. Soc.*, 1925, 127, 365.

III. Aldehyde Form.

*d.*

*Di-Me acetal*: prisms from MeOH. M.p. 122°.  $[\alpha]_D^{20} - 18.5^\circ$  in H<sub>2</sub>O. *Tetra-acetyl*: prisms from Et<sub>2</sub>O-pet. ether. M.p. 80°.  $[\alpha]_D^{20} + 22^\circ$  in CHCl<sub>3</sub>.

*Tetra-Me ether*: b.p. 85°/0.01 mm.  $n_D^{17} 1.4340$ .  $[\alpha]_D^{17} + 16.6^\circ$  in H<sub>2</sub>O.

*Hexa-acetyl*: (·CH(OAc)<sub>2</sub>). Needles from EtOH.Aq. M.p. 89.5°.  $[\alpha]_D^{20} + 28^\circ$  in CHCl<sub>3</sub>.

2:3:4:5-*Diacetone deriv.*: b.p. 80°/0.03 mm.  $n_D^{25} 1.4421$ .  $[\alpha]_D^{17} - 14.4^\circ$  in CHCl<sub>3</sub>.

*l.*

*Tetra-acetyl*: needles from Me<sub>2</sub>CO-EtOH-pet. ether. M.p. 113-15°.  $[\alpha]_D^{26} - 58^\circ$  in

$\text{CHCl}_3$ . *Oxime*: m.p. 137–9°.  $[\alpha]_D^{22} - 5.2^\circ$  in  $\text{CHCl}_3$ . *Semicarbazone*: m.p. 184–7°.

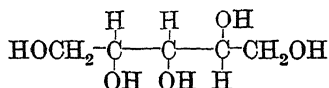
*Hexa-acetyl*: cryst. from EtOH.Aq. M.p. 89.5°.  $[\alpha]_D^{20} - 27^\circ$  in  $\text{CHCl}_3$ .

Montgomery, Hann, Hudson, *J. Am. Chem. Soc.*, 1937, 59, 1124.

Wolfrom, Newlin, *J. Am. Chem. Soc.*, 1930, 52, 3619.

Wiggins, *J. Chem. Soc.*, 1946, 13.

### Arabitol



$\text{C}_5\text{H}_{12}\text{O}_5$  MW, 152

*l.*

Cryst. M.p. 102°. Very sol.  $\text{H}_2\text{O}$ . Sol. 46 parts 90% EtOH at 12°. Sweet taste. Heat of comb.  $\text{C}_v$  611.7 Cal.,  $\text{C}_p$  612.0 Cal. Does not reduce Fehling's.

*Penta-acetyl*: m.p. 76°.

*Di-isopropylidene deriv.*: b.p. 145–52°/23 mm.

*d.*

Found in lichens and the fungus *Ustilago virens*. Prisms. M.p. 103°. Very sol.  $\text{H}_2\text{O}$ . Sol. 48 parts 90% EtOH at 12°.  $[\alpha]_D^{20} + 7.7^\circ$  in saturated borax sol. Sweet taste.

*Penta-acetyl*: prisms from MeOH.Aq. M.p. 74–5° corr.  $[\alpha]_D^{20} + 37.2^\circ$  in  $\text{CHCl}_3$ .

1: *3-Benzylidene*: m.p. 152°.

2: *3-Benzylidene*: m.p. 81–3°.

*dl.*

Prisms from 90% EtOH. M.p. 105–6°. Sol. 66 parts of 90% EtOH at 12°.

*Penta-acetyl*: cryst. from MeOH. M.p. 96–96.5°.

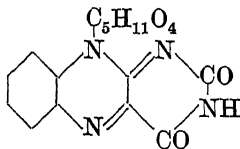
Ruff, *Ber.*, 1899, 32, 555.

Asahina, Yanagita, *Ber.*, 1934, 67, 799.

Lespieau, *Compt. rend.*, 1936, 203, 145.

Raphael, *J. Chem. Soc.*, 1949, 544.

### Araboflavin (9-(1'-Arabityl)-isoalloxazine)



$\text{C}_{15}\text{H}_{16}\text{O}_6\text{N}_4$  MW, 348

*d.*

M.p. 296°.

*Tetra-acetyl*: m.p. 260°.

*l.*

M.p. 296.5° (from  $\text{H}_2\text{O}$ ).  $[\alpha]_D - 108^\circ \pm 10^\circ$  in 0.05N-NaOH,  $-4^\circ \pm 2^\circ$  in  $\text{H}_2\text{O}$ .

*Tetra-acetyl*: m.p. 260°.

*dl.*

M.p. 296°.

*Tetra-acetyl*: m.p. 274°.

Kuhn, Weygand, *Ber.*, 1935, 68, 1001.

Karrer, Schöpp, Benz, Pfaehler, *Ber.*, 1935, 68, 216.

### Arabo-hydroxyglutaric Acid.

See Trihydroxyglutaric Acid.

### Araboketuroic Acid

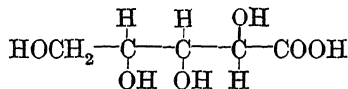
$\text{C}_5\text{H}_8\text{O}_6$  MW, 164

*l.*

*Brucine salt dihydrate*:  $\text{C}_{28}\text{H}_{38}\text{O}_{12}\text{N}_2$ . M.p. 160–1° from  $\text{H}_2\text{O}$ -EtOH. Naphthoresorcinol  $\rightarrow$  pink col. Probably identical with brucine *d*-xyloketuronate.

Crews, Hart, Everett, *J. Am. Chem. Soc.*, 1940, 62, 491.

### Arabonic Acid



$\text{C}_5\text{H}_{10}\text{O}_6$  MW, 166

*d.*

Syrup. Heat on water-bath  $\rightarrow$  lactone.

*Cinchonine salt*: needles from EtOH. M.p. 178–80°.  $[\alpha]_D^{20} + 120.3^\circ$  in  $\text{H}_2\text{O}$ .

*Quinine salt*: cryst. from EtOH. M.p. 172–3°.  $[\alpha]_D^{20} - 106.2^\circ$  in  $\text{H}_2\text{O}$ .

*Brucine salt*: plates from EtOH.Aq. M.p. 167–70°.  $[\alpha]_D^{20} - 26.33^\circ$  in  $\text{H}_2\text{O}$ .

*Strychnine salt*: needles from EtOH. De-comp. at 167–70°.  $[\alpha]_D^{20} - 26.08^\circ$  in  $\text{H}_2\text{O}$ .

*Triacetyl deriv.*: needles or prisms from  $\text{C}_6\text{H}_6$ . M.p. 127°. Sol. EtOH,  $\text{Me}_2\text{CO}$ ,  $\text{CHCl}_3$ . Mod. sol.  $\text{H}_2\text{O}$ . Spar. sol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ , pet. ether.  $[\alpha]_D^{17} + 27.23^\circ$  in EtOH.

*Tetra-acetyl deriv.*: m.p. 135–6°.

*Lactone*:  $\text{C}_5\text{H}_8\text{O}_5$ . MW, 148. Needles from  $\text{Me}_2\text{CO}$ . M.p. 98–9°.  $[\alpha]_D^{20} + 73.7^\circ$  in  $\text{H}_2\text{O}$ .

*Dibenzoyl deriv.*: m.p. 200°. *Tribenzoyl*: m.p. 120°.

*l.*

Cryst. from MeOH or EtOH. M.p. about 118–19°.  $[\alpha]_D - 10.02^\circ \rightarrow -7.11^\circ \rightarrow -41.6^\circ$ . Readily forms the lactone.

*Lactone*: needles from  $\text{Me}_2\text{CO}$ . M.p. 98–100°.  $[\alpha]_D^{20} - 73.9^\circ$  in  $\text{H}_2\text{O}$ . *Triacetyl*: cryst. from  $\text{C}_6\text{H}_6$ -pet. ether. M.p. 52–4°.

Sol. EtOH,  $\text{Me}_2\text{CO}$ ,  $\text{CHCl}_3$ . Spar. sol.  $\text{Et}_2\text{O}$ . Almost insol.  $\text{H}_2\text{O}$ .  $[\alpha]_D^{18.5} - 60.5^\circ$  in  $\text{C}_6\text{H}_6$ .

*Dibenzoyl deriv.*: m.p. 200°.  $[\alpha]_D^{20} - 37.65^\circ$  in  $\text{Me}_2\text{CO}$ . *Tribenzoyl*: m.p. 120°.  $[\alpha]_D^{20} - 24^\circ$  in  $\text{Me}_2\text{CO}$ ,  $-28.2^\circ$  in  $\text{C}_6\text{H}_6$ .

*Triacetyl deriv.*: m.p. 127°.  $[\alpha]_D^{17} - 27.23^\circ$  in EtOH.

*Me ester*:  $\text{C}_6\text{H}_{12}\text{O}_6$ . MW, 180. Cryst. from MeOH. M.p. 148° (rapid heat).  $[\alpha]_D^{20} - 6.30^\circ$  in  $\text{H}_2\text{O}$ . *Tetra-acetyl*: m.p. 130°.

*Et ester*:  $\text{C}_7\text{H}_{14}\text{O}_6$ . MW, 194. M.p. 126.5°.

*Tetra-acetyl*: m.p. 68°.



*Amide*:  $C_5H_{11}O_5N$ . MW, 165. Cryst. from MeOH or 90% EtOH. M.p. 136°. Very sol.  $H_2O$ . Mod. sol. MeOH. Spar. sol. EtOH.  $[\alpha]_D^{20} + 38.4^\circ$  in  $H_2O$ .

*Nitrile*:  $C_5H_9O_4N$ . MW, 147. *Tetra-acetyl*: cryst. from  $H_2O$ . M.p. 117–18°. Sol. EtOH,  $Et_2O$ . Spar. sol.  $H_2O$ .

*Anilide*: m.p. 204°.  $[\alpha]_D^{20} + 68.1^\circ$  in  $H_2O$ .

*o-Toluidide*: m.p. 172°.  $[\alpha]_D^{25} + 56.5^\circ$  in  $H_2O$ .

*m-Toluidide*: m.p. 186°.  $[\alpha]_D^{25} + 67.7^\circ$  in  $H_2O$ .

*p-Toluidide*: m.p. 200°.  $[\alpha]_D^{17} + 68.2^\circ$  in  $H_2O$ .

*Hydrazide*: cryst. M.p. 138–9°. Sol.  $H_2O$ . Insol. EtOH.  $[\alpha]_D^{25} + 51.9^\circ$  in  $H_2O$ .

*Phenylhydrazide*: m.p. 215°.  $[\alpha]_D^{20} - 16.1^\circ$  in  $H_2O$ .

*K salt*: m.p. about 220° decomp.  $[\alpha]_D^{20} + 5.2^\circ$  in  $H_2O$ .

*dl.*

Mod. sol.  $H_2O$ .

*Lactone*: needles from  $Me_2CO$ . M.p. 115–16°. Very sol.  $H_2O$ , EtOH.

*Tetra-acetyl deriv.*: m.p. 141–3°.

Kiliani, *Ber.*, 1925, 58, 2344.

Hasenfratz, *Compt. rend.*, 1927, 184, 210.

Rehorst, *Ber.*, 1930, 63, 2288.

Brackenburg, Upson, *J. Am. Chem. Soc.*, 1933, 55, 2512.

Weidenhagen, *Chem. Abstracts*, 1936, 30, 3411.

Spengler, Pfaffenstiel, D.R.P., 620,248, (*Chem. Abstracts*, 1936, 30, 736).

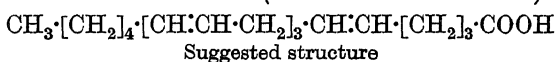
### Arachidic Acid.

See *n*-Eicosanic Acid.

### Arachidic Alcohol.

See Eicosyl Alcohol.

### Arachidonic Acid (*Eicosane-tetraenoic acid*)



$C_{20}H_{32}O_2$  MW, 304

Present in brain tissue, liver lipides and suprarenal glands. M.p. – 49.5°.  $n_D^{20}$  1.4824. Essential for maintenance of normal health of the rat.

*Me ester*: b.p. 194–6°/0.6–0.8 mm., 200–5°/1–2 mm.  $D_4^{20}$  0.9168.  $n_D^{20}$  1.4875.

Dolby, Nunn, Smedley-Maclean, *Biochem. J.*, 1940, 34, 1422.

Shinowara, Brown, *J. Biol. Chem.*, 1940, 134, 331.

Brown, *J. Biol. Chem.*, 1928, 80, 455.

Wesson, *J. Biol. Chem.*, 1924, 60, 183.

Mowry, Brode, Brown, *J. Biol. Chem.*, 1942, 142, 671, 679.

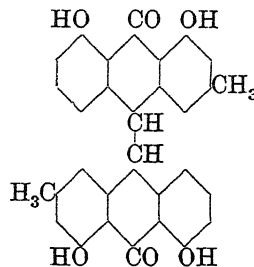
Baudart, *Bull. soc. chim.*, 1942, 9, 919.

Arcus, Smedley-Maclean, *Biochem. J.*, 1943, 37, 1.

### Aralen.

See Chloroquine.

### Ararobinol



$C_{30}H_{22}O_6$  MW, 478

Constituent of some Goa powders and contained in extracted chrysarobin. Yellow cryst. Darkens at 218°. M.p. 224°. Sol. AcOH and 10% KOH. Unstable in sol., developing colour and fluor. In  $H_2SO_4$  orange changing to blue, then through green, to grey.  $CrO_3 \rightarrow$  chrysophanic acid.

Eder, Hauser, *Arch. Pharm.*, 1925, 263, 321, 436, (*J. Chem. Soc.*, 1925, 128, I, 948, 1160).

### Arasaponin A

$C_{30}H_{52}O_{10}$  MW, 572

Occurs in the Chinese drug san-ch'i, *Aralia bipinnatifida*. Amorph. M.p. 195–210°.  $[\alpha]_D + 23^\circ$ . Dil.  $H_2SO_4 \rightarrow$  arasapogenin A + glucose + 2 other cryst. products. Yields a hepta-acetyl derivative with  $Ac_2O$ .

Chou, Chu, *Chinese Journal of Physiology*, 1937, 12, 59.

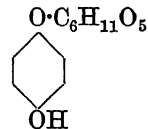
### Arasaponin B

$C_{23}H_{38}O_{10}$  MW, 474

Occurs in the Chinese drug san-ch'i, *Aralia bipinnatifida*. Amorph. M.p. 190–200°.  $[\alpha]_D + 8^\circ$ . EtOH–HCl  $\rightarrow$  arasapogenin B + glucose.

Chou, Chu, *Chinese Journal of Physiology*, 1937, 12, 59; 1941, 16, 139.

### Arbutin (*Hydroquinone-glucose*)



$C_{12}H_{16}O_7$  MW, 272

Glucoside in pear leaves, etc. Needles +  $1H_2O$  from  $H_2O$ . Extracted product usually contaminated with methylarbutin (see below). M.p. 142–3°; melts again at 187° (m.p. anhyd.). Synthetic arbutin has m.p. 163–4° and again 199–200°. Sol.  $H_2O$ , EtOH,  $Et_2O$ .  $[\alpha]_D^{25} - 60.34^\circ$  in  $H_2O$ . Hyd.  $\rightarrow$  glucose + hydroquinone.  $FeCl_3 \rightarrow$  blue col.

*Me ether*: methylarbutin.  $C_{13}H_{18}O_7$ . MW, 286. Cryst. +  $1H_2O$ . M.p. 158–60°; again at

175°. *Tetra-acetyl deriv.*: cryst. from EtOH.Aq. M.p. 95-6°.

*Penta-Me ether*:  $C_{17}H_{26}O_7$ , MW, 342. Needles from EtOH.Aq. M.p. 75.5°. Very sol.  $Me_2CO$ ,  $Et_2O$ . Sol. EtOH,  $CHCl_3$ ,  $C_6H_6$ . Spar. sol.  $H_2O$ .  $[\alpha]_D^{25} - 48.2^\circ$  in EtOH.

*Tetra-acetyl deriv.*: m.p. 136°.

*Penta-acetyl*: needles from EtOH. M.p. 146°.  $[\alpha]_D^{25} - 28.18^\circ$  in  $Me_2CO$ .

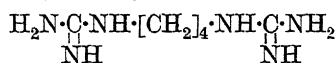
*Benzoyl deriv.*: m.p. 184.5°.

Macbeth, MacKay, *J. Chem. Soc.*, 1923, 123, 717.

Robertson, Waters, *J. Chem. Soc.*, 1930, 2732.

Shishido, *Chem. Abstracts*, 1936, 30, 7119.

#### Arcaine (1:4-Diguanidinobutane)



$C_6H_{16}N_6$  MW, 172

Occurs in the marine bivalve *Arca noae*. Lowers blood sugar of warm-blooded animals. Not hyd. by arginase of guinea-pig liver.

*B,H<sub>2</sub>SO<sub>4</sub>*: needles. Decomp. at 291°.

*B,2HAuCl<sub>4</sub>*: needles. M.p. 170.5°. Spar. sol.

*B,H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 222°. Spar. sol.  $H_2O$ .

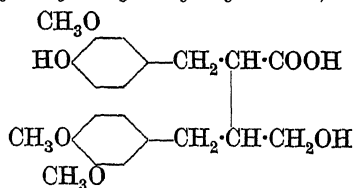
*Picrate*: needles or fine powder. Decomp. at 251-4°.

*Picrolonate*: powder. Decomp. at 303°.

Kutscher, Ackermann, *Z. physiol. Chem.*, 1931, 199, 277; 203, 132.

Sugino, Sjrjai, Aoydgi, *Chem. Abstracts*, 1947, 41, 4455.

#### Arctigenic Acid (1-Hydroxymethoxybenzyl-2-dimethoxybenzyl-3-hydroxybutyric acid)



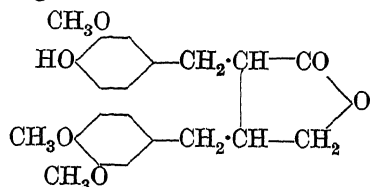
$C_{21}H_{26}O_7$  MW, 390

M.p. 131°.

*Ar.-Me ether*: m.p. 97-8°.

Omaki, *J. Pharm. Soc. Japan*, 1935, 55, 816.

#### L-Arctigenin



$C_{21}H_{24}O_6$  MW, 372

From seeds of burdock (*Arctium lappa*). Plates from MeOH-Et<sub>2</sub>O. M.p. 102°. Spar. sol. Et<sub>2</sub>O, ligroin. Reduces NH<sub>3</sub>-AgNO<sub>3</sub>.

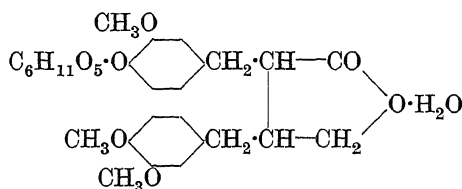
*Me ether*: needles from MeOH. M.p. 125-7°.

*Acetyl*: needles from AcOEt. M.p. 52-60°.

Haworth, Kelly, *J. Chem. Soc.*, 1936, 998.

Shinoda, *J. Pharm. Soc. Japan*, 1929, 49, 565, 1165; *Chem. Abstracts*, 1930, 24, 1387; 1929, 23, 4707.

#### Arctiin



$C_{27}H_{34}O_{11} \cdot H_2O$  MW, 552

Constituent of the seeds of *Arctium lappa*, Linn. M.p. 111-12°.  $[\alpha]_D^{25} - 38.8^\circ$  in EtOH. Reduces Fehling's. Hyd.  $\rightarrow$  arctigenin  $\rightarrow$  arctigenic acid. Acts as a sympathomimetic drug.

Shinoda, Kawagawe, *J. Pharm. Soc. Japan*, 1929, 49, 565.

Omaki, *J. Pharm. Soc. Japan*, 1935, 55, 816.

#### Arctose

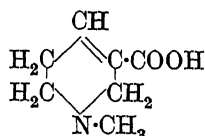
$(C_6H_{10}O_5)_x$  MW, (162)<sub>x</sub>

Occurs in roots of *Arctium lappa*. Needles from EtOH.Aq. M.p. 178°.  $[\alpha]_D^{25} - 41.02^\circ$  in  $H_2O$ . Very sol.  $H_2O$ . Spar. sol. EtOH. Does not reduce Fehling's. Hyd.  $\rightarrow$  fructose. Cryoscopic MW, 1702.

*Acetyl deriv.*: cryst. from AcOH-MeOH. M.p. 108°.  $[\alpha]_D^{25} - 36.48^\circ$  in  $CHCl_3$ .

Murakami, *Acta Phytocimica (Japan)*, 1949, 15, 107; *Chem. Abstracts*, 1949, 43, 8451.

#### Arecaidine (N-Methyl- $\Delta^3$ -tetrahydronicotinic acid, N-methylguvacine, arecaine)



$C_7H_{11}O_2N$  MW, 141

Alkaloid of areca nuts. Plates +  $1H_2O$  from EtOH.Aq. M.p. 223-4° decomp., anhyd. 232°. Sol.  $H_2O$ . Insol. most org. solvents. Dil. aq. sol. reacts neutral, conc. as weak acid.

*B,HCl*: needles. M.p. 262-3° (rapid heat), (250.5-252.0°).

*B,HBr*: cryst. from MeOH. M.p. 248-9° (197° decomp.).

*B,HAuCl<sub>4</sub>*: prisms from dil. HCl. M.p. 200°.  
*B<sub>2</sub>,H<sub>2</sub>PtCl<sub>6</sub>*: yellow cryst. M.p. 234-5° decomp.

*Methochloride*: plates from H<sub>2</sub>O. M.p. 256-8°.  
*Methopicate*: leaflets. M.p. 224-5°.

*Me ester*: see Arecoline.

Hess, Leibbrandt, *Ber.*, 1918, 51, 806.

Freudenberg, *ibid.*, 976.

Merck, D.R.P., 485,139, (*Chem. Abstracts*, 1930, 24, 919).

Ugryumov, *Chem. Abstracts*, 1941, 35, 3644.

Dankova *et al.*, *Chem. Abstracts*, 1943, 37, 381.

**Arecaïne.**

See Arecaidine.

**Arecoline** (N-Methyl-Δ<sup>3</sup>-tetrahydronicotinic acid methyl ester, methyl ester of arecaidine)

C<sub>8</sub>H<sub>13</sub>O<sub>2</sub>N MW, 155

B.p. 209° (220°), 94°/17 mm, (105°/12 mm.), 74°/7 mm. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. D<sub>20</sub><sup>20</sup> 1.0504. n<sub>D</sub><sup>20</sup> 1.4860. Volatile in steam.

*B,HCl*: needles. M.p. 157-8°. Sol. H<sub>2</sub>O, EtOH.

*B,HBr*: prisms from EtOH. M.p. 170° (172°) (177.4-7.9°). Sol. H<sub>2</sub>O, hot EtOH.

*B<sub>2</sub>,H<sub>2</sub>PtCl<sub>6</sub>*: orange-red plates. M.p. 176°.

*Methiodide*: prisms. M.p. 173-4°. Very sol. H<sub>2</sub>O, hot EtOH. Spar. sol. MeOH, Me<sub>2</sub>CO. Insol. Et<sub>2</sub>O.

Hess, Leibbrandt, *Ber.*, 1918, 51, 806.

Freudenberg, *ibid.*, 976.

Chemnitius, *J. prakt. Chem.*, 1927, 117, 147.

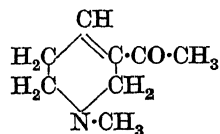
Merck, D.R.P., 485,139, (*Chem. Abstracts*, 1930, 24, 919).

Ugryumov, *Chem. Abstracts*, 1941, 35, 3644.

Mannich, *Ber.*, 1942, 75, 1480.

Dankova *et al.*, *Chem. Abstracts*, 1943, 37, 381.

**Arecolone** (N-Methyl-Δ<sup>3</sup>-piperid-3-yl methyl ketone)



C<sub>8</sub>H<sub>13</sub>ON MW, 139

B.p. 97°/10 mm.

*B,HCl*: m.p. 204°.

*B,HBr*: m.p. 223°.

*Semicarbazone*: m.p. 219° decomp. *B,HCl*: m.p. 233°.

Albers, Kallischnigg, Schmidt, *Ber.*, 1944, 77, 617.

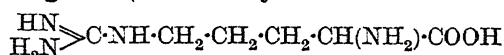
Wohl, Prill, *Ann.*, 1924, 440, 139.

Dict. of Org. Comp.—I.

**Areolatin**

See 1 : 5 : 6 : 7-Tetrahydroxy-2-methylanthraquinone.

**Arginine** (1-Amino-4-guanidino-n-valeric acid)



C<sub>6</sub>H<sub>14</sub>O<sub>2</sub>N<sub>4</sub> MW, 174

*d.*

Constituent of seeds and shoots of pine, fir, acacia, arachis, etc., and present in many proteins. Plates or prisms. M.p. 207° decomp. Sol. H<sub>2</sub>O. Spar. sol. EtOH. [α]<sub>D</sub><sup>20</sup> + 11.37°.

*B,HCl*: sinters at 218°. M.p. 235° (222°) decomp. [α]<sub>D</sub><sup>20</sup> + 12.12° in H<sub>2</sub>O.

*B,HNO<sub>3</sub>*: cryst. + ½H<sub>2</sub>O. M.p. 126°. Sol. H<sub>2</sub>O. [α]<sub>D</sub><sup>20</sup> + 9.31° in H<sub>2</sub>O. Hygroscopic.

*B<sub>2</sub>,HNO<sub>3</sub>*: m.p. 145° decomp. (150°).

*Me ester*: C<sub>7</sub>H<sub>16</sub>O<sub>2</sub>N<sub>4</sub>. MW, 188. Syrup.

*B<sub>2</sub>,HCl*: needles or prisms from EtOH-Et<sub>2</sub>O. M.p. 195° decomp. Very sol. H<sub>2</sub>O. Sol. EtOH, MeOH. Spar. sol. other solvents.

*Dibenzoyl deriv.*: leaflets from EtOH. M.p. 235° decomp. *B,HCl*: m.p. 218°.

*Picrate*: m.p. 217° decomp.

*Dipicrate*: m.p. 190° decomp.

*Picrolonate*: yellow needles from H<sub>2</sub>O. M.p. 231°.

*l.*

*B,HCl*: needles. M.p. 215°.

*B,HNO<sub>3</sub>*: needles. M.p. 183°.

*B<sub>2</sub>,HNO<sub>3</sub>*: m.p. 151° decomp.

*B<sub>2</sub>,H<sub>2</sub>SO<sub>4</sub>*: m.p. 213°.

*Picrate*: needles from H<sub>2</sub>O. M.p. 205°.

*Picrolonate*: yellow needles. M.p. 231°.

*dl.*

*B,HNO<sub>3</sub>*: plates. M.p. 230°.

*B<sub>2</sub>,HNO<sub>3</sub>*: m.p. 151°. Sol. H<sub>2</sub>O.

*Picrate*: prisms from H<sub>2</sub>O. M.p. 200-1°.

*Picrolonate*: yellow needles. M.p. 248°.

*Dipicrate*: decomp. at 196°.

*Dibenzoyl deriv.*: plates + H<sub>2</sub>O from EtOH. M.p. 176°, anhyd. 230°.

Vickery, Leavenworth, *J. Biol. Chem.*, 1927, 75, 115.

Cox, *J. Biol. Chem.*, 1928, 78, 475.

Felix, Dirr, *Z. physiol. Chem.*, 1928, 176, 29.

Cox, King, Berg, *J. Biol. Chem.*, 1929, 81, 755.

**Argol.**

See under Tartaric Acid.

**Aribine.**

See Harman.

**Aricine** (*Cusconine*)

C<sub>23</sub>H<sub>26</sub>O<sub>4</sub>N<sub>2</sub> MW, 394

Constituent of Cusco bark. Prisms from dil. EtOH. M.p. 188-9°. Sol. 100 parts EtOH at 15°, 11 parts at 78°. Sol. 33 parts Et<sub>2</sub>O at 15°.

Sol.  $\text{CHCl}_3$ . Insol.  $\text{H}_2\text{O}$ .  $[\alpha]_{\text{D}} - 58.18^\circ$  in  $\text{EtOH}$ ,  $- 92.5^\circ$  in  $\text{Et}_2\text{O}$ .

*B.HCl*:  $[\alpha]_{\text{D}} - 14.5^\circ$  in  $\text{EtOH}$ .

Moissan, Landrin, *Compt. rend.*, 1890, 110, 469.

Hamet, *Compt. rend.*, 1945, 221, 307.

### Aristolochine

$\text{C}_{32}\text{H}_{22}\text{O}_{13}\text{N}_2$  MW, 642

Constituent of seeds of *Aristolochia clematitis*, roots of *Aristolochia rotunda*, and *Aristolochia India* L. Orange-yellow cryst. from  $\text{MeOH}$ . M.p.  $215^\circ$  decomp. Sol. hot  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ . Insol.  $\text{C}_6\text{H}_6$ , pet. ether. Sol. alkalis, reprecipitated by  $\text{CO}_2$ . Sol.  $\text{H}_2\text{SO}_4$  to dark green sol.

Dawson, *Pharm. J.*, 1927, 119, 396.

Ryo, *Ber. ges. Physiol. exper. Pharmacol.*, 1927, 40, 462.

Krishnaswamy, Manjunath, Rao, *J. Indian Chem. Soc.*, 1935, 12, 476.

### Arjunetin

$\text{C}_{11}\text{H}_{18}\text{O}_4 \cdot \text{H}_2\text{O}$  MW, 232

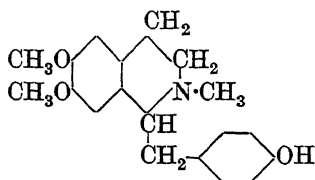
Occurs in the bark of *Terminalia arjuna*, Bedd. M.p.  $215^\circ$ . Contains a lactone ring.

Agarwal, Dutt, *Proceedings of the National Academy of Science of India*, 1936, 6, 305.

### Arlitan.

See Sorbitan.

### Arnepavine



$\text{C}_{19}\text{H}_{23}\text{O}_3\text{N}$  MW, 313

Alkaloid of *Papaver armeniacum*. Needles +  $\text{H}_2\text{O}$  from  $\text{Me}_2\text{CO}-\text{Et}_2\text{O}$ . M.p. about  $100^\circ$ ; solidifies and remelts at  $148-9^\circ$ . Sol.  $\text{EtOH}$ ,  $\text{CHCl}_3$ . Mod. sol.  $\text{Et}_2\text{O}$ . Insol.  $\text{H}_2\text{O}$ .

*B.HCl*: needles from  $\text{EtOH}-\text{Et}_2\text{O}$ . M.p.  $151-2^\circ$ .

*Oxalate*: cryst. from  $\text{EtOH}$ . M.p.  $211-12^\circ$ .

*Methiodide*: m.p.  $199-200^\circ$ .

*Me ether*:  $\text{C}_{20}\text{H}_{25}\text{O}_3\text{N}$ . MW, 327. M.p.  $63-4^\circ$ .  $[\alpha]_{\text{D}} - 84.5^\circ$  in  $\text{CHCl}_3$ . *Methiodide*: m.p.  $135-6^\circ$ .

Junusov, Konovalova, Orékhov, *J. Gen. Chem., U.S.S.R.*, 1940, 10, 641.

Konovalova, Yunusoff, Orechhoff, *Ber.*, 1935, 68, 2161.

### Arnidenediol

$\text{C}_{30}\text{H}_{52}\text{O}_2$  MW, 444

M.p.  $232^\circ$ .

*Diacetyl deriv.*: m.p.  $215^\circ$  ( $210^\circ$ ).

Dieterle, Schreiber, *Arch. Pharm.*, 1941, 279, 312.

Zimmermann, *Helv. Chim. Acta*, 1943, 26, 642.

### Arnidenaldiol

$\text{C}_{30}\text{H}_{48}\text{O}_3$  MW, 456

*Diacetyl deriv.*: m.p.  $230-2^\circ$ .

Dieterle, Schreiber, *Arch. Pharm.*, 1941, 279, 312.

### Arnidenediol (Arnidiol)

$\text{C}_{30}\text{H}_{50}\text{O}_2$  MW, 442

Occurs in *Taraxacum officinale*, Linn., *Arnica montana*, Linn., and other plants. M.p.  $257^\circ$  (from  $\text{Et}_2\text{O}$  or  $\text{EtOH}-\text{AcOEt}$ ).  $[\alpha]_{\text{D}}^{18} + 78.2^\circ$ . Dehydrogenation  $\rightarrow$  arnidenolone.  $\text{CrO}_3 \rightarrow$  arnidenedione.  $\text{O}_3 \rightarrow \text{H}\cdot\text{CHO}$ .

*Diacetyl deriv.*: m.p.  $75^\circ$  (from  $\text{AcOH}$ ),  $189^\circ$  ( $193^\circ$ ) (from  $\text{EtOH}$  or  $\text{Me}_2\text{CO}$ ).  $[\alpha]_{\text{D}} + 80^\circ$ .  $\text{H}_2-\text{PtO}_2-\text{AcOH} \rightarrow$  diacetylarnidenediol.  $\text{SeO}_2 \rightarrow$  diacetylarnidenaldiol.

*Dibenzoyl deriv.*: m.p.  $230^\circ$ .

Dieterle, Engelhard, *Arch. Pharm.*, 1940, 278, 225.

Zimmermann, *Helv. Chim. Acta*, 1941, 24, 393; 1943, 26, 642.

Jeger, Lardelli, *Helv. Chim. Acta*, 1947, 30, 1020.

Lardelli, Krüsi, Jeger, Ruzicka, *Helv. Chim. Acta*, 1948, 31, 1815.

### Arnidenedione

$\text{C}_{30}\text{H}_{46}\text{O}_2$  MW, 438

M.p.  $182^\circ$ .

*Di-oxime*: m.p.  $253-4^\circ$ .

Zimmermann, *Helv. Chim. Acta*, 1943, 26, 642.

### Arnidenolone

$\text{C}_{30}\text{H}_{48}\text{O}_2$  MW, 440

M.p.  $241-3^\circ$ .

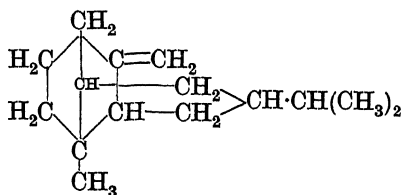
*p-Nitrophenylhydrazone*: orange-red prisms. M.p.  $268^\circ$ .

Dieterle, Engelhard, *Arch. Pharm.*, 1940, 278, 225.

### Arnidiol.

See Arnidenediol.

### Aromadendrene



Suggested structure

$\text{C}_{15}\text{H}_{24}$

MW, 204

Sesquiterpene occurring in various eucalyptus oils. B.p. 260–5°/760 mm., 121–2°/10 mm.  $D^{20}_D$  0.9249.  $n_D^{25}$  1.4993.  $H_2 \rightarrow$  dihydroaromadendrene.  $O_3 \rightarrow$  aromadendrone.

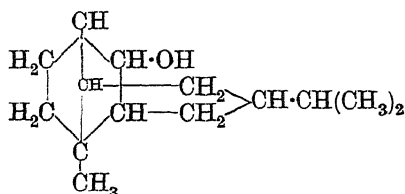
Briggs, Short, *J. Chem. Soc.*, 1928, 2524.  
Radcliffe, Short, *J. Chem. Soc.*, 1938, 1200.

Nares, Perrottet, *Helv. Chim. Acta*, 1940, 23, 912.

Treibs, Barchet, *Ann.*, 1950, 566, 89.

Birch, *Annual Reports on the Progress of Chemistry*, London, 1950, XLVII, 196.

## Aromadendrol



Suggested structure

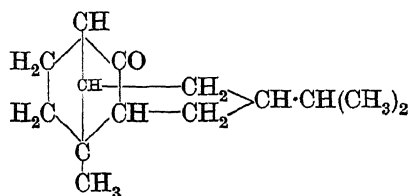
$C_{14}H_{24}O$  MW, 208

Long needles. M.p. 54–9°. B.p. 139–40°/10 mm.

Radcliffe, Short, *J. Chem. Soc.*, 1938, 1200.

Birch, *Annual Reports on the Progress of Chemistry*, London, 1950, XLVII, 196.

## Aromadendrone



Suggested structure

$C_{14}H_{22}O$  MW, 206

M.p. 85° (from MeOH).  $[\alpha]_{5770}^{16} +5.42^\circ$  in EtOH.

*Oxime*: m.p. 103°.

*Semicarbazones*:  $\alpha$ -form: hexagonal plates from MeOH. M.p. 190° decomp.  $\beta$ -form: hexagonal plates from MeOH. M.p. 202° decomp.

*p*-Nitrophenylhydrazone: needles from ligroin. M.p. 131°.

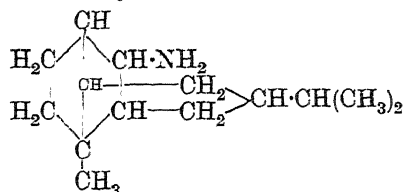
*Benzylidene deriv.*: m.p. 66° (from MeOH). B.p. 182–97°/1 mm.

Radcliffe, Short, *J. Chem. Soc.*, 1938, 1200.

Treibs, Barchet, *Ann.*, 1950, 566, 89.

Birch, *Annual Reports on the Progress of Chemistry*, London, 1950, XLVII, 196.

## Aromadendrylamine



Suggested structure

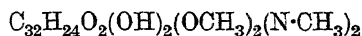
$C_{14}H_{25}N$  MW, 207

$B_3(COOH)_2$ : m.p. 164–5°. MeI  $\rightarrow$  aromadendryltrimethylammonium iodide.

Radcliffe, Short, *J. Chem. Soc.*, 1938, 1200.

Birch, *Annual Reports on the Progress of Chemistry*, London, 1950, XLVII, 196.

## Aromoline



$C_{36}H_{38}O_6N_2$  MW, 594

Cryst. +  $1CHCl_3$  from chloroform. M.p. 174–5°.  $[\alpha]_D^{17} +327^\circ$ .

Bick, Whalley, *Chem. Abstracts*, 1949, 43, 6787.

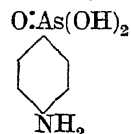
## Arsacetin.

See under Arsanilic Acid.

## Arsacridine.

See Phenarsazine.

**Arsanilic Acid** (*p*-Aminophenylarsonic acid, *p*-aminophenylarsinic acid)



$C_6H_8O_3NAs$  MW, 217

Needles. M.p. 232°. Sol. Et<sub>2</sub>O. Spar. sol. EtOH, AcOH. Insol. Me<sub>2</sub>CO, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Sol. alk. carbonates. Diazotises and couples. Reduce  $\rightarrow$  *p*-aminophenylarsinic oxide,  $NH_2\cdot C_6H_4\cdot AsO$ .  $Sn + HCl \rightarrow$  *pp'*-diaminoarsenobenzene. Na salt + KI + H<sub>2</sub>SO<sub>4</sub>  $\rightarrow$  *p*-iodoaniline. The Na salt is the drug Atoxyl and the *N*-acetyl deriv. of this is Arsacetin.

*N*-Chloroacetyl: plates from H<sub>2</sub>O. M.p. 285° decomp. Sol. hot EtOH. Mod. sol. hot H<sub>2</sub>O, AcOH.

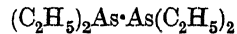
Lewis, Cheetham, *Organic Syntheses*, Collective Vol. I, 63.

Poulenc Frères, D.R.P., 468,757, (*Chem. Abstracts*, 1929, 23, 849).

## Arsanthrene.

See Phenarsine.

**Arsenic diethyl** (*Ethyl cacodyl, diarsenic tetraethyl*)



$C_8H_{20}As_2$  MW, 266

B.p. 185–90°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. Spontaneously inflammable. Reduces Ag and Hg sols. Ox. → diethylarsinic acid, C<sub>2</sub>H<sub>5</sub>)<sub>2</sub>AsO·OH.

Landolt, *Ann.*, 1854, 89, 319.

### Arsenic dimethyl.

See Cacodyl.

### Arsenic triacetate



C<sub>6</sub>H<sub>9</sub>O<sub>6</sub>As MW, 252

Needles. M.p. 82°. B.p. 165–70°/31 mm. Sol. CHCl<sub>3</sub>, AcOEt. Spar. sol. C<sub>6</sub>H<sub>6</sub>, CCl<sub>4</sub>. Insol. CS<sub>2</sub>, pet. ether. Decomp. by dist. at ord. press. H<sub>2</sub>O → As<sub>2</sub>O<sub>3</sub> + CH<sub>3</sub>COOH.

Pictet, Bon, *Bull. soc. chim.*, 1905, 33, 1141.

### Arsenic triethyl.

See Triethylarsine.

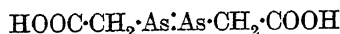
### Arsenic trimethyl.

See Trimethylarsine.

### Arsenic triphenyl.

See Triphenylarsine.

### Arsenoacetic Acid (*Diarsenoacetic acid*)

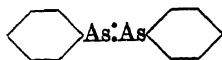


C<sub>4</sub>H<sub>6</sub>O<sub>4</sub>As<sub>2</sub> MW, 268

Yellow needles. Decomp. about 205°. Does not melt below 260°. Sol. Py., alkalis, alk. carbonates.

Palmer, *Organic Syntheses*, Collective Vol. I, 66.

### Arsenobenzene



C<sub>12</sub>H<sub>10</sub>As<sub>2</sub> MW, 304

Needles from chlorobenzene. M.p. 212°. Sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>. Spar. sol. EtOH. Insol. H<sub>2</sub>O, Et<sub>2</sub>O. Sols. resinify. Heat → triphenylarsine + As. Adds Cl<sub>2</sub>.

Michaelis, Schäfer, *Ber.*, 1913, 46, 1742.

Palmer, Scott, *J. Am. Chem. Soc.*, 1928, 50, 536.

Lyon, Mann, *J. Chem. Soc.*, 1945, 30.

### *p*-Arsenophenol (4 : 4'-*Di*hydroxyarsenobenzene)



C<sub>12</sub>H<sub>10</sub>O<sub>2</sub>As<sub>2</sub> MW, 336

Yellowish-brown powder. Decomp. above 200° with darkening. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, and alkalis.

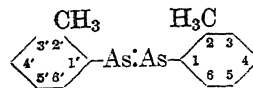
Höchst, *Chem. Zentr.*, 1909, I, 964.

Bart, *Chem. Zentr.*, 1914, I, 1039.

### Arsenoethane.

See Ethylarsenious oxide.

### *o*-Arsenotoluene (2 : 2'-*Dimethylarsenobenzene*)



C<sub>14</sub>H<sub>14</sub>As<sub>2</sub> MW, 332

Cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 205–8°.

Palmer, Adams, *J. Am. Chem. Soc.*, 1922, 44, 1372.

### *m*-Arsenotoluene (3 : 3'-*Dimethylarsenobenzene*)

Amorph. powder. M.p. 106°. Sol. CS<sub>2</sub>, hot cymene. Insol. EtOH, Et<sub>2</sub>O, AcOH, C<sub>6</sub>H<sub>6</sub>, pet. ether.

Michaelis, *Ann.*, 1902, 320, 327.

### *p*-Arsenotoluene (4 : 4'-*Dimethylarsenobenzene*)

Plates from C<sub>6</sub>H<sub>6</sub>. M.p. 202°. (Cryst. from CHCl<sub>3</sub>, m.p. 184°).

Michaelis, *Ann.*, 1902, 320, 301.

Michaelis, Schäfer, *Ber.*, 1913, 46, 1742.

Lyon, Mann, *J. Chem. Soc.*, 1945, 30.

### Arsinobenzene.

See Phenylarsine.

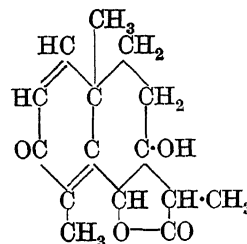
### Arsphenamine.

See Salvarsan.

### Artabotrine.

See Isocorydine.

### Artemisin (*Hydroxysantonin*)



C<sub>15</sub>H<sub>18</sub>O<sub>4</sub> MW, 262

Occurs with santonin in seeds of *Artemisia maritima*, Linn. Cryst. M.p. 203°. Sol. EtOH. Spar. sol. H<sub>2</sub>O. [α]<sub>D</sub> – 84.3° in EtOH.

*Acetyl*: pale yellow cryst. M.p. 200°. [α]<sub>D</sub> – 52.6°. *Oxime*: m.p. 188–9°. *Phenylhydrazone*: m.p. 145°.

*Oxime*: needles from MeOH. M.p. 233–4°.

*Desmotropic form*: m.p. 236°. [α]<sub>D</sub> – 84.16°.

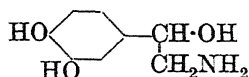
Smith, Smith, *Pharm. J.*, 1927, 119, 688, 701.

Tettweiler, Engel, Wedekind, *Ann.*, 1932, 492, 105.

### Artemisol.

See *p*-Menthanol-9.

**Arterenol** ( $\alpha$ -3 : 4-Trihydroxy- $\beta$ -amino-ethylbenzene,  $\alpha$ -aminomethyl-3 : 4-dihydroxyphenylcarbinol)



$C_8H_{11}O_3N$

MW, 169

Colourless cryst. M.p.  $191^\circ$  decomp. Spar. sol.  $H_2O$ . Very spar. sol. EtOH,  $Et_2O$ . Symptomimetic drug.

*B, HCl*: tan col. cryst. M.p.  $141^\circ$  decomp. Sol.  $H_2O$ . Spar. sol. EtOH. Intense green col. with  $FeCl_3$ .

*Oxalate*: m.p.  $175^\circ$ . Very sol.  $H_2O$ .

Höchst, D.R.P. 157,300.

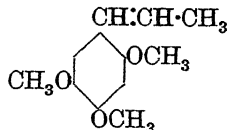
Zernick, *Chem. Zentr.*, 1909, I, 1185.

Beyer, *Physiol. Rev.*, 1946, 26, 169.

### Asaronaldehyde.

See Asarylaldehyde.

**Asarone** (2 : 4 : 5-Trimethoxy-1-propenylbenzene)



$C_{12}H_{16}O_3$

MW, 208

Constituent of roots of *Asarum europaeum*, Linn., and of calmus oil. Monoclinic cryst. M.p.  $67^\circ$  ( $62^\circ$ ). B.p.  $296^\circ$ . Sol. EtOH,  $Et_2O$ , AcOH,  $CHCl_3$ ,  $CCl_4$ . Mod. sol. boiling  $H_2O$ .  $D^{20}_4$  1.091.  $n^{20}_D$  1.5719. Heat of comb.  $C_p$  1575.2 Cal.,  $C_p$  1576.7 Cal. Sublimes with part. decomp. Ox.  $\rightarrow$  asarylaldehyde  $\rightarrow$  asarylic acid.

*Dibromide*: m.p.  $86^\circ$ . Unstable.

*Picrate*: brownish-black needles. M.p.  $82^\circ$ .

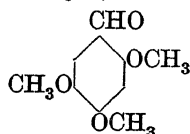
Gattermann, Eggers, *Ber.*, 1899, 32, 290.

Bert, *Compt. rend.*, 1941, 213, 873.

### Asaronic Acid.

See Asarylic Acid.

**Asarylaldehyde** (2 : 4 : 5-Trimethoxybenzaldehyde, asaronaldehyde)



$C_{10}H_{12}O_4$

MW, 196

Needles from  $CHCl_3$ . M.p.  $114^\circ$ . Sol. hot  $H_2O$ ,  $Et_2O$ ,  $C_6H_6$ , ligroin. Sublimes. Sol.  $NaHSO_3$ .

*Di-Et acetal*: cryst. from EtOH. M.p.  $101.5^\circ$ . Sol. EtOH.

*Oxime*: yellowish leaflets from  $H_2O$ . M.p.  $138^\circ$ . *B, HCl*: golden-yellow prisms. M.p.  $159^\circ$ .

*Semicarbazone*: needles from EtOH. M.p.  $205-6^\circ$ .

*Semioxamazone*: pale yellow needles from  $H_2O$ . M.p.  $249-50^\circ$  decomp. Insol. EtOH.

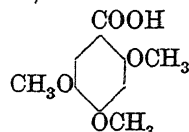
*Phenylhydrazone*: m.p.  $120-1^\circ$ .

*p-Nitrophenylhydrazone*: red needles from EtOH. M.p.  $234^\circ$ . Insol.  $H_2O$ .

v. Alphen, *Rec. trav. chim.*, 1927, 46, 195.

Gattermann, Eggers, *Ber.*, 1899, 32, 289.

**Asarylic Acid** (2 : 4 : 5-Trimethoxybenzoic acid, asaronic acid)



$C_{10}H_{12}O_5$

MW, 212

Needles from  $C_6H_6$ -pet. ether. M.p.  $144^\circ$ . B.p.  $300^\circ$ . Sol. hot  $H_2O$ , EtOH,  $C_6H_6$ , pet. ether.

*Me ester*:  $C_{11}H_{14}O_5$ . MW, 226. Yellow cryst. M.p.  $97.5^\circ$ .

*Et ester*:  $C_{12}H_{16}O_5$ . MW, 240. Yellow cryst. M.p.  $72^\circ$ .

*Isocamyl ester*:  $C_{15}H_{22}O_5$ . MW, 282. Yellow oil. B.p.  $140^\circ/0.2$  mm.

*Bornyl ester*: m.p.  $73^\circ$ .

*Phenyl ester*: m.p.  $119^\circ$ .

*Chloride*:  $C_{10}H_{11}O_4Cl$ . MW, 230.5. Cryst. M.p.  $115-16^\circ$ .

*Nitrile*:  $C_{10}H_{11}O_3N$ . MW, 193. Needles from EtOH. M.p.  $112-14^\circ$ . Sol. EtOH, AcOH,  $C_6H_6$ . Insol.  $H_2O$ , pet. ether.

*Amide*:  $C_{10}H_{13}O_4N$ . MW, 211. M.p.  $184.5^\circ$ .

*Anilide*: m.p.  $154.5^\circ$ .

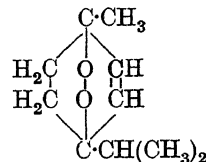
Bargellini, Madesani, *Gazz. chim. ital.*, 1931, 61, 688.

Haraszti, *Chem. Abstracts*, 1931, 25, 5154.

Luff, Perkin, Robinson, *J. Chem. Soc.*, 1910, 97, 1131.

Fabinyi, Szeki, *Ber.*, 1906, 39, 3680.

### Ascaridol



$C_{10}H_{16}O_2$

MW, 168

Chief constituent of oil of *Chenopodium*. M.p.  $2.5^\circ$ . B.p.  $115^\circ/15$  mm.,  $83^\circ/5$  mm.  $D^{20}_4$  0.9985.  $n^{20}_D$  1.4769. Formic acid  $\rightarrow$  *p*-cymene. Explodes on decomposition with HCl,  $H_2SO_4$ ,  $HNO_3$  or  $H_3PO_4$ . Heated to  $150^\circ$  gives ascaridol glycol anhydride which with steam  $\rightarrow$  ascaridol glycol. Anthelmintic.

*Glycol*:  $C_{10}H_{18}O_3$ . MW, 186. Two forms. ( $\alpha$ -) M.p.  $62.5-64^\circ$ . B.p.  $271-2^\circ$ ,  $135-6^\circ/15$  mm.  $D^{20}_4$  1.0981.  $n^{20}_D$  1.4796. ( $\beta$ -) Cryst. +  $H_2O$  from  $CHCl_3-H_2O$ . M.p. anhyd.  $103-5^\circ$ .

Dil.  $H_2SO_4 \rightarrow$  thymol. *Benzoate*: prisms from EtOH. M.p.  $136-7^\circ$ . *Dibenzoate*: needles from EtOH. M.p.  $117^\circ$ . Hyd.  $\rightarrow \alpha$ -form of glycol.

Paget, *Analyst*, 1926, 51, 170.

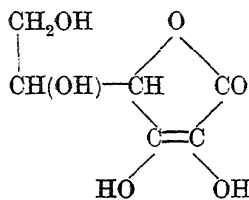
Schimmel, *Chem. Zentr.*, 1908, I, 1839.

Nelson, *J. Am. Chem. Soc.*, 1911, 33, 1408.

Naves, *Parfums de France*, 1935, 13, 4 (Review).

Schenck, Ziegler, *Naturwiss.*, 1945, 32, 157, (*Chem. Abstracts*, 1946, 40, 2132).

## Ascorbic Acid


 $C_6H_8O_6$ 

MW, 176

dl.

M.p.  $168-9^\circ$ .

d.

M.p.  $190^\circ$  ( $187-9^\circ$ ) decomp.  $[\alpha]_D^{25} - 48^\circ$ ,  $[\alpha]_D^{25} - 48.3^\circ$  in MeOH,  $[\alpha]_D^{20} - 23.8^\circ$  in  $H_2O$ . Shows no marked antiscorbutic action.

l. (*l*-Xyloascorbic acid).

Natural ascorbic acid (Vitamin C). Occurs in adrenal cortex, paprika, oranges, cabbages, etc. M.p.  $190^\circ$ , ( $187-9^\circ$ ) decomp.  $[\alpha]_D^{25} + 49^\circ$ ,  $[\alpha]_D^{25} + 48^\circ$  in MeOH,  $[\alpha]_D^{20} + 23.0$  in  $H_2O$ . 12% HCl  $\rightarrow$  furfural. Reduces cold Fehling's. No col. with Schiff's reagent. Violet col. with neutral  $FeCl_3$ . Reduces  $AgNO_3$  and neutral  $KMnO_4$ . Decolourises Br.Aq. and I.Aq. Acid  $KMnO_4 \rightarrow$  *l*-threonic acid. Possesses powerful antiscorbutic properties.

*Di*-phenylhydrazone: red needles. M.p.  $187^\circ$  decomp.

*Di*-*p*-nitrophenylhydrazone: cryst. from EtOH. M.p.  $262^\circ$  decomp.

*Di*-*p*-bromophenylhydrazone: m.p.  $170^\circ$  decomp.

*Di*-2 : 4-dinitrophenylhydrazone: brownish-red needles. M.p.  $232^\circ$  decomp.

Ault, Baird, Carrington, Haworth, Herbert, Hirst, Percival, Smith, Stacey, *J. Chem. Soc.*, 1933, 1419.

Reichstein, Grüssner, Oppenauer, *Helv. Chim. Acta*, 1933, 16, 1019.

Reichstein, Grüssner, *Helv. Chim. Acta*, 1934, 17, 311.

Banga, Szent-Györgyi, *Biochem. J.*, 1934, 28, 1625.

Reichstein, Swiss P., 180,810, (*Chem. Abstracts*, 1936, 30, 8533); U.S.P., 2,056,126, (*Chem. Abstracts*, 1936, 30, 8247).

Hirst, *Fortschritte der Chemie Organischer Naturstoffe* (Springer, Wien), 1939, 2, 132.

Haworth, Hirst, *Ergebnisse der Vitamin- und Hormonforschung* (Akademische Verlag, Leipzig), 1939, 2, 160.

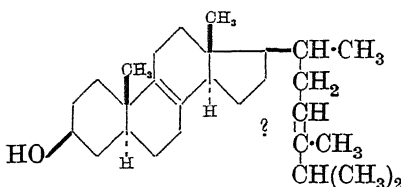
King, White, U.S.P., 2,318,500, (*Chem. Abstracts*, 1943, 37, 6096).

Borisoglebskii, *Chem. Abstracts*, 1944, 38, 2789.

Isbell, *Chem. Abstracts*, 1945, 39, 277.

Góth, *Zeitschrift für Vitaminforschung*, 1943, 14, 103.

## Ascosterol


 $C_{28}H_{46}O$ 

MW, 398

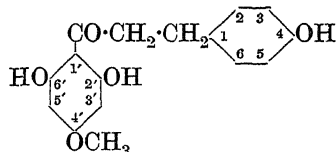
Minor constituent of yeast fat. M.p.  $146-7^\circ$  from MeOH.  $[\alpha]_D^{25} + 45.1^\circ$  in  $CHCl_3$ .  $H_2/PtO_2 \rightarrow$  dihydroascosterol.

*Benzoyl*: m.p.  $135-6^\circ$  from  $Me_2CO$ .  $[\alpha]_D^{25} + 41.1^\circ$ .

*Acetyl*: m.p.  $152-3^\circ$  from  $Me_2CO-MeOH$ .  $[\alpha]_D^{25} + 21.5^\circ$  in  $CHCl_3$ .

Wieland, Kanaoka, *Ann.*, 1937, 530, 146.

Barton, *J. Chem. Soc.*, 1946, 813.

Asebogenin (*Phloretin 4'-methyl Ether*)
 $C_{16}H_{16}O_5$ 

MW, 288

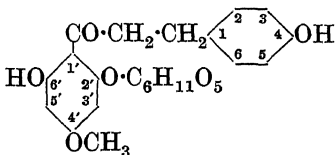
M.p.  $168^\circ$ . KOH  $\rightarrow$  phloroglucinol mono-methyl ether + phloracetic acid.

4 : 2' : 6'-*Triacetyl*: m.p.  $66.7^\circ$  ( $76.5^\circ$ ). Sol. EtOH,  $Me_2CO$ , AcOEt.

4 : 2' : *Di*-*Me ether*: see phloretin 4 : 2' : 4'-trimethyl ether, under Phloretin.

Zemplén, Mester, *Ber.*, 1942, 75, 1298.

Tamura, *J. Chem. Soc. Japan*, 1936, 57, 1141.

p-Asebotin (*Phloridzin 4'-methyl ether*)
 $C_{22}H_{26}O_{10}$ 

MW, 450



Occurs in the leaves of *Andromeda japonica*, Thunb. M.p. 148°.  $[\alpha]_D^{25}$   $-46.2^\circ$  in EtOH. Dil. HCl  $\rightarrow$  asebogenin.  $\text{FeCl}_3 \rightarrow$  reddish-brown col.

4:6'-Di-Me ether: see phloridzin trimethyl ether, under Phloridzin.

Zemplén, Mester, *Ber.*, 1942, 75, 1298.

Tamura, *J. Chem. Soc. Japan*, 1936, 57, 1141.

### Asiatic Acid

$\text{C}_{30}\text{H}_{48}\text{O}_5$  MW, 488

Triterpene acid formed by hydrolysis of asiaticoside, a glycoside present in *Centella asiatica*. Needles. M.p. 300–305°. Sublimes at 230–60°/0.1 mm.

Me ester:  $\text{C}_{31}\text{H}_{50}\text{O}_5$ . MW, 502. Exists in two forms. (i) Cryst. from EtOH. M.p. 160–70°. Resolidifies at 180° giving form (ii). Cryst. from  $\text{C}_6\text{H}_6$ . M.p. 225°. Hot HCl  $\rightarrow$  (i).

Diacetyl deriv.: cryst. M.p. 168–70°.  $[\alpha]_D^{20} + 35.2^\circ$  in  $\text{CHCl}_3$ .

Polonsky, *Compt. rend.*, 1949, 228, 1450; 1950, 230, 485, 1784; 1951, 232, 1878; 233, 93, 671; *Bull. soc. chim.*, 1952, 649.

### Asiaticoside

$\text{C}_{54}\text{H}_{88}\text{O}_{23}$  MW, 1104

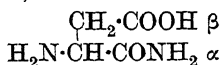
Occurs in leaves and stems of *Centella asiatica*. M.p. 230–3°. Hyd.  $\rightarrow$  *d*-glucose + *l*-rhamnose + asiatic acid.

Boiteau, Buzas, Lederer, Polonsky, *Bull. soc. chim.*, 1949, 31, 46.

### Asparacemic Acid.

See *dl*-Aspartic Acid.

$\alpha$ -Asparagine (*dl*- $\alpha$ -Asparagine, aspartic acid  $\alpha$ -monoamide, *dl*- $\alpha$ -aminosuccinamic acid)



$\text{C}_4\text{H}_8\text{O}_3\text{N}_2$  MW, 132

Cryst. +  $1\text{H}_2\text{O}$ . Decomp. at 213–15° without melting. Sol. hot  $\text{H}_2\text{O}$ . Insol. EtOH,  $\text{Et}_2\text{O}$ .  $D_4^{15}$  1.454. Reacts acid.

*N*- $\alpha$ -Benzoyl: m.p. 190–1° decomp.

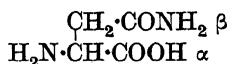
*N*- $\alpha$ -Benzenesulphonyl: m.p. 174–5°.

Piutti, *Gazz. chim. ital.*, 1888, 18, 463.

Wesley Cocker, *J. Chem. Soc.*, 1940, 62, 1489.

Vickery, Pucher, Deuber, *J. Biol. Chem.*, 1945, 45, 142.

$\beta$ -Asparagine (*Asparagine*, aspartic acid  $\beta$ -monoamide)



$\text{C}_4\text{H}_8\text{O}_3\text{N}_2$  MW, 132

*d*-

Rhombic cryst. +  $\text{H}_2\text{O}$ . M.p. 234.5°.  $[\alpha]_D^{15} + 5.41^\circ$ .

*l*-

Ordinary asparagine. Constituent of asparagus, beetroot, peas, beans, etc. Rhombic hemihedral cryst. +  $1\text{H}_2\text{O}$ . M.p. 234–5° (rapid heat), 226–7° decomp., heated slowly in sealed tube. Sol. 3.2% in  $\text{H}_2\text{O}$  at 30°, more in hot. Insol. EtOH.  $D_4^{15}$  1.543.  $[\alpha]_D^{20} - 5.42^\circ$  in  $\text{H}_2\text{O}$ . Triboluminescent. Reacts acid. *k* (acid) = 0.88  $\times 10^{-9}$  at 18°,  $1.3 \times 10^{-9}$  at 25°. *k* (base) =  $1.5 \times 10^{-12}$  at 25°,  $1.9 \times 10^{-11}$  at 60°.  $\text{HNO}_2 \rightarrow$  *l*-malic acid.

*N*-Chloroacetyl: needles from  $\text{H}_2\text{O}$ . M.p. 148–9°.  $[\alpha]_D^{20} + 4.71^\circ$  in KOH.

*N*-Glycyl: needles from EtOH.Aq. M.p. 216° decomp. Very sol.  $\text{H}_2\text{O}$ . Spar. sol. EtOH. Acid to litmus. Cu salts  $\rightarrow$  reddish-violet col.

*N*- $\alpha$ -Bromopropionyl: m.p. 158–9° decomp.  $[\alpha]_D^{19} - 6.60^\circ$  in  $\text{H}_2\text{O}$ .

*N*-Benzoyl: needles. M.p. 189°.  $[\alpha]_D^{20} + 18.9^\circ$  (1.057 gm. in 4.48 c.c. *N*/NaOH and 5.56 c.c.  $\text{H}_2\text{O}$ ).

*N*-Anisoyl: needles from  $\text{Et}_2\text{O}$ . M.p. 190–1°.  $[\alpha]_D^{20} + 15.11^\circ$  in KOH.

*N*-*m*-Nitrobenzoyl: cryst. from  $\text{H}_2\text{O}$ . M.p. 176°.  $[\alpha]_D^{20} + 12.55^\circ$  in KOH.

*N*-*p*-Nitrobenzoyl: prismatic needles. M.p. 178°.  $[\alpha]_D^{20} + 10.96^\circ$  in KOH.

*N*-*p*-Toluenesulphonyl: needles. M.p. 175°.  $[\alpha]_D^{20} + 6.83^\circ$  in KOH.

Bergmann, Zervas, Salzmann, *Ber.*, 1933, 66, 1288.

Berlingozzi, *Gazz. chim. ital.*, 1927, 57, 814.

Piutti, *Chem. Abstracts*, 1925, 19, 3285.

Steward, Thompson, *Nature*, 1952, 169, 739.

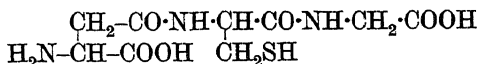
### Asparaginic Acid.

See Aspartic Acid.

### Asparaginimide.

See under Aspartic Acid.

### Asparthione ( $\beta$ -Aspartylcysteinylglycine)



$\text{C}_9\text{H}_{15}\text{O}_6\text{N}_3\text{S}$  MW, 293

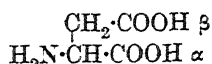
Amorph.  $[\alpha]_D^{20} - 29.0^\circ$  in  $\text{H}_2\text{O}$ . Forms cryst. Cu salt. Can replace glutathione as co-enzyme for glyoxylase.

$\alpha$ -Benzyl-*N*-carbobenzoxy-*S*-benzyl: m.p. 153° (from  $\text{CHCl}_3$ -AcOEt).

*N*-Carbobenzoxy-*S*-benzyl: m.p. 168–70° (from EtOH).

Miller, Behrens, du Vigneaud, *J. Biol. Chem.*, 1941, 140, 411.

**d-Aspartic Acid** (*d-Asparaginic acid*, *d-aminosuccinic acid*)



$\text{C}_4\text{H}_7\text{O}_4\text{N}$  MW, 133

Cryst.  $[\alpha]_D^{20} - 25.5^\circ$  in HCl.Aq. Sol. hot  $\text{H}_2\text{O}$ , dil. HCl. Insol. EtOH.

Amide: see *d*- $\beta$ -Asparagine.

*N*-Benzoyl: cryst. M.p. 184–5°.  $[\alpha]_D^{25} - 37.4^\circ$  in KOH.

Fischer, *Ber.*, 1899, 32, 2463.

**l-Aspartic Acid** (*l-Asparaginic acid*, *l-aminosuccinic acid*).

Constituent of young sugar cane and sugar beet molasses. Leaflets. M.p. 271° (rapid heat. in sealed tube). Sol. hot  $\text{H}_2\text{O}$ , dil. HCl. Insol. EtOH.  $D_{12}^{25} 1.6613$ .  $[\alpha]_D^{20} + 4.36^\circ$  in  $\text{H}_2\text{O}$ ,  $-1.86^\circ$  at 90°. Dextrorotatory in acid sol., levorotatory in alk. sol.  $k$  (acid) =  $13.5 \times 10^{-5}$  at 25°.  $k$  (base) =  $1.20 \times 10^{-12}$  at 25°.  $\text{HNO}_2 \rightarrow$  *l*-malic acid.

*Brucine salt*: prisms + 5 $\text{H}_2\text{O}$  from  $\text{H}_2\text{O}$ , needles from MeOH-AcOEt. M.p. 100°, anhyd. decomp. at 200°. Sol. MeOH. Mod. sol. EtOH. Insol.  $\text{Me}_2\text{CO}$ .  $[\alpha]_D^{20} - 28.4^\circ$  in  $\text{H}_2\text{O}$ .

*Strychnine salt*: needles. M.p. 252–5° decomp. Very sol.  $\text{H}_2\text{O}$ . Insol. EtOH.  $[\alpha]_D^{20} - 28.3^\circ$  in  $\text{H}_2\text{O}$ .

$\beta$ -Me ester:  $\text{C}_5\text{H}_9\text{O}_4\text{N}$ . MW, 147. Cryst. M.p. 181° decomp. Sol.  $\text{H}_2\text{O}$ , boiling EtOH. Insol.  $\text{Et}_2\text{O}$ .

*Di-Me ester*:  $\text{C}_6\text{H}_{11}\text{O}_4\text{N}$ . MW, 161. B.p. 119–20°/15 mm.

$\beta$ -Et ester:  $\text{C}_6\text{H}_{11}\text{O}_4\text{N}$ . MW, 161. Leaflets from EtOH. M.p. 189–90°. Sol.  $\text{H}_2\text{O}$ . Mod. sol. EtOH. Insol.  $\text{Et}_2\text{O}$ . *B,HCl*: needles. M.p. 199–200°.

*Di-Et ester*:  $\text{C}_8\text{H}_{15}\text{O}_4\text{N}$ . MW, 189. B.p. 130°/13 mm.  $D^{20} 1.085$ .  $[\alpha]_D^{20} - 9.93^\circ$ . Misc. with EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Sol.  $\text{H}_2\text{O}$ , ligroin. *B,HCl*: needles. Decomp. at 95°. *N-Chloroacetyl*: needles from pet. ether. M.p. 46–7°.

$\beta$ -Propyl ester:  $\text{C}_7\text{H}_{13}\text{O}_4\text{N}$ . MW, 175. Leaflets. M.p. 200°. Sol.  $\text{H}_2\text{O}$ .

$\beta$ -Isopropyl ester: needles from  $\text{H}_2\text{O}$ . M.p. 210°. Sol.  $\text{H}_2\text{O}$ . Insol.  $\text{Et}_2\text{O}$ .

$\beta$ -Butyl ester:  $\text{C}_8\text{H}_{15}\text{O}_4\text{N}$ . MW, 189. Cryst. M.p. 198°. Sol. hot  $\text{H}_2\text{O}$ .

$\beta$ -Isobutyl ester: cryst. M.p. 197–8°. Sol. hot  $\text{H}_2\text{O}$ .

$\beta$ -Isocamyl ester:  $\text{C}_9\text{H}_{17}\text{O}_4\text{N}$ . MW, 203. Cryst. M.p. 195–6°. Sol. hot  $\text{H}_2\text{O}$ .

$\beta$ -Allyl ester:  $\text{C}_7\text{H}_{11}\text{O}_4\text{N}$ . MW, 173. Yellow needles. M.p. 194–5°. Sol.  $\text{H}_2\text{O}$ .

$\beta$ -Amide: see *l*- $\beta$ -Asparagine.

*Diamide*:  $\text{C}_4\text{H}_9\text{O}_2\text{N}_2$ . MW, 131. Cryst. M.p. 131°. Very sol.  $\text{H}_2\text{O}$ , MeOH. Spar. sol. EtOH. Insol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Alk. Cu salts  $\rightarrow$  violet-red.

*Hydrazide*: needles +  $\text{H}_2\text{O}$  from EtOH.Aq. M.p. 174°. Reduces  $\text{AgNO}_3\cdot\text{NH}_3$  in cold, Fehling's on long heating.

*Dihydrazide*: cryst. from EtOH.Aq. M.p. 135° decomp. Very sol.  $\text{H}_2\text{O}$ .

*N-Chloroacetyl*: cryst. powder from AcOEt. M.p. about 142°. Very sol.  $\text{H}_2\text{O}$ , EtOH. Insol.  $\text{Et}_2\text{O}$ , pet. ether.  $[\alpha]_D^{20} + 4.21^\circ$  in  $\text{H}_2\text{O}$ .

*N-Glycyl*: cryst. powder +  $\text{H}_2\text{O}$ . Loses  $\text{H}_2\text{O}$  at 105° in vac. M.p. 207° decomp. Sol.  $\text{H}_2\text{O}$ . Insol. EtOH.  $[\alpha]_D^{20} + 11.1^\circ$  in  $\text{H}_2\text{O}$ . Strongly acid in aq. sol. Heat with CuO  $\rightarrow$  deep blue col.

*N-Benzoyl*: m.p. 171–3°.  $[\alpha]_D^{20} + 37^\circ$  (0.91 gm. in 7.67 c.c. *N*/NaOH and 2.37 c.c.  $\text{H}_2\text{O}$ ).

Piutti, Magli, *Gazz. chim. ital.*, 1906, 36, II, 742.

Fischer, Koenigs, *Ber.*, 1904, 37, 4599.

Freudenberg, Noë, *Ber.*, 1925, 58, 2399.

Sumiki, *Chem. Abstracts*, 1929, 23, 2531.

**dl-Aspartic Acid** (*dl-Asparaginic acid*, *asparacemic acid*).

Monoclinic prisms. M.p. 338–9°. Sol. 209 parts of  $\text{H}_2\text{O}$  at 15°. Insol. EtOH,  $\text{Et}_2\text{O}$ .  $D_{12}^{25} 1.6632$ .

$\alpha$ -Et ester:  $\text{C}_6\text{H}_{11}\text{O}_4\text{N}$ . MW, 161. Plates. M.p. 165° decomp. Sol.  $\text{H}_2\text{O}$ . Spar. sol. EtOH.

$\beta$ -Et ester: leaflets or needles from EtOH.Aq. M.p. 200° decomp. Sol.  $\text{H}_2\text{O}$ . Spar. sol. EtOH.

*B,HCl*: m.p. 178–80° decomp.

*Di-Me ester*:  $\text{C}_6\text{H}_{11}\text{O}_4\text{N}$ . MW, 161. *N-Propionyl*: needles. M.p. 46–8°. B.p. 150°/1.5 mm. Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ ,  $\text{Me}_2\text{CO}$ , AcOH.  $n_D^{25} 1.4592$ .

*Di-Et ester*:  $\text{C}_8\text{H}_{15}\text{O}_4\text{N}$ . MW, 189. B.p. 150–4°/25 mm., 130.5°/13.5 mm. Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . *N-Acetyl*: b.p. 180°/15 mm., 124°/1–2 mm. *N-Benzoyl*: m.p. 165–6° (on cryst. from boiling water this falls to 158°). *N-Benzenesulphonyl*: m.p. 181–2°.

$\alpha$ -Amide: see  $\alpha$ -Asparagine.

*Imide*: asparaginimide.  $\text{C}_4\text{H}_6\text{O}_2\text{N}_2$  (or  $\text{C}_8\text{H}_{12}\text{O}_4\text{N}_4$ ). MW, 114 (228). Needles. M.p. 275° decomp. Prac. insol.  $\text{H}_2\text{O}$ . Insol. EtOH,  $\text{Et}_2\text{O}$ .

*N-Benzoyl*: cryst. + 1 $\text{H}_2\text{O}$  from  $\text{H}_2\text{O}$ . M.p. 119°, anhyd. 174° (164°).

*N-Carbamyl*: m.p. 178–80°.

*Ephedrine salt*: m.p. 207° decomp.

Wegscheider, Frankl, *Monatsh.*, 1906, 27, 488.

Fischer, *Ber.*, 1899, 32, 2461.

Fischer, Koenigs, *Ber.*, 1904, 37, 4603.

Pachlopník, *Chem. Abstracts*, 1926, 20, 1386.

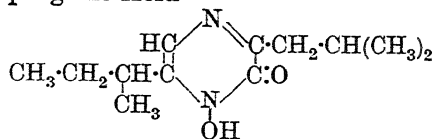
Dunn, Fox, *J. Biol. Chem.*, 1933, 101, 493.

Keimatsu, Kato, *Chem. Abstracts*, 1930, 24, 70.

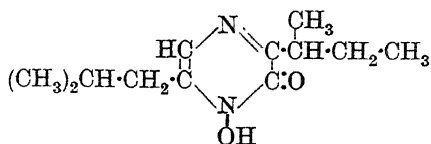
Bergmann, Kann, Miekeley, *Ann.*, 1926, 449, 142.

Klostermann, Painter, *J. Am. Chem. Soc.*, 1947, 69, 1674.

## Aspergillitic Acid



or



$\text{C}_{12}\text{H}_{20}\text{O}_2\text{N}_2$  MW, 224

Antibiotic from *Aspergillus flavus*. Pale yellow rods. M.p. 97-9°.  $[\alpha]_D^{25} + 13^\circ$ .  $\text{pK}_a$  5-95. Sol. most org. solvents. Insol.  $\text{H}_2\text{O}$ .  $\text{FeCl}_3 \rightarrow$  red col.  $\text{AcOH} + \text{P} + \text{I} \rightarrow$  deoxyaspergillitic acid.

*Ag salt*: colourless plates from EtOH. Decomp. at 190°.

*Cu salt*: green leaflets. M.p. 198-9°.

*Phenylhydrazine salt*: m.p. 99-5°.

*B, HCl*: m.p. 182° decomp.

*3:5-Dinitrobenzoyl*: (i) m.p. 166-8°; (ii) m.p. 123°.

*Methiodide*: cryst. + MeI. M.p. 169°.

Dutcher, *J. Biol. Chem.*, 1947, 171, 321, 341.

Dunn, Gallagher, Newbold, Spring, *J. Chem. Soc.*, 1949, *Suppl.*, 126.

Dunn, Newbold, Spring, *ibid.*, *Suppl.*, 131.

## Asperuloside

$\text{C}_{17}\text{H}_{24}\text{O}_{11}$  MW, 404

Glycoside occurring in *Galium aparine*, *Rubia tinctorum*, and *Daphniphyllum macropodium*. Needles from EtOH. M.p. 125-7°.  $[\alpha]_D^{25} - 204^\circ$  in  $\text{H}_2\text{O}$ .  $\text{HCl}-\text{AcOH}$  in presence of Cu  $\rightarrow$  clear bright blue sol.

*Octa-acetyl*: m.p. 153°. Sol. EtOH, MeOH, AcOEt.

Herissey, *Bull. soc. chim. biol.*, 1925, 7, 1009.

Trim, Hill, *Biochem. J.*, 1952, 50, 310.

## Asphodelin.

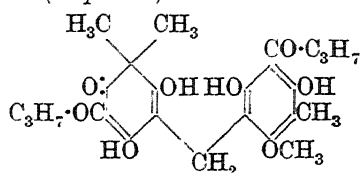
Polysaccharide from *Asphodelus knollen*, containing at least seven hexose units. M.p. 210°. Very sol.  $\text{H}_2\text{O}$ . Sol. EtOH.  $[\alpha]_D^{20} - 30-9^\circ$  in  $\text{H}_2\text{O}$ .

*Acetyl deriv.*:  $[\alpha]_D^{20} - 16-6^\circ$ .

*Methyl deriv.*: brown viscous syrup.  $[\alpha]_D^{20} - 33-3^\circ$  in  $\text{C}_6\text{H}_6$ . Hyd.  $\rightarrow$  mixture of methylated hexoses.

Schlubach, Lenzian, *Ann.*, 1937, 532, 191.

Colin, Neyron, *Bull. soc. chim.*, 1931, 49, 1542.

Aspidin (*Aspidine*)

$\text{C}_{25}\text{H}_{32}\text{O}_8$  MW, 460

Occurs in rhizomes of *Dryopteris spinulosa* and *Dr. austriaca*. Pale yellow cryst. from EtOH. M.p. 125°.

*Diacetyl deriv.*: needles and prisms from MeOH. M.p. 108°.

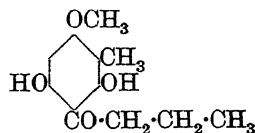
*Anilide*: cryst. from EtOH. M.p. 132°.

Hausmann, *Chem. Zentr.*, 1899, II, 919.

Boehm, *Ann.*, 1903, 329, 321.

Carlsson, Bäckström, *Svensk. Farm. Tids.*, 1943, 47, 33.

**Aspidinol** (*2-Methyl-4-butyrylphloroglucinol-1-methyl ether, 3:5-dihydroxy-1-methoxy-2-methyl-4-butyrylbenzene, 2:6-dihydroxy-3-methyl-4-methoxyphenyl n-propyl ketone*)



$\text{C}_{12}\text{H}_{16}\text{O}_4$  MW, 224

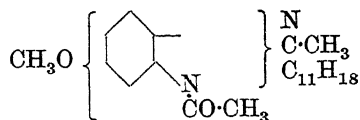
Constituent of male fern. Yellow needles or plates from  $\text{C}_6\text{H}_6$ . M.p. 156-61°. Sol. EtOH.  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ ,  $\text{Me}_2\text{CO}$ . Spar. sol.  $\text{C}_6\text{H}_6$ , hot  $\text{H}_2\text{O}$ . Sol. conc. alkalis.

*Dibenzoyl*: prisms from EtOH. M.p. 108-9°.

Karrer, Widmer, *Helv. Chim. Acta*, 1920, 3, 392.

Fumarola, B.P., 256,758, (*Chem. Abstracts*, 1927, 21, 3105).

## Aspidospermine



$\text{C}_{22}\text{H}_{30}\text{O}_2\text{N}_2$  MW, 354

Alkaloid from bark of *Aspidosperma quebracho*, Schlecht. Identical with vallesine from *Vallesia glabra* and *Vallesia dichotoma*. Needles from EtOH. M.p. 208°. Sol.  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ . Mod. sol. EtOH. Spar. sol.  $\text{H}_2\text{O}$ . Colourless in conc.  $\text{H}_2\text{SO}_4$ .  $[\alpha]_D^{25} - 100-2^\circ$  in EtOH.

Ewins, *J. Chem. Soc.*, 1914, 105, 2738.

Field, *J. Chem. Soc.*, 1924, 125, 1444.

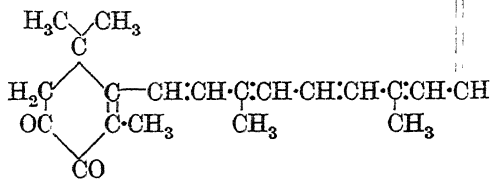
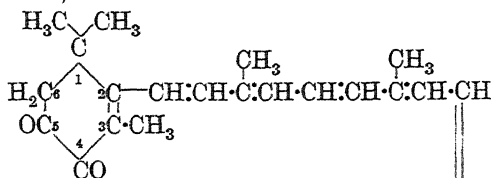
Deulofeu, deLanghe, Labriola, Marquez, *Chem. Abstracts*, 1938, 32, 2135.

Witkop, *J. Am. Chem. Soc.*, 1948, 70, 3712.

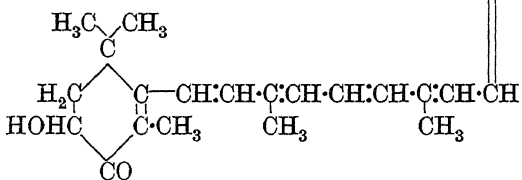
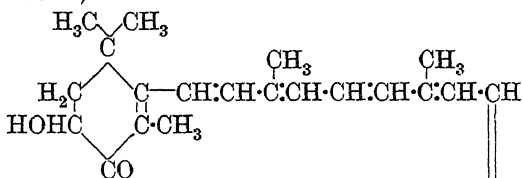
Openshaw, Smith, *Experientia*, 1948, 4, 428.

**Aspirin.**

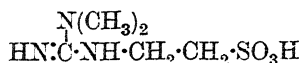
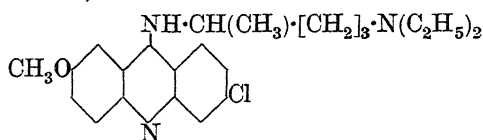
See Acetylsalicylic Acid.

**Astacene** (*Astacin*, 4:5:4':5'-tetraketo- $\beta$ -carotene) $C_{40}H_{48}O_4$  MW, 592Bluish-red needles from Py. M.p. 243°. Sol. AcOEt,  $CHCl_3$ ,  $C_6H_6$ , Py, dioxan. Spar. sol. MeOH,  $Et_2O$ , pet. ether,  $CS_2$ . Insol.  $H_2O$ , NaOH. Absorption maximum at 500 m $\mu$  in Py. Forms dioxime.Karrer, Loewe, Hübner, *Helv. Chim. Acta*, 1935, 18, 96.Kuhn, Lederer, *Ber.*, 1933, 66, 488.

See also references under Astaxanthin below.

**Astaxanthin** (5:5'-Dihydroxy-4:4'-diketo- $\beta$ -carotene) $C_{40}H_{52}O_4$  MW, 596In form of esters or chromoproteins in crustaceans, etc. Violet plates with metallic lustre from Py.Aq. M.p. 215-6° decomp. In absence of air gives blue sol. in alkalis. Alkalis + O  $\rightarrow$  astacene.*Diacetyl*: blue-black needles from Py.Aq. M.p. 203-5°.*Hydrogen palmitate*: m.p. 115°.*Dipalmityl*: violet-red needles from Py-MeOH. M.p. 72°.Kuhn, Sørensen, *Ber.*, 1938, 71, 1879.Kuhn, Stene, Sørensen, *Ber.*, 1939, 72, 1688.**Asterin.**

See Chrysanthemine.

**Asterubin** $C_5H_{13}O_3N_3S$  MW, 195Isolated from starfish. Needles from MeOH.Aq. M.p. 272-3° decomp. Neutral reaction.  $KMnO_4 \rightarrow$  guanidine.Ackermann, *Z. physiol. Chem.*, 1935, 232, 206.Ackermann, Müller, *ibid.*, 235, 233.**Atebrin** (*Acrichine*, *acriquine*, *mepacrine*, *quinacrine*) $C_{23}H_{30}ON_3Cl$  MW, 399.5*l.*Yellow oil.  $[\alpha]_D^{25} - 197^\circ$  in EtOH.*B,2HCl*: yellow needles from EtOH- $Et_2O$ . M.p. 244-5° decomp.  $[\alpha]_D^{25} - 379^\circ$  in  $H_2O$ .*d.*Yellow oil.  $[\alpha]_D^{25} + 205^\circ$  in EtOH.*B,2HCl*: yellow needles from EtOH- $Et_2O$ . M.p. 244-5° decomp.  $[\alpha]_D^{25} + 388^\circ$  in  $H_2O$ .*dl.*M.p. 86-8°. Spar. sol.  $Me_2CO$ . Insol. dry  $Et_2O$ .*B,2HCl*: cryst. from  $H_2O$ . M.p. 248-50°.*Methanesulphonate*: m.p. 143-5°.

Antimalarial drug administered in the form of salts.

Knunyantz *et al.*, *Chem. Abstracts*, 1934, 28, 2126, 4837.Mietzsch, Mauss, *Angew. Chem.*, 1934, 47, 633.

I.G., B.P. 363,392, (U.S.P. 2,113,357).

Poulenc, B.P. 452,805, (U.S.P. 2,092,114).

I.C.I., B.P. 544,846.

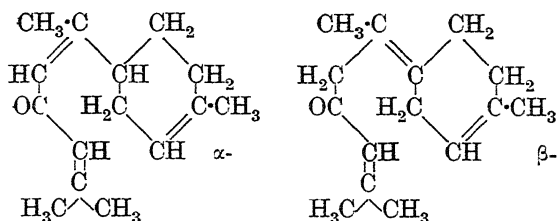
Sherndahl, *Chemical Engineering News*, 1943, 21, 1154.Brown, Hammick, *J. Chem. Soc.*, 1948, 99.**Atisine** (*Anthorine*) $C_{22}H_{31}O_2N$  or  $C_{22}H_{33}O_2N$  MW, 341 (343)Alkaloid from *Aconitum heterophyllum*, Wall. M.p. 57-60°. Sol. EtOH,  $Et_2O$ . MeOH/NaOH  $\rightarrow$  dihydroatisine.  $H_2/PtO_2 \rightarrow$  tetrahydroatisine. Se  $\rightarrow$  1-methylphenanthrene + (?) 1-methyl-6-ethylphenanthrene.*B,HCl*: m.p. 340° (311-12°).  $[\alpha]_D + 26.9^\circ$ .*B,HI*: m.p. 295°.

*Diacetyl*: hydrochloride, m.p. 241–3° decomp.

Jacobs, Craig, *J. Biol. Chem.*, 1942, **143**, 589.

Lawson, Toffs, *J. Chem. Soc.*, 1937, 1640.  
Govis, *Compt. rend.*, 1937, 205, 1007.

### Atlantone



$C_{15}H_{22}O$  MW, 218

Present in a mixture, b.p. 120–1°/1 mm., containing  $\alpha$ - and  $\beta$ -atlantones and sesquiterpene alcohols, in oil from *Cedrus atlantica*, Manet, and *C. deodara*, Loud.

St. Pfau, Plattner, *Helv. Chim. Acta*, 1934, **17**, 129.

### Atophan.

See 2-Phenylquinoline-4-carboxylic Acid.

### Atoquinol.

See under 2-Phenylquinoline-4-carboxylic Acid.

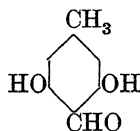
### Atoxyl.

See under Arsanilic Acid.

### Atractylol.

See Eudesmol.

**Atranol** (*p*-Orsellinaldehyde,  $\gamma$ -orcylaldehyde, 3:5-dihydroxy-*p*-toluic aldehyde, 4-methyl- $\gamma$ -resorcylic aldehyde)



$C_8H_8O_3$  MW, 152

Yellow needles from  $H_2O$ . M.p. 124°. Takes up  $\frac{1}{2}H_2O$  from air  $\rightarrow$  hydrate, m.p. 118–19°. Sol. alkalis and alkali carbonates with yellow col. Slightly volatile in steam.  $FeCl_3 \rightarrow$  olive-green col. in dil. alc. sol.

*Di-Me ether*:  $C_{10}H_{12}O_3$ . MW, 180. Needles from pet. ether. M.p. 90–1°.

*Mono-acetyl deriv.*: needles from EtOH.Aq. M.p. 75–75.5°.

*Triacetyl deriv.*: m.p. 140–2°.

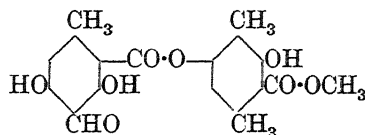
*Oxime*: cryst. from  $C_6H_6$ . M.p. 194–5° decomp.

*Semicarbazone*: cryst. from EtOH. M.p. 273–5°.

*Anil*: brownish-red needles from EtOH.Aq. M.p. 207–9°.

St. Pfau, *Helv. Chim. Acta*, 1934, **17**, 1327: 1926, **9**, 661.

### Atranorin



$C_{19}H_{18}O_8$  MW, 374

Obtained from lichens. Prisms from  $CHCl_3$ . M.p. 196–7° (187–8°). Sol. hot  $CHCl_3$ . Sol. alkalis to yellow sols.

*Di-Me ether*:  $C_{21}H_{22}O_8$ . MW, 402. Prisms from AcOEt-ligroin. M.p. 136°. Alc.  $FeCl_3 \rightarrow$  light brown col.

*Tri-Me ether*:  $C_{22}H_{24}O_8$ . MW, 416. Prisms from MeOH. M.p. 123.5°.

Curd, Robertson, Stephenson, *J. Chem. Soc.*, 1933, 130.

St. Pfau, *Helv. Chim. Acta*, 1926, **9**, 650.

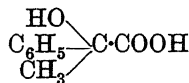
### Atroglyceric Acid.

See 1-Phenylglyceric Acid.

### Atrolactic Acid.

See Atrolactic Acid.

**Atrolactic Acid** (1-Phenyl-lactic acid, 1-phenyl-1-hydroxypropionic acid,  $\alpha$ -hydroxyhydratropic acid,  $\alpha$ -methylmandelic acid, atrolactic acid)



$C_9H_{10}O_3$  MW, 166

*d*-.

Prisms from  $H_2O$ . M.p. 116–17°. Sol. 20 parts  $H_2O$  at 18°.  $[\alpha]_D^{18} + 37.7^\circ$  in EtOH.

*Quinine salt*: needles from EtOH. M.p. about 216° decomp.

*l-Menthyl ester*: liq. B.p. 154–5°/0.03 mm.  $[\alpha]_D^{18} - 58.8^\circ$  in EtOH.

*l*-.

Needles from  $C_6H_6$ . M.p. 115–16°. Sol. EtOH,  $Me_2CO$ , hot  $C_6H_6$ . Mod. sol.  $H_2O$ .  $[\alpha]_D^{18} - 37.7^\circ$  in EtOH.

*Et ester*:  $C_{11}H_{14}O_3$ . MW, 194. B.p. 127°/12 mm.  $D_4^{18} 1.097$ .  $[\alpha]_D^{18} - 26.7^\circ$ .

*l-Menthyl ester*: m.p. 55.5–56°.  $[\alpha]_D - 102.7^\circ$  in  $CHCl_3$ .

*Amide*:  $C_9H_{11}O_2N$ . MW, 165. Rhombic plates from  $C_6H_6$ . M.p. 62.5–63.5°.  $[\alpha]_D + 12.6^\circ$  in EtOH.

*dl*-.

Needles or prisms +  $\frac{1}{2}H_2O$  from  $H_2O$ . M.p. 68°. Loses  $H_2O$  of cryst. at 85–90°: m.p. anhyd. 94°. Sol.  $H_2O$ . Misc.  $H_2O$  all proportions at 100°. Boiling HCl  $\rightarrow$  atropic acid. Br at 0°  $\rightarrow$  1-bromohydratropic acid.

*Et ester*: b.p. 259°, 129–30°/13 mm.  $D_4^{18} 1.100$ .  $n_D^{20} 1.50997$ .

*l-Menthyl ester*: b.p. 190–2°/10–11 mm.  $[\alpha]_D - 67.5^\circ$  in  $CHCl_3$ .

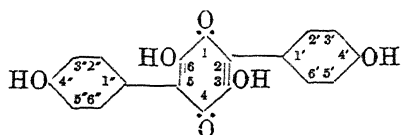
*Amide*: leaflets from dichloroethylene. M.p. 101–2°. Sol.  $H_2O$ .

*Et ether*:  $C_{11}H_{14}O_3$ . MW, 194. Cryst. from ligroin. M.p. 60–2°. Sol.  $Et_2O$ . Mod. sol. hot  $H_2O$ .

McKenzie, Clough, *J. Chem. Soc.*, 1910, 97, 1018; 1912, 101, 393 (Note).

Wren, Wright, *J. Chem. Soc.*, 1921, 119, 798.

## Atromentin



$C_{18}H_{12}O_6$  MW, 324  
Colouring matter from the fungus *Paxillus atromentosus*.

4':4''-Di-Me ether:  $C_{20}H_{16}O_6$ . MW, 352. Bronze plates from toluene. M.p. 297–8°.

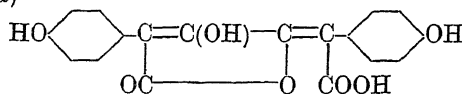
Tetra-Me ether:  $C_{22}H_{20}O_6$ . MW, 380. Red cryst. from EtOH. M.p. 199°.

Tetra-acetyl: cryst. from AcOH. M.p. 242°. Shildneck, Adams, *J. Am. Chem. Soc.*, 1931, 53, 2378.

Kögl, Becker, Detzel, Voss, *Ann.*, 1928, 465, 211.

Kögl, Becker, Voss, Wirth, *ibid.*, 243.

Atromentinic Acid (pp'-Dihydroxyypulvinic acid)



$C_{18}H_{12}O_7$  MW, 340

Red needles +  $H_2O$  from  $H_2O$ . M.p. 332°. Anhyd. at 100° → yellow needles which take up  $H_2O$  in air → red needles.

*Et ester*:  $C_{20}H_{16}O_7$ . MW, 368. Orange cryst. from EtOH. M.p. 346°.

Tri-Me ether: yellow leaflets from AcOH. M.p. 170°.

Tetra-Me deriv.: yellow needles from AcOH.Aq. M.p. 168°.

Lactone: yellow leaflets from AcOH. M.p. 346° decomp.

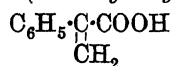
Kögl, Becker, Voss, Wirth, *Ann.*, 1928, 465, 253.

Asano, Huziwarra, *J. Pharm. Soc. Japan*, 1939, 59, 284.

## Atropamine.

See Apotropine.

## Atropic Acid (1-Phenylacrylic acid)



$C_9H_8O_2$  MW, 148

Cryst. from  $H_2O$  or EtOH. M.p. 106–7°. B.p. 267° part. decomp. 202–4°/75 mm. Sol.  $Et_2O$ ,  $C_6H_6$ ,  $CS_2$ . Mod. sol. EtOH. Spar. sol. cold  $H_2O$ . Volatile in steam. Heat of comb. 1044 Cal.  $k = 1.43 \times 10^{-4}$  at 25°.  $CrO_3 \rightarrow$

benzoic acid +  $CO_2$ .  $NaHg \rightarrow$  hydratropic acid.  $KOH$  fusion → phenylacetic + formic acids. Conc.  $HCl \rightarrow$  2-chlorohydratropic acid. Dry  $HBr$  at 0° → 1-bromohydratropic acid. Fuming  $HBr$  at 100° → 2-bromohydratropic acid.  $Br \rightarrow$  dibromohydratropic acid.  $HOCl \rightarrow$  chlorotropic acid.

*Et ester*:  $C_{11}H_{12}O_2$ . MW, 176. B.p. 124°/16 mm.  $D_4^{16}$  1.0508.  $n_D^{16}$  1.52605.

*Amide*:  $C_9H_9ON$ . MW, 147. Cryst. from  $H_2O$ . M.p. 121–2°. Spar. sol.  $H_2O$ .

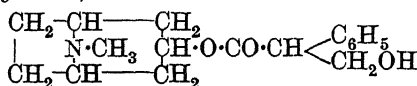
*Chloride*:  $C_9H_7OCl$ . MW, 166.5. B.p. 87–8°/0.35 mm.

*Anilide*: m.p. 134°.

McKenzie, Wood, *J. Chem. Soc.*, 1919, 115, 834.

I.C.I., B.P., 446,908, (*Chem. Abstracts*, 1936, 30, 6763).

Atropine (*Tropine ester of tropic acid, dl-hyoscyamine*)



$C_{17}H_{23}O_3N$  MW, 289

In *Atropa belladonna*, *Datura stramonium*, etc. Probably formed by racemisation of *l*-hyoscyamine during extraction. Cryst. M.p. 118° (114–15°). Sol. to 68% in EtOH at 25°, to 6% in  $Et_2O$  at 25°, to 64% in  $CHCl_3$  at 25°. Spar. sol.  $H_2O$ . Insol. pet. ether. Optically inactive. Strong base. Used in medicine as a mydriatic.

*B.HBr*: m.p. 163–4°.

$B_2, H_2SO_4$ : cryst. +  $H_2O$ . M.p. anhyd. 194°. Sol.  $H_2O$ , EtOH.

$B_2, (COOH)_2$ : m.p. 198°.

$B, HAuCl_4$ : m.p. 137–9°.

$B_2, H_2PtCl_6$ : m.p. 197–200°.

*Picrate*: m.p. 175–6°.

*Styphnate*: m.p. 180°.

Duilius, *Chem.-Ztg.*, 1930, 54, 182.

Chemnitius, *J. prakt. Chem.*, 1927, 116, 276.

Barrowcliff, Tutin, *J. Chem. Soc.*, 1909, 95, 1966.

Zalay, *Chem. Abstracts*, 1941, 35, 8204.

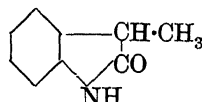
## Atropine oxide.

See Genatropine.

## Atroscine.

See Hyoscyne.

Atroxindole (3-Methyloxindole, o-amino-hydratropic lactam)



$C_9H_9ON$  MW, 147

Exists in two modifications. 1. Cryst. from  $C_6H_6$ , m.p. 123°. 2. Needles from  $H_2O$ , m.p.

113°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O. Very spar. volatile in steam. Distills undecomposed in small quantities. Aq. sol. reacts neutral. Reduces NH<sub>3</sub>·AgNO<sub>3</sub>, hot Fehling's.

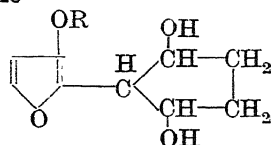
*N-Me*: see 1:3-Dimethyloxindole.

Brunner, *Monatsh.*, 1897, **18**, 533.

### Aubépine.

See Anisaldehyde.

### Aucubine



R = glucose residue

C<sub>15</sub>H<sub>22</sub>O<sub>9</sub> MW, 346

Glucoside from *Plantago lanceolata*, Linn., *Aucuba japonica*, Thunb., etc. Cryst. + 1H<sub>2</sub>O from EtOH. Aq. M.p. 181°. [α]<sub>D</sub><sup>21</sup> - 171.4° in H<sub>2</sub>O.

*Hexa-acetyl deriv.*: m.p. 128°. [α]<sub>D</sub><sup>18</sup> - 154.9° in CHCl<sub>3</sub>.

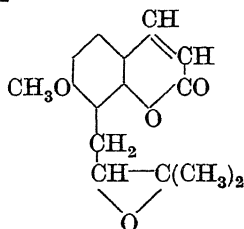
Bergmann, Michalis, *Ber.*, 1927, **60**, 935.

Kariyone, Kondo, *Chem. Abstracts*, 1929, **23**, 393.

Karrer, Schmidt, *Helv. Chim. Acta.*, 1946, **29**, 525.

Trim, Hill, *Biochem. J.*, 1952, **50**, 310.

### Aurapten



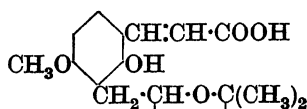
C<sub>15</sub>H<sub>16</sub>O<sub>4</sub> MW, 260

Occurs in orange peel oil. M.p. 98°. B.p. 140-50°/0.02 mm. Sol. C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>, Et<sub>2</sub>O, AcOH, AcOEt, dioxan. Pd/H<sub>2</sub> → dihydroaurapten. NaOMe → *cis*-auraptenic acid. Heat in solution → *trans*-auraptenic acid. AcOH/H<sub>2</sub>SO<sub>4</sub> → isoaurapten. Oxalic acid → aurapten hydrate. CrO<sub>3</sub> → acetone + ostholic acid.

Böhme, Pietsch, *Arch. Pharm.*, 1938, **276**, 482.

Böhme, Schneider, *Ber.*, 1939, **72**, 780.

### Auraptenic Acid



Probable structure

C<sub>15</sub>H<sub>18</sub>O<sub>5</sub> MW, 278

*Cis*-.

M.p. 151°. [α]<sub>D</sub><sup>15</sup> + 2° in EtOH. Pt/H<sub>2</sub> → dihydroauraptenic acid. Ac<sub>2</sub>O → acetyl deriv. of *trans*-form.

*Trans*-.

M.p. 204°. [α]<sub>D</sub><sup>15</sup> + 90.4° in EtOH. Pt/H<sub>2</sub> → dihydroauraptenic acid.

*Me ester*: m.p. 99°.

*Acetyl*: m.p. 180°.

Böhme, Schneider, *Arch. Pharm.*, 1941, **279**, 213.

### Aureomycin.

C<sub>22</sub>H<sub>23</sub>O<sub>8</sub>N<sub>2</sub>Cl MW, 478.5

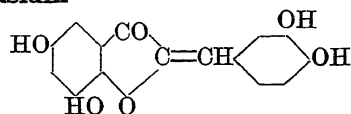
Antibiotic produced by *Streptomyces aureofaciens*. M.p. 168-9°. [α]<sub>D</sub><sup>23</sup> - 275.0° in MeOH. Sol. to 0.5-0.6% in H<sub>2</sub>O at 25°. Very sol. cellosolve, dioxan. Spar. sol. MeOH, EtOH, butanol, Me<sub>2</sub>CO, AcOEt, C<sub>6</sub>H<sub>6</sub>. Insol. Et<sub>2</sub>O, pet. ether. Very sol. in aq. sols. of pH above 8.5. Used in undulant fever, pneumonia, sinusitis and bacterial endocarditis.

*B.HCl*: decomp. above 210°. [α]<sub>D</sub><sup>23</sup> - 24.0° in H<sub>2</sub>O.

Stephens *et al.*, *J. Am. Chem. Soc.*, 1952, **74**, 4976.

Waller *et al.*, *ibid.*, 4978.

### Aureusidin



C<sub>15</sub>H<sub>10</sub>O<sub>5</sub> MW, 286

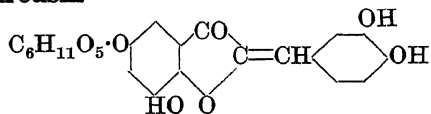
Aglucone from yellow *Antirrhinum majus*. Deep yellow cryst. + 1H<sub>2</sub>O from MeOH. Aq. Melts and resolidifies at 270°. Decomp. at 295°. 10% NaOH or conc. H<sub>2</sub>SO<sub>4</sub> → orange-red col. FeCl<sub>3</sub> → brown col.

*Tetra-Me ether*: C<sub>19</sub>H<sub>16</sub>O<sub>6</sub>. MW, 342. Greenish-yellow needles from MeOH. Aq. M.p. 169-72°. Conc. H<sub>2</sub>SO<sub>4</sub> → dark red col.

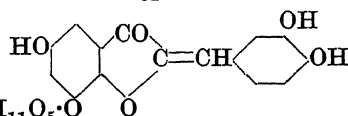
*Tetra-acetyl*: yellow needles from pet. ether. M.p. 184-5°.

Seikel, Geissman, *J. Am. Chem. Soc.*, 1950, **72**, 5725.

### Aureusin



or



C<sub>21</sub>H<sub>20</sub>O<sub>11</sub> MW, 448

Pigment of *Antirrhinum majus*.

*Hepta-acetyl*: colourless needles from AcOEt. M.p. 264.5–265.5°. 10% NaOH, slowly → red sol. Conc. H<sub>2</sub>SO<sub>4</sub> → orange-red col.

Seikel, Geissman, *J. Am. Chem. Soc.*, 1950, 72, 5725.

### Aurofusarin

C<sub>30</sub>H<sub>20</sub>O<sub>12</sub> MW, 572

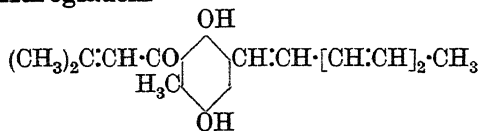
Occurs in *Fusarium culmorum*, Socc. M.p. above 360°. Contains two -OCH<sub>3</sub> groups. H<sub>2</sub> → tetrahydroaurofusarin.

*Benzoyl deriv.*: m.p. 212–15°.

*Anisate*: m.p. 205°.

Ashley, Hobbs, Raistrick, *Biochem. J.*, 1937, 31, 385.

### Auroglaucin



C<sub>19</sub>H<sub>22</sub>O<sub>3</sub> MW, 298

Occurs in the *Aspergillus* colouring matters. Orange-red pigment. M.p. 153°. Pd/H → octahydroauroglaucin and decahydroauroglaucin. FeCl<sub>3</sub> → red col.

*Me ether*: yellowish-brown. M.p. 100°.

*Oxime*: yellowish-green cryst. M.p. 117° decomp.

2 : 4-Dinitrophenylhydrazone: brick red. M.p. 223–4°.

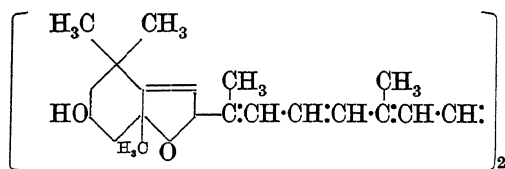
*Phenylurethane*: pale yellow cryst. M.p. 161°.

Raistrick, Robinson, Todd, *J. Chem. Soc.*, 1937, 80.

Cruickshank, Raistrick, Robinson, *J. Chem. Soc.*, 1938, 2056.

Quilico, Panizzi, Mugnani, *Gazz. chim. ital.*, 1949, 79, 89.

### Auroxanthin



Probable structure

C<sub>40</sub>H<sub>56</sub>O<sub>4</sub> MW, 600

Carotenoid pigment from *Viola tricolor*. Long bright yellow needles from EtOH. M.p. 203°. λ<sub>max</sub> 382, 403, 428 mμ (in EtOH); 423, 454 mμ (in CS<sub>2</sub>).

*Monohydrate*: m.p. 191–2°.

Karrer, Jucker, *Helv. Chim. Acta*, 1945, 28, 300.

Karrer, Ruthschmann, *Helv. Chim. Acta*, 1942, 25, 1624.

### Australene.

See α-Pinene.

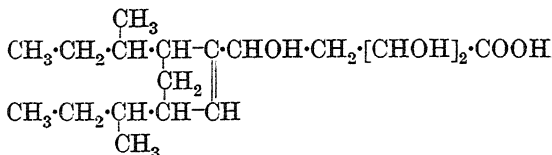
### Auxenolonic Acid.

See Auxin B.

### Auxentriolic Acid.

See Auxin A.

### Auxin A (*Auxentriolic acid*)



Suggested structure

C<sub>18</sub>H<sub>32</sub>O<sub>5</sub> MW, 328

Plant growth hormone. Isolated from human urine and yeast. Hexagonal cryst. from EtOH-ligroin. M.p. 196°. Mod. sol. MeOH, EtOH, AcOEt. Spar. sol. Et<sub>2</sub>O, H<sub>2</sub>O. Insol. pet. ether, C<sub>6</sub>H<sub>6</sub>. [α]<sub>D</sub><sup>20</sup> - 3.19° in EtOH. Readily decomp. by alkalis.

*Lactone*: C<sub>18</sub>H<sub>30</sub>O<sub>4</sub>. MW, 310. Needles from Me<sub>2</sub>CO.Aq. M.p. 173°. Spar. sol. H<sub>2</sub>O, pet. ether, C<sub>6</sub>H<sub>6</sub>. [α]<sub>D</sub><sup>20</sup> - 3.44°.

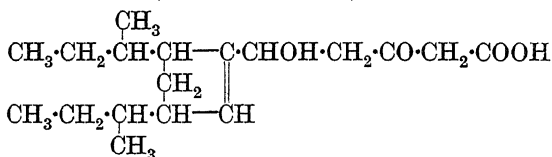
*Me ester*: C<sub>19</sub>H<sub>34</sub>O<sub>5</sub>. MW, 342. Cryst. from Et<sub>2</sub>O. M.p. 150°. [α]<sub>D</sub><sup>20</sup> - 3.77°.

*p-Phenylphenacyl ester*: C<sub>32</sub>H<sub>42</sub>O<sub>6</sub>. MW, 522. Cryst. from EtOH.Aq. M.p. 166°.

*Tri-m-dinitrobenzoyl*: cryst. from EtOH. M.p. 168°.

Kögl *et al.*, *Z. physiol. Chem.*, 1934, 227, 51; 1934, 225, 215; 1933, 216, 31; 1933, 214, 241; 1935, 235, 201.

### Auxin B (*Auxenolonic acid*)



Suggested structure

C<sub>18</sub>H<sub>30</sub>O<sub>4</sub> MW, 310

Plant growth hormone. Isolated from various grain oils and from urine. Cryst. from EtOH-ligroin. M.p. 183°. [α]<sub>D</sub><sup>20</sup> - 2.8°.

*p-Phenylphenacyl ester*: needles from EtOH. Aq. M.p. 174°.

*Semicarbazone*: prisms from MeOH.Aq. M.p. 176°.

Kögl, Erxleben, *Z. physiol. Chem.*, 1934, 227, 51.

Kögl, Erxleben, Haagen-Smit, *Z. physiol. Chem.*, 1934, 225, 215.

### Avenacein

C<sub>25</sub>H<sub>44</sub>O<sub>7</sub>N<sub>2</sub> MW, 484

Antibiotic of *Fusaria avenaceum*. Tetrahedra from MeOH.Aq. M.p. 139°. [α]<sub>D</sub><sup>19</sup> - 101° ± 2°

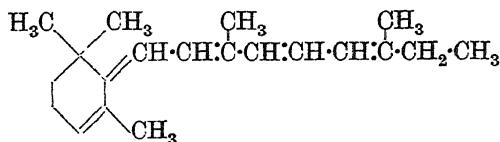


(c = 1 in EtOH). HCl  $\rightarrow$  D- $\alpha$ -hydroxyisovaleric acid + N-methyl-L-valine hydrochloride.

Cook, Cox, Farmer, *J. Chem. Soc.*, 1949, 1022.

**Avertin.**

See 2 : 2 : 2-Tribromoethyl Alcohol.

**Axerophthene**

Probable structure

$C_{20}H_{30}$  MW, 270

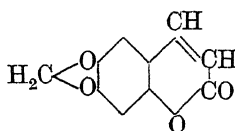
Purified by mol. distillation. Thick yellow oil.  $SbCl_3 \rightarrow$  violet-blue col. ( $\lambda_{max}$  577 m $\mu$ ). Shows slight vitamin A type activity.

Karrer, Benz, *Helv. Chim. Acta*, 1948, 31, 1049.

**Axerophthol.**

See Vitamin-A.

**Ayapin** (6 : 7-Methylenedioxy coumarin)



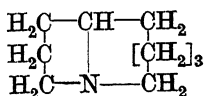
$C_{10}H_6O_4$  MW, 190

Present in leaves of *Eupatorium ayapana* Vent. Cryst. from MeOH. M.p. 231-2° (evacuated tube).

Späth, Bose, Schläger, *Ber.*, 1937, 70, 702.

**Ayfinin.**

See Bacitracin.

**1-Azabicyclo-[5 : 3 : 0]-decane**

$C_9H_{17}N$  MW, 139

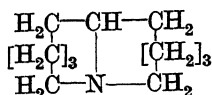
B.p. 71-73.5°/14 mm.  $n_D^{20}$  1.4822.

Picrate : m.p. 214-15°.

Picronate : m.p. 191-2°.

Methiodide : m.p. 279-80°.

Leonard, Goode, *J. Am. Chem. Soc.*, 1950, 72, 5404.

**1-Azabicyclo-[5 : 5 : 0]-dodecane**

$C_{11}H_{21}N$  MW, 167

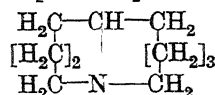
B.p. 111-12°/18 mm.  $n_D^{20}$  1.4930.

Picrate : m.p. 139-40°.

Picronate : m.p. 186-7°.

**Methiodide** : m.p. 243-4°.

Leonard, Goode, *J. Am. Chem. Soc.*, 1950, 72, 5404.

**1-Azabicyclo-[5 : 4 : 0]-hendecane**

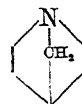
$C_{10}H_{19}N$  MW, 153

B.p. 90°/16 mm.  $n_D^{20}$  1.4872.

Picrate : cryst. from EtOH. M.p. 161-2°.

Picronate : cryst. from EtOH. M.p. 213° decomp.

Leonard, Goode, *J. Am. Chem. Soc.*, 1950, 72, 5404.

**Azabicyclo-[2 : 2 : 1]-heptane**

$C_6H_{11}N$  MW, 97

M.p. 78-9°. B.p. 130°/755 mm. Se  $\rightarrow$   $\gamma$ -picoline.

Methiodide : m.p. 320° decomp. Slightly hygroscopic.

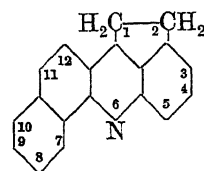
Chloraurate : yellow. M.p. 280° decomp.

Picrate : m.p. 285° decomp.

Picronate : pale yellow. M.p. 255°.

Clema, Prelog, *J. Chem. Soc.*, 1938, 400.

Prelog, Cerkovnikov, Ustricev, *Ann.*, 1938, 535, 37.

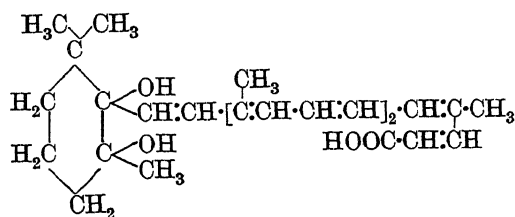
**6-Azacholanthrene**

$C_{19}H_{13}N$  MW, 255

M.p. 187-8°.

Picrate : M.p. 222-4° decomp.

Postovski, Lundin, *J. Gen. Chem. U.S.S.R.*, 1940, 10, 71.

**Azafrin**

$C_{27}H_{35}O_4$  MW, 426

Pigment of the *Eschobedia* class. Orange-red prisms from Me<sub>2</sub>CO-toluene. M.p. 213-14°.

$[\alpha]_{\text{D}}^{20}$  — 75.5° in EtOH. Absorption bands in  $\text{CHCl}_3$ , 458, 428  $\mu$ , in  $\text{CS}_2$ , 476, 445, 419  $\mu$ . Ethereal sol. + HCl  $\rightarrow$  deep violet acid layer. *Me ester*: methylazafrin.  $\text{C}_{23}\text{H}_{40}\text{O}_4$ . MW, 440. Orange leaflets from MeOH. M.p. 193°.  $[\alpha]_{\text{D}}^{20}$  — 73° in EtOH.

Kuhn, Deutsch, *Ber.*, 1933, 66, 883.

### Azaindole.

See Pyrrolopyridine.

### Azanthracene.

See Anthrapyridine.

### Azanthraquinone.

See  $\alpha$ -Anthrapyridinequinone.

### Azaphenanthrene.

See Benzquinoline and Phenanthridine.

**Azelaic Acid** (*n*-Heptane-1 : 7-dicarboxylic acid, *lepargylic acid*)



$\text{C}_9\text{H}_{16}\text{O}_4$  MW, 188

Needles or leaflets. M.p. 106.5°. B.p. 287°/100 mm., 265°/50 mm., 237°/15 mm., 226°/10 mm. Distills at ord. pressure above 360° with partial anhydridation. Non-volatile in steam. Sol. to 2.2% in  $\text{H}_2\text{O}$  at 65°. Sol. EtOH. Spar. sol.  $\text{Et}_2\text{O}$ .  $D$  1.0287.  $n_{\text{D}}^{20}$  1.42808. Heat of comb.  $C_v$  1140.1 Cal.  $k$  (first) =  $2.88 \times 10^{-5}$  at 25°;  $k$  (second) =  $2.8 \times 10^{-6}$  at 25°.

*Di-Me ester*:  $\text{C}_{11}\text{H}_{20}\text{O}_4$ . MW, 216. B.p. 140–1°/9 mm.  $D_4^{20}$  1.0082.  $n_{\text{D}}^{20}$  1.43669.

*Et ester*:  $\text{C}_{11}\text{H}_{20}\text{O}_4$ . MW, 216. M.p. 28–9°. B.p. 178–9°/5.5 mm.

*Di-Et ester*:  $\text{C}_{13}\text{H}_{24}\text{O}_4$ . MW, 244. B.p. 291°, 148°/7.5 mm.  $D_4^{20}$  0.97294.  $n_{\text{D}}^{20}$  1.43509.

*Diphenyl ester*:  $\text{C}_{21}\text{H}_{24}\text{O}_4$ . MW, 340. Needles. M.p. 49°. Sol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ .

*Diphenacyl ester*: m.p. 69.7°.

*Di-p-bromophenacyl ester*: m.p. 130.6°.

*Dinitrile*:  $\text{C}_9\text{H}_{14}\text{N}_2$ . MW, 150. B.p. 195°/20 mm., 183°/11 mm., 159–60°/3 mm.  $n_{\text{D}}^{25}$  1.4426. Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Insol.  $\text{H}_2\text{O}$ .

*Dichloride*:  $\text{C}_9\text{H}_{14}\text{O}_2\text{Cl}_2$ . MW, 225. B.p. 166°/18 mm.

*Monoamide*:  $\text{C}_9\text{H}_{17}\text{O}_3\text{N}$ . MW, 187. Needles. M.p. 93–5°.

*Diamide*:  $\text{C}_9\text{H}_{18}\text{O}_2\text{N}_2$ . MW, 186. Prisms. M.p. 175°.

*Anhydride*: m.p. 53–5°.

*Monoanilide*: m.p. 107–8°.

*Dianilide*: m.p. 186–7°. Prac. insol.  $\text{H}_2\text{O}$ ,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ .

*Di-o-toluidide*: m.p. 164°.

*Di-p-toluidide*: m.p. 191°.

*Di-p-bromoanilide*: m.p. 215°.

Carmichael, *J. Chem. Soc.*, 1922, 121, 2545.

Grün, Wittka, *Chem. Abstracts*, 1926, 20, 301.

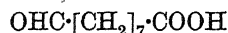
Fourneau, Sabetay, *Bull. soc. chim.*, 1929, 45, 834.

Rieche, D.R.P., 565,158, (*Chem. Abstracts*, 1933, 27, 1008).

Hill, McEwen, *Organic Syntheses*, 1933, XIII, 4.

Mowry, Ringwald, *J. Am. Chem. Soc.*, 1950, 72, 4439.

**Azelaic Semi-aldehyde** (*7-Formylcaprylic acid*, *7-aldehydo-octioic acid*, *7-aldehydocaprylic acid*)



$\text{C}_9\text{H}_{16}\text{O}_3$  MW, 172

M.p. 57–63° (70°). B.p. 181–2°/15 mm. Sol. common org. solvents. Insol.  $\text{H}_2\text{O}$ .

*Me ester*:  $\text{C}_{10}\text{H}_{18}\text{O}_3$ . MW, 186. B.p. 111–12°/3 mm. (140–5°/15 mm.).  $D_4^{20}$  0.9704.  $n_{\text{D}}^{20}$  1.4384. *Semicarbazone*: m.p. 104–5° (107°). *2:4-Dinitrophenylhydrazone*: m.p. 67–8°. *Di-Me acetal*:  $\text{C}_{12}\text{H}_{24}\text{O}_4$ . MW, 232. B.p. 148–50°/14 mm.  $D_4^{19}$  0.9379.  $n_{\text{D}}^{19}$  1.4312. *Trimeride*: cryst. from pet. ether. M.p. 34–6°.

*Et ester*:  $\text{C}_{11}\text{H}_{20}\text{O}_3$ . MW, 200. B.p. 158–68°/14 mm., 100–2°/1 mm. *Di-Et acetal*: b.p. 158–60°/14 mm. *2:4-Dinitrophenylhydrazone*: m.p. 63–4°.

*Semicarbazone*: m.p. 163° (166.5°).

*3-Nitrophenylhydrazone*: m.p. 114–15°.

*2:4-Dinitrophenylhydrazone*: m.p. 120°.

*Trimeride*: cryst. from  $\text{Me}_2\text{CO}$ . M.p. 112–13°.

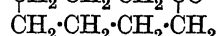
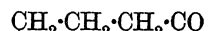
Fischer, Düll, Ertel, *Ber.*, 1932, 65, 1471.

Noller, Adams, *J. Am. Chem. Soc.*, 1926, 48, 1074.

Helferich, Schäfer, *Ber.*, 1924, 57, 1911.

Haller, Brochet, *Compt. rend.*, 1910, 150, 496.

### Azelaone (Cyclo-octanone)



$\text{C}_8\text{H}_{14}\text{O}$  MW, 126

M.p. 28°. B.p. 195–7°, 91°/23 mm., 73°/12 mm.  $D^{20}$  0.9581.  $n_{\text{D}}^{20}$  1.4694. Gives bisulphite compound.  $\text{CrO}_3$  in  $\text{H}_2\text{SO}_4 \rightarrow$  suberic acid.

*Semicarbazone*: m.p. 167–8°.

*Oxime*: m.p. 36–7°.

Ruzicka, Brugger, *Helv. Chim. Acta*, 1926, 9, 339.

Ruzicka, Kobelt, Häfiker, Prelog, *Helv. Chim. Acta*, 1949, 32, 544.

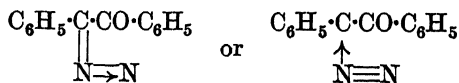
### Azetidine.

See Trimethyleneimine.

### Azetidinone.

See  $\beta$ -Propiolactam.

**Azibenzil** (*Phenylbenzoyldiazomethane*, *phenylbenzoylazimethylene*)



$\text{C}_{14}\text{H}_{10}\text{ON}_2$

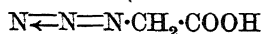
MW, 222

Red cryst. from Et<sub>2</sub>O. M.p. 63° decomp. Explodes on rapid heating above m.p. HCl → desyl chloride (monochlorodeoxybenzoin).

Curtius, *Ber.*, 1889, 22, 2162.

Schroeter, *Ber.*, 1909, 42, 3356.

### Azidoacetic Acid (*Triazoacetic acid*)



C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>N<sub>3</sub> MW, 101

Cryst. M.p. about 16°. B.p. 116°/12 mm., 92°/3 mm. Sol. H<sub>2</sub>O. D<sub>20</sub><sup>25</sup> 1.354. Explodes on heating.

*Et ester*: C<sub>4</sub>H<sub>7</sub>O<sub>2</sub>N<sub>3</sub>. MW, 129. B.p. 75°/21 mm., 45°/2 mm. D<sub>20</sub><sup>25</sup> 1.127. n<sub>D</sub><sup>25</sup> 1.43487.

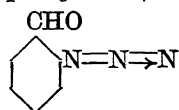
*Chloride*: azidoacetyl chloride. C<sub>2</sub>H<sub>3</sub>ON<sub>3</sub>Cl. MW, 119.5. B.p. 50°/20 mm., 43–4°/14 mm. Decomp. by H<sub>2</sub>O.

*Amide*: azidoacetamide. C<sub>2</sub>H<sub>4</sub>ON<sub>3</sub>. MW, 100. Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 58°. Sol. H<sub>2</sub>O, EtOH. Explodes on heating.

Forster, Müller, *J. Chem. Soc.*, 1909, 95, 200.

Curtius, Bockmühl, *Ber.*, 1912, 45, 1035.

### *o*-Azidobenzaldehyde (*o*-Triazobenzaldehyde, *o*-aldehydophenyl azide)



C<sub>7</sub>H<sub>5</sub>ON<sub>3</sub> MW, 147

Plates from EtOH or pet. ether. M.p. 37–8°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, hot pet. ether. Heat with H<sub>2</sub>O → anthranil + N. KMnO<sub>4</sub> → *o*-azidobenzoic acid. NaOH → anthranilic acid.

*Oxime*: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 103°. Spar. volatile in steam.

*Phenylhydrazone*: m.p. 101–2°.

Bamberger, Demuth, *Ber.*, 1901, 34, 1314.

### *p*-Azidobenzaldehyde (*p*-Triazobenzaldehyde, *p*-aldehydophenyl azide).

Colourless liq. Turns brown in air.

*syn-Oxime*: yellowish needles from C<sub>6</sub>H<sub>6</sub>. M.p. 142° decomp. Sol. most solvents. Volatile in steam. Darkens in light.

*anti-Oxime*: plates from EtOH.Aq. M.p. 98°. Sol. most solvents. Spar. sol. pet. ether. Volatile in steam. Turns dark brown in light.

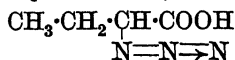
*Phenylhydrazone*: m.p. 190°.

Forster, Judd, *J. Chem. Soc.*, 1910, 97, 254.

### Azidobenzene.

See Phenyl azide.

### 1-Azidobutyric Acid (*1-Triazobutyric acid*)



C<sub>4</sub>H<sub>7</sub>O<sub>2</sub>N<sub>3</sub> MW, 129

*l*.

Yellow oil. [α]<sub>D</sub> – 63.3° in Et<sub>2</sub>O.

*Et ester*: C<sub>6</sub>H<sub>11</sub>O<sub>2</sub>N<sub>3</sub>. MW, 157. B.p. 63°/6 mm. [α]<sub>D</sub><sup>21</sup> – 48.1° in Et<sub>2</sub>O.

*Amide*: C<sub>4</sub>H<sub>8</sub>ON<sub>3</sub>. MW, 128. Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 59°. [α]<sub>D</sub> + 47.1° in Me<sub>2</sub>CO.

*dl*.

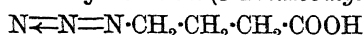
Needles. M.p. 24°. B.p. 81°/0.2 mm. D<sub>20</sub><sup>25</sup> 1.1519.

*Et ester*: b.p. 64°/7 mm. D<sub>20</sub><sup>25</sup> 1.038. Volatile in steam.

*Amide*: needles from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 38–9°. Sol. H<sub>2</sub>O, EtOH. Spar. sol. C<sub>6</sub>H<sub>6</sub>, pet. ether.

Forster, Müller, *J. Chem. Soc.*, 1909, 96, 191.

### 3-Azidobutyric Acid (*3-Triazobutyric acid*)



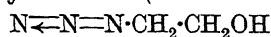
C<sub>4</sub>H<sub>7</sub>O<sub>2</sub>N<sub>3</sub> MW, 129

B.p. 135°/11 mm. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O.

*Et ester*: C<sub>6</sub>H<sub>11</sub>O<sub>2</sub>N<sub>3</sub>. MW, 157. B.p. 102–4°/22 mm. Misc. with EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O. D<sub>4</sub><sup>17.7</sup> 1.0590. n<sub>D</sub><sup>17.7</sup> 1.44271.

Curtius, Guilini, *Ber.*, 1912, 45, 1047.

### Azidoethyl Alcohol (*2-Triazoethyl alcohol*)

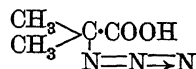


C<sub>2</sub>H<sub>5</sub>ON<sub>3</sub> MW, 87

B.p. 73°/20 mm., 60°/8 mm. Misc with H<sub>2</sub>O. D<sub>24</sub><sup>25</sup> 1.149. n<sub>D</sub><sup>25</sup> 1.45778. SnCl<sub>2</sub> + HCl → 2-aminoethyl alcohol.

Forster, Fierz, *J. Chem. Soc.*, 1908, 93, 1867.

### 1-Azidoisobutyric Acid (*1-Triazoisobutyric acid*)



C<sub>4</sub>H<sub>7</sub>O<sub>2</sub>N<sub>3</sub> MW, 129

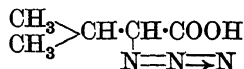
Needles. M.p. 31°. B.p. 75°/0.2 mm. D<sub>20</sub><sup>25</sup> 1.1433. Volatile in steam.

*Et ester*: C<sub>6</sub>H<sub>11</sub>O<sub>2</sub>N<sub>3</sub>. MW, 157. B.p. 71°/16 mm., 52–3°/7 mm. D<sub>20</sub><sup>25</sup> 1.0344.

*Amide*: C<sub>4</sub>H<sub>8</sub>ON<sub>3</sub>. MW, 128. Plates. M.p. 93–4°. Sol. EtOH, warm C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O.

Forster, Müller, *J. Chem. Soc.*, 1909, 95, 191.

### 1-Azidoisovaleric Acid (*1-Triazoisovaleric acid*)



C<sub>5</sub>H<sub>9</sub>O<sub>2</sub>N<sub>3</sub> MW, 143

B.p. 82°/0.1 mm. D<sub>20</sub><sup>25</sup> 1.0638.

*Et ester*: C<sub>7</sub>H<sub>13</sub>O<sub>2</sub>N<sub>3</sub>. MW, 171. B.p. 82°/16 mm., 68°/8 mm. D<sub>20</sub><sup>25</sup> 1.0295.

*Amide*:  $C_5H_{10}ON_4$ . MW, 142. Needles from  $C_6H_6$ . M.p. 78–9°. Sol. EtOH, warm  $C_6H_6$ .

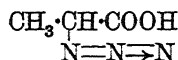
Forster, Müller, *J. Chem. Soc.*, 1909, 95, 191.

**Azidomethane.**

See Methyl azide.

**Azidonaphthalene.**

See Naphthyl azide.

**1-Azidopropionic Acid (1-Triazopropionic acid)**

$C_3H_5O_2N_3$  MW, 115  
l.

Oil.  $D_{20}^{21}$  1.229.  $[\alpha]_D^{25}$  – 28.9° in  $Et_2O$ .

*Et ester*:  $C_5H_9O_2N_3$ . MW, 143. B.p. 49°/5 mm.  $D_{20}^{22}$  1.063.  $[\alpha]_D^{25}$  – 18.5° in  $Et_2O$ .

*Amide*:  $C_3H_6ON_4$ . MW, 114. Needles from  $C_6H_6$ . M.p. 85°.  $[\alpha]_D$  + 49.1° in  $H_2O$ .

dl.

B.p. 121.5°/20 mm., 97–8°/3 mm. Explodes on heating.

*Et ester*: b.p. 70°/16 mm., 46°/2 mm.  $D_{20}^{23}$  1.065.  $n_D^{25}$  1.42857. Volatile in steam.

*Amide*: plates from  $C_6H_6$ . M.p. 80°.

Forster, Fierz, *J. Chem. Soc.*, 1908, 93, 1859.

**2-Azidopropionic Acid (2-Triazopropionic acid)**

$C_3H_5O_2N_3$  MW, 115

*Et ester*:  $C_5H_9O_2N_3$ . MW, 143. B.p. 62°/5 mm.  $D_{19}^{19}$  1.087.  $n_D^{25}$  1.43833. Volatile in steam.

Forster, Fierz, *J. Chem. Soc.*, 1908, 93, 669.

**Azidotoluene.**

See Toly azide.

**Azimethylene.**

See Diazomethane.

**Azimidol.**

See under Benztriazole.

**Aziminobenzene.**

See Benztriazole.

**Aziminotoluene.**

See Methylbenztriazole.

**Azirane.**

See Ethyleneimine.

**Aziridine.**

See Ethyleneimine.

**Azoaniline.**

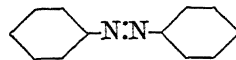
See Diaminoazobenzene.

**Azoanisole.**

See under Dihydroxyazobenzene.

**Azobenzaldehyde.**

See Dialdehydeazobenzene.

**Azobenzene (Benzeneazobenzene, azobenzide)**

$C_{12}H_{10}N_2$  MW, 182

*Trans*:

Orange-red rhombic cryst. M.p. 68°. B.p. 293°, deep red vapour. Sol. EtOH,  $Et_2O$ , AcOH, ligroin. Spar. sol.  $H_2O$ . Sol. conc.  $H_2SO_4$  with sulphonation. Heat of comb.  $C_v$  1555.0 Cal. Alk. red. → hydrazobenzene.  $Zn + AcOH$  → aniline.  $Sn + HCl$  → benzidine.  $CrO_3$  in AcOH → azoxybenzene. Salts are unstable.

Henke, Brown, *J. Phys. Chem.*, 1922, 26, 631.

Opolnick, *Ind. Eng. Chem.*, 1935, 27, 1045.

Alekseevskii, Golbrakht, *Russ. P.*, 32,499, (*Chem. Abstracts*, 1934, 28, 3425).

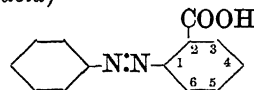
*Cis*:

Orange-red plates from pet. ether. M.p. 71°. Slowly converted to *trans* form at ord. temps.

Cook, *J. Chem. Soc.*, 1938, 876.

Cook, Jones, *J. Chem. Soc.*, 1939, 1309.

Hartley, *J. Chem. Soc.*, 1938, 633; *Nature*, 1937, 140, 281.

**Azobenzene-2-carboxylic Acid (Benzene-azo-o-benzoic acid)**

$C_{13}H_{10}O_2N_2$  MW, 226

Dark red cryst. from EtOH. M.p. 95° (92°). Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ , AcOH. Heat → azobenzene +  $CO_2$ .  $Zn + AcOH$  → hydrazobenzene-2-carboxylic acid.

*Me ester*:  $C_{14}H_{12}O_2N_2$ . MW, 240. Red cryst. M.p. 56°. Sol. EtOH,  $Et_2O$ . Less sol. ligroin.  $D^4$  1.1486.  $n_{D70}^{40}$  1.6179.

*Et ester*:  $C_{15}H_{14}O_2N_2$ . MW, 254. Red liq. B.p. 206–10°/12 mm.  $D^{20}$  1.1195.  $n_{D70}^{20}$  1.6126.

*Propyl ester*:  $C_{16}H_{16}O_2N_2$ . MW, 268. B.p. 210–15°/10 mm.  $D^{20}$  1.1158.  $n_{D70}^{20}$  1.6037.

Duval, *Bull. soc. chim.*, 1912, 11, 18.

Jacobson, *Ann.*, 1909, 367, 327.

**Azobenzene-3-carboxylic Acid (Benzene-azo-m-benzoic acid).**

Orange leaflets from EtOH. M.p. 170–1° (167°). Sol.  $Et_2O$ ,  $CHCl_3$ , AcOEt,  $C_6H_6$ . Mod. sol. hot  $H_2O$ . Spar. sol. ligroin.

*Me ester*: yellow leaflets from MeOH. M.p. 58°. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ ,  $CS_2$ .

*Amide*:  $C_{13}H_{11}ON_3$ . MW, 225. Orange leaflets from EtOH. M.p. 198–9°. Spar. sol. cold EtOH.

Jacobson, *Ann.*, 1909, 367, 329.

**Azobenzene-4-carboxylic Acid (Benzene-azo-p-benzoic acid).**

Red leaflets with golden lustre from EtOH. M.p. 241°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, warm C<sub>6</sub>H<sub>6</sub>, AcOH. Spar. sol. ligroin, CS<sub>2</sub>.

*Me ester*: C<sub>14</sub>H<sub>12</sub>O<sub>2</sub>N<sub>2</sub>. MW, 240. Orange-red leaflets from MeOH. M.p. 123-4°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>.

*Et ester*: C<sub>15</sub>H<sub>14</sub>O<sub>2</sub>N<sub>2</sub>. MW, 254. Orange-red needles from EtOH. M.p. 86-7°. Very sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>. Sol. ligroin, AcOH.

*Propyl ester*: C<sub>16</sub>H<sub>16</sub>O<sub>2</sub>N<sub>2</sub>. MW, 268. Red cryst. from ligroin. M.p. 64°. Sol. org. solvents.

*Amide*: C<sub>13</sub>H<sub>11</sub>ON<sub>3</sub>. MW, 225. Red leaflets. M.p. 224-5°. Insol. cold EtOH.

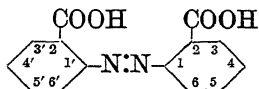
*Nitrile*: 4-cyanoazobenzene. C<sub>13</sub>H<sub>9</sub>N<sub>3</sub>. MW, 207. Brown needles from C<sub>6</sub>H<sub>6</sub>. M.p. 120-1°. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, warm EtOH.

Jacobson, Steinbrenck, *Ann.*, 1898, 303, 385.

Mentha, Heumann, *Ber.*, 1886, 19, 3022.

Anspen, *Organic Syntheses*, 1945, XXV, 86.

#### Azobenzene - 2 : 2' - dicarboxylic Acid (o : o'-Azobenzoic acid)



C<sub>14</sub>H<sub>10</sub>O<sub>4</sub>N<sub>2</sub> MW, 270

Dark yellow needles from EtOH. M.p. 245°. Sol. hot EtOH. Spar. sol. hot H<sub>2</sub>O. Insol. C<sub>6</sub>H<sub>6</sub>.

*Di-Me ester*: C<sub>16</sub>H<sub>14</sub>O<sub>4</sub>N<sub>2</sub>. MW, 298. Red needles from MeOH. M.p. 101°. Sol. usual solvents.

*Di-Et ester*: C<sub>18</sub>H<sub>18</sub>O<sub>4</sub>N<sub>2</sub>. MW, 326. Light red leaflets from EtOH. M.p. 85°. Sol. usual solvents.

*Monoamide*: C<sub>14</sub>H<sub>11</sub>O<sub>3</sub>N<sub>3</sub>. MW, 269. Reddish brown cryst. from AcOEt. M.p. 215° decomp. Sol. hot AcOEt, EtOH. Spar. sol. Et<sub>2</sub>O, ligroin.

*Diamide*: C<sub>14</sub>H<sub>12</sub>O<sub>2</sub>N<sub>4</sub>. MW, 268. Reddish brown cryst. from AcOH. M.p. about 294° decomp.

Bamberger, *Ber.*, 1906, 39, 4269.

#### Azobenzene-2 : 3'-dicarboxylic Acid (o : m'-Azobenzoic acid).

Red needles from AcOH. M.p. 237° decomp. Spar. sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO. Prac. insol. C<sub>6</sub>H<sub>6</sub>, ligroin. Zn + AcOH → hydrazobenzene-2 : 3'-dicarboxylic acid. Sn + HCl → benzidine-dicarboxylic acid.

Paal, Fritzweiler, *Ber.*, 1892, 25, 3590.

#### Azobenzene - 3 : 3' - dicarboxylic Acid (m : m'-Azobenzoic acid).

Yellow needles from AcOH. M.p. 340° decomp. Sol. 413 parts boiling 88% EtOH. Prac. insol. H<sub>2</sub>O, Et<sub>2</sub>O.

*Di-Me ester*: C<sub>16</sub>H<sub>14</sub>O<sub>4</sub>N<sub>2</sub>. MW, 298. Golden

leaflets from AcOH. M.p. 163°. Sol. hot AcOH, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>. Mod. sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>.

*Di-Et ester*: C<sub>18</sub>H<sub>18</sub>O<sub>4</sub>N<sub>2</sub>. MW, 326. Golden needles from EtOH. M.p. 109°. Sol. usual solvents.

Maier, *Ber.*, 1901, 34, 4132.

Meyer, Dahlem, *Ann.*, 1903, 326, 331.

#### Azobenzene - 4 : 4' - dicarboxylic Acid (p : p'-Azobenzoic acid).

Red needles from AcOH. Decomp. at 330°. Insol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Stable to HCl.

*Di-Me ester*: red needles from AcOH. M.p. 242°. Sol. hot C<sub>6</sub>H<sub>6</sub>, AcOH, Me<sub>2</sub>CO, CHCl<sub>3</sub>. Spar. sol. EtOH, Et<sub>2</sub>O, ligroin.

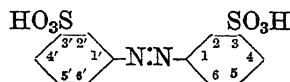
*Di-Et ester*: orange-red needles or leaflets from EtOH. M.p. 145·8°.

*Dichloride*: C<sub>14</sub>H<sub>8</sub>O<sub>2</sub>N<sub>2</sub>Cl<sub>2</sub>. MW, 307. Red needles from C<sub>6</sub>H<sub>6</sub>. M.p. 144-5°.

Maier, *Ber.*, 1901, 34, 4132.

Meyer, Dahlem, *Ann.*, 1903, 326, 331.

#### Azobenzene - 3 : 3' - disulphonic Acid (m : m'-Disulphoazobenzene)



C<sub>12</sub>H<sub>10</sub>O<sub>6</sub>N<sub>2</sub>S<sub>2</sub> MW, 342

Yellow leaflets + 5H<sub>2</sub>O. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Sn + HCl → metanilic acid.

*Di-Et ester*: C<sub>16</sub>H<sub>18</sub>O<sub>6</sub>N<sub>2</sub>S<sub>2</sub>. MW, 398. Golden-yellow needles from Et<sub>2</sub>O. M.p. 100°. Sol. EtOH, Et<sub>2</sub>O.

*Diamide*: C<sub>12</sub>H<sub>12</sub>O<sub>4</sub>N<sub>4</sub>S<sub>2</sub>. MW, 340. Yellow needles from EtOH. M.p. 305°. Spar. sol. org. solvents.

*Dichloride*: C<sub>12</sub>H<sub>8</sub>O<sub>4</sub>N<sub>2</sub>Cl<sub>2</sub>S<sub>2</sub>. MW, 379. Red needles from Et<sub>2</sub>O. M.p. 166°.

Mahrenholtz, Gilbert, *Ann.*, 1880, 202, 331.

#### Azobenzene - 3 : 4' - disulphonic Acid (m : p'-Disulphoazobenzene).

Syrup.

*Diamide*: yellowish needles from EtOH. M.p. 288°. Spar. sol. H<sub>2</sub>O.

*Dichloride*: red needles from Et<sub>2</sub>O or CS<sub>2</sub>. M.p. 123-5°.

Limpricht, *Ber.*, 1881, 14, 1359.

#### Azobenzene-4 : 4'-disulphonic Acid (p : p'-Disulphoazobenzene).

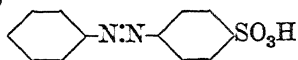
Red needles from H<sub>2</sub>O with 2, 3 or 5 mols. H<sub>2</sub>O. M.p. anhyd. 169° decomp. Deliquescent. SnCl<sub>2</sub> + HCl → sulphanilic acid.

*Diamide*: orange cryst. from EtOH. Begins to decomp. at about 250°. Sol. hot EtOH. Insol. Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

*Dichloride*: red leaflets from C<sub>6</sub>H<sub>6</sub>. M.p. 222° (170°). Stable to H<sub>2</sub>O.

Laar, *Ber.*, 1881, 14, 1928.

Janovsky, *Monatsh.*, 1882, 3, 240.

**Azobenzene-4-sulphonic Acid** (*p*-Sulphoazobenzene)

$C_{12}H_{10}O_3N_2S$  MW, 262

Orange-red leaflets +  $3H_2O$  from  $H_2O$ . M.p.  $127^\circ$ . Sol. 17 parts  $H_2O$  at  $10^\circ$ . Spar. sol. EtOH, Et<sub>2</sub>O.

*Chloride*:  $C_{12}H_9O_2N_2ClS$ . MW, 280.5. Orange needles from Et<sub>2</sub>O. M.p.  $82^\circ$ . Insol. cold  $H_2O$ .

*Amide*:  $C_{12}H_{11}O_2N_3S$ . MW, 261. Orange powder from boiling EtOH. Spar. sol. boiling EtOH. Insol.  $H_2O$ .

Janovsky, *Monatsh.*, 1881, 2, 221.

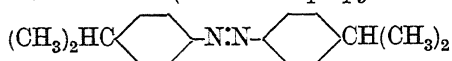
Griess, *Ann.*, 1864, 131, 89.

**Azobenzide.**

See Azobenzene.

**Azobenzoic Acid.**

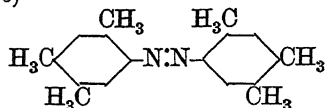
See Azobenzene-dicarboxylic Acid.

**p-Azocumene** (4 : 4'-Di-isopropylazobenzene)

$C_{18}H_{22}N_2$  MW, 266

Pale yellow leaflets from EtOH. M.p.  $107.5^\circ$ . Sol. 50 parts EtOH at  $19^\circ$  and 5 parts Et<sub>2</sub>O at  $16^\circ$ .

Pospjehow, *J. Russ. Phys.-Chem. Soc.*, 1886, 18, 52.

**Azo-ψ-cumene** (2 : 4 : 5 : 2' : 4' : 5'-Hexamethylazobenzene)

$C_{18}H_{22}N_2$  MW, 266

Brick-red cryst. from AcOH. M.p.  $173-4^\circ$  ( $171-2^\circ$ ). Sol.  $C_6H_6$ . Spar. sol. EtOH, Et<sub>2</sub>O. Sol.  $H_2SO_4$  to deep red sol.

Meigen, Nottebohm, *Ber.*, 1906, 39, 744.

Vorländer, Meyer, *Ann.*, 1902, 320, 128.

**Azodicarbanilide.**

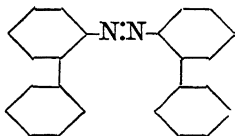
See under Azoformic Acid.

**Azodicarbonamide.**

See under Azoformic Acid.

**Azodicarboxylic Acid.**

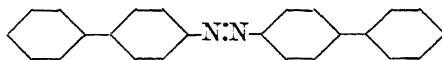
See Azoformic Acid.

**o-Azodiphenyl**

$C_{24}H_{18}N_2$  MW, 334

Reddish-purple needles from EtOH. M.p.  $144.5^\circ$ .

Friebel, Rassow, *J. prakt. Chem.*, 1901, 63, 464.

**p-Azodiphenyl**

$C_{24}H_{18}N_2$  MW, 334

Orange-red plates from  $C_6H_6$ . M.p.  $249-50^\circ$ . Sol. Et<sub>2</sub>O. Insol. EtOH, AcOH. Zn + KOH → *p*-hydrazodiphenyl.

Bandrowski, Prokopeczko, *Chem. Zentr.*, 1904, I, 1491.

Bell, Kenyon, Robinson, *J. Chem. Soc.*, 1926, 1239.

**Azoformamide.**

See under Azoformic Acid.

**Azoformanilide.**

See under Azoformic Acid.

**Azoformic Acid** (*Azodicarboxylic acid*)

$C_2H_3O_4N_2$  MW, 118

K salt deflagrates at  $100^\circ$ , and is decomp. by  $H_2O$ , giving  $K_2CO_3$ ,  $CO_2$ , hydrazine and nitrogen. The Ba salt is also decomp. by  $H_2O$ .

*Di-Me ester*:  $C_4H_6O_4N_2$ . MW, 146. Oil. B.p.  $96^\circ/25$  mm.

*Di-Et ester*:  $C_6H_{10}O_4N_2$ . MW, 174. Yellow oil. B.p.  $106^\circ/13$  mm.

*Diamide*: azodicarbonamide, azoformamide.  $C_2H_4O_2N_4$ . MW, 116. Orange cryst. Sol. hot  $H_2O$ . Heat at  $180^\circ$  → cyanuric acid +  $NH_3$ .

*Dianilide*: azodicarbanilide, azoformanilide.  $C_{14}H_{12}O_2N_4$ . MW, 268. Red needles from  $Me_2CO$ . M.p.  $183^\circ$ . Sol. EtOH, Et<sub>2</sub>O, AcOH. Prac. insol.  $H_2O$ .

Thiele, *Ann.*, 1892, 270, 42.

Diels, Fritzsche, *Ber.*, 1911, 44, 3018.

**Azoisobutyric Acid**

$C_8H_{14}O_4N_2$  MW, 202

*Di-Me ester*:  $C_{10}H_{18}O_4N_2$ . MW, 230. Cryst. M.p.  $33^\circ$ . Heat at  $80^\circ$  → tetramethylsuccinic Me ester + nitrogen.

*Di-Et ester*:  $C_{12}H_{22}O_4N_2$ . MW, 258. Liq.  $D_4^{25}$  0.9884.

*Diamide*:  $C_8H_{16}O_2N_4(+2H_2O)$ . MW, 200. M.p. (hydrate)  $95^\circ$  decomp. Anhyd. decomp. at  $104^\circ$ .

*Dinitrile*:  $C_8H_{12}N_4$ . MW, 164. Prisms. M.p.  $106^\circ$ , decomp. to tetramethylsuccinic nitrile + nitrogen. Sol. EtOH, Et<sub>2</sub>O.

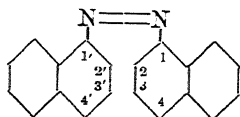
Thiele, Heuser, *Ann.*, 1896, 290, 1.

**Azomethane**

$C_2H_6N_2$  MW, 58

F.p.  $-78^\circ$ . B.p.  $1.5^\circ$ . Sol.  $H_2O$  and most org. solvents.  $D_{15}^{20}$  0.744. Red. → dimethylhydrazine. Explodes readily.

Ramsperger, *J. Am. Chem. Soc.*, 1927, 49, 912.

1 : 1'-Azonaphthalene ( $\alpha\alpha$ -Azonaphthalene)

$C_{20}H_{14}N_2$  MW, 282

Reddish needles from AcOH. M.p. 190°. Sublimes. Sol.  $C_6H_6$ , hot AcOH. Spar. sol. EtOH. Sol. conc.  $H_2SO_4$  to blue sol. Zn dust + NaOH  $\rightarrow$  1 : 1'-hydrazonaphthalene.

Wacker, *Ann.*, 1901, 317, 384.

Bryd, *Chem. Abstracts*, 1928, 22, 2372.

1 : 2'-Azonaphthalene ( $\alpha\beta$ -Azonaphthalene).

Brown leaflets from AcOH. M.p. 136°. Sol. AcOH. Mod. sol. EtOH. Sol. conc.  $H_2SO_4$  to violet sol.

Nietzki, Gottig, *Ber.*, 1887, 20, 612.

2 : 2'-Azonaphthalene ( $\beta\beta$ -Azonaphthalene).

Red leaflets from  $C_6H_6$ . M.p. 208°. Sublimes. Sol.  $C_6H_6$ ,  $CHCl_3$ . Spar. sol. MeOH, EtOH,  $Et_2O$ . Sol. conc.  $H_2SO_4$  to red sol. Zn + AcOH  $\rightarrow$  2 : 2'-hydrazonaphthalene.

Meisenheimer, Witte, *Ber.*, 1903, 36, 4159.

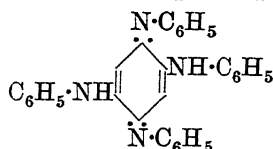
Bryd, *Chem. Abstracts*, 1928, 22, 2372.

## Azonaphthol.

See Dihydroxyazonaphthalene.

## Azophenetole.

See under Dihydroxyazobenzene.

Azophenine (*Dianilino-p-benzoquinonedianil*)

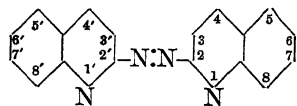
$C_{30}H_{24}N_4$  MW, 440

Red plates from toluene. M.p. 240°. Sol. aniline,  $C_6H_6$ , toluene. Insol. EtOH,  $Et_2O$ , alkalis. Blackens in conc. HCl.

Goldschmidt, Wurzschmidt, *Ber.*, 1922, 55, 3220.

## Azophenol.

See Dihydroxyazobenzene.

2 : 2'-Azoquinoline ( $\alpha$ -Azoquinoline)

$C_{18}H_{12}N_4$  MW, 284

Red leaflets. M.p. 230-1°. Sol. hot EtOH, min. acids. Sublimes. Zn + AcOH  $\rightarrow$  2 : 2'-hydrazoquinoline. Zn + HCl  $\rightarrow$  2-aminoquinoline.

Marckwald, Meyer, *Ber.*, 1900, 33, 1894.

## 6 : 6'-Azoquinoline.

Orange-red needles from EtOH or  $C_6H_6$ . M.p. 248°. Sol. dil. acids with yellowish-red col.

Knueppel, *Ann.*, 1900, 310, 75, 84.

## Azoresorufin.

See Resorufin.

## Azotoluene.

See Dimethylazobenzene.

## Azoxyacetanilide.

See under Diaminoazoxybenzene.

## Azoxyaniline.

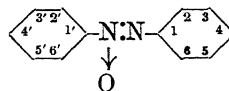
See Diaminoazoxybenzene.

## Azoxyanisole.

See under Dihydroxyazoxybenzene.

## Azoxybenzaldehyde.

See Dialdehydeazoxybenzene.

Azoxybenzene (*Azoxybenzide*)

$C_{12}H_{10}ON_2$  MW, 198

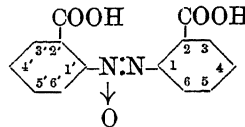
Bright yellow needles. M.p. 36°. Sol. EtOH,  $Et_2O$ . Insol.  $H_2O$ . Decomp. on dist., giving azobenzene and aniline. Dist. with Fe  $\rightarrow$  azobenzene. Zn or Fe + NaOH  $\rightarrow$  azobenzene  $\rightarrow$  hydrazobenzene. Zn + AcOH  $\rightarrow$  aniline. Conc.  $H_2SO_4$   $\rightarrow$  4-hydroxyazobenzene.

Bigelow, Palmer, *Organic Syntheses*, 1931, XI, 16.

Kerns, *Chem. Abstracts*, 1932, 26, 4759.

Opolonick, *Ind. Eng. Chem.*, 1935, 27, 1045.

Deutsche Gold- und Silber-Scheideanstalt v. Roessler, D.R.P., 486,598, (*Chem. Abstracts*, 1930, 24, 1389).

Azoxybenzene-2 : 2'-dicarboxylic Acid (*o*-Azoxybenzoic acid)

$C_{14}H_{10}O_5N_2$  MW, 286

Yellowish plates or prisms from EtOH. M.p. 254.5° (246°). Very sol. Py. Sol. hot EtOH, AcOH,  $Me_2CO$ . Spar. sol.  $H_2O$ ,  $Et_2O$ . Almost insol.  $CHCl_3$ ,  $C_6H_6$ , ligroin.

*Di-Me ester*:  $C_{16}H_{14}O_5N_2$ . MW, 314. Prisms or needles from MeOH. M.p. 116-17°. Sol. most org. solvents.

*Di-Et ester*:  $C_{18}H_{18}O_5N_2$ . MW, 342. Yellow needles from EtOH. M.p. 81-2° (77°). Sol. usual solvents.

*Dinitrile*:  $C_{14}H_8ON_4$ . MW, 248. Needles from EtOH. M.p. 194-5°. Sol. amyl alc.

Mod. sol. hot EtOH, AcOH. Spar. sol. Et<sub>2</sub>O, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>, AcOEt.

Ekecrantz, Ahlqvist, *Ber.*, 1908, 41, 878.  
Heller, *J. prakt. Chem.*, 1908, 77, 164.  
Pinnow, Müller, *Ber.*, 1895, 28, 157.

**Azoxybenzene-3 : 3'-dicarboxylic Acid**  
(*m*-Azoxybenzoic acid).

Needles or leaflets from AcOH. M.p. 320°  
decomp. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

*Di-Me ester* : C<sub>16</sub>H<sub>14</sub>O<sub>5</sub>N<sub>2</sub>. MW, 314. Orange  
needles from AcOH, pale yellowish leaflets from  
MeOH. M.p. 134°. Sol. hot AcOH. Spar. sol.  
hot EtOH.

*Di-Et ester* : C<sub>18</sub>H<sub>18</sub>O<sub>5</sub>N<sub>2</sub>. MW, 342. Yellow  
needles from EtOH. M.p. 78°. Sol. usual  
solvents.

*Dichloride* : C<sub>14</sub>H<sub>8</sub>O<sub>3</sub>N<sub>2</sub>Cl<sub>2</sub>. MW, 323. Needles.  
M.p. 120–121.5°. Sol. C<sub>6</sub>H<sub>6</sub>.

Schultz, *Ann.*, 1879, 196, 18.  
Carré, *Compt. rend.*, 1905, 141, 594.  
Meyer, Dahlem, *Ann.*, 1903, 326, 342.  
Uspenski, *J. Russ. Phys.-Chem. Soc.*,  
1891, 23, 92.

**Azoxybenzene-4 : 4'-dicarboxylic Acid**  
(*p*-Azoxybenzoic acid).

Yellow amorph. powder. Decomp. about  
240°. Insol. usual solvents.

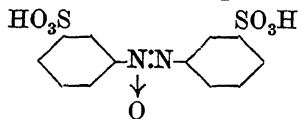
*Di-Me ester* : yellowish needles from AcOH.  
M.p. 207°. Sol. hot C<sub>6</sub>H<sub>6</sub>, AcOH, Me<sub>2</sub>CO.  
Spar. sol. EtOH, Et<sub>2</sub>O, ligroin.

*Di-Et ester* : yellow needles from EtOH.  
M.p. 115°, to anisotropic liq.

*Dipropyl ester* : m.p. 103°.  
*Di-isopropyl ester* : m.p. 96°.  
*Dibutyl ester* : m.p. 105°.  
*Di-isoamyl ester* : m.p. 122°.  
*Diallyl ester* : m.p. 88–9°.  
*Dibenzyl ester* : m.p. 147°.

Meyer, Dahlem, *Ann.*, 1903, 326, 334.  
Vorländer, *Ber.*, 1906, 39, 805.

**Azoxybenzene-3 : 3'-disulphonic Acid**



C<sub>12</sub>H<sub>10</sub>O<sub>7</sub>N<sub>2</sub>S<sub>2</sub> MW, 358

Yellow needles. M.p. 126°. Very sol. H<sub>2</sub>O,  
EtOH, Et<sub>2</sub>O. Decomp. above m.p. NaHg  
→ azobenzene-3 : 3'-disulphonic acid.

*Dichloride* : C<sub>12</sub>H<sub>8</sub>O<sub>5</sub>N<sub>2</sub>Cl<sub>2</sub>S<sub>2</sub>. MW, 395. Yellow  
cryst. from toluene. M.p. 138°. Sol. Et<sub>2</sub>O,  
C<sub>6</sub>H<sub>6</sub>.

*Diamide* : C<sub>12</sub>H<sub>12</sub>O<sub>5</sub>N<sub>4</sub>S<sub>2</sub>. MW, 356. Yellow  
prisms. M.p. 273°. Spar. sol. hot H<sub>2</sub>O.

Brunnemann, *Ann.*, 1880, 202, 340.

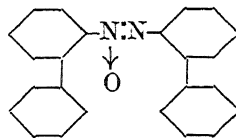
**Azoxybenzide.**

See Azoxybenzene.

**Azoxybenzoic Acid.**

See Azoxybenzene-dicarboxylic Acid.

***o*-Azoxydiphenyl**

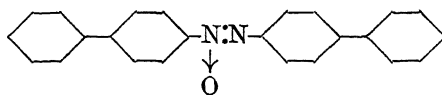


C<sub>24</sub>H<sub>18</sub>ON<sub>2</sub> MW, 350

Yellow cryst. from Me<sub>2</sub>CO. M.p. 157–8°.  
Sol. EtOH, Et<sub>2</sub>O, AcOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, pet.  
ether.

Friebel, Rassow, *J. prakt. Chem.*, 1901,  
63, 458.

***p*-Azoxydiphenyl**



C<sub>24</sub>H<sub>18</sub>ON<sub>2</sub> MW, 350

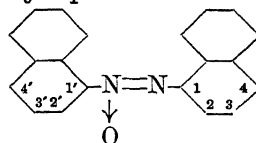
Orange-red plates from AcOH. M.p. 212°.  
Sol. C<sub>6</sub>H<sub>6</sub>, Et<sub>2</sub>O. Spar. sol. AcOH. Insol.  
EtOH.

Bell, Kenyon, Robinson, *J. Chem. Soc.*,  
1926, 1245.

**Azo-xylene.**

See Tetramethylazobenzene.

**1 : 1'-Azoxynaphthalene**



C<sub>20</sub>H<sub>14</sub>ON<sub>2</sub> MW, 298

Yellow or reddish cryst. from EtOH. M.p.  
127°. Sol. conc. H<sub>2</sub>SO<sub>4</sub> to violet sol. → blue  
on standing.

Wacker, *Ann.*, 1901, 317, 379.

**2 : 2'-Azoxynaphthalene.**

Small yellow needles from Et<sub>2</sub>O. M.p. 167–8°  
to deep red liq. Sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, hot AcOH.  
Spar. sol. MeOH, EtOH, Et<sub>2</sub>O. Zn + alkali  
→ 2 : 2'-azonaphthalene.

Meisenheimer, Witte, *Ber.*, 1903, 36, 4163.

**Azoxyphenetole.**

See under Dihydroxyazoxybenzene.

**Azoxyphenol.**

See Dihydroxyazoxybenzene.

**Azoxytoluene.**

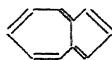
See Dimethylazoxybenzene.

**Azoxytoluidine.**

See Diaminoazoxytoluene.



**Azulene** (*Bicyclo*-[0.3.5]-*deca*-1 : 3 : 5 : 7 : 9-*pentaene*)



$C_{10}H_8$  MW, 128

Occurs in camomile and other essential oils. Greenish-black cryst. M.p. 98.5–99°. Heat at 270° → naphthalene.

*Picrate*: m.p. 120° decomp. Greenish-blue sol. in EtOH.

*Trinitrobenzene add. comp.*: m.p. 167°.

*Trinitrotoluene add. comp.*: m.p. 95.5–100°.

Plattner, St. Pfau, *Helv. Chim. Acta*, 1937, 20, 224.

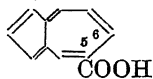
Hüter, *Chem. Zentr.*, 1943, I, 686 (Review).

Plattner, Heilbronner, Weber, *Helv. Chim. Acta*, 1952, 35, 1036.

Heilbronner, Simonetta, *ibid.*, 1049.

Gordon, *Chem. Reviews*, 1952, 50, 127 (Bibl.).

#### Azulene-5-carboxylic Acid



$C_{11}H_8O_2$

MW, 172

Violet cryst. M.p. 206–7°.

*Me ester*:  $C_{12}H_{10}O_2$ . MW, 186. Violet platelets. M.p. 40–1°. *Trinitrobenzene add. comp.*: m.p. 122°.

*Et ester*:  $C_{13}H_{12}O_2$ . MW, 200. Violet-blue cryst. M.p. 30–1°.

*Trinitrobenzene add. comp.*: m.p. 152–3°.

*S-Benzylthiuronium salt*: m.p. 164°.

Plattner *et al.*, *Helv. Chim. Acta*, 1951, 34, 971.

#### Azulene-6-carboxylic Acid.

Green needles. M.p. 225–7° decomp.

*Me ester*:  $C_{12}H_{10}O_2$ . MW, 186. M.p. 126°.

*Trinitrobenzene add. comp.*: m.p. 113°.

Plattner *et al.*, *Helv. Chim. Acta*, 1951, 34, 971.

#### Azulmic Acid

$C_4H_5ON_5$  MW, 139

Brown solid formed by decomp. of aq. sols. of cyanogen. Spar. sol.  $H_2O$ , giving violet fluor. Sols. in KOH or  $H_2SO_4$  fluoresce green.

Bohart, U.S.P., 1,464,802, (*Chem. Abstracts*, 1923, 17, 3259).

## B

**Bacitracin** (*Ayfviv*).

Antibiotic polypeptide elaborated by *Bacillus licheniformis*. Consists of three components, bacitracins A, B and C, of which A and C have similar antibiotic activities and B one third of that of A and C.

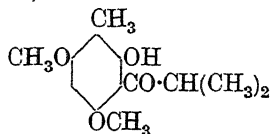
Newton, Abraham. *Biochem. J.*, 1950, **47**, 257.

Sharp, Arriagada, Newton, Abraham, *Brit. J. Exptl. Path.*, 1949, **30**, 444.

**Badische Acid.**

See 2-Naphthylamine-8-sulphonic Acid.

**Bæckeol** (*Methylphloroisobutyrophenone dimethyl ether*)



$C_{13}H_{18}O_4$  MW, 238

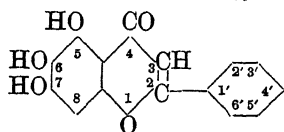
Phenol occurring in the essential oils of various species of Myrtaceae, especially *Bæckea crenulata* and *Darwinia grandiflora*. Pale yellow needles from MeOH. M.p. 103–4°. Sol. hot EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, alkalis. Spar. sol. ligroin. Sublimes. FeCl<sub>3</sub> → bluish-black col. H<sub>2</sub>O<sub>2</sub> → isobutyric acid. NaOEt at 200° → methylphloroglucinol di-Me ether.

*Acetyl*: dimorphous. (i) Prisms from MeOH.Aq. M.p. 73°. Heat at 75° → (ii) Needles from MeOH.Aq. M.p. 79–80°.

Penfold, Morrison, *J. Proc. Roy. Soc. N.S. Wales*, 1922, **56**, 87, (*Chem. Abstracts*, 1923, **17**, 1006).

Penfold, Simonsen, *J. Proc. Roy. Soc. N.S. Wales*, 1938, **71**, 291, (*Chem. Zentr.*, 1938, **II**, 2258).

Ramage, Stowe, *J. Chem. Soc.*, 1940, 426.  
Hems, Todd, *ibid.*, 1208.

**Baicalein** (5 : 6 : 7-Trihydroxyflavone)

$C_{15}H_{10}O_5$  MW, 270

Occurs in roots of *Scutellaria baicalensis*. Yellow prisms from EtOH. M.p. 264–5° decomp. Sol. EtOH, MeOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, AcOEt, hot AcOH. Spar. sol. CHCl<sub>3</sub>, PhNO<sub>2</sub>. Alc. FeCl<sub>3</sub> → greenish-brown col. Conc. H<sub>2</sub>SO<sub>4</sub> → yellow sol.

6 : 7-Di-Me ether:  $C_{17}H_{14}O_5$ . MW, 298. Yellowish needles from MeOH. M.p. 155–6°.

Alc. sol. with trace FeCl<sub>3</sub> → red col. → greenish with excess FeCl<sub>3</sub>.

*Tri-Me ether*:  $C_{18}H_{16}O_5$ . MW, 312. Yellowish needles from EtOH. M.p. 165–6°. Conc. H<sub>2</sub>SO<sub>4</sub> → yellow col.

*Diacetyl deriv.*: yellowish needles from AcOH.Aq. M.p. 198–200°. Sol. EtOH. FeCl<sub>3</sub> → red col.

*Triacetyl*: needles from EtOH. M.p. 190–2°. Sol. hot AcOH. Less sol. EtOH.

Shibata, Iwata, Nakamura, *Acta Phytochim.*, 1923, **I**, 109.

Bargellini, *Gazz. chim. ital.*, 1919, **49**, ii, 47.

**Baicalin**

$C_{21}H_{18}O_{11}$  MW, 446

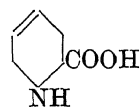
Found in roots of *Scutellaria baicalensis*. Yellow cryst. M.p. 223°. Hyd. → baicalein + glucuronic acid.

*Tetra-acetyl*: prisms. M.p. 256–7°.

*Tetrabenzoyl*: m.p. 229–30°.

Shibata *et al.*, *Acta Phytochim.*, 1923, **1**, 105, (*Chem. Abstracts*, 1923, **17**, 3506); 1930, **5**, 117, (*Chem. Abstracts*, 1931, **25**, 1528).

Charaux, Rabaté, *J. pharm. chim.*, 1941, **1**, 404, (*Chem. Abstracts*, 1944, **38**, 1848).

**Baikiain** (1 : 2 : 3 : 6-Tetrahydropyridine-2-carboxylic acid)

$C_6H_9O_2N$  MW, 127

Amino-acid present in *Baikiaea plurijuga*. Prisms from MeOH. M.p. 274° decomp.  $[\alpha]_D^{20}$  –201.6° in H<sub>2</sub>O. Very sol. H<sub>2</sub>O. Spar. sol. EtOH. Insol. Me<sub>2</sub>CO, AcOEt, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Zn dust → α-picoline. H → l-pipecolinic acid. Ninhydrin → yellow-brown col.

*Me ester*:  $C_7H_{11}O_2N$ . MW, 141. B.p. 110–12°/15 mm. *B,HCl*: prisms from MeOH–Me<sub>2</sub>CO. M.p. 164°. *Benzoyl*: oil. B.p. 140–45° (bath temp.)/0.1 mm. Turns brown in air.

*B,HCl*: prisms from MeOH or EtOH. M.p. 264°.  $[\alpha]_D^{20}$  –90.1° in H<sub>2</sub>O.

*Picrate*: needles or plates from H<sub>2</sub>O. M.p. 172–3°.

*Benzoyl*: prisms from AcOEt, needles from Et<sub>2</sub>O and H<sub>2</sub>O. M.p. 178–9°.  $[\alpha]_D^{20}$  –91.9°.

King, King, Warwick, *J. Chem. Soc.*, 1950, 3590.

**B.A.L.**

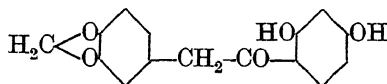
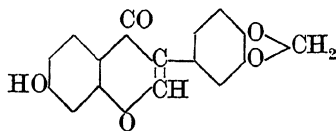
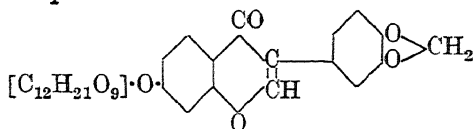
See 1 : 2-Dithioglycerol.

**B.A.L.-Intrav.**

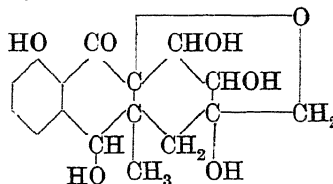
See under 1 : 2-Dithioglycerol.

**Balsaminasterol** $C_{27}H_{40}O$  MW, 380Unsaturated sterol found in balsam seeds. Needles from  $Me_2CO$  or  $Et_2O$ . M.p.  $160\cdot1^\circ$ .  $[\alpha]_D^{25} + 7\cdot66^\circ$ .Acetyl : m.p.  $170\text{--}1^\circ$ .Tutiya, *J. Chem. Soc. Japan*, 1940, 61, 717, (*Chem. Abstracts*, 1942, 36, 7337).**Banisterine.**

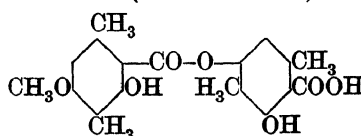
See Harmine.

**Baptifoline** $C_{15}H_{20}O_2N_2$  MW, 260Alkaloid of *Baptisia perfoliata*, Linn., R. Br. and *B. minor*, Lehm. M.p.  $210^\circ$ .  $[\alpha]_D^{25} - 147\cdot7^\circ$  ( $c = 0\cdot325$  in  $EtOH$ ). $B,2HClO_4$  : m.p.  $289\cdot5^\circ$ .  $[\alpha]_D^{25} - 89\cdot05^\circ$  ( $c = 1\cdot415$  in  $H_2O$ ).Picrate : cryst. +  $MeOH$ . M.p.  $145^\circ$ , then again at  $256^\circ$ .Marion, Turcotte, *J. Am. Chem. Soc.*, 1948, 70, 3253. **$\psi$ -Baptigenetin** (2 : 4-Dihydroxy-3' : 4'-methylenedioxybenzoïn) $C_{15}H_{12}O_5$  MW, 272Hydrolysis product of  $\psi$ -baptigenin. M.p.  $151^\circ$ .Me ether :  $C_{16}H_{14}O_5$ . MW, 286. M.p.  $145^\circ$ .Di-Me ether :  $C_{17}H_{16}O_5$ . MW, 300. B.p.  $200\text{--}20^\circ/0\cdot01$  mm.Et ether :  $C_{17}H_{16}O_5$ . MW, 300. M.p.  $129^\circ$ .Oxime : m.p.  $206^\circ$  decomp.Späth, Schmidt, *Monatsh.*, 1929, 53-54, 454. **$\psi$ -Baptigenin** (7-Hydroxy-3-[3' : 4'-methylenedioxyphenyl]-chromone) $C_{16}H_{10}O_5$  MW, 282Found naturally in root of *Baptisia* species as the glycoside  $\psi$ -baptisin. M.p.  $296\text{--}8^\circ$ . Spar. sol. most solvents. Sublimes in vacuo. Hyd.  $\rightarrow$   $\psi$ -baptigenetin +  $H\cdot COOH$ .Acetyl deriv. : m.p.  $173^\circ$ Et ether :  $C_{18}H_{14}O_5$ . MW, 310. M.p.  $172^\circ$ .Späth, Schmidt, *Monatsh.*, 1929, 53-54, 454. **$\psi$ -Baptisin** $C_{28}H_{30}O_{14}$  MW, 590Cryst. +  $3H_2O$ . M.p.  $148\text{--}50^\circ$ , resolidifies at  $180\text{--}210^\circ$  and melts again at  $249\text{--}51^\circ$ .  $[\alpha]_D^{25} - 98\cdot1^\circ$ .  $H_2SO_4 \rightarrow$  yellowish-brown col. changing to orange-red. Hyd.  $\rightarrow$   $\psi$ -baptigenin + *d*-glucose + rhamnose.Späth, Schmidt, *Monatsh.*, 1929, 53-54, 454.**Baptitoxine.**

See Cytisine.

**Barbaloin**

Suggested structure

 $C_{16}H_{18}O_7$  ( $C_{21}H_{24}O_9$ ) MW, 322 (420)Found in Barbados aloes. Yellow needles from  $EtOH$ . M.p.  $146\text{--}8^\circ$  ( $150^\circ$ ). Easily sol.  $H_2O$ ,  $EtOH$ . Spar. sol.  $Et_2O$ .  $[\alpha]_D^{25} - 8\cdot3^\circ$  in  $EtOH\cdot Aq$ ;  $-10\cdot4^\circ$  in  $AcOEt$ . Dist. with  $Zn \rightarrow$  methylantracene. Alc  $HCl \rightarrow$  aloemodin + *d*-arabinose.Acetyl deriv. : cryst. from pet. ether. M.p.  $95\text{--}6^\circ$  ( $92^\circ$ ). Ox.  $\rightarrow$  rhein acetate + aloemodin acetate.Me ether : prisms from  $EtOH$ . M.p.  $177\text{--}9^\circ$ .  $[\alpha]_{5461}^{25} - 12\cdot05^\circ$  in  $CHCl_3$ .Jowett, Potter, *J. Chem. Soc.*, 1905, 87, 878.Robinson, Simonsen, *J. Chem. Soc.*, 1909, 95, 1085.Léger, *Ann. chim.*, 1916, 6, 318; 1917, 8, 265.Gibson, Simonsen, *J. Chem. Soc.*, 1930, 553.Cahn, Simonsen, *J. Chem. Soc.*, 1932, 2573.Léger, *Bull. soc. chim.*, 1936, [5], 3, 435.Gardner, Joseph, *J. Am. Pharm. Assoc.*, 1937, 26, 794.Owen, Simonsen, *J. Am. Chem. Soc.*, 1942, 64, 2516.**Barbatic Acid** (*Barbatinic acid*) $C_{19}H_{20}O_7$ 

MW, 360

Occurs in majority of lichens of genus *Usnea* and in *Alectoria ochroleuca*. Cryst. from  $C_6H_6$ . M.p.  $191^\circ$  ( $186^\circ$ ). Insol.  $H_2O$ . Hyd.  $\rightarrow$  rhizonic acid and  $\beta$ -orcinol.  $FeCl_3 \rightarrow$  violet col.

*Mono-acetyl deriv.*: needles from AcOH. M.p.  $172^\circ$ .

*Me ester*:  $C_{20}H_{22}O_7$ . MW, 374. Prisms from MeOH. M.p.  $170^\circ$ .

*Et ester*:  $C_{21}H_{24}O_7$ . MW, 388. Cubes from  $C_6H_6$ . M.p.  $189^\circ$ .

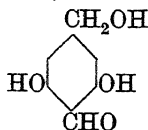
St. Pfau, *Helv. Chim. Acta*, 1928, 11, 864 (*Bibl.*).

Robertson, Stephenson, *J. Chem. Soc.*, 1932, 1678.

### Barbatic Acid.

See Barbatic Acid.

**Barbatol** (3 : 5-Dihydroxy-4-aldehydobenzyl alcohol, 2 : 6-dihydroxy-4-hydroxymethyl-benzaldehyde, 4-hydroxymethyl- $\gamma$ -resorcylic aldehyde)



$C_8H_8O_4$  MW, 168

Brownish-yellow prisms from  $H_2O$ . M.p.  $186-9^\circ$  decomp.

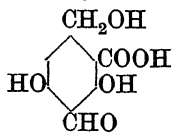
*Oxime*: cryst. from  $H_2O$ . M.p.  $195-8^\circ$ . *Tetra-acetyl*: needles. M.p.  $116^\circ$ .

*Phenylhydrazone*: yellow needles from AcOH. M.p.  $183-4^\circ$  decomp.

*Anil*: orange needles +  $1H_2O$  from 20% EtOH. M.p.  $184-5^\circ$ .

Schöpf, Heuck, Duntze, *Ann.*, 1931, 491, 240.

**Barbatol-carboxylic Acid** (2 : 4-Dihydroxy-6-hydroxymethyl-3-aldehydobenzoic acid)

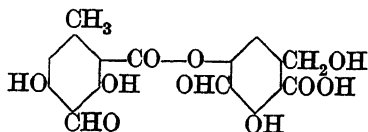


$C_9H_8O_6$  MW, 212

Cryst. from  $H_2O$ . M.p.  $243-4^\circ$  decomp. Sol. hot EtOH,  $Me_2CO$ ,  $H_2O$ . Spar. sol. Et<sub>2</sub>O.

Suominen, *Chem. Abstracts*, 1940, 34, 400.

### Barbatolic Acid



$C_{18}H_{14}O_{10}$  MW, 390

Constituent of *Usnea barbata*. Needles from AcOH. M.p.  $205-7^\circ$ . Sol. alkalis. Spar. sol. most org. solvents.

*Me ester*:  $C_{19}H_{16}O_{10}$ . MW, 404. M.p.  $193^\circ$ .

*Dioxime*: m.p.  $207-9^\circ$ . *Diacetyl*: m.p.  $196-9^\circ$ . *Dibenzoyl*: m.p.  $183-5^\circ$ .

Schöpf, Heuck, Duntze, *Ann.*, 1931, 491, 231.

Suominen, *Brit. Chem. Abstracts*, 1939, A II, 549.

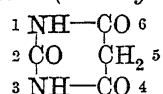
### Barbital.

See Veronal.

### Barbitone.

See Veronal.

### Barbituric Acid (Malonylurea)



$C_4H_4O_3N_2$  MW, 128

Prisms +  $2H_2O$  from  $H_2O$ . Decomp. on heating. Sol. hot  $H_2O$ .  $k = 0.98 \times 10^{-4}$  at  $25^\circ$ .  $KOH \rightarrow$  K malonate + urea ( $K_2CO_3$  and  $NH_3$ ).  $HNO_2 \rightarrow$  violuric acid. Forms metallic salts. Has hypnotic action.

Wood, Anderson, *J. Chem. Soc.*, 1909, 95, 979.

Chem. Fabr. Schering, D.R.P., 171,294, (*Chem. Zentr.*, 1906, II, 387).

Bornwater, *Rec. trav. chim.*, 1915, 35, 128.

### Basseol

$C_{30}H_{50}O$  MW, 426

Diethenoid tetracyclic triterpene alcohol isolated from unsaponifiable portion of shea nut fat and shea cambium. Needles from EtOH.Aq. M.p.  $109.5^\circ$ . Sol. Et<sub>2</sub>O,  $CHCl_3$ ,  $C_6H_6$ . Mod. sol. EtOH, AcOEt.  $[\alpha]_D^{25} - 11.9^\circ$  in  $CHCl_3$ .  $AcOH-H_2SO_4 \rightarrow$  yellow  $\rightarrow$  brown  $\rightarrow$  red col. with marked green fluorescence. Red.  $\rightarrow$  dihydro-deriv.  $O_3 \rightarrow$  H-CHO. Se  $\rightarrow$   $C_{18}H_{18}$  or  $C_{17}H_{16}$  hydrocarbon.

*Acetyl*: clusters of needles from EtOH or AcOEt. M.p.  $141^\circ$ .  $[\alpha]_D^{18.5} + 23^\circ$  in  $CHCl_3$ . Cyclised to  $\beta$ -amyrin acetate by a variety of reagents.

*Benzoyl*: plates from  $C_6H_6$ -EtOH. M.p.  $130^\circ$ .

Heilbron, Moffet, Spring, *J. Chem. Soc.*, 1934, 1583.

Beynon, Heilbron, Spring, *J. Chem. Soc.*, 1937, 989; *Nature*, 1938, 142, 434.

Picard, Sharples, Spring, *Chemistry and Industry*, 1939, 58, 58.

Heilbron, Jones, Robins, *J. Chem. Soc.*, 1949, 444.

### Basic Acid

$C_{30}H_{46}O_5$  MW, 486

Sapogenin isolated from the seeds of most *Sapotaceae*. Cryst. from MeOH. M.p.  $319-24^\circ$ .  $[\alpha]_D^{25} + 72^\circ$  in Py.

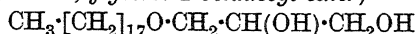
*Me ester*: two forms. ( $\alpha$ -). Cryst. from  $C_6H_6$ . M.p.  $214-5^\circ$ .  $[\alpha]_D^{25} + 64^\circ$ . ( $\beta$ -). Cryst. from MeOH or EtOH. M.p.  $220^\circ$ .  $[\alpha]_D^{25} + 55.5^\circ$ .

*Triacetyl-β-ester*: m.p. 148–9°. *Acetonyl-β-ester*: prisms from Me<sub>2</sub>CO. M.p. 205–6°.

*Triacetyl*: yellow powder from MeOH. M.p. 117°.

Heywood, Kon, *J. Chem. Soc.*, 1940, 713.

**Batyl Alcohol** (1-Octadecyl 2:3-dihydroxypropyl ether, glycerol 1-octadecyl ether)



C<sub>21</sub>H<sub>44</sub>O<sub>3</sub> MW, 344

Constituent of many shark and ray liver oils. Colourless cryst. M.p. 70–1°. HI → octadecyl iodide.

*Phenylurethane*: m.p. 98°.

*Anthraquinone-2-carboxylate*: m.p. 79–80°.

*Bis-p-nitrobenzoate*: yellow cryst. M.p. 65–6°: +2MeOH, m.p. 53–4°.

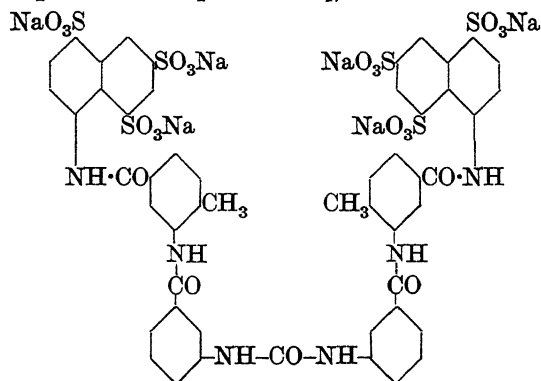
Davies, Heilbron, Jones, *J. Chem. Soc.*, 1933, 165.

Heilbron, Owens, *J. Chem. Soc.*, 1928, 942.

Nakamiya, *Bull. Inst. Phys. Chem. Research (Tokyo)*, 1938, 17, 837.

Baer, Fischer, *J. Am. Chem. Soc.*, 1945, 67, 2031.

**Bayer 205** (*Antrypol*, *Fourneau 309*, *Germanin*, *Moranyl*, *Naganol*, *Suramin*, hexa-Na salt of 3:3'-ureidodi-[8(3-benzamido-p-toluido)-1:3:5-naphthalenetrisulphonic acid])



C<sub>51</sub>H<sub>34</sub>O<sub>23</sub>N<sub>6</sub>S<sub>6</sub>Na<sub>6</sub> MW, 1428

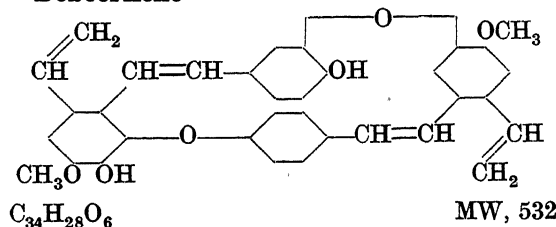
Greyish-white powder. Very sol. H<sub>2</sub>O. Insol. EtOH. Strong trypanocidal action.

Fourneau, Tréfouël, Tréfouël, Vallée, *Compt. rend.*, 1924, 178, 675.

**B.B.C.**

See α-Bromobenzyl cyanide.

**Bebeerilene**



C<sub>34</sub>H<sub>28</sub>O<sub>6</sub>

MW, 532

Degradation product of curine.

*Di-Me ether*: plates from AcOH. M.p. 198–9°. Cold conc. H<sub>2</sub>SO<sub>4</sub> → red col.

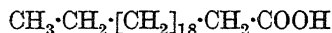
*Di-Et ether*: plates from AcOH. M.p. 168–9°.

King, *J. Chem. Soc.*, 1935, 1381; 1939, 1157; 1948, 265.

**Bebeerine.**

See Curine.

**Behenic Acid** (*n-Docosanic acid*, *n-docosonic acid*)



C<sub>22</sub>H<sub>44</sub>O<sub>2</sub> MW, 340

Occurs in *Lophira alata* kernel fat, Carnauba wax, *Mimusops elengi* seed oil. M.p. 81–2°.

*Me ester*: C<sub>23</sub>H<sub>46</sub>O<sub>2</sub>. MW, 354. M.p. 54°.

*Et ester*: C<sub>24</sub>H<sub>48</sub>O<sub>2</sub>. MW, 368. M.p. 50°.

B.p. 240–2°/10 mm., 185°/0.2 mm.

*Chloride*: C<sub>22</sub>H<sub>43</sub>OCl. MW, 358.5. Colourless flakes. M.p. 73–5° (40°).

*Amide*: C<sub>22</sub>H<sub>45</sub>ON. MW, 339. M.p. 111°.

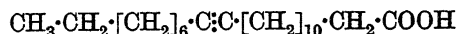
*Anilide*: C<sub>28</sub>H<sub>49</sub>ON. MW, 415. M.p. 101–2°.

Levene, Taylor, *J. Biol. Chem.*, 1924, 59, 905.

Bleyberg, Ulrich, *Ber.*, 1931, 64, 2504.

Morgan, Holmes, *J. Soc. Chem. Ind.*, 1925, 44, 491t.

**Behenic Acid**



C<sub>22</sub>H<sub>40</sub>O<sub>2</sub> MW, 336

Constituent of rape oil. Needles. M.p. 57–5°.

*Me ester*: C<sub>23</sub>H<sub>42</sub>O<sub>2</sub>. MW, 350. M.p. 22°.

*Et ester*: C<sub>24</sub>H<sub>44</sub>O<sub>2</sub>. MW, 364. M.p. 15–16°.

*Chloride*: C<sub>22</sub>H<sub>39</sub>OCl. MW, 354.5. M.p. 29–30°.

*Amide*: C<sub>22</sub>H<sub>41</sub>ON. MW, 335. M.p. 90°.

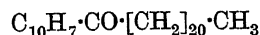
*Anilide*: m.p. 73°.

Bhattacharya, Saletore, Simonsen, *J. Chem. Soc.*, 1928, 2678.

Holt, *Ber.*, 1892, 25, 964.

Hofmann-La Roche, D.R.P., 243,582, (*Chem. Zentr.*, 1912, I, 695).

**Behenonaphthone** (*Heneicosyl 2-naphthyl ketone*)

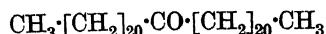


C<sub>32</sub>H<sub>50</sub>O MW, 450

Cryst. from Me<sub>2</sub>CO or pet. ether. M.p. 67–9°.

Mikeska, Cohen, *J. Org. Chem.*, 1941, 9, 787.

**Behenone** (22-Tritetracontanone)



C<sub>43</sub>H<sub>86</sub>O

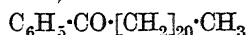
MW, 618

M.p. 96.05–96.30° (92°). Spar. sol. org. solvents.

Grün, Ulbrich, Krczil, *Z. angew. Chem.*, 1926, **39**, 423.

Becker, Strating, *Rec. trav. chim.*, 1940, **59**, 933.

**Behenophenone** (*n*-Heneicosyl phenyl ketone, docosanophenone)

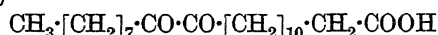


$C_{28}H_{48}O$  MW, 400

Cryst. from  $Me_2CO$ . M.p. 73–6°.

Mikeska, Cohen, *J. Org. Chem.*, 1941, **6**, 788.

**Behenoxylic Acid** (12 : 13-Diketobehenic acid)



$C_{22}H_{40}O_4$  MW, 368

Yellow plates from EtOH. M.p. 95°. Sol.  $Et_2O$ ,  $C_6H_6$ . Spar. sol. ligroin. Insol.  $H_2O$ .

*Me ester*:  $C_{23}H_{42}O_4$ . MW, 382. Yellow leaflets from EtOH. M.p. 63–3.5°.

*Monoxime*: needles from EtOH. M.p. 85–6°.

*Dioxime*: needles from EtOH. M.p. 144–5°.

Hausknecht, *Ann.*, 1887, **143**, 46.

Spieckermann, *Ber.*, 1896, **29**, 810.

**Behenyl Alcohol**.

See Docosyl Alcohol.

**Belmacamdin** (*Belmacamgenin glucoside*)

$C_{22}H_{22}O_{13}$  MW, 494

Found in root of *Belmacamda sinensis*. Colourless cryst. from EtOH. M.p. above 300°. Alc. HCl  $\rightarrow$  glucose + belmacamgenin.  $Me_2SO_4 \rightarrow$  7 : 5'-dimethylirigenin.

Wang, Hu, *J. Chem. Soc.*, 1944, 307.

**Belmacamgenin** (*Irigenol monomethyl ether, pentahydroxy-methoxyisoflavone*)

$C_{16}H_{12}O_8$  MW, 332

Yellow needles from EtOH.Aq. M.p. 227°.  $Me_2SO_4 \rightarrow$  penta-Me ether identical with tri-Me ether of irigenin.

*Acetyl*: cryst. from EtOH. M.p. 184–5°.

Wang, Hu, *J. Chem. Soc.*, 1944, 307.

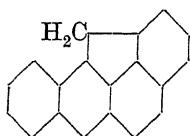
**Benihinol**.

See under Myrtenol.

**Benihiol**.

See under Myrtanol.

**Benzaceanthrylene**



$C_{19}H_{12}$

MW, 240

Cryst. from EtOH. M.p. 122–3° corr. Greenish yellow fluor. No carcinogenic activity. sym.-*Trinitrobenzene add. comp.*: orange needles from EtOH. M.p. 162.5–163° corr.

*Picrate*: dark red needles from EtOH. M.p. 141.5–142° corr.

Fieser, Cason, *J. Am. Chem. Soc.*, 1939, **61**, 1740; 1940, **62**, 1293.

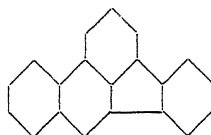
**1 : 2-Benzacenaphthene**.

See Fluoranthene.

**3 : 4-Benzacenaphthenequinone**.

See Aceanthrenequinone.

**Benzacephenanthrylene**



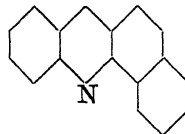
$C_{20}H_{12}$

MW, 252

Needles from  $C_6H_6$ . M.p. 167°.

Tobler, Holbro, Sutter, Kern, *Helv. Chim. Acta*, 1941, **24**, 100E.

**1 : 2-Benzacridine** ( *$\alpha$ -Chrysidine,  $\alpha$ -naphth-acridine*)



$C_{17}H_{11}N$

MW, 229

Needles from EtOH.Aq. M.p. 108°. Sol. common org. solvents. Base and salts show blue or green fluor. in sol. Salts hyd. by  $H_2O$ .

*B, HCl*: yellow needles. M.p. 244° decomp.

*B, HNO<sub>3</sub>*: yellow leaflets. M.p. 188–9° decomp.

*Chloroaurate*: m.p. 228°.

*Chloroplatinate*: yellow needles from dil. HCl. Decomp. at 255°.

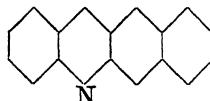
*Picrate*: yellow needles from  $PhNO_2$ . M.p. 240°.

*Methiodide*: orange-yellow needles from EtOH. M.p. 262–3°.

Ullmann, *Ann.*, 1907, **355**, 349.

v. Braun, Wolff, *Ber.*, 1922, **55**, 3680.

**2 : 3-Benzacridine**



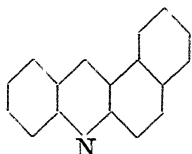
$C_{17}H_{11}N$

MW, 229

Prisms from  $CHCl_3$ . M.p. 225–6°. Sol. conc.  $H_2SO_4$  with violet col. Salts sol. EtOH with red col. and greenish-blue fluor.

Schöpf, *Ber.*, 1894, **27**, 2843.

**3 : 4-Benzacridine** (*β-Chrysidine*, *β-naphth-acridine*)



$C_{17}H_{11}N$  MW, 229

Needles from EtOH.Aq. M.p. 132°. Sol. common org. solvents with blue fluor. Sol. conc.  $H_2SO_4$  with yellow col. and green fluor.

$B_2HCl$ : yellow needles. M.p. about 220°.

$B_2HNO_3$ : yellow needles. M.p. 217° decomp.

*Chloroaurate*: m.p. 245° decomp.

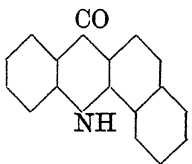
$B_2H_2PtCl_6 \cdot 2H_2O$ : yellow needles from dil. HCl. M.p. 245° decomp.

*Picrate*: yellow needles from  $PhNO_2$ . M.p. 260° decomp.

*Methiodide*: orange-yellow needles. M.p. 264°.

Ullmann, *Ann.*, 1907, 355, 351.

### 1 : 2-Benzacridone



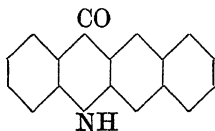
$C_{17}H_{11}ON$  MW, 245

Yellow needles from Py. M.p. 365-6°. Spar. sol. EtOH, AcOH,  $C_6H_6$ . Insol.  $Et_2O$ , ligroin. Green fluor. in Py. Blue fluor. in conc.  $H_2SO_4$ .

Ullmann, *Ann.*, 1907, 355, 349.

Kramer, D.R.P., 590,579, (*Chem. Zentr.*, 1934, II, 3846).

### 2 : 3-Benzacridone



$C_{17}H_{11}ON$  MW, 245

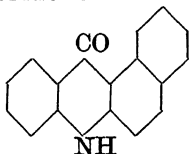
Yellow leaflets from EtOH. M.p. 304-5°. Spar. sol. common org. solvents with yellow col. and green fluor. Sol. conc.  $H_2SO_4$  with red col.

*N-Et*:  $C_{19}H_{15}ON$ . MW, 273. Yellow needles from EtOH. M.p. 174-5°.

*N-Benzyl*:  $C_{24}H_{17}ON$ . MW, 235. Yellow needles from EtOH. M.p. 188-9°.

Schöpf, *Ber.*, 1893, 26, 2590.

### 3 : 4-Benzacridone



$C_{17}H_{11}ON$

MW, 245

Yellow needles from Py. M.p. 383°. Spar. sol. EtOH with blue fluor. Sol. conc.  $H_2SO_4$  with bluish-green fluor.

Ullmann, *Ann.*, 1907, 355, 351.

Kramer, D.R.P., 590,579, (*Chem. Zentr.*, 1934, II, 3846).

### Benzal-

See Benzylidene-

### Benzaldehyde

$C_6H_5 \cdot CHO$

$C_7H_6O$

MW, 106

F.p. -55.6 to -56.9°. M.p. -26°. B.p. 179°/751 mm., 62°/10 mm. Sol. 300 parts  $H_2O$ . Misc. with EtOH,  $Et_2O$ .  $D_4^{15}$  1.0504. Volatile in steam. Forms bisulphite comp. Reduces  $NH_3 \cdot AgNO_3$  but not Fehling's.  $NaHg \rightarrow$  benzyl alcohol. Easily ox. to benzoic acid.  $PCl_5 \rightarrow$  benzylidene chloride. Condenses with primary amines yielding Schiff bases: e.g., aniline  $\rightarrow$  benzylideneaniline.  $NH_3 \rightarrow$  hydrobenzamide.  $KCN \rightarrow$  benzoin.  $NaOH \rightarrow$  benzyl alcohol + benzoic acid.

*Oxime*: see Benzaldoxime.

*Di-Et acetal*: b.p. 217-21°.  $D_4^{25}$  0.97875.  $n_D^{15}$  1.4843.

*Semicarbazone*: m.p. 222° (rapid heat., 233-5°).

*Thiosemicarbazone*: benzylidenethiosemicarbazide. M.p. 160°. Sol. hot EtOH.

*Phenylsemicarbazone*: m.p. 180-1°.

*Cyanhydrin*: mandelonitrile. See under Mandelic Acid.

*Hydrazone*: see Benzylidenehydrazine.

*Methylhydrazone*: see Methylbenzylidenehydrazine.

*Phenylhydrazone*: two isomers. M.p. 157-8° and 154-5°.

*p-Nitrophenylhydrazone*: two isomers. Stable, m.p. 261-2°. Less stable, m.p. 234-6°.

*2 : 4-Dinitrophenylhydrazone*: m.p. 237°.

*Methylphenylhydrazone*: see Methylphenylbenzylidenehydrazine.

Holloway, Krase, *Ind. Eng. Chem.*, 1933, 25, 497.

Hinkel, Ayling, Morgan, *J. Chem. Soc.*, 1932, 2793.

du Pont, U.S.P., 1,989,700, (*Chem. Abstracts*, 1935, 29, 1834).

Evdokimov, *Chem. Abstracts*, 1930, 24, 2737.

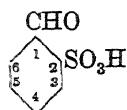
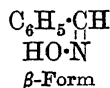
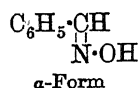
Kakutani, Yamaguchi, *Chem. Abstracts*, 1929, 23, 3217.

### Benzaldehyde-carboxylic Acid.

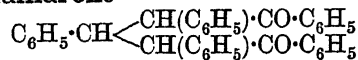
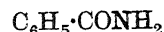
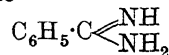
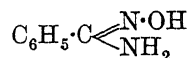
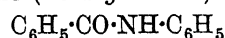
See Aldehydobenzoic Acid.

### Benzaldehyde-2 : 6-dicarboxylic Acid.

See 2-Aldehydoisophthalic Acid.

**Benzaldehyde-*o*-sulphonic Acid** (*o*-*Sulphobenzaldehyde*)C<sub>7</sub>H<sub>6</sub>O<sub>4</sub>S MW, 186Sol. H<sub>2</sub>O.*Me ester*: C<sub>8</sub>H<sub>8</sub>O<sub>4</sub>S. MW, 200. M.p. 62–5°.*Chloride*: C<sub>7</sub>H<sub>5</sub>O<sub>3</sub>ClS. MW, 204.5. M.p. 114–15°.Goldeberger, *Monatsh.*, 1916, 37, 125.**Benzaldehyde-*m*-sulphonic Acid** (*m*-*Sulphobenzaldehyde*).Cryst. HNO<sub>3</sub> → *m*-sulphobenzoic acid.  
KOH fusion → *m*-hydroxybenzoic acid.Wallach, *Wüsten, Ber.*, 1883, 16, 150.**Benzaldehyde-*p*-sulphonic Acid** (*p*-*Sulphobenzaldehyde*).Conc. KOH.Aq. at 220–40° → benzoic and *p*-hydroxybenzoic acids.*Amide*: C<sub>7</sub>H<sub>7</sub>O<sub>3</sub>NS. MW, 185. Plates or needles from H<sub>2</sub>O. M.p. 122–4°. Sol. H<sub>2</sub>O, EtOH, Me<sub>2</sub>CO. Spar. sol. Et<sub>2</sub>O. *Hydrazone*: plates and needles from 80% EtOH. M.p. 288–90°. *Semicarbazone*: prisms from H<sub>2</sub>O. M.p. 250–1°. *Phenylhydrazone*: m.p. 244–5° decomp.Dakin, *Biochem. J.*, 1917, 11, 93.Reitlinger, *Z. Elektrochem.*, 1914, 20, 268.**Benzaldoxime**C<sub>7</sub>H<sub>7</sub>ON MW, 121

Exists in two stereoisomeric forms (see above formulæ).

 $\alpha$ -Form:Stable. M.p. 35°. B.p. 118–19°/10 mm. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 1.110. *O-Me*: b.p. 190–2°. $\beta$ -Form:Needles from Et<sub>2</sub>O. M.p. 130°. D<sub>4</sub><sup>20</sup> 1.145. Labile. Gradually inverts to  $\alpha$ -form: more rapidly on heating or by dil. acids. Red. → benzylhydroxylamine. *O-Me*: b.p. 79°/11 mm.Auwers, *Ottens, Ber.*, 1924, 57, 446.Wuyts, Koeck, *Bull. soc. chim. Belg.*, 1932, 41, 197.**Benzamarone**C<sub>35</sub>H<sub>28</sub>O<sub>2</sub> MW, 480M.p. 218–19°. Spar. sol. cold C<sub>6</sub>H<sub>6</sub>. Alc. NaOH → amaric acid.Klingemann, *Ber.*, 1893, 26, 818.**Benzamide**C<sub>7</sub>H<sub>7</sub>ON MW, 121Cryst. in plates from H<sub>2</sub>O. M.p. 130°. B.p. 288°. Sol. EtOH, hot H<sub>2</sub>O, hot C<sub>6</sub>H<sub>6</sub>. Spar. sol. Et<sub>2</sub>O. D<sub>4</sub><sup>1</sup> 1.341. Heat of comb. C<sub>7</sub> 851.9 Cal., C<sub>7</sub> 852.3 Cal. Distils with part. decomp. to benzonitrile. Forms Na, K, Ag and Hg derivs. (e.g. C<sub>6</sub>H<sub>5</sub>·CO·NHNa or C<sub>6</sub>H<sub>5</sub>·C(ONa):NH). P<sub>2</sub>O<sub>5</sub> → benzonitrile.*N-Chloro*: cryst. from H<sub>2</sub>O. M.p. 116°. Insol. EtOH, C<sub>6</sub>H<sub>6</sub>.*N-Bromo*: m.p. 130–3°. Sol. Et<sub>2</sub>O, AcOH.*N-Benzoyl*: see Dibenzamide.*N-Dibenzoyl*: see Tribenzamide.Fischer, *Dilthey, Ber.*, 1902, 35, 855.I.G., D.R.P., 584,142, (*Chem. Abstracts*, 1934, 28, 174).Kao, Ma, *J. Chem. Soc.*, 1930, 2788.**Benzamidine**C<sub>7</sub>H<sub>8</sub>N<sub>2</sub> MW, 120Cryst. M.p. 75–80°. Sol. H<sub>2</sub>O, EtOH. Spar. sol. Et<sub>2</sub>O.*B, HCl, 2H<sub>2</sub>O*: m.p. 72°, anhyd. 169°.*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 209–10° decomp.*B, CH<sub>3</sub>·COOH*: m.p. 229° decomp.*B, CH<sub>2</sub>Cl·COOH*: m.p. 185° decomp.*B, CHCl<sub>2</sub>·COOH*: m.p. 194° decomp.*B, CCl<sub>3</sub>·COOH*: m.p. 127° decomp.*B, C<sub>6</sub>H<sub>5</sub>·COOH*: m.p. 230° decomp.*Salicylate*: m.p. 202°.*Picrate*: orange. M.p. 230°.*Toluene-p-sulphonate*: m.p. 195°.Crayen, *Ber.*, 1891, 24, 386.Partridge, Short, *J. Chem. Soc.*, 1947, 390.**Benzamidoxime**C<sub>7</sub>H<sub>8</sub>ON<sub>2</sub> MW, 136M.p. 80°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. HNO<sub>2</sub> → benzamide.*O-Acetyl*: m.p. 96°.*O-Benzoyl*: m.p. 140°.Krüg, *Ber.*, 1885, 18, 1053.**Benzanilide** (*Benzoylaniline*)C<sub>13</sub>H<sub>11</sub>ON MW, 197Leaflets. M.p. 163°. B.p. 117–9°/10 mm. Distils undecomp. Spar. sol. Et<sub>2</sub>O. Sol. 24.5 parts EtOH at 30°. PCl<sub>5</sub> → chloroimide, C<sub>6</sub>H<sub>5</sub>CCl<sub>2</sub>N·C<sub>6</sub>H<sub>5</sub>, m.p. 39–40°, b.p. 310°.*N-Chloro*: colourless cryst. M.p. 78–80°. Sol. EtOH, Et<sub>2</sub>O, ligroin.



N-Bromo: yellowish cryst. M.p. 99°. Sol.  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ .

Schmidt, B.P., 252, 460, (*Chem. Abstracts*, 1927, 21, 2273).

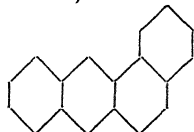
I.G., D.R.P., 633,083, (*Chem. Abstracts*, 1936, 30, 7582).

Webb, *Organic Syntheses*, Collective Vol. I, 75.

### Benzanisidide.

See under Hydroxybenzanilide.

**1 : 2-Benzanthracene** (*Naphthanthracene*, 2 : 3-benzphenanthrene)



$\text{C}_{18}\text{H}_{12}$  MW, 228

Leaflets from EtOH-AcOH. M.p. 158-9° (141°). Sublimes. Sols. fluor. intense yellowish-green.

*Picrate*: red needles. M.p. 133°.

Barnett, Matthews, *Chem. News*, 1925, 130, 339, (*Chem. Zentr.*, 1925, II, 562).

Gabriel, Colman, *Ber.*, 1900, 33, 447.

Graebe, *Ann.*, 1905, 340, 258.

**2 : 3-Benzanthracene** (*Naphthacene*)



$\text{C}_{18}\text{H}_{12}$  MW, 228

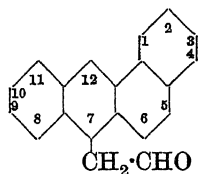
Orange-red leaflets from xylene. M.p. 341° (335-6°, 331°). Sublimes. Sol. conc.  $\text{H}_2\text{SO}_4$  with greenish col. Insol.  $\text{C}_6\text{H}_6$ .

Clar, *Ber.*, 1932, 65, 517.

Dziewoński, Ritt, *Chem. Abstracts*, 1928, 22, 2561.

Deichler, Weizmann, *Ber.*, 1903, 36, 552.

**1' : 2'-Benzanthracene-7-acetaldehyde**



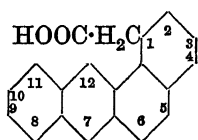
$\text{C}_{20}\text{H}_{14}\text{O}$  MW, 270

Colourless needles from EtOH. M.p. 150-1°. No growth-inhibitory activity.

sym.-*Trinitrobenzene add. comp*: vermilion needles from EtOH. M.p. 149-50°.

Badger, Cook, *J. Chem. Soc.*, 1940, 409.

**1' : 2'-Benzanthracene-1-acetic Acid**



$\text{C}_{20}\text{H}_{14}\text{O}_2$  MW, 286

Leaflets from  $\text{C}_6\text{H}_6$ -pet. ether. M.p. 203-6-204-6° corr.

Fieser, Heymann, *J. Am. Chem. Soc.*, 1941, 63, 2333.

**1' : 2'-Benzanthracene-7-acetic Acid.**

Needles from AcOH.Aq. M.p. 270-4°. No growth-inhibitory activity. *Na salt*: sol. hot  $\text{H}_2\text{O}$ .

*Et ester*: m.p. 85°.

Dansi, Ferri, *Gazz. chim. ital.*, 1939, 69, 195.

Badger, Cook, *J. Chem. Soc.*, 1940, 409.

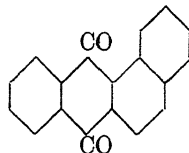
**1' : 2'-Benzanthracene-8-acetic Acid.**

Needles from  $\text{Me}_2\text{CO}-\text{C}_6\text{H}_6$ . M.p. 232-3°.

*Me ester*: m.p. 116°.

Bachmann, *J. Org. Chem.*, 1938, 3, 434.

**1 : 2-Benzanthraquinone** (*Naphthanthraquinone*)



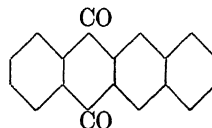
$\text{C}_{18}\text{H}_{10}\text{O}_2$  MW, 258

Yellow prisms from AcOH. M.p. 169°. Very sol.  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ , toluene. Sol.  $\text{Me}_2\text{CO}$ , AcOH. Spar. sol. EtOH,  $\text{Et}_2\text{O}$ . Sol. conc.  $\text{H}_2\text{SO}_4$  with olive-green col.  $\text{KMnO}_4 \rightarrow$  anthraquinone-1 : 2-dicarboxylic acid.

Heller, Schülke, *Ber.*, 1908, 41, 3633.

Groggins, Newton, *Ind. Eng. Chem.*, 1930, 22, 159.

**2 : 3-Benzanthraquinone** (*Naphthacene-quinone*)



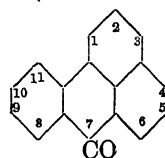
$\text{C}_{18}\text{H}_{10}\text{O}_2$  MW, 258

Yellow needles from  $\text{PhNO}_2$ . M.p. 294° (284-5° from AcOH). Sublimes. Sol. conc.  $\text{H}_2\text{SO}_4$  with reddish-violet col. Spar. sol. hot  $\text{Me}_2\text{CO}$ , hot  $\text{C}_6\text{H}_6$ . Very spar. sol. AcOH.

Fieser, *J. Am. Chem. Soc.*, 1931, 53, 2336.

Waldmann, Mathiowetz, *Ber.*, 1931, 64, 1713.

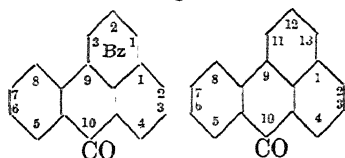
**Benanthrone** (*Mesobenzanthrone*)



$\text{C}_{17}\text{H}_{10}\text{O}$  MW, 230

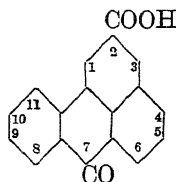
Yellow needles from xylene or EtOH. M.p. 170°. Sol. conc.  $H_2SO_4$  to orange-red sol. with olive-green fluor. Alk.  $Na_2S_2O_4 \rightarrow$  dihydrobenzanthrone. Alk. fusion  $\rightarrow$  dibenzanthrone (violanthrone).

*Note.*—The following systems of numbering of the benzanthrone ring are also in use :



Caswell, Marshall, U.S.P., 1,626,392, (*Chem. Abstracts*, 1927, 21, 1992).  
Scholl, *Ann.*, 1912, 394, 143.  
I.G., D.R.P., 596,592, (*Chem. Abstracts*, 1934, 23, 5082).

### Benzanthrone-2-carboxylic Acid



$C_{18}H_{10}O_3$  MW, 274  
Yellow needles from  $PhNO_2$ . M.p. 347° (341–2°).  
*Et ester* : yellow needles from EtOH. M.p. 172–3°.

*Amide* :  $C_{18}H_{11}O_2N$ . MW, 273. Cryst. from  $PhNO_2$ . M.p. 306°.

Heilbron, Heslop, Irving, *J. Chem. Soc.*, 1936, 785.

Schaarschmidt, *Ber.*, 1917, 50, 300.

### Benzanthrone-3-carboxylic Acid.

Yellow needles from  $PhNO_2$ . M.p. about 335°. Sol. conc.  $H_2SO_4$  with golden-yellow col. and yellow fluor.

Kränzlein, Vollmann, U.S.P., 1,740,771, (*Chem. Zentr.*, 1903, I, 1539).

I.G., Swiss P., 136,237, (*Chem. Zentr.*, 1930, II, 2698.)

### Benzanthrone-4-carboxylic Acid.

Orange-red cryst. from  $PhNO_2$ . M.p. 307–8°. Sol. conc.  $H_2SO_4$  with red col. Alk.  $\rightarrow$  yellow sol. with green fluor.

I.G., Swiss P., 130,696, (*Chem. Zentr.*, 1929, II, 218).

### Benzanthrone-11-carboxylic Acid.

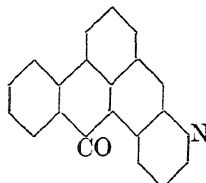
Orange-yellow leaflets from EtOH. M.p. 273°. Sol. conc.  $H_2SO_4$  with blood-red col. Dil. alk.  $\rightarrow$  yellow sol. with brilliant yellowish-green fluor. Quinoline + Cu bronze  $\rightarrow$  benzanthrone.

*Me ester* :  $C_{19}H_{12}O_3$ . MW, 288. Yellow

needles from EtOH. M.p. 159–60°. Conc.  $H_2SO_4 \rightarrow$  orange sol. with yellow fluor.

Rule, Pursell, Barnett, *J. Chem. Soc.*, 1935, 572, 573.

### Benzanthronequinoline



$C_{20}H_{11}ON$  MW, 281

Yellow needles from toluene. M.p. 251°.

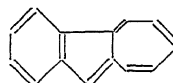
Bally, *Ber.*, 1905, 38, 194.

Badische, D.R.P., 171,939, (*Chem. Zentr.*, 1906, II, 573).

### Benzazimidol.

*See* 1-Hydroxybenztriazole.

### 1:2-Benzazulene (*Benz-[a]-azulene*)



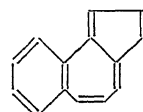
$C_{14}H_{10}$  MW, 178

Blue cryst. from EtOH. M.p. 176°. (Dark green leaflets from light petroleum. M.p. 225°.) Sublimes readily. Shows light absorption at 696–682, 632–613 and 569–556  $\mu$ .

Plattner, Furst, Chopin, Winteler, *Helv. Chim. Acta*, 1948, 31, 502.

Trieb, *Ber.*, 1948, 81, 38.

### 4:5-Benzazulene (*Benz-[e]-azulene*)



$C_{14}H_{10}$  MW, 178

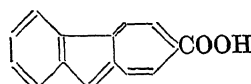
Viscous pale blue oil. Unstable  $\rightarrow$  green polymer.

1:3:5-*Trinitrobenzene add. comp.* : brown needles. M.p. 160–1°.

2:4:6-*Trinitrotoluene add. comp.* : brownish-black needles from EtOH. M.p. 120°.

Nunn, Rapson, *J. Chem. Soc.*, 1949, 1051.

### 1:2-Benzazulene-7-carboxylic Acid

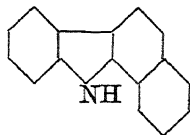


$C_{15}H_{10}O_2$  MW, 222

Spar. sol.  $Et_2O$ .

*Et ester* :  $C_{17}H_{14}O_2$ . MW, 250. Dark green leaflets. M.p. 176°.

Trieb, *Ber.*, 1948, 81, 38.

1 : 2-Benzcarbazole ( $\alpha$ -Benzocarbazole) $C_{16}H_{11}N$ 

MW, 217

Leaflets from EtOH. M.p. 228°. Spar. sol. EtOH, AcOH. Insol. pet. ether. Sol. conc.  $H_2SO_4$  with yellow col. Anhyd. oxalic acid  $\rightarrow$  blue col.

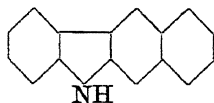
*Picrate*: red needles from EtOH. M.p. 185-6°.

*N-Acetyl*: needles from EtOH. M.p. 289-90°.

Borsche, *Ann.*, 1908, 359, 79.

Bucherer, Sonnenburg, *J. prakt. Chem.*, 1910, 81, 19.

Ghigi, *Gazz. chim. ital.*, 1931, 61, 45.

2 : 3-Benzcarbazole ( $\beta$ -Benzocarbazole) $C_{16}H_{11}N$ 

MW, 217

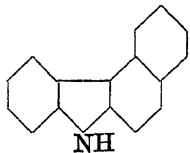
Leaflets from toluene. M.p. 332°. B.p. 440-50°. Sublimes. Spar. sol. EtOH, AcOH,  $C_6H_6$ . Sols. show intense blue fluor. Sol. conc.  $H_2SO_4$  with yellow col.

*N-Acetyl*: two forms from EtOH. (a) M.p. 117°. (b) M.p. 121°. Interconvertible by cryst. Sols. show blue fluor.

*N-Nitroso*: reddish prisms from  $Et_2O$ . M.p. 240°.

Graebe, Knecht, *Ann.*, 1880, 202, 16.

Bucherer, Sonnenburg, *J. prakt. Chem.*, 1910, 81, 29.

3 : 4-Benzcarbazole ( $\gamma$ -Benzocarbazole) $C_{16}H_{11}N$ 

MW, 217

Needles or leaflets from EtOH.Aq. M.p. 135°. B.p. 447°/741 mm. Sol. EtOH, AcOH,  $C_6H_6$ . Spar. sol.  $Et_2O$ , ligroin. Sols. slow blue fluor. Sol. conc.  $H_2SO_4$  with yellowish-brown col.

*N-Acetyl*: leaflets from EtOH. M.p. 144° (149°).

*N-Benzoyl*: needles from AcOH. M.p. 191°.

*N-Nitroso*: yellow needles from ligroin. M.p. 144-5° decomp. (rapid heat.).

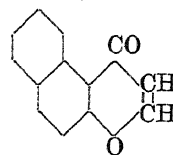
*Picrate*: red needles from  $C_6H_6$ . M.p. 174-5° decomp.

Bucherer, Sonnenburg, *J. prakt. Chem.*, 1910, 81, 27.

Ullmann, *Ann.*, 1904, 332, 101.

Fuchs, Nizel, *Ber.*, 1927, 60, 213.

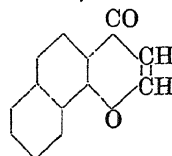
Dict. of Org. Comp.—I.

5 : 6-Benzchromone ( $\beta$  :  $\alpha$ -Naphthapyrone, " $\beta$ -naphthochromone") $C_{13}H_8O_2$ 

MW, 196

Stout pale yellow needles from pet. ether. M.p. 103°. Sol. EtOH,  $C_6H_6$ , AcOH. Spar. sol. cold pet. ether. The colourless sol. in boiling AcOH + 1 drop conc.  $H_2SO_4$   $\rightarrow$  blue fluor.

Menon, Venkataraman, *J. Chem. Soc.*, 1931, 2593.

7 : 8-Benzchromone ( $\alpha$  :  $\beta$ -Naphthapyrone, " $\alpha$ -naphthochromone") $C_{13}H_8O_2$ 

MW, 196

Needles from EtOH.Aq. M.p. 125°. Yellow sol. in conc.  $H_2SO_4$   $\rightarrow$  intense bluish-green fluor.

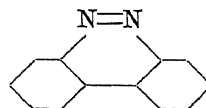
*Semicarbazone*: m.p. 256° decomp.

Pfeiffer, Grimmer, *Ber.*, 1917, 50, 922.

## Benzchrysenone.

See Dibenzphenanthrene.

## Benzcinnoline (o-Diphenyleneazine)

 $C_{12}H_8N_2$ 

MW, 180

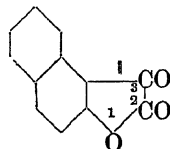
Yellow needles from EtOH.Aq. M.p. 156° (241-3°). Distills above 360°. Very sol. AcOH,  $CHCl_3$ . Sol.  $Et_2O$ , EtOH,  $C_6H_6$ . Spar. sol.  $H_2O$ , pet. ether.

*Picrate*: brown needles. M.p. 194°.

Traube, *Ber.*, 1891, 24, 3081.

Sandin, Cairns, *J. Am. Chem. Soc.*, 1936, 58, 2019.

Slack, Slack, *Nature*, 1947, 160, 437.

4 : 5-Benzcoumarandione ( $\beta$ -Naphthofurandione) $C_{12}H_6O_3$ 

MW, 198

16

Orange-yellow needles from AcOH or  $C_6H_6$ . M.p.  $182^\circ$  decomp. Sol. EtOH. Spar. sol.  $H_2O$ , pet. ether. The blood-red sol. in conc.  $H_2SO_4$  turns colourless on warming.

2-Anil : m.p.  $126-7^\circ$ .

2 : 3-Phenazine : m.p.  $286-7^\circ$ .

3-Semicarbazone : m.p.  $240-1^\circ$ .

3-Phenylhydrazone : m.p.  $226-7^\circ$ .

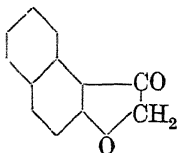
Picrate : m.p.  $109^\circ$ .

Giua, Franciscis, *Gazz. chim. ital.*, 1924, **54**, 509.

Passerini, *ibid.*, 184.

Staudinger, Swiss P.s., 92,688, 93,486, (*Chem. Abstracts*, 1924, **18**, 989).

4 : 5 - Benzcoumaranone - 3 ( $\beta$  - Naphtha-furanone-3)



$C_{12}H_8O_2$

MW, 184

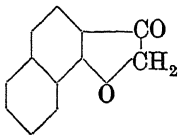
Colourless needles from pet. ether, EtOH, or AcOH. M.p.  $133^\circ$ . Sol.  $Et_2O$ ,  $C_6H_6$ . Sol. conc.  $H_2SO_4$  with pale yellow col. Sol. alc. NaOH with bluish-red col.  $HNO_3 \rightarrow$  2-nitro deriv., m.p.  $190^\circ$  decomp.

2-p-Nitrobenzylidene : m.p.  $270^\circ$ .

Dziewoński, Duzyk, *Chem. Abstracts*, 1934, **28**, 4415.

Fries, Frellstedt, *Ber.*, 1921, **54**, 715.

6 : 7 - Benzcoumaranone - 3 ( $\alpha$  - Naphtha-furanone-3)



$C_{12}H_8O_2$

MW, 184

Pale yellow needles. M.p.  $119^\circ$ . Yellow sol. in conc.  $H_2SO_4 \rightarrow$  green fluor. Fehling's  $\rightarrow$  deep purple col.

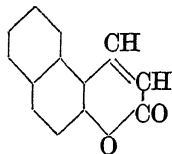
2-Benzylidene : m.p.  $130^\circ$ .

Ingham, Stephen, Timpe, *J. Chem. Soc.*, 1931, 895.

3 : 4-Benzcoumarin.

See under 2'-Hydroxydiphenyl-2-carboxylic Acid.

5 : 6-Benzcoumarin ( $\alpha$  :  $\beta$ -Naphthacoumarin)



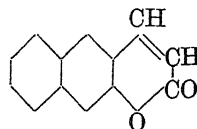
$C_{13}H_8O_2$

MW, 196

Bright yellow needles from EtOH.Aq. M.p.  $118^\circ$ . Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ , AcOH. Spar. sol. hot  $H_2O \rightarrow$  bluish fluor.

Dey, Rao, Sankaranarayanan, *J. Indian Chem. Soc.*, 1932, **9**, 71.

6 : 7-Benzcoumarin ( $\beta$  :  $\beta$ -Naphthacoumarin)



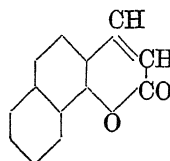
$C_{13}H_8O_2$

MW, 196

Pale yellowish cryst. from  $CHCl_3$ -pet. ether. M.p.  $163-4^\circ$ .

Boehm, Profft, *Arch. Pharm.*, 1931, **269**, 25, (*Chem. Zentr.*, 1931, I, 1922).

7 : 8-Benzcoumarin ( $\beta$  :  $\alpha$ -Naphthacoumarin)



$C_{13}H_8O_2$

MW, 196

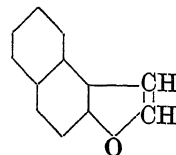
Pale yellow needles from EtOH. M.p.  $141-2^\circ$  ( $138^\circ$ ). Sol.  $Me_2CO$ ,  $CHCl_3$ ,  $C_6H_6$ , AcOH. Spar. sol.  $Et_2O$ . Insol.  $H_2O$ . Greenish-yellow sol. in conc.  $H_2SO_4 \rightarrow$  blue fluor.

Dey, Rao, Sankaranarayanan, *J. Indian Chem. Soc.*, 1932, **9**, 71.

Bezdzik, Friedländer, *Monatsh.*, 1909, **30**, 280.

Boehm, Profft, *Arch. Pharm.*, 1931, **269**, 25, (*Chem. Zentr.*, 1931, I, 1922).

4 : 5-Benzcoumarone ( $\beta$ -Naphthafuran)



$C_{12}H_8O$

MW, 168

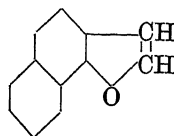
Needles. M.p.  $60-1^\circ$  ( $65^\circ$ ). B.p.  $284-6^\circ$  ( $280^\circ$ ). Sol. conc.  $H_2SO_4 \rightarrow$  yellowish-green col., on warming  $\rightarrow$  pale violet  $\rightarrow$  dirty bluish-green  $\rightarrow$  brownish-violet fluor.

Picrate : red needles. M.p.  $141^\circ$ .

Stoermer, *Ann.*, 1900, **312**, 310.

Boes, *Chem. Zentr.*, 1902, I, 1356.

6 : 7-Benzcoumarone ( $\alpha$ -Naphthafuran)



$C_{12}H_8O$

MW, 168:

Pale yellow oil. M.p.  $-7^{\circ}$ . B.p.  $282-4^{\circ}/755$  mm.  $D_4^{14}$  1.1504.  $n_D^{25}$  1.634. Sol. conc.  $H_2SO_4 \rightarrow$  yellowish-green col., on warming  $\rightarrow$  blue  $\rightarrow$  violet fluor.

*Picrate*: reddish-yellow needles. M.p.  $113^{\circ}$ .

Stoermer, *Ann.*, 1900, 312, 310.

Boes, *Chem. Zentr.*, 1902, 1, 1356.

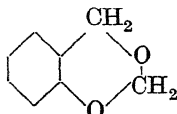
### Benzdiazole.

See Indazole.

### Benzdiketohydrindene.

See  $\alpha$ :  $\beta$ -Naphthindandione.

### 1:3-Benzdioxan (*Sativin methylene ether*)



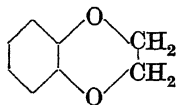
$C_8H_8O_2$  MW, 136

M.p.  $12.5^{\circ}$ . B.p.  $210-11^{\circ}/754$  mm.,  $161-2^{\circ}/225$  mm.,  $100.5-1.5^{\circ}/20$  mm.  $D_4^{20}$  1.174.  $n_D^{20}$  1.5478. Very sol. most org. solvents. Insol.  $H_2O$ .

Chattaway, Irving, *J. Chem. Soc.*, 1931, 2492.

Baker, *J. Chem. Soc.*, 1931, 1770.

### 1:4-Benzdioxan (1:2-Ethylenedioxybenzene, catechol ethylene ether)



$C_8H_8O_2$  MW, 136

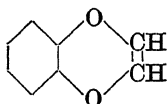
B.p.  $212-14^{\circ}/757$  mm.  $D_4^{20}$  1.180,  $D_{20}^{20}$  1.1831. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Insol. H<sub>2</sub>O.

Vorländer, *Ann.*, 1894, 280, 205.

Ghosh, *J. Chem. Soc.*, 1915, 107, 1591.

Favorski, *J. Russ. Phys. Chem. Soc.*, 1906, 38, 741.

### 1:4-Benzdioxin



$C_8H_6O_2$  MW, 134

M.p.  $-20^{\circ}$  to  $-10^{\circ}$ . B.p.  $193^{\circ}/760$  mm.,  $76^{\circ}/13$  mm.  $D_0^0$  1.204.

Moureu, *Compt. rend.*, 1899, 128, 559;

*Bull. soc. chim.*, 1899, [3], 21, 295.

Becker, Bothell, *Monatsh.*, 1947, 77, 80.

### Benzdioxole.

See under Catechol.

### Benzedrine.

See 2-Phenylisopropylamine.

### Benzene (*Benzol*, *cyclohexatriene*)



$C_6H_6$

MW, 78

Colourless cryst. and liq. M.p.  $5.525^{\circ}$ . B.p.  $80.08^{\circ}$  ( $80.103^{\circ}$ ,  $80.12^{\circ}$ ,  $80.36^{\circ}$ ,  $80.49^{\circ}$ )/ $760$  mm.,  $77.8^{\circ}/700$  mm.,  $73.1^{\circ}/600$  mm.,  $65^{\circ}/463$  mm.,  $60^{\circ}/394$  mm.,  $50^{\circ}/273$  mm.,  $40^{\circ}/184$  mm.,  $30^{\circ}/122$  mm.,  $20^{\circ}/76$  mm.,  $10^{\circ}/46$  mm.,  $0^{\circ}/26$  mm. 100 vols.  $H_2O$  dissolve 0.082 vol. at  $22^{\circ}$ . Misc. with EtOH, Et<sub>2</sub>O, CS<sub>2</sub>, AcOH, Me<sub>2</sub>CO, toluene, etc. Benzene dissolves 0.265%  $H_2O$  at  $70^{\circ}$ , 0.054% at  $15^{\circ}$ .  $D_4^0$  0.8941,  $D_4^{25}$  0.8787,  $D_4^{20}$  0.87896.  $n_D^{20}$  1.50141 (1.50110, 1.50108). Sp. heat 0.397 at  $0^{\circ}$ , 0.4369 at  $70^{\circ}$ . Heat of comb. C<sub>r</sub> 781.4 (783.4) Cal., C<sub>p</sub> 782.3 (784.3) Cal. Latent heat of fusion 30.1 cal./gram. Latent heat of vap. 105.9 at  $10^{\circ}$ , 94.61 at  $80^{\circ}$ . Mol. f.p. depression 50. Mol. b.p. elevation 26.

For bibliography see *Reports of the National Benzole Association*, 1923 onwards.

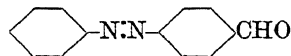
Ingold, *Proc. Roy. Soc.*, 1938, 169A, 149.

Rybicka, Wynne-Jones, *J. Chem. Soc.*, 1950, 3671.

### Benzeneazoanisole.

See under Hydroxyazobenzene.

### p-Benzeneazobenzaldehyde (4-Aldehydeazobenzene)



$C_{13}H_{10}ON_2$  MW, 210

Reddish-brown leaflets. M.p.  $120-1^{\circ}$ . Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Sublimes.

*Oxime*: m.p.  $143^{\circ}$ .

*Phenylhydrazone*: m.p.  $165-6^{\circ}$ .

*Anil*: orange needles from ligroin. M.p.  $125-30^{\circ}$ .

Freundler, *Compt. rend.*, 1902, 134, 1359.

### Benzeneazobenzoic Acid.

See Azobenzene-carboxylic Acid.

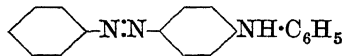
### Benzeneazocatechol.

See 3:4-Dihydroxyazobenzene.

### Benzeneazocresol.

See Hydroxy-methyl-azobenzene.

### Benzeneazodiphenylamine (p-Anilinoazobenzene)



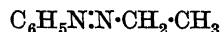
$C_{18}H_{15}N_3$  MW, 273

Golden-yellow leaflets. M.p.  $82^{\circ}$ . Sol. EtOH, Et<sub>2</sub>O, ligroin. HCl added to EtOH sol. pptes. grey hydrochloride. Zn + HCl  $\rightarrow$  p-aminodiphenylamine.

*Nitroso deriv.*: m.p.  $119.5^{\circ}$ . Sol. C<sub>6</sub>H<sub>6</sub>, AcOH.

Witt, *Ber.*, 1879, 12, 259.

### Benzeneazoethane



$C_8H_{10}N_2$  MW, 134

Yellow oil. B.p.  $175-85^{\circ}/760$  mm.,  $88-93^{\circ}/20-25$  mm. Volatile in steam. Sol. EtOH,

$\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ , conc. acid. Spar. sol.  $\text{H}_2\text{O}$ .  $D_4^{21}$  0.9628.  $n_D^{21}$  1.53133. Stand with 60%  $\text{H}_2\text{SO}_4$  or heat with  $\text{NaOEt}$   $\rightarrow$  acetaldehyde phenylhydrazone. Warm dil. acids  $\rightarrow$   $\text{C}_6\text{H}_5\text{NH}\cdot\text{NH}_2$  +  $\text{CH}_3\cdot\text{CHO}$ .

Fischer, Ehrhard, *Ann.*, 1879, 199, 326.

Fischer, *Ber.*, 1896, 29, 794.

Bamberger, Pemsel, *Ber.*, 1903, 36, 56.

### Benzeneazohydroquinone.

See 2 : 5-Dihydroxyazobenzene.

### Benzeneazomethane



$\text{C}_7\text{H}_8\text{N}_2$  MW, 120

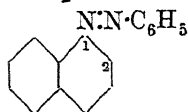
Yellow oil. B.p. 150°/760 mm. Very volatile in steam.

Tafel, *Ber.*, 1885, 18, 1742.

Baly, Tuck, *J. Chem. Soc.*, 1906, 89, 986.

Stobbe, Nowack, *Ber.*, 1914, 47, 578.

### 1-Benzeneazonaphthalene



$\text{C}_{16}\text{H}_{12}\text{N}_2$  MW, 232

Red leaflets. M.p. 70°. Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ , ligroin.

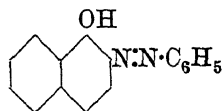
Michaelis, Petow, *Ber.*, 1898, 31, 995.

### 2-Benzeneazonaphthalene.

M.p. 131°.

Pascal, Normand, *Bull. soc. chim.*, 1913, 13, 884.

### 2-Benzeneazo-1-naphthol (1 : 2-Naphthoquinone 2-phenylhydrazone)



$\text{C}_{16}\text{H}_{12}\text{ON}_2$  MW, 248

Dark orange-red needles. M.p. 138°. Sol. hot  $\text{EtOH}$ , hot  $\text{AcOH}$ . Sublimes. Sol.  $\text{H}_2\text{SO}_4$  to reddish-violet sol.

*Me ether*:  $\text{C}_{17}\text{H}_{14}\text{ON}_2$ . MW, 262. Orange leaflets from  $\text{EtOH}$ . M.p. 102-3°. Conc.  $\text{H}_2\text{SO}_4$   $\rightarrow$  ruby-red col.

*Et ether*:  $\text{C}_{18}\text{H}_{16}\text{ON}_2$ . MW, 276. Red needles from  $\text{EtOH}$ . M.p. 46°. Conc.  $\text{H}_2\text{SO}_4$   $\rightarrow$  red col.

*Acetyl*: m.p. 120-1°.

*Benzoyl*: yellow needles from  $\text{C}_6\text{H}_6$ -ligroin. M.p. 191°.

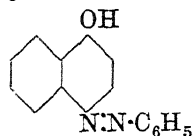
Charrier, Ferreri, *Gazz. chim. ital.*, 1914, 44, II, 232.

Charrier, Casale, *Gazz. chim. ital.*, 1914, 44, I, 607.

Auwers, *Ber.*, 1907, 40, 2157.

Zincke, Bindewald, *Ber.*, 1884, 17, 3030.

### 4-Benzeneazo-1-naphthol (1 : 4-Naphthoquinone phenylhydrazone)



$\text{C}_{16}\text{H}_{12}\text{ON}_2$  MW, 248

Brownish-violet cryst. M.p. 206° decomp. Sol. hot  $\text{AcOH}$ , alkalis. Mod. sol. hot  $\text{EtOH}$ , hot  $\text{C}_6\text{H}_6$ . Sol. conc.  $\text{H}_2\text{SO}_4$  to bluish-violet sol.

*Me ether*:  $\text{C}_{17}\text{H}_{14}\text{ON}_2$ . MW, 262. Brown needles. M.p. 83°.

*Et ether*:  $\text{C}_{18}\text{H}_{16}\text{ON}_2$ . MW, 276. Brown needles. M.p. 99-100°.

*Benzyl ether*:  $\text{C}_{23}\text{H}_{18}\text{ON}_2$ . MW, 339. M.p. 102°.

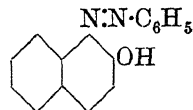
*Acetyl*: m.p. 128°.

*Benzoyl*: m.p. 121°.

Witt, Dedichen, *Ber.*, 1897, 30, 2657.

McPherson, *Am. Chem. J.*, 1899, 22, 376.

### 1-Benzeneazo-2-naphthol (1 : 2-Naphthoquinone 1-phenylhydrazone)



$\text{C}_{16}\text{H}_{12}\text{ON}_2$  MW, 248

Dark reddish-yellow leaflets. M.p. 134°. Sol.  $\text{Et}_2\text{O}$ ,  $\text{CS}_2$ ,  $\text{C}_6\text{H}_6$ , ligroin, conc.  $\text{HCl}$ . Reddish-violet in conc.  $\text{H}_2\text{SO}_4$ .

*Me ether*:  $\text{C}_{17}\text{H}_{14}\text{ON}_2$ . MW, 262. Red plates from  $\text{EtOH}$ . M.p. 62°.

*Et ether*:  $\text{C}_{18}\text{H}_{16}\text{ON}_2$ . MW, 276. Red plates from ligroin. M.p. 79°.

*Propyl ether*:  $\text{C}_{19}\text{H}_{18}\text{ON}_2$ . MW, 290. Red leaflets from  $\text{EtOH}$ . M.p. 40-1°.

*Isopropyl ether*: red leaflets from  $\text{EtOH}$ . M.p. 70°.

*Acetyl*: m.p. 117°.

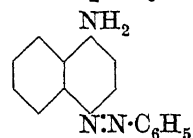
*Benzoyl*: m.p. 125°.

*Cu deriv.*: brown cryst. M.p. 288°.

Bamberger, *Ber.*, 1920, 53, 2319

Charrier, *Gazz. chim. ital.*, 1916, 46, I, 407.

### 4-Benzeneazo-1-naphthylamine



$\text{C}_{16}\text{H}_{13}\text{N}_3$  MW, 247

Reddish-violet cryst. M.p. 123°.

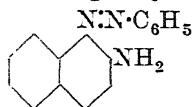
*B, HCl*: m.p. 205°.

*B, H2SO4*: m.p. 214-15°.

Thiel, Wulfken, *Z. anorg. allgem. Chem.*, 1924, 136, 393.

Woroshzow, *J. prakt. Chem.*, 1911, 84, 527.

## 1-Benzeneazo-2-naphthylamine

 $C_{16}H_{13}N_3$ 

MW, 247

Red plates. M.p. 102–4°. Sol. EtOH, AcOH.

Blue in conc.  $H_2SO_4$ .

N-Acetyl: red needles. M.p. 153°.

N-Benzoyl: red cryst. from AcOH. M.p. 162–3°.

Cu deriv.: greenish-black cryst. M.p. 174°.

Ni deriv.: green cryst. M.p. 260–5°.

Bamberger, Schiefflin, *Ber.*, 1889, 22, 1376.

## Benzeneazonitrophenol.

See 5-Nitro-2-hydroxyazobenzene and 3-Nitro-4-hydroxyazobenzene.

## Benzeneazonitrosalicylic Acid.

See 5-Nitro-4-hydroxyazobenzene-3-carboxylic Acid.

## Benzeneazonitrotoluene.

See Nitromethylazobenzene.

## Benzeneazophenole.

See under Hydroxyazobenzene.

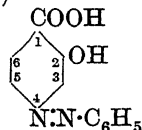
## Benzeneazoresorcinol.

See Hydroxyazobenzene.

## Benzeneazoresorcinol.

See 2:4-Dihydroxyazobenzene.

## 4-Benzeneazosalicylic Acid (3-Hydroxy-4-carboxyazobenzene)

 $C_{13}H_{10}O_3N_2$ 

MW, 242

Nitrile:  $C_{13}H_9ON_3$ . MW, 223. Reddish yellow needles from AcONa. Aq. Me ether: red needles.Finger, Wilner, *J. prakt. Chem.*, 1909, 79, 452.

## 5-Benzeneazosalicylic Acid (4-Hydroxy-3-carboxyazobenzene).

Yellow needles. M.p. 218°. Sol. EtOH,  $Et_2O$ ,  $Me_2CO$ . Spar. sol.  $C_6H_6$ ,  $CHCl_3$ , hot  $CS_2$ .Me ether:  $C_{14}H_{12}O_3N_2$ . MW, 256. Cryst. from EtOH. M.p. 162–5°. Me ester: cryst. from EtOH. M.p. 63–4°.Me ester:  $C_{14}H_{12}O_3N_2$ . MW, 256. Reddish-yellow leaflets. M.p. 108°. Acetyl deriv.: yellow orange needles, m.p. 109°.Et ester:  $C_{15}H_{14}O_3N_2$ . MW, 270. Yellow cryst. M.p. 101°.Phenyl ester:  $C_{19}H_{14}O_3N_2$ . MW, 318. M.p. 121°. Acetyl: m.p. 132°.Amide:  $C_{13}H_{11}O_2N_3$ . MW, 241. M.p. 235° (240°).Anilide:  $C_{19}H_{15}O_2N_3$ . MW, 317. M.p. 188–9°.

Acetyl: orange cryst. from EtOH. M.p. 145°.

Limpricht, *Ann.*, 1891, 263, 224.

## Benzeneazotoluene.

See Methylazobenzene.

## 2-Benzeneazo-m-toluic Acid.

See 6-Methylazobenzene-2-carboxylic Acid.

## Benzeneazo-xylene.

See Dimethylazobenzene.

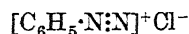
## Benzeneazo-xenol.

See Hydroxydimethylazobenzene.

## Benzene-diacetic Acid.

See Phenylene-diacetic Acid.

## Benzenediazonium chloride (Diazobenzene chloride)

 $C_6H_5N_2Cl$ 

MW, 140.5

Colourless cryst. Sol. EtOH,  $H_2O$ . Insol.  $Et_2O$ ,  $C_6H_6$ , ligroin. Decomp. on standing in moist air. Explosive. Aq. sol. reacts neutral. Strongly dissociated in  $H_2O$ . Hot  $H_2O \rightarrow$  phenol. Hot EtOH  $\rightarrow$  benzene.Hantzsch, Jochem, *Ber.*, 1901, 34, 3338.

## Benzenediazonium nitrate (Diazobenzene nitrate)

 $C_6H_5O_3N_3$ 

MW, 167

Needles. Readily explodes. Sol.  $H_2O$ . Mod. sol. EtOH. Insol.  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ . Strongly dissociated in  $H_2O$ . Hot  $H_2O \rightarrow$  phenol.Bamberger, *Ber.*, 1898, 31, 579.

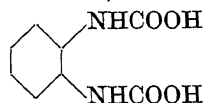
## Benzenediazonium sulphate (Diazobenzene sulphate)

 $C_6H_6O_4N_2S$ 

MW, 202

Colourless prisms. Sol.  $H_2O$ . Insol.  $Et_2O$ . Explodes at about 100°. Strongly dissociated in  $H_2O$ . Hot  $H_2O \rightarrow$  phenol. Hot EtOH  $\rightarrow$  benzene.Knoevenagel, *Ber.*, 1895, 28, 2049.Hodgson, Mahadevan, *J. Chem. Soc.*, 1947, 325.

## o-Benzenedicarbamic Acid (N : N'-Dicarboxy-o-phenylenediamine)

 $C_8H_8O_4N_2$ 

MW, 196

Acid not known in free state.

Di-Et ester: needles from EtOH. M.p. 88°.

Di-phenyl ester: needles. M.p. 189–90°.

Di-benzyl ester: plates. M.p. 107°.

Diamide: needles. M.p. 290°.

Lellmann, *Ber.*, 1883, 16, 592.Snape, *J. Chem. Soc.*, 1886, 259.Ruggli, Dahn, *Helv. Chim. Acta*, 1944, 27, 1116.

***m*-Benzenedicarbamic Acid** (*N*:*N'*-*Di-carboxy-m-phenylenediamine*).

Acid not known in free state.

*Di-Et ester*: plates from ligroin. M.p. 145°.

*Di-phenyl ester*: needles. M.p. 163-5°.

*Di-benzyl ester*: cryst. from MeOH. M.p. 115-16°.

*Di-octadecyl ester*: m.p. 96°.

*Diamide*: melts above 300°.

Davidis, *J. prakt. Chem.*, 1896, 54, 85.

Ruggli, Dahn, *Helv. Chim. Acta*, 1944, 27, 1116.

Warder, *Ber.*, 1867, 8, 1180.

***p*-Benzenedicarbamic Acid** (*N*:*N'*-*Dicarboxy-p-phenylenediamine*).

Acid not known in free state.

*Di-Et ester*: plates. M.p. 196°.

*Di-phenyl ester*: brown leaflets. M.p. 238-9°.

*Di-benzyl ester*: plates. M.p. 222.5-253°.

*Di-octadecyl ester*: m.p. 146°.

*Diamide*: plates. Decomp. without melting.

Davidis, *J. prakt. Chem.*, 1896, 54, 87.

Lellmann, *Ann.*, 1883, 221, 14.

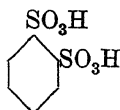
**Benzene-dipropiolic Acid.**

See Phenylene-dipropiolic Acid.

**Benzene-dipropionic Acid.**

See Phenylene-dipropionic Acid.

**Benzene-*o*-disulphonic Acid**



$C_6H_6O_6S_2$  MW, 238

*Dichloride*:  $C_6H_4O_4Cl_2S_2$ . MW, 275. M.p. 143°.

*Mono-amide*: *Et ester*,  $C_8H_{11}O_5NS_2$ . MW, 265. M.p. 190°.

*Diamide*:  $C_6H_4 \langle SO_2 \rangle N \cdot NH_4$ . Imide  $NH_4$  salt.  $C_6H_8O_4N_2S_2$ . MW, 236. M.p. 254°.

*Dianilide*: m.p. 241°.

*Anhydride*:  $C_6H_4O_5S_2$ . MW, 220. M.p. 180°.

*Imide*:  $C_6H_5O_4NS_2$ . MW, 219. M.p. 186° (192°).

*Phenylimide*:  $C_{12}H_9O_4NS_2$ . MW, 295. M.p. 195°.

Hurtley, Smiles, *J. Chem. Soc.*, 1926, 1821.

**Benzene-*m*-disulphonic Acid.**

Very deliquescent cryst. +  $2\frac{1}{2}H_2O$ . Alkali fusion  $\rightarrow$  resorcinol. Na salt cryst. with  $4H_2O$ .

*Dichloride*:  $C_6H_4O_4Cl_2S_2$ . MW, 275. Prisms. M.p. 63°. B.p.  $211^\circ/20$  mm.

*Difluoride*:  $C_6H_4O_4F_2S_2$ . MW, 242. M.p. 38-9°.

*Diamide*:  $C_6H_8O_4N_2S_2$ . MW, 236. Needles. M.p. 229°.

Heinzelmann, *Ann.*, 1877, 188, 159.

Soc. des usines chimiques Rhône-Poulenc, U.S.P., 1,956,571, (*Chem. Abstracts*, 1934, 28, 4071).

Voluinkin, *Chem. Abstracts*, 1936, 30, 7555.

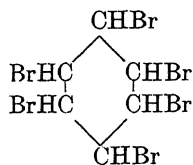
**Benzene-*p*-disulphonic Acid.**

*Dichloride*:  $C_6H_4O_4Cl_2S_2$ . MW, 275. Needles. M.p. 131° (139°).

*Diamide*:  $C_6H_8O_4N_2S_2$ . MW, 236. M.p. 288°.

Drushel, Felty, *Am. J. Sci.*, 1917, 43, 57, (*Chem. Abstracts*, 1917, 11, 581).

**Benzene hexabromide** (*Hexabromocyclohexane*)



$C_6H_6Br_6$  MW, 558

Exists in stereoisomeric forms.

*Trans*-form, ( $\alpha$ ). Prisms. M.p. 212°. Cryst. from xylene. Spar. sol. EtOH, Et<sub>2</sub>O. Alc. KOH  $\rightarrow$  1:2:4-tribromobenzene.

*Cis*-form, ( $\beta$ ). M.p. 253°. Insol. EtOH, Et<sub>2</sub>O.

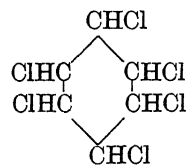
Matthews, *J. Chem. Soc.*, 1898, 73, 243.

Blair, Ledbury, Wheeler, *J. Soc. Chem. Ind.*, 1924, 43, 289r.

**Benzene-hexacarboxylic Acid.**

See Mellitic Acid.

**Benzene hexachloride** (*Hexachlorocyclohexane*)



$C_6H_6Cl_6$  MW, 291

Exists in stereoisomeric forms.

( $\alpha$ ) *Trans*-form. M.p. 157°. B.p. 288° decomp. to 1:2:4-trichlorobenzene. Mod. sol.  $CHCl_3$ ,  $C_6H_6$ . D<sup>20</sup> 1.87. Volatile in steam.

( $\beta$ ) *Cis*-form. M.p. 310° (297°). Spar. sol. cold  $CHCl_3$ , cold  $C_6H_6$ . D<sup>19</sup> 1.89. Sublimes at m.p. Alc. KOH  $\rightarrow$  trichlorobenzene.

( $\gamma$ ) Gammexane. Lindane. Needles. M.p. 112-13°. Powerful insecticide.

( $\delta$ ) Plates. M.p. 129-32°.

van der Linden, *Ber.*, 1912, 45, 231.

Tei, Komatsu, *Mem. Coll. Sci. Kyoto Imp. Univ.*, 1927, 10A, 325.

Slade, *Chemistry and Industry*, 1945, 314.

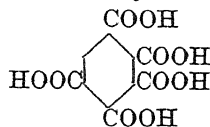
Marrison, *J. Soc. Chem. Ind.*, 1949, 68, 192.

Bastiansen *et al.*, *Research*, 1949, 2, 248.



**Benzenehydrazonaphthalene.**

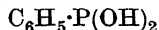
See Phenyl-naphthylhydrazine.

**Benzene-pentacarboxylic Acid** $C_{11}H_6O_{10}$  MW, 298

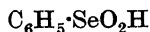
Cryst. +  $5H_2O$ . M.p. 228–30°, anhyd. 238°. Sol.  $H_2O$ , EtOH. Spar. sol.  $Et_2O$ , AcOEt. Insol.  $C_6H_6$ , pet. ether. Heat  $\rightarrow$  di-anhydride. *Penta-Me ester*:  $C_{16}H_{16}O_{10}$ . MW, 368. M.p. 147–8°.

Fleischer, Retze, *Ber.*, 1923, 56, 228.Ruzicka, Rudolph, *Helv. Chim. Acta*, 1927, 10, 919.**Benzenephosphonic Acid** $C_6H_7O_3P$  MW, 158

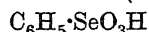
Plates from  $H_2O$ . M.p. 158°. Sol. EtOH,  $Et_2O$ . Insol.  $C_6H_6$ . Heat at 250°  $\rightarrow$   $C_6H_6$  + metaphosphoric acid.

*Di-Me ester*: b.p. 247°.*Di-Et ester*: b.p. 267°, 117–18°/1.5 mm.*Phenyl ester*: m.p. 57°.*Di-phenyl ester*: needles. M.p. 63.5°.*Anhydride*: cryst. from  $C_6H_6$ . M.p. 100°.*Dichloride*: b.p. 258°.  $D_{20}^{20}$  1.375.Michaelis, *Ann.*, 1876, 181, 305; *Ber.*, 1879, 12, 564.Michaelis, Köhler, *Ber.*, 1876, 9, 521.**Benzenephosphonic Acid** $C_6H_7O_2P$  MW, 142

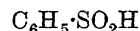
Plates. M.p. about 70°. Very sol. EtOH. Spar. sol.  $Et_2O$ . Oxidised by air. Dist.  $\rightarrow$  phenylphosphine + aniline + metaphosphoric acid.

*Phenylhydrazine salt*: prisms. M.p. 135°.*p-Tolylhydrazine salt*: needles. M.p. 148°.*Di-Me ester*: b.p. 94.5°/13 mm.  $D_0^0$  1.0972.  $D_{20}^{20}$  1.0732.*Di-Et ester*: b.p. 235°.  $D_{16}^{16}$  1.032.*Dipropyl ester*: b.p. 137°/15 mm.  $D_0^0$  1.0123.  $D_{20}^{20}$  0.9925.  $n_D^{20}$  1.4939.*Di-isopropyl ester*: b.p. 121–2°/10 mm.  $D_0^0$  1.0103.  $D_{17}^{17}$  0.9952.  $n_D^{20}$  1.5021.*Dichloride*: b.p. 223°, 140–2°/57 mm.  $D_{20}^{20}$  1.319.  $D_4^4$  1.3428.Köhler, Michaelis, *Ber.*, 1877, 10, 810.Michaelis, Ananow, *Ber.*, 1874, 7, 1688.Arbuzov, Razumov, *Chem. Abstracts*, 1946, 40, 3411.**Benzeneseleninic Acid** (*Phenylseleninic acid*) $C_6H_6O_2Se$  MW, 189

Plates from  $H_2O$ . M.p. 124–5°. Ox.  $\rightarrow$  benzeneselenonic acid. Red.  $\rightarrow$  selenophenol. *Nitrate*: needles. M.p. 112°.

Stoecker, Krafft, *Ber.*, 1906, 39, 2197.Doughty, *Am. Chem. J.*, 1909, 41, 326.Pyman, *J. Chem. Soc.*, 1919, 167.**Benzeneselenonic Acid** (*Phenylselenic acid*) $C_6H_6O_3Se$  MW, 205

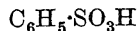
Needles. M.p. 140°. Very sol.  $H_2O$ , EtOH. Insol.  $Et_2O$ ,  $C_6H_6$ . Red.  $\rightarrow$  selenophenol.

*K salt*: +  $2H_2O$ . Sinters about 50°.Stoecker, Krafft, *Ber.*, 1906, 39, 2197.Doughty, *Am. Chem. J.*, 1909, 41, 326.Pyman, *J. Chem. Soc.*, 1919, 167.**Benzenesulphinic Acid** $C_6H_6O_2S$  MW, 142

Prisms. M.p. 83–4°. Decomp. at about 100°. Sol. hot  $H_2O$ , EtOH,  $Et_2O$ ,  $C_6H_6$ . Spar. sol. cold  $H_2O$ .  $FeCl_3$   $\rightarrow$  orange ppt.

*Anhydride*:  $C_{12}H_{10}O_3S_2$ . MW, 266. M.p. 67°. Sol.  $CHCl_3$ , MeOH, EtOH,  $C_6H_6$ ,  $Me_2CO$ , AcOEt.*Chloride*:  $C_6H_5OClS$ . MW, 160.5. Colourless plates. M.p. 38°. Hyd. by  $H_2O$ .*Hydrazine salt*:  $A_2NH_2 \cdot NH_2$ . MW, 316. M.p. 139–41°.*Diethylamine salt*: m.p. 109–10°.*Aniline salt*:  $A \cdot C_6H_5NH_2$ . MW, 235. M.p. 132°.*p-Toluidine salt*:  $A \cdot CH_3 \cdot C_6H_4NH_2$ . MW, 249. M.p. 124–5°.*Amide*:  $C_6H_7ONS$ . MW, 141. M.p. 121°.*Dimethylamide*: b.p. 90°/2–3 mm.*Anilide*: m.p. 112–14°.Knoevenagel, Kenner, *Ber.*, 1908, 41, 3318.Knoll, D.R.P., 171,789, (*Chem. Zentr.*, 1906, II, 469).Braun, Kaiser, *Ber.*, 1923, 56, 549.**Benzene sulphone.**

See Diphenyl sulphone.

**Benzenesulphonic Acid** $C_6H_6O_3S$  MW, 158

Colourless plates +  $1\frac{1}{2}H_2O$ . M.p. 43–4°, anhyd. 65–6° (50–1°). Deliquescent. Very sol.  $H_2O$ , EtOH. Spar. sol.  $C_6H_6$ . Insol.  $Et_2O$ ,  $CS_2$ .  $k = 2 \times 10^{-1}$  at 25°. Hot conc.  $H_2SO_4$   $\rightarrow$  benzene. Alkali fusion  $\rightarrow$  phenol.

*Na salt*: leaflets +  $1H_2O$ . M.p. about 450° decomp. Sol. 1.75 parts  $H_2O$  at 30°.*Phenylhydrazine salt*: m.p. 179°.*Me ester*:  $C_7H_8O_3S$ . MW, 172. B.p. 150°/15 mm.  $D_4^{17}$  1.2730.

*Et ester*:  $C_8H_{10}O_3S$ . MW, 186. B.p.  $156^\circ/15$  mm. Spar. sol.  $H_2O$ .  $D_4^{17}$  1.2192.

*n-Propyl ester*:  $C_9H_{12}O_3S$ . MW, 200. B.p.  $162-3^\circ/15$  mm.  $D_4^{17}$  1.1804.

*Phenyl ester*:  $C_{12}H_{10}O_3S$ . MW, 234. M.p.  $34-5^\circ$ .

*Amide*:  $C_6H_7O_2NS$ . MW, 157. M.p.  $156^\circ$  ( $147-8^\circ$ ). Sol.  $Et_2O$ , hot  $EtOH$ . Spar. sol. cold  $H_2O$ . Forms metallic derivs. (e.g.  $C_6H_5\cdot SO_2\cdot NHNa$ ).

*Anhydride*:  $C_{12}H_{10}O_5S_2$ . MW, 298. M.p.  $92^\circ$ . B.p.  $240^\circ/10$  mm. decomp.

*Chloride*:  $C_6H_5O_2ClS$ . MW, 176.5. M.p.  $14.5^\circ$ . B.p.  $251-2^\circ$ ,  $177^\circ/100$  mm.,  $120^\circ/10$  mm. Insol.  $H_2O$ .  $D_{15}^{15}$  1.3842. Stable to cold  $H_2O$ .  $Zn + H_2SO_4 \rightarrow$  thiophenol.

*Fluoride*: b.p.  $203-4^\circ$ .  $D_4^{20}$  1.3286.

*Anilide*: m.p.  $110^\circ$ .

$A, H_2N\cdot NH\cdot CO\cdot NH_2$ : m.p.  $206^\circ$ .

$A, CH_3\cdot NH_2$ : m.p.  $147^\circ$ .

$A, (CH_3)_2NH$ : m.p.  $110^\circ$ .

$A, (CH_3)_3N$ : m.p.  $89^\circ$ .

$A, C_2H_5\cdot NH_2$ : m.p.  $92^\circ$ .

$A, (C_2H_5)_2NH$ : m.p.  $139^\circ$ .

$A, (C_2H_5)_3N$ : m.p.  $120-1^\circ$ .

Guyot, *Chimie et Industrie*, 1919, 2, 879.  
Hochstetter, *J. Am. Chem. Soc.*, 1898, 20, 549.

Davies, Dick, *J. Chem. Soc.*, 1931, 2104.  
Mazónski, Sucharda, *Chem. Abstracts*, 1935, 29, 6218.

Clarke, Babcock, Murray, *Organic Syntheses*, Collective Vol. I, 77.

### Benzene sulphoxide.

See Diphenyl sulphoxide.

### Benzene-1 : 2 : 3 : 4-tetracarboxylic Acid.

See Prehnitic Acid.

### Benzene-1 : 2 : 3 : 5-tetracarboxylic Acid.

See Mellophanic Acid.

### Benzene-1 : 2 : 4 : 5-tetracarboxylic Acid.

See Pyromellitic Acid.

### Benzenethiosulphonic Acid



$C_6H_6O_2S_2$  MW, 174

Free acid unknown. Aq. sols. decomp.  $\rightarrow$  benzenesulphonic acid + S.

*Ag salt*: benzenesulphonic acid + S.

*Me ester*:  $C_7H_8O_2S_2$ . MW, 188. Liq. B.p.  $123^\circ/1$  mm.

Gibson, *J. Chem. Soc.*, 1932, 1822.

Otto, Troeger, *Ber.*, 1891, 24, 491.

### Benzene-1 : 2 : 3-tricarboxylic Acid.

See Hemimellitic Acid.

### Benzene-1 : 2 : 4-tricarboxylic Acid.

See Trimellitic Acid.

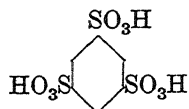
### Benzene-1 : 3 : 5-tricarboxylic Acid.

See Trimesic Acid.

### Benzene triozoneide.

See Ozobenzene.

### Benzene-1 : 3 : 5-trisulphonic Acid



$C_6H_6O_9S_3$  MW, 318

Cryst. +  $3H_2O$ . Decomp. above  $100^\circ$ .

*Tri-Et ester*:  $C_{12}H_{18}O_9S_3$ . MW, 402. Cryst. from  $C_6H_6$ . M.p.  $147^\circ$ .

*Trichloride*:  $C_6H_3O_6Cl_3S_3$ . MW, 373.5. Needles or leaflets. M.p.  $187^\circ$ .  $PCl_5$  at  $200^\circ \rightarrow$  1 : 3 : 5-trichlorobenzene.

*Trifluoride*:  $C_6H_3O_6F_3S_3$ . MW, 324. Cryst. from xylene. M.p.  $179-81^\circ$ .

*Triamide*:  $C_6H_3O_6N_3S_3$ . MW, 315. Needles. M.p.  $310-15^\circ$ .

*Trianilide*: m.p.  $237^\circ$ .

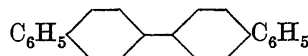
Senhofer, *Ann.*, 1874, 174, 243.

Lamberts, D.R.P., 113,784, (*Chem. Zentr.*, 1900, II, 883).

Behrend, Mertelsmann, *Ann.*, 1911, 378, 361.

Davies, Dick, *J. Chem. Soc.*, 1931, 2108.

### Benzerythrene (pp'-Diphenyldiphenyl, dixenyl, p-quaterphenyl)



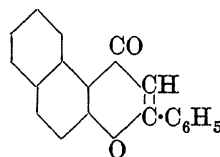
$C_{24}H_{18}$  MW, 306

Leaflets from  $C_6H_6$ . M.p.  $320^\circ$ . B.p.  $428^\circ/18$  mm. Sol. boiling  $PhNO_2$ , aniline. Spar. sol. hot  $AcOH$ . Insol.  $EtOH$ ,  $Et_2O$ ,  $CHCl_3$ , ligroin. Sol. 100 parts boiling  $C_6H_6$ .

Schmidlin, *Ber.*, 1912, 45, 3179.

Bowden, *J. Chem. Soc.*, 1931, 1111.

### 5 : 6-Benzflavone ( $\alpha\beta$ -Naphthaflavone)



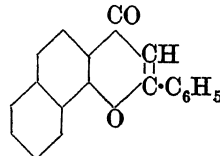
$C_{19}H_{12}O_2$  MW, 272

Needles from  $EtOH$ . M.p.  $164-5^\circ$ . Sol. conc.  $H_2SO_4$  with blue fluor.

Menon, Venkataraman, *J. Chem. Soc.*, 1931, 2594.

Tambor, Plattner, Zäch, *Helv. Chim. Acta*, 1926, 9, 463.

### 7 : 8-Benzflavone ( $\beta\alpha$ -Naphthaflavone)



$C_{19}H_{12}O_2$  MW, 272

Yellow plates from EtOH. M.p. 155° (167°). Pale yellow sol. in conc. H<sub>2</sub>SO<sub>4</sub> shows weak green fluor.

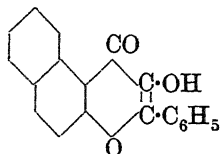
Bhuller, Venkataraman, *J. Chem. Soc.*, 1931, 1165.

Pfeiffer, Grimmer, *Ber.*, 1917, 50, 925.

Ruhemann, *Ber.*, 1914, 47, 120.

Smith, *J. Chem. Soc.*, 1946, 542.

### 5 : 6-Benzflavonol ( $\alpha\beta$ -Naphthaflavonol)

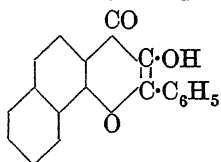


C<sub>19</sub>H<sub>12</sub>O<sub>3</sub> MW, 288

Yellow needles from AcOEt. M.p. 147°. Sol. AcOH. Spar. sol. EtOH. Orange sol. in conc. H<sub>2</sub>SO<sub>4</sub>, on dil. with H<sub>2</sub>O → blue col. with green fluor.

Ingham, Stephen, Timpe, *J. Chem. Soc.*, 1931, 899.

### 7 : 8-Benzflavonol ( $\beta\alpha$ -Naphthaflavonol)



C<sub>19</sub>H<sub>12</sub>O<sub>3</sub> MW, 288

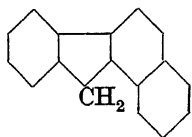
Pale greenish leaflets from EtOH. M.p. 210°. Spar. sol. EtOH, H<sub>2</sub>O. Sol. conc. H<sub>2</sub>SO<sub>4</sub> with yellowish-green col. with green fluor.

*Acetyl*: leaflets from EtOH. M.p. 194-5°.

*Isonitroso deriv.*: m.p. 173-4°.

Woker, *Ber.*, 1906, 39, 1651.

### 1 : 2-Benzfluorene (*Chrysofluorene*)



C<sub>17</sub>H<sub>12</sub> MW, 216

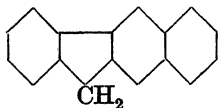
Cryst. from AcOH. M.p. 189-90° (183-4°). B.p. 413° (398-400°). Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, hot C<sub>6</sub>H<sub>6</sub>.

*Picrate*: m.p. 127.5° (124-6°).

Græbe, *Ann.*, 1904, 335, 134.

Cook, Hewett, *J. Chem. Soc.*, 1934, 375, 1737.

### 2 : 3-Benzfluorene



C<sub>17</sub>H<sub>12</sub>

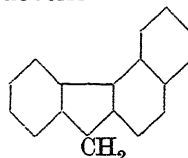
MW, 216

Cryst. from ligroin or AcOH. M.p. 208-9° (204-6°). B.p. 401-2°. Sol. ligroin with greenish fluor.

Koelsch, *J. Am. Chem. Soc.*, 1933, 55, 3887.

Barnett, Goodway, Watson, *Ber.*, 1933, 66, 1891.

### 3 : 4-Benzfluorene



C<sub>17</sub>H<sub>12</sub> MW, 216

Plates from EtOH. M.p. 124-5°.

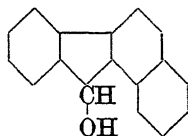
*Picrate*: red needles from EtOH. M.p. 130-1°.

Cook *et al.*, *J. Chem. Soc.*, 1935, 1323.

### Benz-[jk]-fluorene.

See Fluoranthene.

### 1 : 2-Benzfluorenone

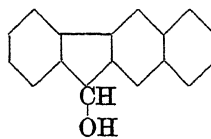


C<sub>17</sub>H<sub>12</sub>O MW, 232

Needles or leaflets. M.p. 166-7°. Very sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin. Sublimes. Sol. conc. H<sub>2</sub>SO<sub>4</sub> with reddish-violet col.

Bamberger, Kranzfeld, *Ber.*, 1885, 18, 1934.

### 2 : 3-Benzfluorenone



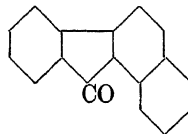
C<sub>17</sub>H<sub>12</sub>O MW, 232

Plates from ligroin or C<sub>6</sub>H<sub>6</sub>. M.p. 185°. Very sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, CHCl<sub>3</sub>. Sol. conc. H<sub>2</sub>SO<sub>4</sub> with violet col.

*Acetyl*: needles from pet. ether. M.p. 97°.

Thiele, Wanscheidt, *Ann.*, 1910, 376, 274.

### 1 : 2-Benzfluorenone (*Chrysofluorenone*, *chrysoketone*)



C<sub>17</sub>H<sub>10</sub>O MW, 230

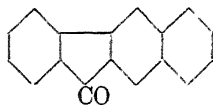
Yellow needles or orange-red prisms. M.p. 132.5°. Sol. common org. solvents. Sol. conc. H<sub>2</sub>SO<sub>4</sub> with red col.

*Oxime*: golden-yellow plates. M.p. 202° decomp.

*Phenylhydrazone*: m.p. 174°.

Graebe, *Ann.*, 1904, 335, 132.

### 2 : 3-Benzfluorenone



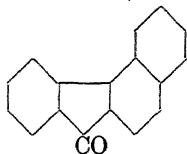
$C_{17}H_{10}O$  MW, 230

Yellow needles from EtOH. M.p. 152°. Sol.  $Et_2O$ ,  $C_6H_6$ .

*Oxime*: yellow needles from EtOH. M.p. 231°.

Thiele, Wanscheidt, *Ann.*, 1910, 376, 273.

### 3 : 4-Benzfluorenone (*Allochrysoketone*)



$C_{17}H_{10}O$  MW, 230

Orange cryst. from toluene. M.p. 161°.

*Oxime*: cryst. from EtOH. M.p. 215°.

*Semicarbazone*: yellow needles from dioxan. M.p. 235° decomp.

*Phenylhydrazone*: yellow cryst. from AcOH. M.p. 180°.

Schaarschmidt, *Ber.*, 1916, 49, 1449.

Cook *et al.*, *J. Chem. Soc.*, 1935, 1323.

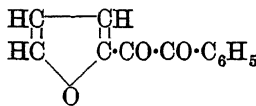
### Benzfuran.

See Coumarone.

### 3 : 4-Benzfuranone-2.

See Phthalide.

**Benzfuryl** (*Benzoyl- $\alpha$ -furoyl, phenyl furyl diketone*)

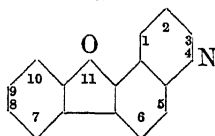


$C_{12}H_8O_3$  MW, 200

Yellow needles. M.p. 41°. Sol. EtOH,  $Et_2O$ . *Tetrabromide*: yellow needles. M.p. 127-8°.

Fischer, *Ann.*, 1882, 211, 229.

### Benzfuro-[2, 3-f]-quinoline



$C_{15}H_9ON$  MW, 219

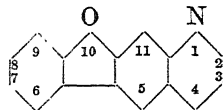
Cryst. from EtOH.Aq. M.p. 168-9°.

*B,HCl*: yellow. M.p. 216-33°.

Mosettig, Robinson, *J. Am. Chem. Soc.*, 1935, 57, 902.

Kirkpatrick, Parker, *J. Am. Chem. Soc.*, 1935, 57, 1123.

### Benzfuro-[3, 2-g]-quinoline



$C_{15}H_9ON$  MW, 219

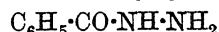
Cryst. from EtOH.Aq. M.p. 112° (106-7°).

*B,HCl*: yellow. M.p. 266-85°.

Mosettig, Robinson, *J. Am. Chem. Soc.*, 1935, 57, 902.

Kirkpatrick, Parker, *J. Am. Chem. Soc.*, 1935, 57, 1123.

### Benzhydrazide (*Benzoylhydrazine*)



$C_7H_8ON_2$  MW, 136

Plates. M.p. 112.5°. If quickly heated, boils almost undecomposed. Mod. sol.  $H_2O$ , EtOH. Spar. sol.  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ .

*Oxime*: needles. M.p. 110° decomp.

Stollé, *J. prakt. Chem.*, 1904, 69, 145.

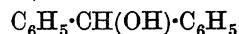
### Benzhydrindene.

See  $\alpha$ -Naphthindene.

### Benzhydrindone.

See  $\alpha$ -Naphthindanone.

**Benzhydrol** (*Diphenylcarbinol,  $\alpha$ -hydroxy-diphenylmethane*)



$C_{13}H_{12}O$  MW, 184

Silky needles. M.p. 69°. B.p. 297°/748 mm., 180°/20 mm. 1 part dissolves in 2000 parts  $H_2O$  at 20°. Sol. EtOH,  $Et_2O$ , AcOH,  $CHCl_3$ ,  $CCl_4$ . Deep red sol. in cold  $H_2SO_4$ . Ox.  $\rightarrow$  benzophenone.

*Acetyl*: m.p. 41-2°.

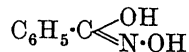
3 : 5-Dinitrobenzoyl: m.p. 142°.

p-Diphenylurethane: m.p. 197°.

Zechmeister, Rom, *Ann.*, 1929, 468, 117.

Marvel, Hansen, *Organic Syntheses*, Collective Vol. I, 84.

### Benzhydroxamic Acid



$C_7H_7O_2N$  MW, 137

Rhombic tablets. M.p. 125°. Sol. 44 parts  $H_2O$  at 6°. Sol. EtOH. Spar. sol.  $Et_2O$ ,  $C_6H_6$ . Aq. sol. +  $FeCl_3 \rightarrow$  dark red ppt., sol. to dark cherry red in excess  $FeCl_3$ . Hyd.  $\rightarrow NH_2OH$  + benzoic acid.

*Benzoyl deriv.*:  $C_6H_5 \cdot C(N \cdot O \cdot CO \cdot C_6H_5)OH$ . Needles. M.p. 161°. Prac. insol.  $H_2O$ .

Jones, Hurd, *J. Am. Chem. Soc.*, 1921, 43, 2446.

Ponzio, *Gazz. chim. ital.*, 1929, 59, 554.

### Benzhydrylamine.

See  $\alpha$ -Aminodiphenylmethane.

$\alpha$ -Benzhydrylbenzhydrol.

See 1 : 1 : 2 : 2-Tetraphenylethyl Alcohol.

**Benzhydrylbenzoic Acid.**

See Triphenylmethane-carboxylic Acid.

**Benzhydryl bromide.**

See Diphenylmethyl bromide.

**Benzhydryl chloride.**

See Diphenylmethyl chloride.

**Benzhydrylglycollic Acid.**

See 2 : 2-Diphenyl-lactic Acid.

**Benzhydryl Mercaptan.**

See Thiobenzhydrol.

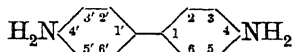
**Benzhydrylphenol.**

See Hydroxytriphenylmethane.

**Benzhydrylsuccinic Acid.**

See 3 : 3-Diphenylpropane-1 : 2-dicarboxylic Acid.

**Benzidine (4 : 4'-Diaminodiphenyl)**



$C_{12}H_{12}N_2$  MW, 184

Exists in three forms. (a). M.p. 125°; and (b), m.p. 122° are both metastable and are deposited from molten benzidine on cooling to about 100°. The stable form (c), m.p. 128°, is obtained at temps. nearer the m.p. All three forms co-exist indefinitely at ord. temps. B.p. 400°/740 mm. Sol. 2447 parts  $H_2O$  at 12°, 106.5 parts at 100°. Sol. EtOH.

*B,2HCl*: leaflets, sol.  $H_2O$ : ppd. by conc. HCl. Boil aq. sol.  $\rightarrow$  ppt. of spar. sol. *B,HCl*.

*B,H\_2SO\_4*: scales. Prac. insol.  $H_2O$ , EtOH.

*Monoacetyl*: needles from EtOH.Aq. M.p. 199°. Sol. EtOH. Insol.  $Et_2O$ .

*Diacetyl deriv.*: m.p. 317°.

*Tetra-acetyl*: needles from EtOH- $C_6H_6$ . M.p. 214-15°.

*Monobenzoyl*: m.p. 203-5°.

*Dibenzoyl deriv.*: needles. M.p. 352°.

Ismailsky, Kolpensky, *Z. angew. Chem.*, 1926, 39, 507.

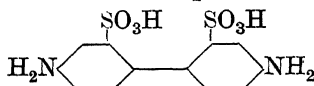
Amiantov, Toporkov, *Chem. Zentr.*, 1932, I, 1437.

Fichter, *Chem. Abstracts*, 1933, 27, 2886.

Swann Research Inc., U.S.P., 1,954,469, (*Chem. Abstracts*, 1934, 28, 3744).

Weygand, *Z. ges. Naturwiss.*, 1937, 2, 408, (*Chem. Zentr.*, 1937, I, 4095).

**Benzidine-2 : 2'-disulphonic Acid**



$C_{12}H_{12}O_6N_2S_2$  MW, 344

Prisms. Decomp. without melting. Spar. sol. hot  $H_2O$ . Prac. insol. EtOH,  $Et_2O$ .

*B,2HCl*: prisms +  $2H_2O$ . M.p. 205°.

*d-Diphenyl ester*:  $C_{24}H_{20}O_6N_2S_2$ . MW, 496. Leaflets from  $Me_3CO$ -pet. ether. M.p. 222-3°. [ $\alpha$ ]<sub>5791</sub> + 28.0° in  $Me_2CO$ .

*l-Diphenyl ester*: m.p. 222-3°. [ $\alpha$ ]<sub>5791</sub> -24.6° in  $Me_2CO$ .

*Amide*:  $C_{12}H_{14}O_4N_4S_2$ . MW, 342. Cryst. from  $H_2O$ . M.p. 278°. Insol.  $Et_2O$ ,  $CHCl_3$ . *Hydrochloride*. m.p. 205°.

Elbs, Wohlfahrt, *J. prakt. Chem.*, 1902, 66, 558.

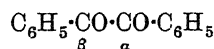
Lesslie, Turner, *J. Chem. Soc.*, 1932, 2025.

**Benzidine-3 : 3'-disulphonic Acid.**

Leaflets. Spar. sol. hot  $H_2O$ . Insol. EtOH,  $Et_2O$ .

Griess, Duisberg, *Ber.*, 1889, 22, 2461.

**Benzil (Dibenzoyl, diphenyl  $\alpha\beta$ -diketone, diphenylglyoxal)**



$C_{14}H_{10}O_2$  MW, 210

Yellow prisms from EtOH. M.p. 95°. B.p. 346-8°, 188°/12 mm. Sol. EtOH,  $Et_2O$ . Insol.  $H_2O$ .  $Na_2S_2O_4$ , or  $SnCl_2 + HCl \rightarrow$  benzoin. Ox.  $\rightarrow$  benzoic acid. Warm alc. KOH  $\rightarrow$  benzoic acid.

*Oximes*: see Benzil monoxime and Benzil dioxime.

*Mono-semicarbazone*: m.p. 174-5° decomp. (rapid heat.).

*Di-semicarbazone*: leaflets. M.p. 243-4° decomp.

*Di-phenylsemicarbazone*: plates from AcOH. M.p. 253° decomp.

*Mono-semioxamazone*: prisms from EtOH. M.p. 181-2°.

*Di-semioxamazone*: m.p. 275-8°.

*Mono-hydrazone*: cryst. M.p. 151°.

*Di-hydrazone*: needles from EtOH. M.p. 134°.

*Mono-phenylhydrazone*: cryst. from EtOH. M.p. 134°.

*Di-phenylhydrazone*: benzil osazone. Needles. M.p. 225° (rapid heat.).

*Anil*: phenyliminodeoxybenzoin. Yellow prisms from EtOH. M.p. 105°.

Biltz, *Ann.*, 1909, 368, 224.

Hatt, Pilgrim, Hurran, *J. Chem. Soc.*, 1936, 93.

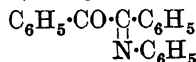
Corson, McAllister, *J. Am. Chem. Soc.*, 1929, 51, 2823.

Clarke, Dreger, *Organic Syntheses*, Collective Vol. I, 80.

**Benzilam.**

See Triphenylloxazole.

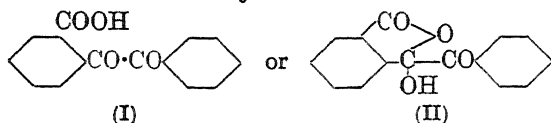
**Benzil-anil (Phenyliminodeoxybenzoin)**



$C_{20}H_{15}ON$  MW, 285

Yellow prisms from EtOH. M.p. 105°. Spar. sol. cold EtOH. Mod. sol.  $Et_2O$ ,  $C_6H_6$ . Blood red sol. in  $H_2SO_4$ .

Biltz, *Ann.*, 1909, 368, 224.

Benzil-*o*-carboxylic Acid

$C_{15}H_{10}O_4$  MW, 254

Exists in two modifications:

(1) *Keto form*: yellow cryst. M.p. 143–4°.

(2) *Lactone form*: white cryst. M.p. 130°.

Begins to isomerise to (1) at about 66°. Keto form more sol. EtOH,  $CHCl_3$  than lactone. Alkalis  $\rightarrow$  benzhydrol-dicarboxylic acid.

*Me ester*:  $C_{16}H_{12}O_4$ . MW, 268. Yellow. M.p. 117°.

*Et ester*:  $C_{17}H_{14}O_4$ . MW, 282. M.p. 71°.

*Chloride*:  $C_{15}H_9O_3Cl$ . MW, 272.5. Cryst. from  $CHCl_3$ . M.p. 61–3°.

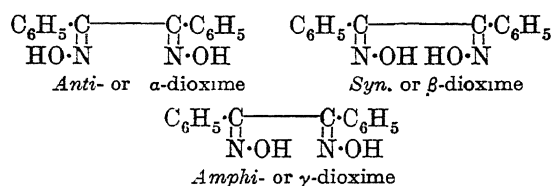
*Monoxime*: m.p. 166°.

Hantzsch, Schwiete, *Ber.*, 1916, 49, 213.

Schaum, *Ann.*, 1928, 462, 204.

## Benzil-2 : 2'-dicarboxylic Acid.

See Diphthalyllic Acid.

Benzil dioxime (*Diphenylglyoxime*)

$C_{14}H_{12}O_2N_2$  MW, 240

Three stereoisomers. See above formulæ.

$\alpha$  :

Leaflets. M.p. 238° decomp. Prac. insol. EtOH,  $Et_2O$ , AcOH. Sol. conc. NaOH.

*O-Me*:  $C_{15}H_{14}O_2N_2$ . MW, 254. Needles from  $Me_2CO$ . M.p. 181–2°. *Acetyl*: plates from EtOH. M.p. 107–8°.

*O*: *O-Di-Me*:  $C_{16}H_{16}O_2N_2$ . MW, 268. Cryst. from  $Me_2CO$ . M.p. 163–4°.

*Diacetyl*: m.p. 148°.

*Dibenzoyl*: needles from  $Me_2CO-EtOH$ . M.p. 220°.

$\beta$  :

M.p. 207° decomp. Sol. EtOH,  $Et_2O$ , AcOH. Sol.  $NH_3$ , conc. NaOH.

*O-Me*: prisms from AcOH. M.p. 177°. *Acetyl*: prisms from EtOH. M.p. 81°. *Benzoyl*: prisms from AcOH. M.p. 162°.

*O*: *O-Di-Me*: cryst. from EtOH. M.p. 72–3°.

*Diacetyl*: m.p. 124–5°.

*Dibenzoyl*: cryst. from EtOH. M.p. 135°.

$\gamma$  :

M.p. 164–5° (163°)  $\rightarrow$   $\beta$ -dioxime. Cryst. from EtOH with EtOH of cryst., m.p. 100°. Insol. ligroin. Sol. conc. alkalis.

*O-Me*: needles from  $CHCl_3$ -pet. ether.

M.p. 172°. *Acetyl*: needles from EtOH. M.p. 80°. *Benzoyl*: prisms from AcOH. M.p. 79°. *O*: *O-Di-Me*: plates from 80% EtOH. M.p. 59°.

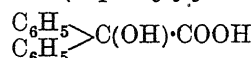
*Dibenzoyl*: cryst. from EtOH. M.p. 135°.

Meisenheimer, Lamparter, *Ber.*, 1924, 57, 276.

Ponzio, Avogadro, *Gazz. chim. ital.*, 1923, 53, 511.

Brady, Perry, *J. Chem. Soc.*, 1925, 127, 2874.

Brady, Muers, *J. Chem. Soc.*, 1930, 220.

Benzilic Acid (*Diphenylglycollic acid*)

$C_{14}H_{12}O_3$  MW, 228

Needles. M.p. 150°. Sol. EtOH,  $Et_2O$ , hot  $H_2O$ . Reddish-violet sol. in conc.  $H_2SO_4$ .  $CrO_3 \rightarrow$  benzophenone +  $CO_2$ . HI  $\rightarrow$  diphenylacetic acid.  $k = 9.2 \times 10^{-4}$  at 25°.

*Me ether*:  $C_{15}H_{14}O_3$ . MW, 242. Needles from AcOH. M.p. 111–12°.

*Et ether*:  $C_{16}H_{16}O_3$ . MW, 256. Plates from  $Et_2O$ . M.p. 114–15°.

*Me ester*:  $C_{15}H_{14}O_3$ . MW, 242. M.p. 74–5°. B.p. 187°/13 mm. *Acetyl*: m.p. 122°.

*Et ester*:  $C_{16}H_{16}O_3$ . MW, 256. M.p. 34°. B.p. 201°/21 mm. *Acetyl*: m.p. 65°.

*Propyl ester*:  $C_{17}H_{18}O_3$ . MW, 270. B.p. 220°/35 mm.

*Isoamyl ester*:  $C_{19}H_{22}O_3$ . MW, 298. B.p. 232°/26 mm.

*Benzyl ester*:  $C_{21}H_{18}O_3$ . MW, 318. M.p. 75–6°.

*Amide*:  $C_{14}H_{13}O_2N$ . MW, 227. M.p. 154–5°.

*Anilide*:  $C_{20}H_{17}O_2N$ . MW, 303. M.p. 175°.

*Hydrazide*: needles from EtOH.Aq. M.p. 168–9°.

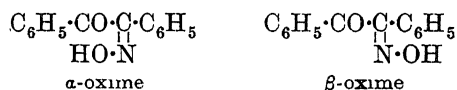
*Acetyl*: needles from AcOH. M.p. 98°.

*Chloride*: b.p. 193–5°/27 mm. *Anilide*: m.p. 176°.

Ballard, Dehn, *Organic Syntheses*, Collective Vol. I, 82.

Kao, Ma, *J. Chem. Soc.*, 1931, 443.

## Benzil monoxime



$C_{14}H_{11}O_2N$  MW, 225

Exists in two stereoisomeric forms. See above formulæ.

$\alpha$  :

Leaflets. M.p. 137–8°. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ , AcOH. Spar. sol. cold  $C_6H_6$ , ligroin. Decomp. at 200°  $\rightarrow$  benzoic acid + benzonitrile.

*Me ether*: m.p. 62–3°.

*Benzoyl*: m.p. 95–6°.

3- :  
M.p. 113–14°. Cryst. from  $C_6H_6$  with  $\frac{1}{2}C_6H_6$ ,  
m.p. 70°. Sol. most ord. org. solvents except  
ligroin.

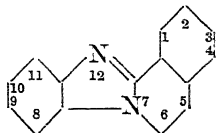
*Me ether* : m.p. 64–5°. B.p. 220°/40 mm.  
*Benzoyl* : m.p. 138°.

Meisenheimer, *Ber.*, 1921, 54, 3206.

Brady, Perry, *J. Chem. Soc.*, 1925, 127,  
2876.

Brady, Muers, *J. Chem. Soc.*, 1930, 219.

**Benziminazo - [2, 1 - a] - isoquinoline** (*Iso-*  
*quinolo*[1' : 2' : 1 : 2]*benziminazole*)



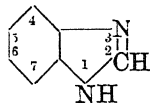
$C_{15}H_{10}N_2$  MW, 218

Needles from pet. ether. M.p. 129°. Becomes  
pink on exposure to light and air.

9 : 11-*Dinitro* : golden needles. Melts above  
280°.

Morgan, Stewart, *J. Chem. Soc.*, 1938,  
1292.

### Benziminazole



$C_7H_6N_2$  MW, 118

Plates. M.p. 170°. Sol.  $H_2O$ , EtOH.

*N-Acetyl* : needles from  $C_6H_6$ . M.p. 113–14°.

*Picrate* : yellow cryst. from  $C_6H_6$ . M.p. 158°.

*N-Propionyl* : cryst. from EtOH. M.p. 125°.

*Picrate* : yellow cryst. from EtOH. M.p. 228°.

*N-Benzoyl* : needles from EtOH. M.p. 93°.

*Picrate* : yellow cryst. from EtOH. M.p. 215°.

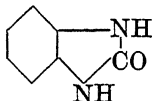
*Picrate* : yellow needles. M.p. 223°.

Phillips, *J. Chem. Soc.*, 1928, 2393.

Oddo, Ingrassia, *Gazz. chim. ital.*, 1932,  
62, 1095.

Wagner, Simons, *J. Chem. Education*,  
1936, 13, 265.

### Benziminazolone (o-Phenyleneurea)



$C_7H_6ON_2$  MW, 134

Plates. M.p. 311°.

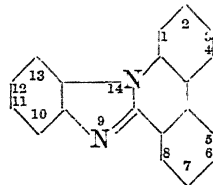
*N : N-Dibenzoyl* : needles. M.p. 212–13°.

*Anil* : needles from  $C_6H_6$ , prisms from  
EtOH. M.p. 190°. B.p. 440–50° decomp.

Heller, *J. prakt. Chem.*, 1925, 111, 1.

Mistry, Guha, *J. Indian Chem. Soc.*, 1930,  
I, 795.

**Benziminazo - [1, 2 - f]-phenanthridine**  
(1 : 2 : 10' : 9'-*Phenanthrido*-4 : 5-*benz*-1 : 3-*di-*  
*azaline*)



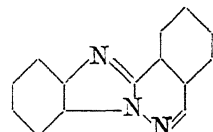
$C_{19}H_{12}N_2$  MW, 268

Needles from EtOH.Aq. M.p. 155°.

10 : 12-*Dinitro* : deep yellow needles. M.p.  
above 280°.

Morgan, Stewart, *J. Chem. Soc.*, 1938,  
1292.

**Benziminazo-[2, 1-a]-phthalazine** (2' : 4-  
*Anhydro*-2'-*amino*-3-*phenylphthalaz*-4-*one*)

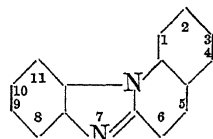


$C_{14}H_9N_3$  MW, 219

Needles from MeOH. M.p. 178°. Very sol.  
dil. acids. Insol. aq. alkalis.

Rowe, Adams, Peters, Gillam, *J. Chem.*  
*Soc.*, 1937, 96.

**Benziminazo-[1, 2-a]-quinoline** (*Quinolo*-  
[1' : 2' : 1 : 2]-*benziminazole*, 1 : 2-*quinolo*-4 : 5-  
*benz*-1 : 3-*diazaline*)



$C_{15}H_{10}N_2$  MW, 218

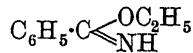
Needles from EtOH.Aq. M.p. 102–3°. Be-  
comes yellow on exposure to light and air.

8 : 10-*Dinitro* : yellow needles from nitro-  
benzene. M.p. above 300°.

10-*Nitro* : yellow needles from toluene. M.p.  
242–3°.

Morgan, Stewart, *J. Chem. Soc.*, 1938,  
1292; 1939, 1057.

### Benziminoether (Benzimino-ethyl ether)



$C_9H_{11}ON$  MW, 149

Oil. B.p. 101°/15 mm.  $k = 11.0 \times 10^{-9}$  at  
25°.

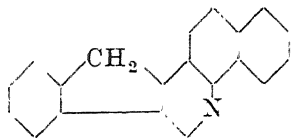
*N-Benzoyl* : m.p. 65°.

*B.HCl* : m.p. 119–20° decomp.

Lander, *J. Chem. Soc.*, 1900, 77, 736.

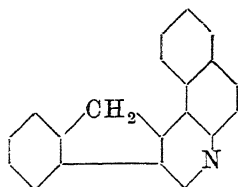
**2 : 3-Benzindene.**

See Fluorene.

**11-Benz[h]indeno-[1,2-c]-quinoline**  
(1,2(2,1)-Naphtha-3-azafluorene) $C_{20}H_{13}N$ 

MW, 267

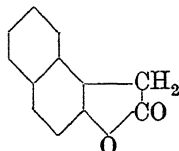
Dark yellow. M.p. 223°.

Borsche, Wagner-Roemmich, *Ann.*, 1940,  
544. 272.**13-Benz[f]indeno-[1,2-c]-quinoline** (1,2  
(1,2)-Naphtha-3-azafluorene) $C_{20}H_{13}N$ 

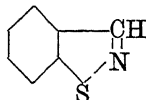
MW, 267

Yellow. M.p. 200°.

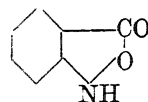
Picrate: yellow. M.p. 241° decomp.

Borsche, Noll, *Ann.*, 1937, 532, 127.**4 : 5-Benzisocoumaranone** (2-Hydroxy-1-  
naphthylacetic lactone,  $\beta$ -naphthafuranone-2) $C_{12}H_8O_2$ 

MW, 184

Leaflets. M.p. 107° (104°). Very spar. sol.  
 $H_2O$ . Sol. conc.  $H_2SO_4 \rightarrow$  green fluor.I.G., D.R.P., 562,391; B.P., 330,916,  
(*Chem. Abstracts*, 1933, 27, 735; 1930,  
24, 6031).Mayer, Schäfer, Rosenbach, *Chem. Zentr.*,  
1929, II, 3009.**6 : 7-Benzisoquinoline.**See  $\beta$ -Anthrapyridine.**Benzisothiazole** $C_7H_5NS$ 

MW, 135

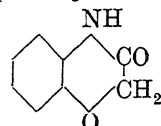
Cryst. M.p. 37°. B.p. 220°. Sol. EtOH,  
 $Et_2O$ . Insol.  $H_2O$ . Volatile in steam. Gives  
with  $AgNO_3$  a comp.  $(C_7H_5NS)_2 \cdot AgNO_3$ , white  
needles from  $H_2O$ . M.p. 105°.Stollé, *Ber.*, 1925, 58, 2096.**Benzisoxazolone** (*Hydroxyanthranil, o-hydroxy-*  
*oxylaminobenzoic anhydride*) $C_7H_5O_2N$ 

MW, 135

Colourless needles from  $C_6H_6$ . M.p. 112°  
decomp. Acid reaction.

N-Acetyl: needles. M.p. 121°.

N-Benzoyl: needles from EtOH. M.p. 153-4°.

Bamberger, Pyman, *Ber.*, 1909, 42, 2317.**Benzmorpholone** (*o-Aminophenoxyacetic*  
*lactam, o-aminophenoxyacetic anhydride*) $C_8H_7O_2N$ 

MW, 149

Needles or prisms. M.p. 173.5°. Sublimes.  
Sol.  $H_2O$ , EtOH,  $Et_2O$ ,  $C_6H_6$ , conc. alkalis.  
Forms N-Na deriv.N-Me:  $C_9H_9O_2N$ . MW, 163. M.p. 58-9°.  
B.p. 156°/14 mm.

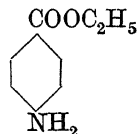
N-Acetyl: needles. M.p. 77°.

Jacobs, Heidelberger, *J. Am. Chem. Soc.*,  
1917, 39, 2188.**2 : 3-Benz-6 : 7-naphtha-anthraquinone.**

See 6 : 15-Hexacenedione.

**Benznaphthalide.**

See under Naphthylamine.

**Benzocaine** (*Anæsthesin, p-aminobenzoic*  
*ethyl ester*) $C_9H_{11}O_2N$ 

MW, 165

Rhombohedra from  $Et_2O$ . M.p. 92°. Sol.  
EtOH, min. acids. Sol. 7 parts  $Et_2O$ . Prac.  
insol.  $H_2O$ . Local anæsthetic.

B,HCl: m.p. 207-8°.

Picrate: m.p. 131°.

N-Acetyl: m.p. 110° (181°). Sol.  $H_2O$ , EtOH,  
 $Me_2CO$ , AcOH. Spar. sol.  $CHCl_3$ . Insol. MeOH,  
 $Et_2O$ .

N-Chloroacetyl: needles. M.p. 116°.

N-Propionyl: cryst. from EtOH. M.p. 111°.

N-Butyryl: needles from EtOH. M.p. 87°.

N- $\alpha$ -Bromoisovaleryl: m.p. 115°.N-Benzoyl: needles from EtOH. M.p. 150°.  
Sol.  $Me_2CO$ ,  $C_6H_6$ ,  $CHCl_3$ , AcOH. Insol.  $H_2O$ .

N-Phthaloyl: needles from EtOH. M.p. 152°.

Coniglio, *Chem. Abstracts*, 1931, 25, 1811.Tsofin, Raduchkevich, *Chem. Abstracts*,  
1934, 28, 5599.Adams, Cohen, *Organic Syntheses*, Col-  
lective Vol. I, 235.

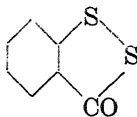
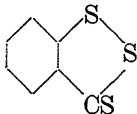


**Benzocatechol.**

See Dihydroxybenzophenone.

**Benzocresol.**

See Hydroxymethylbenzophenone.

**1 : 2 : 3-Benzodithiol-3-one** (2-Dithio-*benzoyl*) $C_7H_4OS_2$  MW, 168Pale needles from EtOH.Aq. M.p. 77°. Red.  $\rightarrow H_2S +$  thiobenzoic acid.Smiles, McClelland, *J. Chem. Soc.*, 1922, 86.**1 : 2 : 3-Benzodithiol-3-thione** (2 : 3-Dithio-*sulphindene*) $C_7H_4S_3$  MW, 184Red cryst. from AcOH,  $C_6H_6$  or EtOH. M.p. 98° (94-5°). Sol. most org. solvents. Insol. cold  $H_2O$ . Py  $\rightarrow$  orange-yellow col. Conc.  $H_2SO_4 \rightarrow$  brownish-yellow col.*Oxime*: yellow. M.p. 210° decomp.*Hydrazone*: orange. M.p. 125°.*Phenylhydrazone*: brown. M.p. 106°.Mannessier, *Gazz. chim. ital.*, 1916, 46, 231.McClelland, Warren, Jackson, *J. Chem. Soc.*, 1929, 1582.**Benzofuran.**

See Phenyl furyl Ketone.

**Benzoguaiacol.**

See under 3 : 4-Dihydroxybenzophenone.

**Benzohydroquinone.**

See 2 : 5-Dihydroxybenzophenone.

**Benzoic Acid** $C_6H_5 \cdot COOH$  MW, 122White leaflets or needles. M.p. 122°. B.p. 249°, 234°/500 mm., 186°/100 mm., 133°/10 mm. Sublimes at 100°. Volatile in steam. 1000 parts  $H_2O$  dissolve 1.8 parts at 4°, 2.1 at 10°, 2.7 at 18°, 4.2 at 31°, 5.5 at 40°, 12 at 60°, 17.8 at 70° and 22 at 75°. Sol. EtOH to 32% at 15°, 90% EtOH to 29.4% at 15°. 60 parts  $Et_2O$  dissolve 24 parts at 15°. Sol.  $CHCl_3$ ,  $CCl_4$ ,  $Me_2CO$ , MeOH,  $C_6H_6$ .  $D_4^{15}$  1.2659.  $n_D^{15}$  1.53974. Heat of comb.  $C_7$  774.1 Cal.,  $C_p$  771.7 Cal.  $k = 6.52 \times 10^{-5}$  at 25°.*Anhydride*: see Benzoic Anhydride.*Chloride*: see Benzoyl chloride.*Iodide*: see Benzoyl iodide.*Bromide*: see Benzoyl bromide.*Fluoride*: see Benzoyl fluoride.*Amide*: see Benzamide.*Anilide*: see Benzanilide.*Toluidide*: see under Toluidine.*Xylidide*: see under Xylidene.*Tolyl ester*: see under Cresol.*Naphthyl ester*: see under Naphthol.*Menthyl ester*: see under Menthol.*Nitrile*: see Benzonitrile.*Propyl ester*:  $C_{10}H_{12}O_2$ . MW, 164. B.p. 230°.  $D_4^{15}$  1.0276.*Isopropyl ester*: b.p. 218-19°. Sol. EtOH,  $Et_2O$ . Insol.  $H_2O$ .  $D_4^{15}$  1.0172.*Butyl ester*:  $C_{11}H_{14}O_2$ . MW, 178. B.p. 248-9°.  $D_4^{15}$  1.0111.*Isobutyl ester*: b.p. 241°.  $D_4^{15}$  1.0035.*sec.-Butyl ester*: *d.* B.p. 120°/20 mm.  $D_4^{20}$  1.0018.  $n_D^{20}$  1.4930.  $[\alpha]_D^{20} + 39.2^\circ$ . *l.* B.p. 98-9°/13 mm.  $D_4^{17}$  1.002.  $n_D^{22}$  1.5005.  $[\alpha]_{5461}^{17}$  -44.1°. *dl.* B.p. 235°, 115-17°/20 mm.  $D_4^{25}$  0.9945.  $n_D^{21}$  1.4933.*Isoamyl ester*:  $C_{12}H_{16}O_2$ . MW, 192. B.p. 261°/746 mm.  $D_{14}^{14}$  0.9925.*Hexyl ester*:  $C_{13}H_{18}O_2$ . MW, 206. B.p. 272°/770 mm.*Octyl ester*:  $C_{15}H_{22}O_2$ . MW, 234. B.p. 305-6°.  $D_4^{15}$  0.9679.*Cetyl ester*:  $C_{23}H_{38}O_2$ . MW, 346. M.p. 30°. Sol.  $Et_2O$ .*Allyl ester*:  $C_{10}H_{10}O_2$ . MW, 162. B.p. 242° (230°).  $D_4^{15}$  1.0578.*Phenylethyl ester*:  $C_6H_5CO \cdot OCH_2 \cdot CH_2 \cdot C_6H_5$ .  $C_{15}H_{14}O_2$ . MW, 226. B.p. 189°/21 mm.Gilman, Kirby, *Organic Syntheses*, Collective Vol. I, 355 (Note 10).Morton, Le Fevre, Hechenbleikner, *J. Am. Chem. Soc.*, 1936, 58, 754.I.G., U.S.P., 2,005,183, (*Chem. Abstracts*, 1935, 29, 5125).Kenyon *et al.*, *J. Chem. Soc.*, 1935, 1080.**Benzoic Anhydride** $C_6H_5CO \cdot O \cdot COC_6H_5$  MW, 226Colourless rhombic prisms. M.p. 42°. B.p. 360°. Insol.  $H_2O$ . Sol. EtOH,  $Et_2O$ .  $D_4^{15}$  1.1989.  $n_D^{15}$  1.57665. Stable to  $H_2O$  and cold alkalis. Hyd. by boiling alk. carbonates and caustic alkalis.Kaufmann, Luterbacher, *Ber.*, 1909, 42, 3484.Gazopulos, *Chem. Abstracts*, 1932, 26, 4318.I.G., D.R.P., 520,153, (*Chem. Abstracts*, 1931, 25, 2739).Monsanto Chem. Co., U.S.P., 1,948,342, (*Chem. Abstracts*, 1934, 28, 2730).**Benzoic sulphimide.**

See Saccharin.

**Benzoin** (*Phenyl  $\alpha$ -hydroxybenzyl ketone*) $C_6H_5 \cdot CH(OH) \cdot CO \cdot C_6H_5$  MW, 212

*dl.*  
Prisms. M.p. 137°. B.p. 344°/768 mm., 194°/12 mm. Spar. sol. hot H<sub>2</sub>O, Et<sub>2</sub>O. Sol. EtOH. Reduces Fehling's. Conc. HNO<sub>3</sub> → benzil. NaHg in EtOH → hydrobenzoin. HI at 250° → dibenzyl.

*Me ether*: C<sub>15</sub>H<sub>14</sub>O<sub>2</sub>. MW, 226. Needles. M.p. 49°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. *Oxime*: needles from EtOH. Aq. M.p. 130-2°.

*Et ether*: C<sub>16</sub>H<sub>16</sub>O<sub>2</sub>. MW, 240. Needles. M.p. 62°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Acetyl*: prisms. M.p. 83°. Sol. EtOH, Et<sub>2</sub>O. *Benzoyl*: needles from EtOH, prisms from Et<sub>2</sub>O. M.p. 125°.

*syn-Oxime*: (β-oxime). Prisms. M.p. 99°. *anti-Oxime*: (α-oxime). Prisms. M.p. 151-2°.

*Phenylhydrazone*: two forms. α-, needles, m.p. 158-9°. β-, prisms, m.p. 106°.

*Semicarbazone*: prisms, m.p. 206° decomp. *Phenylsemicarbazone*: α-, needles from EtOH. M.p. 198° decomp. β-, needles from EtOH. M.p. 169°.

*Hydrazone*: prisms from EtOH. M.p. 75°.

2:4-Dinitrophenylhydrazone: orange-yellow. M.p. 234°.

2:4-Dinitrophenylsemicarbazone: m.p. 228°.

*l.*  
Needles. M.p. 131-132.5°. Sol. Me<sub>2</sub>CO, hot EtOH, hot MeOH. [α]<sub>D</sub><sup>20</sup> -117.5° in Me<sub>2</sub>CO.

*Me ether*: m.p. 53-4°. [α]<sub>D</sub><sup>20</sup> -88.2° in CHCl<sub>3</sub>. [α]<sub>D</sub><sup>15</sup> -94.3° in EtOH.

*Acetyl*: colourless needles. [α]<sub>D</sub><sup>14</sup> -217.7° in CHCl<sub>3</sub>.

*Oxime*: m.p. 164°. [α]<sub>D</sub><sup>20</sup> -3.2° in CHCl<sub>3</sub>. [α]<sub>D</sub><sup>15</sup> +4.4° in EtOH.

*d.*  
Needles. M.p. 131-132.5°. [α]<sub>D</sub><sup>20</sup> +120.5° in Me<sub>2</sub>CO.

*Enol form*: see α:β-Dihydroxystilbene.

Adams, Marvel, *Organic Syntheses*, Collective Vol. I, 88.

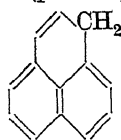
Buck, Jenkins, *J. Am. Chem. Soc.*, 1929, 51, 2163.

Arnold, Fuson, *J. Am. Chem. Soc.*, 1936, 58, 1295.

Corson, Saliani, *Organic Syntheses*, 1932, XII, 1.

Wren, *J. Chem. Soc.*, 1909, 95, 1597.  
Benton, Voss, McCusker, *J. Am. Chem. Soc.*, 1945, 67, 82.

### Benzonaphthene (peri-Naphindene)



C<sub>13</sub>H<sub>10</sub> MW, 166  
M.p. 85°. Readily sol. most org. solvents.

*Picrate*: red needles. Decomp. at 110°.  
Lock, Gergely, *Ber.*, 1944, 77, 461.

### Benzonitrile (Phenyl cyanide, cyanobenzene)

C<sub>6</sub>H<sub>5</sub>CN MW, 103

C<sub>7</sub>H<sub>5</sub>N  
M.p. -13°. B.p. 190.7°, 174°/500 mm., 121°/100 mm., 69°/10 mm. Misc. with EtOH, Et<sub>2</sub>O.

Sol. 100 parts H<sub>2</sub>O at 100°. D<sub>4</sub><sup>20</sup> 1.0102. n<sub>D</sub><sup>20</sup> 1.52892. Heat of comb. C<sub>v</sub> 865.5 Cal., C<sub>p</sub> 865.9 Cal. Caustic alkalis or hot mod. conc. min. acids → benzoic acid.

I.G., B.P., 326,149, (*Chem. Abstracts*, 1930, 24, 4055).

Gen. Aniline Works, U.S.P., 1,879,209, (*Chem. Abstracts*, 1933, 27, 997).

v. Braun, Rudolf, *Ber.*, 1934, 67, 1769.  
Rozhdestvenskii, Zepalova-Mikhailova, *Chem. Abstracts*, 1934, 28, 2698.

### Benzonitric Acid (ω-Nitrobenzaldoxime, ω-nitro-ω-oximinotoluene)

C<sub>6</sub>H<sub>5</sub>C(=N.OH)NO<sub>2</sub> MW, 166

C<sub>7</sub>H<sub>6</sub>O<sub>3</sub>N<sub>2</sub>  
Colourless needles. M.p. 58°. Unstable. Sol. alkalis to orange sols. with decomp.

Wieland, Semper, *Ber.*, 1906, 39, 2522.

### Benzophenone (Diphenyl ketone)

C<sub>13</sub>H<sub>10</sub>O MW, 182

Exists in stable and labile modifications. *Stable form*: rhombic prisms, m.p. 49°. B.p. 306°. Sol. EtOH, Et<sub>2</sub>O, AcOH. Insol. H<sub>2</sub>O.

D<sub>20</sub><sup>20</sup> 1.0976. *Labile form*: monoclinic prisms, m.p. 26°. Sunlight → benzpinacol. Na + EtOH → diphenylmethane. NaHg → benzhydrol. Zn + H<sub>2</sub>SO<sub>4</sub> → benzpinacol → α-benzpinacolin → β-benzpinacolin.

*Di-Me acetal*: plates from Et<sub>2</sub>O. M.p. 106-7°. B.p. 288-90°.

*Di-Et acetal*: prisms from EtOH. M.p. 51-2°. B.p. 294-5°.

*Dipropyl acetal*: prisms from pet. ether. M.p. 33-4°. B.p. 204°/40 mm.

*Di-isobutyl acetal*: plates. M.p. 35-7°. B.p. 210°/35 mm.

*Diphenyl acetal*: cryst. from EtOH. M.p. 132°.

*Dibenzyl acetal*: cryst. from MeOH. M.p. 104-5°. B.p. 305°/40 mm.

*Oxime*: m.p. 144° (140°). Sol. Et<sub>2</sub>O, Me<sub>2</sub>CO. Mod. sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O. *Me ether*: plates from pet. ether. M.p. 102°.

*Acetyl*: cryst. from CHCl<sub>3</sub>. M.p. 55°.

*Hydrazone*: m.p. 98°. B.p. 225-30°/55 mm. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Semicarbazone*: m.p. 167°.

*Phenylsemicarbazone*: m.p. 163-4°.

*Phenylhydrazone*: needles. M.p. 137°.

*p-Nitrophenylhydrazone*: yellow cryst. M.p. 154-5°. Isomer, red cryst. M.p. 144°.

2:4-Dinitrophenylhydrazone: m.p. 238°.

*o*-Chlorobenzoylhydrazone : m.p. 142°.  
*p*-Chlorobenzoylhydrazone : m.p. 137-9°.

Marvel, Sperry, *Organic Syntheses*, Collective Vol. I, 89.  
 Lachmann, *Organic Syntheses*, 1930, X, 10.  
 Mackenzie, *J. Chem. Soc.*, 1896, 69, 987; 1901, 79, 1206.  
 Rivkin, Russ. P., 38,634, (*Chem. Abstracts*, 1936, 30, 3446).  
 I.G., D.R.P., 633,083, (*Chem. Abstracts*, 1936, 30, 7582).

**Benzophenone-4-aldehyde.**

See 4-Benzoylbenzaldehyde.

**Benzophenone-carboxylic Acid.**

See Benzoylbenzoic Acid.

**Benzophenone chloride.**

See  $\alpha$ -Dichlorodiphenylmethane.

**Benzophenone-2 : 3-dicarboxylic Acid.**

See 3-Benzoylphthalic Acid.

**Benzophenone-2 : 4-dicarboxylic Acid.**

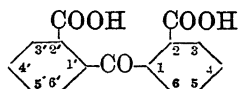
See 4-Benzoylisophthalic Acid.

**Benzophenone-2 : 5-dicarboxylic Acid.**

See Benzoylterephthalic Acid.

**Benzophenone-2 : 6-dicarboxylic Acid.**

See 2-Benzoylisophthalic Acid.

**Benzophenone-2 : 2'-dicarboxylic Acid**

$C_{15}H_{10}O_5$  MW, 270

M.p. 150-5° decomp. Sol. EtOH, Et<sub>2</sub>O, AcOH. Spar. sol. H<sub>2</sub>O. At 200°  $\rightarrow$  anhydride.

*Di-Me ester* :  $C_{17}H_{14}O_5$ . MW, 298. Leaflets. M.p. 85-6°. Sol. EtOH, MeOH.

*Di-Et ester* :  $C_{19}H_{18}O_5$ . MW, 326. Prisms. M.p. 73-4°.

*Anhydride* :  $C_{15}H_8O_4$ . MW, 252. Leaflets. M.p. 212°. Sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Sublimes.

*Imide* :  $C_{15}H_9O_3N$ . MW, 251. Leaflets. M.p. 251-2°. Sol. EtOH, alkalis.

Graebe, Juillard, *Ann.*, 1887, 242, 243.

**Benzophenone-2 : 4'-dicarboxylic Acid.**

Needles from H<sub>2</sub>O. M.p. 235°. Sol. EtOH, hot AcOH. Spar. sol. H<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Di-Me ester* :  $C_{17}H_{14}O_5$ . MW, 298. M.p. 107°.

*Dichloride* :  $C_{15}H_8O_3Cl_2$ . MW, 307. M.p. 102°.

*Diamide* :  $C_{15}H_{12}O_3N_2$ . MW, 268. M.p. above 285°.

Limpricht, *Ann.*, 1899, 309, 98.

**Benzophenone-3 : 4'-dicarboxylic Acid.**

Needles from EtOH. M.p. 326-7°. Insol. H<sub>2</sub>O.

Lavaux, *Ann. chim.*, 1910, 21, 144.

Dict. of Org. Comp.—I.

**Benzophenone-4 : 4'-dicarboxylic Acid.**

Sublimes below 360° without melting. Mod. sol. AcOH. Spar. sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, Me<sub>2</sub>CO.

*Di-Me ester* :  $C_{17}H_{14}O_5$ . MW, 298. M.p. 224° (231°).

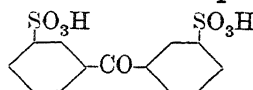
*Dichloride* :  $C_{15}H_8O_3Cl_2$ . MW, 307. M.p. 133°.

*Diamide* :  $C_{15}H_{12}O_3N_2$ . MW, 268. M.p. above 300°.

*Dinitrile* :  $C_{15}H_8ON_2$ . MW, 232. Cryst. M.p. 204-5°.

Limpricht, *Ann.*, 1900, 312, 92.

Staudinger, *Clar, Ber.*, 1911, 44, 1632.

**Benzophenone-3 : 3'-disulphonic Acid**

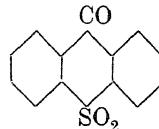
$C_{13}H_{10}O_7S_2$  MW, 342

*Dichloride* :  $C_{13}H_8O_5Cl_2S_2$ . MW, 379. M.p. 137-8°. Sol. CHCl<sub>3</sub>. Isomer, m.p. 121.5°.

*Diamide* :  $C_{13}H_{12}O_5N_2S_2$ . MW, 340. Needles. M.p. 157°. Sol. EtOH, Me<sub>2</sub>CO.

*Dianilide* : m.p. 177-8°.

Lapworth, *J. Chem. Soc.*, 1898, 73, 404.

**Benzophenone sulphone (Thioxanthone 5-dioxide)**

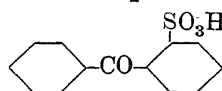
$C_{13}H_8O_3S$  MW, 244

Needles or prisms. M.p. 186-7°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Alc. KOH  $\rightarrow$  blue sol.

Lapworth, *J. Chem. Soc.*, 1898, 73, 404.

Graebe, Schultess, *Ann.*, 1891, 263, 10.

Ulmann, v. Glenck, *Ber.*, 1916, 49, 2509.

**Benzophenone-2-sulphonic Acid**

$C_{13}H_{10}O_4S$  MW, 262

Syrup. KOH fusion  $\rightarrow$  benzoic + benzenesulphonic acids.

*NH<sub>4</sub> salt*, 1H<sub>2</sub>O : m.p. 202°. Sol. H<sub>2</sub>O, EtOH.

*Na salt*, 4H<sub>2</sub>O : m.p. 60°. M.p. anhyd. 236°.

*K salt*, 1H<sub>2</sub>O : m.p. 211° (182°).

*Ba salt*, 1H<sub>2</sub>O : m.p. anhyd. 197-8°.

*Et ester* :  $C_{15}H_{14}O_4S$ . MW, 290. M.p. 126°.

*Chloride* :  $C_{13}H_9O_3ClS$ . MW, 280.5. M.p. 96-7°.

*Anilide* : m.p. 143-5°.

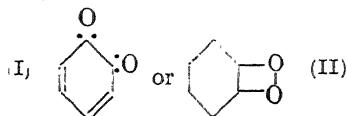
List, Stein, *Ber.*, 1898, 31, 1663.

Remsen, Saunders, *Am. Chem. J.*, 1895, 17, 355.

 **$\gamma$ -Benzopyrone.**

See Chromone.

## o-Benzoquinone (o-Quinone)



$C_6H_4O_2$  MW, 108

(I). Quinone form.

Light red prisms. Decomp. at 60–70° or on standing. Sol.  $C_6H_6$ ,  $Et_2O$ ,  $Me_2CO$ . Insol. pet. ether. Non-volatile. Decomp. by  $H_2O$ .  $SO_2$ , etc. → catechol.

Monoxime: see o-Nitrosophenol.

Dioxime: yellow needles. M.p. 142° decomp. Sol. EtOH, AcOH.

(II). Peroxide form.

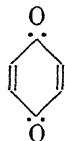
Colourless prisms. Mod. sol.  $Et_2O$ . Changes rapidly to I.  $SO_2$  → catechol.

Pfannenstiel, *Ber.*, 1904, 37, 4745.

Willstätter, Müller, *Ber.*, 1908, 41, 2581.

Kehrmann, *Ber.*, 1911, 44, 2632.

## p-Benzoquinone (Quinone)



$C_6H_4O_2$  MW, 108

Yellow prisms. M.p. 115.7°. Sol. EtOH,  $Et_2O$ , hot  $H_2O$ , hot ligroin. Cryst. from  $H_2O$  or pet. ether. Sublimes. Volatile in steam.  $D_4^{20}$  1.318. Heat of comb.  $C_p$  and  $C_v$  659.2 Cal.  $SO_2$ ,  $H_2S$ , HI, etc. → hydroquinone. Forms additive comps. with many phenols and thiophenols. *E.g.* with hydroquinone → quinhydrone.

Monoxime: see p-Nitrosophenol.

Dioxime: pale yellow needles. Decomp. at 240°. Sol. hot  $H_2O$ .

Mono-semicarbazone: yellow needles. M.p. 178° decomp.

Di-semicarbazone: reddish cryst. powder. M.p. 241–3° decomp.

Picrate: m.p. 78–9°.

Underwood, Walsh, *Organic Syntheses*, 1936, XVI, 73.

Palfremann, Knibbs, B.P., 430,572, (*Chem. Abstracts*, 1935, 29, 7834).

Eastman Kodak Co., U.S.P., 2,043,912, (*Chem. Abstracts*, 1936, 30, 5241).

Vliet, *Organic Syntheses*, Collective Vol. I, 469.

## Benzoquinoneimine Oxime.

See p-Nitrosoaniline.

## Benzorcin.

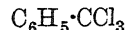
See 4 : 6-Dihydroxy-2-methylbenzophenone.

## Benzosorciniol.

See Dihydroxybenzophenone.

## Benzotetronic Acid.

See 4-Hydroxycoumarin.

Benzotrchloride ( $\omega$ -Trichlorotoluene, phenylchloroform)

$C_7H_5Cl_3$  MW, 195.5

M.p. –5°. B.p. 214°.  $D_4^{14}$  1.380. Sol. EtOH,  $Et_2O$ . Insol.  $H_2O$ .  $H_2O$  at 150°, or aq. alkalis → benzoic acid.

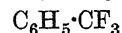
Seldon, Gibbs, B.P., 123,341, (*Chem. Abstracts*, 1919, 13, 1478).

Meyer, *Monatsh.*, 1915, 36, 729.

Kyrides, U.S.P., 1,345,373, (*Chem. Abstracts*, 1930, 14, 2644).

## Benzotrchloride-carboxylic Acid.

See  $\omega$ -Trichlorotoluic Acid.

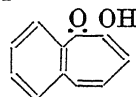
Benzotrfluoride ( $\omega$ -Trifluorotoluene)

$C_7H_5F_3$  MW, 146

B.p. 98–9°/725 mm.

Pouterman, Giradet, *Helv. Chim. Acta*, 1947, 30, 107.

## 3 : 4-Benzotropolone (3 : 4-Benzotropolone)



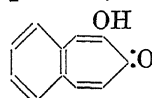
$C_{11}H_8O_2$  MW, 172

Cryst. from cyclohexane. M.p. 85–6°.

Cook, Somerville, *Nature*, 1949, 163, 410.

Cook et al., *J. Chem. Soc.*, 1952, 603.

## 4 : 5-Benzotropolone (4 : 5-Benzotropolone)



$C_{11}H_8O_2$  MW, 172

Cryst. from EtOH. M.p. 159.5–160.5°.

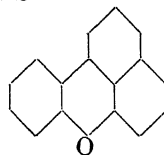
Acetyl: cryst. from AcOEt–hexane. M.p. 103–4°.

Tarbell, Scott, Kemp, *J. Am. Chem. Soc.*, 1950, 72, 379.

## Benzoveratrol.

See under 3 : 4-Dihydroxybenzophenone.

## Benzoxanthene



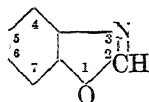
$C_{16}H_{10}O$  MW, 218

Cryst. M.p. 107.4–108°.

1 : 3 : 5-Trinitrobenzene add. comp.: red cryst. M.p. 147.8–148.4°.

Orchin, *J. Am. Chem. Soc.*, 1948, 70, 495.  
Kruber, *Ber.*, 1937, 70, 1556.

## Benzoxazole

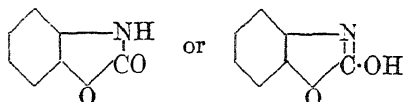


$C_7H_5ON$  MW, 119

Cryst. M.p. 31°. B.p. 183°. Insol.  $H_2O$ . Hot conc.  $HCl \rightarrow o$ -aminophenol.

*Methiodide*: yellowish needles. M.p. 202°.

Bamberger, *Ber.*, 1903, 36, 2051.

Benzoxazolone (*o*-Hydroxyphenylcarbamic lactone)

$C_7H_5O_2N$  MW, 135

Needles +  $1H_2O$  from hot dil.  $HCl$ . M.p. 97–8°, anhyd. 141–2°. Sol.  $EtOH$ . Mod. sol.  $Et_2O$ . Spar. sol. cold  $H_2O$ .

*N-Me*:  $C_8H_7O_2N$ . MW, 149. M.p. 86°.

*N-Et*:  $C_9H_9O_2N$ . MW, 163. M.p. 29°. B.p. 300°.

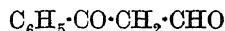
*N-Acetyl*: m.p. 95°.

*N-Benzoyl*: m.p. 173–4°.

*Phenylhydrazone*: m.p. 280°.

Meyer, *J. prakt. Chem.*, 1915, 92, 255.

Lindemann, Schultheis, *Ann.*, 1927, 451, 253.

Benzoylacetalddehyde ( $\omega$ -Formylacetophenone,  $\omega$ -aldehydoacetophenone, benzoylviny alcohol, hydroxymethyleneacetophenone, hydroxyvinyl phenyl ketone, phenacyl aldehyde, phenacyl formaldehyde)

or



$C_9H_8O_2$  MW, 148

Yellow unstable oil. Resinifies readily.  $FeCl_3$  on  $EtOH$  sol.  $\rightarrow$  intense red col. Forms stable Na and Cu derivs. Heat in  $AcOH \rightarrow$  1 : 3 : 5-tribenzoylbenzene.

*Oxime*: benzoylacetaldoxime. Prisms from  $C_6H_6$ . M.p. 86–7°.

Stähler, *Ber.*, 1914, 47, 590.

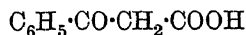
Mumm, Münchmeyer, *Ber.*, 1910, 43, 3338.

Bülow, Sicherer, *Ber.*, 1901, 34, 3891.

Chelintsev, Dukinin, *J. Gen. Chem.*

*U.S.S.R.*, 1937, 7, 2309.

## Benzoylactic Acid



$C_9H_8O_3$  MW, 164

Needles. M.p. 103–4° decomp. Sol.  $EtOH$ ,  $Et_2O$ . Spar. sol.  $H_2O$ , ligroin.  $FeCl_3$  on  $EtOH$  sol.  $\rightarrow$  reddish-violet col. Heat alone or with

dil.  $H_2SO_4 \rightarrow$  acetophenone. Hot alkalis  $\rightarrow$  acetophenone + benzoic acid.

*Di-Et acetal*: cryst. M.p. 63° decomp.

*Me ester*:  $C_{10}H_{10}O_3$ . MW, 178. B.p. 152°/15 mm.  $D_4^{20}$  1.173.  $n_D^{25}$  1.542.

*Et ester*:  $C_{11}H_{12}O_3$ . MW, 192. B.p. 265–70° part. decomp., 147–9°/11 mm.  $D^{15}$  1.1219. Volatile in steam. Forms Na and Cu derivs. (enol form). *Semicarbazone*: cryst. from  $H_2O$ . M.p. 125° decomp.

*Propyl ester*:  $C_{12}H_{14}O_3$ . MW, 206. B.p. 154–6°/12 mm.  $D^0$  1.114.

*Isopropyl ester*: b.p. 158–8.5°/15 mm.

*Butyl ester*:  $C_{13}H_{16}O_3$ . MW, 220. B.p. 169–70°/1 mm.,  $n_D^{25}$  1.5180.

*Crotyl ester*: b.p. 112–14°/0.2 mm.

*Isobutyl ester*:  $C_{13}H_{16}O_3$ . MW, 220. B.p. 160°/12 mm.

*l-Menthyl ester*: needles from  $EtOH$ . M.p. 41°.  $[\alpha]_D^{20}$  –56.9° in  $EtOH$ . *Semicarbazone*: leaflets from  $EtOH$ . M.p. 167°.

*Amide*:  $C_9H_9O_2N$ . MW, 163. M.p. 113°. Sol.  $EtOH$ ,  $CHCl_3$ .

*Nitrile*:  $\omega$ -cyanoacetophenone.  $C_6H_7ON$ . MW, 145. Leaflets. M.p. 80–1°. Sol.  $EtOH$ ,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ .

*Anilide*: leaflets. M.p. 107–8°.

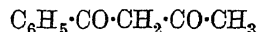
Meyer, Tögel, *Ann.*, 1906, 347, 79.

Wahl, Doll, *Bull. soc. chim.*, 1913, 13, 277.

Claisen, *Ann.*, 1896, 291, 67.

Dorsch, McElvain, *J. Am. Chem. Soc.*, 1932, 54, 2962.

Chi, Lee, *Chem. Abstracts*, 1935, 29, 467.

Benzoylacetone (*Methyl phenacyl ketone*, acetylbenzoylmethane,  $\omega$ -acetylacetophenone)

$C_{10}H_{10}O_2$  MW, 162

Cryst. M.p. 61°. B.p. 261–2°, 132°/14 mm. Sol.  $EtOH$ ,  $Et_2O$ , conc. caustic alkalis. Spar. sol. cold  $H_2O$ . Volatile in steam. Conc.  $H_2SO_4 \rightarrow$  acetophenone.  $FeCl_3 \rightarrow$  deep red col. Forms metallic derivs.

Claisen, *Ber.*, 1905, 38, 695.

## Benzoylacetophenone.

See Dibenzoylmethane.

## 2-Benzoylacrylic Acid



$C_{10}H_8O_3$  MW, 176

Leaflets +  $1H_2O$ . M.p. 64°, anhyd. 99°. Sol.  $EtOH$ ,  $Et_2O$ , hot  $H_2O$ . Hot alkalis  $\rightarrow$  acetophenone + glyoxylic acid. Red.  $\rightarrow$  2-benzoylpropionic acid.

*Me ester*:  $C_{11}H_{10}O_3$ . MW, 190. M.p. 30–2°. B.p. 185°/16 mm., 150°/5 mm.

*Oxime*: m.p. 168° decomp.

*Semicarbazone*: m.p. 190°.

*Hydrazone*: cryst. from  $EtOH$ . M.p. 185–6°.

*Phenylhydrazone*: m.p. 197°.

*Dibromide*: 1:2-dibromo-2-benzoylpropionic acid. M.p. 148°.

Koźniewski, Marchlewski, *Chem. Zentr.*, 1906, II, 1189.

Bogert, Ritter, *J. Am. Chem. Soc.*, 1925, 47, 529.

Lutz, *J. Am. Chem. Soc.*, 1930, 52, 3430.

### Benzoylaminoacetylhydrazide.

See Hippuryl hydrazide.

### Benzoylaminoacetic Acid.

See Hippuric acid.

### Benzoyl-o-aminobenzoic Acid.

See Benzoylanthranilic Acid.

### Benzoyl-p-aminobenzoic Acid

See under p-Aminobenzoic Acid.

### 1-Benzoylamino-2- $\alpha$ -furylacrylic Acid.

See Furfurylidenehippuric Acid.

### Benzoylaminophenol.

See Hydroxybenzanilide.

### Benzoylaminophenylacetic Acid.

See 1-Phenylhippuric Acid.

### Benzoylanisidine.

See under Hydroxybenzanilide.

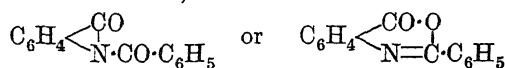
### Benzoylanisole.

See under Hydroxybenzophenone.

### ms-Benzoylanthracene.

See Anthraphenone.

### Benzoylanthranil (*Anhydro-benzoyl-o-aminobenzoic acid*)



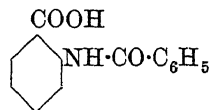
$\text{C}_{14}\text{H}_9\text{O}_2\text{N}$  MW, 223

Needles. M.p. 122–3°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O, ligroin. Insol. cold dil. alkalis.

Heller, *Ber.*, 1920, 53, 731.

Meyer, Bellmann, *J. prakt. Chem.*, 1886, 33, 19.

### Benzoylanthranilic Acid (*Benzoyl-o-aminobenzoic acid*)



$\text{C}_{14}\text{H}_{11}\text{O}_3\text{N}$  MW, 241

Needles. M.p. 181°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

*Me ester*:  $\text{C}_{15}\text{H}_{13}\text{O}_3\text{N}$ . MW, 255. Needles. M.p. 100°.

*Et ester*:  $\text{C}_{16}\text{H}_{15}\text{O}_3\text{N}$ . MW, 269. Needles from EtOH or ligroin. M.p. 98°.

*Amide*:  $\text{C}_{14}\text{H}_{12}\text{O}_2\text{N}_2$ . MW, 240. Needles. M.p. 218–19°.

*Nitrile*:  $\text{C}_{14}\text{H}_{10}\text{ON}_2$ . MW, 222. M.p. 156°.

*Anilide*: needles. M.p. 279°.

*Anhydro-comp.*: see Benzoylanthranil.

Fischer, *Ber.*, 1896, 29, 2063.

Bell, *J. Phys. Chem.*, 1928, 32, 882.

Alessandri, *Atti. accad. Lincei*, 1913, 22, II, 229.

### Benzoylanthraquinone.

See Phenyl anthraquinonyl Ketone.

### Benzoyl azide (*Benzazide, benzoylazimide*)

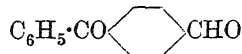


$\text{C}_7\text{H}_5\text{ON}_3$  MW, 147

Colourless plates. M.p. 32°. Explodes on heating. Sol. Et<sub>2</sub>O. Mod. sol. EtOH. Insol. H<sub>2</sub>O.

Bergel, *Z. angew. Chem.*, 1927, 40, 974.

### 4-Benzoylbenzaldehyde (*p-Formylbenzophenone, 4-aldehydobenzophenone, benzophenone-4-aldehyde*)



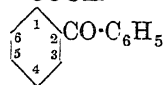
$\text{C}_{14}\text{H}_{10}\text{O}_2$  MW, 210

Plates from H<sub>2</sub>O. M.p. 64°. Very sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Insol. C<sub>6</sub>H<sub>6</sub>, pet. ether. Forms bisulphite comp.

Bourcet, *Bull. soc. chim.*, 1896, 15, 950.

### o-Benzoylbenzoic Acid (*2-Benzoylbenzoic acid, benzophenone-o-carboxylic acid*)

COOH



$\text{C}_{14}\text{H}_{10}\text{O}_3$  MW, 226

Needles + 1H<sub>2</sub>O from hot H<sub>2</sub>O. M.p. 90°. M.p. anhyd. 127°.  $k = 3.7 \times 10^{-4}$  at 25°. Conc. H<sub>2</sub>SO<sub>4</sub> → anthraquinone.

*Me ester*:  $\text{C}_{15}\text{H}_{12}\text{O}_3$ . MW, 240. Prisms. M.p. 52°. B.p. 350–2°.

*Et ester*:  $\text{C}_{16}\text{H}_{14}\text{O}_3$ . MW, 254. M.p. 58°.

*Benzyl ester*:  $\text{C}_{21}\text{H}_{16}\text{O}_3$ . MW, 316. M.p. 64°.

*p-Nitrobenzyl ester*: m.p. 100°.

*Chloride*:  $\text{C}_{14}\text{H}_9\text{O}_2\text{Cl}$ . MW, 244.5. Prisms. M.p. 70°.

*Anhydride*:  $\text{C}_{28}\text{H}_{18}\text{O}_5$ . MW, 434. M.p. 140°.

*Amide*:  $\text{C}_{14}\text{H}_{11}\text{O}_2\text{N}$ . MW, 225. M.p. 165°.

Rubidge, Qua, *J. Am. Chem. Soc.*, 1914, 36, 732.

Stone, Jacobson, U.S.P., 1,656,575, (*Chem. Abstracts*, 1928, 22, 966).

Calco Chemical Co., U.S.P., 1,942,430, (*Chem. Abstracts*, 1934, 28, 1717).

### m-Benzoylbenzoic Acid (*3-Benzoylbenzoic acid, benzophenone-m-carboxylic acid*)

Needles. M.p. 161–2°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O. Sublimes.

*Me ester*:  $\text{C}_{15}\text{H}_{12}\text{O}_3$ . MW, 240. M.p. 62°. Sol. Et<sub>2</sub>O, hot EtOH.

Senff, *Ann*, 1883, 220, 252.

### p-Benzoylbenzoic Acid (*4-Benzoylbenzoic acid, benzophenone-p-carboxylic acid*)

Plates from EtOH. M.p. 197–200° (226–7°). Sol. EtOH, Et<sub>2</sub>O, AcOH. Spar. sol. cold H<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Sublimes.

*Me ester*:  $\text{C}_{15}\text{H}_{12}\text{O}_3$ . MW, 240. M.p. 107°.

*Et ester*: C<sub>16</sub>H<sub>14</sub>O<sub>3</sub>. MW, 254. M.p. 52°. *Nitrile*: *p*-cyanobenzophenone. C<sub>14</sub>H<sub>9</sub>ON. MW, 207. M.p. 107–8°. *Oxime*: leaflets. M.p. 176°.

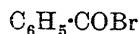
Bauer, Endres, *J. prakt. Chem.*, 1913, **87**, 546.

Wertheim, *J. Am. Chem. Soc.*, 1933, **55**, 2541.

***p*-Benzoylbenzyl Alcohol.**

See 4-Hydroxymethyl-benzophenone.

**Benzoyl bromide**



C<sub>7</sub>H<sub>5</sub>OBr MW, 185  
Fuming liq. F.p. –24°. B.p. 218–19°. D<sub>15</sub><sup>4</sup> 1.570.

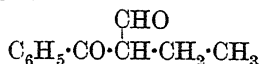
Claisen, *Ber.*, 1881, **14**, 2473.

Staudinger, *Anthes, Ber.*, 1913, **46**, 1423.

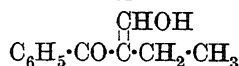
**4-Benzoylbutyl Alcohol.**

See ω-Hydroxyvaleraldehyde.

**1-Benzoylbutyraldehyde** (*β*-Formylbutyrophenone, *β*-aldehydobutyrophenone, *β*-hydroxymethylenebutyrophenone)



or

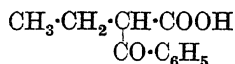


C<sub>11</sub>H<sub>12</sub>O<sub>2</sub> MW, 176

Leaflets from EtOH.Aq. M.p. 87–9°. B.p. 260–2° decomp.

Bishop, Claisen, Sinclair, *Ann.*, 1894, **281**, 397.

**1-Benzoylbutyric Acid** (*Ethyl-benzoylacetic acid*)



C<sub>11</sub>H<sub>12</sub>O<sub>3</sub> MW, 192

Plates from pet. ether–C<sub>6</sub>H<sub>6</sub>. M.p. 85–7° decomp.

*Et ester*: C<sub>13</sub>H<sub>16</sub>O<sub>3</sub>. MW, 220. B.p. 168–71°/19 mm., 118–23°/1.5 mm. Insol. cold KOH.Aq. Boiling dil. alkali → propyl phenyl ketone. Conc. alc. KOH → benzoic and butyric acids.

*Butyl ester*: C<sub>15</sub>H<sub>20</sub>O<sub>3</sub>. M.W., 248. B.p. 116–17°/1 mm. n<sub>D</sub><sup>20</sup> 1.5003.

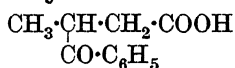
*Amide*: C<sub>11</sub>H<sub>13</sub>O<sub>2</sub>N. MW, 191. M.p. 148–9°.

*Nitrile*: C<sub>11</sub>H<sub>11</sub>ON. MW, 173. B.p. 134–5°/3 mm.

Hope, Perkin, *J. Chem. Soc.*, 1909, **95**, 2047.

Dorsch, McElvain, *J. Am. Chem. Soc.*, 1932, **54**, 2962.

**2-Benzoylbutyric Acid**



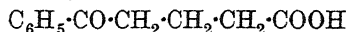
C<sub>11</sub>H<sub>12</sub>O<sub>3</sub> MW, 192

Rhombohedra from hot H<sub>2</sub>O. M.p. 59–60°. Sol. most org. solvents except pet. ether.

*Semicarbazone*: plates from EtOH. M.p. 177–8°. Spar. sol. H<sub>2</sub>O.

Higginbotham, Lapworth, Simpson, *J. Chem. Soc.*, 1924, **125**, 2342.

**3-Benzoylbutyric Acid** (*Butyrophenone-ω-carboxylic acid*)



C<sub>11</sub>H<sub>12</sub>O<sub>3</sub> MW, 192

Plates. M.p. 127°. Mod. sol. hot H<sub>2</sub>O.

*Me ester*: C<sub>12</sub>H<sub>14</sub>O<sub>3</sub>. MW, 206. M.p. –2°. B.p. 147–8°/8 mm. 2:4-Dinitrophenylhydrazones: red leaflets from CHCl<sub>3</sub>–MeOH. M.p. 149°.

*Et ester*: C<sub>13</sub>H<sub>16</sub>O<sub>3</sub>. MW, 220. B.p. 315°.

*Oxime*: m.p. 35–6°.

*Oxime*: m.p. 110°.

Fichter, Bauer, *Ber.*, 1898, **31**, 2001.

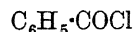
Allen, Cressman, *J. Am. Chem. Soc.*, 1933, **55**, 2955.

Somerville, Allen, *Organic Syntheses*, 1933, **XIII**, 13 (Note 8).

**Benzoylcarbinol.**

See Phenacyl Alcohol.

**Benzoyl chloride**



C<sub>7</sub>H<sub>5</sub>OCl MW, 140.5

Colourless, fuming liq. M.p. –1°. B.p. 197°, 194°/742 mm. D<sub>15</sub><sup>20</sup> 1.2187. n<sub>D</sub><sup>20</sup> 1.55369. Heat of comb. C<sub>p</sub> 784.3 Cal., C<sub>v</sub> 784.03 Cal. Hyd. by alkalis and boiling H<sub>2</sub>O. Reacts with alcohols, phenols and amines to give benzoyl derivs.

Montanna, *J. Am. Chem. Soc.*, 1927, **49**, 2114.

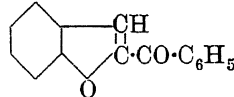
Monsanto Chem. Co., U.S.P., 2,006,335, (*Chem. Abstracts*, 1935, **29**, 5460).

Dow Chemical Co., U.S.P., 1,965,556, (*Chem. Abstracts*, 1934, **28**, 5474).

**Benzoyl-chlorobenzoic Acid.**

See Chloro-benzoylbenzoic Acid.

**2-Benzoylcoumarone** (*Phenyl 2-coumaryl ketone*)



C<sub>15</sub>H<sub>10</sub>O<sub>2</sub> MW, 222

Prisms. M.p. 91°. B.p. 360°. Sol. EtOH, Et<sub>2</sub>O. Red. → benzylcoumarone → benzylcoumaran.

*Oxime*: needles. M.p. 125–6°.

*Phenylhydrazones*: yellow needles. M.p. 128–9°.

*Semicarbazone*: m.p. 137°.

Stoermer, Chydenius, Schinn, *Ber.*, 1924, **57**, 72.

**5-Benzoyl- $\psi$ -cumene.**

See 2 : 4 : 5-Trimethylbenzophenone.

**Benzoyl cyanide.**

See under Benzoylformic Acid.

**Benzoylcyclohexane.**

See Hexahydrobenzophenone.

**Benzoyl-dimethylbenzoic Acid.**

See Dimethylbenzophenonecarboxylic Acid.

**Benzoyldiphenyl.**

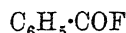
See Phenylbenzophenone.

**Benzoyl disulphide.**

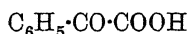
See Dibenzoyl disulphide.

**Benzoylethyl Alcohol.**

See Hydroxypropionophenone.

**Benzoylethylene Glycol.**See  $\beta$  :  $\gamma$ -Dihydroxypropionophenone.**Benzoyl fluoride** $C_7H_5OF$  MW, 124Fuming liq. B.p. 154-5° (145°). Hyd. by hot  $H_2O$ .Traube, Krahmer, *Ber.*, 1919, 52, 1296.Tseng, Mai, *J. Chinese Chem. Soc.*, 1936, 4, 22.**Benzoylformaldehyde.**

See Phenylglyoxal.

**Benzoylformic Acid (Phenylglyoxylic acid)** $C_8H_6O_3$  MW, 150Cryst. M.p. 66°. B.p. 147-51°/12 mm. Sol.  $H_2O$ . Decomp. on dist. Conc.  $H_2SO_4$   $\rightarrow$  benzoic acid + CO. Na.Hg  $\rightarrow$  mandelic acid. *Me ester*:  $C_9H_8O_3$ . MW, 164. B.p. 246-8°, 137°/14 mm. *Oxime*: needles from  $H_2O$ . M.p. 138-9°.*Et ester*:  $C_{10}H_{10}O_3$ . MW, 178. B.p. 256-7°, 156°/30 mm., 138°/15 mm., 118°/5 mm.  $D_4^{25}$  1.1222.  $n_D^{25}$  1.51904. *Oxime*: needles from  $H_2O$ . M.p. 112-13°. *Phenylhydrazone*: orange. M.p. 156° (rapid heat.). Very slow heat.  $\rightarrow$  yellow form at 140°, then m.p. 162-3.5°.*Propyl ester*:  $C_{11}H_{12}O_3$ . MW, 192. B.p. 174°/60 mm.*Isobutyl ester*:  $C_{12}H_{14}O_3$ . MW, 206. B.p. 170-4°/38 mm.*d-Amyl ester*:  $C_{13}H_{16}O_3$ . MW, 220. B.p. 163°/16 mm.  $D_4^{19}$  1.050.  $[\alpha]_D^{19}$  + 4.1°.*Isoamyl ester*: b.p. 179-82°/40 mm.*l-Menthyl ester*: needles from EtOH. M.p. 73-4°.  $[\alpha]_D^{20}$  - 44.4° in EtOH.*l-Bornyl ester*: prisms from EtOH. M.p. 42-3°.  $[\alpha]_D^{20}$  - 26.6° in EtOH.*Chloride*:  $C_8H_5O_2Cl$ . MW, 168.5. B.p. 125°/9 mm.*Nitrile*: benzoyl cyanide.  $C_8H_5ON$ . MW, 131. M.p. 32-3°. B.p. 206-8°.  $NH_3$   $\rightarrow$  benzamide. Alkalis  $\rightarrow$  benzoic acid + formic acid.*Amide*:  $C_8H_7O_2N$ . MW, 149. M.p. 91°.*Oxime*:  $\alpha$ -isonitrosophenylacetic acid. Twoforms.  $\alpha$ -. Prisms from  $Et_2O$ . M.p. 127°. Very unstable.  $\beta$ -. Needles from  $H_2O$ . M.p. 145° decomp. Less sol. than  $\alpha$ -form.*Thiosemicarbazone*: pale yellow. M.p. 188-9° (corr.).*2 : 4-Dinitrophenylhydrazone*: yellow. M.p. 196-7° decomp. (corr.).Wislicenus, Schäfer, *Ber.*, 1908, 41, 4170.  
Acree, *Am. Chem. J.*, 1913, 50, 389.Claisen, *Ber.*, 1879, 12, 729.Corson, Dodge, Harris, Hazen, *Organic Syntheses*, Collective Vol. I, 236.**Benzoylformoxime.**

See Isonitrosoacetophenone.

**Benzoylfuran.**

See Phenyl furyl Ketone.

**1-Benzoyl-2-furylethylene.**

See Furfurylideneacetophenone.

**Benzoylglycine.**

See Hippuric Acid.

 **$\omega$ -Benzoylhexahydrostyrene.**

See Hexahydrobenzylideneacetophenone.

**Benzoylhydrazine.**

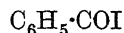
See Benzhydrazide.

**Benzoylhydrocinnamic Acid.**

See Phenyl benzoylpropionic Acid.

**Benzoyl hydroperoxide.**

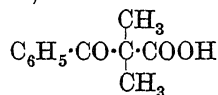
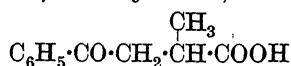
See Perbenzoic Acid.

**Benzoyl iodide** $C_7H_5OI$  MW, 232

Needles. M.p. 3°. B.p. 128°/20 mm.

Kishner, *Chem. Zentr.*, 1909, II, 1132.Staudinger, Anthes, *Ber.*, 1913, 46, 1423.**2-Benzoylisobutylene.**

See Seneciophenone.

**1-Benzoylisobutyric Acid (1 : 1-Dimethylbenzoylacetic acid)** $C_{11}H_{12}O_3$  MW, 192*Me ester*:  $C_{12}H_{14}O_3$ . MW, 206. B.p. 140-2°/14 mm.*Et ester*:  $C_{13}H_{16}O_3$ . MW, 220. B.p. 152°/20 mm. *Oxime*: needles from EtOH. M.p. 135-6°.Blaise, Courtot, *Bull. soc. chim.*, 1906, 35, 599.Scheibler, Stein, *J. prakt. Chem.*, 1934, 139, 105.**2-Benzoylisobutyric Acid (1-Methyl-2-benzoylpropionic acid, 1-phenacylpropionic acid, butyrophene- $\gamma$ -carboxylic acid)** $C_{11}H_{12}O_3$  MW, 192

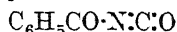


Needles from EtOH.Aq. or C<sub>6</sub>H<sub>6</sub>. M.p. 140-5°. Sublimes. Very sol. MeOH, EtOH, CHCl<sub>3</sub>. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, AcOH.

Oppenheim, *Ber.*, 1901, 34, 4228.

Krollpfeiffer, Schäfer, *Ber.*, 1923, 56, 630.

### Benzoyl isocyanate



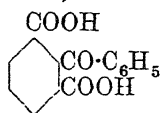
C<sub>8</sub>H<sub>5</sub>O<sub>2</sub>N MW, 147

Prisms from Et<sub>2</sub>O. M.p. 26°. B.p. 202°/724 mm., 88-91°/20 mm. Polymerises on keeping.

Billeter, *Ber.*, 1903, 36, 3218.

Hill, Desnan, *J. Am. Chem. Soc.*, 1940, 62, 1595.

### 2-Benzoylisophthalic Acid (Benzophenone-2:6-dicarboxylic acid)



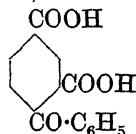
C<sub>15</sub>H<sub>10</sub>O<sub>5</sub> MW, 270

Needles from EtOH.Aq. M.p. 260°. Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O. Conc. H<sub>2</sub>SO<sub>4</sub> at 145° → anthraquinone-1-carboxylic acid.

Graebe, Leonhardt, *Ann.*, 1896, 290, 232.

Hayashi, Tsuruoka Morikawa, Nami-kawa, *Chem. Abstracts*, 1936, 30, 5965.

### 4-Benzoylisophthalic Acid (Benzophenone-2:4-dicarboxylic acid)



C<sub>15</sub>H<sub>10</sub>O<sub>5</sub> MW, 270

Prisms from EtOH.Aq. M.p. 278-80°. Sublimes. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. hot H<sub>2</sub>O, CHCl<sub>3</sub>, toluene.

*Di-Me ester*: C<sub>17</sub>H<sub>14</sub>O<sub>5</sub>. MW, 298. Pale yellow triclinic cryst. M.p. 119.5-20°.

*Di-Et ester*: C<sub>19</sub>H<sub>18</sub>O<sub>5</sub>. MW, 326. M.p. 95°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>.

Zincke, Blatzbecker, *Ber.*, 1876, 9, 1762.

### Benzoylisopropyl Alcohol.

See  $\gamma$ -Hydroxybutyrophenone.

### Benzoyl isothiocyanate



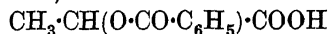
C<sub>8</sub>H<sub>5</sub>ONS MW, 163

Oil. B.p. 133-7°/18 mm., 119°/10 mm. D<sup>18</sup> 1.2142.  $n_D^{18}$  1.6382.

Wheeler, Merriam, *J. Am. Chem. Soc.*, 1901, 23, 285, 298.

Ambelang, Johnson, *J. Am. Chem. Soc.*, 1939, 61, 632.

### O-Benzoyl-lactic Acid (1-Benzoylhydroxypropionic acid)



C<sub>10</sub>H<sub>10</sub>O<sub>4</sub> MW, 194

Cryst. M.p. 112°. Sol. EtOH, Et<sub>2</sub>O. Mod. sol. hot H<sub>2</sub>O. Hyd. by hot dil. H<sub>2</sub>SO<sub>4</sub>.

*Et ester*: C<sub>12</sub>H<sub>14</sub>O<sub>4</sub>. MW, 222. B.p. 288°

*Amide*: C<sub>16</sub>H<sub>11</sub>O<sub>3</sub>N. MW, 193. M.p. 124°.

*Nitrile*: C<sub>10</sub>H<sub>9</sub>O<sub>2</sub>N. MW, 175. B.p. 269-70°, 198-200°/125 mm.

$\alpha$ -Naphthalide: C<sub>20</sub>H<sub>17</sub>O<sub>3</sub>N. MW, 319. Needles from EtOH. M.p. 155°.

$\beta$ -Naphthalide: needles from EtOH. M.p. 177°.

Wislicenus, *Ann.*, 1865, 133, 277.

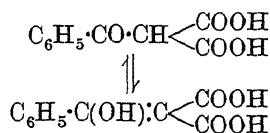
Davis, *J. Chem. Soc.*, 1910, 97, 950.

Aloy, Rabaut, *Bull. soc. chim.*, 1912, 11, 393.

### 2-Benzoyl-lactic Acid.

See Phenacylglycollic Acid.

### Benzoylmalonic Acid (Acetophenone- $\omega$ -dicarboxylic acid)



C<sub>10</sub>H<sub>8</sub>O<sub>5</sub> MW, 208

*Di-Et ester*: C<sub>14</sub>H<sub>16</sub>O<sub>5</sub>. MW, 264. Oil. B.p. 194-5°/14 mm., 187-90°/12 mm. Alc. sol. + FeCl<sub>3</sub> → red col. Zn + AcOH → benzylmalonic acid. *Cu deriv.*: Cu(C<sub>14</sub>H<sub>15</sub>O<sub>5</sub>)<sub>2</sub>. Green needles from EtOH.Aq. M.p. 180°.

*Me ester-nitrile*: C<sub>11</sub>H<sub>9</sub>O<sub>3</sub>N. MW, 203. Prisms. M.p. 74°.

*Et ester-nitrile*: C<sub>12</sub>H<sub>11</sub>O<sub>3</sub>N. MW, 217. Prisms. M.p. 41°.

Lund, *Ber.*, 1934, 67, 935.

Bülow, Hailer, *Ber.*, 1902, 35, 934.

### Benzylmesitylene.

See 2:4:6-Trimethylbenzophenone.

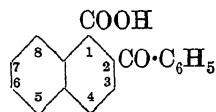
### Benzylmethylamine.

See Phenacylamine.

### Benzoylnaphthalene.

See Phenyl naphthyl Ketone.

### 2-Benzoyl-1-naphthoic Acid



C<sub>18</sub>H<sub>12</sub>O<sub>3</sub> MW, 276

Needles from MeOH. M.p. 141.8-142.8° (corr.). KOH at 260-80° → 1-naphthoic + benzoic acids.

*Me ester*: C<sub>19</sub>H<sub>14</sub>O<sub>3</sub>. MW, 290. Needles from MeOH. M.p. 72.5-73.5°.

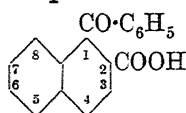
$\psi$ -*Me ester*: cryst. from MeOH. M.p. 156.5°.

Waldman, *J. prakt. Chem.*, 1931, 131, 71.

Fieser, Newman, *J. Am. Chem. Soc.*, 1936, 58, 2381.

**4-Benzoyl-1-naphthoic Acid.**

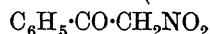
Cryst. from AcOH. M.p. 184°.

I.G., D.R.P., 557,249, (*Chem. Zentr.*, 1932, II, 2376); 558,471, (*Chem. Zentr.*, 1932, II, 2730).**8-Benzoyl-1-naphthoic Acid.**Needles from AcOH.Aq. M.p. 129-30° (110-12° decomp.). Sol. common org. solvents. Sol. conc. H<sub>2</sub>SO<sub>4</sub> with deep yellow col.*Et ester*: C<sub>20</sub>H<sub>16</sub>O<sub>3</sub>. MW, 304. Prisms. M.p. 166-7°. Sol. hot C<sub>6</sub>H<sub>6</sub>.*Chloride*: C<sub>18</sub>H<sub>11</sub>O<sub>2</sub>Cl. MW, 294.5. M.p. 125-7°.Mason, *J. Chem. Soc.*, 1924, 125, 2121.Knapp, *Monatsh.*, 1936, 67, 336.**1-Benzoyl-2-naphthoic Acid**C<sub>18</sub>H<sub>12</sub>O<sub>3</sub>

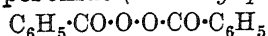
MW, 276

Cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 223.5-224.5° (corr.). Sol. conc. H<sub>2</sub>SO<sub>4</sub> with green col. KOH fusion → 2-naphthoic acid. PCl<sub>5</sub> → 1:2-benz-anthraquinone.*Me ester*: C<sub>19</sub>H<sub>14</sub>O<sub>3</sub>. MW, 290. Cryst. from MeOH. M.p. 113-14°.Waldmann, *J. prakt. Chem.*, 1930, 127, 195.Fieser, Newman, *J. Am. Chem. Soc.*, 1936, 58, 2381.**3-Benzoyl-2-naphthoic Acid.**Prisms from CHCl<sub>3</sub> or toluene. M.p. 210°. Sol. conc. H<sub>2</sub>SO<sub>4</sub> with red col. AlCl<sub>3</sub> → 2:3-benzanthraquinone.*Me ester*: cryst. from MeOH. M.p. 119-20°.Waldmann, Mathiowetz, *Ber.*, 1931, 64, 1717.**6-Benzoyl-2-naphthoic Acid.**

Yellowish-green needles. M.p. 198°.

Dziewoński, Wodelski, *Chem. Abstracts*, 1933, 27, 2145.**Benzoylnitromethane (ω-Nitroacetophenone)**C<sub>8</sub>H<sub>7</sub>O<sub>3</sub>N

MW, 165

Needles. M.p. 106°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, AcOH. Mod. sol. warm H<sub>2</sub>O.*Oxime*: needles from H<sub>2</sub>O. M.p. 96°.*Di-Me-acetal*: needles from EtOH. M.p. 55-6°.*Phenylhydrazone*: yellow needles from EtOH. M.p. 105-5.5°.Wieland, *Ann.*, 1903, 328, 239.Fujise, Takeuchi, Kamioka, Tiba, *Ber.*, 1935, 68, 1275.Thiele, Haeckel, *Ann.*, 1902, 325, 10.**Benzoyl peroxide (Dibenzoyl peroxide)**C<sub>14</sub>H<sub>10</sub>O<sub>4</sub>

MW, 242

Prisms. M.p. 103.5° (106-8°). Spar. sol. H<sub>2</sub>O. Mod. sol. EtOH, C<sub>6</sub>H<sub>6</sub>. Explodes on heating.Vanino, Herzer, *Chem. Abstracts*, 1916, 10, 1252.Gambarjan, *Ber.*, 1909, 42, 4008.Nencki, Zaleski, *Z. physiol. Chem.*, 1899, 27, 493.**Benzoyl-phenetidine.**

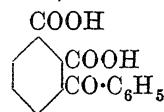
See under Hydroxybenzanilide.

**Benzoylphenetole.**

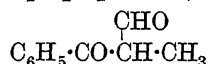
See under Hydroxybenzophenone.

**Benzoylphenol.**

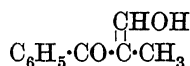
See Hydroxybenzophenone.

**3-Benzoylphthalic Acid (Benzophenone-2:3-dicarboxylic acid)**C<sub>15</sub>H<sub>10</sub>O<sub>5</sub>

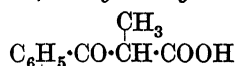
MW, 270

Plates or needles + 1H<sub>2</sub>O. M.p. 140-1°. Heated to 145-50° → anhydride. Sol. EtOH, hot H<sub>2</sub>O.*Anhydride*: C<sub>15</sub>H<sub>8</sub>O<sub>4</sub>. MW, 252. M.p. 183°.Graebe, Blumenfeld, *Ber.*, 1897, 30, 1115.Hayashi, Tsuruoka, Morikawa, Nami-kawa, *Chem. Abstracts*, 1936, 30, 5965.**4-Benzoylphthalic Acid (Benzophenone-3:4-dicarboxylic acid).**Shining leaflets from xylene. M.p. 177°. Heat with Ac<sub>2</sub>O → anhydride. M.p. 152°.Chardonnens, Schlapbach, *Helv. Chim. Acta*, 1946, 29, 1413.**1-Benzoylpropionaldehyde (β-Formylpropio-phenone, 1-formylethyl phenyl ketone, β-hydroxymethylene-propio-phenone)**

or

C<sub>10</sub>H<sub>10</sub>O<sub>2</sub>

MW, 162

Needles from EtOH.Aq. M.p. 118-19°. B.p. 155°/25 mm. Sol. MeOH, EtOH, C<sub>6</sub>H<sub>6</sub>, hot H<sub>2</sub>O. Spar. sol. Et<sub>2</sub>O, CS<sub>2</sub>. Very spar. sol. ligroin. FeCl<sub>3</sub> on EtOH sol. → deep violet col.Reynolds, *Am. Chem. J.*, 1910, 44, 313.**1-Benzoylpropionic Acid (Propio-phenone-β-carboxylic acid, methylbenzoylacetic acid)**C<sub>10</sub>H<sub>10</sub>O<sub>3</sub>

MW, 178

Cryst. from  $C_6H_6$ -pet. ether. M.p. 82-3° decomp.  $FeCl_3 \rightarrow$  brown col.

*Et ester*:  $C_{12}H_{14}O_3$ . MW, 206. Oil with pleasant odour. B.p. 148-150°/12 mm., 115-18°/1 mm. *Cu deriv.*: green powder. Decomp. at 180°.

*Isopropyl ester*: b.p. 151-5°/10 mm.

*tert.-Butyl ester*: b.p. 151-5°/11 mm.

*Amide*:  $C_{10}H_{11}O_2N$ . MW, 177. M.p. 145-6°.

*Anilide*: prisms from EtOH. M.p. 137-8°.

Spar. sol.  $H_2O$ ,  $Et_2O$ . Very sol. EtOH,  $C_6H_6$ .

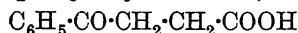
*Phenylhydrazone*: slightly brownish needles from  $C_6H_6$ . M.p. 100-104°.

Dorsch, McElvain, *J. Am. Chem. Soc.*, 1932, **54**, 2963.

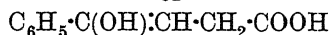
Rupe, Pieper, *Helv. Chim. Acta*, 1929, **12**, 644.

Hope, Perkin, *J. Chem. Soc.*, 1909, **95**, 2045.

### 2-Benzoylpropionic Acid (In enol form, 3-hydroxy-3-phenylvinylacetic acid)



or



$C_{10}H_{10}O_3$  MW, 178

Leaflets. M.p. 116°. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ ,  $CS_2$ , hot  $H_2O$ . Ox.  $\rightarrow$  benzoic + propionic acids.  $k = 2.2 \times 10^{-5}$  at 25°.

*Me ester*:  $C_{11}H_{12}O_3$ . MW, 192. M.p. 18-20°. B.p. 290°, 187°/30 mm.

*Et ester*:  $C_{12}H_{14}O_3$ . MW, 206. M.p. 18-19°. B.p. 295°, 192°/33 mm., 163-5°/10 mm.

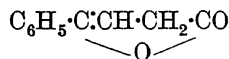
*Allyl ester*: b.p. 117-19°/0.1 mm.  $n_D^{20}$  1.5243.

*Amide*:  $C_{10}H_{11}O_2N$ . MW, 177. Needles from  $H_2O$ . M.p. 145-6°.

*Nitrile*:  $C_{10}H_9ON$ . MW, 159. B.p. 128-30°/3 mm.

*Anilide*: m.p. 150° (145°).

*Lactone*:



$C_{10}H_8O_2$ . MW, 160. Leaflets. M.p. 90-1°. Sol.  $Et_2O$ , AcOH. Mod. sol. EtOH,  $C_6H_6$ . Volatile in steam. Hyd. by alkalis.

*Oxime*: *labile form*, m.p. 95-6° (91°). *Stable form*, m.p. 129°.

*Semicarbazone*: m.p. 181° decomp.

Komppa, Rohrmann, *Ann.*, 1934, **509**, 259.

Somerville, Allen, *Organic Syntheses*, 1933, **XIII**, 12.

Gabriel, Colman, *Ber.*, 1899, **32**, 398.

### Benzoylpropyl Alcohol.

See  $\beta$ -Hydroxybutyrophenone.

### 1-Benzoylpropylene.

See Crotonophenone.

### Benzoylprotocatechuic Acid.

See 4 : 5-, and 5 : 6-Dihydroxybenzophenone-2-carboxylic Acids.

### Benzoylpyridine.

See Phenyl pyridyl Ketone.

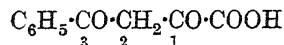
### 4-Benzoylpyrogallol.

See Gallobenzophenone.

### Benzoylpyrrole.

See Phenyl pyrrol Ketone.

### Benzoylpyruvic Acid (Phenacylglyoxylic acid)



$C_{10}H_8O_4$  MW, 192

Prisms +  $1H_2O$  from EtOH. Aq. M.p. 156-8° decomp., (161°). Sol. EtOH, MeOH. Insol.  $H_2O$ ,  $C_6H_6$ .  $k = 6.5 \times 10^{-3}$  at 25°.  $H_2SO_4 \rightarrow$  purple-red col. Heat  $\rightarrow CO + CO_2 +$  acetophenone.

*Me ester*:  $C_{11}H_{10}O_4$ . MW, 206. Prisms. M.p. 59° (62°).

*Et ester*:  $C_{12}H_{12}O_4$ . MW, 220. Prisms from pet. ether. M.p. 46°.

*Amide*:  $C_{10}H_9O_3N$ . MW, 191. M.p. 138° decomp.

*1-Oxime*: prisms +  $1H_2O$ . M.p. 98-100° decomp.

*3-Semicarbazone*: m.p. 170°.

*Di-thiosemicarbazone*: m.p. 168°.

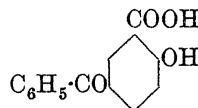
Mumm, Münchmeyer, *Ber.*, 1910, **43**, 3335.

Gault, Funke, *Bull. soc. chim.*, 1927, **41**, 473.

### Benzoylquinoline.

See Phenyl quinolyl Ketone.

### 5-Benzoylsalicylic Acid (4-Hydroxybenzophenone-3-carboxylic acid)



$C_{14}H_{10}O_4$  MW, 242

Cryst. from EtOH. M.p. 207-10°. Sol. EtOH,  $Et_2O$ , AcOH.  $FeCl_3 \rightarrow$  violet col. Heat with lime  $\rightarrow p$ -hydroxybenzophenone.

*Me ester*:  $C_{15}H_{12}O_4$ . MW, 256. Leaflets. M.p. 92°.

*Et ester*:  $C_{16}H_{14}O_4$ . MW, 270. M.p. 97°. Sol.  $C_6H_6$ .

*Phenyl ester*: benzoylsalol.  $C_{20}H_{14}O_4$ . MW, 318. Cryst. from hot EtOH. M.p. 84°. Sol.  $Et_2O$ .

*Me ether*:  $C_{15}H_{12}O_4$ . MW, 256. M.p. 156°.

*Et ether*:  $C_{16}H_{14}O_4$ . MW, 270. Needles from EtOH. Aq. M.p. 109°. *Et ester*: needles from ligroin. M.p. 56°.

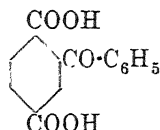
Limpricht, *Ann.*, 1896, **290**, 164.

Oliverio, Piccaluga, *Chem. Zentr.*, 1933, **II**, 3273.

### Benzoyl sulphide.

See Dibenzoyl sulphide.

**Benzoyltterephthalic Acid** (*Benzophenone-2:5-dicarboxylic acid*)



$C_{15}H_{10}O_5$  MW, 270  
M.p. 291–2°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O, toluene.

*Di-Me ester*:  $C_{17}H_{14}O_5$ . MW, 298. Needles. M.p. 100–1°.

*Di-Et ester*:  $C_{19}H_{18}O_5$ . MW, 326. Prisms. M.p. 100–1°.

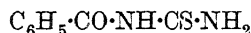
Elbs, Larsen, *J. prakt. Chem.*, 1887, **35**, 479.

v. Braun, Manz, Reinsch, *Ann.*, 1928, **468**, 287.

**Benzoylthiophene.**

See Phenyl thienyl Ketone.

**Benzoylthiourea** (*Benzoylthiocarbamide*)



$C_8H_8ON_2S$  MW, 180

Prisms from EtOH.Aq. M.p. 171°. Sol. EtOH. Spar. sol. H<sub>2</sub>O. Insol. Et<sub>2</sub>O.

Pike, *Ber.*, 1873, **6**, 755.

**Benzoylurea**

(*Benzoylaminoformamide, benzoylcarbamide*)

$C_8H_8O_2N_2$



MW, 164

Leaflets from EtOH. M.p. 215°. Mod. sol. hot EtOH, hot H<sub>2</sub>O. Insol. Et<sub>2</sub>O. Heat → benzamide + cyanuric acid.

Rupe, *Ber.*, 1895, **28**, 256.

**Benzoylvanillic Acid.**

See under 4:5-Dihydroxybenzophenone-2-carboxylic Acid.

**Benzoylveratric Acid.**

See under 4:5-, and 5:6-Dihydroxybenzophenone-2-carboxylic Acids.

**Benzoylvinyl Alcohol.**

See Benzoylacetalddehyde.

**Benzoylxlenol.**

See Hydroxydimethylbenzophenone.

**1:2-Benzpentacene** (*Benzo[α]pentacene*)



$C_{26}H_{16}$  MW, 328

Violet-blue leaflets from PhNO<sub>2</sub>. M.p. 357°. Conc. H<sub>2</sub>SO<sub>4</sub> → violet → brown col. Sol.

in C<sub>6</sub>H<sub>6</sub> → orange-red sol. with yellowish-green fluor.

Clar, *Ber.*, 1948, **81**, 52.

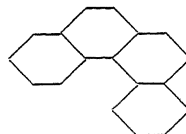
**1:2-Benzphenanthrene.**

See Chrysene.

**2:3-Benzphenanthrene.**

See 1:2-Benzanthracene.

**3:4-Benzphenanthrene**



$C_{18}H_{12}$  MW, 228

Needles from EtOH. M.p. 68°. Has carcinogenic properties.

*Picrate*: red needles from EtOH. M.p. 128–128.5°.

Hewett, *J. Chem. Soc.*, 1936, 599.

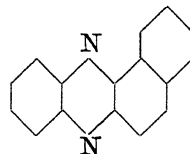
Newmann, Joshel, *J. Am. Chem. Soc.*, 1938, **60**, 487.

Bachman, Edgerton, *J. Am. Chem. Soc.*, 1940, **62**, 2972.

**9:10-Benzphenanthrene.**

See Triphenylene.

**1:2-Benzphenazine** (ang.-*Naphthaphenazine*)



$C_{16}H_{10}N_2$  MW, 230

Yellow needles. M.p. 142°. Dist. undecomp. above 360°. Sol. EtOH, Et<sub>2</sub>O, AcOH. Insol. H<sub>2</sub>O. Sol. conc. H<sub>2</sub>SO<sub>4</sub> with reddish-brown col.

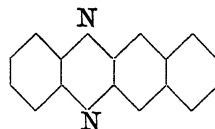
*Ethiodide*:  $C_{18}H_{15}N_2I$ . MW, 386. Black needles with violet reflex. M.p. 150° decomp.

*N-Oxide*:  $C_{16}H_{10}ON_2$ . MW, 246. Green cryst. M.p. 182°.

Kehrmann, Mermud, *Helv. Chim. Acta*, 1927, **10**, 64.

Fischer, Hepp, *Ber.*, 1897, **30**, 393.

**2:3-Benzphenazine** (lin.-*Naphthaphenazine*)



$C_{16}H_{10}N_2$  MW, 230

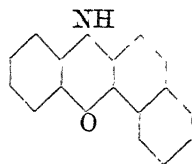
Red leaflets from C<sub>6</sub>H<sub>6</sub>. M.p. 233°. Sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, hot AcOH. Spar. sol. EtOH. Sol. conc. H<sub>2</sub>SO<sub>4</sub> with yellow col.

Hinsberg, *Ann.*, 1901, **319**, 261.

**Benz-phenetidine.**

See under Hydroxybenzanilide.

## 1 : 2-Benzphenoxazine

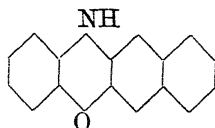
 $C_{16}H_{11}ON$ 

MW, 233

Yellow cryst. from EtOH containing  $SO_2$ . M.p. (sealed tube) 127–8°. Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ , AcOH. EtOH sol. shows intense green fluor.

Goldstein, Ludwig-Semelic, *Helv. Chim. Acta*, 1919, 2, 660.

## 2 : 3-Benzphenoxazine

 $C_{16}H_{11}ON$ 

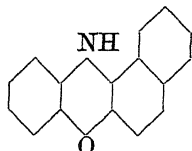
MW, 233

Plates from  $C_6H_6$ -EtOH. M.p. 302°. Sol. EtOH,  $C_6H_6$ , AcOH, with bluish-violet fluor. Sol. conc.  $H_2SO_4$  with red col. → bluish-violet on heating.

N-Acetyl: plates. M.p. 151°.

Kehrmann, Neil, *Ber.*, 1914, 47, 3102.

## 3 : 4-Benzphenoxazine

 $C_{16}H_{11}ON$ 

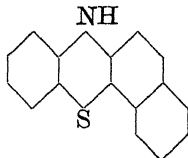
MW, 233

Yellow solid. M.p. (air exclusion) 107° decomp. Sol. EtOH,  $Et_2O$ , AcOH,  $C_6H_6$ . Intense green fluor. in EtOH. Sol. conc.  $H_2SO_4$  with pale blue col. → red on dil. Rapidly decomp. by light.

Goldstein, Ludwig-Semelic, *Helv. Chim. Acta*, 1919, 2, 657.

Lantz, Wahl, *Bull. soc. chim.*, 1935, 2, 488.

## 1 : 2-Benzpenthiazine

 $C_{16}H_{11}NS$ 

MW, 249

Yellow needles from EtOH, toluene or ligroin. M.p. 178°. Sol.  $C_6H_6$ . Spar. sol. EtOH, AcOH. Sols. in  $C_6H_6$  and EtOH fluor. green. Sol. conc.  $H_2SO_4$  with deep blue col.

N-Acetyl: cryst. from  $C_6H_6$ . M.p. 126°.

N-Me:  $C_{17}H_{13}NS$ . MW, 263. Yellowish-

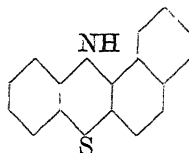
green needles from EtOH- $C_6H_6$ . M.p. 132–3°. Sol. conc.  $H_2SO_4$  with deep blue col.

Kehrmann, Christopoulos, *Ber.*, 1921, 54, 653.

Kehrmann, *Ann.*, 1902, 322, 47.

Knoevenagel, *J. prakt. Chem.*, 1914, 89, 14.

## 3 : 4-Benzpenthiazine

 $C_{16}H_{11}NS$ 

MW, 249

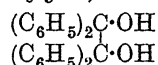
Yellow leaflets from EtOH. M.p. 137–8°. Sols. in org. solvents fluor. bluish-green. Sol. conc.  $H_2SO_4$  with deep blue col. Cu powder at 280° → 1 : 2-benzcarbazole.

Kehrmann, Christopoulos, *Ber.*, 1921, 54, 649.

Kehrmann, Gressly, Misslin, *Ann.*, 1902, 322, 44.

Knoevenagel, *J. prakt. Chem.*, 1914, 89, 14.

**Benzpinacol** (*Benzpinacone*, *benzopinacone*, *tetraphenylethylene glycol*)

 $C_{26}H_{22}O_2$ 

MW, 366

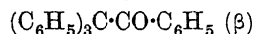
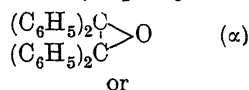
Prisms. M.p. (capillary tube) 185–6° decomp. → benzophenone and benzhydrol. Sol.  $Et_2O$ ,  $CHCl_3$ ,  $CS_2$ .  $PCl_5$ , hot conc. HCl, etc. →  $\beta$ -benzpinacolin. HI + P at 170° → tetraphenylethane.

*Diphenyl ether*:  $C_{33}H_{30}O_2$ . MW, 518. Plates from  $C_6H_6$ . M.p. about 196°.

Meyer, Wieland, *Ber.*, 1911, 44, 2559.

Bachmann, *Organic Syntheses*, 1934, XIV, 8.

**Benzpinacolin** (*sym.-Tetraphenylethylene oxide*, *benzopinacolone*, *triphenylbenzoylmethane*)

 $C_{26}H_{20}O$ 

MW, 348

 $\alpha$ -Form.

Needles. M.p. 204–5°. Sol.  $CHCl_3$ ,  $CS_2$ ,  $C_6H_6$ . Prac. insol. cold EtOH, AcOH.  $CrO_3$  in AcOH → benzophenone.

 $\beta$ -Form.

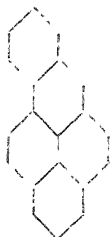
Needles. M.p. 181°. Sol.  $CHCl_3$ ,  $CS_2$ ,  $C_6H_6$ . Spar. sol. cold EtOH.  $CrO_3$  in AcOH → triphenylcarbinol + benzoic acid.

Delacre, *Bull. soc. chim.*, 1909, 5, 1144.

Bachmann, *Organic Syntheses*, 1934, XIV, 12.

**Benzpyrazole.**

See Indazole.

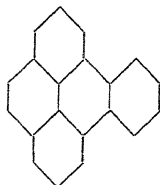
**1 : 2-Benzpyrene** $C_{20}H_{12}$ 

MW, 252

Carcinogenic constituent of coal tars. Pale yellow needles from  $C_6H_6$ -MeOH. M.p. 176.5-7.5°. B.p. 310-12°/10 mm. Violet fluor. in  $C_6H_6$ .

*Picrate*: purplish-black needles. M.p. 197-8°.

Cook, Hewett, *J. Chem. Soc.*, 1933, 398.

**4 : 5-Benzpyrene** $C_{20}H_{12}$ 

MW, 252

Constituent of coal tars. Non-carcinogenic. Prisms from  $C_6H_6$ . M.p. 178-9°. Sublimes at 250°/3-4 mm.

*Picrate*: ruby-red needles from  $C_6H_6$ . M.p. 229-30°.

Cook, Hewett, *J. Chem. Soc.*, 1933, 398.

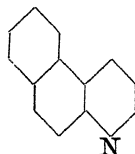
 **$\gamma$ -Benzpyrone.**

See Chromone.

**3 : 4-Benzquinoline.**

See Phenanthridine.

**5 : 6-Benzquinoline** ( $\beta$ -Naphthaquinoline, naphtha-2' : 1' : 2 : 3-pyridine, 1-azaphenanthrene)

 $C_{13}H_9N$ 

MW, 179

Leaflets from  $H_2O$  or pet. ether. M.p. 94°. B.p. 350°/721 mm., 210-15°/22 mm. Sol. ord. org. solvents. Difficultly volatile in steam. Very spar. sol.  $H_2O$ .

$B_2H_2SO_4$ : yellow needles. M.p. 90°.

*Methochloride*: needles from EtOH-Et<sub>2</sub>O. M.p. anhyd. 236°.

*Methiodide*: yellow needles from  $H_2O$  or EtOH. M.p. 200-5° decomp. (186°).

*Ethobromide*: needles from amyl alcohol. M.p. 238°.

*Ethiodide*: yellow needles from  $H_2O$ . M.p. 206° decomp.

*Benzyl chloride quaternary salt*: m.p. anhyd. 196°.

*Picrate*: yellow prisms from EtOH or  $C_6H_6$ . M.p. 251-2°.

1 : 3 : 5-Trinitrobenzene add. comp.: reddish-yellow needles. M.p. 112° corr.

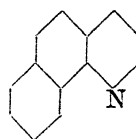
Bamberger, Müller, *Ber.*, 1891, 24, 2643.

Knueppel, *Ber.*, 1896, 29, 708.

Braun, Gruber, *Ber.*, 1922, 55, 1714.

**6 : 7-Benzquinoline.**See  $\alpha$ -Anthrapyridine.

**7 : 8-Benzquinoline** ( $\alpha$ -Naphthaquinoline, naphtha-1' : 2' : 2 : 3-pyridine, 4-azaphenanthrene)

 $C_{13}H_9N$ 

MW, 179

Plates from pet. ether. M.p. 52°. B.p. 338°/719 mm., 223°/47 mm. Sol. ord. org. solvents. Volatile in superheated steam.

$B, HCl$ : yellowish needles. M.p. 213°.

$B, H_2SO_4$ : yellowish prisms from EtOH. M.p. 213°.

$B, HNO_3$ : m.p. anhyd. 135-7°.

$B_2, H_2PtCl_6$ : yellow prisms. M.p. 224° decomp.

*Methochloride*: needles from EtOH-Et<sub>2</sub>O. M.p. 133°.

*Methiodide*: yellow needles from  $H_2O$  or EtOH. M.p. 179°.

*Methosulphate*:  $C_{15}H_{14}O_4NS$ . MW, 305. Needles from EtOH-Et<sub>2</sub>O. M.p. 162°.

1 : 3 : 5-Trinitrobenzene add. comp.: yellow needles from EtOH. M.p. 133.5° (corr.).

*Picrate*: m.p. 191-2°.

Stewart, *J. Chem. Soc.*, 1925, 127, 1332.

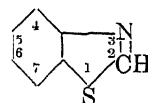
Haid, *Monatsh.*, 1906, 27, 318.

Claus, Imhoff, *J. prakt. Chem.*, 1898, 57, 68.

**Benzselenophenone.**

See Selenonaphthene.

**Benzthiazole** (*Benzothiazole*. See Note under 2-Aminobenzthiazole)

 $C_7H_5NS$ 

MW, 135

B.p. 223-5°. Sol. EtOH, CS<sub>2</sub>. Very spar. sol.  $H_2O$ . Neutral reaction. Volatile in steam.  $B, HCl$ : m.p. 192°.

$B_2, H_2SO_4$ : m.p. 157-7.5°.

*Picrate*: m.p. 176°.

*Methiodide*: needles. M.p. 210°.

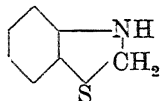
*Ethiodide*: prisms. M.p. 138–9°.

Bruni, Levi, *Gazz. chim. ital.*, 1924, **54**, 402.

Mills, *J. Chem. Soc.*, 1922, **121**, 460.

Kiprianov, Suitnik, Grigor'eva, *Chem. Abstracts*, 1936, **30**, 4859.

**Benzthiazoline** (*Benzothiazoline*)



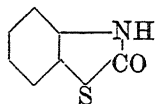
$C_7H_7NS$

MW, 137

Yellow oil. B.p. 270°.

Claasz, *Ber.*, 1912, **45**, 1031.

**Benzthiazolone** (*Benzothiazolone*)



$C_7H_5ONS$

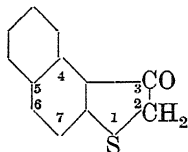
MW, 151

Needles from EtOH. M.p. 128°. Sol. conc. alkalis and min. acids.

*N-Acetyl*: needles from EtOH. Aq. M.p. 50°.

Mills, Whitworth, *J. Chem. Soc.*, 1927, 2752.

**4 : 5-Benzthioindoxyl** (*3-Hydroxy-4 : 5-benzthionaphthene*)



$C_{12}H_8OS$

MW, 200

Needles. M.p. 121°. Sol. most org. solvents. Volatile in steam.

Friedländer, Woroshow, *Ann.*, 1912, **388**, 18.

**5 : 6-Benzthioindoxyl** (*3-Hydroxy-5 : 6-benzthionaphthene*).

Greenish-yellow powder.

Harley-Mason, Mann, *J. Chem. Soc.*, 1942, 410.

**6 : 7-Benzthioindoxyl** (*3-Hydroxy-6 : 7-benzthionaphthene*).

Dark brown cryst. from EtOH. Aq. M.p. 142°. Readily sol. most org. solvents.

Friedländer, Woroshow, *Ann.*, 1912, **388**, 18.

**Benzthiophene.**

See Thionaphthene.

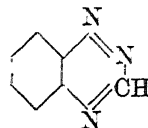
**Benzthiopyrone.**

See Thiochromone.

**Benz-toluidide.**

See under Toluidine.

**Benztriazine**



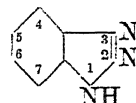
$C_7H_5N_3$

MW, 131

Yellow to orange-red needles from  $C_6H_6$ . M.p. 74–5°. B.p. 235–40°. Sol. hot  $Et_2O$ ,  $H_2O$ , EtOH.

Bischler, *Ber.*, 1889, **22**, 2806.

**Benztriazole** (*Benzeneazimide, benzotriazole, aziminobenzene*)



$C_6H_5N_3$

MW, 119

Needles from  $C_6H_6$ . M.p. 100°.

*1-Hydroxy deriv.*: azimidol. M.p. 157°.

*1-N-Acetyl*: m.p. 51°.

*1-N-Benzoyl*: needles. M.p. 112°.

Charrier, Beretta, *Gazz. chim. ital.*, 1921, **51**, II, 267.

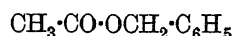
**Benztropolone.**

See Benzotropolone.

**Benzylacetaldehyde.**

See Hydrocinnamaldehyde.

**Benzyl acetate**



$C_9H_{10}O_2$

MW, 150

Constituent of jasmin, gardenia, and other ethereal oils. B.p. 213.5°/756 mm., 93–4°/10 mm.  $D^{16}_4$  1.057.  $n^{20}_D$  1.5232.

Seelig, *J. prakt. Chem.*, 1889, **39**, 162.

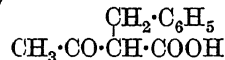
Shapiro, *Chem. Abstracts*, 1936, **30**, 723.

Givaudan Soc. Anon., Swiss P., 169,040, (*Chem. Abstracts*, 1935, **29**, 481).

**Benzylacetic Acid.**

See Hydrocinnamic Acid.

**1-Benzylacetoacetic Acid** ( *$\alpha$ -Acetohydrocinnamic acid*)



$C_{11}H_{12}O_3$

MW, 192

Oil with aromatic odour. B.p. 156–62°/13 mm. Spar. sol.  $H_2O$ . Heat  $\rightarrow$  benzylacetone.

*Me ester*:  $C_{12}H_{14}O_3$ . MW, 206. B.p. 180–82°/15 mm.  $D^{17}_4$  1.091. Alc.  $FeCl_3 \rightarrow$  violet col.

*Et ester*:  $C_{13}H_{16}O_3$ . MW, 220. B.p. 283–4° (276°), 157–8°/14 mm., 164–5°/12 mm.

*Menthyl ester*: two forms. (a) M.p. 68°.  $[\alpha]^{20}_D - 121.2^\circ$  in  $C_6H_6$ . (b) Needles from AcOH–EtOH. M.p. 48–51°.  $[\alpha]^{20}_D - 55.1^\circ$  in  $C_6H_6$ .

*Amide*:  $C_{11}H_{13}O_2N$ . MW, 191. Needles from  $H_2O$ . M.p. 150–1°. Sol. EtOH.

Nitrile: C<sub>11</sub>H<sub>11</sub>ON. MW, 173. B.p. 158–66°/13 mm. Semicarbazone: leaflets from EtOH. M.p. 168°. Phenylhydrazone: m.p. 112°.

2:4-Dinitrophenylhydrazone: m.p. 71·5°.

Conrad, Bischoff, *Ann.*, 1880, 204, 179.

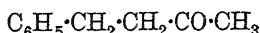
Ehrlich, *Ann.*, 1877, 187, 12.

Ceresole, *Ber.*, 1882, 15, 1871, 1875.

ω-Benzylacetone

See Phenylethyl naphthyl Ketone.

Benzylacetone (*Methyl phenylethyl ketone*)



C<sub>10</sub>H<sub>12</sub>O MW, 148

B.p. 235°, 115°/13 mm. D<sub>4</sub><sup>22</sup> 0·9849. n<sub>D</sub><sup>22</sup> 1·511. Forms bisulphite comp. CrO<sub>3</sub> → benzoin and acetic acids and CO<sub>2</sub>.

Oxime: needles. M.p. 87°.

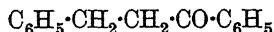
Semicarbazone: leaflets. M.p. 142°.

2:4-Dinitrophenylhydrazone: scarlet cryst. M.p. 131–2°.

Neber, Uber, *Ann.*, 1928, 467, 52.

Mattar, Hastings, Walker, *J. Chem. Soc.*, 1930, 2455.

ω-Benzylacetophenone (*Phenyl phenylethyl ketone*)



C<sub>15</sub>H<sub>14</sub>O MW, 210

Leaflets. M.p. 72–3°. Distills above 360°. Sol. EtOH, Et<sub>2</sub>O. Ox. → benzoic acid + CO<sub>2</sub>.

*Di-Et acetal*: b.p. 189°/18 mm. D<sub>4</sub><sup>22</sup> 1·0425. n<sub>D</sub><sup>22</sup> 1·5407.

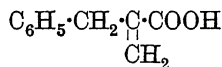
Oxime: needles from EtOH.Aq. M.p. 87°.

Semicarbazone: m.p. 144°.

Perkin, Stenhouse, *J. Chem. Soc.*, 1891, 59, 1007.

Adams, Kern, Shriner, *Organic Syntheses*, Collective Vol. I, 95.

1-Benzylacrylic Acid



C<sub>10</sub>H<sub>10</sub>O<sub>2</sub> MW, 162

Prisms. M.p. 68–9°. Sol. most org. solvents. Spar. sol. H<sub>2</sub>O. KMnO<sub>4</sub> → benzyl alcohol and 1-benzylglyceric acid.

*Et ester*: C<sub>12</sub>H<sub>14</sub>O<sub>2</sub>. MW, 190. B.p. 134°/15 mm.

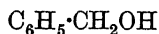
Mannich, Ritsert, *Ber.*, 1924, 57, 1116.

Simonsen, *J. Chem. Soc.*, 1920, 117, 567.

2-Benzylacrylic Acid.

See 3-Phenylcrotonic Acid.

Benzyl Alcohol (*Phenylcarbinol*, ω-*hydroxy-toluene*)



C<sub>7</sub>H<sub>8</sub>O MW, 108

Constituent of jasmin and other ethereal oils, both free and as esters. Colourless liq. B.p. 205·3°, 189°/500 mm., 141°/100 mm., 93°/10 mm. D<sub>4</sub><sup>1</sup> 1·0579, D<sub>15</sub><sup>15</sup> 1·050. Sol. to 4% in H<sub>2</sub>O at 17°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO. Heat of comb. C<sub>p</sub> 895·3 Cal. n<sub>D</sub><sup>20</sup> 1·53955. Dil. HNO<sub>3</sub> → benzaldehyde. CrO<sub>3</sub> → benzoic acid.

*Me ether*: see Methyl benzyl Ether.

*Et ether*: see Ethyl benzyl Ether.

*Allyl ether*: C<sub>10</sub>H<sub>12</sub>O. MW, 148. B.p. 204–5°.

Meisenheimer, *Ber.*, 1908, 41, 1420.

Hobart, *Pharm. J.*, 1924, 113, 635.

Chemische Fabrik Pott, D.R.P., 484,662, (*Chem. Abstracts*, 1930, 24, 1125).

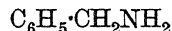
Benzyl Alcohol carboxylic Acid

See Hydroxymethyl-benzoic Acid.

1-Benzylallene.

See 4-Phenyl-1:2-butadiene.

Benzylamine (ω-*Aminotoluene*)



C<sub>7</sub>H<sub>9</sub>N MW, 107

B.p. 185°, 90°/12 mm. Misc. in all proportions with H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. D<sub>4</sub><sup>19</sup> 0·9826. n<sub>D</sub><sup>20</sup> 1·5401. Heat of comb. C<sub>p</sub> 967·6 Cal. Strong alkaline reaction. Absorbs CO<sub>2</sub>. k = 2·4 × 10<sup>-5</sup> at 25°.

*B,HCl*: m.p. 248° (rapid heat.). Sol. H<sub>2</sub>O.

*B,HBr*: m.p. 204°.

*B,HI*: leaflets. M.p. 162°.

*B,H<sub>2</sub>SO<sub>4</sub>*: needles. M.p. 93°.

*N-Allyl*: C<sub>10</sub>H<sub>13</sub>N. MW, 147. B.p. 205–8°.

*N-p-Toluenesulphonyl*: m.p. 185°.

*N-Benzoyl*: see Benzylbenzamide.

*Picrate*: m.p. 194°.

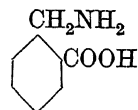
Erickson, *Ber.*, 1926, 59, 2665.

Ing, Manske, *J. Chem. Soc.*, 1926, 2348.

I.G., U.S.P., 1,873,402, (*Chem. Abstracts*, 1932, 28, 5965).

Knoll A.-G., U.S.P., 1,926,756, (*Chem. Abstracts*, 1933, 27, 5752).

Benzylamine-*o*-carboxylic Acid (ω-*Amino-o-toluic acid*)



C<sub>8</sub>H<sub>9</sub>O<sub>2</sub>N MW, 151

Cryst. from H<sub>2</sub>O. M.p. 217–20°. Heat above m.p. → phthalimidine.

Wegscheider, Glogau, *Monatsh.*, 1903, 24, 953.

Gabriel, Landsberger, *Ber.*, 1898, 31, 2738.

Benzylamine-*m*-carboxylic Acid (ω-*Amino-m-toluic acid*).

Cryst. from H<sub>2</sub>O. M.p. 215–18°.



*Nitrile*:  $C_8H_8N_2$ . MW, 132. Basic oil. *B,HCl*: needles from EtOH. M.p. 221°.  $B_2H_2PtCl_6$ : golden prisms from  $H_2O$ . M.p. 240°. *Picrate*: light yellow needles. M.p. 217° decomp.

*N-Chloroacetyl*: needles from EtOH. M.p. 176°. *Et ester*: needles from EtOH. M.p. 86-7°.

*N-Benzoyl*: m.p. 186°.

Reinglass, *Ber.*, 1891, 24, 2419.

Einhorn, *Ann.*, 1905, 343, 207.

Ehrlich, *Ber.*, 1901, 34, 3367.

**Benzylamine-*p*-carboxylic Acid** ( $\omega$ -*Amino-p-toluic acid*).

Yellow cryst. from  $H_2O$ . Insol. EtOH,  $Et_2O$ ,  $Me_2CO$ ,  $C_6H_6$ , ligroin.

*Et ester*: b.p. 145-8°. *B,HCl*: m.p. 235-7°.

*Nitrile*: oil. *B,HCl*: leaflets from EtOH. M.p. 274°.  $B_2H_2PtCl_6$ : red yellow cryst. M.p. 250° decomp. *Picrate*: needles. M.p. 218°.

Ehrlich, *Ber.*, 1901, 34, 3368 (*Note*).

Günther, *Ber.*, 1890, 23, 1060.

Dewing, *J. Chem. Soc.*, 1946, 466.

**Benzylamine-*p*-sulphonic Acid.**

See Homosulphanilic Acid.

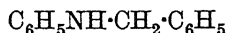
**Benzylaminoacetic Acid.**

See Benzylglycine.

$\omega$ -**Benzylaminoacetophenone.**

See Benzylphenacylamine.

**Benzylaniline** (*Phenylbenzylamine*)



$C_{13}H_{13}N$  MW, 183

Prisms. M.p. 37-8°. B.p. 306-7°, 201-3°/37 mm.  $D_{15}^{25}$  1.0698.  $n_D^{25}$  1.6118.

*B,HCl*: m.p. 214-16°.

*B,HBr*: cryst. from  $CHCl_3$ . Decomp. at 193°.

$B_2H_2PtCl_6$ : yellowish-red leaflets. M.p. 155°.

*p-Toluenesulphonate*: m.p. 148-9°.

*N-Nitroso*: phenylbenzyl nitrosamine.

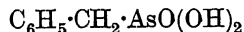
$C_{13}H_{12}ON_2$ . MW, 212. Yellow needles. M.p. 58°. Sol. EtOH,  $Et_2O$ , ligroin.

Willson, Wheeler, *Organic Syntheses*, Collective Vol. I, 97.

**Benzylanisole.**

See under Hydroxydiphenylmethane.

**Benzylarsinic Acid**



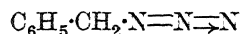
$C_7H_9O_3As$  MW, 216

Needles. M.p. 167°.

Dehn, McGrath, *J. Am. Chem. Soc.*, 1906, 28, 347.

Quick, Adams, *J. Am. Chem. Soc.*, 1922, 44, 811.

**Benzyl azide** ( $\omega$ -*Triazotoluene*)



$C_7H_7N_3$  MW, 133

B.p. 108°/23 mm., 74°/11 mm. Insol.  $H_2O$ . Misc. with EtOH,  $Et_2O$ . Volatile in steam.  $D_4^{25}$  1.0655.  $n_D^{25}$  1.53414. Explodes on strong heating.

Curtius, Ehrhart, *Ber.*, 1922, 55, 1559.

**Benzylbenzamide** (*Benzoylbenzylamine*)



$C_{14}H_{13}ON$  MW, 211

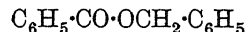
Leaflets. M.p. 105-6°. Sol. EtOH, AcOH.

*N-Nitroso*: pink cryst. turning green in air. M.p. 46-7°.

Beckmann, *Ber.*, 1904, 37, 4136.

Blacher, *Ber.*, 1895, 28, 434.

**Benzyl benzoate**



$C_{14}H_{12}O_2$  MW, 212

Contained in balsam of Peru. Leaflets. M.p. 21°. B.p. 323-4° (316-17°). Sol. EtOH,  $Et_2O$ .  $D^{18}$  1.114.  $n_D^{20}$  1.5681. Spar. volatile in steam.

Kamm, Kamm, *Organic Syntheses*, Collective Vol. I, 99.

Matheson, B.P., 270,651, (*Chem. Abstracts*, 1928, 22, 1597).

**Benzylbenzoic Acid.**

See Diphenylmethane-carboxylic Acid.

**Benzylbenzoyl acetic Acid.**

See 2-Phenyl-1-benzoylpropionic Acid.

**Benzylbenzoylcarbinol.**

See  $\beta$ -Hydroxy- $\gamma$ -phenylpropiofenone.

**1-Benzyl-1-benzoylpropionic Acid.**

See 2-Phenyl-1-benzoylisobutyric Acid.

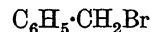
**1-Benzyl-2-benzoylpropionic Acid.**

See 2-Phenyl-2'-benzoylisobutyric Acid.

**Benzyl borate.**

See Tribenzyl borate.

**Benzyl bromide** ( $\omega$ -*Bromotoluene*)



$C_7H_7Br$  MW, 171

Colourless lachrymatory liq. B.p. 198°, 127°/80 mm.  $D_4^{20}$  1.4380.

Schramm, *Ber.*, 1885, 18, 608.

Soc. chim. des usines du Rhône, F.P., 483,622, (*Chem. Abstracts*, 1922, 16, 4215).

**Benzyl bromide carboxylic Acid.**

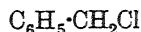
See  $\omega$ -Bromotoluic Acid.

**2-Benzylbutyric Acid.**

See 3-Phenylisovaleric Acid.

**Benzylcarbinol.**

See Phenylethyl Alcohol.

**Benzyl chloride** (*ω-Chlorotoluene*) $\text{C}_7\text{H}_7\text{Cl}$  MW, 126.5

M.p.  $-43^\circ$  ( $-48^\circ$ ). B.p.  $179^\circ$ ,  $106^\circ/92$  mm.,  $99^\circ/62$  mm.,  $63^\circ/8$  mm.  $D_4^{20}$  1.1135,  $D_{20}^{20}$  1.1002.  $n_D^{20}$  1.5415. Volatile in steam. Hyd. slowly by boiling  $\text{H}_2\text{O}$  to benzyl alcohol.

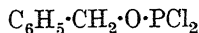
Schering-Kahlbaum, D.R.P., 478,084, (*Chem. Abstracts*, 1929, 23, 4228).

I.C.I., B.P., 334,260, (*Chem. Abstracts*, 1931, 25, 973).

Sors, *Chem. Zeit.*, 1933, 57, 321.

Nikolyuk, *Chem. Abstracts*, 1935, 29, 1786.

Kharasch, Brown, *J. Am. Chem. Soc.*, 1939, 61, 2142.

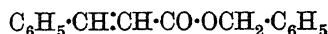
**Benzyl chlorophosphite** (*Benzyl phosphochloride*) $\text{C}_7\text{H}_7\text{OCl}_2\text{P}$  MW, 209

B.p.  $113-4^\circ/11$  mm.  $D_4^0$  1.3243.  $n_D^{19}$  1.5584.

Razumov, *J. Gen. Chem. U.S.S.R.*, 1944, 14, 464.

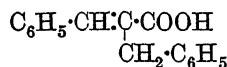
**Benzyl chlorophosphonate.**

See Dibenzyl chlorophosphonate.

**Benzyl cinnamate** $\text{C}_{16}\text{H}_{14}\text{O}_2$  MW, 238

Constituent of storax, tolu and Peru balsams. Prisms. M.p.  $39^\circ$ . B.p.  $195-200^\circ/5$  mm. Decomp. on dist. at ord. press. at  $350^\circ$ . Mod. sol. warm EtOH.

Kalle, D.R.P., 127,649, (*Chem. Zentr.*, 1902, I, 445).

 **$\alpha$ -Benzylcinnamic Acid** ( *$\alpha$ -Benzylidenehydrocinnamic acid*) $\text{C}_{16}\text{H}_{14}\text{O}_2$  MW, 238

Needles. M.p.  $158^\circ$ . Mod. sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ .  $\text{NaHg} \rightarrow$  dibenzylacetic acid.

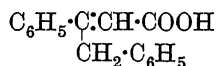
Me ester:  $\text{C}_{17}\text{H}_{16}\text{O}_2$ . MW, 252. M.p.  $27-8^\circ$ . B.p.  $200-2^\circ/12$  mm.

Et ester:  $\text{C}_{18}\text{H}_{18}\text{O}_2$ . MW, 266. M.p.  $38-9^\circ$ . B.p.  $227-9^\circ/30$  mm.  $D_4^{20}$  1.0831.  $n_D^{16-1}$  1.5885.

Anhydride:  $\text{C}_{32}\text{H}_{26}\text{O}_3$ . MW, 458. M.p.  $108-9^\circ$ . Spar. sol. EtOH. Prac. insol.  $\text{Et}_2\text{O}$ .

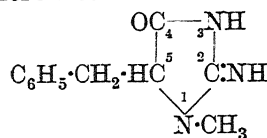
Rupe, *Ann.*, 1913, 395, 106.

Foldi, B.P., 319,273, (*Chem. Abstracts*, 1930, 24, 2472).

 **$\beta$ -Benzylcinnamic Acid** (*2:3-Diphenylcrotonic acid*) $\text{C}_{16}\text{H}_{14}\text{O}_2$  MW, 238

Prismatic needles from EtOH. M.p.  $169^\circ$ . Sol. boiling EtOH.

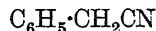
Spring, *J. Chem. Soc.*, 1934, 1333.

**5-Benzylcreatinine** $\text{C}_{11}\text{H}_{13}\text{ON}_3$  MW, 203

Flakes. M.p.  $282^\circ$  decomp.  $\text{Ba}(\text{OH})_2 \rightarrow$  *N*-methylphenylalanine.

Picrate: yellow needles from hot  $\text{H}_2\text{O}$ . M.p.  $206-8^\circ$ .

Nicolet, Campbell, *J. Am. Chem. Soc.*, 1928, 50, 1155.

**Benzyl cyanide** (*Phenylacetoneitrile, ω-cyanotoluene*) $\text{C}_8\text{H}_7\text{N}$  MW, 117

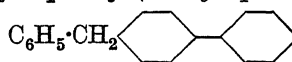
B.p.  $234^\circ$ ,  $107^\circ/12$  mm.  $D_{15}^{25}$  1.0214.  $n_D^{25}$  1.52105. Heat of comb.  $\text{C}_v$  1023 Cal. Boil with acid or alkali  $\rightarrow$  phenylacetic acid. Red.  $\rightarrow$  2-phenylethylamine.

Adams, Thal, *Organic Syntheses*, Collective Vol. I, 101.

**Benzyl-dichloroarsine** $\text{C}_7\text{H}_7\text{Cl}_2\text{As}$  MW, 237

B.p.  $175^\circ/50$  mm. Decomp. on standing in air.

Michaelis, Paetow, *Ann.*, 1886, 233, 91.

***p*-Benzylidiphenyl** (*Phenylidiphenylmethane*) $\text{C}_{19}\text{H}_{16}$  MW, 244

Leaflets. M.p.  $85^\circ$ . B.p.  $285-6^\circ/100$  mm. Sol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Mod. sol. EtOH.

Goldschmiedt, *Monatsh.*, 1881, 2, 433.

Nenitzescu, Isacesu, Ionescu, *Ann.*, 1931, 491, 211.

**Benzyl disulphide.**

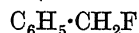
See Dibenzyl disulphide.

**Benzylethylaniline.**

See Ethylbenzylaniline.

**Benzyl- $\alpha$ -ethylbenzyl-amine.**

See  $\alpha$ -Ethylidibenzylamine.

**Benzyl fluoride** (*ω-Fluorotoluene*) $\text{C}_7\text{H}_7\text{F}$  MW, 110

Colourless mobile liq. Does not fume in air. M.p.  $-36^\circ$ . B.p.  $140^\circ$ ,  $40^\circ/14$  mm.  $D_4^{25}$  1.02278. Non-lachrymatory.

Ingold, *J. Chem. Soc.*, 1928, 2249.

**Benzylfumaric Acid.**

See Phenylmesaconic Acid.

**Benzylglycine** (*Benzylaminoacetic acid*)

$C_6H_5 \cdot CH_2 \cdot NH \cdot CH_2 \cdot COOH$   
 $C_9H_{11}O_2N$  MW, 165

Needles from  $H_2O$ . M.p. 197–8°.

*Hydrochloride*: m.p. 226°. Sol.  $H_2O$ .

*Et ester*:  $C_{11}H_{15}O_2N$ . MW, 193. Decomp. on dist. at ord. press. B.p. 165°/16 mm. Sol.  $EtOH$ ,  $Et_2O$ ,  $C_6H_6$ .

*N-Acetyl*: m.p. 126–7°.

Scheibler, Baumgarten, *Ber.*, 1922, 55, 1358.

Gränacher, Wolf, Weidinger, *Helv. Chim. Acta*, 1928, 11, 1228.

Mannich, Kuphal, *Ber.*, 1912, 45, 317.

**2-Benzylhydracrylic Acid.**

See 2-Hydroxy-3-phenylbutyric Acid.

 **$\alpha$ -Benzylhydratropic Acid.**

See 1 : 2-Diphenylisobutyric Acid.

**Benzylhydrazine**

$C_6H_5 \cdot CH_2 \cdot NH \cdot NH_2$   
 $C_7H_{10}N_2$  MW, 122

B.p. 103°/41 mm. Decomp. by heat at ord. press.  $\rightarrow$  dibenzyl +  $N_2$ .

*B, HCl*: leaflets from  $EtOH$ . M.p. 111°.

*B, 2HCl*: decomp. at 145°.

*N-Nitroso*: m.p. 72°.

Wohl, Oesterlin, *Ber.*, 1900, 33, 2739.

Hale, Lange, *J. Am. Chem. Soc.*, 1920, 42, 107.

**Benzylhydroquinone.**

See 2 : 5-Dihydroxydiphenylmethane.

**N-Benzylhydroxylamine** ( $\beta$ -*Benzylhydroxylamine*)

$C_6H_5 \cdot CH_2 \cdot NH \cdot OH$   
 $C_7H_9ON$  MW, 123

Cryst. from ligroin. M.p. 57°. Mod. sol.  $H_2O$ . Reduces Fehling's.

*B, HCl*: m.p. 110°. Sol.  $EtOH$ .

*N-Formyl*: needles from  $Et_2O$ -ligroin. M.p. 49–50°.

*N-Acetyl*: plates. M.p. 124°.

*N-Benzoyl*: needles from  $Et_2O$ . Alc.  $FeCl_3$   $\rightarrow$  intense red col.

*Nitroso*: m.p. 77–8°.

Neubauer, *Ann.*, 1897, 298, 200.

**O-Benzylhydroxylamine** ( $\alpha$ -*Benzylhydroxylamine*)

$C_6H_5 \cdot CH_2O \cdot NH_2$   
 $C_7H_9ON$  MW, 123

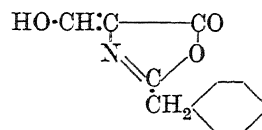
B.p. 118–19°/30 mm. Volatile in steam. Heated at 160°  $\rightarrow$  benzaldoxime benzyl ether.

*B, HCl*: leaflets. Sublimes at 230–50°. Sol. warm  $H_2O$ ,  $EtOH$ .

*p-Aminobenzenesulphonyl*: m.p. 130°.

Behrend, Leuchs, *Ann.*, 1890, 257, 207.

Dict. of Org. Comp.—I.

**2-Benzyl-4-hydroxymethylene-5-oxazolone**

$C_{11}H_9O_3N$  MW, 203

Needles from  $Me_2CO$ -light petroleum. M.p. 130–2°.  $FeCl_3$   $\rightarrow$  deep blue col. Penicillamine  $\rightarrow$  benzyl penicillenate + benzylpenicillin.

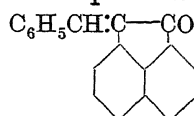
*Me ether*:  $C_{12}H_{11}O_3N$ . MW, 217. Cryst. M.p. 92–4° (118–19°). *B, HCl*: m.p. 180–2°.

*Et ether*:  $C_{13}H_{13}O_3N$ . MW, 231. Cryst. M.p. 34–6°. B.p. 140°/0.02 mm. *B, HBr*: m.p. 90–115°.

*Na salt*: m.p. 238–40°.

*Benzylamine salt*: cryst. from  $MeOH-Et_2O$ . M.p. 115–16°.

Brown, Cornforth, Hunter, Hinman, Carter, *Chemistry of Penicillin*, 521, 806, 807, 916.

**Benzylidene-acenaphthenone**

$C_{19}H_{12}O$  MW, 256

Yellow needles from  $EtOH$ . Aq. M.p. 107°. Sol.  $EtOH$ ,  $Et_2O$ ,  $C_6H_6$ .

*Oxime*: m.p. 48°.

Graebe, Jequier, *Ann.*, 1896, 290, 204.

**Benzylideneacetone** (*Benzalacetone*, *methyl styryl ketone*, *acetocinnamone*)

$C_6H_5 \cdot CH : CH \cdot CO \cdot CH_3$   
 $C_{10}H_{10}O$  MW, 146

Lustrous plates. M.p. 42°. B.p. 260–2°, 151–3°/25 mm., 126–8°/9 mm. Sol.  $EtOH$ ,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ . Spar. sol. ligroin.  $D_4^{20}$  1.0377.  $n_D^{20}$  1.5836. Heat of comb.  $C_p$  1258.1 Cal.,  $C_v$  1256.9 Cal.  $H_2SO_4$   $\rightarrow$  orange-red col.

*Oxime*: needles. M.p. 116°.

*Phenylhydrazone*: yellow needles. M.p. 156–7°.

*Semicarbazone*: m.p. 185° (187°).

*p-Nitrophenylhydrazone*: m.p. 165–7°.

Drake, Allen, *Organic Syntheses*, Collective Vol. I, 69.

Grignard, Fluchaire, *Ann. chim.*, 1928, 9, 22.

**Benzylideneacetophenone.**

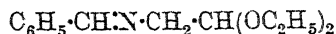
See Chalkone.

**Benzylidene-acetylacetone** ( $\beta$  :  $\beta$ -*Diacetostyrene*)

$C_6H_5 \cdot CH : C(COCH_3)_2$  MW, 188

B.p. 185–8°/15 mm.

Knoevenagel, Ruschhaupt, *Ber.*, 1898, 31, 1026.

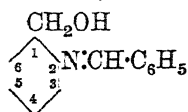
**Benzylidene-aminoacetal**

$\text{C}_{13}\text{H}_{19}\text{O}_2\text{N}$  MW, 221

B.p. 156°/12 mm. Heat with  $\text{H}_2\text{SO}_4 \rightarrow$  isoquinoline.

Fischer, *Ber.*, 1893, 26, 467.

**Benzylidene-*o*-aminobenzyl Alcohol**  
(2-Benzylideneaminobenzyl alcohol, *o*-hydroxy-methylbenzylideneaniline)



$\text{C}_{14}\text{H}_{13}\text{ON}$  MW, 211

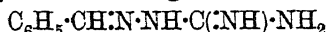
Leaflets. M.p. 115°. Spar. sol. ligroin.

Paal, Laudenheim, *Ber.*, 1892, 25, 2970.

**Benzylidene-*p*-aminobenzyl Alcohol**  
(4-Benzylideneaminobenzyl alcohol, *p*-hydroxy-methylbenzylideneaniline).

Leaflets. M.p. 67–8°.

O. Fischer, G. Fischer, *Ber.*, 1895, 28, 881.

**Benzylideneaminoguanidine**

$\text{C}_8\text{H}_{10}\text{N}_4$  MW, 162

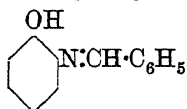
Silvery leaflets. M.p. 178°. Sol. EtOH. Spar. sol. cold  $\text{H}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Strong basic properties.

*B, HNO*<sub>3</sub>: m.p. 158°. Spar. sol. cold  $\text{H}_2\text{O}$ .

*Diacetyl deriv.*: m.p. 158–9°.

Thiele, *Ann.*, 1898, 302, 299.

**Benzylidene-*o*-aminophenol** (2-Benzylideneaminophenol, *o*-hydroxybenzylideneaniline)



$\text{C}_{13}\text{H}_{11}\text{ON}$  MW, 197

Leaflets. M.p. 89°. Sol. Et<sub>2</sub>O,  $\text{C}_6\text{H}_6$ . Mod. sol. EtOH.

*Acetyl deriv.*: m.p. 93–6°. Boil with  $\text{H}_2\text{O} \rightarrow$  *N*-acetyl-*o*-aminophenol.

*Et ether*: benzylidene-*o*-phenetidine.  $\text{C}_{15}\text{H}_{15}\text{ON}$ . MW, 225. B.p. 215–16°/20 mm.

Pictet, Ankersmit, *Ann.*, 1891, 266, 140.

**Benzylidene-*p*-aminophenol** (4-Benzylideneaminophenol, *p*-hydroxybenzylideneaniline).

Leaflets. M.p. 183°. Sol. EtOH.

*Me ether*: benzylidene-*p*-anisidine.  $\text{C}_{14}\text{H}_{13}\text{ON}$ . MW, 211. Leaflets. M.p. 62°. Sol. EtOH.

*Et ether*: benzylidene-*p*-phenetidine.  $\text{C}_{15}\text{H}_{15}\text{ON}$ . MW, 225. Leaflets. M.p. 76° (71°). Sol. Et<sub>2</sub>O,  $\text{C}_6\text{H}_6$ . Mod. sol. EtOH, AcOH. *B, HCl*: decomp. at 138–9°.

*Benzyl ether*:  $\text{C}_{20}\text{H}_{17}\text{ON}$ . MW, 287. Cryst. from pet. ether. M.p. 118°. Spar. sol. EtOH.

*Acetyl deriv.*: needles. M.p. 92°.

*Benzoyl deriv.*: needles. M.p. 144°.

Philipp, *Ber.*, 1892, 25, 3248.

Pope, Fleming, *J. Chem. Soc.*, 1908, 93, 1915.

**Benzylideneaniline (Benzalaniline)**

$\text{C}_{13}\text{H}_{11}\text{N}$  MW, 181

Needles or leaflets. M.p. 48° (54°). B.p. 300°. Sol. EtOH, Et<sub>2</sub>O. Insol.  $\text{H}_2\text{O}$ . Volatile in steam. Hot min. acids  $\rightarrow$  benzaldehyde + aniline. NaHg  $\rightarrow$  benzylaniline.

*Picrate*: m.p. 183° (173°).

*Styphnate*: pale yellow cryst. from EtOH. M.p. 193°.

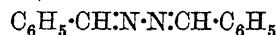
Bigelow, Eatnough, *Organic Syntheses*, Collective Vol. I, 73.

Strain, *J. Am. Chem. Soc.*, 1928, 50, 2218.

**Benzylidene-*p*-anisidine.**

See under Benzylidene-*p*-aminophenol.

**Benzylideneazine** (Benzalazine, dibenzylidenehydrazine)



$\text{C}_{14}\text{H}_{12}\text{N}_2$  MW, 208

Yellow prisms. M.p. 93°. Sol. Et<sub>2</sub>O,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ , hot EtOH. Part. volatile in steam. Decomp. on dist. to stilbene, benzonitrile, etc. Hot dil. min. acids  $\rightarrow$  benzaldehyde + hydrazine. NaHg  $\rightarrow$  dibenzylhydrazine. Na + EtOH  $\rightarrow$  benzylamine.

*B, HCl*: yellow powder. M.p. 150°.

*B, HBr*: m.p. 165°.

*Picrate*: yellow needles. M.p. 148°.

*Styphnate*: yellow needles from EtOH. M.p. 152°.

Curtius, Jay, *J. prakt. Chem.*, 1889, 39, 44.

Thiele, *Ann.*, 1910, 376, 244 (Note 2).

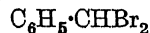
**Benzylidenebiuret**

$\text{C}_9\text{H}_9\text{O}_2\text{N}_3$  MW, 191

M.p. 272–3°. Sol. caustic alkalis. Spar. sol. Et<sub>2</sub>O,  $\text{CHCl}_3$ . Insol.  $\text{CS}_2$ .

Schiff, *Ann.*, 1896, 291, 369.

**Benzylidene bromide** (Benzal bromide,  $\omega$ -dibromotoluene)



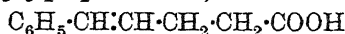
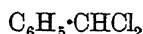
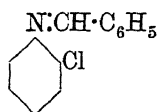
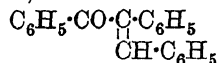
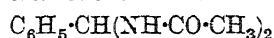
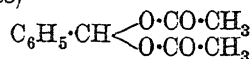
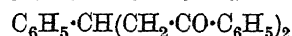
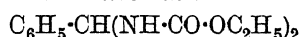
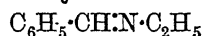
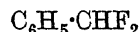
$\text{C}_7\text{H}_6\text{Br}_2$  MW, 250

B.p. 156°/23 mm.  $D^{25}$  1.51.  $n_D^{20}$  1.541.

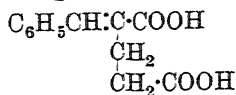
Vorländer, *Ann.*, 1905, 341, 22.

**2-Benzylidenebutane.**

See  $\beta$ -Methyl- $\beta$ -ethylstyrene.

**1-Benzylidenebutyric Acid.***See*  $\alpha$ -Ethylcinnamic Acid.**3-Benzylidenebutyric Acid** (*Cinnamylacetic acid, 2-styrylpropionic acid*) $\text{C}_{11}\text{H}_{12}\text{O}_2$  MW, 176Leaflets. M.p. 90–1°. Sol.  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ ,  $\text{CS}_2$ . Mod. sol. hot  $\text{H}_2\text{O}$ . Alk.  $\text{KMnO}_4 \rightarrow$  succinic + benzoic acids.Erlenmeyer, Kreutz, *Ber.*, 1905, 38, 3505.**Benzylidene chloride** (*Benzal chloride,  $\omega$ -dichlorotoluene*) $\text{C}_7\text{H}_6\text{Cl}_2$  MW, 161F.p.  $-17^\circ$ . M.p.  $-16^\circ$ . B.p.  $207^\circ$  ( $203.5^\circ/756$  mm.). Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ . Insol.  $\text{H}_2\text{O}$ .  $D^{14}$  1.2557. Hyd. by alkalis, conc.  $\text{H}_2\text{SO}_4$ , or  $\text{H}_2\text{O}$  + iron catalyst, to benzaldehyde.Staudinger, *Ber.*, 1909, 42, 3976.Lorges, *Chem. Abstracts*, 1925, 19, 1700.Meyer, *Monatsh.*, 1915, 36, 729.Kharasch, Brown, *J. Am. Chem. Soc.*, 1939, 61, 2142.**Benzylidene-*o*-chloroaniline** $\text{C}_{13}\text{H}_{10}\text{NCl}$  MW, 215.5Yellowish needles from pet. ether. M.p.  $34^\circ$ .Fischer, Neber, *Ber.*, 1912, 45, 1094.**Benzylidene-*m*-chloroaniline.**Viscous oil. B.p.  $338^\circ$ .Lachowicz, *Monatsh.*, 1888, 9, 697.**Benzylidene-*p*-chloroaniline.**Leaflets. M.p.  $62^\circ$ .*B, HCl*: m.p.  $194^\circ$  decomp.Hantzsch, Schwab, *Ber.*, 1901, 34, 829.**Benzylidenecyanoacetic Acid.***See*  $\alpha$ -Cyanocinnamic Acid.**Benzylidenedeoxybenzoin** (1 : 2-*Diphenyl-1-benzoylethylene*) $\text{C}_{21}\text{H}_{16}\text{O}$  MW, 284Needles. M.p. 101–2°. Sol.  $\text{AcOH}$ ,  $\text{CS}_2$ ,  $\text{C}_6\text{H}_6$ , hot  $\text{EtOH}$ . An isomeric modification has m.p. 88–9°, and is more sol. than higher-melting form.*Oxime*: silky needles. M.p. 208–9°.*Phenylhydrazone*: m.p. 163–4°.*Note*.—The “*oxime*” and “*phenylhydrazone*” are probably cyclic comps.Stobbe, Niedenzu, *Ber.*, 1901, 34, 3908.Thiele, Ruggli, *Ann.*, 1912, 393, 71.**Benzylidenediacetamide** $\text{C}_{11}\text{H}_{14}\text{O}_2\text{N}_2$  MW, 206M.p.  $245^\circ$ . Sol.  $\text{EtOH}$ . Mod. sol. hot  $\text{H}_2\text{O}$ . Spar. sol.  $\text{Et}_2\text{O}$ .  $\text{HCl} \rightarrow$  benzaldehyde,  $\text{AcOH}$  and  $\text{NH}_4\text{Cl}$ .Chattaway, Swinton, *J. Chem. Soc.*, 1912, 101, 1206.**Benzylidene diacetate** (*Phenylmethyleneglycol diacetate*) $\text{C}_{11}\text{H}_{12}\text{O}_4$  MW, 208M.p.  $46^\circ$ . B.p.  $220^\circ$ ,  $154^\circ/20$  mm. Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ .  $D^{20}$  1.11.Nef, *Ann.*, 1897, 298, 277.Peski, *Rec. trav. chim.*, 1921, 40, 103.Knoevenagel, *Ann.*, 1913, 402, 117.**Benzylidene-diacetic Acid.***See* 2-Phenylglutaric Acid.**Benzylidene-diacetophenone** (2-*Phenyl-1:3-dibenzoylpropane, phenyl-diphenacylmethane*) $\text{C}_{23}\text{H}_{20}\text{O}_2$  MW, 328Prisms. M.p.  $85^\circ$ . Decomp. on dist.  $\rightarrow$  acetophenone + chalkone.*Oxime*: needles. M.p.  $144^\circ$ .*Dioxime*: needles. M.p.  $164^\circ$ .*Di-semicarbazone*: m.p.  $232\text{--}3^\circ$ .Kostanecki, Rossbach, *Ber.*, 1896, 29, 1493.Dieckmann, Fischer, *Ber.*, 1911, 44, 973.Kohler, Jones, *J. Am. Chem. Soc.*, 1919, 41, 1255.**Benzylidene-diurethane** $\text{C}_{13}\text{H}_{18}\text{O}_4\text{N}_2$  MW, 266M.p.  $178\text{--}9^\circ$ . Sol. hot  $\text{EtOH}$ . Aq. Sublimes.Lehmann, *Ber.*, 1901, 34, 370.**Benzylidene-ethylamine** $\text{C}_9\text{H}_{11}\text{N}$  MW, 133B.p.  $195^\circ/749$  mm.  $D_4^{20}$  0.937. Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ . Insol.  $\text{H}_2\text{O}$ .Zaunschirm, *Ann.*, 1888, 245, 279.Auwers, Ottens, *Ber.*, 1924, 57, 446.**Benzylidene fluoride** (*Benzal fluoride,  $\omega$ -difluorotoluene*) $\text{C}_7\text{H}_6\text{F}_2$  MW, 128B.p.  $139\text{--}95^\circ$ .  $D^{19}$  1.13696. Heat of comb.  $\text{C}_6$  853.9 Cal. Conc.  $\text{H}_2\text{SO}_4$  or  $\text{H}_2\text{O}$  at  $200^\circ \rightarrow$  benzaldehyde +  $\text{HF}$ .Swarts, *J. Chim. phys.*, 1919, 17, 31.

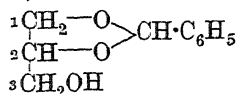
## 1-Benzylideneglutaric Acid



$\text{C}_{12}\text{H}_{12}\text{O}_4$  MW, 220

Needles from  $\text{H}_2\text{O}$ . M.p. 177°. Sol.  $\text{Et}_2\text{O}$ .  
Spar. sol.  $\text{CS}_2$ ,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ , ligroin.

Fittig, Roedel, *Ann.*, 1894, 282, 336.

1 : 2-Benzylideneglycerol (*Glycerol* 1 : 2-benzylidene ether)

$\text{C}_{10}\text{H}_{12}\text{O}_3$  MW, 180

B.p. 143-4°/2 mm.  $D_4^{20}$  1.1916.  $n_D^{20}$  1.5389.  
Readily hydrolysed by dil. min. acids.

3-Me ether:  $\text{C}_{11}\text{H}_{14}\text{O}_3$  MW, 194. B.p. 138-41°/10 mm.  $n_D^{20}$  1.5128.

Hill, Whelen, Hibbert, *J. Am. Chem. Soc.*, 1928, 50, 2235.

1 : 3-Benzylideneglycerol (*Glycerol* 1 : 3-benzylidene ether, 2-phenyl-m-dioxanol-5)

Exists in two isomeric forms.

(i). Needles from  $\text{C}_6\text{H}_6$ -ligroin. M.p. 83.5°. Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Insol. ligroin.

2-Me ether: needles from  $\text{C}_6\text{H}_6$ -ligroin. M.p. 52°.

2-O-Acetyl: m.p. 115-16°.

2-O-Benzoyl: cryst. from ligroin. M.p. 103°.

(ii). Needles from  $\text{C}_6\text{H}_6$ -ligroin. M.p. 62.5-63°. Part. isomerised on standing.

$\beta$ -Caproyl: m.p. 31°.

$\beta$ -Caprylyl: m.p. 35°.

$\beta$ -Elaidyl: m.p. 43.5-4°.

$\beta$ -Oleyl: m.p. 4-5°.

2-O-Benzoyl: plates from ligroin. M.p. 80-1°. Very labile.

The two isomers form a 1 : 1 mol. comp. M.p. 65-6°.

Hill, Whelen, Hibbert, *J. Am. Chem. Soc.*, 1928, 50, 2235.

Davies, Heilbron, Jones, *J. Chem. Soc.*, 1934, 1234.

Verkade, van Roon, *Rec. trav. chim.*, 1942, 61, 831.

Benzylidenehydrazine (*Benzaldehyde hydr-azone*)

$\text{C}_7\text{H}_8\text{N}_2$  MW, 120

Leaflets. M.p. 16°. B.p. 140°/14 mm. Sol.  $\text{EtOH}$ . Decomp. by acids, alkalis,  $\text{H}_2\text{O}$ . Unstable in moist air. Reduces  $\text{NH}_3\cdot\text{AgNO}_3$ .  $\text{NaHg} \rightarrow$  benzylhydrazine.

Acetyl deriv.:  $\text{C}_6\text{H}_5\cdot\text{CH}:\text{N}\cdot\text{NH}\cdot\text{COCH}_3$ .  $\text{C}_9\text{H}_{10}\text{ON}_2$ . MW, 162. Needles. M.p. 134°. Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ .

Benzoyl deriv.:  $\text{C}_6\text{H}_5\cdot\text{CH}:\text{N}\cdot\text{NH}\cdot\text{CO}\cdot\text{C}_6\text{H}_5$ .  $\text{C}_{14}\text{H}_{12}\text{ON}_2$ . MW, 224. M.p. 206°. Sol.  $\text{EtOH}$ .  $\text{CHCl}_3$ .

Curtius, Franzen, *Ber.*, 1902, 35, 3236.

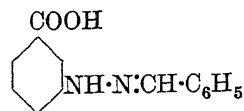
## Benzylidenehydrazinoacetic Acid



$\text{C}_9\text{H}_{10}\text{O}_2\text{N}_2$  MW, 178

Silky needles. M.p. 156-7°. Sol. hot  $\text{EtOH}$ . Spar. sol.  $\text{H}_2\text{O}$ ,  $\text{Et}_2\text{O}$ .

Curtius, *Ber.*, 1890, 23, 3030.

Benzylidene-m-hydrazinobenzoic Acid (*m-Carboxyphenyl-benzylidenehydrazine*)

$\text{C}_{14}\text{H}_{12}\text{O}_2\text{N}_2$  MW, 240

Plates. M.p. 173°. Sol.  $\text{EtOH}$ ,  $\text{AcOH}$ . Spar. sol.  $\text{H}_2\text{O}$ . Does not reduce Fehling's.

Wohl, Schiff, *Ber.*, 1900, 33, 2754.

Benzylidene-p-hydrazinobenzoic Acid (*p-Carboxyphenyl-benzylidenehydrazine*).

Et ester:  $\text{C}_{16}\text{H}_{16}\text{O}_2\text{N}_2$ . MW, 268. M.p. 160°.

Thoms, Ritsert, *Chem. Zentr.*, 1921, I, 584.

 $\alpha$ -Benzylidenehydrocinnamic Acid.

See  $\alpha$ -Benzylcinnamic Acid.

## Benzylidene-lactic Acid.

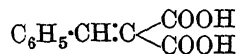
See Styrylglycollic Acid.

## 4-Benzylidene-lepidine.

See 4-Styrylquinoline.

## Benzylidenelutidine.

See Methylstyrylpyridine.

Benzylidenemalonic Acid (*Benzalmalonic acid*)

$\text{C}_{10}\text{H}_8\text{O}_4$  MW, 192

Prisms. M.p. 195-6° decomp. Sol. hot  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ ,  $\text{Me}_2\text{CO}$ ,  $\text{AcOEt}$ . Spar. sol.  $\text{CS}_2$ , cold  $\text{H}_2\text{O}$ ,  $\text{AcOH}$ ,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ , ligroin. Heat of comb. 1056.8 Cal.  $k$  (first) =  $4.08 \times 10^{-3}$  at 25°;  $k$  (second) =  $3.15 \times 10^{-6}$ .

Di-Me ester:  $\text{C}_{12}\text{H}_{12}\text{O}_4$ . MW, 220. M.p. 45°. B.p. 171°/10 mm.

Et ester:  $\text{C}_{12}\text{H}_{12}\text{O}_4$ . MW, 220. M.p. 85°.

Di-Et ester:  $\text{C}_{14}\text{H}_{16}\text{O}_4$ . MW, 248. M.p. 32°. B.p. 215-17°/30 mm., 196°/14 mm., 176-7°/5 mm.  $D_4^{20}$  1.1045.  $n_D^{20}$  1.5389.

Di-isopropyl ester: b.p. 127-30°/0.5 mm.  $n_D^{20}$  1.5197.

Diallyl ester: b.p. 144-7°/0.5 mm.  $n_D^{20}$  1.5489.

Di-l-menthyl ester: needles from  $\text{EtOH}$ . M.p. 95°.

*Dichloride*:  $C_{10}H_6O_2Cl_2$ . MW, 229. Needles from pet. ether. M.p.  $77^\circ$ .

*Diamide*:  $C_{10}H_{10}O_2N_2$ . MW, 190. M.p.  $189-90^\circ$ .

*Mononitrile*: see  $\alpha$ -Cyanocinnamic Acid.

*Di-nitrile*:  $C_{10}H_6N_2$ . MW, 154. M.p.  $87^\circ$ .

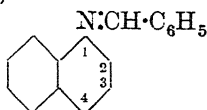
Knoevenagel, *Ber.*, 1898, 31, 2605.

Claisen, Crismer, *Ann.*, 1883, 218, 131.

Staudinger, Ott, *Ber.*, 1911, 44, 1636.

Odell, Hines, *J. Am. Chem. Soc.*, 1913, 35, 82.

**Benzylidene-1-naphthylamine** (*Benzal- $\alpha$ -naphthylamine*)



$C_{17}H_{13}N$  MW, 231

Yellow leaflets. M.p.  $73^\circ$ . Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

Bucherer, Schwalbe, *Ber.*, 1906, 39, 2812.

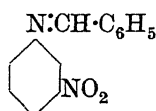
**Benzylidene-2-naphthylamine** (*Benzal- $\beta$ -naphthylamine*).

Pale yellow needles. M.p.  $103^\circ$ . Sol. CHCl<sub>3</sub>. Mod. sol. hot EtOH.

*B.HCl, 1H<sub>2</sub>O*: yellow cryst. M.p.  $162-3^\circ$ . Unstable.

Claisen, *Ann.*, 1887, 237, 273.

**Benzylidene-*m*-nitroaniline**



$C_{13}H_{10}O_2N_2$  MW, 226

Yellow needles. M.p.  $73^\circ$  ( $66^\circ$ ).

Miller, Plöchl, *Ber.*, 1892, 25, 2053.

Bogoslovskii, Vatulya, *J. Gen. Chem.*

*U.S.S.R.*, 1945, 15, 653.

**Benzylidene-*p*-nitroaniline.**

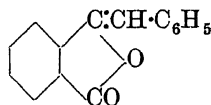
Yellow needles. M.p.  $117-18^\circ$ . Sol. hot EtOH, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>. Spar. sol. Et<sub>2</sub>O. Insol. ligroin.

Schwalbe, *Ber.*, 1902, 35, 3302.

**Benzylidenephenetidine.**

See under Benzylidenaminophenol.

**Benzylidenephthalide**



$C_{15}H_{10}O_2$  MW, 222

Monoclinic prisms. M.p.  $108^\circ$ . Sol. hot EtOH. Insol. H<sub>2</sub>O.

*Allo.*

Pale yellow cryst. M.p.  $185-7^\circ$ .

Weiss, Saueremann, *Ber.*, 1925, 58, 2736.

**Benzylidenepinacolin.**

See *tert.*-Butyl styryl Ketone.

**1-Benzylidenepropionic Acid.**

See  $\alpha$ -Methylcinnamic Acid.

**2-Benzylidenepropionic Acid.**

See Styrylacetic Acid.

**Benzylidenequinaldine.**

See 2-Styrylquinoline.

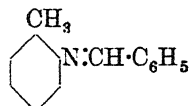
**Benzylidenesuccinic Acid.**

See Phenylitaconic Acid.

**Benzylidenethiosemicarbazide.**

See under Benzaldehyde.

**Benzylidene-*o*-toluidine**



$C_{14}H_{13}N$  MW, 195

Practically colourless oil. B.p.  $314^\circ$  ( $309-10^\circ/745$  mm.),  $176^\circ/15$  mm.  $D_4^{20}$  1.041.  $n_D^{20}$  1.635.

Lachowicz, *Monatsh.*, 1888, 9, 698.

Auwers, Ottens, *Ber.*, 1924, 57, 446.

Mailhe, *Bull. soc. chim.*, 1919, 25, 321.

**Benzylidene-*m*-toluidine.**

Pale yellow oil. B.p.  $315^\circ/775$  mm.

*B<sub>2</sub>HCl*: m.p.  $199-200^\circ$ .

Law, *J. Chem. Soc.*, 1912, 101, 154.

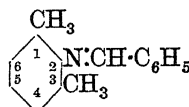
**Benzylidene-*p*-toluidine.**

Yellowish cryst. M.p.  $35^\circ$ . B.p.  $318^\circ/755$  mm.,  $178^\circ/11$  mm.

Law, *J. Chem. Soc.*, 1912, 101, 154.

Strain, *J. Am. Chem. Soc.*, 1928, 50, 2218.

**Benzylidene-*m*-2-xylidine** (*Benzal-m-xylidine*)



$C_{15}H_{15}N$  MW, 209

Oil.

Busch, *Ber.*, 1899, 32, 1009.

**Benzylidene-*m*-4-xylidine.**

Yellow oil. B.p. above  $300^\circ$ .

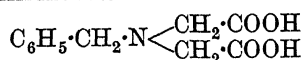
Michaelis, *Ann.*, 1893, 274, 235.

**Benzylidene-*p*-xylidine** (*Benzal-p-xylidine*).

Pale yellow cryst. M.p.  $102-3^\circ$  ( $96^\circ$ ). Dil. min. acids  $\rightarrow$  *p*-xylidine + benzaldehyde.

Michaelis, *Ann.*, 1893, 274, 235.

**Benzyliminodiacetic Acid**



$C_{11}H_{13}O_4N$  MW, 223

Needles. M.p.  $197-8^\circ$  decomp. Behaves to alkalis as monobasic acid.

*Nitrate*: colourless needles. M.p. 117° decomp.

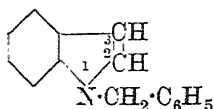
*Hydrochloride*: decomp. at 197°.

*Diamide*:  $C_{11}H_{15}O_2N_3$ . MW, 221. Pale yellow needles +  $H_2O$ , m.p. 159°, anhyd. 166°.

*Di-nitrile*:  $C_{11}H_{11}N_3$ . MW, 185. Prisms. M.p. 45°. *Hydrochloride*: m.p. 105°.

Dubsky, Dingemanse, *Ber.*, 1921, 54, 2659.

### 1-Benzylindole (N-Benzylindole)



$C_{15}H_{13}N$  MW, 207  
Needles. M.p. 45°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, ligroin.

Antrick, *Ann.*, 1885, 227, 363.

### 2-Benzylindole.

Cryst. from pet. ether. M.p. 86°.

*N-Me*:  $C_{16}H_{15}N$ . MW, 221. Cryst. from Et<sub>2</sub>O-pet. ether. M.p. 65°. *Picrate*: brick red needles from Et<sub>2</sub>O. M.p. 97°.

*Picrate*: brick red needles from MeOH. M.p. 115°.

Julian, Pikel, *J. Am. Chem. Soc.*, 1933, 55, 2108.

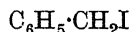
### 3-Benzylindole.

M.p. 111°.

*Picrate*: m.p. 113°.

Robinson, Cornforth, West, B.P. 550,060, (*Chem. Abstracts*, 1944, 38, 1077).

### Benzyl iodide (ω-Iodotoluene)



$C_7H_7I$  MW, 218

Cryst. M.p. 24°. B.p. 93°/10 mm. Decomp. on dist. at ord. press. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. CS<sub>2</sub>. Insol. H<sub>2</sub>O. D<sup>25</sup> 1.7335.

Kumpf, *Ann.*, 1884, 224, 126.

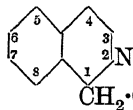
Späth, *Monatsh.*, 1913, 34, 1995.

Fischer, *Ber.*, 1915, 48, 101.

### 4-Benzylisophthalic Acid.

See Diphenylmethane-2 : 4-dicarboxylic Acid.

**1-Benzylisoquinoline** (*Phenyl-1-isoquinolyl-methane*)



$C_{18}H_{13}N$  MW, 219

Prisms from CHCl<sub>3</sub>-pet. ether. M.p. 56°. B.p. 211-13°/11 mm., 140-50°/1 mm.

*B.HCl*: needles from EtOH-Et<sub>2</sub>O. M.p. 175°.

$B_2H_2PtCl_6$ : reddish needles from H<sub>2</sub>O. M.p. 216°.

*Picrate*: yellow prisms from EtOH. M.p. 182°.

*Methiodide*: yellow needles. M.p. 247-8°.

Rügheimer, *Ber.*, 1900, 33, 1719.

Spath, Berger, Kuntara, *Ber.*, 1930, 63, 139.

Pictet, Grams, *Ber.*, 1910, 43, 2387.

**3-Benzylisoquinoline** (*Phenyl-3-isoquinolyl-methane*).

Prisms from EtOH. M.p. 104°. B.p. 311°/23 mm. Very sol. CHCl<sub>3</sub>. Sol. C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin.

*B.HNO<sub>3</sub>*: needles. M.p. 136-7°.

$B_2H_2PtCl_6$ : needles +  $H_2O$ . M.p. anhyd. 216-17°.

*Picrate*: needles. M.p. 199°.

Rügheimer, *Ber.*, 1900, 33, 1719.

**4-Benzylisoquinoline** (*Phenyl-4-isoquinolyl-methane*).

Colourless plates. M.p. 118°. B.p. 238°/23 mm. Spar. volatile in steam.

$B_2H_2PtCl_6 \cdot 1H_2O$ : m.p. anhyd. 219-20°.

$B_2H_2SO_4$ : m.p. 208-9°.

*Methiodide*: m.p. 188°.

*Ethiodide*: m.p. 188-9°.

*Picrate*: m.p. 191°.

Rügheimer, Friling, *Ann.*, 1903, 326, 265.

**Benzyl isothiocyanate** (*Benzyl mustard oil*)



$C_8H_7NS$  MW, 149

Occurs in cress oil. B.p. 243°, 124-5°/12 mm. Insol. H<sub>2</sub>O.

Schneider, Clibbens, Hüllweck, Steibelt, *Ber.*, 1914, 47, 1248.

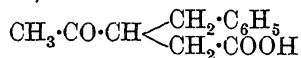
### 1-Benzyl-lactic Acid.

See 1-Hydroxy-2-phenylisobutyric Acid.

### 2-Benzyl-lactic Acid.

See 1-Hydroxy-3-phenylbutyric Acid.

**2-Benzyl-levulinic Acid** (*2-Aceto-3-phenyl-n-butyric acid*)



$C_{12}H_{14}O_3$  MW, 206

Cryst. from dil. EtOH. M.p. 99°. B.p. 230-50°/4 mm. Decomp. on dist. at ord. pressures. NaHg → 3-hydroxy-2-benzyl-n-valeric acid.

Erdmann, *Ann.*, 1889, 254, 202.

**4-Benzyl-levulinic Acid** (*3-Keto-5-phenyl-caproic acid, 3-keto-5-phenyl-n-hexoic acid*)



$C_{12}H_{14}O_3$  MW, 206

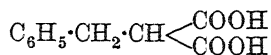
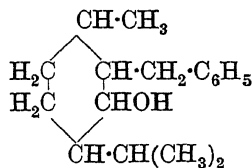
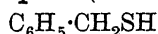
Needles from H<sub>2</sub>O. M.p. 89°. Sol. CHCl<sub>3</sub>, hot H<sub>2</sub>O. Spar. sol. CS<sub>2</sub>. H<sub>2</sub>SO<sub>4</sub> → reddish-yellow col.

Erdmann, *Ann.*, 1890, 258, 131.



**Benzylmaleic Acid.**

See Phenylcitraconic Acid.

**Benzylmalonic Acid (2-Phenylisosuccinic acid)** $\text{C}_{10}\text{H}_{10}\text{O}_4$  MW, 194M.p.  $117^\circ$  ( $121^\circ$ ). Sol  $\text{H}_2\text{O}$ , EtOH, Et<sub>2</sub>O, hot  $\text{C}_6\text{H}_6$ . Heat of comb.  $C_p$  1085.9 Cal.,  $C_v$  1085.6 Cal.  $k$  (first) =  $1.51 \times 10^{-3}$  at  $25^\circ$ ;  $k$  (second) =  $0.49 \times 10^{-6}$  at  $100^\circ$ . Heat at  $180^\circ \rightarrow \text{CO}_2 +$  hydrocinnamic acid.*Di-Me ester*:  $\text{C}_{12}\text{H}_{14}\text{O}_4$ . MW, 222. B.p.  $282-5^\circ$ .*Di-Et ester*:  $\text{C}_{14}\text{H}_{18}\text{O}_4$ . MW, 250. B.p.  $300^\circ$ ,  $169^\circ/12$  mm.  $D_{15}^{20}$  1.077.*Di-n-butyl ester*:  $\text{C}_{18}\text{H}_{26}\text{O}_4$ . MW, 306. B.p.  $154^\circ$ .  $n_D^{20}$  1.4760.*Di-p-nitrobenzyl ester*:  $\text{C}_{24}\text{H}_{20}\text{O}_8\text{N}_2$ . MW, 464. M.p.  $119-5^\circ$ .*Dichloride*:  $\text{C}_{10}\text{H}_8\text{O}_2\text{Cl}_2$ . MW, 231. B.p.  $141^\circ/15$  mm.*Diamide*:  $\text{C}_{10}\text{H}_{12}\text{O}_2\text{N}_2$ . MW, 192. Needles. M.p.  $225^\circ$ .*Mono-nitrile*: see  $\alpha$ -Cyanohydrocinnamic Acid.*Di-nitrile*: benzylmalonitrile.  $\text{C}_{10}\text{H}_8\text{N}_2$ . MW, 156. M.p.  $91^\circ$  ( $79^\circ$ ). B.p.  $174^\circ/23$  mm. Sol. EtOH, Et<sub>2</sub>O.*Di-hydrazide*: needles. M.p.  $164^\circ$ . *B,2HCl*: m.p.  $135^\circ$ .*Dianilide*: m.p.  $217^\circ$ .Claisen, Crismer, *Ann.*, 1883, 218, 139.Hantzsch, Osswald, *Ber.*, 1899, 32, 649.Leuchs, *Ber.*, 1911, 44, 1509.Darapsky, *J. prakt. Chem.*, 1917, 96, 301.Wojcik, Adkins, *J. Am. Chem. Soc.*, 1934, 56, 2424.**Benzylmenthol (1-Methyl-4-isopropyl-2-benzylcyclohexanol-3)** $\text{C}_{17}\text{H}_{26}\text{O}$  MW, 246Exists in two forms. (i). Cryst. from Et<sub>2</sub>O: m.p.  $111-2^\circ$ . (ii). Oil: b.p.  $180-3^\circ/10$  mm.Wallach, *Ann.*, 1899, 305, 263.**Benzyl Mercaptan (Thiobenzyl alcohol)** $\text{C}_7\text{H}_8\text{S}$  MW, 124B.p.  $194-5^\circ$ .  $D^{20}$  1.058. Oxidises in air to dibenzyl disulphide.*Me ether*: methyl benzyl sulphide.  $\text{C}_8\text{H}_{10}\text{S}$ . MW, 138. B.p.  $195-8^\circ$ .*Et ether*: ethyl benzyl sulphide.  $\text{C}_9\text{H}_{12}\text{S}$ . MW, 152. B.p.  $214-16^\circ$  ( $218-24^\circ$ ).*Phenyl ether*: phenyl benzyl sulphide.  $\text{C}_{13}\text{H}_{12}\text{S}$ . MW, 200. M.p.  $42^\circ$ .*Benzyl ether*: see Dibenzyl sulphide.Smythe, *J. Chem. Soc.*, 1913, 104, i, 174.  
Hess. Leaper, U.S.P., 1,729,615, (*Chem. Abstracts*, 1929, 23, 5474).Adams, Bramlet, Tendick, *J. Am. Chem. Soc.*, 1920, 42, 2369.National Aniline Co., U.S.P., 1,842,414, (*Chem. Abstracts*, 1932, 26, 1618).**Benzyl Mercaptan carboxylic Acid.**See  $\omega$ -Mercapto-*o*-toluic Acid.**Benzylmesitylene.**

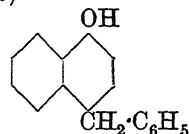
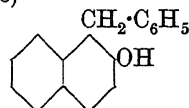
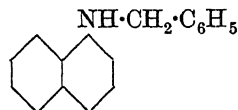
See Phenylmesitylmethane.

**Benzylmethylaniline.**

See Methylbenzylaniline.

**Benzyl-naphthalene.**

See Phenyl-naphthylmethane.

**4-Benzyl-1-naphthol (Phenyl-4-hydroxy-naphthylmethane)** $\text{C}_{17}\text{H}_{14}\text{O}$  MW, 234Prisms from  $\text{C}_6\text{H}_6$ . M.p.  $125-6^\circ$ .*Acetyl*: m.p.  $87-8^\circ$ .*Benzoyl*: m.p.  $103^\circ$ .*Me ether*:  $\text{C}_{18}\text{H}_{16}\text{O}$ . MW, 248. M.p.  $85-7^\circ$ .Dziewoński, Dziecielewski, *Chem. Abstracts*, 1928, 22, 2164.Behagel, Freiresehner, *Ber.*, 1934, 67, 1375.**1-Benzyl-2-naphthol (Phenyl-2-hydroxy-naphthylmethane)** $\text{C}_{17}\text{H}_{14}\text{O}$  MW, 234Needles from 85% formic acid. M.p.  $110^\circ$ . B.p.  $247-50^\circ/15$  mm.Behagel, Freiresehner, *Ber.*, 1934, 67, 1375.Cf. Bakunin, Altieri, *Gazz. chim. ital.*, 1903, 33, ii, 488.**N-Benzyl-1-naphthylamine (1-Naphthyl-benzylamine)** $\text{C}_{17}\text{H}_{15}\text{N}$  MW, 233Needles. M.p.  $73^\circ$ . Sol. EtOH, Et<sub>2</sub>O.Froté, Tommasi, *Bull. soc. chim.*, 1873, 20, 67.Berlingozzi, *Gazz. chim. ital.*, 1920, 50, i, 215.Zechmeister, Truka, *Ber.*, 1930, 63, 2883.

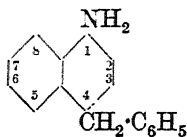
**N-Benzyl-2-naphthylamine** (*2-Naphthylbenzylamine*).

Prisms from Et<sub>2</sub>O. M.p. 68°. B.p. 405°.  
Sol. C<sub>6</sub>H<sub>6</sub>, ligroin. HNO<sub>2</sub> → nitroso deriv.  
B.HCl: m.p. 219°.  
N-Benzoyl: m.p. 115°.  
Picrate: m.p. 140-1°.  
Nitroso: m.p. 112°.

Ciusa, Cremonini, *Gazz. chim. ital.*, 1928, 58, 153.

Zechmeister, Truka, *Ber.*, 1930, 63, 2883.

**4-Benzyl-1-naphthylamine** (*Phenyl-4-aminonaphthylmethane*)



C<sub>17</sub>H<sub>15</sub>N MW, 233  
M.p. 114.5°.

N-Acetyl: violet cryst. M.p. 208-9°.

Dziewoński, Dziecielewski, *Chem. Abstracts*, 1928, 22, 2164.

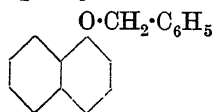
**6-Benzyl-2-naphthylamine** (*Phenyl-6-amino-2-naphthylmethane*).

Needles. M.p. 95°. Turns blue in air.

N-Acetyl: needles. M.p. 189°.

Dziewoński, Wodelski, *Chem. Zentr.*, 1933, I, 774.

**Benzyl 1-naphthyl Ether**



C<sub>17</sub>H<sub>14</sub>O MW, 234  
M.p. 61°. B.p. 200°/12 mm.

v. Braun, Reich, *Ann.*, 1925, 445, 233.

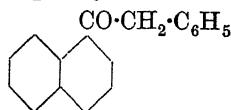
**Benzyl 2-naphthyl Ether.**

Leaflets from EtOH. M.p. 99°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

Staedel, *Ann.*, 1883, 217, 47.

Gomberg, Buchler, *J. Am. Chem. Soc.*, 1920, 42, 2059.

**Benzyl 1-naphthyl Ketone**



C<sub>18</sub>H<sub>14</sub>O MW, 246  
Plates from EtOH. M.p. 66-7°. Sol. EtOH, Et<sub>2</sub>O. HI → benzyl-1-naphthylmethane.

Oxime: m.p. 148-52° decomp.

Phenylhydrazone: m.p. 101°.

Picrate: m.p. 101-2°.

Luce, *Compt. rend.*, 1925, 180, 145.

Ruggli, Reinert, *Helv. Chim. Acta*, 1926, 9, 67.

**Benzyl 2-naphthyl Ketone.**

Needles from EtOH. M.p. 99.5°.

Oxime: m.p. 129°.

Phenylhydrazone: m.p. 165-7°.

Picrate: m.p. 143°.

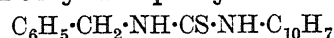
Luce, *Compt. rend.*, 1925, 180, 145.

Ruggli, Reinert, *Helv. Chim. Acta*, 1926, 9, 67.

**Benzyl naphthyl sulphide.**

See under Thionaphthol.

**sym.-Benzyl-1-naphthylthiourea**



C<sub>18</sub>H<sub>16</sub>N<sub>2</sub>S MW, 292

Cryst. from EtOH. M.p. 172-3°.

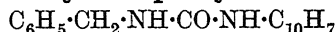
Dixon, *J. Chem. Soc.*, 1891, 59, 558.

**sym.-Benzyl-2-naphthylthiourea.**

Plates from EtOH. M.p. 165-6°.

Dixon, *J. Chem. Soc.*, 1891, 59, 558.

**sym.-Benzyl-1-naphthylurea**



C<sub>18</sub>H<sub>16</sub>ON<sub>2</sub> MW, 276

Leaflets. M.p. 203°. Cryst. from EtOH.

French, Wirtel, *J. Am. Chem. Soc.*, 1926, 48, 1736.

**Benzyl nitrate**



C<sub>7</sub>H<sub>7</sub>O<sub>3</sub>N MW, 153

Oil. B.p. 106°/20 mm. Explodes on heating to 180°.

Brunner, *Ber.*, 1876, 9, 1745.

Nef, *Ann.*, 1899, 309, 171.

**Benzyl nitrite**



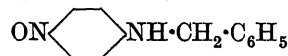
C<sub>7</sub>H<sub>7</sub>O<sub>2</sub>N MW, 137

Oil. B.p. 80-3°/35 mm., 71°/18 mm. D<sub>4</sub><sup>20</sup> 1.075. n<sub>D</sub><sup>20</sup> 1.4989. Decomp. spontaneously.

Baeyer, Villiger, *Ber.*, 1901, 34, 755.

Chretien, Longi, *Compt. rend.*, 1945, 220, 746.

**Benzyl-p-nitrosoaniline** (*p-Nitrosophenylbenzylamine, p-nitrosobenzylamine*)



C<sub>13</sub>H<sub>12</sub>ON<sub>2</sub> MW, 212

Greenish cryst. with blue cast. M.p. 129°. Sol. C<sub>6</sub>H<sub>6</sub>. Spar. sol. cold EtOH, Et<sub>2</sub>O.

(NH<sub>4</sub>)<sub>2</sub>S → benzyl-p-phenylenediamine.

Nitrosamine: unstable. M.p. 77°.

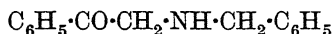
Böddinghaus, *Ann.*, 1891, 263, 300.

**Benzylxyethanol.**

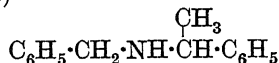
See Hydroxyethyl Ether.

**Benzylpenaldic Acid.**

See Penaldic Acid.

**Benzylpenicillenic Acid.***See* Penicillenic-G Acid.**Benzylpenicillin.***See* Penicillin-G.**Benzylpenicilloic Acid.***See* Penicilloic-G Acid.**Benzylpenillamine.***See* Penillamine-G.**Benzylpenillic Acid.***See* Penillic-G Acid.**Benzylpenilloaldehyde.***See* Penilloaldehyde-G.**Benzylpenilloic Acid.***See* Penilloic-G Acid.**Benzylpenillonic Acid.***See* Penillonic-G Acid.**Benzylphenacylacetic Acid.***See* 2-Phenyl-2'-benzoylisobutyric Acid.**Benzylphenacylamine ( $\omega$ -Benzylaminoacetophenone)**
 $\text{C}_{15}\text{H}_{15}\text{ON}$  MW, 225

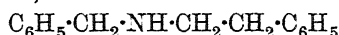
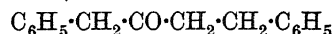
Free base unstable.

*B, HCl*: cryst. from EtOH. M.p. 215°.Spar. sol. cold  $\text{H}_2\text{O}$ .*B, HBr*: needles. M.p. 201-3°. Spar. sol.cold  $\text{H}_2\text{O}$ .*Phenylhydrazone*: leaflets. M.p. 76°.*Picrate*: yellow needles. M.p. 151-2°.Busch, Hefele, *J. prakt. Chem.*, 1911, 83, 425.Gabriel, *Ber.*, 1914, 47, 1336.**p-Benzylphenetole.***See* under 4-Hydroxydiphenylmethane.**Benzylphenol.***See* Hydroxydiphenylmethane.**Benzyl-1-phenylethylamine ( $\alpha$ -Phenylethylbenzylamine)**
 $\text{C}_{15}\text{H}_{17}\text{N}$  MW, 211
*d*-.[ $\alpha$ ]<sub>D</sub><sup>20</sup> + 56.2° in EtOH.*B, HCl*: m.p. 177°.*B, HNO*<sub>3</sub>: m.p. 113°.*d-Tartrate*: plates + 2 $\text{H}_2\text{O}$ . M.p. 62°.

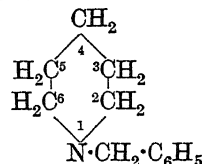
Stable in air.

*l*-.B.p. 171°/15 mm. [ $\alpha$ ]<sub>D</sub><sup>20</sup> - 56.1° in EtOH.*d-Tartrate*: prisms + 3 $\text{H}_2\text{O}$  from  $\text{H}_2\text{O}$ . M.p.

72°. Decomp. in air.

*dl*-.B.p. 171°/15 mm. Sol. EtOH, Et<sub>2</sub>O. Insol.  $\text{H}_2\text{O}$ .*B, HCl*: prisms from  $\text{H}_2\text{O}$ . M.p. 184°. Mod. sol.  $\text{H}_2\text{O}$ .*B, HNO*<sub>3</sub>: needles. M.p. 124°. Mod. sol.  $\text{H}_2\text{O}$ .*B, H<sub>2</sub>SO*<sub>4</sub>: cryst. M.p. 166°. Sol.  $\text{H}_2\text{O}$ .*Oxalate*: plates from EtOH.Aq. M.p. 193°. Spar. sol.  $\text{H}_2\text{O}$ , EtOH.Parck, *J. prakt. Chem.*, 1912, 86, 284.**Benzyl-2-phenylethylamine ( $\beta$ -Phenylethylbenzylamine)**
 $\text{C}_{15}\text{H}_{17}\text{N}$  MW, 211
B.p. 327-8°, 86-7°/15 mm. Misc. with EtOH, Et<sub>2</sub>O.*B, HCl*: m.p. 265-6° (254°).*B, HI*: m.p. 233°.*B, H<sub>2</sub>SO*<sub>4</sub>: m.p. 191-2°.*N-Nitroso*: m.p. 142°.*N-Benzoyl*: m.p. 123°.*Picrate*: m.p. 146°.v. Braun, Blessing, Zobel, *Ber.*, 1923, 56, 1988.**Benzyl phenylethyl Ketone (2-Keto-1:4-diphenylbutane)**
 $\text{C}_{16}\text{H}_{16}\text{O}$  MW, 224

B.p. 206°/11 mm. decomp.

*Oxime*: m.p. 120°.Goldschmiedt, Kreczmar, *Monatsh.*, 1901, 22, 665.**N-Benzylpiperidine (1-Benzylpiperidine)**
 $\text{C}_{12}\text{H}_{17}\text{N}$  MW, 175
B.p. 133-4°/21 mm., 113°/13 mm. Insol.  $\text{H}_2\text{O}$ .  $D_4^{16}$  0.9625.  $n_D^{20}$  1.5227.*B, HCl*: m.p. 178°.*B, H<sub>2</sub>PtCl*<sub>6</sub>: m.p. 191-3°. Spar. sol. prac. all solvents.*N-Oxide*: needles +  $\frac{1}{2}\text{H}_2\text{O}$  from  $\text{Me}_2\text{CO}$ -Et<sub>2</sub>O. M.p. 148°. *B, HCl*: m.p. 135°. *Picrate*: m.p. 128°.Baille, Tafel, *Ber.*, 1899, 32, 74.v. Braun, *Ber.*, 1904, 37, 2920.Haase, Wolfenstein, *Ber.*, 1904, 37, 3232.I.G., D.R.P., 620,510, (*Chem. Abstracts*, 1936, 30, 732).**2-Benzylpiperidine (Phenyl-2-piperidylmethane).**Needles. M.p. 32°. B.p. 267-8°, 139-40°/19 mm., 128°/12 mm. Sol. EtOH, Et<sub>2</sub>O. Insol.  $\text{H}_2\text{O}$ .*B, HCl*: needles from AcOEt. M.p. 137°.*B, H<sub>2</sub>PtCl*<sub>6</sub>: m.p. 216-17° decomp.*B, H<sub>2</sub>AuCl*<sub>4</sub>: m.p. 168-70°.*N-Acetyl*: b.p. 189°/12 mm.

*N*-Benzoyl: m.p. 68°.

*N*-Benzenesulphonyl: prisms from ligroin. M.p. 65°.

*Picrate*: dark yellow prisms. M.p. 156-7°.

*Methodide*: m.p. 226°.

Tschitschibabin, *Chem. Zentr.*, 1902, II, 597.

Bryans, Pyman, *J. Chem. Soc.*, 1929, 550.  
Overhoff, Wibaut, *Rec. trav. chim.*, 1931, 50, 972.

Adkins, Kuick, Farlow, Wojcik, *J. Am. Chem. Soc.*, 1934, 56, 2425.

Veer, Goldschmidt, *Rec. trav. chim.*, 1946, 65, 793.

### 3-Benzylpiperidine (Phenyl-3-piperidylmethane).

Viscous liquid. B.p. 278-9°. Insol. H<sub>2</sub>O. Strong base. Absorbs CO<sub>2</sub> from air.

*B*<sub>2</sub>*H*<sub>2</sub>*PtCl*<sub>6</sub>: m.p. 191-2° decomp.

*B*<sub>2</sub>*H**AuCl*<sub>4</sub>: yellow powder. M.p. 138-40°.

Tschitschibabin, *Ber.*, 1903, 36, 2711.

### 4-Benzylpiperidine (Phenyl-4-piperidylmethane).

M.p. 6-7°. B.p. 279°, 150-2°/17 mm. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. D<sub>20</sub><sup>0</sup> 0.9972. Absorbs CO<sub>2</sub> from air.

*B**HCl*: white leaflets from AcOEt. M.p. 172-3°.

*B*<sub>2</sub>*H*<sub>2</sub>*PtCl*<sub>6</sub>: m.p. 197°.

*B*<sub>2</sub>*H**AuCl*<sub>4</sub>: m.p. 145-6°.

*Picrate*: golden yellow leaflets from EtOH. M.p. 187-8°.

*N*-Benzenesulphonyl: needles from EtOH. M.p. 118°.

Tschitschibabin, *Chem. Zentr.*, 1902, II, 597.

Bryans, Pyman, *J. Chem. Soc.*, 1929, 550.  
Overhoff, Wibaut, *Rec. trav. chim.*, 1931, 50, 973.

Veer, Goldschmidt, *Rec. trav. chim.*, 1946, 65, 793.

### 1-Benzylpropionaldehyde.

See  $\alpha$ -Methylhydrocinnamaldehyde.

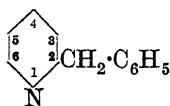
### 1-Benzylpropionic Acid.

See  $\alpha$ -Methylhydrocinnamic Acid.

### 2-Benzylpropionic Acid.

See 3-Phenylbutyric Acid.

### 2-Benzylpyridine ( $\alpha$ -Benzylpyridine, phenyl-2-pyridylmethane)



C<sub>12</sub>H<sub>11</sub>N MW, 169

B.p. 276°/742 mm., 148-9°/16 mm., 93-4°/1 mm. Sol EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. D<sub>20</sub><sup>0</sup> 1.067.  
*B**HNO*<sub>3</sub>: m.p. 116°.

*B*<sub>2</sub>*H*<sub>2</sub>*PtCl*<sub>6</sub>: m.p. 183°.

*Picrate*: prisms from benzene. M.p. 140-1°.

Laforge, *J. Am. Chem. Soc.*, 1928, 50, 2484.

Bryans, Pyman, *J. Chem. Soc.*, 1929, 549.  
Veer, Goldschmidt, *Rec. trav. chim.*, 1946, 65, 793.

### 3-Benzylpyridine ( $\beta$ -Benzylpyridine, phenyl-3-pyridylmethane).

Needles. M.p. 34°. B.p. 286°/740 mm. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

*B**HNO*<sub>3</sub>: m.p. 140°.

*B*<sub>2</sub>*H*<sub>2</sub>*PtCl*<sub>6</sub>: m.p. 200-2° decomp.

*Picrate*: m.p. 119° (126-7°).

Tschitschibabin, *Ber.*, 1903, 36, 2711.

Laforge, *J. Am. Chem. Soc.*, 1928, 50, 2484.

### 4-Benzylpyridine ( $\gamma$ -Benzylpyridine, phenyl-4-pyridylmethane).

B.p. 287°/742 mm., 180-1°/31 mm. Sol. EtOH, Et<sub>2</sub>O. D<sub>20</sub><sup>0</sup> 1.0756.

*B**HNO*<sub>3</sub>: m.p. 110°.

*B*<sub>2</sub>*H*<sub>2</sub>*PtCl*<sub>6</sub>: m.p. 207°.

*Picrate*: fine needles. M.p. 140-1°.

*B*<sub>2</sub>*ZnCl*<sub>2</sub>: m.p. 161°.

Laforge, *J. Am. Chem. Soc.*, 1928, 50, 2484.

Veer, Goldschmidt, *Rec. trav. chim.*, 1946, 65, 793.

### Benzylpyruvic Acid (1-Keto-3-phenylbutyric acid)



C<sub>10</sub>H<sub>10</sub>O<sub>3</sub> MW, 178

Plates. M.p. 48-50°. Cryst. + 1½H<sub>2</sub>O from H<sub>2</sub>O. Sol. hot H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Spar. sol. CS<sub>2</sub>.

*Amide*: C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 177. M.p. 180°.

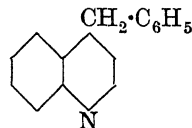
*Phenylhydrazone*: m.p. 144-5°.

*Oxime*: m.p. 165°.

*Semicarbazone*: m.p. 175° decomp.

Fittig, Petkow, *Ann.*, 1898, 299, 28.

### 4-Benzylquinoline (Phenyl- $\gamma$ -quinolylmethane)



C<sub>16</sub>H<sub>13</sub>N MW, 219

Yellow, viscous oil. B.p. 223°/19 mm.

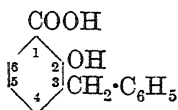
*B*<sub>2</sub>*H*<sub>2</sub>*SO*<sub>4</sub>*·2H*<sub>2</sub>*O*: m.p. 105-8°, anhyd. 132-3°.

*Picrate*: m.p. 178°.

*Methodide*: orange plates. M.p. 226°.

Rabe, Pasternack, *Ber.*, 1913, 46, 1026, 1032.

**3-Benzylsalicylic Acid** (2-Hydroxydiphenylmethane-3-carboxylic acid, 3-benzyl-o-hydroxybenzoic acid)



$\text{C}_{14}\text{H}_{12}\text{O}_3$  MW, 228  
M.p. 133-5°.

Monsanto Chem. Co., U.S.P., 2,042,343,  
(*Chem. Abstracts*, 1936, 30, 4998).

**5-Benzylsalicylic Acid** (4-Hydroxydiphenylmethane-3-carboxylic acid, 5-benzyl-o-hydroxybenzoic acid).

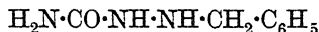
Needles from  $\text{H}_2\text{O}$ . M.p. 135-6°. Sol. EtOH, Et<sub>2</sub>O,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ .  $\text{FeCl}_3 \rightarrow$  violet-blue col.  
Me ester:  $\text{C}_{15}\text{H}_{14}\text{O}_3$ . MW, 242. M.p. 79-80°. B.p. 134-8°/1 mm.

Me ether:  $\text{C}_{15}\text{H}_{14}\text{O}_3$ . MW, 242. M.p. 201-3°.

Földi, *Ber.*, 1928, 61, 1609.

Oliverio, Piccalagua, *Chem. Abstracts*, 1934, 28, 6135.

**1-Benzylsemicarbazide** ( $\alpha$ -Benzylsemicarbazide)

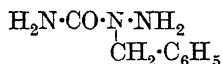


$\text{C}_8\text{H}_{11}\text{ON}_3$  MW, 165

Prisms from 20% EtOH. M.p. 155°. Sol. EtOH,  $\text{Me}_2\text{CO}$ , AcOH. Mod. sol.  $\text{CHCl}_3$ ,  $\text{H}_2\text{O}$ , AcOEt. Spar. sol. Et<sub>2</sub>O,  $\text{C}_6\text{H}_6$ . Insol. ligroin. Reduces Fehling's slowly in cold.

Hale, Lange, *J. Am. Chem. Soc.*, 1920, 42, 115.

**2-Benzylsemicarbazide** ( $\beta$ -Benzylsemicarbazide)



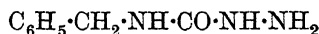
$\text{C}_8\text{H}_{11}\text{ON}_3$  MW, 165

Prisms from  $\text{CHCl}_3$ -ligroin. M.p. 135-6°. Sol. EtOH,  $\text{Me}_2\text{CO}$ ,  $\text{CHCl}_3$ , AcOH. Mod. sol.  $\text{H}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Spar. sol. Et<sub>2</sub>O. Insol. ligroin. Slowly reduces warm Fehling's. Above m.p.  $\rightarrow$  1-benzylsemicarbazide.

Bougault, Leboucq, *Compt. rend.*, 1928, 186, 957.

Hale, Lange, *J. Am. Chem. Soc.*, 1920, 42, 115.

**4-Benzylsemicarbazide** ( $\delta$ -Benzylsemicarbazide)



$\text{C}_8\text{H}_{11}\text{ON}_3$  MW, 165

White cryst. powder. M.p. 111°. Sol.  $\text{H}_2\text{O}$ , Et<sub>2</sub>O, EtOH,  $\text{CHCl}_3$ , hot  $\text{C}_6\text{H}_6$ . Insol. pet. ether.

B, HCl: white needles. M.p. 224-5°. Sol.  $\text{H}_2\text{O}$ , EtOH.

N-Acetyl: m.p. 145°.

Oxalate: m.p. 135° decomp.

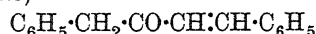
Hopper, *Chem. Abstracts*, 1928, 22, 3640.

Wilson, Hopper, Crawford, *J. Chem. Soc.*, 1922, 121, 866.

**Benzylstyrylacetic Acid.**

See 1:4-Diphenyl-1-butylene-3-carboxylic Acid.

**Benzyl styryl Ketone** (sym.-Phenylbenzylideneacetone)



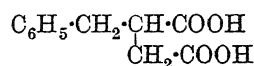
$\text{C}_{16}\text{H}_{14}\text{O}$  MW, 222

Cryst. M.p. 71°. Sol.  $\text{C}_6\text{H}_6$ , EtOH-Et<sub>2</sub>O. Distills undecomp. Brilliant yellow sol. in conc.  $\text{H}_2\text{SO}_4$ .

Oxime: m.p. 102-3°.

Goldschmiedt, Krczmař, *Monatsh.*, 1901, 22, 659.

**Benzylsuccinic Acid**



$\text{C}_{11}\text{H}_{12}\text{O}_4$  MW, 208

Needles or leaflets. M.p. 161°. Sol. hot  $\text{H}_2\text{O}$ , EtOH, Et<sub>2</sub>O. Spar. sol.  $\text{CHCl}_3$ ,  $\text{CS}_2$ ,  $\text{C}_6\text{H}_6$ .  $k = 9.1 \times 10^{-5}$  at 25°.

Di-Me ester:  $\text{C}_{13}\text{H}_{16}\text{O}_4$ . MW, 236. B.p. 159°/7 mm., 128-35°/1.5 mm.

Imide: m.p. 97-8°.

Di-hydrazide: m.p. 146°.

Anhydride:  $\text{C}_{11}\text{H}_{10}\text{O}_3$ . MW, 190. Needles. M.p. 102°. Sol. Et<sub>2</sub>O,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ .

Fittig, Brooke, *Ann.*, 1899, 305, 40.

Reynolds, *Am. Chem. J.*, 1911, 46, 209.

Haworth, Jones, Way, *J. Chem. Soc.*, 1943, 10.

**Benzyl sulphide.**

See Dibenzyl sulphide.

**Benzyl sulphone.**

See Dibenzyl sulphone

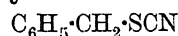
**Benzylsulphonic Acid.**

See Toluene- $\alpha$ -sulphonic Acid.

**Benzyl sulphoxide.**

See Dibenzyl sulphoxide.

**Benzyl thiocyanate**

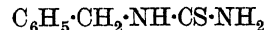


$\text{C}_8\text{H}_7\text{NS}$  MW, 149

Prisms. M.p. 43° (36-8°). B.p. 256° (235° decomp.). Sol. Et<sub>2</sub>O,  $\text{CS}_2$ , hot EtOH. Insol.  $\text{H}_2\text{O}$ .

Barbaglia, *Ber.*, 1872, 5, 687.

**Benzylthiourea** (Benzylthiocarbamide, car-pasemine)



$\text{C}_8\text{H}_{10}\text{N}_2\text{S}$  MW, 166

Isolated from seeds of *Carica papaya*, Linn. Prisms. M.p. 165°. Spar. sol. cold EtOH. Insol. cold  $\text{H}_2\text{O}$ .

Acetate: m.p. 131°.

*Methiodide*: m.p. 103–5°.

Dixon, *J. Chem. Soc.*, 1891, 59, 552.

Pause, Paranjpe, *Proc. Indian Acad. Sci.*, 1943, 18A, 140.

**Benzylthiourethane** (*Benzylthiocarbamic ester*)



$C_{10}H_{13}ONS$  MW, 195

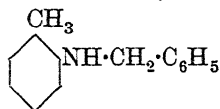
B.p. 125–30°/0.3–0.4 mm. Heat with  $C_2H_5I$  → isomeric comp.  $C_6H_5 \cdot CH_2 \cdot NH \cdot CO \cdot SC_2H_5$ .

Schneider, Clibbens, Hüllweck, Steibelt, *Ber.*, 1914, 47, 1248.

**Benzyltoluene.**

See Phenyltolylmethane.

**N-Benzyl-o-toluidine** (*o-Tolylbenzylamine*)



$C_{14}H_{15}N$  MW, 197

Cryst. M.p. 56° from EtOH, 60° from  $Et_2O$ . B.p. 200–10°/15–25 mm., 176°/10 mm. Sol. most org. solvents. Insol.  $H_2O$ . Rapidly turns green on exposure to light.  $D_4^{25}$  1.01416.  $n_D^{25}$  1.58611.

*B, HCl*: m.p. 165–6°.

Courtot, Petitcolas, *Bull. soc. chim.*, 1926, 39, 452.

Law, *J. Chem. Soc.*, 1912, 101, 158.

**N-Benzyl-m-toluidine** (*m-Tolylbenzylamine*).

Pale yellow oil. B.p. 312°, 179.5°/10 mm.  $D_4^{25}$  1.00833.  $n_D^{25}$  1.58451.

*B, HCl*: m.p. 199–200°.

Courtot, Petitcolas, *Bull. soc. chim.*, 1926, 39, 452.

Law, *J. Chem. Soc.*, 1912, 101, 158.

**N-Benzyl-p-toluidine** (*p-Tolylbenzylamine*).

Leaflets. M.p. 19–20°. B.p. 312–13°, 205–15°/10–15 mm., 181°/10 mm. Sol. EtOH,  $Et_2O$ . Insol.  $H_2O$ .  $D_4^{25}$  1.00641.  $n_D^{25}$  1.58324.

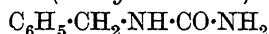
*B, HCl*: needles. M.p. 181–2°.

Courtot, Petitcolas, *Bull. soc. chim.*, 1926, 39, 452.

Law, *J. Chem. Soc.*, 1912, 101, 158.

Kirssanow, Iwastchenko, *Bull. soc. chim.*, 1935, 2, 2121.

**Benzylurea** (*Benzylcarbamide*)



$C_8H_{10}ON_2$  MW, 150

Needles from EtOH. M.p. 147–8°. Sol. EtOH. Mod. sol. hot  $H_2O$ .

Paterno, Spica, *Ber.*, 1876, 9, 81.

**Benzylurethane** (*Benzylaminoformic ethyl ester*)



$C_{10}H_{13}O_2N$  MW, 179

Leaflets from ligroin. M.p. 48–9° (44°).

Basterfield, Wright, *J. Am. Chem. Soc.*, 1926, 48, 2367.

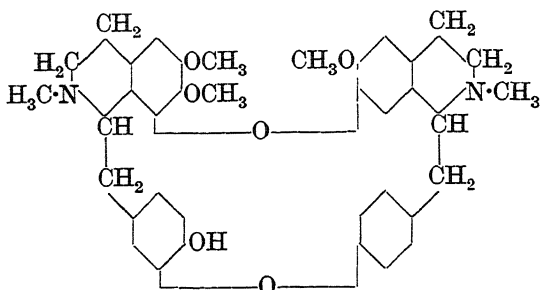
**3-Benzylvaleric Acid.**

See 4-Phenylisocaproic Acid.

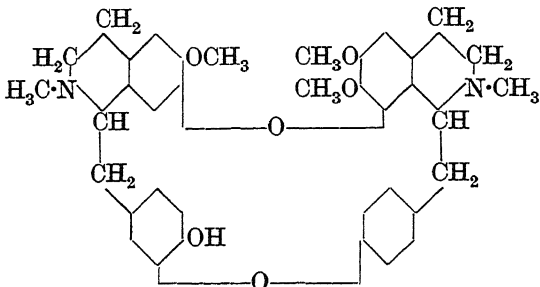
**Benzylvalerolactone.**

See under 3-Hydroxy-2-benzyl-*n*-valeric Acid.

**Berberamine**



or



$C_{37}H_{40}O_6N_2$  MW, 608

Alkaloid of *Berberis vulgaris* and *B. thunbergii*. Leaflets +  $2H_2O$  from EtOH. M.p. anhyd. 156°. Cryst. from pet. ether, m.p. 197–210°.  $[\alpha]_D^{25} + 108.6^\circ$  in  $CHCl_3$ .

*Me ether*:  $C_{38}H_{42}O_6N_2$ . MW, 622. M.p. 182°.

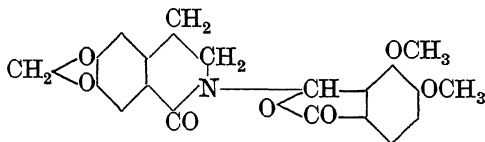
*Et ether*:  $C_{39}H_{44}O_6N_2$ . MW, 636. M.p. 188°.

Bruchhausen, Gericke, *Arch. pharm.*, 1931, 269, 119.

Rüdel, *Arch. pharm.*, 1891, 229, 631.

Santos, *Chem. Abstracts*, 1930, 24, 1647.

**Berberal**



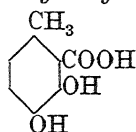
$C_{20}H_{17}O_7N$  MW, 383

Glistening plates. M.p. 148–50°. Hyd. → ω-aminoethylpiperonal-carboxylic anhydride + ψ-opianic acid.

Perkin, Robinson, *J. Chem. Soc.*, 1910, 97, 321.

Perkin, *J. Chem. Soc.*, 1890, 57, 1079.

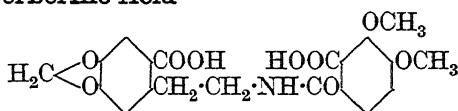
**Berberic Acid** (5:6-Dihydroxy-2-methylbenzoic acid, 3:4-dihydroxy-o-toluic acid)



$C_8H_8O_4$  MW, 168  
Needles +  $1H_2O$ . M.p. anhyd.  $165^\circ$  decomp. Sol. EtOH,  $Et_2O$ , hot  $H_2O$ .  $H_2SO_4 \rightarrow$  yellow col. in cold, green on heating.  $FeCl_3 \rightarrow$  bluish-green. Dist.  $\rightarrow$  homocatechol -  $CO_2$ .

Perkin, *J. Chem. Soc.*, 1889, 55, 88.

### Berberic Acid

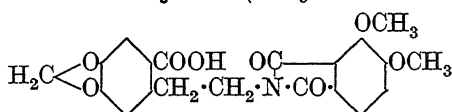


$C_{20}H_{19}O_9N$  MW, 417  
Cryst. M.p.  $177-82^\circ \rightarrow$  anhydride. Sol. EtOH. Heat  $\rightarrow$   $\omega$ -aminoethylpiperonal-carboxylic anhydride + isovanillic acid.  
*Di-Me ester*:  $C_{22}H_{23}O_9N$ . MW, 445. M.p.  $173-4^\circ$ .

*Anhydride*: see Berberilic Anhydride.

Perkin, *J. Chem. Soc.*, 1890, 57, 1048.

### Berberilic Anhydride (Anhydroberberilic acid)



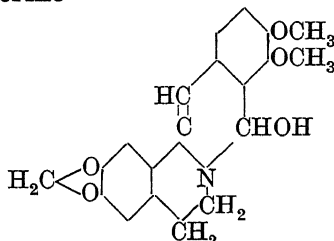
$C_{20}H_{17}O_8N$  MW, 399  
Lustrous cryst. M.p.  $236-7^\circ$ . Sol. hot AcOH. Spar. sol. EtOH,  $C_6H_6$ ,  $Me_2CO$ , ligroin.  
*Me ester*:  $C_{21}H_{19}O_8N$ . MW, 413. M.p.  $178-9^\circ$ .  
*Acetyl deriv.*:  $C_{22}H_{19}O_9N$ . MW, 441. M.p.  $139-40^\circ$ .  
*Chloride*:  $C_{20}H_{16}O_7NCl$ . MW, 417.5. M.p.  $167^\circ$ .

*Amide*:  $C_{20}H_{18}O_7N_2$ . MW, 398. M.p.  $203^\circ$ .

*Anilide*:  $C_{26}H_{22}O_7N_2$ . MW, 474. M.p.  $199^\circ$ .

Perkin, *J. Chem. Soc.*, 1890, 57, 1037.

### Berberine



$C_{20}H_{19}O_5N$  MW, 353  
Alkaloid from *Hydrastis canadensis*, *Berberis vulgaris* and other plants. Yellow needles. M.p.  $145^\circ$ . Cryst. from  $H_2O$  with  $6H_2O$ , from  $CHCl_3$  with 1  $CHCl_3$ . Sol. 22 parts  $H_2O$  at  $20^\circ$ . Sol. EtOH. Spar. sol.  $CHCl_3$ ,  $C_6H_6$ .

Prac. insol.  $Et_2O$ . Optically inactive.  $Zn + H_2SO_4 \rightarrow$  tetrahydroberberine.

*B, HCl, 2H\_2O*: yellow cryst. Spar. sol.  $H_2O$ . Insol.  $Et_2O$ ,  $CHCl_3$ , cold EtOH.

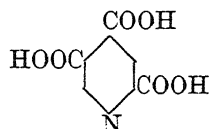
*B, H\_2SO\_4*: sol. 100 parts  $H_2O$ .

Haworth, Perkin, Rankin, *J. Chem. Soc.*, 1924, 125, 1686.

Perkin, Ráy, Robinson, *J. Chem. Soc.*, 1925, 127, 740.

Mizuno, Yoshida, *Jap. P.*, 99,230, (*Chem. Abstracts*, 1934, 28, 2468).

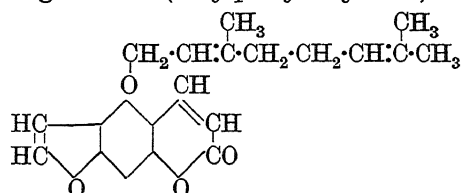
**Berberonic Acid** (Pyridine-2:4:5-tricarboxylic acid)



$C_8H_5O_6N$  MW, 211  
Cryst. from  $H_2O$  in prisms with  $2H_2O$ . Loses  $1H_2O$  on standing in air. M.p.  $235^\circ$ , anhyd.  $243^\circ$ . Sol. hot  $H_2O$ . Spar. sol. hot EtOH. Insol.  $Et_2O$ ,  $C_6H_6$ ,  $CHCl_3$ .  $FeCl_3 \rightarrow$  blood-red col.

Mumm, Hüneke, *Ber.*, 1918, 51, 150.

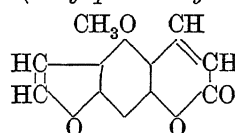
### Bergamottin (Bergaptol geranyl ether)



$C_{21}H_{22}O_4$  MW, 338  
Constituent of bergamot oil. Cryst. from  $Et_2O$ -pet. ether. M.p.  $59-61^\circ$ . Decomp at  $200-230^\circ$  in high vac.  $\rightarrow$  bergaptol.

Späth, Kainrath, *Ber.*, 1937, 70, 2272.

### Bergapten (Bergaptol methyl ether)

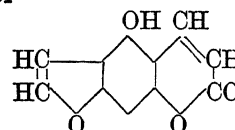


$C_{12}H_8O_4$  MW, 216  
Constituent of bergamot oil (about 5%). Needles from EtOH. M.p.  $188^\circ$ . Spar. sol. EtOH. Sublimes. KOH fusion  $\rightarrow$  phloroglucinol.

Thoms, Baetcke, *Ber.*, 1912, 45, 3705.

Cf. Karrer et al., *Helv. Chim. Acta*, 1920, 3, 541; 1921, 4, 718.

### Bergaptol



$C_{11}H_6O_4$  MW, 202

Constituent of bergamot oil. Needles from AcOEt. M.p. 277-8° (vac. tube).

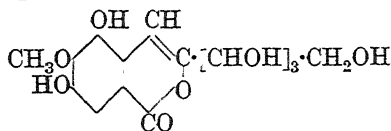
*Me ether*: see Bergapten.

*Geranyl ether*: see Bergamottin.

Späth, Socias, *Ber.*, 1934, 67, 59.

Späth, Kubiczek, *Ber.*, 1937, 70, 1253.

### Bergenin



$C_{14}H_{16}O_9$  MW, 328

Occurs in root of *Saxifraga siberica*. Prisms +  $1H_2O$  from  $H_2O$ . M.p. anhyd. 138-9° (130°), solidifying and re-melting at 230°.  $[\alpha]_D^{25} - 37.3^\circ$  in EtOH,  $-47.3^\circ$  in  $H_2O$ . Reduces warm Fehling's. Bitter taste.

*Penta-acetyl*: m.p. 199-203° (192.5-3.5°).

*Di-Me ether*:  $C_{16}H_{20}O_9$ . MW, 356. Cryst. +  $2H_2O$ . M.p. 89°, anhyd. 194-6°.

Tschitschibabin, Kirssanow, Korolew, Woroschzow, *Ann.*, 1929, 469, 98.

Garreau, Machelart, *Compt. rend.*, 1880, 91, 942.

Ssadikow, Guthner, *Biochem. Z.*, 1927, 190, 347.

Morelle, *Compt. rend.*, 1881, 93, 646.

### Bessisterol.

See  $\alpha$ -Spinasterol.

**Betaine** (*Anhydride or lactone of carboxymethyltrimethylammonium hydroxide, lysine, oxyneurine*)

$(CH_3)_3N^+ \cdot CH_2 \cdot COO^-$   
 $C_5H_{11}O_2N$  MW, 117

Occurs in beetroot, cottonseed, etc. Prisms or leaflets. M.p. 293°. Isomerises at the m.p. to methyl ester of dimethylaminoacetic acid. Crystallises from aq. solvents with  $1H_2O$ , in which the free acid  $HO \cdot N(CH_3)_3 \cdot CH_2 \cdot COOH$  is present ( $k = 7.0 \times 10^{-13}$  at 25°). The  $H_2O$  is lost at 100°, giving betaine. Hydrated form sol.  $H_2O$ , EtOH. Spar. sol.  $Et_2O$ . Conc. KOH.Aq.  $\rightarrow$  trimethylamine.

*B.HCl*: acidol. M.p. 227-8° decomp.

*B.HBr*: m.p. 233° decomp.

*B.HI*: m.p. 200° (188-9°).

*B.HAuCl\_4*: plates, m.p. 200-9°, and rhombohedra m.p. 248-50° decomp.

*Picrate*: yellow prisms from  $H_2O$ . M.p. 183°.

Waterman, *Proc. Acad. Sci. Amsterdam*, 1918, 20, 88.

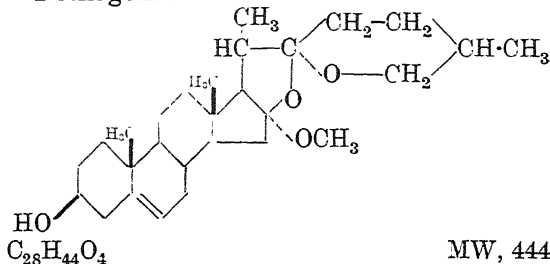
Reychler, *Bull. soc. chim. Belg.*, 1923, 32, 247.

Takayama, U.S.P., 1,870,319, (*Chem. Abstracts*, 1932, 26, 5783).

### Betelphenol.

See Chavicol.

### Bethogenin



$C_{28}H_{44}O_4$  MW, 444

Isolated from *Beth* root via cryptogenin. Colourless needles from MeOH. M.p. 193-4°. Ppd. from EtOH by digitonin.  $[\alpha]_D^{25} - 98.4^\circ$  in dioxan.

*Acetyl*: cryst. from EtOH- $C_6H_6$ . M.p. 230-2°.  $[\alpha]_D^{25} - 94.4^\circ$  in dioxan.

*Benzoyl*: needles from MeOH- $C_6H_6$ . M.p. 212-15°.  $[\alpha]_D^{25} - 65.1^\circ$  in dioxan.

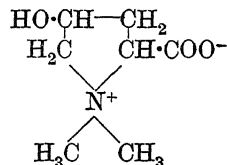
Barusch, Noller, *et al.*, *J. Am. Chem. Soc.*, 1942, 64, 2581; 1943, 65, 1786.

Marker *et al.*, *J. Am. Chem. Soc.*, 1943, 65, 1658; 1947, 69, 2167, 2386, 2395.

### Betol.

See under 2-Naphthol.

### Betonicine



$C_7H_{13}O_3N$  MW, 159

Present in *Betonica officinalis* and *Stachys silvatica*, and is stereoisomeric with turicine. Prisms from EtOH. M.p. 252° decomp.  $[\alpha]_D^{25} - 36.60^\circ$  in  $H_2O$ . Spar. sol. cold EtOH.

*B.HCl*: needles or prisms from EtOH. M.p. 232° decomp.

*B.HAuCl\_4*: yellow leaflets. Decomp. at 230-2°.

*B\_2.H\_2PtCl\_6*: prisms +  $2H_2O$  from  $H_2O$ . M.p. 225-6° decomp.

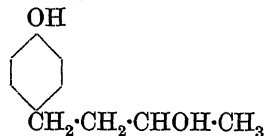
Goodson, Clewer, *J. Chem. Soc.*, 1919, 115, 923.

Küng, *Z. physiol. Chem.*, 1913, 85, 217.

### Betulic Acid.

See Betulinic acid.

### Betuligenol (p- $\gamma$ -Hydroxybutylphenol)



$C_{10}H_{14}O_2$  MW, 166

Aglycone from betuloside. Cryst. M.p. 81.5°.  $D^{20} 1.156$ .  $[\alpha]_D^{18.5} - 18.5^\circ$  in EtOH.

*Me ether*:  $C_{11}H_{16}O_2$ . MW, 180. B.p. 158-9°/14 mm., 130-1°/4 mm.  $D^{20} 1.0361$ .  $n_D^{20}$



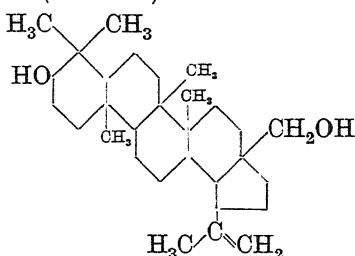
1-5237.  $[\alpha]_{586}^{18.5} -17.5^\circ$  in EtOH. Ox.  $\rightarrow$  anisic acid. *p*-Nitrobenzoyl: m.p.  $285^\circ$  decomp.

*Benzoyl*: m.p.  $68-9^\circ$ .  $[\alpha]_{58}^{18.5} -12.8^\circ$  in EtOH.

Sosa, *Ann. Chim.*, 1940, 14, 5.

Delépine, Sosa, *Bull. soc. chim.*, 1942, 9, 771.

### Betulin (Betulinol)



$C_{30}H_{50}O_2$

MW, 442

Triterpene alcohol present in birch bark. Needles from EtOH. M.p.  $251-2^\circ$ .  $[\alpha]_{58}^{15} + 19.96^\circ$  in Py. Mod. sol. hot EtOH, hot  $Et_2O$ , hot  $CHCl_3$ , hot  $C_6H_6$ , hot AcOH, AcOEt. Spar. sol. ligroin. Insol.  $H_2O$ . Sublimes with part decomp.  $H-COOH \rightarrow$  allobetulin formate.

*Acetyl deriv.*: leaflets from EtOH. M.p.  $260^\circ$ .

*Diacetyl*: prisms from EtOH. M.p.  $216-7^\circ$ .

$[\alpha]_D + 22^\circ$  in  $CHCl_3$ .

*Dipropionyl*: m.p.  $164-5^\circ$ .

*Dibutyryl*: m.p.  $107^\circ$ .

*Dibenzoyl*: needles from Py-EtOH. M.p.  $181^\circ$ .  $[\alpha]_{58}^{14.5} + 43^\circ$ .

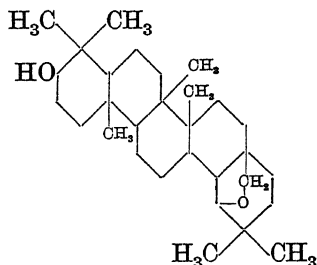
*Di-p-bromobenzoyl*: needles from EtOH- $C_6H_6$ . M.p.  $221-2^\circ$ .  $[\alpha]_{58}^{16} + 44^\circ$ .

*Di-m-nitrobenzoyl*: needles from  $C_6H_6$ -EtOH. M.p.  $267-8^\circ$ .  $[\alpha]_{58}^{15} + 38.4^\circ$  in  $CHCl_3$ .

*Di-anisoyl*: cryst. from AcOH. M.p.  $192-3^\circ$ .  $[\alpha]_{58}^{17} + 49^\circ$  in  $CHCl_3$ .

*Acid phthaloyl*: needles from EtOH.Aq. M.p.  $180-2^\circ$ .  $[\alpha]_{58}^{15} + 24.5^\circ$ .

*Allo-*.



Plates from EtOH. M.p.  $260-1^\circ$ .  $[\alpha]_{58}^{15} + 48.3^\circ$ .

*Formyl*: needles. M.p.  $311-12^\circ$ .  $[\alpha]_{58}^{15} + 51.1^\circ$ .

*Acetyl*: plates. M.p.  $277-8^\circ$ .  $[\alpha]_{58}^{15} + 54.2^\circ$ .

*Benzoyl*: leaflets from EtOH- $C_6H_6$ . M.p.  $275-6^\circ$ .  $[\alpha]_{58}^{15} + 70.3^\circ$ .

*m-Nitrobenzoyl*: leaflets from EtOH-AcOH. M.p.  $277-8^\circ$ .  $[\alpha]_{58}^{20} + 69.2^\circ$  in  $CHCl_3$ .

*p-Bromobenzoyl*: cryst. from EtOH- $C_6H_6$ . M.p.  $276^\circ$ .  $[\alpha]_{58}^{16} + 66.2^\circ$  in  $CHCl_3$ .

*Anisoyl*: cryst. from AcOH. M.p.  $295^\circ$ .  $[\alpha]_{58}^{16.5} + 77.3^\circ$  in  $CHCl_3$ .

*Acid succinyl*: leaflets from EtOH- $C_6H_6$ . M.p.  $265-6^\circ$ .  $[\alpha]_{58}^{15} + 48^\circ$ .

*Acid phthaloyl*: needles from EtOH. M.p.  $260-1^\circ$ .  $[\alpha]_{58}^{15} + 58^\circ$ .

Ruzicka, Brenner, *Helv. Chim. Acta*, 1940, 23, 1325.

Ruzicka *et al.*, *Helv. Chim. Acta*, 1934, 17, 426.

Ruzicka, Brüngger, Gustus, *Helv. Chim. Acta*, 1932, 15, 634.

Ruzicka, Isler, *Helv. Chim. Acta*, 1936, 19, 511.

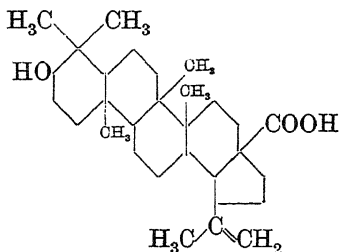
Schulze, Pieroh, *Ber.*, 1922, 55, 2332.

Dischendorfer, Grillmayer, *Monatsh.*, 1926, 47, 241, 419.

Davy, Halsall, Jones, *J. Chem. Soc.*, 1951, 2696.

Davy, Halsall, Jones, Meakins, *ibid.*, 2702.

### Betulonic Acid (*Betulic acid, gratiolone*)



$C_{30}H_{48}O_3$

MW, 456

Unsaturated monobasic triterpene hydroxy-acid, isolated from *Cornus florida*, Linn., *Zizyphus vulgaris*, Lamark, cabbage and other sources. Also obtained by ox. of betulin. Plates or needles + EtOH from EtOH. M.p.  $316-18^\circ$ .  $[\alpha]_{5461}^{22} + 7.89^\circ$  in Py. Sol. Py. Spar. sol. EtOH,  $Me_2CO$ , AcOEt,  $CHCl_3$ ,  $C_6H_6$ . Na salt almost insol.  $H_2O$ .

*Acetyl*: plates from EtOH. M.p.  $289-91^\circ$ .  $[\alpha]_{5461}^{22} + 7.70^\circ$  in  $CHCl_3$ .

*Benzoyl*: m.p.  $341-4^\circ$  decomp.

*Me ester*: needles from MeOH. M.p.  $223-4^\circ$ .  $[\alpha]_{5461}^{22} + 8.01^\circ$  in  $CHCl_3$ . *Acetyl*: m.p.  $290-2^\circ$ .

*Benzoyl*: m.p.  $248-50^\circ$  decomp.

Ruzicka, Lamberton, Christie, *Helv. Chim. Acta*, 1938, 21, 1706.

Robertson, Soliman, Owen, *J. Chem. Soc.*, 1939, 1267.

Maurer, Meier, Reiff, *Ber.*, 1939, 72, 1870.

Davy, Halsall, Jones, *J. Chem. Soc.*, 1951, 2696.

### Betulinol.

See Betulin.

### Betulonic Acid

$C_{30}H_{46}O_3$

MW, 454

Oxidation product of betulin. Needles or rosettes from EtOH. M.p.  $253^\circ$  decomp.  $[\alpha]_D + 31^\circ$  in  $CHCl_3$ .

*Me ester*: cryst. from Et<sub>2</sub>O-MeOH. M.p. 165°. [ $\alpha$ ]<sub>D</sub><sup>20</sup> -31.5° in CHCl<sub>3</sub>. *Oxime*: cryst from EtOH. M.p. 238° decomp.

*Semicarbazone*: scales. M.p. 282-3°.

Ruzicka, Rey, *Helv. Chim. Acta*, 1941, 24, 529.

Kawaguti, Kim, *J. Pharm. Soc. Japan*, 1940, 60, 595.

**Betuloside** (*Betuligenol-β-D-glucopyranoside*)

C<sub>16</sub>H<sub>24</sub>O<sub>7</sub> MW, 333

Glucoside isolated from *Betula alba*. Colourless cryst. powder. M.p. 190° corr. [ $\alpha$ ]<sub>D</sub><sup>18.5</sup> -42.0° in MeOH. [ $\alpha$ ]<sub>D</sub><sup>18.5</sup> -44.4° in H<sub>2</sub>O. Spar. sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, H<sub>2</sub>O. Sol. 10% NaOH.Aq. Hyd. → glucose + betuligenol.

*Dibenzoyl*: m.p. 136-7° corr. [ $\alpha$ ]<sub>D</sub><sup>18</sup> -36.7° in EtOH.

Sosa, *Ann. chim.*, 1940, 14, 5.

**Bhilawanol**

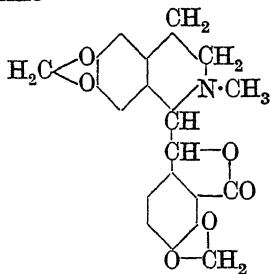
C<sub>21</sub>H<sub>32</sub>O<sub>2</sub> MW, 316

Constituent of the marking nut, *Semecarpus anacardium*. B.p. 215-245°/4 mm.

*Hydro deriv.*: m.p. 56-8°.

Rastogi, Sharma, Siddiqui, *Journal of Scientific and Industrial Research (India)*, 1948, 7B, No. 5, 61, (*Chem. Abstracts*, 1948, 42, 7998).

**Bicuculline**



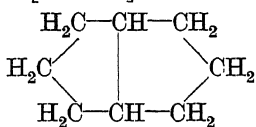
C<sub>20</sub>H<sub>17</sub>O<sub>6</sub>N MW, 367

Constituent of *Dicentra cucullaria*, *Corydalis sempervirens*, *C. aurea*, *C. nobilis*, Pero., and *C. platycarpa*. Plates from CHCl<sub>3</sub>-MeOH. M.p. 215°, (196°, 177°). Sol. CHCl<sub>3</sub>. Spar. sol. MeOH, EtOH.

Manske, *Can. J. Research*, 1932, 7, 265; 1933, 8, 210, 407; 1933, 9, 436; 1940, 18, 288.

Groenewoud, Robinson, *J. Chem. Soc.*, 1936, 199.

**cis-Bicyclo-[3 : 3 : 0]-octane**



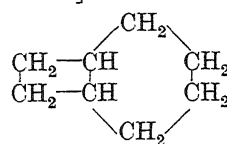
C<sub>8</sub>H<sub>14</sub>

MW, 110

B.p. 136-136.5°. D<sub>4</sub><sup>25</sup> 0.8638. n<sub>D</sub><sup>25</sup> 1.4595.

Cope, Schmitz, *J. Am. Chem. Soc.*, 1950, 72, 3056.

**Bicyclo-[4 : 2 : 0]-octane**

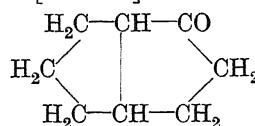


C<sub>8</sub>H<sub>14</sub> MW, 110

B.p. 136°. D<sub>4</sub><sup>20</sup> 0.8573. n<sub>D</sub><sup>20</sup> 1.4613.

Reppe, Schichting, Klager, Toepel, *Ann.*, 1948, 560, 1.

**cis-Bicyclo-[3 : 3 : 0]-octanone-2**



C<sub>8</sub>H<sub>12</sub>O MW, 124

B.p. 50°/2.3 mm. D<sub>4</sub><sup>25</sup> 1.0060. n<sub>D</sub><sup>25</sup> 1.4766.

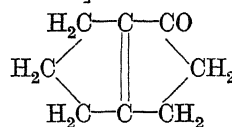
*Semicarbazone*: cryst. from EtOH. M.p. 178.8-180.2°.

2 : 4-Dinitrophenylhydrazone: two forms. (i) M.p. 110-113°. (ii) M.p. 140-140.2°.

Cope, Schmitz, *J. Am. Chem. Soc.*, 1950, 72, 3056.

Cooke, Linstead, *J. Chem. Soc.*, 1934, 955.

**Bicyclo-[3 : 3 : 0]-1-octenone-2**



C<sub>8</sub>H<sub>10</sub>O MW, 122

M.p. 17.2-19°. B.p. 62°/0.9 mm. D<sub>4</sub><sup>25</sup> 1.0534. n<sub>D</sub><sup>25</sup> 1.5202.

*Semicarbazone*: m.p. 230-232.2°.

Cope, Schmitz, *J. Am. Chem. Soc.*, 1950, 72, 3056.

**Bigitaligenin.**

See Gitoxigenin.

**Bigitalin.**

See Gitoxin.

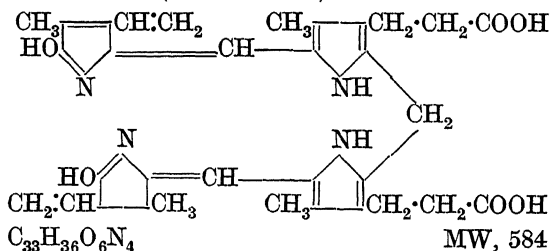
**Biguanide.**

See Diguamide.

**Bilinearine.**

See Choline.

**Bilirubin** (*Haematoidine*)



C<sub>33</sub>H<sub>36</sub>O<sub>6</sub>N<sub>4</sub>

MW, 584

Occurs in blood, gallstones and urine. Brown cryst. Sol.  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ ,  $\text{CS}_2$ . Spar. sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ . Insol.  $\text{H}_2\text{O}$ . Absorption max. at  $420 \text{ m}\mu$ . Sol. aq. alkalis to orange-red sols. Ox.  $\rightarrow$  biliverdin.

*Di-Me ester*: orange cryst., m.p.  $204-5^\circ$ ; and red cryst., m.p.  $168-9^\circ$ .

Fischer, Lindner, *Z. physiol. Chem.*, 1926, 161, 1.

Rich, Bumstead, *Chem. Abstracts*, 1935, 19, 2832.

Barron, *Medicine*, 1931, 10, 77 (*Bibl.*).

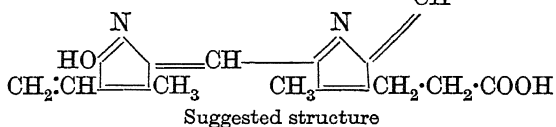
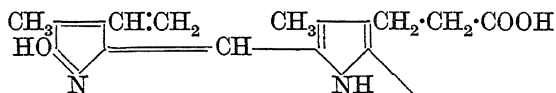
Fischer, Haberland, *Z. physiol. Chem.*, 1935, 232, 236.

Peterman, U.S.P., 2,049,134, (*Chem. Abstracts*, 1936, 30, 6392).

Fischer-Orth, *Die Chemie des Pyrrols*, 1937, II, 621.

Fischer, Plieninger, *Z. physiol. Chem.*, 1941, 268, 197; 1942, 274, 231; *Naturwiss.*, 1942, 30, 382.

**Biliverdin** (*Dihydrobilirubin*, *oöcyan*, *utero-verdin*)



$\text{C}_{33}\text{H}_{34}\text{O}_6\text{N}_4$  MW, 582

Constituent of eggshells of birds and of dog placenta. Dark green plates or prisms with violet surface colour. M.p. above  $300^\circ$ . Spar. sol.  $\text{MeOH}$ ,  $\text{CHCl}_3$ ,  $\text{Et}_2\text{O}$ . Absorption max. at  $680 \text{ m}\mu$ , min. at  $500 \text{ m}\mu$ . Gives Gmelin reaction with conc.  $\text{HNO}_3$  in  $\text{CHCl}_3$ .

*Di-Me ester*:  $\text{C}_{35}\text{H}_{38}\text{O}_6\text{N}_4$ . MW, 610. Cryst. from  $\text{CHCl}_3$ -pet. ether. M.p.  $220-1^\circ$  corr. Absorption max. at  $384$  and  $665 \text{ m}\mu$ .

Lemberg, *Biochem. J.*, 1934, 28, 978; *Ann.*, 1932, 499, 25.

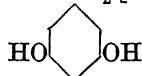
Lemberg, Barcroft, *Proc. Roy. Soc.*, 1932, 110, 362.

Lemberg, Legge, *Chem. Abstracts*, 1940, 34, 6952.

Fischer, Reinecke, *Z. physiol. Chem.*, 1940, 265, 9.

Fexier, *Bull. soc. chim. biol.*, 1945, 27, 621. See also references under Bilirubin.

### Bilobol



$\text{C}_{21}\text{H}_{34}\text{O}_2$

Dict. of Org. Comp.—I.

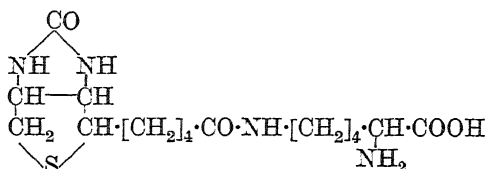
MW, 318

Constituent of fruit of *Ginkgo biloba*, Linn. Needles from pet. ether. M.p.  $36-7^\circ$ . H + Pt  $\rightarrow$  hydrobilobol.

*Di-Me ether*:  $\text{C}_{23}\text{H}_{38}\text{O}_2$ . MW, 346. B.p.  $250-2^\circ/6 \text{ mm}$ .

Furukawa, *Sci. Papers Inst. Phys. Chem. Research, Tokyo*, 1935, 26, 178.

### Bioctin



$\text{C}_{16}\text{H}_{28}\text{O}_4\text{N}_4\text{S}$  MW, 372

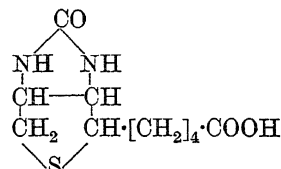
Biotin complex occurring in yeast extract. Cryst. from  $\text{Me}_2\text{CO}$ . Aq. M.p.  $245-52^\circ$  decomp. (slow crystallization), m.p.  $228-30^\circ$  (rapid crystallization). Hyd.  $\rightarrow$  lysine + biotin.

Wright *et al.*, *Science*, 1951, 114, 635.

Folkers *et al.*, *J. Am. Chem. Soc.*, 1952, 74, 1999, 2002.

Wright *et al.*, *ibid.*, 1996, 2004.

### Biotin (Vitamin H)



$\text{C}_{10}\text{H}_{16}\text{O}_3\text{N}_2\text{S}$  MW, 244

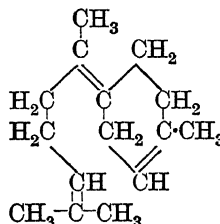
Occurs in yeast, eggs and liver. Bacterial growth factor and curative factor for "egg white injury." Needles from  $\text{H}_2\text{O}$ . M.p.  $230-2^\circ$  decomp. Sol.  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ . Spar. sol.  $\text{CHCl}_3$ ,  $\text{Et}_2\text{O}$ , pet. ether.  $[\alpha]_D^{25} +92^\circ$  in  $\text{NaOH}$ . Aq.

*Me ester*: plates from  $\text{MeOH}$ - $\text{Et}_2\text{O}$ . M.p.  $166-7^\circ$ . Sublimes in vac. Sol.  $\text{MeOH}$ ,  $\text{EtOH}$ ,  $\text{CHCl}_3$ . Spar. sol.  $\text{C}_6\text{H}_6$ . Insol.  $\text{H}_2\text{O}$ ,  $\text{Et}_2\text{O}$ , pet. ether.  $[\alpha]_D^{25} +57^\circ$  in  $\text{CHCl}_3$ .

du Vigneau, *J. Biol. Chem.*, 1942, 142, 615.

Hofmann, *Advances in Enzymology*, 1943, 3, 289 (Review).

### Bisabolene (Limene)



$\text{C}_{15}\text{H}_{24}$

MW, 204  
19

Occurs in opoponax and bisabol myrrh oils. Chief constituent of Chinese star-anise oil. B.p. 155-7°/12 mm., 118-20°, 0.5 mm.  $D_4^{25}$  0.9223.  $n_D^{25}$  1.4917.

*Trihydrochloride*: m.p. 79-80°.

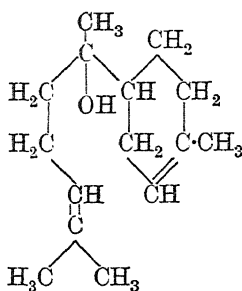
Ruzicka, van Veen, *Ann.*, 1929, 468, 133.

Ruzicka, Liguori, *Helv. Chim. Acta*, 1932, 15, 3.

Jackson, Short, *J. Soc. Chem. Ind.*, 1936, 55, 8T.

Grob, Sprecher, *Helv. Chim. Acta*, 1952, 35, 885.

### Bisabolol



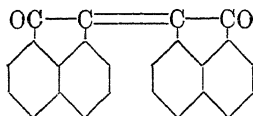
$C_{15}H_{26}O$  MW, 222

B.p. 154-6°/12 mm.  $D_4^{25}$  0.9216.  $n_D^{25}$  1.4939. Dry HCl  $\rightarrow$  bisabolene trihydrochloride.

Ruzicka, Capato, *Helv. Chim. Acta*, 1925, 8, 270.

Ruzicka, Liguori, *Helv. Chim. Acta*, 1932, 15, 3.

### Bis-acenaphthylidene Diketone (*Biacenedione*)



$C_{24}H_{12}O_2$  MW, 332

Orange-red needles. M.p. 287-8°. Spar. sol. AcOH,  $C_6H_6$ . Ox.  $\rightarrow$  naphthalic anhydride.  $H_2SO_4$   $\rightarrow$  green col.

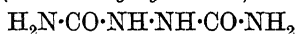
*Mono-phenylhydrazone*: brownish-red cryst. M.p. 105-10°.

Dziewoński, Lityński, *Ber.*, 1925, 58, 2539.

### Bis-trimethylethylene nitrosate.

See Amylene nitrosate.

### Biurea (*Dicarbamylhydrazine*)



$C_2H_6O_2N_4$  MW, 118

M.p. 244-6°.

Jacini, *Gazz. chim. ital.*, 1937, 67, 715.

### Biuret (*Allophanamide, ureidoformamide*)



$C_2H_5O_2N_3$  MW, 103

Needles +  $1H_2O$ . M.p. 190° (193°) decomp. Cryst. anhyd. from EtOH. Heat  $\rightarrow$  cyanuric acid +  $NH_3$ .  $CuSO_4$  on KOH sol.  $\rightarrow$  violet col. (Biuret reaction).

*N-Me deriv.*: allophanic methylamide.  $CH_3 \cdot NH \cdot CO \cdot NH \cdot CO \cdot NH_2$ .  $C_3H_7O_2N_3$ . MW, 117. Cryst. from  $H_2O$  or EtOH. M.p. 166°.

*N-Et deriv.*: allophanic ethylamide.  $C_2H_5 \cdot NH \cdot CO \cdot NH \cdot CO \cdot NH_2$ .  $C_4H_9O_2N_3$ . MW, 131. Prismatic needles from  $H_2O$ . M.p. 153°. De-comp. above m.p.

*Acetyl deriv.*:  $CH_3 \cdot CO \cdot NH \cdot CO \cdot NH \cdot CO \cdot NH_2$ . Needles from EtOH. M.p. 193°.

*Benzoyl deriv.*: cryst. from  $H_2O$ . M.p. 220°.

*m-Nitrobenzoyl deriv.*: cryst. from  $H_2O$ . M.p. 187-190°.

Thiele, Uhlfelder, *Ann.*, 1898, 303, 95.

Werner, Carpenter, *J. Chem. Soc.*, 1918, 113, 699.

Warren, Wilson, *Ber.*, 1935, 68, 957.

Adams, U.S.P., 2,401,599, (*Chem. Abstracts*, 1946, 40, 5449).

### Biuret Base (*Triglycylglycine ethyl ester*)

$NH_2 \cdot CH_2 \cdot CO \cdot [NH \cdot CH_2 \cdot CO]_2 \cdot NH \cdot CH_2 \cdot CO \cdot OC_2H_5$

$C_{10}H_{18}O_5N_4$  MW, 274

Plates. Sinters at 218°, chars at 270° without melting. Sol.  $H_2O$ . Prac. insol. EtOH.  $Et_2O$ ,  $C_6H_6$ . Aq. sol. shows alk. reaction, and gives reactions of the proteins.

*B,HCl*: leaflets. M.p. 212-14° decomp.

$B_2, H_2PtCl_6, 2H_2O$ : orange plates. M.p. 112° decomp.

*Picrate*: m.p. 189°.

Fischer, *Ber.*, 1904, 37, 2504.

Curtius, *ibid.*, 1284.

### Bixane (4:8:12:16-Tetramethyleicosane)

$CH_3 \cdot CH_2 \cdot CH_2 \cdot [CH_2 \cdot CH(CH_3) \cdot CH_2 \cdot CH_2]_4 \cdot CH_3$

$C_{24}H_{50}$  MW, 338

Parent hydrocarbon of bixin series. Obtained by red. of bixin derivs. B.p. 218°/15 mm., 162°/0.5 mm. Spar. sol. EtOH, AcOH. Very sol.  $CHCl_3$ ,  $CCl_4$ ,  $CS_2$ , pet. ether.  $D_4^{20}$  0.8054.  $n_D^{20}$  1.4502.

Kuhn, Ehmman, *Helv. Chim. Acta.*, 1929, 12, 904.

### Bixin (*Norbixin methyl ester*)

$CH_3O \cdot OC \cdot CH \cdot [CH \cdot C(CH_3) \cdot CH \cdot CH]_4 \cdot CH \cdot COOH$

$C_{25}H_{30}O_4$  MW, 394

From seeds of *Bixa orellana*, Linn. Violet prisms. M.p. 198°. Sol.  $CHCl_3$ , hot EtOH. Spar. sol. cold EtOH,  $Et_2O$ ,  $C_6H_6$ ,  $CS_2$ , AcOH. Insol.  $H_2O$ . Optically inactive. Absorption max. at 523.5, 489, and 457  $\mu$  in  $CS_2$ .

*Me ester* : norbixin dimethyl ester.  $C_{26}H_{32}O_4$ . MW, 408. M.p. 164°.

Kuhn, Winterstein, *Helv. Chim. Acta*, 1928, 11, 427.

Karrer, Helfenstein, Widmer, Itallie, *Helv. Chim. Acta*, 1929, 12, 741.

Kuhn, Ehmann, *ibid.*, 904.

Rinkes, *Rec. trav. chim.*, 1929, 48, 603.

Winterstein, *Angew. Chem.*, 1934, 47, 315 (*Bibl.*).

Holmes, Bromund, *Science*, 1935, 82, 202.

Zechmeister, Escue, *J. Am. Chem. Soc.*, 1944, 66, 322.

β-Bixin.

See Isobixin.

Blepharin

$C_{16}H_{20}O_{10}$  MW, 372

Optically active glycoside from *Blepharis edulis*, Pers. Contains 5 OH groups. M.p. 222°.  $[\alpha]_D^{25} + 121.5^\circ$ .  $ClCOOEt \rightarrow$  penta-carbethoxy deriv.

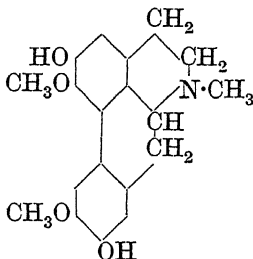
*Penta-acetyl* : needles from EtOH.Aq. M.p. 161.5°.

*Pentakis-p-nitrobenzoyl* : m.p. 264° (from Py.Aq.).

*Me deriv.* : m.p. 130° decomp.

Lal, *J. Indian Chem. Soc.*, 1940, 17, 269.

Boldine



$C_{19}H_{21}O_4N$  MW, 327

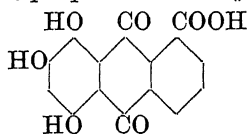
Constituent of leaves and stem of *Peumus boldus*, Mol. Plates from  $C_6H_6$ . M.p. 161-3° (softens at 156°). Sensitive to light. Bitter taste.

*Di-Me ether* : see Glaucine.

Späth, Tharrer, *Ber.*, 1933, 66, 904.

Schlitter, *Ber.*, 1933, 66, 988.

**Boletol** (5 : 7 : 8-Trihydroxyanthraquinone-1-carboxylic acid, purpurin-8-carboxylic acid)



$C_{15}H_8O_7$  MW, 300

Dyestuff from *Boletus satanas* and *B. badius*. Red needles from Et<sub>2</sub>O-ligroin. Carbonises at 275-80°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O. H<sub>2</sub>O<sub>2</sub>  $\rightarrow$  hemimellitic acid.

*Triacetyl* : yellow prisms from AcOH. M.p. above 300°.

Leuco-

*Penta-acetyl* : colourless prisms from AcOH. M.p. 252°.

*Trimethyl* : diacetate : colourless prisms from MeOH. M.p. 213°.

Kögl, Deijs, *Ann.*, 1934, 515, 10.

Pastac, *Chem. Zentr.*, 1941, I, 1303 (*Review*).

Bombicesterol.

See Inagosterol.

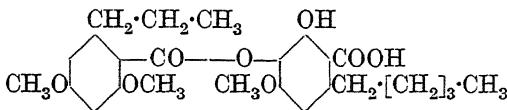
Bonelline

$C_{34}H_{36}O_4N_4$  MW, 564

Occurs in the gephyrean worm *Bonellia viridis*. Fine dark green needles from Et<sub>2</sub>O or toluene. Probably similar to mesopyrrochlorine. Forms complex salts with metals.

Lederer, *Compt. rend.*, 1939, 209, 528.

Boninic Acid



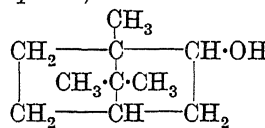
$C_{25}H_{32}O_8$  MW, 460

Constituent of the lichen *Ramalina bovinensis*, Y. Asahina. Plates from  $C_6H_6$ -pet. ether. M.p. 134.5°. Sol. most org. solvents. Spar. sol. cold  $C_6H_6$ . Insol. pet. ether.  $FeCl_3 \rightarrow$  reddish-violet col. in EtOH.

*Me ester* :  $C_{26}H_{34}O_8$ . MW, 474. Plates from EtOH. M.p. 86°.  $FeCl_3 \rightarrow$  red col. in EtOH.

Asahina, Kusaka, *Ber.*, 1937, 70, 1817.

**Borneol** (*Bornyl alcohol*, *Borneo camphor*, *2-hydroxycamphane*)



$C_{10}H_{18}O$  MW, 154

*d.*

Hexagonal plates. M.p. 208°. B.p. 212°. Sol. EtOH, Et<sub>2</sub>O,  $C_6H_6$ , ligroin. Spar. sol. H<sub>2</sub>O. Sublimes.  $[\alpha]_D^{20} + 37.44^\circ$  in EtOH. Heat of comb.  $C_7$  1464.7 Cal. Dil.  $HNO_3 \rightarrow$  *d*-camphor.  $PCl_5 \rightarrow$  isobornyl chloride.

*Formyl* : b.p. 98-9°/15 mm., 90°/10 mm.  $D^{22}$  1.009.  $n_D^{25} 1.47078$ .  $[\alpha]_D + 48.45^\circ$ .

*Acetyl* : m.p. 29°. B.p. 225-6°, 106-7°/15 mm. Insol. H<sub>2</sub>O.  $[\alpha]_D$  liq. + 44.38°.

*Benzoyl* : m.p. 25.5°.  $[\alpha]_D + 43.9^\circ$ .

*p-Nitrobenzoyl* : plates. M.p. 137°. Spar. sol. cold EtOH. Insol. H<sub>2</sub>O.

*Phenylurethane* : m.p. 138°.

*Me ether* :  $C_{11}H_{20}O$  MW, 168. B.p. 193-5°, 97-100°/38 mm.  $D_4^{20} 0.9162$ .  $n_D^{23} 1.46237$ .

*Et ether* :  $C_{12}H_{22}O$  MW, 182. B.p. 204-5°, 97°/20 mm.  $D_4^{20} 0.9008$ .  $n_D^{25} 1.45554$ .

*l.*

Hexagonal plates. M.p. 204° (208-9°). B.p. 210°/779 mm. Sublimes.  $[\alpha]_D^{25} - 37.74^\circ$  in EtOH. Heat of comb.  $C_6$  1472.5 Cal.

*Formyl*: b.p. 215°, 97°/15 mm.  $D_4^{20}$  1.0058.  $[\alpha]_D^{20} - 40.46^\circ$ ,  $[\alpha]_D$  liq. -47.24°.

*Acetyl*: m.p. 29°. B.p. 223-4° (225-6°).  $D_4^{20}$  (liq.) 0.9855.  $n_D^{15}$  1.46635.  $[\alpha]_D^{15}$  liq. -44.45°.

*Oxalate*: m.p. 108°.  $[\alpha]_D - 45.2^\circ$  in  $C_6H_6$ , -51.6° in EtOH.

*Acid succinate*: m.p. 60°.  $[\alpha]_D - 35.2^\circ$  in EtOH.

*Benzoyl*: m.p. 25.5°.  $[\alpha]_D - 44.2^\circ$ .

*p-Nitrobenzoyl*: m.p. 136°.  $[\alpha]_D - 33.1^\circ$  in  $C_6H_6$ .

*dl.*

M.p. 210.5°.

Fujita, *Chem. Abstracts*, 1928, 22, 3406.

Schwyzer, *Pharm. Ztg.*, 1930, 75, 1275.

Saisei Syōnō K.K., Jap. P., 100,798,

(*Chem. Abstracts*, 1934, 28, 3745).

Hercules Powder Co., U.S.P., 1,961,398,

(*Chem. Abstracts*, 1934, 28, 4746).

Schering-Kahlbaum A.-G., D.R.P.,

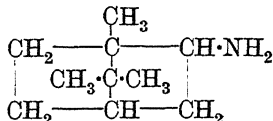
582,043, (*Chem. Abstracts*, 1933, 27,

5086).

Hüchel, Kaluba, *Ann.*, 1942, 550, 269.

**Bornesite.**

See under Inositol.

**Bornylamine (Aminocamphane)** $C_{10}H_{19}N$ 

MW, 153

*d.*

M.p. 163°. Sublimes. Sol. most ord. org. solvents. Insol.  $H_2O$ .  $[\alpha]_D^{20} + 47.2^\circ$  in EtOH.

*B,HCl*: needles from  $H_2O$  or EtOH.  $[\alpha]_D + 23.3^\circ$  in EtOH.

*B,HNO<sub>3</sub>*: m.p. 240° decomp.

*N-Formyl*: m.p. 93°.  $[\alpha]_D^{20} - 43.17^\circ$  in EtOH.

*N-Acetyl*: white leaflets. M.p. 145°.  $[\alpha]_D - 43.48^\circ$  in EtOH.

*N-Benzoyl*: needles from EtOH. M.p. 138.5°.

*N-o-Nitrobenzoyl*: needles from EtOH.Aq.

M.p. 173°.  $[\alpha]_D^{20} - 22.39^\circ$  in EtOH.

*N-m-Nitrobenzoyl*: needles from EtOH.Aq.

M.p. 161°.  $[\alpha]_D^{20} - 27.91^\circ$  in EtOH.

*N-p-Nitrobenzoyl*: needles from EtOH.Aq.

M.p. 167°.  $[\alpha]_D^{20} - 16.56^\circ$  in EtOH.

*Picrate*: m.p. 257° decomp.

*l.*

M.p. 163°. B.p. 200-1°.  $[\alpha]_D^{20} - 50.8^\circ$  in EtOH.

*B,HCl*: m.p. 358°.  $[\alpha]_D^{15} - 23.5^\circ$  in EtOH.  $[\alpha]_D^{16} - 22.3^\circ$  in  $H_2O$ .

*B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>*:  $[\alpha]_D^{15} - 14.8^\circ$  in  $H_2O$ .

*B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>*:  $[\alpha]_D^{15} - 20.4^\circ$  in  $H_2O$ .

*B,HNO<sub>3</sub>*: decomp. at 202°.  $[\alpha]_D^{15} - 21.5^\circ$  in EtOH.

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: darkens at 270°.

*Picrate*: decomp. at 256°.

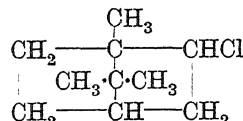
Goodson, *J. Chem. Soc.*, 1927, 930.

Frankland, Barrow, *J. Chem. Soc.*, 1909, 95, 2024.

Ingersoll, Brown, Kim, Beauchamp, Jennings, *J. Am. Chem. Soc.*, 1936, 58, 1810.

Krestinsky, Bardyshev, *J. Gen. Chem.*, U.S.S.R., 1940, 10, 1894.

**Bornyl chloride (Chlorocamphane, "pinene hydrochloride," artificial camphor)**

 $C_{10}H_{17}Cl$ 

MW, 172.5

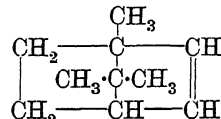
Leaflets. Odour very similar to camphor.

M.p. 132°. B.p. 207°. Sublimes. Sol. EtOH, Et<sub>2</sub>O. Insol.  $H_2O$ .  $[\alpha]_D^{15} + 30.96^\circ$  in EtOH.

Frankforter, Frary, *J. Am. Chem. Soc.*, 1906, 28, 1461.

Rostovskii, Sheremeteva, *Chem. Abstracts*, 1936, 30, 1372.

**Bornylene (1:7:7-Trimethylbicyclo-[1:2:2]-heptene-2)**

 $C_{10}H_{16}$ 

MW, 136

*l.*

M.p. 113°. B.p. 146°/750 mm. Sublimes.  $[\alpha]_D^{20} - 22.27^\circ$  in  $C_6H_6$ .  $KMnO_4$  in  $C_6H_6 \rightarrow$

*d*-camphoric acid.

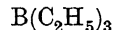
*d.*

Cryst. from EtOH. M.p. 109-10°. B.p. 146°.  $[\alpha]_D + 30.5^\circ$  in toluene.  $KMnO_4$ .Aq.  $\rightarrow$  *l*-camphoric acid.

Meerwein, Joussen, *Ber.*, 1922, 55, 2529.

Henderson, Caw, *J. Chem. Soc.*, 1912, 101, 1416.

Tschugaëff, Budrick, *Ann.*, 1912, 388, 288.

**Boron triethyl** $C_6H_{15}B$ 

MW, 98

Fuming liq. B.p. 95°.  $D_4^{23}$  0.6961.

Stock, Zeidler, *Ber.*, 1921, 54, 531.

**Boron trimethyl** $C_3H_9B$ 

MW, 56

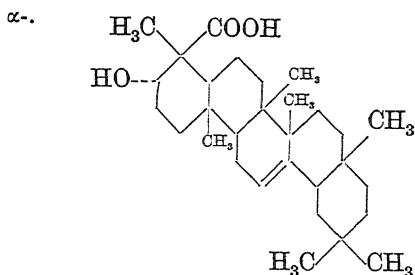
Gas at ord. temps. Forms add. comp. with  $INH_3$ , m.p. 56°, b.p. 110°.

Stock, Zeidler, *Ber.*, 1921, 54, 531.

**Boswellic Acid** $C_{30}H_{48}O_3$ 

MW, 456

Two isomeric hydroxytriterpene acids, isolated from frankincense (*Olibanum*), in which the  $\beta$ -acid predominates.

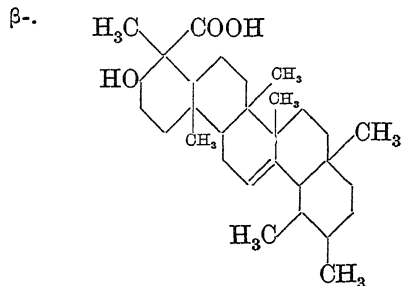


Hexagonal plates from MeOH. M.p. 289° corr.  $[\alpha]_D^{19} + 114.5^\circ$  in  $\text{CHCl}_3$ .

*Me ester*:  $\text{C}_{31}\text{H}_{50}\text{O}_3$ . MW, 470. Plates from MeOH-Et<sub>2</sub>O. M.p. 214–15° corr.  $[\alpha]_D^{19} + 115.4^\circ$  in  $\text{CHCl}_3$ . *Acetyl*: m.p. 229–30° corr.  $[\alpha]_D^{19} + 68^\circ$  in  $\text{CHCl}_3$ .

*Formyl*: needles from EtOH. M.p. 254–7° corr.  $[\alpha]_D^{20} + 65.5^\circ$  in  $\text{CHCl}_3$ .

*Acetyl*: prisms from  $\text{CHCl}_3$ . M.p. 241–3° corr.  $[\alpha]_D^{19} + 65.3^\circ$  in  $\text{CHCl}_3$ . *Chloride*: cryst. from hexane. M.p. 195–6° corr.



Suggested formula

Prisms from MeOH. M.p. 238–40° corr.  $[\alpha]_D + 237^\circ$  in  $\text{CHCl}_3$ . Contains unreactive double bond but gives colours with  $\text{C}(\text{NO}_2)_4$  and Liebermann-Burchard reagent. Replacement of  $-\text{COOH}$  by  $-\text{CH}_3 \rightarrow \alpha$ -amyrin.

*Me ester*: prisms from  $\text{CHCl}_3$ -MeOH. M.p. 195° corr.  $[\alpha]_D^{14} + 161^\circ$  in  $\text{CHCl}_3$ . *Acetyl*: m.p. 197–198.5° corr.  $[\alpha]_D^{19} + 73.8^\circ$  in  $\text{CHCl}_3$ .

*Formyl*: needles from EtOH. M.p. 272–5° decomp. corr.  $[\alpha]_D^{20} + 91.6^\circ$  in  $\text{CHCl}_3$ .

*Acetyl*: cryst. from MeOH. M.p. 273–5°.  $[\alpha]_D^{19} + 68.9^\circ$  in  $\text{CHCl}_3$ . *Chloride*: m.p. 193°.

Winterstein, Stein, *Z. physiol. Chem.*, 1932, 208, 9.

Trost, *Chem. Zentr.*, 1937, II, 3759.

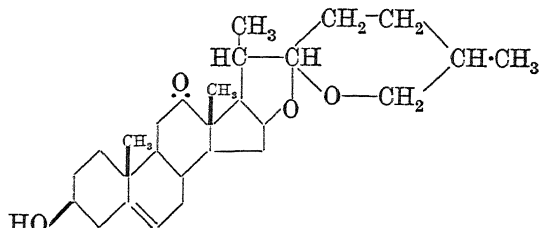
Simpson, Williams, *J. Chem. Soc.*, 1938, 686, 1712.

Ruzicka, Wirz, *Helv. Chim. Acta*, 1939, 22, 948; 1940, 23, 132; 1941, 24, 248.

Huzii, Osumi, *J. Pharm. Soc. Japan*, 1940, 60, 291.

Jeger, *Über die Konstitution der Triterpene, Fortschritte der Chemie Organischer Naturstoffe*, Vol. 7, 1950, p. 1.

### Botogenin (12-Ketodiosgenin)



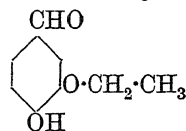
$\text{C}_{27}\text{H}_{40}\text{O}_4$  MW, 428

Sapogenin of *Dioscorea mexicana*. Cryst. from EtOH. M.p. 262°.

*Acetyl*: cryst. from MeOH. M.p. 248°.

Marker *et al.*, *J. Am. Chem. Soc.*, 1947, 69, 2167.

**Bourbonal** (4-Hydroxy-3-ethoxybenzaldehyde, vanillal, protocatechuic aldehyde 3-ethyl ether)



$\text{C}_9\text{H}_{10}\text{O}_3$  MW, 166

M.p. 76–8° from EtOH. Strong vanilla-like flavour.

4-*Acetyl*: m.p. 48–9°.

4-*Benzyl*: m.p. 57°.

*Semicarbazone*: m.p. 175°.

*Phenylhydrazone*: m.p. 124–6°. Insol. org. solvents.

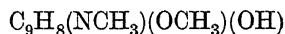
2-*Nitro-4-cyanophenylhydrazone*: m.p. 308°.

Kloty, *Am. J. Pharm.*, 1930, 102, 274.

Shorygin, Bogacheva, *Chem. Abstracts*, 1942, 36, 3627.

Yakhilevich, *Chem. Abstracts*, 1942, 36, 3628.

### Bractamine



$\text{C}_{11}\text{H}_{15}\text{O}_2\text{N}$  MW, 193

Alkaloid of *Papaver bracteatum*. Cryst. from EtOH. M.p. 216°. Optically inactive. Sol.  $\text{CHCl}_3$ , 10% NaOH. Spar. sol. hot EtOH, Et<sub>2</sub>O. Insol. cold Py, xylene, H<sub>2</sub>O.  $\text{FeCl}_3 \rightarrow$  green col.

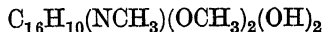
*B,HCl*: cryst. from EtOH-Et<sub>2</sub>O. M.p. 143°.

*Picrate*: m.p. 184–5°.

*Methiodide*: cryst. from EtOH. M.p. 220–1°.

Kisenev, Konovalova, *J. Gen. Chem. U.S.S.R.*, 1948, 18, 142, (*Chem. Abstracts*, 1948, 42, 5037).

### Bracteine



$\text{C}_{19}\text{H}_{21}\text{O}_4\text{N}$  MW, 327

Alkaloid of *Papaver bracteatum*. Cryst. from Et<sub>2</sub>O. M.p. 230° decomp.  $[\alpha]_D^{20} + 120^\circ$  in

EtOH. Sol. EtOH, CHCl<sub>3</sub>. Spar. sol. Et<sub>2</sub>O. Insol. H<sub>2</sub>O. FeCl<sub>3</sub> → green col.

*B.HCl*: m.p. 258°.

*B.HClO<sub>4</sub>*: m.p. 231-2°.

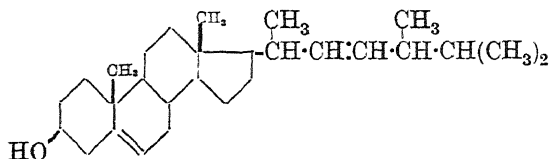
*Methiodide*: m.p. 205-15°.

Kisener, Konovalova, *J. Gen. Chem. U.S.S.R.*, 1948, 18, 142, (*Chem. Abstracts*, 1948, 42, 5037).

**Brasilic Acid.**

See Brazilic Acid.

**Brassicasterol (7 : 8-Dihydroergosterol)**



C<sub>28</sub>H<sub>46</sub>O MW, 398

Phytosterol from unrefined rapeseed oil. Plates + 1H<sub>2</sub>O from EtOH. M.p. 148°. [α]<sub>D</sub><sup>18</sup> -64.4° in CHCl<sub>3</sub>. Ppt. with digitonin. Red. → ergostanol.

*Acetyl*: plates from EtOH. M.p. 157-8°. [α]<sub>D</sub><sup>22</sup> -65° in CHCl<sub>3</sub>. *Tetrabromide*: plates from CHCl<sub>3</sub>-EtOH. M.p. 209° decomp.

*Propionyl*: plates from EtOH. M.p. 132°. *Tetrabromide*: plates from CHCl<sub>3</sub>-EtOH. M.p. 206° decomp.

*Benzoyl*: needles from EtOH. M.p. 167°. *3 : 5-Dinitrobenzoyl*: plates from EtOH-C<sub>6</sub>H<sub>6</sub>. M.p. 219°. [α]<sub>D</sub><sup>25</sup> -28° in CHCl<sub>3</sub>.

*Toluene-p-sulphonyl*: m.p. 139.5-40.5°. [α]<sub>D</sub><sup>24</sup> -61.6° in CHCl<sub>3</sub>.

Fernholz, Stavely, *J. Am. Chem. Soc.*, 1939, 61, 142; 1940, 62, 428.

Windaus, Welsch, *Ber.*, 1909, 42, 612.

**Brassicidic Acid (Brassic acid, Δ<sup>12</sup>-docosenoic acid, trans-erucic acid, isoerucic acid)**



C<sub>22</sub>H<sub>42</sub>O<sub>2</sub> MW, 338

Present in rape-seed oil. Plates from EtOH. M.p. 61.5°. B.p. 282°/30 mm., 256°/10 mm. Spar. sol. cold EtOH. D<sub>4</sub><sup>27</sup> 0.8585. n<sub>D</sub><sup>100</sup> 1.4347. Heat of comb. C<sub>p</sub> 3290.1 Cal., C<sub>v</sub> 3284.6 Cal. k = 3.25 × 10<sup>-7</sup> at 18.1°.

*Na salt*: leaflets. M.p. 245-8°.

*Me ester*: C<sub>23</sub>H<sub>44</sub>O<sub>2</sub>. MW, 352. M.p. 34-5°.

*Et ester*: C<sub>24</sub>H<sub>46</sub>O<sub>2</sub>. MW, 366. Leaflets. M.p. 30.5°. B.p. above 360°. n<sub>D</sub><sup>25</sup> 1.4587.

*Phenyl ester*: C<sub>28</sub>H<sub>46</sub>O<sub>2</sub>. MW, 414. M.p. 44°. B.p. 285°/12 mm.

*Chloride*: C<sub>22</sub>H<sub>41</sub>OCl. MW, 356.5. M.p. 14°.

*Amide*: C<sub>22</sub>H<sub>43</sub>ON. MW, 337. M.p. 94°.

*Nitrile*: C<sub>22</sub>H<sub>41</sub>N. MW, 319. M.p. 22°. B.p. 257°/17 mm.

*Anhydride*: needles. M.p. 64°. D<sub>4</sub><sup>70</sup> 0.835.

*Phenylhydrazide*: m.p. 98°.

Mascarelli, *Atti accad. Lincei*, 1917, 26, I, 71, (*Chem. Abstracts*, 1918, 12, 362).

Holde, Zadek, *Ber.*, 1923, 56, 2052.

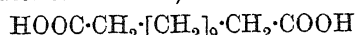
Gonzalés, *Anales soc. españ. fis. quim.* 1926, 24, 156.

Reimer, Will, *Ber.*, 1886, 19, 3321.

Rankoff, *J. prakt. Chem.*, 1931, 131, 293.

Keffler, Maiden, *Bull. soc. chim. Belg.*, 1935, 44, 467.

**Brassylic Acid (Undecane-1 : 11-dicarboxylic acid, tridecanedioic acid)**



C<sub>13</sub>H<sub>24</sub>O<sub>4</sub> MW, 244

Needles from EtOH.Aq. or AcOEt. M.p. 114°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Spar. sol. H<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Me ester*: C<sub>14</sub>H<sub>26</sub>O<sub>4</sub>. MW, 258. M.p. 58°.

*Di-Me ester*: C<sub>15</sub>H<sub>28</sub>O<sub>4</sub>. MW, 272. Plates. M.p. 36°. B.p. 326-8°, 194°/11 mm.

*Di-Et ester*: C<sub>17</sub>H<sub>32</sub>O<sub>4</sub>. MW, 300. M.p. 20°. B.p. 204°/12 mm.

*Et ester-chloride*: C<sub>15</sub>H<sub>27</sub>O<sub>3</sub>Cl. MW, 290.5. B.p. 185-8°/5 mm.

*Et ester-amide*: C<sub>15</sub>H<sub>29</sub>O<sub>3</sub>N. MW, 271. M.p. 91-2°.

*Diamide*: C<sub>13</sub>H<sub>26</sub>O<sub>2</sub>N<sub>2</sub>. MW, 242. Needles. M.p. 177°. Sol. EtOH. Insol. H<sub>2</sub>O.

*Di-nitrile*: C<sub>13</sub>H<sub>22</sub>N<sub>2</sub>. MW, 206. B.p. 210-215°/16 mm

*Monoanilide*: m.p. 118.5-9.5°.

*Di-anilide*: m.p. 160-1°.

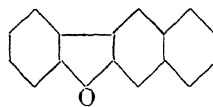
*Di-p-bromoanilide*: m.p. 202°.

*Di-o-toluidide*: m.p. 142°.

*Di-p-toluidide*: m.p. 156°.

Holde, Zadek, *Ber.*, 1923, 56, 2052.

**Brazan (Phenylene-2 : 3-naphthylene oxide)**



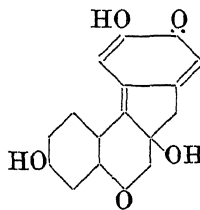
C<sub>16</sub>H<sub>10</sub>O MW, 218

Leaflets. M.p. 202°. Cryst from EtOH. EtOH sol. shows greenish-blue fluor.

Sabatier, Mailhe, *Compt. rend.*, 1912, 155, 260.

Winterstein, Schön, *Z. physiol. Chem.*, 1934, 230, 166.

**Brazilein**



C<sub>16</sub>H<sub>12</sub>O<sub>5</sub> MW, 284



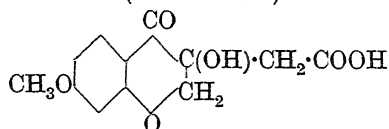
Oxidation product of brazilin. Reddish-brown needles with grey metallic sheen. Sol. MeOH, EtOH, CHCl<sub>3</sub>, AcOH, C<sub>6</sub>H<sub>6</sub>. Spar. sol. Et<sub>2</sub>O.

*Tri-Me ether*: amber prisms from EtOH. M.p. 177–8°.

Engels, Perkin, Robinson, *J. Chem. Soc.*, 1908, 1115.

Micovic, Robinson, *J. Chem. Soc.*, 1937, 43.

### Brazilic Acid (*Brasilic acid*)



C<sub>12</sub>H<sub>12</sub>O<sub>6</sub> MW, 252

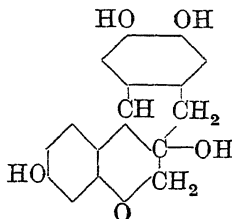
Needles from H<sub>2</sub>O or C<sub>6</sub>H<sub>6</sub>. M.p. 129–30°. Very sol. EtOH, Et<sub>2</sub>O, AcOH, hot C<sub>6</sub>H<sub>6</sub>. Sol. CHCl<sub>3</sub>. Spar. sol. pet. ether.

*Semicarbazone*: cryst. Decomp. above 160°.

Perkin, *J. Chem. Soc.*, 1902, 81, 226.

Pfeiffer, Heinrich, *J. prakt. Chem.*, 1940, 156, 241.

### Brazilin



C<sub>16</sub>H<sub>14</sub>O<sub>5</sub> MW, 286

In Brazilwood. White or pale yellow cryst. from EtOH. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Sol. aq. alkalis to deep carmine-red sols.

*Triacetyl deriv*: needles. M.p. 105–6°.

*Tetra-acetyl deriv*: needles. M.p. 149–51°.

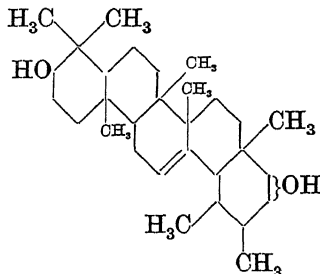
*Tri-Me ether*: C<sub>19</sub>H<sub>20</sub>O<sub>5</sub>. MW, 328. Prisms. M.p. 139–40°. In conc. H<sub>2</sub>SO<sub>4</sub> reddish-yellow sol. with green fluor. *Acetyl*: m.p. 174–6°.

*Tetra-Me ether*: C<sub>20</sub>H<sub>22</sub>O<sub>5</sub>. MW, 342. Leaflets. M.p. 137–9°.

Perkin, Rây, Robinson, *J. Chem. Soc.*, 1928, 1504.

Pfeiffer, Quehl, Tappermann, *Ber.*, 1930, 63, 1301.

### Brein



Suggested structure

C<sub>30</sub>H<sub>50</sub>O<sub>2</sub>

MW, 442

Minor triterpene constituent of *Manila elemi* resin. Prisms from EtOH.Aq., needles from MeOH.Aq. M.p. 221–2°. [ $\alpha$ ]<sub>D</sub><sup>20</sup> + 63.5° in CHCl<sub>3</sub>. ([ $\alpha$ ]<sub>D</sub><sup>25</sup> + 143.4°). C(NO<sub>2</sub>)<sub>4</sub> → yellow col. Liebermann–Burchard → reddish-brown col.

*Diformyl deriv*: prisms from Me<sub>2</sub>CO.Aq. M.p. 220–1°. [ $\alpha$ ]<sub>D</sub><sup>21</sup> + 67° in CHCl<sub>3</sub>.

*Monoacetyl*: cryst. from Et<sub>2</sub>O–light petroleum. M.p. 208.5–209°.

*Diacetyl deriv*: prisms from EtOH.Aq. M.p. 197–8°. [ $\alpha$ ]<sub>D</sub><sup>17</sup> + 70° in CHCl<sub>3</sub>. ([ $\alpha$ ]<sub>D</sub><sup>23</sup> + 215.0°).

*Dibenzoyl deriv*: cryst. from EtOH or Me<sub>2</sub>CO.Aq., m.p. 175–7°. Rosettes of needles from ligroin, m.p. 209–10°. [ $\alpha$ ]<sub>D</sub><sup>17</sup> + 58° in CHCl<sub>3</sub>.

Morice, Simpson, *J. Chem. Soc.*, 1940, 798; 1942, 198.

Lieb, Mladenovic, Hoffmann, *Monatsh.*, 1940, 73, 219.

Büchi, Jeger, Ruzicka, *Helv. Chim. Acta*, 1946, 29, 442.

### British Anti-Lewisite.

*See* 1: 2-Dithioglycerol.

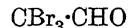
### Bromacetal.

*See under* Bromoacetaldehyde.

### Bromacetol.

*See* 2: 2-Dibromopropane.

### Bromal (*Tribromoacetaldehyde*)



C<sub>2</sub>HOBBr<sub>3</sub> MW, 281

B.p. 174°, 78°/26 mm., 61°/9 mm. D<sub>4</sub><sup>25</sup> 2.6650. Hot alkalis → bromoform + formic acid.

*Hydrate*: bromal hydrate. CBr<sub>3</sub>CH(OH)<sub>2</sub>. C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>Br<sub>3</sub>. MW, 299. Colourless monoclinic prisms + 1H<sub>2</sub>O. M.p. 53.5°.

*Diacetyl*: tribromoethylidene diacetate. CBr<sub>3</sub>CH(OOC-CH<sub>3</sub>)<sub>2</sub>. M.p. 77–8°.

*Di-Et acetal*: diethoxytribromoethane. CBr<sub>3</sub>CH(OC<sub>2</sub>H<sub>5</sub>)<sub>2</sub>. B.p. 138–41°/22–3 mm.

Schäffer, *Ber.*, 1871, 4, 366.

Gaathaug, B.P. 430,608, (*Chem. Abstracts*, 1935, 29, 8003).

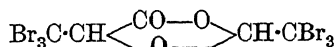
Cristol, Haller, *J. Am. Chem. Soc.*, 1946, 68, 140.

Balaban, B.P. 586,864, (*Chem. Abstracts*, 1947, 41, 6664).

### Bromal Hydrate.

*See under* Bromal.

### Bromalide

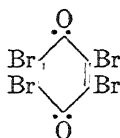


C<sub>5</sub>H<sub>2</sub>O<sub>3</sub>Br<sub>6</sub> MW, 590

M.p. 158°. Sol. Et<sub>2</sub>O. Insol. H<sub>2</sub>O. Decomp. by EtOH.

Wallach, *Ann.*, 1878, 193, 52.

**Bromanil** (*Tetrabromo-p-benzoquinone, tetrabromoquinone*)

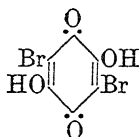


$C_6O_2Br_4$  MW, 424

Golden-yellow cryst. M.p. 300°. Mod. sol. hot EtOH. Spar. sol. cold Et<sub>2</sub>O. Insol. H<sub>2</sub>O. Sublimes.

Kempf, Moehrke, *Ber.*, 1914, 47, 2615.  
Graebe, Weltner, *Ann.*, 1891, 263, 33.  
Holliday, B.P., 274,700, (*Chem. Abstracts*, 1929, 23, 2990).  
Hodgson, Foster, *J. Chem. Soc.*, 1942, 583.

**Bromanilic Acid** (3 : 6-Dibromo-2 : 5-dihydroxy-p-benzoquinone)



$C_6H_2O_4Br_2$  MW, 298

Dark red needles or bronzy leaflets. Sublimes. Sol. H<sub>2</sub>O, EtOH to purple sol. Yellow sol. in Et<sub>2</sub>O.

*Na salts*: NaC<sub>6</sub>H<sub>3</sub>O<sub>4</sub>Br<sub>2</sub>, 5H<sub>2</sub>O. Lustrous black prisms, sol. H<sub>2</sub>O. Na<sub>2</sub>C<sub>6</sub>H<sub>3</sub>O<sub>4</sub>Br<sub>2</sub>, 4H<sub>2</sub>O. Lustrous black prisms. 100 parts H<sub>2</sub>O at 21° dissolve 2.95 parts anhyd. salt.

*Diacetyl*: yellow plates from CCl<sub>4</sub>. M.p. 205°.

*Dibenzyl ether*: orange-red plates. M.p. 146°.

*Di-m-tolyl ether*: reddish needles from C<sub>6</sub>H<sub>5</sub>-ligroin. M.p. 193°.

*Di-p-tolyl ether*: needles from toluene. M.p. 262-3° decomp. (rapid heat.).

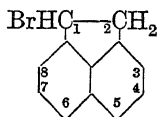
Graebe, Weltner, *Ann.*, 1891, 263, 31.

Jackson, Bolton, *J. Am. Chem. Soc.*, 1914, 36, 1478.

### Brometone.

See Tribromo-*tert.*-butyl Alcohol.

### 1-Bromoacenaphthene



$C_{12}H_9Br$  MW, 233

Yellowish leaflets. M.p. 70.5-71.5°. Unstable.

Backmann, Sheehan, *J. Am. Chem. Soc.*, 1941, 63, 204.

### 3-Bromoacenaphthene.

Needles from MeOH. M.p. 78°.

Morgan, Harrison, *J. Soc. Chem. Ind.*, 1930, 49, 417r.

### 5-Bromoacenaphthene.

Plates. M.p. 52°. B.p. 335-6°. CrO<sub>3</sub> + H<sub>2</sub>SO<sub>4</sub> → 4-bromonaphthalic anhydride.

*Picrate*: needles. M.p. 114°. Spar. sol. cold EtOH.

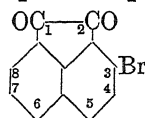
Crompton, Walker, *J. Chem. Soc.*, 1912, 101, 958.

Sachs, Mosebach, *Ber.*, 1910, 43, 2475.

Maxim, *Bull. soc. chim.*, 1932, 51, 1149.

Buu-Hoi, *Ann.*, 1944, 556, 1.

### 3-Bromoacenaphthenequinone



$C_{12}H_5O_2Br$  MW, 261

Yellow needles from AcOH. M.p. 238°.

*Monophenylhydrazone*: vermilion needles from AcOH. M.p. 180°.

Guha, *J. Chem. Soc.*, 1931, 583.

### 4-Bromoacenaphthenequinone.

Yellow needles from AcOH. M.p. 194° (237°). Spar. sol. AcOH.

Graebe, Guinsbourg, *Ann.*, 1903, 327, 87.

De Fazi, *Gazz. chim. ital.*, 1923, 53, 499.

### 5-Bromoacenaphthenequinone.

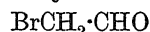
Cryst. from AcOH. M.p. 238°.

*Monoxime*: m.p. 213-14.5°.

*Quinoxaline deriv.*: m.p. 303°.

Rule, Thompson, *J. Chem. Soc.*, 1937, 1761.

### Bromoacetaldehyde



$C_2H_3OBr$  MW, 123

B.p. 107-12° (104-5°). Reduces Fehling's.

*Di-Me acetal*: C<sub>4</sub>H<sub>9</sub>O<sub>2</sub>Br. MW, 169. B.p. 145°, 58-9°/25 mm., 49.5-50.5°/15 mm. D<sub>4</sub><sup>18</sup> 1.5049 (D<sub>4</sub><sup>20</sup> 1.430). n<sub>D</sub><sup>19</sup> 1.4758 (n<sub>D</sub><sup>20</sup> 1.4450).

*Di-Et acetal*: bromoacetal. C<sub>6</sub>H<sub>13</sub>O<sub>2</sub>Br. MW, 197. B.p. 170° decomp., 57-8°/9 mm., 48-9°/3 mm. D<sub>4</sub><sup>20</sup> 1.280. n<sub>D</sub><sup>20</sup> 1.4418.

*Dipropyl acetal*: C<sub>8</sub>H<sub>17</sub>O<sub>2</sub>Br. MW, 225. B.p. 94-5°/19 mm. D<sub>20</sub><sup>20</sup> 1.199. n<sub>D</sub><sup>25</sup> 1.4406.

*Dibutyl acetal*: C<sub>10</sub>H<sub>21</sub>O<sub>2</sub>Br. MW, 253. B.p. 86-5°/1 mm. D<sub>4</sub><sup>20</sup> 1.1511. n<sub>D</sub><sup>20</sup> 1.4477.

*Di-isobutyl acetal*: C<sub>10</sub>H<sub>21</sub>O<sub>2</sub>Br. MW, 253. B.p. 109-110°/19 mm. D<sub>20</sub><sup>20</sup> 1.129. n<sub>D</sub><sup>25</sup> 1.4390.

*Di-isoamyl acetal*: C<sub>12</sub>H<sub>25</sub>O<sub>2</sub>Br. MW, 281. B.p. 137-9°/20 mm. D<sub>20</sub><sup>20</sup> 1.102. n<sub>D</sub><sup>25</sup> 1.440.

*Di-phenyl acetal*: C<sub>14</sub>H<sub>13</sub>O<sub>2</sub>Br. MW, 293. B.p. 150-7°/0.2 mm. D<sub>4</sub><sup>20</sup> 1.1544. n<sub>D</sub><sup>20</sup> 1.5795.

*Semicarbazone*: m.p. 128° (130°) decomp.

2:4-Dinitrophenylhydrazone: orange. M.p. 150°.

Hartung, Adkins, *J. Am. Chem. Soc.*, 1927, 49, 2517.

Tschitschibabin, Schtschukina, *Ber.*, 1929, 62, 1075.

Stepanow, Preobraschensky, Schtschukina, *Ber.*, 1925, 58, 1718.

Hibbert, Hill, *J. Am. Chem. Soc.*, 1923, 45, 743.

Rotbart, *Ann. chim.*, 1934, 1, 505.

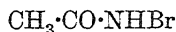
McElvain *et al.*, *J. Am. Chem. Soc.*, 1942, 64, 1059; 1945, 67, 650.

Bedoukian, *J. Am. Chem. Soc.*, 1944, 66, 651.

Jacobs, Cramer, Hanson, *J. Am. Chem. Soc.*, 1942, 64, 223.

Wizinger, Al-Attar, *Helv. Chim. Acta*, 1947, 30, 189.

### N-Bromoacetamide (Acetobromoamide)



$\text{C}_2\text{H}_4\text{ONBr}$  MW, 138

Large plates +  $\text{H}_2\text{O}$ . M.p. anhyd. 108°. Sol. hot  $\text{H}_2\text{O}$ ,  $\text{Et}_2\text{O}$ . Decomp. by boiling  $\text{H}_2\text{O}$ .

Wohl, *Ber.*, 1919, 52, 51.

Behrend, Schreiber, *Ann.*, 1901, 318, 373.

Likhosherstov, Alekseev, *Chem. Abstracts*, 1934, 28, 3054.

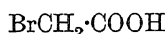
### Bromoacetamide.

See also under Bromoacetic Acid.

### Bromoacetanilide.

See under Bromoaniline.

### Bromoacetic Acid



$\text{C}_2\text{H}_3\text{O}_2\text{Br}$  MW, 139

M.p. 50°. B.p. 208°, 168°/250 mm., 118°/15 mm. Sol.  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ .  $k = 1.38 \times 10^{-3}$  at 25°.

Me ester:  $\text{C}_3\text{H}_5\text{O}_2\text{Br}$ . MW, 153. B.p. 144° decomp.

Et ester:  $\text{C}_4\text{H}_7\text{O}_2\text{Br}$ . MW, 167. B.p. 168-9°. Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ .  $D_{20}^{20}$  1.5059.  $n_D^{15}$  1.45420.

Propyl ester:  $\text{C}_5\text{H}_9\text{O}_2\text{Br}$ . MW, 181. B.p. 178°.  $D_4^{15}$  1.4166.

Isopropyl ester: b.p. 165.5°/769 mm.  $D_4^{15}$  1.3989.

Butyl ester:  $\text{C}_6\text{H}_{11}\text{O}_2\text{Br}$ . MW, 195. B.p. 78°/10 mm.

Isobutyl ester: b.p. 188°/752 mm., 74.5°/10 mm.  $D_4^{15}$  1.3327.

tert.-Butyl ester: b.p. 62-3°/14 mm., 50°/14 mm.

Allyl ester:  $\text{C}_5\text{H}_7\text{O}_2\text{Br}$ . MW, 179. B.p. 73°/10 mm.

Phenyl ester:  $\text{C}_8\text{H}_7\text{O}_2\text{Br}$ . MW, 215. M.p. 32°. B.p. 140°/20 mm.

Anhydride:  $\text{C}_4\text{H}_4\text{O}_3\text{Br}_2$ . MW, 260. M.p. 41-2°. B.p. 230-2° decomp., 133-5°/12.5 mm., 121-5°/11 mm. Insol. ligroin.

Chloride:  $\text{C}_2\text{H}_5\text{OClBr}$ . MW, 157.5. B.p. 133-5°.  $D_4^{15}$  1.908.

Bromide:  $\text{C}_2\text{H}_5\text{OBr}_2$ . MW, 202. B.p. 150°.  $D_0^{15}$  2.425.

Amide: bromoacetamide.  $\text{C}_2\text{H}_4\text{ONBr}$ . MW, 138. M.p. 91°. Sol.  $\text{H}_2\text{O}$ . Mod. sol.  $\text{EtOH}$ . Insol.  $\text{Et}_2\text{O}$ .

Nitrile: bromoacetonitrile.  $\text{C}_2\text{H}_3\text{NBr}$ . MW, 120. Yellow oil. B.p. 150-1°, 46°/13 mm. Sol.  $\text{Et}_2\text{O}$ .

Ward, *J. Chem. Soc.*, 1922, 121, 1161.

Auwers, Bernhardt, *Ber.*, 1891, 24, 2219.

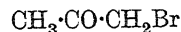
Steinkopf, *Ber.*, 1908, 41, 2542; 1912, 45, 3137.

Natelson, Gottfried, *J. Am. Chem. Soc.*, 1939, 61, 970; *Organic Syntheses*, 1943, XXIII, 37.

### Bromoacetonaphthalide.

See under Bromonaphthylamine.

### Bromoacetone



$\text{C}_3\text{H}_5\text{OBr}$  MW, 137

Liq. Powerful lachrymator. Rapidly turns violet even in absence of air. B.p. 136.5°/725 mm., 31.5°/8 mm. Sol.  $\text{EtOH}$ ,  $\text{Me}_2\text{CO}$ . Spar. sol.  $\text{H}_2\text{O}$ .  $D^{23}$  1.634. Forms add. comps. with  $\text{NaHSO}_3$  and  $\text{NH}_3$ .

Oxime: needles. M.p. 36.5°. B.p. 83°/8 mm.

Semicarbazone: cryst. from  $\text{C}_6\text{H}_6$ . M.p. 135° decomp. Unstable.

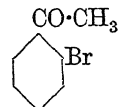
Brendler, Tafel, *Ber.*, 1898, 31, 2683

Levene, *Organic Syntheses*, 1930, X, 12.

### Bromoacetonitrile.

See under Bromoacetic Acid.

### o-Bromoacetophenone (Methyl o-bromo-phenyl ketone)



$\text{C}_8\text{H}_7\text{OBr}$  MW, 199

Pale yellow liq. B.p. 112°/10 mm.

Semicarbazone: prisms from  $\text{EtOH}$ . M.p. 177°.

Elson, Gibson, Johnson, *J. Chem. Soc.*, 1930, 1131.

### m-Bromoacetophenone (Methyl m-bromo-phenyl ketone).

Cryst. M.p. 7-8°. B.p. 131°/16 mm., 127.5°/14 mm.

Semicarbazone: needles from  $\text{EtOH}$ . M.p. 238° (232-3°) decomp.

Elson, Gibson, Johnson, *J. Chem. Soc.*, 1930, 1131.

### p-Bromoacetophenone (Methyl p-bromo-phenyl ketone).

Leaflets. M.p. 51°. B.p. 255.5°/736 mm., 129-30°/11 mm., 117°/7 mm. Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ ,  $\text{AcOH}$ ,  $\text{C}_6\text{H}_6$ , ligroin. Volatile in steam.

Ox.  $\rightarrow$  p-bromobenzoic acid.

*Oxime*: m.p. 128–9°.

*Hydrazone*: m.p. 164°.

*m-Tolylhydrazone*: m.p. 90–1°.

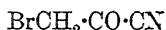
Adams, Noller, *Organic Syntheses*, Collective Vol. I, 103.

 $\omega$ -Bromoacetophenone.

See Phenacyl bromide.

## Bromoacet-toluidide.

See under Bromotoluidine.

Bromoacetyl cyanide (*Bromopyruvic nitrile*)

$\text{C}_3\text{H}_2\text{ONBr}$  MW, 148

Plates. M.p. 77–9°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Insol. H<sub>2</sub>O. Boiling H<sub>2</sub>O  $\rightarrow$  bromoacetic acid.

Hübner, *Ann.*, 1864, 131, 70.

## Bromoacetylene



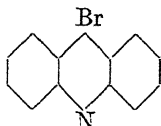
$\text{C}_2\text{HBr}$  MW, 105

Gas. B.p. –2°. Odour resembles that of phosphorus. Mod. sol. H<sub>2</sub>O, dil. HNO<sub>3</sub>. Burns with purple flame. Polymerises in light, forming *sym.*-tribromobenzene, etc. Poisonous.

Nef, *Ann.*, 1897, 298, 357.

Hofmann, Kirmreuther, *Ber.*, 1909, 42, 4235.

**5-Bromoacridine** (*ms-* or *9-Bromoacridine*: see formulæ under Acridine)



$\text{C}_{13}\text{H}_9\text{NBr}$  MW, 258

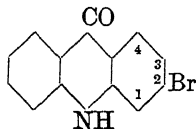
Brownish-yellow needles. M.p. 116°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Hot dil. EtOH  $\rightarrow$  acridone.

*B,HCl*: needles. Decomp. at 238°.

*Picrate*: needles. M.p. 212–13°.

Edinger, Arnold, *J. prakt. Chem.*, 1901, 64, 473.

## 2-Bromoacridone



$\text{C}_{13}\text{H}_8\text{ONBr}$  MW, 274

Pale yellow needles from AcOH. M.p. above 360°. Very spar. sol. EtOH  $\rightarrow$  pale yellow sol. with bluish-violet fluor. Sol. boiling AcOH with pale blue fluor. Prac. insol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, ligroin. Sol. conc. H<sub>2</sub>SO<sub>4</sub> with bluish-green fluor.

Ullmann, *Ann.*, 1907, 355, 341.

## 3-Bromoacridone.

Brownish-yellow needles of very high m.p. Sol. EtOH with violet fluor. Sol. conc. H<sub>2</sub>SO<sub>4</sub> with yellowish-brown col. and blue fluor.

Lehmstedt, *Ber.*, 1932, 65, 839.

## 1-Bromoacrylic Acid



$\text{C}_3\text{H}_3\text{O}_2\text{Br}$  MW, 151

Cryst. from pet. ether. M.p. 71–2°. Sol. H<sub>2</sub>O, EtOH. Turns brown and decomp. on standing. Sublimes. Decomp. on dist.

*NH*<sub>4</sub> salt: leaflets. M.p. 148° decomp.

*Me ester*: C<sub>4</sub>H<sub>5</sub>O<sub>2</sub>Br. MW, 165. B.p. 72.5–4°/78 mm. D<sub>20</sub><sup>20</sup> 1.61. n<sub>D</sub><sup>20</sup> 1.4840.

*Et ester*: C<sub>5</sub>H<sub>7</sub>O<sub>2</sub>Br. MW, 179. B.p. 155–8°, 76–7°/33 mm.

*sec.-Butyl ester*: b.p. 80–2°/23 mm. D<sub>20</sub><sup>20</sup> 1.303. n<sub>D</sub><sup>20</sup> 1.4729. *d.-form*: b.p. 58–60°/8 mm. [α]<sub>D</sub><sup>20</sup> +19.37° in dioxan.

*tert.-Butyl ester*: b.p. 80–2°/23 mm. D<sub>20</sub><sup>20</sup> 1.303. n<sub>D</sub><sup>20</sup> 1.4660.

*Cyclohexyl ester*: b.p. 100–6°/4 mm. n<sub>D</sub><sup>20</sup> 1.4954.

*Phenyl ester*: b.p. 95–6°/2 mm. n<sub>D</sub><sup>20</sup> 1.5480.

Marvel, Dec, Cooke, Cowan, *J. Am. Chem. Soc.*, 1940, 62, 3497.

Lossen, Kowski, *Ann.*, 1905, 342, 135.

Wagner, Tollens, *Ann.*, 1874, 171, 341.

Warren, *J. Am. Chem. Soc.*, 1912, 34, 1085.

Marvel, Cowan, *J. Am. Chem. Soc.*, 1939, 61, 3156.

## 2-Bromoacrylic Acid



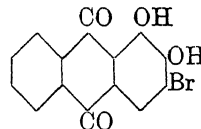
$\text{C}_3\text{H}_3\text{O}_2\text{Br}$  MW, 151

Cryst. from Et<sub>2</sub>O. M.p. 115–16°.

Wallach, *Ann.*, 1878, 193, 56.

Thomas-Mamert, *Compt. rend.*, 1894, 118, 653.

**3-Bromoalizarin** (*3-Bromo-1:2-dihydroxy-anthraquinone*)



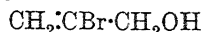
$\text{C}_{14}\text{H}_7\text{O}_4\text{Br}$  MW, 319

Brownish-red needles from toluene. M.p. 260–1°. Sol. aq. alkalis to violet sols. Spar. sol. EtOH, AcOH, C<sub>6</sub>H<sub>6</sub>. Sublimes undecomp.

*Diacetyl deriv*: pale yellow needles. M.p. 204–5°. Mod. sol. C<sub>6</sub>H<sub>6</sub>, AcOH. Spar. sol. EtOH, Et<sub>2</sub>O.

Hardacre, Perkin, *J. Chem. Soc.*, 1929, 180.

Heller, *Ber.*, 1913, 46, 2704.

**Bromoallicinnamic Acid.**See  $\alpha$ - and  $\beta$ -Bromocinnamic Acids.**2-Bromoallyl Alcohol**C<sub>3</sub>H<sub>5</sub>OBr MW, 137B.p. 153–4°/755 mm. D<sup>15</sup> 1.6.*Me ether*: C<sub>4</sub>H<sub>7</sub>OBr. MW, 151. B.p. 115–6°.D<sup>10</sup> 1.35.*Et ether*: C<sub>5</sub>H<sub>9</sub>OBr. MW, 165. B.p. 130–5°.D<sup>12</sup> 1.26.Henry, *Ber.*, 1881, 14, 404.Lespieau, *Ann. chim.*, 1897, 11, 245.**3-Bromoallyl Alcohol**C<sub>3</sub>H<sub>5</sub>OBr MW, 137B.p. 169–70°. D<sup>0</sup> 1.59.*Me ether*: C<sub>4</sub>H<sub>7</sub>OBr. MW, 151. B.p. 127–8°.*Et ether*: C<sub>5</sub>H<sub>9</sub>OBr. MW, 165. B.p. 145–6°.D<sup>0</sup> 1.47.Lespieau, *Ann. chim.*, 1897, 11, 245.**Bromoallyl bromide.**

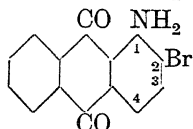
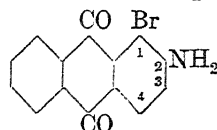
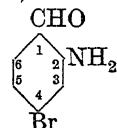
See Dibromopropylene.

**3-Bromoallylene.**

See Propargyl bromide.

**Bromoaminoanisole.**

See Bromoanisidine.

**2-Bromo-1-aminoanthraquinone**C<sub>14</sub>H<sub>8</sub>O<sub>2</sub>NBr MW, 302Orange-red needles. M.p. 182°. Sol. AcOH, toluene. Sol. conc. H<sub>2</sub>SO<sub>4</sub> to yellow sol.; in 40% oleum bluish-violet.*N-Benzoyl*: yellow needles. M.p. 230–2°.*N-Furoyl*: green plates. M.p. 232–3°.Ullmann, Eiser, *Ber.*, 1916, 49, 2154.I.G., B.P., 355,464, (*Chem. Abstracts*, 1932, 26, 5768).Bayer, D.R.P., 236,604, (*Chem. Zentr.*, 1911, II, 318).Mangini, Weger, *Chem. Abstracts*, 1945, 39, 417.**3-Bromo-1-aminoanthraquinone.**Red needles from toluene. M.p. 243°. Sol. PhNO<sub>2</sub>, Py. Insol. most other org. solvents.*N-Acetyl*: m.p. 214°.*N-p-Toluenesulphonyl*: greenish-yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 227°.Ullmann, Eiser, *Ber.*, 1916, 49, 2154.I.G., B.P., 355,464, (*Chem. Abstracts*, 1932, 26, 5768).**4-Bromo-1-aminoanthraquinone.**Red cryst. from AcOH or Py. Sol. org. solvents with yellow col. Insol. H<sub>2</sub>O. 65% oleum → reddish-violet sol.*N-Di-Me*: C<sub>16</sub>H<sub>10</sub>O<sub>2</sub>NBr. MW, 330. Red plates from Py-MeOH. M.p. 178°.Bayer, D.R.P., 144,634, (*Chem. Zentr.*, 1903, II, 750).Badische, D.R.P., 265,727, (*Chem. Zentr.*, 1913, II, 1634).**1-Bromo-2-aminoanthraquinone**C<sub>14</sub>H<sub>8</sub>O<sub>2</sub>NBr MW, 302Orange yellow cryst. Sol. AcOH, Py, PhNO<sub>2</sub>. Insol. H<sub>2</sub>O. Conc. H<sub>2</sub>SO<sub>4</sub> → pale yellow sol.Badische, D.R.P., 266,563, (*Chem. Zentr.*, 1913, II, 1717).**3-Bromo-2-aminoanthraquinone.**Orange-yellow leaflets. M.p. 307° (311°). Cryst. from AcOH. Yellow sol. in conc. H<sub>2</sub>SO<sub>4</sub>.*N-Acetyl*: m.p. 259° (217°).*N-Benzoyl*: m.p. 279°.*N-Benzylidene*: m.p. 174°.Junghans, *Ann.*, 1913, 399, 316.Bayer, D.R.P., 275,299, (*Chem. Zentr.*, 1914, II, 98).Eckert, Halla, *Monatsh.*, 1914, 35, 753.**4-Bromo-*o*-aminobenzaldehyde (4-Bromo-2-aminobenzaldehyde)**C<sub>7</sub>H<sub>6</sub>ONBr MW, 200

Glistening leaflets. M.p. 85°.

*Oxime*: m.p. 194°.*Phenylhydrazone*: m.p. 215°.Müller, *Ber.*, 1909, 42, 3695.**5-Bromo-*o*-aminobenzaldehyde (5-Bromo-2-aminobenzaldehyde).***N-Acetyl*: needles from MeOH. M.p. 170–1°.*Oxime*: needles from EtOH. M.p. 191–2°.

Sol. most org. solvents.

Auwers, Ernecke, Wolter, *Ann.*, 1930,

478, 170.

**2-Bromo-*p*-aminobenzaldehyde (2-Bromo-4-aminobenzaldehyde).**Cryst. from H<sub>2</sub>O. M.p. 148°. Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O.*N-Acetyl*: pale yellow needles from H<sub>2</sub>O. M.p. 135°.Blanksma, *Chem. Zentr.*, 1910, I, 261.**Bromo-*o*-aminobenzoic Acid.**

See Bromoanthranilic Acid.

4-Bromo-*m*-aminobenzoic Acid

$C_7H_6O_2NBr$  MW, 216

Needles. M.p. 225–6°. Sol. EtOH.

Koopal, *Rec. trav. chim.*, 1915, 34, 149.

5-Bromo-*m*-aminobenzoic Acid.

Needles. M.p. 220–2°. Sol. EtOH. Spar. sol.  $C_6H_6$ . Prac. insol.  $H_2O$ .

*N*-Acetyl: m.p. 279–81°.

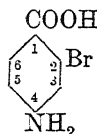
McAlister, Kenner, *J. Chem. Soc.*, 1928, 1913.

6-Bromo-*m*-aminobenzoic Acid.

Needles. M.p. 180°.

Hübner, Burghard, *Ber.*, 1875, 8, 560.

Koopal, *Rec. trav. chim.*, 1915, 34, 148.

2-Bromo-*p*-aminobenzoic Acid

$C_7H_6O_2NBr$  MW, 216

Cryst. M.p. 202° decomp. Sol. EtOH, hot  $H_2O$ .

*Aq* salt: m.p. 234°.

*Et* ester:  $C_9H_{10}O_2NBr$ . MW, 244. M.p. 125°.

*N*-Acetyl:  $C_9H_8O_3NBr$ . MW, 258. M.p. 206°. Sol. EtOH.

Frejka, Vitha, *Chem. Abstracts*, 1925, 19, 2332.

Blanksma, *Chem. Zentr.*, 1910, I, 260.

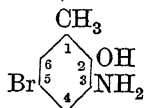
3-Bromo-*p*-aminobenzoic Acid.

Needles from EtOH. M.p. 204°.

*N*-Acetyl: m.p. 226–9°.

Raiford, Davis, *J. Am. Chem. Soc.*, 1928, 50, 158.

Aliazam, Desai, Hunter, *Rec. trav. chim.*, 1934, 53, 12.

5-Bromo-3-amino-*o*-cresol (5-Bromo-2-hydroxy-3-aminotoluene)

$C_7H_8ONBr$  MW, 202

Needles. M.p. 113°. Sublimes.  $FeCl_3 \rightarrow$  red col.

*N*-Acetyl: colourless needles from EtOH. *Aq*. M.p. 119°. Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ , alkalis.

*N*-Benzoyl: rose-pink needles. M.p. 194–5°. *Acetyl deriv.*: m.p. 168°.

*Diacetyl deriv.*: pale brown needles. M.p. 200° (203°). Sol. most ord. org. solvents.

Raiford, Couture, *J. Am. Chem. Soc.*, 1922, 44, 1792.

3-Bromo-5-amino-*o*-cresol (3-Bromo-2-hydroxy-5-aminotoluene).

Needles. M.p. 146–8°.

*B*, *HCl*: m.p. 265–70° decomp.

*N*-Acetyl: m.p. 154–5°.

*Diacetyl deriv.*: m.p. 169–70°.

Jacobs, Heidelberger, *J. Am. Chem. Soc.*, 1917, 39, 2209.

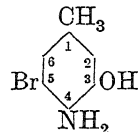
Raiford, *J. Am. Chem. Soc.*, 1922, 44, 158.

4-Bromo-5-amino-*o*-cresol (4-Bromo-2-hydroxy-5-aminotoluene).

Needles from EtOH. M.p. 180°.

*O*:*N*-Dibenzoyl: needles from EtOH. M.p. 200°.

Gattermann, *Ber.*, 1894, 27, 1927.

5-Bromo-4-amino-*m*-cresol (5-Bromo-3-hydroxy-4-aminotoluene)

$C_7H_8ONBr$  MW, 202

Glistening needles. M.p. 140–1°.

*B*, *HCl*: m.p. 225–8°.

Auwers, Borsche, Weller, *Ber.*, 1921, 54, 1313.

6-Bromo-4-amino-*m*-cresol (6-Bromo-3-hydroxy-4-aminotoluene).

Colourless leaflets. M.p. 116°.

*B*, *HCl*: m.p. 145°.

*N*-Acetyl: prac. colourless needles. M.p. 199° decomp. Sol. EtOH, MeOH,  $Me_2CO$ , alkalis. Spar. sol. ligroin.

*Diacetyl deriv.*: m.p. 188°.

*N*-Benzoyl: m.p. 223° decomp. *Acetyl deriv.*: m.p. 157–8°.

*O*-Benzenesulphonyl: tan needles. M.p. 100°.

Raiford, Couture, *J. Am. Chem. Soc.*, 1922, 44, 1792.

Raiford, Shelton, *J. Am. Chem. Soc.*, 1943, 65, 2048.

4-Bromo-6-amino-*m*-cresol (4-Bromo-3-hydroxy-6-aminotoluene).

Needles. M.p. 215° (205–8° decomp., 145°). Sol. EtOH. Spar. sol.  $H_2O$ .

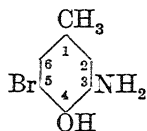
*Diacetyl deriv.*: m.p. 171–2°.

*Dibenzoyl deriv.*: m.p. 229°.

Gattermann, *Ber.*, 1894, 27, 1931.

Raiford, Leavell, *J. Am. Chem. Soc.*, 1914, 36, 1498.

**5-Bromo-3-amino-*p*-cresol** (5-Bromo-4-hydroxy-3-aminotoluene)



$C_7H_8ONBr$  MW, 202

Needles from EtOH. M.p. 93°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O.

*N*-Acetyl: m.p. 129°.

*Diacetyl deriv.*: m.p. 169°.

*N*-Benzoyl: m.p. 185°. *Acetyl deriv.*: m.p. 172°.

*O*:*N*-Dibenzoyl: m.p. 166°.

*N*-Benzenesulphonyl: m.p. 157°. *O*-Benzoyl: m.p. 172°.

*O*:*N*-Di-benzenesulphonyl: m.p. 230°.

*N*-Carbomethoxyl: m.p. 112–112.5°.

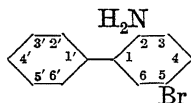
*N*-Carbethoxyl: m.p. 83°. *O*-Benzoyl: m.p. 142°. *O*-Benzenesulphonyl: m.p. 115–115.5°.

Thiele, Eichwede, *Ann.*, 1900, 311, 375.

Raiford, *J. Am. Chem. Soc.*, 1919, 41, 2068.

Raiford, Grosz, *J. Am. Chem. Soc.*, 1931, 53, 3422.

### 5-Bromo-2-aminodiphenyl



$C_{12}H_{10}NBr$  MW, 248

Needles from EtOH.Aq. M.p. 57–5°.

*N*-Acetyl: needles from EtOH.Aq. M.p. 130°.

*N*-Benzoyl: needles from EtOH.Aq. M.p. 162°.

Chaix, Rochebouët, *Bull. soc. chim.*, 1935, 2, 277.

Scarborough, Waters, *J. Chem. Soc.*, 1927, 94.

### 2'-Bromo-2-aminodiphenyl.

M.p. 46–50°. B.p. 196–7°/27 mm. Readily volatile in steam.

Mascarelli, Gatta, Pirona, *Gazz. chim. ital.*, 1931, 61, 793.

### 3'-Bromo-2-aminodiphenyl.

Plates from EtOH.Aq. M.p. 69–70° corr. B.p. 195°/11 mm.

*N*-Di-Me:  $C_{14}H_{14}NBr$ . MW, 276. Plates or prismatic needles from EtOH. M.p. 47–8°. B.p. 187–8°/12 mm., 176–8°/9 mm.

Lesslie, Turner, *J. Chem. Soc.*, 1933, 1591.

### 4-Bromo-3-aminodiphenyl.

Dark oil. Decomp. on dist.

*B.HBr*: needles from dil. HBr. M.p. 255° decomp.

*N*-Acetyl: plates from EtOH.Aq. M.p. 163°. Blakey, Scarborough, *J. Chem. Soc.*, 1927, 3007.

### 5-Bromo-3-aminodiphenyl.

Light brown prisms from pet. ether. M.p. 88°.

*N*-Acetyl: prisms from EtOH-pet. ether. M.p. 140°.

Hinkel, Hey, *J. Chem. Soc.*, 1928, 1839.

### 2'-Bromo-3-aminodiphenyl.

M.p. 57°.

*N*-Acetyl: m.p. 135°.

Case, *J. Am. Chem. Soc.*, 1938, 60, 424.

### 4'-Bromo-3-aminodiphenyl.

Needles from EtOH.Aq. M.p. 105°.

*N*-Acetyl: needles from EtOH. M.p. 193°.

Blakey, Scarborough, *J. Chem. Soc.*, 1927, 3005.

### 3-Bromo-4-aminodiphenyl.

Needles from EtOH.Aq. M.p. 66°.

*N*-Acetyl: needles from EtOH. M.p. 161°.

Kenyon, Robinson, *J. Chem. Soc.*, 1926, 3051.

Case, Sloviter, *J. Am. Chem. Soc.*, 1937, 59, 2381.

### 2'-Bromo-4-aminodiphenyl.

B.p. 183–5°/3 mm.

*N*-Acetyl: m.p. 155–6°.

Case, *J. Am. Chem. Soc.*, 1938, 60, 424.

### 3'-Bromo-4-aminodiphenyl.

M.p. 64–5°.

*N*-Acetyl: m.p. 182–3°.

Case, *J. Am. Chem. Soc.*, 1938, 60, 424.

### 4'-Bromo-4-aminodiphenyl.

Plates from EtOH, needles from AcOH.Aq. M.p. 145°. Mod. sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO. C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O.

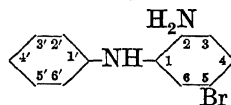
*N*-Acetyl: needles from EtOH. M.p. 247°. Sol. EtOH. Mod. sol. boiling H<sub>2</sub>O.

*N*-*p*-Toluenesulphonyl: m.p. 174°.

Codolosa, *Chem. Abstracts*, 1934, 28, 3069. Le Fèvre, Turner, *J. Chem. Soc.*, 1926, 2045.

Scarborough, Waters, *J. Chem. Soc.*, 1926, 560.

### 5-Bromo-2-aminodiphenylamine



$C_{12}H_{11}N_2Br$  MW, 263

Colourless cryst. M.p. 106°. Darkens on standing in air.

Jacobson, Grosse, *Ann.*, 1898, 303, 322.

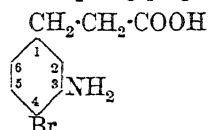
**4'-Bromo-4-aminodiphenylamine.**

Needles from ligroin. M.p. 93.5° (79°). Turns brown in air. FeCl<sub>3</sub> → bluish-violet col. → brick-red on standing. Forms spar. sol. hydrochloride and sulphate.

Jacobson, *Ann.*, 1922, 427, 185.

**4-Bromo-2-aminohydrocinnamic Acid Lactam.**

See 7-Bromohydrocarhostyryl.

**4-Bromo-3-aminohydrocinnamic Acid**  
(*p*-Bromo-*m*-amino-2-phenylpropionic acid)

C<sub>9</sub>H<sub>10</sub>O<sub>2</sub>NBr MW, 244

Prisms. M.p. 117-19°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Cryst. from H<sub>2</sub>O.

Gabriel, Zimmermann, *Ber.*, 1880, 13, 1684.

**3-Bromo-4-aminohydrocinnamic Acid**  
(*m*-Bromo-*p*-amino-2-phenylpropionic acid).

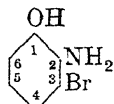
Cryst. from H<sub>2</sub>O. M.p. 104-5°. Sol. most org. solvents, alkalis, and min. acids.

*N*-Acetyl: needles. M.p. 160°. Sol. Et<sub>2</sub>O.

Gabriel, *Ber.*, 1882, 15, 2293.

**Bromoaminophenetole.**

See Bromophenetidine.

**3-Bromo-2-aminophenol**

C<sub>6</sub>H<sub>6</sub>ONBr MW, 188

Needles. M.p. 138°.

*O*-*p*-Toluenesulphonyl: needles from EtOH. M.p. 120-1°.

Hodgson, Kershaw, *J. Chem. Soc.*, 1928, 2703.

**4-Bromo-2-aminophenol.**

Leaflets. M.p. 128° (88°). Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O. FeCl<sub>3</sub> on aq. sol. → bluish-red col.

*Me ether*: see 4-Bromo-*o*-anisidine.

*Et ether*: see 4-Bromo-*o*-phenetidine.

*N*-Acetyl: see 5-Bromo-2-hydroxyacetanilide.

Schlieper, *Ber.*, 1893, 26, 2469.

**5-Bromo-2-aminophenol.**

Prisms. M.p. 150°.

Hodgson, Kershaw, *J. Chem. Soc.*, 1928, 2703.

Auwers, Murbe, Sauerwein, Deines, Schornstein, *Chem. Abstracts*, 1925, 19, 2340.

**6-Bromo-3-aminophenol.**

Leaflets from H<sub>2</sub>O. M.p. 150° decomp. Sol. EtOH, Me<sub>2</sub>CO, AcOH, hot C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin.

*N*-Acetyl: see 4-Bromo-3-hydroxyacetanilide.

*O*-*p*-Toluenesulphonyl: prisms from EtOH. M.p. 135-6°.

Jacobs, Heidelberger, Rolf, *J. Am. Chem. Soc.*, 1919, 41, 458.

**2-Bromo-4-aminophenol.**

Pale brown needles. M.p. 165° (155°). Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O.

*Me ether*: see 2-Bromo-*p*-anisidine.

*Et ether*: see 2-Bromo-*p*-phenetidine.

*N*-Acetyl: see 3-Bromo-4-hydroxyacetanilide.

*N*-Benzoyl: m.p. 184-5°.

*O*: *N*-Dibenzoyl: m.p. 192°.

Hodurek, *Ber.*, 1897, 30, 480.

Gattermann, *Ber.*, 1894, 27, 1927.

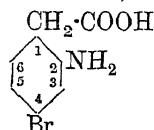
Raiford, *Am. Chem. J.*, 1911, 46, 419.

Jacobs, Heidelberger, *J. Am. Chem. Soc.*, 1917, 39, 2208.

**3-Bromo-4-aminophenol.**

Needles. M.p. 151°.

Hodgson, Kershaw, *J. Chem. Soc.*, 1928, 2703.

**4-Bromo-2-aminophenylacetic Acid** (4-Bromo-2-amino- $\alpha$ -toluic acid)

C<sub>8</sub>H<sub>8</sub>O<sub>2</sub>NBr MW, 230

Needles. M.p. 167° decomp. Sol. EtOH, CHCl<sub>3</sub>, hot H<sub>2</sub>O. Spar. sol. Et<sub>2</sub>O.

Bedson, *J. Chem. Soc.*, 1880, 37, 98.

**4-Bromo-3-aminophenylacetic Acid** (4-Bromo-3-amino- $\alpha$ -toluic acid).

Needles. M.p. 134°. Sol. EtOH, CHCl<sub>3</sub>. Mod. sol. hot H<sub>2</sub>O. Spar. sol. Et<sub>2</sub>O.

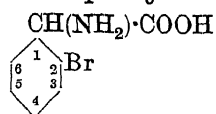
Bedson, *J. Chem. Soc.*, 1880, 37, 98.

**3-Bromo-4-aminophenylacetic Acid** (3-Bromo-4-amino- $\alpha$ -toluic acid).

Cryst. from hot H<sub>2</sub>O. M.p. 136°. Sol. EtOH, Et<sub>2</sub>O, AcOH, C<sub>6</sub>H<sub>6</sub>. Spar. sol. CHCl<sub>3</sub>. Insol. CS<sub>2</sub>.

*N*-Acetyl: needles. M.p. 164-5°.

Gabriel, *Ber.*, 1882, 15, 840.

**2-Bromo- $\alpha$ -aminophenylacetic Acid**

C<sub>8</sub>H<sub>8</sub>O<sub>2</sub>NBr MW, 230

Leaflets from EtOH. Aq. M.p. 221° decomp. (sealed tube). Sublimes at 220-25°.

Wislicenus, Fischer, *Ber.*, 1910, 43, 2241.

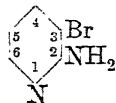


**4-Bromo- $\alpha$ -aminophenylacetic Acid.**

Leaflets from EtOH.Aq. Sublimes about 265°. Spar. sol. solvents.

Wislicenus, Elvert, *Ber.*, 1908, 41, 4131.

**3-Bromo-2-aminopyridine** (*3-Bromo-2-pyridylamine*).



$C_5H_5N_2Br$  MW, 173  
M.p. 64.5–65.5°.

Hertog, *Rec. trav. chim.*, 1945, 64, 85.

**4-Bromo-2-aminopyridine** (*4-Bromo-2-pyridylamine*).

M.p. 143–45°.

*Picrate*: m.p. 262–3°.

Hertog, *Rec. trav. chim.*, 1945, 64, 85.

**5-Bromo-2-aminopyridine** (*5-Bromo-2-pyridylamine*).

Cryst. from  $C_6H_6$ . M.p. 137°.

*Picrate*: yellow needles. M.p. 257° decomp.

Tschitschibabin, Tjashelowa, *Chem. Zentr.*, 1923, III, 1021.

Caldwell, Tyson, Lauer, *J. Am. Chem. Soc.*, 1944, 66, 1479.

**6-Bromo-2-aminopyridine** (*6-Bromo-2-pyridylamine*).

Needles from ligroin. M.p. 90°.

*Picrate*: m.p. 174–5°.

Hertog, Wibaut, *Rec. trav. chim.*, 1936, 55, 125; 1932, 51, 387.

**5-Bromo-3-aminopyridine** (*5-Bromo-3-pyridylamine*).

M.p. 66–7°. B.p. 149–50°/12 mm.

*N-Acetyl*: cryst. +  $2H_2O$  from EtOH.Aq. M.p. 76–8°, anhyd. 127–8°.

*Chloroaurate*: orange-red needles from dil. HCl. M.p. 185–7°.

*Picrate*: yellow needles. M.p. 212–13°.

Graf, Lederer-Ponzer, Kopetz, Purkert, László, *J. prakt. Chem.*, 1933, 138, 251.

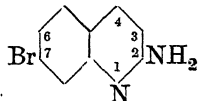
**3-Bromo-4-aminopyridine** (*3-Bromo-4-pyridylamine*).

M.p. 69.5–70.5°.

*Picrate*: m.p. 235–6°.

Wibaut, Hertog, *Rec. trav. chim.*, 1945, 64, 30.

**7-Bromo-2-aminoquinoline** (*7-Bromo-2-quinolylamine*)



$C_9H_7N_2Br$  MW, 223  
Needles from EtOH. M.p. 62°.

Claus, Vis, *J. prakt. Chem.*, 1888, 38, 391.

**3-Bromo-4-aminoquinoline** (*3-Bromo-4-quinolylamine*).

Needles. M.p. 203° (199°). Sol. EtOH, Et<sub>2</sub>O. Sublimes.

Claus, Howitz, *J. prakt. Chem.*, 1894, 50, 232.

**3-Bromo-5-aminoquinoline** (*3-Bromo-5-quinolylamine*).

Needles. M.p. 135°.

*5-N-Acetyl*: m.p. 212°.

Claus, Decker, *J. prakt. Chem.*, 1889, 39, 301.

Claus, Setzer, *J. prakt. Chem.*, 1896, 53, 413.

**6-Bromo-5-aminoquinoline** (*6-Bromo-5-quinolylamine*).

Needles +  $1H_2O$ . Prisms from Et<sub>2</sub>O. M.p. anhyd. 164°. Sol. EtOH, H<sub>2</sub>O.

*5-N-Acetyl*: m.p. 104–5°.

La Coste, *Ber.*, 1882, 15, 1920.

**8-Bromo-5-aminoquinoline** (*8-Bromo-5-quinolylamine*).

Brownish-yellow needles from EtOH.Aq. M.p. 156–7° (136°). Sol. AcOH with red col. Yellow sols. in min. acids → orange-red on dilution with H<sub>2</sub>O.

*5-N-Acetyl*: light brown prismatic needles from  $C_6H_6$ . M.p. 179–80° (250°).

Slater, *J. Chem. Soc.*, 1932, 2106.

Cf. Claus, Setzer, *J. prakt. Chem.*, 1896, 53, 411.

**3-Bromo-6-aminoquinoline** (*3-Bromo-6-quinolylamine*).

Needles. M.p. 106°. Sol. EtOH, hot H<sub>2</sub>O. Sublimes.

Claus, Schnell, *J. prakt. Chem.*, 1896, 53, 112.

**5-Bromo-6-aminoquinoline** (*5-Bromo-6-quinolylamine*).

Cryst. +  $2H_2O$ . M.p. 83°, anhyd. 127°.

*6-N-Acetyl*: cryst. from H<sub>2</sub>O. M.p. 165°. *B,HBr*: m.p. 241°.

Meigen, *J. prakt. Chem.*, 1906, 73, 248.

**7-Bromo-6-aminoquinoline** (*7-Bromo-6-quinolylamine*).

Colourless leaflets. M.p. 67°.

*6-N-Acetyl*: bronze laminæ. M.p. 165°.

Claus, Schnell, *J. prakt. Chem.*, 1896, 53, 106.

**3-Bromo-8-aminoquinoline** (*3-Bromo-8-quinolylamine*).

M.p. 106–7°.

Hauser *et. al.*, *J. Am. Chem. Soc.*, 1946, 68, 1544.

**4-Bromo-8-aminoquinoline** (*4-Bromo-8-quinolylamine*).

Needles. M.p. 107°.

*B, HCl*: m.p. 252° decomp.

Claus, Howitz, *J. prakt. Chem.*, 1893, 48, 158; 1894, 50, 239.

**5-Bromo-8-aminoquinoline** (*5-Bromo-8-quinolylamine*).

Needles. M.p. 104°. Sol. EtOH.

*S-N-Acetyl*: needles. M.p. 140°.

Claus, Setzer, *J. prakt. Chem.*, 1896, 53, 404.

**6-Bromo-8-aminoquinoline** (*6-Bromo-8-quinolylamine*).

Needles from EtOH. M.p. 77°. Volatile in steam.

*B, HCl, 2H<sub>2</sub>O*: dark yellow needles. M.p. 236-7°.

Claus, Reinhard, *J. prakt. Chem.*, 1894, 49, 529.

**7-Bromo-8-aminoquinoline** (*7-Bromo-8-quinolylamine*).

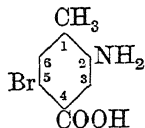
M.p. 62°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>.

Claus, Vis, *J. prakt. Chem.*, 1889, 40, 383.

**Bromo-aminotoluene.**

See Bromotoluidine and Bromobenzylamine.

**5-Bromo-2-amino-*p*-toluic Acid**



C<sub>8</sub>H<sub>8</sub>O<sub>2</sub>NBr MW, 230

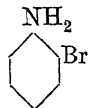
Plates from EtOH. M.p. 186-7°. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O. Prac. insol. CHCl<sub>3</sub>, ligroin.

Fileti, Crosa, *Gazz. chim. ital.*, 1888, 18, 307.

**Bromo-aminoxylene.**

See Bromoxylidine.

***o*-Bromoaniline**



C<sub>6</sub>H<sub>6</sub>NBr MW, 172

F.p. 28-7°. M.p. 32°. B.p. 229°, 138-41°/48-53 mm. Sol. EtOH, Et<sub>2</sub>O.

*N-Formyl*: *o*-bromoformanilide. C<sub>7</sub>H<sub>6</sub>ONBr. MW, 200. M.p. 87°.

*N-Acetyl*: *o*-bromoacetanilide. C<sub>8</sub>H<sub>8</sub>ONBr. MW, 214. M.p. 99°.

*N-Benzoyl*: *o*-bromobenzanilide. C<sub>13</sub>H<sub>10</sub>ONBr. MW, 276. M.p. 116°.

*Picrate*: m.p. 128-5°.

Hewitt, Phillips, *J. Chem. Soc.*, 1901, 79, 165.

West, *J. Chem. Soc.*, 1925, 127, 494.

Hazlet, Dornfeld, *J. Am. Chem. Soc.*, 1944, 66, 1781.

***m*-Bromoaniline.**

F.p. 16-7°. M.p. 18-5°. B.p. 251°, 130°/12 mm. Sol. EtOH, Et<sub>2</sub>O. *k* = 3.8 × 10<sup>-11</sup> at 25°. D<sub>4</sub><sup>20</sup> 1.5793. n<sub>D</sub><sup>20</sup> 1.62604.

*N-Acetyl*: *m*-bromoacetanilide. C<sub>8</sub>H<sub>8</sub>ONBr. MW, 214. M.p. 87-5°.

*N-Chloroacetyl*: needles from EtOH. M.p. 114°.

*N-Benzoyl*: *m*-bromobenzanilide. C<sub>13</sub>H<sub>10</sub>ONBr. MW, 276. M.p. 120°.

*Picrate*: m.p. 180°.

Blanksma, *Rec. trav. chim.*, 1909, 28, 107.

Mailhe, Murat, *Bull. soc. chim.*, 1910, 7, 955.

***p*-Bromoaniline.**

M.p. 66°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. *k* = 8.8 × 10<sup>-11</sup> at 25° (1.04 × 10<sup>-10</sup> at 25°).

*N-Formyl*: *p*-bromoformanilide. C<sub>7</sub>H<sub>6</sub>ONBr. MW, 200. M.p. 119°.

*N-Acetyl*: *p*-bromoacetanilide. C<sub>8</sub>H<sub>8</sub>ONBr. MW, 214. M.p. 168°.

*N-Chloroacetyl*: needles. M.p. 180-1°.

*N-Bromoacetyl*: m.p. 169-70°.

*N-Benzoyl*: *p*-bromobenzanilide. C<sub>13</sub>H<sub>10</sub>ONBr. MW, 276. Plates from EtOH. M.p. 202°.

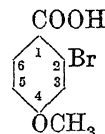
Vecchiotti, *Gazz. chim. ital.*, 1928, 58, 233.

Fuchs, *Monatsh.*, 1915, 36, 138.

**Bromoanisaldehyde.**

See under Bromo-4-hydroxybenzaldehyde.

**2-Bromoanisic Acid** (*o*-Bromo-*p*-methoxybenzoic acid)



C<sub>8</sub>H<sub>7</sub>O<sub>3</sub>Br MW, 231

Needles. M.p. 199°.

Hodgson, Jenkinson, *J. Chem. Soc.*, 1927, 3041.

**3-Bromoanisic Acid** (*m*-Bromo-*p*-methoxybenzoic acid).

Needles. M.p. 218-19° (223-4°). Sublimes. *k* = 7.2 × 10<sup>-5</sup> at 25°.

*Me ester*: C<sub>9</sub>H<sub>9</sub>O<sub>3</sub>Br. MW, 245. Prisms from EtOH. M.p. 99-100°. B.p. 172-3°/25 mm. Spar. sol. pet. ether.

*Et ester*: C<sub>10</sub>H<sub>11</sub>O<sub>3</sub>Br. MW, 259. Needles. M.p. 74°.

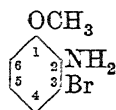
*Amide*: C<sub>8</sub>H<sub>8</sub>O<sub>2</sub>NBr. MW, 230. Leaflets. M.p. 185°. Sol. Et<sub>2</sub>O.

Cahours, *Ann.*, 1845, 56, 311.

Hoering, *Ber.*, 1904, 37, 1546.

Gattermann, *Ber.*, 1899, 32, 1121.

Paty, Quelet, *Compt. rend.*, 1943, 217, 229.

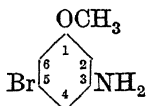
**3-Bromo-*o*-anisidine** (*3-Bromo-*o*-amino-phenol methyl ether, 3-bromo-2-aminoanisole*)C<sub>7</sub>H<sub>8</sub>ONBr

MW, 202

Prisms from EtOH. M.p. 65°.

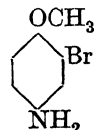
*B.HCl*: decomp. at 225°.*N-Benzoyl*: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 90°.Madesani, *Gazz. chim. ital.*, 1932, 62, 56.**4-Bromo-*o*-anisidine** (*p-Bromo-*o*-amino-phenol methyl ether, p-bromo-*o*-aminoanisole*).Prisms. M.p. 97–8°. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, hot EtOH.*B.HCl*: decomp. at 217°.*N-Acetyl*: needles from EtOH. M.p. 159–60°.*N-Benzoyl*: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 108°.Staedel, *Ann.*, 1883, 217, 59.Madesani, *Gazz. chim. ital.*, 1932, 62, 54.**5-Bromo-*o*-anisidine** (*5-Bromo-*o*-amino-phenol methyl ether, 5-bromo-2-aminoanisole*).

Cryst. M.p. 60–1°.

General Aniline Works, U.S.P., 1,792,156, (*Chem. Abstracts*, 1931, 25, 1844).**6-Bromo-*o*-anisidine** (*6-Bromo-*o*-amino-phenol methyl ether, 6-bromo-2-aminoanisole*).B.p. 157–9°/30 mm. *D*<sub>20</sub><sup>20</sup> 1.5548. *n*<sub>D</sub><sup>20</sup> 1.6550.Chien, Adams, *J. Am. Chem. Soc.*, 1934, 56, 1790.**5-Bromo-*m*-anisidine** (*5-Bromo-*m*-amino-phenol methyl ether, 5-bromo-3-aminoanisole*)C<sub>7</sub>H<sub>8</sub>ONBr

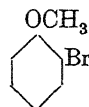
MW, 202

Cryst. M.p. 52°.

Hodgson, Wignall, *J. Chem. Soc.*, 1926, 2077.**6-Bromo-*m*-anisidine** (*6-Bromo-*m*-amino-phenol methyl ether, 6-bromo-3-aminoanisole*).Plates. M.p. 90.5°. Sol. hot H<sub>2</sub>O.*N-Benzoyl*: C<sub>14</sub>H<sub>12</sub>O<sub>2</sub>NBr. MW, 306. M.p. 124°.Griffiths, Hope, *J. Chem. Soc.*, 1925, 127, 990.**2-Bromo-*p*-anisidine** (*o-Bromo-*p*-amino-phenol methyl ether, o-bromo-*p*-aminoanisole*)C<sub>7</sub>H<sub>8</sub>ONBr

MW, 202

Dict. of Org. Comp.—I.

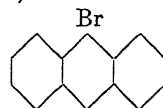
Leaflets. M.p. 64°. Sol. EtOH, Et<sub>2</sub>O, AcOEt. Spar. sol. H<sub>2</sub>O.*B.HCl*: m.p. 254–5°.*B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>*: decomp. at 243°.*B<sub>2</sub>(COOH)<sub>2</sub>*: m.p. 159–60°.*B<sub>2</sub>(CH<sub>2</sub>COOH)<sub>2</sub>*: m.p. 61°.*N-Acetyl*: 3-bromo-4-methoxyacetanilide. C<sub>9</sub>H<sub>10</sub>O<sub>2</sub>NBr. MW, 244. M.p. 111°.Staedel, *Ann.*, 1883, 217, 68.***o*-Bromoanisole** (*2-Bromoanisole, o-bromo-phenol methyl ether*)C<sub>7</sub>H<sub>7</sub>OBr

MW, 187

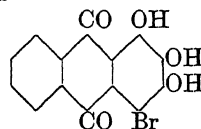
B.p. 210° (218°, 223°).

Wallach, Heusler, *Ann.*, 1888, 243, 237.***m*-Bromoanisole** (*3-Bromoanisole, m-bromo-phenol methyl ether*).

B.p. 210–11°/752 mm., 108–10°/22 mm.

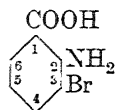
Diels, Bunzl, *Ber.*, 1905, 38, 1496.Silverman, Bogert, *J. Org. Chem.*, 1946, 11, 34.***p*-Bromoanisole** (*4-Bromoanisole, o-bromo-phenol methyl ether*).M.p. 11°. B.p. 215°, 100°/16 mm. *D*<sub>20</sub><sup>20</sup> 1.494. *n*<sub>D</sub><sup>20</sup> 1.5640.Wohl, *Ber.*, 1919, 52, 51.Slotta, Heller, *Ber.*, 1930, 63, 3043.Paty, *Compt. rend.*, 1942, 214, 910.**9-Bromoanthracene** (*ms-Bromoanthracene, γ-bromoanthracene*)C<sub>14</sub>H<sub>9</sub>Br

MW, 257

Yellow needles. M.p. 101° (98–9°). Sol. AcOH, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>. Mod. sol. hot EtOH.Barnett, Cook, *J. Chem. Soc.*, 1924, 125, 1084.**4-Bromoanthragallo** (*4-Bromo-1 : 2 : 3-tri-hydroxyanthraquinone*)C<sub>14</sub>H<sub>7</sub>O<sub>5</sub>Br

MW, 335

Yellowish-brown needles. M.p. 217° (212°). Cryst. from AcOH. Reddish-brown sol. in conc. H<sub>2</sub>SO<sub>4</sub>.*Triacetyl*: yellow needles. M.p. 178°.Slama, *Chem. Zentr.*, 1899, II, 966.Bayer, D.R.P., 126,015, (*Chem. Zentr.*, 1901, II, 1242).

**3-Bromoanthranilic Acid** (*3-Bromo-2-aminobenzoic acid*)

$C_7H_6O_2NBr$  MW, 216  
Needles. M.p. 178°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>.

Hübner, Petermann, *Ann.*, 1869, 149, 134.

**4-Bromoanthranilic Acid** (*4-Bromo-2-aminobenzoic acid*).

Needles. M.p. 222°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, hot H<sub>2</sub>O.

*Me ester*:  $C_8H_8O_2NBr$ . MW, 230. Needles from 50% MeOH. M.p. 78°.

*N-Acetyl*: 4-bromo-acetylanthranilic acid.  $C_9H_8O_3NBr$ . MW, 258. M.p. 217°.

*N-Me*:  $C_8H_8O_2NBr$ . MW, 230. Needles from EtOH. M.p. 189°. Spar. sol. H<sub>2</sub>O.

Friedländer, Bruckner, Deutsch, *Ann.*, 1912, 388, 23.

Robertson, Waters, *J. Chem. Soc.*, 1931, 73.

Frejka, Vymetal, *Chem. Abstracts*, 1936, 30, 1370.

**5-Bromoanthranilic Acid** (*5-Bromo-2-aminobenzoic acid*).

Needles. M.p. 219—20°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, AcOH, Me<sub>2</sub>CO. Spar. sol. H<sub>2</sub>O.

*Hydrobromide*: m.p. 238—40°.

*N-Acetyl*: 5-bromo-acetylanthranilic acid.  $C_9H_8O_3NBr$ . MW, 258. M.p. 227—8°. Sol. EtOH, Et<sub>2</sub>O. Insol. CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>.

*Me ester*:  $C_8H_8O_2NBr$ . MW, 230. M.p. 74°.  
*Et ester*:  $C_9H_{10}O_2NBr$ . MW, 244. M.p. 187°.

*Amide*:  $C_7H_7ON_2Br$ . MW, 215. M.p. 177°. Sol. EtOH, AcOH, Me<sub>2</sub>CO. Mod. sol. H<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Insol. Et<sub>2</sub>O.

Wheeler, Oates, *J. Am. Chem. Soc.*, 1910, 32, 770.

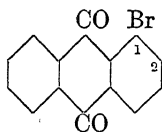
Freundler, *Bull. soc. chim.*, 1911, 9, 607.

**6-Bromoanthranilic Acid** (*6-Bromo-2-aminobenzoic acid*).

Cryst. M.p. 136°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. C<sub>6</sub>H<sub>6</sub>, ligroin.

*N-Acetyl*: 6-bromo-acetylanthranilic acid.  $C_9H_8O_3NBr$ . MW, 258. M.p. 224°.

Friedländer, Bruckner, Deutsch, *Ann.*, 1912, 388, 23.

**1-Bromoanthraquinone** (*α-Bromoanthraquinone*)

$C_{14}H_7O_2Br$

MW, 287

Yellow cryst. M.p. 188°. Cryst. from C<sub>6</sub>H<sub>6</sub>, PhNO<sub>2</sub>, or xylene. Sublimes. Yellow sol. in conc. H<sub>2</sub>SO<sub>4</sub>.

Pechmann, *Ber.*, 1879, 12, 2127.

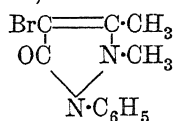
Bayer, D.R.P., 205,195, (*Chem. Zentr.*, 1909, I, 414).

**2-Bromoanthraquinone** (*β-Bromoanthraquinone*).

Yellow cryst. M.p. 204·5°.

Kaufler, Imhoff, *Ber.*, 1904, 37, 4708.

Heller, *Ber.*, 1912, 45, 673.

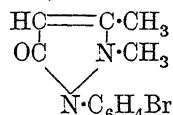
**4-Bromoantipyridine** (*4-Bromo-1-phenyl-2:3-dimethylpyrazolone-5*)

$C_{11}H_{11}ON_2Br$  MW, 267

Needles. M.p. 117°. Sol. EtOH, CHCl<sub>3</sub>. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O.

Knorr, *Ann.*, 1887, 238, 216.

Shimidzu, *Chem. Abstracts*, 1926, 20, 2857.

**p-Bromoantipyridine** (*1-p-Bromophenyl-2:3-dimethylpyrazolone-5*)

$C_{11}H_{11}ON_2Br$  MW, 267.

Cryst. M.p. 122°. B.p. 300°/9 mm. Sol. EtOH, CHCl<sub>3</sub>, hot Et<sub>2</sub>O, hot H<sub>2</sub>O.

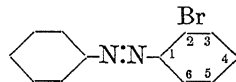
*B,HCl*: m.p. 213°.

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 208—10° decomp.

Michaelis, Schwabe, *Ber.*, 1900, 33, 2609.

**Bromoazidobenzene.**

See Bromophenyl azide.

**2-Bromoazobenzene** (*o-Bromoazobenzene*)

$C_{12}H_9N_2Br$  MW, 261

Golden leaflets. M.p. 87°. Sol. Et<sub>2</sub>O, Me<sub>2</sub>CO, ligroin. SnCl<sub>2</sub> → aniline + *o*-bromoaniline.

Janovsky, Erb, *Ber.*, 1886, 19, 2156; 1887, 20, 357.

**3-Bromoazobenzene** (*m-Bromoazobenzene*).

Yellowish-brown leaflets. M.p. 69°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, CHCl<sub>3</sub>, ligroin, C<sub>6</sub>H<sub>6</sub>. Sublimes. SnCl<sub>2</sub> → aniline + *m*-bromoaniline.

Janovsky, Erb, *Ber.*, 1886, 19, 2156; 1887, 20, 357.

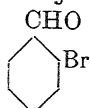
**4-Bromoazobenzene** (*p*-Bromoazobenzene).

Orange-red cryst. M.p. 89°. Sol. Et<sub>2</sub>O, Me<sub>2</sub>CO, ligroin. Spar. sol. cold EtOH. Sublimes. SnCl<sub>2</sub> → aniline + *p*-bromoaniline.

Angeli, Valori, *Atti accad. Lincei*, 1912, 21, i, 160.

Bamberger, *Ber.*, 1896, 29, 103.

Janovsky, Erb, *Ber.*, 1886, 19, 2156; 1887, 20, 357.

***o*-Bromobenzaldehyde**

C<sub>7</sub>H<sub>5</sub>OBr MW, 185

M.p. 22°. B.p. 230°, 118–19°/12 mm.

Oxidises readily in air.

*α*-Oxime: cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 102°.

*B, HCl*: cryst. powder. M.p. 115° decomp.

*Acetyl deriv.*: plates from Me<sub>2</sub>CO.Aq. M.p. 66°.

*β*-Oxime: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 126°.

*Semicarbazone*: leaflets. M.p. 214°.

*p*-Nitrophenylhydrazone: m.p. 240–1°.

Adams, Vollweiler, *J. Am. Chem. Soc.*, 1918, 40, 1732.

Brady, Cosson, Roper, *J. Chem. Soc.*, 1925, 127, 2427.

Rupe, Bernstein, *Helv. Chim. Acta*, 1930, 13, 464.

***m*-Bromobenzaldehyde.**

B.p. 233–6°, 215–16°/716 mm.

*Oxime*: m.p. 71–2°.

*Semicarbazone*: pale yellow needles. M.p. 205°.

*p*-Nitrophenylhydrazone: m.p. 220°.

Buck, Ide, *Organic Syntheses*, 1933, XIII, 30, (Note 6).

***p*-Bromobenzaldehyde.**

Leaflets. M.p. 67°.

*syn*-Oxime: m.p. 157°.

*anti*-Oxime: m.p. 110–11°.

*Semicarbazone*: m.p. 227–8°.

*Phenylhydrazone*: m.p. 112–13°.

*p*-Nitrophenylhydrazone: m.p. 207–8°.

2 : 4 - *Dinitrophenylhydrazone*: m.p. 128° (260–1°).

Coleman, Honeywell, *Organic Syntheses*, 1937, XVII, 20.

Wuyts, Berman, Lacourt, *Bull. soc. chim. Belg.*, 1931, 40, 665.

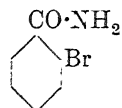
Snyder, Handrick, *J. Am. Chem. Soc.*, 1944, 66, 1860.

***N*-Bromobenzamide**

C<sub>7</sub>H<sub>6</sub>ONBr MW, 200

Plates from C<sub>6</sub>H<sub>6</sub>. M.p. 129–31°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, AcOH. Spar. sol. cold C<sub>6</sub>H<sub>6</sub>.

Hauser, Renfrow, *J. Am. Chem. Soc.*, 1937, 59, 122.

***o*-Bromobenzamide**

C<sub>7</sub>H<sub>6</sub>ONBr MW, 200

Needles. M.p. 155–6°. Sublimes. Cryst. from H<sub>2</sub>O. Spar. sol. Et<sub>2</sub>O.

Reid, *Am. Chem. J.*, 1900, 24, 397.

Kao, Ma, *Sci. Repts. Nat. Tsinghua Univ.*, 1931, 1, 17 (*Chem. Zentr.*, 1932, I, 1091).

***m*-Bromobenzamide.**

Leaflets. M.p. 155°. Sol. EtOH. Mod. sol. hot H<sub>2</sub>O. Sublimes.

*B, HCl*: m.p. 218·5°.

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 251° decomp.

Kindler, *Chem. Abstracts*, 1927, 21, 2669.

Kao, Ma, *Sci. Repts. Nat. Tsinghua Univ.*, 1931, 1, 17 (*Chem. Zentr.*, 1932, I, 1091).

***p*-Bromobenzamide.**

Cryst. from H<sub>2</sub>O. M.p. 189–90°. Sol. EtOH, CHCl<sub>3</sub>, AcOH, hot H<sub>2</sub>O. Spar. sol. Et<sub>2</sub>O. Insol. C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>, ligroin.

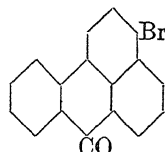
Schotten, *Ber.*, 1888, 21, 2249.

Kao, Ma, *Sci. Repts. Nat. Tsinghua Univ.*, 1931, 1, 17 (*Chem. Zentr.*, 1932, I, 1091).

**Bromobenzanilide.**

See under Bromoaniline.

**3-Bromobenzanthrone** (*Bz*-1-bromobenzanthrone. See formulæ under Benzanthrone)



C<sub>17</sub>H<sub>9</sub>OBr MW, 309

Yellow needles. M.p. 170°. Cherry-red sol. in conc. H<sub>2</sub>SO<sub>4</sub>, red sol. with yellowish-brown fluor. in oleum.

Badische, D.R.P., 193,959, (*Chem. Zentr.*, 1908, I, 1112).

**Bromobenzene**

C<sub>6</sub>H<sub>5</sub>Br MW, 157

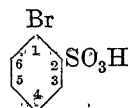
M.p. –31°. B.p. 155–6°, 43°/18 mm. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O. D<sub>15</sub><sup>15</sup> 1·4991.

*n*<sub>D</sub><sup>20</sup> 1·56252. H + Ni at 270° → benzene. Na in Et<sub>2</sub>O → diphenyl.

Sandmeyer, *Ber.*, 1884, 17, 2652.

Stark, *Ber.*, 1910, 43, 672.

**Bromobenzene-*o*-sulphonic Acid** (1-Bromobenzene-2-sulphonic acid)



C<sub>6</sub>H<sub>5</sub>O<sub>3</sub>BrS

MW, 237

Needles. Sol. EtOH. Deliquescent. Salts are sol. H<sub>2</sub>O.

*Chloride*: C<sub>6</sub>H<sub>4</sub>O<sub>2</sub>ClBrS. MW, 255.5. Cryst. from Et<sub>2</sub>O. M.p. 51°.

*Amide*: C<sub>6</sub>H<sub>6</sub>O<sub>2</sub>NBrS. MW, 236. Needles. M.p. 186°. Spar. sol. H<sub>2</sub>O.

Bahlmann, *Ann.*, 1876, 181, 203.

**Bromobenzene-*m*-sulphonic Acid** (1-*Bromobenzene-3-sulphonic acid*).

Cryst. Deliquescent. KOH fusion → resorcinol.

*Amide*: C<sub>6</sub>H<sub>6</sub>O<sub>2</sub>NBrS. MW, 236. M.p. 154°. Cryst. from H<sub>2</sub>O or EtOH.

Berndsen, *Ann.*, 1875, 177, 92.

**Bromobenzene-*p*-sulphonic Acid** (1-*Bromobenzene-4-sulphonic acid*).

Needles. M.p. 102-3°. Deliquescent.

*Me ester*: C<sub>7</sub>H<sub>7</sub>O<sub>3</sub>BrS. MW, 251. M.p. 60°. B.p. 176°/15 mm.

*Et ester*: C<sub>8</sub>H<sub>9</sub>O<sub>3</sub>BrS. MW, 265. M.p. 39.5°. B.p. 182°/15 mm.

*Chloride*: C<sub>6</sub>H<sub>4</sub>O<sub>2</sub>ClBrS. MW, 255.5. Cryst. from Et<sub>2</sub>O. M.p. 75°. B.p. 153°/15 mm.

*Bromide*: C<sub>6</sub>H<sub>4</sub>O<sub>2</sub>Br<sub>2</sub>S. MW, 300. Cryst. from Et<sub>2</sub>O. M.p. 77°. Stable to cold H<sub>2</sub>O.

*Amide*: C<sub>6</sub>H<sub>6</sub>O<sub>2</sub>NBrS. MW, 236. M.p. 166°.

*Anhydride*: C<sub>12</sub>H<sub>8</sub>O<sub>5</sub>Br<sub>2</sub>S<sub>2</sub>. MW, 456. Cryst. from Et<sub>2</sub>O. M.p. 164-7° decomp. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, pet. ether.

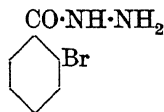
Krafft, Wilke, *Ber.*, 1900, 33, 3208.

Rây, Dey, *J. Chem. Soc.*, 1920, 117, 1405.

**Bromobenzene-2:3:5-tricarboxylic Acid.**

See 6-Bromotrimellitic Acid.

***o*-Bromobenzhydrazide** (2-*Bromobenzoylhydrazine*)



C<sub>7</sub>H<sub>7</sub>ON<sub>2</sub>Br MW, 215

Needles. M.p. 153°. Spar. sol. H<sub>2</sub>O. Cryst. from C<sub>6</sub>H<sub>6</sub>.

Struve, Radenhausen, *J. prakt. Chem.*, 1895, 52, 234.

***m*-Bromobenzhydrazide** (3-*Bromobenzoylhydrazine*).

Needles. M.p. 151°. Sol. EtOH. Spar. sol. hot H<sub>2</sub>O. Insol. Et<sub>2</sub>O, CHCl<sub>3</sub>.

*B, HCl*: m.p. 248°.

*ω*-N-Acetyl: prisms. M.p. 169°. Sol. EtOH.

Curtius, Portner, *J. prakt. Chem.*, 1898, 58, 190.

***p*-Bromobenzhydrazide** (4-*Bromobenzoylhydrazine*).

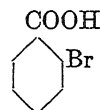
Prisms. M.p. 164°. Sol. EtOH. Spar. sol. hot H<sub>2</sub>O.

*B, HCl*: m.p. 262°.

Curtius, Portner, *J. prakt. Chem.*, 1898, 58, 190.

Kahl, *Chem. Zentr.*, 1904, II, 1493.

***o*-Bromobenzoic Acid**



C<sub>7</sub>H<sub>5</sub>O<sub>2</sub>Br MW, 201

Needles. M.p. 150°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, hot H<sub>2</sub>O. Sublimes.  $k = 1.45 \times 10^{-3}$  at 25°. KOH fusion → salicylic acid.

*Me ester*: C<sub>8</sub>H<sub>7</sub>O<sub>2</sub>Br. MW, 215. B.p. 243-4° (250°), 122°/17 mm.

*Et ester*: C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Br. MW, 229. B.p. 254-5°.

*d-Amyl ester*: C<sub>12</sub>H<sub>15</sub>O<sub>2</sub>Br. MW, 271. B.p. 285-7°/737 mm.  $D^{16}_D$  1.279.  $n_D$  1.5243.  $[\alpha]^{16}_D$  + 2.45°.

*p*-Nitrobenzyl ester: m.p. 109.8°.

*p*-Phenylphenacyl ester: m.p. 98°.

*Anhydride*: C<sub>14</sub>H<sub>8</sub>O<sub>3</sub>Br<sub>2</sub>. MW, 384. Cryst. from Et<sub>2</sub>O. M.p. 75-6°.

*Amide*: see *o*-Bromobenzamide.

*Chloride*: see *o*-Bromobenzoyl chloride.

*Nitrile*: see *o*-Bromobenzonitrile.

*Hydrazide*: see *o*-Bromobenzhydrazide.

Graebe, *Ann.*, 1893, 276, 56.

Holleman, de Bruyn, *Rec. trav. chim.*, 1901, 20, 210.

***m*-Bromobenzoic Acid.**

Needles. M.p. 155°. Distils above 280°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O.  $k = 1.37 \times 10^{-4}$  at 25°. KOH fusion → *m*-hydroxybenzoic acid. Spar. volatile in steam.

*Me ester*: C<sub>8</sub>H<sub>7</sub>O<sub>2</sub>Br. MW, 215. Plates. M.p. 31-2°. B.p. 122-3°/15 mm.

*Et ester*: C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Br. MW, 229. B.p. 254-5°, 133°/15 mm.

*d-Amyl ester*: C<sub>12</sub>H<sub>15</sub>O<sub>2</sub>Br. MW, 271. B.p. 286-9°/737 mm.  $D^{17}_D$  1.285.  $n_D$  1.5243.  $[\alpha]^{16}_D$  + 3.52°.

*Phenyl ester*: C<sub>13</sub>H<sub>9</sub>O<sub>2</sub>Br. MW, 277. Rhombohedra. M.p. 65°.

*o*-Nitrophenyl ester: plates from EtOH. M.p. 105°.

*m*-Nitrophenyl ester: needles from AcOH. M.p. 132°.

*p*-Nitrophenyl ester: needles from AcOH. M.p. 122°.

*p*-Nitrobenzyl ester: cryst. from EtOH. M.p. 105°.

*p*-Phenylphenacyl ester: m.p. 155°.

*Anhydride*: C<sub>14</sub>H<sub>8</sub>O<sub>3</sub>Br<sub>2</sub>. MW, 384. Cryst. M.p. 148-9°. Sol. C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Spar. sol. Et<sub>2</sub>O, ligroin.

*Amide*: see *m*-Bromobenzamide.

*Chloride*: see *m*-Bromobenzoyl chloride.

*Nitrile*: see *m*-Bromobenzonitrile.

*Hydrazide*: see *m*-Bromobenzhydrazide.

Friedländer, Bruckner, Deutsch, *Ann.*, 1912, 388, 33.

Koopal, *Rec. trav. chim.*, 1915, 34, 145.

Holleman, de Bruyn, *Rec. trav. chim.*, 1901, 20, 214.

Varma, Panicker, *J. Indian Chem. Soc.*, 1930, 7, 503.

### p-Bromobenzoic Acid.

Needles or leaflets. M.p. 251–3°. Sol. EtOH, Et<sub>2</sub>O. Mod. sol. hot H<sub>2</sub>O.

*Me ester*: C<sub>8</sub>H<sub>7</sub>O<sub>2</sub>Br. MW, 215. M.p. 81° (79.5°). Sol. EtOH, Et<sub>2</sub>O.

*Et ester*: C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Br. MW, 229. B.p. 262°/737 mm.

*d-Amyl ester*: C<sub>12</sub>H<sub>15</sub>O<sub>2</sub>Br. MW, 271. B.p. 287–90°/724 mm. D<sup>16</sup> 1.2881. n<sub>D</sub> 1.5282. [α]<sub>D</sub><sup>18</sup> + 4.15°.

*Phenyl ester*: C<sub>13</sub>H<sub>9</sub>O<sub>2</sub>Br. MW, 277. M.p. 117°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>.

*p-Nitrobenzyl ester*: needles from EtOH. M.p. 140.5°.

*Phenyl ester*: cryst. from EtOH.Aq. M.p. 87°.

*p-Phenylphenacyl ester*: m.p. 160°.

*Anhydride*: C<sub>14</sub>H<sub>8</sub>O<sub>3</sub>Br<sub>2</sub>. MW, 384. M.p. 218–20° (212–13°). Prac. insol. Et<sub>2</sub>O, AcOH.

*Amide*: see *p*-Bromobenzamide.

*Chloride*: see *p*-Bromobenzoyl chloride.

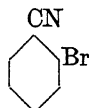
*Nitrile*: see *p*-Bromobenzonitrile.

*Hydrazide*: see *p*-Bromobenzhydrazide.

Conn, Lowy, *Chem. Zentr.*, 1937, II, 2789.

Chiang, Tseng, *Chem. Zentr.*, 1937, I, 3482.

### o-Bromobenzonitrile



C<sub>7</sub>H<sub>4</sub>NBr MW, 182

Needles. M.p. 53°. B.p. 251–3°/754 mm. Sol. EtOH, hot H<sub>2</sub>O. Volatile in steam.

Korczynski, Fandrich, *Compt. rend.*, 1926, 183, 421.

Varma, Sen-Gupta, *J. Indian Chem. Soc.*, 1933, 10, 593.

### m-Bromobenzonitrile.

Cryst. M.p. 38°. B.p. 225°. Sol. EtOH, Et<sub>2</sub>O.

Schöpf, *Ber.*, 1890, 23, 3437.

Reid, *Am. Chem. J.*, 1910, 43, 162.

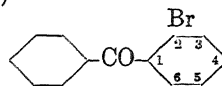
### p-Bromobenzonitrile.

Needles. M.p. 113°. B.p. 235–7°. Sol. EtOH, hot H<sub>2</sub>O. Volatile in steam.

Korczynski, Fandrich, *Compt. rend.*, 1926, 183, 421.

Varma, Sen-Gupta, *J. Indian Chem. Soc.*, 1933, 10, 593.

### 2-Bromobenzophenone (*Phenyl o*-bromophenyl ketone)



C<sub>13</sub>H<sub>9</sub>OBr MW, 261

Prisms. M.p. 42°. B.p. 345°. Sol. EtOH. D<sup>14</sup> 1.517.

*Oxime*: m.p. 133° (125°).

Koopal, *Rec. trav. chim.*, 1915, 34, 115.

### 3-Bromobenzophenone (*Phenyl m*-bromophenyl ketone).

Needles. M.p. 77°. Sol. EtOH.

*syn-Oxime*: α-oxime. Prisms. M.p. 168°.

PCl<sub>5</sub> → benzoyl-*m*-bromoaniline.

*anti-Oxime*: β-oxime. M.p. 134°. PCl<sub>5</sub> → benzoyl-*m*-bromoaniline.

Koopal, *Rec. trav. chim.*, 1915, 34, 115.

### 4-Bromobenzophenone (*Phenyl p*-bromophenyl ketone).

Leaflets. M.p. 82°. B.p. 350°. Mod. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. EtOH, pet. ether.

*α-Oxime*: m.p. 168–70°. PCl<sub>5</sub> → benzoyl-*p*-bromoaniline.

*β-Oxime*: m.p. 110–11°.

*α-Hydrazone*: m.p. 166–7°.

*β-Hydrazone*: m.p. 102–3.5°.

2: 4-*Dinitrophenylhydrazone*: m.p. 207–9°.

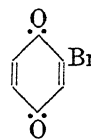
Schäfer, *Ann.*, 1891, 264, 153.

Allen, Allan, *J. Am. Chem. Soc.*, 1944, 66, 7.

### Bromobenzophenone-carboxylic Acid.

See Bromobenzoylbenzoic Acid.

### Bromo-*p*-benzoquinone (*Bromoquinone*)



C<sub>6</sub>H<sub>3</sub>O<sub>2</sub>Br MW, 187

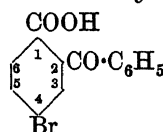
Plates. M.p. 55–6°. Sol. EtOH, Et<sub>2</sub>O, AcOH, CHCl<sub>3</sub>, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>. Mod. sol. pet. ether, hot H<sub>2</sub>O. Sublimes.

1-*Oxime*: 3-bromo-4-nitrosophenol. Orange cryst. M.p. 188° decomp.

4-*Oxime*: 2-bromo-4-nitrosophenol. Pale greenish-yellow plates. M.p. 196°.

Sarauw, *Ann.*, 1881, 209, 106.

### 4-Bromo-o-benzoylbenzoic Acid (5-Bromobenzophenone-2-carboxylic acid)



C<sub>14</sub>H<sub>9</sub>O<sub>3</sub>Br

MW, 305

Needles and plates from MeOH. M.p. 174°.

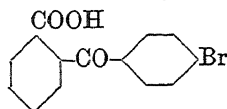
Kohler, Heritage, Burnley, *Am. Chem. J.*, 1910, 44, 74.

**3-(or 6)-Bromo-*o*-benzoylbenzoic Acid**  
(6 or 3)-*Bromobenzophenone-2-carboxylic acid*).

Cryst. from EtOH. M.p. 219–21°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, Me<sub>2</sub>CO. Spar. sol. C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O, ligroin. Conc. H<sub>2</sub>SO<sub>4</sub> at 180° → 1-bromoanthraquinone.

v. Pechmann, *Ber.*, 1879, 12, 2126.

***o*-4-Bromobenzoylbenzoic Acid** (4'-*Bromobenzophenone-2-carboxylic acid*)



C<sub>14</sub>H<sub>9</sub>O<sub>3</sub>Br MW, 305

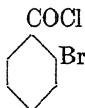
Leaflets from EtOH.Aq. M.p. 173°. Conc. H<sub>2</sub>SO<sub>4</sub> at 160° → 2-bromoanthraquinone.

*Me ester*: m.p. 104°.

*Et ester*: m.p. 83·5°.

Ullmann, Sone, *Ann.*, 1911, 380, 337.

***o*-Bromobenzoyl chloride**



C<sub>7</sub>H<sub>4</sub>OClBr MW, 219·5

Needles. M.p. 11°. B.p. 245°, 125°/20 mm.

Adams, Ulich, *J. Am. Chem. Soc.*, 1920, 42, 599.

Sudborough, *J. Chem. Soc.*, 1895, 67, 589.

***m*-Bromobenzoyl chloride.**

B.p. 243° (239°).

Sudborough, *J. Chem. Soc.*, 1895, 67, 590.

***p*-Bromobenzoyl chloride.**

Needles. M.p. 42°. B.p. 245–7° slight decomp., 181–2°/125 mm. Sol. C<sub>6</sub>H<sub>6</sub>, ligroin.

Adams, Ulich, *J. Am. Chem. Soc.*, 1920, 42, 599.

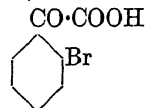
Carré, Libermann, *Compt. rend.*, 1934, 199, 1422.

Sudborough, *J. Chem. Soc.*, 1895, 67, 591.

**Bromobenzoyl cyanide.**

See under Bromobenzoylformic Acid.

***o*-Bromobenzoylformic Acid** (2-*Bromophenylglyoxylic acid*)



C<sub>8</sub>H<sub>5</sub>O<sub>3</sub>Br MW, 229

Cryst. M.p. 93–103°.

*Amide*: C<sub>8</sub>H<sub>6</sub>O<sub>2</sub>NBr. MW, 228. Cryst. from H<sub>2</sub>O. M.p. 136–7°.

*Nitrile*: 2-bromobenzoyl cyanide, C<sub>8</sub>H<sub>4</sub>ONBr. MW, 210. Yellow prisms. M.p. 62–4°.

*Oxime*: m.p. 162–4° decomp.

Russanow, *Ber.*, 1892, 25, 3298.

***p*-Bromobenzoylformic Acid** (4-*Bromophenylglyoxylic acid*).

Leaflets. M.p. 108°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Spar. sol. CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>.

*Amide*: m.p. 128–9°.

*Nitrile*: 4-bromobenzoyl cyanide. M.p. 65–6°.

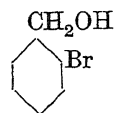
*Oxime*: m.p. 162–3°.

Wislicenus, Elvert, *Ber.*, 1908, 41, 4133.

**Bromobenzoylhydrazine.**

See Bromobenzhydrazide.

***o*-Bromobenzyl Alcohol.**



C<sub>7</sub>H<sub>7</sub>OBr MW, 187

Needles. M.p. 80°. Sol. EtOH, Et<sub>2</sub>O. Mod. sol. hot H<sub>2</sub>O, hot ligroin. Volatile in steam. KMnO<sub>4</sub> → *o*-bromobenzoic acid.

Mettler, *Ber.*, 1906, 39, 2938.

Bodroux, *Bull. soc. chim.*, 1899, 21, 289.

***m*-Bromobenzyl Alcohol.**

B.p. 252–3°/711 mm.

*Et ether*: C<sub>9</sub>H<sub>11</sub>OBr. MW, 215. B.p. 237°.

Mettler, *Ber.*, 1905, 38, 1749.

***p*-Bromobenzyl Alcohol.**

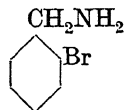
Needles. M.p. 77°. Sol. EtOH, Et<sub>2</sub>O, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>. Prac. insol. cold H<sub>2</sub>O. Volatile in steam.

*Acetyl*: prisms. M.p. 32°. B.p. 260–3°.

*Et ether*: b.p. 243°/729 mm.

Wallach, Carothers, Adams, *J. Am. Chem. Soc.*, 1924, 46, 1675.

***o*-Bromobenzylamine**



C<sub>7</sub>H<sub>8</sub>NBr MW, 186

B.p. 118°/9 mm. Sol. Et<sub>2</sub>O. Insol. H<sub>2</sub>O. Absorbs CO<sub>2</sub> from the air.

*B.HCl*: m.p. 241–2° (208°).

*Carbonate*: m.p. 95°. Sol. H<sub>2</sub>O, EtOH.

Rupe, Bernstein, *Helv. Chim. Acta*, 1930, 13, 465.

***m*-Bromobenzylamine.**

B.p. 244–5°, 84°/14 mm. Absorbs CO<sub>2</sub>.

*B.HCl*: m.p. 218·5°.

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 251° decomp.



Benzoate : m.p. 135·5°.

Picrate : m.p. 205° decomp.

Kindler, *Chem. Zentr.*, 1927, II, 574.

Rupe, Bernstein, *Helv. Chim. Acta*, 1930, 13, 466.

**p-Bromobenzylamine.**

M.p. 20°. B.p. 250°, 126-7°/15 mm. Volatile in steam. Absorbs CO<sub>2</sub> from the air.

B.HCl : m.p. 279°.

Carbonate : m.p. 132°. Sol. H<sub>2</sub>O, EtOH.

Benzoate : m.p. 162°.

N-Acetyl : cryst. from ligroin. M.p. 113°.

N-Benzoyl : m.p. 143°.

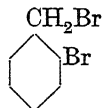
Picrate : m.p. 221°.

v. Braun, Kuhn, Weismantel, *Ann.*, 1926, 449, 249.

Kindler, *Chem. Zentr.*, 1927, II, 574.

Rupe, Bernstein, *Helv. Chim. Acta*, 1930, 13, 466.

**o-Bromobenzyl bromide (2 : ω-Dibromotoluene)**



C<sub>7</sub>H<sub>6</sub>Br<sub>2</sub> MW, 250

Cryst. M.p. 31°. Decomp on dist. Misc. with EtOH, Et<sub>2</sub>O, AcOH, CS<sub>2</sub>. Volatile in steam.

Shoemith, Slater, *J. Chem. Soc.*, 1926, 214.

**m-Bromobenzyl bromide (3 : ω-Dibromotoluene).**

Leaflets. M.p. 41°. Sol. Et<sub>2</sub>O, AcOH, CS<sub>2</sub>. Mod. sol. EtOH. Spar. volatile in steam.

Shoemith, Slater, *J. Chem. Soc.*, 1926, 214.

**p-Bromobenzyl bromide (4 : ω-Dibromotoluene).**

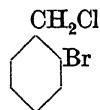
Needles. M.p. 63°. Sol. Et<sub>2</sub>O, AcOH, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>, hot EtOH. Spar. sol. H<sub>2</sub>O. Sublimes. Volatile in steam. CrO<sub>3</sub> → p-bromobenzoic acid. Alc. KOH → p-bromobenzoic acid + p-bromobenzyl alcohol.

Pajeau, *Compt. rend.*, 1937, 204, 1203.

Shoemith, Slater, *J. Chem. Soc.*, 1926, 214.

Weizmann, Patai, *J. Am. Chem. Soc.*, 1946, 68, 150.

**o-Bromobenzyl chloride (ω-Chloro-2-bromotoluene)**



C<sub>7</sub>H<sub>6</sub>ClBr MW, 205·5

B.p. 124-6°/20 mm.

Jacobs, Heidelberger, *J. Biol. Chem.*, 1915, 20, 659.

**m-Bromobenzyl chloride (ω-Chloro-3-bromotoluene).**

M.p. 22-3°. B.p. 119°/18 mm.

Olivier, *Rec. trav. chim.*, 1922, 41, 646.

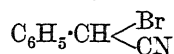
**p-Bromobenzyl chloride (ω-Chloro-4-bromotoluene).**

Needles from EtOH or pet. ether. M.p. 50°. B.p. 238°. Sol. hot EtOH.

Dippy, Williams, *J. Chem. Soc.*, 1934, 164.

Quelet, *Bull. soc. chim.*, 1927, 41, 329.

**α-Bromobenzyl cyanide (B.B.C., Camite, α-bromophenylacetoneitrile, α-bromo-α-tolunitrile)**



C<sub>8</sub>H<sub>6</sub>NBr MW, 196

M.p. 29°. B.p. 242° decomp., 132-34°/12 mm. Insol. H<sub>2</sub>O. Sol. most org. solvents. Sp. gr. 1·539. Boil. alc. KOH → diphenylmaleic acid. Powerful lachrymator.

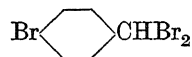
Steinkopf *et al.*, *Ber.*, 1920, 53, 1146.

Nekrassov, *J. prakt. Chem.*, 1928, 119, 108.

**Bromobenzyl cyanide.**

See also under Bromophenylacetic Acid.

**p-Bromobenzylidene bromide (p-Bromobenzal bromide, 4 : ω : ω-tribromotoluene)**

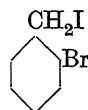


C<sub>7</sub>H<sub>5</sub>Br<sub>3</sub> MW, 329

B.p. 170-1°/19 mm.

Pajeau, *Comp. rend.*, 1937, 204, 1202.

**o-Bromobenzyl iodide (ω-Iodo-2-bromotoluene)**



C<sub>7</sub>H<sub>6</sub>BrI MW, 297

Needles. M.p. 47°.

Shoemith, Slater, *J. Chem. Soc.*, 1926, 214.

**m-Bromobenzyl iodide (ω-Iodo-3-bromotoluene).**

Prisms. M.p. 42°.

Shoemith, Slater, *J. Chem. Soc.*, 1926, 214.

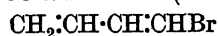
**p-Bromobenzyl iodide (ω-Iodo-4-bromotoluene).**

Needles. M.p. 80-1° (73°).

Hantzsch, Schultze, *Ber.*, 1896, 29, 2253.

Shoemith, Slater, *J. Chem. Soc.*, 1926, 214.

**1-Bromo-1 : 3-butadiene (1-Bromoerythrene)**



C<sub>4</sub>H<sub>5</sub>Br MW, 133

Colourless, volatile liq. B.p. 92-4°.  $D_4^{25}$  1.416. Misc. with EtOH, Et<sub>2</sub>O, pet. ether. Turns brown on standing.

Willstätter, Bruce, *Ber.*, 1907, 40, 3994.

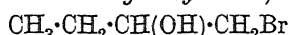
### 2-Bromo-1 : 3-butadiene.

See Bromoprene.

### Bromobutane.

See Butyl bromide.

**1-Bromo-sec.-n-butyl Alcohol** (1-Bromobutanol-2, 1-bromo-2-hydroxybutane)



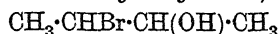
$\text{C}_4\text{H}_9\text{OBr}$  MW, 153

B.p. 61-3°/12 mm., 56-8°/11 mm.  $[\alpha]_D^{25}$  -11.8°.

Montmollin, Matile, *Helv. Chim. Acta*, 1924, 7, 108.

Levene, Walti, *J. Biol. Chem.*, 1931, 94, 367.

**3-Bromo-sec.-n-butyl Alcohol** (3-Bromobutanol-2, 3-bromo-2-hydroxybutane)



$\text{C}_4\text{H}_9\text{OBr}$  MW, 153

B.p. 154°/760 mm., 70-1°/23 mm., 46-50°/8 mm.  $D_4^{25}$  1.5016,  $D_{20}^{25}$  1.4500.  $n_D^{25}$  1.4780.  $[\alpha]_D^{25}$  +8.05°.

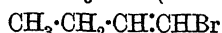
*Benzoyl*: b.p. 140-1°/4 mm.

Cottle, Powell, *J. Am. Chem. Soc.*, 1936, 58, 2270.

Levene, Walti, *J. Biol. Chem.*, 1928, 76, 415.

Fourneau, Puyal, *Bull. soc. chim.*, 1922, 31, 427.

**1-Bromo-1-butylene** (1-Bromobutene-1)



$\text{C}_4\text{H}_7\text{Br}$  MW, 135

*Cis*:

B.p. 86.15°.  $D_4^{15}$  1.3265.  $n_D^{20}$  1.4536.

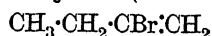
*Trans*:

B.p. 94.7°.  $D_4^{15}$  1.3275.

Lépingle, *Bull. soc. chim.*, 1926, 39, 741, 864.

Bachmann, *J. Am. Chem. Soc.*, 1933, 55, 4279.

**2-Bromo-1-butylene** (2-Bromobutene-1)



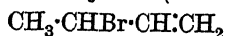
$\text{C}_4\text{H}_7\text{Br}$  MW, 135

B.p. 88° (81°).  $D_4^{15}$  1.3209.  $n_D^{20}$  1.4527. HBr → 1 : 2-dibromobutane.

Lépingle, *Bull. soc. chim.*, 1926, 39, 741.

Kirrmann, *Bull. soc. chim.*, 1927, 41, 316.

**3-Bromo-1-butylene** (3-Bromobutene-1)



$\text{C}_4\text{H}_7\text{Br}$  MW, 135

B.p. 7°/10 mm.  $D_4^{25}$  1.2998.  $n_D^{20}$  1.4618.

Kharasch, Margolis, Mayo, *J. Org. Chem.*, 1936, 1, 393.

**4-Bromo-1-butylene** (4-Bromobutene-1)



$\text{C}_4\text{H}_7\text{Br}$  MW, 135

B.p. 98.5-99°/758 mm., 25°/40.5 mm. Insol. H<sub>2</sub>O.  $D_4^{20}$  1.3230.  $n_D^{20}$  1.46215.

Juvala, *Ber.*, 1930, 63, 1992.

**1-Bromo-2-butylene** (1-Bromobutene-2, *crotyl bromide*)



$\text{C}_4\text{H}_7\text{Br}$  MW, 135

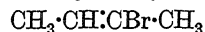
B.p. 103-6°, 13°/10 mm.  $D_4^{25}$  1.3371.  $n_D^{20}$  1.4822.

Claisen, Tietze, *Ber.*, 1926, 59, 2344.

I.G., D.R.P., 522,650, (*Chem. Abstracts*, 1931, 25, 3672).

Kharasch, Margolis, Mayo, *J. Org. Chem.*, 1936, 1, 393.

**2-Bromo-2-butylene** (2-Bromobutene-2)



$\text{C}_4\text{H}_7\text{Br}$  MW, 135

*Cis*:

B.p. 94.8° (93.9°).  $D_D^{18}$  1.3416.  $n_D^{23}$  1.4596.

*Trans*:

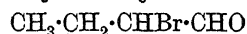
B.p. 85.8° (81.0°).  $D_4^{15}$  1.3323.

Lépingle, *Bull. soc. chim.*, 1926, 39, 741.

Timmermans, *Bull. soc. chim. Belg.*, 1927, 36, 502.

Gredy, *Bull. soc. chim.*, 1935, 2, 1038.

**1-Bromobutyraldehyde**

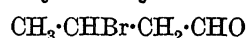


$\text{C}_4\text{H}_7\text{OBr}$  MW, 151

B.p. 33°/17 mm.  $D^{20}$  1.469.  $n_D^{20}$  1.4683. Lachrymatory.

Kirrmann, *Ann. chim.*, 1929, 11, 268.

**2-Bromobutyraldehyde**



$\text{C}_4\text{H}_7\text{OBr}$  MW, 151

B.p. 42-4°/12 mm.

*Di-Et acetal*: b.p. 82-5°/12-15 mm.

*Trimer*: needles from ligroin. M.p. 98°.

Lespieau, Wakeman, *Compt. rend.*, 1931, 192, 1572.

Baker, Burton, *J. Chem. Soc.*, 1933, 818.

**1-Bromobutyric Acid**



$\text{C}_4\text{H}_7\text{O}_2\text{Br}$  MW, 167

*dl*.

M.p. -4°. B.p. 181°/250 mm., 127°/25 mm. Sol. 15 parts cold H<sub>2</sub>O.  $D_{20}^{20}$  1.567.  $k = 1.06 \times 10^{-3}$  at 25°.

*Me ester*:  $C_5H_9O_2Br$ . MW, 181. B.p. 165–72°.

*Et ester*:  $C_6H_{11}O_2Br$ . MW, 195. B.p. 177–8° slight decomp., 140°/250 mm.  $D_{20}^{25}$  1.3297.

*n-Propyl ester*:  $C_7H_{13}O_2Br$ . MW, 209. B.p. 190.5–194°.

*Isopropyl ester*: b.p. 179–82°.

*Allyl ester*:  $C_7H_{11}O_2Br$ . MW, 207. B.p. 189–193°.

*Phenyl ester*:  $C_{10}H_{11}O_2Br$ . MW, 243. B.p. 263–4°, 157°/31 mm.  $D_{15}^{15}$  1.373.

*o-Nitrophenyl ester*:  $C_{10}H_{10}O_4NBr$ . MW, 288. B.p. 187°/10 mm.

*m-Nitrophenyl ester*: b.p. 247°/100 mm.

*p-Nitrophenyl ester*: m.p. 48–9°.

*Guaiacol ester*:  $C_{11}H_{13}O_3Br$ . MW, 273. B.p. 159°/15 mm.

*o-Tolyl ester*:  $C_{11}H_{13}O_2Br$ . MW, 257. B.p. 139.5°/12 mm.

*m-Tolyl ester*: b.p. 144°/12 mm.

*p-Tolyl ester*: b.p. 148.5°/12 mm.

*1-Naphthyl ester*:  $C_{14}H_{13}O_2Br$ . MW, 293. B.p. 198°/15 mm.

*2-Naphthyl ester*: m.p. 54°. B.p. 202°/15 mm.

*Chloride*:  $C_4H_6OClBr$ . MW, 185.5. B.p. 150–2°, 43°/12 mm.

*Bromide*:  $C_4H_6OBr_2$ . MW, 230. B.p. 172–4°.

*Anhydride*:  $C_5H_{12}O_3Br_2$ . MW, 316. B.p. 148–52°/10 mm.

*Amide*:  $C_4H_8ONBr$ . MW, 166. M.p. 112° (108°).

*d.*

B.p. 83–5°/0.5 mm.  $[\alpha]_D^{20} + 15.43°$ .

*Isobutyl ester*:  $C_8H_{15}O_2Br$ . MW, 223. B.p. 205°.  $D_{25}^{25}$  1.216.  $n_D^{25}$  1.4483.  $[\alpha]_D + 6.7°$ .

*Chloride*: b.p. 65–9°/15 mm., 34–6°/2.5 mm.

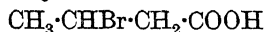
*l.*

$[\alpha]_D^{16} - 34.4°$  in  $CHCl_3$ .

Fischer, Mouneyrat, *Ber.*, 1900, 33, 2387.  
Abderhalden, Chang, *Z. physiol. Chem.*, 1912, 77, 474.

Ahlberg, *J. prakt. Chem.*, 1933, 135, 335.

## 2-Bromobutyric Acid



$C_4H_7O_2Br$  MW, 167

M.p. 20°. B.p. 122°/16 mm. KOH.Aq. → crotonic acid.

*Et ester*:  $C_6H_{11}O_2Br$ . MW, 195. B.p. 183–4°, 41–2°/2 mm.  $D_{25}^{25}$  1.3103.  $n_D^{25}$  1.4445.

*Isoamyl ester*: b.p. 105–111°/13 mm.

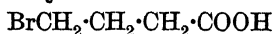
*Amide*:  $C_4H_8ONBr$ . MW, 166. M.p. 92–3°.

Brulé, *Bull. soc. chim.*, 1909, 5, 1019.

Madsen, *Z. physik. Chem.*, 1917, 92, 98.

Lovén, Johansson, *Ber.*, 1915, 48, 1256.

## 3-Bromobutyric Acid



$C_4H_7O_2Br$  MW, 167

M.p. 33°.  $k = 2.6 \times 10^{-5}$  at 25°.

*Me ester*:  $C_5H_9O_2Br$ . MW, 181. B.p. 186–7°.

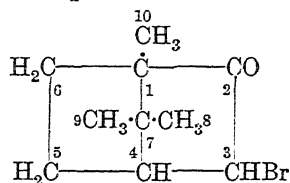
*Et ester*: b.p. 196–7°, 104–5°/28 mm.  $D_{25}^{25}$  1.3531.  $n_D^{25}$  1.4539.

*Nitrile*:  $C_4H_6NBr$ . MW, 148. B.p. 91°/12 mm.

Henry, *Bull. soc. chim.*, 1886, 46, 65.

Derick, Hess, *J. Am. Chem. Soc.*, 1918, 40, 546.

## 3-Bromocamphor



$C_{10}H_{15}OBr$  MW, 231

$\alpha$ -Bromocamphor:

Monoclinic cryst. M.p. 76°. B.p. 274° slight decomp. Very sol. hot EtOH. Sol.  $Et_2O$ ,  $CHCl_3$ ,  $CCl_4$ ,  $C_6H_6$ . Sublimes above m.p.  $[\alpha]_{5461} + 165°$ ,  $[\alpha]_{50}^{20} + 134°$ . Triboluminescent.

$\alpha'$ -Bromocamphor:

Needles. M.p. 78°.  $[\alpha]_{5461} - 40°$ .

Lowry, Steele, Burgess, *J. Chem. Soc.*, 1922, 121, 633.

Chemnitius, *Pharm. Zentralhalle*, 1928, 69, 305.

Nikon, Syono K.K., *Jap. P.*, 92,929, (*Chem. Abstracts*, 1932, 26, 4069).

**5-Bromocamphor** ( $\beta$ -*Pericyclocamphanone hydrobromide*).

M.p. 114°. Sol. most org. solvents. Insol.  $H_2O$ .  $[\alpha]_D^{15} + 13.23°$ .

Bredt, Holz, *J. prakt. Chem.*, 1917, 95, 133.

## 8-Bromocamphor ( $\pi$ -Bromocamphor)

*d.*

Prisms from ligroin. M.p. 93°. Sol. usual solvents.  $[\alpha]_D^{19} + 122.2°$  in  $CHCl_3$ . Sublimes. Volatile in steam.

*Oxime*: needles from EtOH.Aq. M.p. 124.5°. Sol.  $CHCl_3$ , AcOEt,  $C_6H_6$ .

Sahashi, Takeuchi, Shimamoto, Iki, Takebe, *Chem. Abstracts*, 1935, 29, 1083.

**10-Bromocamphor** ( $\omega$ -Bromocamphor,  $\beta$ -bromocamphor).

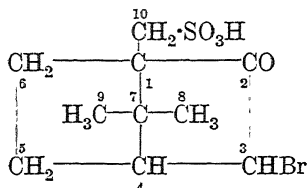
*d.*

Prisms from pet. ether. M.p. 78°. Very sol.  $CHCl_3$ , AcOH,  $C_6H_6$ , hot EtOH.  $[\alpha]_D + 19.2°$  in EtOH. Volatile in steam.

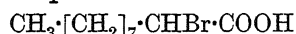
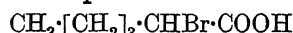
*Oxime*: leaflets from EtOH. M.p. 156°.  $[\alpha]_D^{25} - 73.5°$  in  $CHCl_3$ .

*dl.*

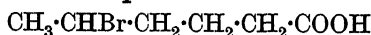
Cryst. M.p. 76–7°.

Lipp, Lausberg, *Ann.*, 1924, 436, 274.Qvist, *Chem. Abstracts*, 1930, 24, 1636.**3-Bromo-*d*-camphor-10-sulphonic Acid**  
(*α*-Bromo-*d*-camphor- $\beta$ -sulphonic acid) $C_{10}H_{15}O_4BrS$  MW, 311Prisms + 3H<sub>2</sub>O from H<sub>2</sub>O. M.p. 47·5°. Sol. H<sub>2</sub>O and most org. solvents.  $[\alpha]_D^{20} + 98\cdot3^\circ$  in H<sub>2</sub>O.*NH*<sub>4</sub> salt: m.p. anhyd. 228°.  $[\alpha]_D$  (dihydrate) + 83·5° in H<sub>2</sub>O.*Ca* salt: plates + 6H<sub>2</sub>O from H<sub>2</sub>O.  $[\alpha]_D$  (anhyd.) + 92·3° in H<sub>2</sub>O.*Me* ester:  $C_{11}H_{17}O_4BrS$ . MW, 325. M.p. 64°.  $[\alpha]_D^{16} + 141^\circ$  in CHCl<sub>3</sub>.*Et* ester:  $C_{12}H_{19}O_4BrS$ . MW, 339. M.p. 61°.  $[\alpha]_D^{18} + 140^\circ$  in CHCl<sub>3</sub>.*Chloride*:  $C_{10}H_{14}O_3ClBrS$ . MW, 329·5. Prisms from Et<sub>2</sub>O or C<sub>6</sub>H<sub>6</sub>. M.p. 65°.  $[\alpha]_D^{15} + 104^\circ$  in CHCl<sub>3</sub>.*Bromide*:  $C_{10}H_{14}O_3Br_2S$ . MW, 374. M.p. 61°.  $[\alpha]_D^{12} + 119^\circ$  in CHCl<sub>3</sub>.*Amide*:  $C_{10}H_{16}O_3NBrS$ . MW, 310. Needles from H<sub>2</sub>O. M.p. 156°.  $[\alpha]_D^{17} + 106^\circ$  in Me<sub>2</sub>CO.Armstrong, Lowry, *J. Chem. Soc.*, 1902, 81, 1451.Pope, Read, *J. Chem. Soc.*, 1914, 105, 801, 805.Patterson, Loudon, *J. Chem. Soc.*, 1932, 1725.**10-Bromocamphor-3-sulphonic Acid** ( $\beta$ -Bromocamphor- $\alpha$ -sulphonic acid).*Ca* salt: rhombic plates + 4H<sub>2</sub>O.  $[\alpha]_{54} + 59^\circ$  in H<sub>2</sub>O.*Chloride*: m.p. 97°.*Amide*: m.p. 100–102°.Burgess, Lowry, *J. Chem. Soc.*, 1925, 127, 271.**3-Bromocamphor-8-sulphonic Acid** ( $\alpha$ -Bromocamphor- $\pi$ -sulphonic acid).*d.*  $\alpha$ -Bromo-*d*-camphor- $\pi$ -sulphonic acid. Pyramids + H<sub>2</sub>O from H<sub>2</sub>O. M.p. anhyd. 195–96°. Sol. EtOH.  $[\alpha]_D^{14} + 88\cdot3^\circ$  in H<sub>2</sub>O.*NH*<sub>4</sub> salt: prisms from H<sub>2</sub>O. M.p. 270° decomp.  $[\alpha]_D^{10} + 84\cdot8^\circ$  in H<sub>2</sub>O.*Na* salt: plates + 5H<sub>2</sub>O from H<sub>2</sub>O. M.p. 52°.  $[\alpha]_D^{10} + 80\cdot2^\circ$  in H<sub>2</sub>O.*K* salt: plates + 1½H<sub>2</sub>O from H<sub>2</sub>O.  $[\alpha]_D^{10} + 80^\circ$  in H<sub>2</sub>O.*Chloride*: m.p. 136–7°.  $[\alpha]_D^{14} + 131^\circ$  in CHCl<sub>3</sub>.*Bromide*: pyramids from CHCl<sub>3</sub> or AcOEt. Decomp. at 137°.  $[\alpha]_D^{13} + 143^\circ$  in CHCl<sub>3</sub>.*Amide*: prisms from EtOH. Needles from H<sub>2</sub>O. M.p. 145°.  $[\alpha]_D^{11} + 112\cdot4^\circ$  in EtOH.Kipping, Pope, *J. Chem. Soc.*, 1895, 67, 356; 1893, 63, 577, 583.Pope, Peachey, *J. Chem. Soc.*, 1898, 73, 895.Kipping, *J. Chem. Soc.*, 1905, 87, 628.Regler, Hein, *J. prakt. Chem.*, 1937, 148, 1.*l.*  $\alpha$ -Bromo-*l*-camphor- $\pi$ -sulphonic acid.*NH*<sub>4</sub> salt:  $[\alpha]_D^{18} - 84\cdot2^\circ$  in H<sub>2</sub>O.Pope, Harvey, *J. Chem. Soc.*, 1901, 79, 76.*dl.*

M.p. 250–54° decomp.

Ingersoll, Babcock, *J. Am. Chem. Soc.*, 1933, 55, 341.**1-Bromocaproic Acid** $C_{10}H_{19}O_2Br$  MW, 251M.p. 4°. Sol. Et<sub>2</sub>O.*Et* ester:  $C_{12}H_{23}O_2Br$ . MW, 279. B.p. 163–4°/21 mm.Bagard, *Bull. soc. chim.*, 1907, 1, 310, 348.**1-Bromo-*n*-caproic Acid** $C_6H_{11}O_2Br$  MW, 195*dl.*

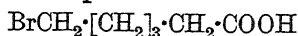
B.p. 148–53°/30 mm., 128–36°/17 mm.

*Et* ester:  $C_8H_{15}O_2Br$ . MW, 223. B.p. 205–10°, 99–102°/32 mm. (103°/11 mm.)*l.*B.p. 106–7°/4 mm.  $[\alpha]_D^{20} - 37\cdot97^\circ$ ,  $[M]_D^{25} - 71\cdot4^\circ$ .*Me* ester:  $C_7H_{13}O_2Br$ . MW, 209.  $[M]_D^{25} - 104^\circ$ .Clark, Taylor, *Organic Syntheses*, Collective Vol. I, 108.Levene, Mardashew, *J. Biol. Chem.*, 1937, 117, 707.**2-Bromo-*n*-caproic Acid** $C_6H_{11}O_2Br$  MW, 195Needles. M.p. 35°. Sol. CHCl<sub>3</sub>, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>, ligroin.Fittig, Baker, *Ann.*, 1894, 283, 122.**4-Bromo-*n*-caproic Acid** $C_6H_{11}O_2Br$  MW, 195

*Et ester*:  $C_8H_{15}O_2Br$ . MW, 223. B.p. 121–2°/21 mm., 69–71°/3 mm.  $D_{25}^{25}$  1.1943.  $n_D^{25}$  1.4525.

Linstead, Rydon, *J. Chem. Soc.*, 1934, 2000.

Lease, McElvain, *J. Am. Chem. Soc.*, 1933, 55, 808.

5-Bromo-*n*-caproic Acid

$C_6H_{11}O_2Br$  MW, 195

B.p. 165–70°/20 mm.

*Et ester*:  $C_8H_{15}O_2Br$ . MW, 223. B.p. 126–7°/21 mm,  $n_D^{21}$  1.4566.  $D_{23}^{23}$  1.241.

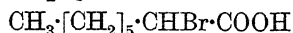
Marvel, MacCorquodale, Kendall, Lazier, *J. Am. Chem. Soc.*, 1924, 46, 2838.

Barger, Robinson, Smith, *J. Chem. Soc.*, 1937, 721.

Mitter, Mukherjee, *J. Indian Chem. Soc.*, 1942, 19, 303.

Brown, Partridge, *J. Am. Chem. Soc.*, 1944, 66, 839.

## 1-Bromocaprylic Acid



$C_8H_{15}O_2Br$  MW, 223

B.p. 118–21°/0.5 mm.

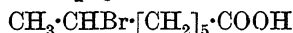
*Et ester*:  $C_{10}H_{19}O_2Br$ . MW, 251. B.p. 245–7°, 137–40°/25 mm.

*Chloride*:  $C_8H_{14}OClBr$ . MW, 241.5. B.p. 112–14°/15 mm.

Braun, Anton, Fischer, Keller, Manz, *Ber.*, 1934, 67, 224.

Bernhard, Lincke, *Helv. Chim. Acta*, 1946, 29, 1457.

## 6-Bromocaprylic Acid



$C_8H_{15}O_2Br$  MW, 223

*Et ester*: b.p. 95–6°/2 mm.  $D_{25}^{25}$  1.1660.  $n_D^{25}$  1.4564.

Lease, McElvain, *J. Am. Chem. Soc.*, 1933, 55, 808.

## 7-Bromocaprylic Acid



$C_8H_{15}O_2Br$  MW, 223

Needles from pet. ether. M.p. 38.5–39°.

B.p. 147–50°/2 mm. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. pet. ether.

*Me ester*: b.p. 124°/6 mm.

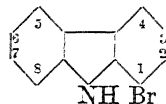
*Et ester*: b.p. 120–3°/3 mm.

Chuit, Hausser, *Helv. Chim. Acta*, 1929, 12, 466.

Hunsdiecker, Hunsdiecker, *Ber.*, 1942, 75, 291.

Baudart, *Chem. Abstracts*, 1946, 40, 5398.

## 1-Bromocarbazole



$C_{12}H_8NBr$

MW, 246

M.p. 111–12°.

Barclay, Campbell, *J. Chem. Soc.*, 1945, 530.

## 2-Bromocarbazole.

M.p. 250–1°.

Barclay, Campbell, *J. Chem. Soc.*, 1945, 530.

## 3-Bromocarbazole.

Plates from EtOH. M.p. 199°. B.p. 160°/6 mm.

*N-Acetyl*: leaflets from EtOH. M.p. 128°. Spar. sol. Et<sub>2</sub>O.

*N-Benzoyl*: yellow prisms from C<sub>6</sub>H<sub>6</sub>. M.p. 124–5°.

Tucker, *J. Chem. Soc.*, 1924, 125, 1146.

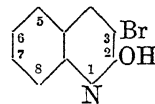
Ciamician, Silber, *Gazz. chim. ital.*, 1882, 12, 276.

## 4-Bromocarbazole.

M.p. 104–5°.

Barclay, Campbell, *J. Chem. Soc.*, 1945, 530.

**3-Bromocarbostryril** (*3-Bromo-2-hydroxyquinoline*: cf. formulæ under Carbostryril)



$C_9H_8ONBr$

MW, 224

Prisms. M.p. 253°. Sol. hot EtOH, hot C<sub>6</sub>H<sub>6</sub>. Sublimes.

Decker, *J. prakt. Chem.*, 1892, 45, 49.

## 4-Bromocarbostryril.

Needles. M.p. 266°. Cryst. from EtOH. Sublimes.

*Me ether*:  $C_{10}H_8ONBr$ . MW, 238. M.p. 93°. Sol. EtOH.

Baeyer, Bloem, *Ber.*, 1882, 15, 2149.

## 5-Bromocarbostryril.

Needles from EtOH. M.p. 300°. Spar. sol. EtOH.

Welter, *J. prakt. Chem.*, 1891, 43, 503.

## 6-Bromocarbostryril.

Yellow needles. M.p. 269°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, AcOH.

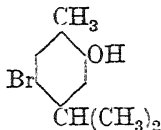
Welter, *J. prakt. Chem.*, 1891, 43, 503.

## 7-Bromocarbostryril.

Needles. M.p. 228°. Spar. sol. EtOH. Sublimes.

Welter, *J. prakt. Chem.*, 1891, 43, 503.

## 5-Bromocarvacrol



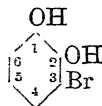
$C_{10}H_{13}OBr$  MW, 229

Cryst. from ligroin. M.p. 46°. B.p. 162-3°/12 mm.

*Me ether*:  $C_{11}H_{15}OBr$ . MW, 243. B.p. 147-50°/15 mm.

Wallach, Neumann, *Ber.*, 1895, 28, 1664.  
Mazzara, *Gazz. chim. ital.*, 1886, 16, 194.

## 3-Bromocatechol (3-Bromo-1:2-dihydroxybenzene)



$C_6H_5O_2Br$  MW, 189

*1-Me ether*: 3-bromoguaiacol.  $C_7H_7O_2Br$ . MW, 203. Cryst. from MeOH. M.p. 63°.

*Di-Me ether*: 3-bromoveratrol.  $C_8H_9O_2Br$ . MW, 217. B.p. 114°/5 mm.

Robertson, *J. Chem. Soc.*, 1908, 93, 792.  
Simonsen, Rau, *J. Chem. Soc.*, 1918, 113, 785.

## 4-Bromocatechol (4-Bromo-1:2-dihydroxybenzene)

Prisms. M.p. 87°. Sol.  $H_2O$ , EtOH,  $C_6H_6$ . Spar. sol. pet. ether. Reduces  $NH_3 \cdot AgNO_3$ .  $FeCl_3 \rightarrow$  blue col.

*1-Me ether*: 4-bromoguaiacol. Prisms from pet. ether. M.p. 65°. B.p. 150°/20 mm. Sol. most org. solvents. Spar. sol.  $H_2O$ . *Acetyl*: leaflets from pet. ether. M.p. 63-5°. B.p. 164-5°/22 mm.

*2-Me ether*: 5-bromoguaiacol. Needles. M.p. 46°. B.p. 181-2°/60 mm.

*Di-Me ether*: 4-bromoveratrol. B.p. 255-6° (250-4°), 157-8°/30 mm.

*1-Me-2-Et ether*:  $C_9H_{11}O_2Br$ . MW, 231. Needles from EtOH.Aq. M.p. 58-60°.

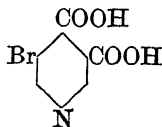
*Dibenzoyl*: m.p. 111°.

Rosenmund, Kuhnenn, *Ber.*, 1923, 56, 1262.

Hindmarsh, Knight, Robinson, *J. Chem. Soc.*, 1917, 111, 941.

Buu-Hoi, *Ann.*, 1944, 556, 1.

## 5-Bromocinchomeronic Acid (5-Bromopyridine-3:4-dicarboxylic acid)



$C_7H_4O_4NBr$  MW, 246

Cryst. from  $H_2O$ . M.p. 237°.

*Di-Me ester*: m.p. 75.5-76.5°.

Edinger, Bössung, *J. prakt. Chem.*, 1891, 43, 194.

 $\alpha$ -Bromocinnamaldehyde (1-Bromo-2-phenylacrylic aldehyde)

$C_6H_5 \cdot CH : CBr \cdot CHO$

$C_9H_7OBr$  MW, 211

M.p. 72-3°. B.p. 148-9°/10 mm. Cryst. from EtOH or  $Et_2O$ .  $CrO_3$  in AcOH  $\rightarrow$   $\alpha$ -bromocinnamic acid.

*Oxime*: pearly cryst. M.p. 135-6°.

*Phenylhydrazone*: m.p. 129-30°.

*Di-Me acetal*: b.p. 161-2°/15 mm.  $D^{15}_4$  1.358.

*Di-Et acetal*: b.p. 170-1°/15 mm., 146.9°/5 mm.  $D^{15}_4$  1.266.

Straus, *Ber.*, 1909, 42, 2876.

Auwers, Seyfried, *Ann.*, 1930, 484, 222.

Allen, Edens, *Organic Syntheses*, 1945, XXV, 92.

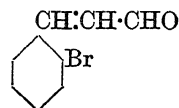
 $\beta$ -Bromocinnamaldehyde (2-Bromo-2-phenylacrylic aldehyde)

$C_6H_5 \cdot CBr : CH \cdot CHO$

$C_9H_7OBr$  MW, 211

B.p. 144-6°/12 mm.  $D^{20}_4$  1.492.  $n^{25}_D$  1.63884. Loses HBr slowly in air.

Auwers, Seyfried, *Ann.*, 1930, 484, 231.

*o*-Bromocinnamaldehyde (*o*-Bromophenylacrylic aldehyde)

$C_9H_7OBr$  MW, 211

Cryst. M.p. 67°. B.p. 160°/14 mm. Oxidises readily to *o*-bromocinnamic acid.

Betti, Lucchi, *Atti. accad. Lincei*, 1936, 23, 465.

*p*-Bromocinnamaldehyde (*p*-Bromophenylacrylic aldehyde)

Needles from pet. ether. M.p. 81°.

*Semicarbazone*: m.p. 240°.

*Phenylhydrazone*: yellow. M.p. 145°.

v. Braun, Nelles, *Ber.*, 1933, 66, 1468.

 $\alpha$ -Bromocinnamic Acid (1-Bromo-2-phenylacrylic acid)

$C_6H_5 \cdot CH : CBr \cdot COOH$

$C_9H_7O_2Br$  MW, 227

*Trans*-:

Needles. M.p. 131-2°. Mod. sol.  $Et_2O$ . Very sol. EtOH.  $k = 9.3 \times 10^{-4}$  at 25°.  $KMnO_4 \rightarrow$  benzaldehyde.

*Me ester*:  $C_{10}H_{11}O_2Br$ . MW, 241. M.p. 23°. B.p. 120-21°/0.6 mm.  $D^{20}_4$  1.4975.

*Et ester*:  $C_{11}H_{13}O_2Br$ . MW, 255. B.p. 294-6°, 160°/10 mm.  $D^{25}_4$  1.3885.  $n^{25}_D$  1.5845.

*Chloride*: C<sub>9</sub>H<sub>6</sub>OClBr. MW, 245.5. B.p. 153°/12 mm.

*Bromide*: C<sub>9</sub>H<sub>6</sub>OBr<sub>2</sub>. MW, 290. B.p. 170°/23 mm.

*Amide*: C<sub>9</sub>H<sub>8</sub>ONBr. MW, 226. Leaflets. M.p. 119°.

*Anhydride*: C<sub>18</sub>H<sub>12</sub>O<sub>3</sub>Br<sub>2</sub>. MW, 436. Needles. M.p. 100°.

*Cis*-: α-Bromoallocinnamic acid.

M.p. 120° (121°). Sol. EtOH, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>, hot H<sub>2</sub>O.  $k = 1.44 \times 10^{-2}$  at 25°. Heat at 204° → *trans*-acid.

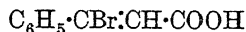
*Me ester*: b.p. 111°/0.6 mm. D<sub>4</sub><sup>20</sup> 1.4726.

*Et ester*: b.p. 173-4°/30 mm. D<sub>4</sub><sup>25</sup> 1.3713. n<sub>D</sub><sup>25</sup> 1.5697.

*Amide*: m.p. 129°.

Stoermer, Kirchner, *Ber.*, 1920, 53, 1289.

β-Bromocinnamic Acid (2-Bromo-2-phenylacrylic acid)



C<sub>9</sub>H<sub>7</sub>O<sub>2</sub>Br MW, 227

*Trans*-:

Needles or prisms. M.p. 135°. Sol. EtOH, hot C<sub>6</sub>H<sub>6</sub>. Spar. sol. CS<sub>2</sub>, hot H<sub>2</sub>O.

*Me ester*: C<sub>10</sub>H<sub>9</sub>O<sub>2</sub>Br. MW, 241. B.p. 122°/0.6 mm.

*Et ester*: C<sub>11</sub>H<sub>11</sub>O<sub>2</sub>Br. MW, 255. B.p. 167°/12 mm. D<sub>4</sub><sup>10-1</sup> 1.4044. n<sub>D</sub><sup>10-1</sup> 1.58405.

*Cis*-: β-Bromoallocinnamic acid.

Monoclinic cryst. M.p. 160°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, hot C<sub>6</sub>H<sub>6</sub>. Spar. sol. cold EtOH.

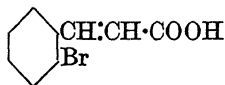
*Me ester*: prisms. M.p. 59°. B.p. 110-11°/0.6 mm. D<sub>4</sub><sup>16</sup> 1.3810. n<sub>D</sub><sup>16-18</sup> 1.56124.

*Et ester*: C<sub>11</sub>H<sub>11</sub>O<sub>2</sub>Br. MW, 255. B.p. 150-2°/15 mm., 146°/12 mm. D<sub>4</sub><sup>10-1</sup> 1.3818. n<sub>D</sub><sup>10-1</sup> 1.56761.

α-Bornyl ester: cryst. from EtOH. M.p. 76°.

Stoermer, Kirchner, *Ber.*, 1920, 53, 1289.

o-Bromocinnamic Acid (o-Bromophenylacrylic acid)



C<sub>9</sub>H<sub>7</sub>O<sub>2</sub>Br MW, 227

Cryst. from EtOH. M.p. 215-6°. Sol. Et<sub>2</sub>O, AcOH, hot EtOH. Spar. sol. CHCl<sub>3</sub>, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>.

*Cis*-.

$k = 0.95 \times 10^{-4}$ .

*Trans*-.

$k = 0.39 \times 10^{-4}$ .

Reich, Chaskelis, *Bull. soc. chim.*, 1916, 19, 287.

Betti, Lucchi, *Chem. Abstracts*, 1942, 36, 5470.

*m*-Bromocinnamic Acid (*m*-Bromophenylacrylic acid).

M.p. 178-9°. Sol. EtOH, Et<sub>2</sub>O, AcOH, hot CS<sub>2</sub>, hot CHCl<sub>3</sub>, hot C<sub>6</sub>H<sub>6</sub>.

Miller, Rohde, *Ber.*, 1890, 23, 1890.

Sikhbhusan, Dutt, *Quart. J. Indian Chem. Soc.*, 1925, 1, 297.

Pandya, Pandya, *Proc. Indian Acad. Sci.*, 1941, 14.4, 112.

*p*-Bromocinnamic Acid (*p*-Bromophenylacrylic acid).

Needles. M.p. 257° (251-3°).

*Me ester*: C<sub>10</sub>H<sub>9</sub>O<sub>2</sub>Br. MW, 241. M.p. 80°.

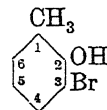
*Chloride*: C<sub>9</sub>H<sub>6</sub>OClBr. MW, 245.5. B.p. 175-80°/12 mm.

*Anilide*: m.p. 183°.

Krauss, *Ber.*, 1902, 35, 2932.

Braun, Nelles, *Ber.*, 1933, 66, 1467.

3-Bromo-*o*-cresol



C<sub>7</sub>H<sub>7</sub>OBr MW, 187

B.p. 200°/749 mm.

Robertson, *J. Chem. Soc.*, 1908, 93, 789.

Huston, Neeley, *J. Am. Chem. Soc.*, 1935, 57, 2177.

4-Bromo-*o*-cresol.

Needles. M.p. 80° (78°). Volatile in steam.

*Benzoyl*: m.p. 41°.

Hodgson, Moore, *J. Chem. Soc.*, 1926, 2036.

5-Bromo-*o*-cresol.

Needles. M.p. 64°. B.p. 235°. Sol. most ord. org. solvents. Sublimes.

*Et ether*: C<sub>9</sub>H<sub>11</sub>OBr. MW, 215. B.p. 238-40°. D<sub>4</sub><sup>15-16</sup> 1.3590. n<sub>D</sub><sup>15-16</sup> 1.549.

*Benzoyl*: needles from EtOH. M.p. 67-8°.

Auwers, *Ann.*, 1918, 415, 157.

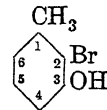
Jadhau, Rangwala, *J. Indian Chem. Soc.*, 1935, 12, 90.

6-Bromo-*o*-cresol.

Needles. M.p. 95°. Sol. most ord. org. solvents. Spar. sol. H<sub>2</sub>O.

Nölting, *Ber.*, 1904, 37, 1022.

2-Bromo-*m*-cresol



C<sub>7</sub>H<sub>7</sub>OBr MW, 187

M.p. 58.5-59°. B.p. 83-4°/4 mm.

Hodgson, Beard, *J. Chem. Soc.*, 1925, 127, 498.

Huston, Neeley, *J. Am. Chem. Soc.*, 1935, 57, 2177.

Huston, Peterson, *J. Am. Chem. Soc.*, 1933, 55, 3880.

**4-Bromo-*m*-cresol.**

Cryst. M.p. 38°. B.p. 206–8°/731 mm., 81–2°/4 mm.

Hodgson, Moore, *J. Chem. Soc.*, 1926, 2036.

Huston, Peterson, *J. Am. Chem. Soc.*, 1933, 55, 3880.

**5-Bromo-*m*-cresol.**

Needles. M.p. 56–7° (54°). Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O. KOH at 280–300° → orcinol.

*Acetyl*: m.p. 83°.

*Picrate*: m.p. 130°.

Kohn, Weissberg, *Monatsh.*, 1924, 45, 295.

**6-Bromo-*m*-cresol.**

Needles. from pet. ether. M.p. 63·5°. B.p. 118–23°/7 mm. Very sol. Py. Spar. sol. H<sub>2</sub>O, ligroin, pet. ether.

*Me ether*: C<sub>8</sub>H<sub>9</sub>OBr. MW, 201. B.p. 108·5°/12 mm. Turns brown in air.

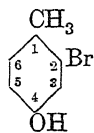
*Benzoyl*: needles from EtOH. M.p. 83·5°.

*Benzenesulphonyl*: m.p. 79–80°.

*p-Toluenesulphonyl*: m.p. 84–5°.

Huston, Neeley, *J. Am. Chem. Soc.*, 1935, 57, 2176.

Zeide, Dubinin, *Chem. Abstracts*, 1933, 27, 963.

**2-Bromo-*p*-cresol**

C<sub>7</sub>H<sub>7</sub>OBr MW, 187

Cryst. M.p. 56°. B.p. 245°. Sol. most ord. org. solvents. Spar. sol. H<sub>2</sub>O. Volatile in superheated steam. Also exists in labile form, m.p. 16°.

*Me ether*: C<sub>8</sub>H<sub>9</sub>OBr. MW, 201. B.p. 103–5°/10 mm.

*Benzoyl*: m.p. 75°.

Badische, D.R.P., 156,333, (*Chem. Zentr.*, 1904, II, 1672).

Lucas, Scudder, *J. Am. Chem. Soc.*, 1928, 50, 244.

Higginbottom, Hill, Short, *J. Chem. Soc.*, 1937, 264.

**3-Bromo-*p*-cresol.**

B.p. 213–14° (218–19°), 102–4°/20 mm. D<sub>20</sub><sup>24</sup> 1·547. NaNO<sub>2</sub> in AcOH → 3-bromo-5-nitro-*p*-cresol.

*Me ether*: b.p. 225–7°.

*Et ether*: C<sub>9</sub>H<sub>11</sub>OBr. MW, 215. B.p. 239–40°.

*p-Toluenesulphonyl*: m.p. 121°.

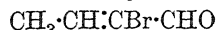
Cain, Norman, *J. Chem. Soc.*, 1906, 89, 24.

Jadhav, Rangwala, *J. Indian Chem. Soc.*, 1935, 12, 90.

Ungnade, Orwoll, *J. Am. Chem. Soc.*, 1943, 65, 1736.

**Bromocresotinic Acid.**

See Bromohydroxytoluic Acid.

**1-Bromocrotonaldehyde**

C<sub>4</sub>H<sub>5</sub>OBr MW, 149

Pale yellow oil. B.p. 63°/15 mm. D<sub>4</sub><sup>15</sup> 1·5797. n<sub>D</sub><sup>20</sup> 1·5184.

*Di-Me acetal*: b.p. 175° decomp., 59°/10 mm. D<sub>15</sub><sup>15</sup> 1·357.

*Oxime*: glistening leaflets from EtOH. M.p. 110–11°.

*Semicarbazone*: needles from EtOH or H<sub>2</sub>O. Decomp. at 162° (m.p. 228–30°).

*Phenylhydrazone*: yellow needles from EtOH. M.p. 125°.

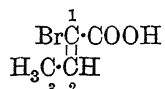
*Benzoylhydrazone*: m.p. 151°.

2: 4-Dinitrophenylhydrazone: deep red needles from AcOEt. M.p. 220° decomp.

Auwers, Heyna, *Ann.*, 1923, 434, 152.

Claisen, *Ber.*, 1911, 44, 1164.

**1-Bromocrotonic Acid** (*α*-Bromocrotonic acid. Cf. 1-Bromoisocrotonic Acid)



C<sub>4</sub>H<sub>5</sub>O<sub>2</sub>Br MW, 165

Needles from H<sub>2</sub>O. M.p. 107–8°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Mod. sol. hot H<sub>2</sub>O. Al.Hg → crotonic acid. K salt insol. EtOH.

*Me ester*: C<sub>5</sub>H<sub>7</sub>O<sub>2</sub>Br. MW, 179. B.p. 61°/9 mm.

*Et ester*: C<sub>6</sub>H<sub>9</sub>O<sub>2</sub>Br. MW, 193. B.p. 192°, 80°/15 mm. n<sub>D</sub><sup>20</sup> 1·476.

Moknach, Stoloyarov, *Chem. Abstracts*, 1937, 31, 5249.

Backer, Bente, *Rec. trav. chim.*, 1935, 54, 551.

Bachmann, *J. Am. Chem. Soc.*, 1933, 55, 4283.

**2-Bromocrotonic Acid.**

Leaflets. M.p. 97° (94–5°). Cryst. from H<sub>2</sub>O or ligroin. Sol. EtOH, Et<sub>2</sub>O, AcOH, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>.

Melikow, *J. prakt. Chem.*, 1900, 61, 558.

Autenrieth, *Ber.*, 1905, 38, 2545.

Moknach, Stoloyarov, *Chem. Abstracts*, 1937, 31, 5249.

**3-Bromocrotonic Acid.**

Plates from ligroin. M.p. 74°. Very sol. Et<sub>2</sub>O, Me<sub>2</sub>CO, CHCl<sub>3</sub>. Spar. sol. cold ligroin. Sol. to 3% in H<sub>2</sub>O.

*Me ester*: C<sub>5</sub>H<sub>7</sub>O<sub>2</sub>Br. MW, 179. B.p. 87°/15 mm. D<sub>4</sub><sup>19</sup> 1·490. n<sub>D</sub><sup>19</sup> 1·498.

*Et ester*: C<sub>6</sub>H<sub>9</sub>O<sub>2</sub>Br. MW, 193. B.p. 97–8°/15 mm., 80–2°/2 mm. D<sub>4</sub><sup>16</sup> 1·402. n<sub>D</sub><sup>16</sup> 1·490.

*Propyl ester*: C<sub>7</sub>H<sub>11</sub>O<sub>2</sub>Br. MW, 207. B.p. 108–9°/15 mm. D<sub>4</sub><sup>18</sup> 1·337. n<sub>D</sub><sup>18</sup> 1·487.

*Amide*: C<sub>4</sub>H<sub>8</sub>ONBr. MW, 164. M.p. 101°.



Nitrile:  $C_4H_4NBr$ . MW, 146. M.p.  $-14^\circ$ .  
B.p.  $84-5^\circ/12$  mm.

Glattfeld, Rietz, *J. Am. Chem. Soc.*, 1940,  
62, 976.

Rambaud, *Bull. soc. chim.*, 1934, 1, 1342.

Braun, *J. Am. Chem. Soc.*, 1930, 52, 3172.

**2-Bromocrotyl Alcohol** (2-Bromo-1-hydroxy-2-butylene)



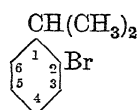
$C_4H_7OBr$  MW, 151

B.p.  $73-5^\circ/21$  mm.,  $69-70^\circ/13$  mm.  $D_4^{20}$   
1.547.  $n_D^{20}$  1.50161.

Meerwein, v. Bock, Kirschnick, Lenz,

Migge, *J. prakt. Chem.*, 1936, 147, 211.

**2-Bromocumene**



$C_9H_{11}Br$  MW, 199

B.p.  $205-7^\circ/741$  mm.

Fileti, *Gazz. chim. ital.*, 1886, 16, 131.

**3-Bromocumene.**

B.p.  $208-10^\circ$ ,  $94-6^\circ/20$  mm.

Sterling, Bogert, *J. Org. Chem.*, 1939, 4,  
20.

Haworth, Barker, *J. Chem. Soc.*, 1939,  
1299.

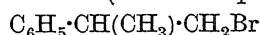
**4-Bromocumene.**

B.p.  $216^\circ$ ,  $95-100^\circ/12$  mm.,  $97-8^\circ/5$  mm.  
 $D_4^{20}$  1.3145.  $n_D^{20}$  1.5569. Dil.  $HNO_3 \rightarrow p$ -  
bromobenzoic acid.

Copenhaver, Roy, Marvel, *J. Am. Chem.*  
*Soc.*, 1935, 57, 1311.

Qvist, *Chem. Abstracts*, 1937, 31, 6627.

**$\beta$ -Bromocumene** (1-Bromo-2-phenylpropane)



$C_9H_{11}Br$  MW, 199

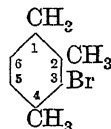
*l*-. B.p.  $78^\circ/1$  mm.  $n_D^{25}$  1.5448.  $[M]_D^{25} - 5.09^\circ$ .

*dl*-.  
B.p.  $188-9^\circ$ .  $117-18^\circ/20$  mm.

Amagat, *Bull. soc. chim.*, 1931, 49, 1411.

Levene, Marker, Rothen, *J. Biol. Chem.*,  
1933, 100, 598.

**3-Bromo- $\psi$ -cumene** (3-Bromo-1 : 2 : 4-tri-  
methylbenzene)



$C_9H_{11}Br$  MW, 199

B.p.  $237-8^\circ$ .

Huender, *Rec. trav. chim.*, 1915, 34, 1.

Meyer, Meyer, *Ber.*, 1918, 51, 1571.

**5-Bromo- $\psi$ -cumene** (5-Bromo-1 : 2 : 4-tri-  
methylbenzene).

Cryst. from EtOH. M.p.  $73^\circ$ . B.p.  $233-5^\circ$ .  
Sol. hot EtOH.

Huender, *Rec. trav. chim.*, 1915, 34, 1.

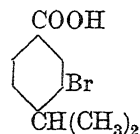
Meyer, Meyer, *Ber.*, 1918, 51, 1571.

**6-Bromo- $\psi$ -cumene** (6-Bromo-1 : 2 : 4-tri-  
methylbenzene).

B.p.  $236-8^\circ$  ( $223^\circ$ ).

Huender, *Rec. trav. chim.*, 1915, 34, 1.

**3-Bromocuminic Acid** (3-Bromo-4-isopro-  
pylbenzoic acid)



$C_{10}H_{11}O_2Br$  MW, 243

M.p.  $151-2^\circ$ . Sol.  $Et_2O$ . Mod. sol. hot  
EtOH. Insol.  $H_2O$ .

Amide:  $C_{10}H_{12}ONBr$ . MW, 242. Needles.  
M.p.  $103^\circ$ . Sol. EtOH,  $Et_2O$ , hot  $C_6H_6$ .

Fileti, Crosa, *Gazz. chim. ital.*, 1886, 16,  
296.

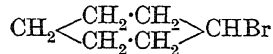
**Bromocyanoacetic Ester.**

See under Bromomalonic Acid.

**4-Bromo-3-cyanobenzoic Acid.**

See under 4-Bromoisophthalic Acid.

**Bromocyclohexane** (Cyclohexyl bromide, hexa-  
hydrobromobenzene)



$C_6H_{11}Br$  MW, 163

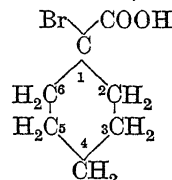
B.p.  $163-5^\circ$ ,  $72^\circ/32$  mm.  $D_{15}^{15}$  1.3290.  $n_D^{15}$   
1.49564. Alc. KOH  $\rightarrow$  cyclohexene.

Kohler, Burnley, *Am. Chem. J.*, 1910, 43,  
413.

Reid, Ruhoff, Burnett, *Organic Syntheses*,  
1935, XV, 26, (Note 9).

Tseng, Hsü, Hu, *Chem. Abstracts*, 1935,  
29, 6568.

**1-Bromocyclohexane-carboxylic Acid** (1-  
Bromohexahydrobenzoic acid)



$C_7H_{11}O_2Br$  MW, 207

Plates or prisms from formic acid. M.p.  $63^\circ$ .  
Unstable.

Et ester:  $C_9H_{15}O_2Br$ . MW, 235. B.p.  $125-$   
 $7^\circ/25$  mm. decomp.

Aschan, *Ann.*, 1892, 271, 265.

**2-Bromocyclohexane-carboxylic Acid** (2-Bromohexahydrobenzoic acid).

Prisms or plates from formic acid. M.p. 108–9°.

Aschan, *Ann.*, 1892, 271, 275.

**3-Bromocyclohexane-carboxylic Acid** (3-Bromohexahydrobenzoic acid).

*Trans* -:

Plates from  $C_6H_6$ . M.p. 167°. Sol. MeOH,  $CHCl_3$ , hot  $C_6H_6$ .

*Cis* :

M.p. 62–3°.

*Et ester* :  $C_9H_{15}O_2Br$ . MW, 235. B.p. 143°/25 mm.

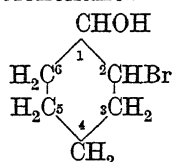
Perkin, Tattersall, *J. Chem. Soc.*, 1907, 91, 489.

**4-Bromocyclohexane-carboxylic Acid** (4-Bromohexahydrobenzoic acid).

*Trans* -:

Plates from pet. ether. M.p. 167°. Sol. EtOH,  $CHCl_3$ ,  $C_6H_6$ . Spar. sol. pet. ether.

Perkin, *J. Chem. Soc.*, 1904, 85, 431.

**2-Bromocyclohexanol**

$C_6H_{11}OBr$  MW, 179

B.p. 85–6°/10 mm., 60–1°/1 mm.  $D_4^{20}$  1.4604.  $n_D^{20}$  1.5169.

*Acetyl* : b.p. 109–10°/11 mm.  $D_4^{20}$  1.3762.  $n_D^{20}$  1.4867.

*Butyryl* : b.p. 145°/14 mm.

*Benzoyl* : m.p. 66°.

*Me ether* :  $C_7H_{13}OBr$ . MW, 193. B.p. 72–4°/8 mm.  $D_4^{20}$  1.3257.  $n_D^{20}$  1.4871.

Schmidt, *Ber.*, 1926, 59, 1279.

Schmidt, Schumacker, Asmus, *Ber.*, 1923, 56, 1239.

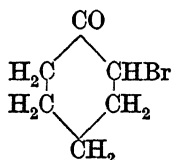
**4-Bromocyclohexanol.**

B.p. 113°/15 mm.  $D_4^{16}$  1.5063.  $n_D^{16}$  1.5417.

*Acetyl* : b.p. 124°/17 mm.  $D_4^{19.5}$  1.1282.  $n_D^{19.5}$  1.4659.

*Benzoyl* : b.p. 203–4°/18 mm.  $D_4^{25}$  1.3456.  $n_D^{25}$  1.5520.

Palfray, Rothstein, *Compt. rend.*, 1929, 189, 701.

**2-Bromocyclohexanone**

$C_6H_9OBr$

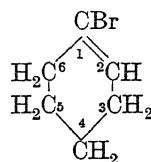
MW, 177

Strongly refracting liq. B.p. 89–90°/14 mm., 112–13°/20 mm.  $D_4^{25}$  1.340.  $n_D^{25}$  1.5085. Loses HBr in air.

Kötz, *Ann.*, 1908, 358, 195.

Grethe, *J. prakt. Chem.*, 1909, 80, 487.

Bedoukian, *J. Am. Chem. Soc.*, 1945, 67, 1430.

**1-Bromocyclohexene**

$C_6H_9Br$

MW, 161

B.p. 164–6°, 69°/35 mm., 48–53°/14 mm.  $D_4^{20}$  1.3901.  $n_D^{20}$  1.5134.  $KMnO_4$  → adipic acid.

Willstätter, Hatt, *Ber.*, 1912, 45, 1468.

Zelinsky, Gorski, *Ber.*, 1911, 44, 2314.

**3-Bromocyclohexene.**

Liq. with geranium odour. B.p. 80–2°/40 mm., 74°/28 mm.  $D^{20}$  1.366.  $n^{20}$  1.5230.

Zelinsky, Gorski, *Ber.*, 1911, 44, 2315.

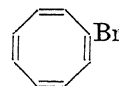
Crossley, *J. Chem. Soc.*, 1904, 85, 1422.

Berlande, *Bull. soc. chim.*, 1942, 9, 644.

**4-Bromocyclohexene.**

B.p. 160–3° part. decomp., 54°/15 mm.  $D_4^{15}$  1.3772.

Sobecki, *Ber.*, 1910, 43, 1038.

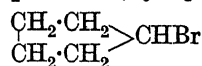
**Bromocyclo-octatetraene**

$C_8H_7Br$

MW, 183

Orange-yellow oil. B.p. 52.5–53°/18 mm.  $D_4^{25}$  1.4206.  $n_D^{25}$  1.5870. Heat →  $\beta$ -bromostyrene.

Cope, Burg, *J. Am. Chem. Soc.*, 1952, 74, 168.

**Bromocyclopentane** (*Cyclopentyl bromide*)

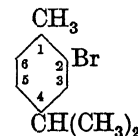
$C_5H_9Br$

MW, 149

B.p. 137–9°.  $D_4^{15}$  1.3692.  $n_D^{15}$  1.4875. Turns brown on standing.

Borsche, Lange, *Ber.*, 1907, 40, 2221.

Goheen, *J. Am. Chem. Soc.*, 1941, 63, 744.

**2-Bromocymene** (2-Bromo-1-methyl-4-isopropylbenzene)

$C_{10}H_{13}Br$

MW, 213

B.p. 233-5°, 118°/15 mm.  $D^{18}$  1.269.  
Bogert, Tuttle, *J. Am. Chem. Soc.*, 1916,  
38, 1349.  
Le Fèvre, *J. Chem. Soc.*, 1933, 983.

**3-Bromocymene** (3-Bromo-1-methyl-4-iso-  
*propylbenzene*).

B.p. 232-3°/741 mm.  
Bogert, Tuttle, *J. Am. Chem. Soc.*, 1916,  
38, 1349.  
Le Fèvre, *J. Chem. Soc.*, 1933, 983.

**1-Bromodecane.**

See Decyl bromide.

**Bromodeoxybenzoin.**

See Desyl bromide.

**Bromodiaminobenzene.**

See Bromophenylenediamine.

**Bromodiaminotoluene.**

See Bromotolylenediamine.

**Bromodibenzoylmethane.**

See Dibenzoylmethyl bromide.

**Bromodicyanomethane.**

See under Bromomalonic Acid.

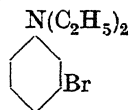
**Bromodiethylacetamide.**

See Neuronal.

**Bromodiethylacetylurea.**

See Adalin.

**3-Bromodiethylaniline**



$\text{C}_{10}\text{H}_{14}\text{NBr}$  MW, 223

B.p. 140-2°/9-10 mm.

Jacobs, Heidelberger, *J. Biol. Chem.*,  
1915, 21, 103.

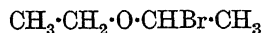
**4-Bromodiethylaniline.**

Needles or prisms. M.p. 33°. B.p. 270°.

Claus, Howitz, *Ber.*, 1884, 17, 1327.

Esselen, Clarke, *J. Am. Chem. Soc.*,  
1914, 36, 321.

**1-Bromodiethyl Ether** (*Ethyl 1-bromoethyl ether*)

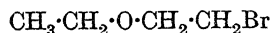


$\text{C}_4\text{H}_9\text{OBr}$  MW, 153

B.p. 105°.  $D^{12}$  1.0632. Decomp. by  $\text{H}_2\text{O}$ .

Henry, *Compt. rend.*, 1885, 100, 1007.

**2-Bromodiethyl Ether** (*Ethyl 2-bromoethyl ether*)



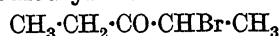
$\text{C}_4\text{H}_9\text{OBr}$  MW, 153

B.p. 127-8°, 40°/24 mm.  $D_4^{20}$  1.3852.  $n_D^{20}$   
1.44474.

Foran, *J. Soc. Chem. Ind.*, 1925, 44, 173T.

Chalmers, *Can. J. Research*, 1932, 7, 464.

**1-Bromodiethyl Ketone**



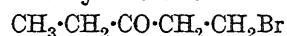
$\text{C}_5\text{H}_9\text{OBr}$  MW, 165

Dict. of Org. Comp.—I.

B.p. 158°/732 mm.  $D^{15}$  1.37. Does not  
form bisulphite comp.

Pauly, *Ber.*, 1901, 34, 1771.

**2-Bromodiethyl Ketone**



$\text{C}_5\text{H}_9\text{OBr}$  MW, 165

Colourless liq. B.p. 72°/16 mm. Rapidly  
darkens on standing.

Maire, *Bull. soc. chim.*, 1908, 3, 280.

Harrison, Diehl, *Organic Syntheses*, 1943,  
XXIII, 32.

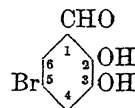
**$\omega$ -Bromodihydroxyacetophenone.**

See Dihydroxyphenacyl bromide.

**Bromodihydroxyanthraquinone.**

See Bromoalizarin and Bromoquinizarin.

**5-Bromo-2 : 3-dihydroxybenzaldehyde**



$\text{C}_7\text{H}_5\text{O}_3\text{Br}$  MW, 217

3-*Me ether*: 5-bromo-*o*-vanillin, 5-bromo-*o*-  
2-hydroxy-3-methoxybenzaldehyde.  $\text{C}_8\text{H}_7\text{O}_3\text{Br}$ .  
MW, 231. Pale yellow needles from EtOH.  
M.p. 127-9°.

*Di-Me ether*: 5-bromo-*o*-veratric aldehyde.  
 $\text{C}_9\text{H}_9\text{O}_3\text{Br}$ . MW, 245. Needles. M.p. 81°.

Henry, Sharp, *J. Chem. Soc.*, 1930,  
2288.

Davies, *J. Chem. Soc.*, 1923, 123, 1586.

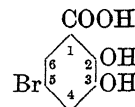
**2-Bromo-3 : 4-dihydroxybenzaldehyde.**

See 2-Bromoprotocatechuic Aldehyde.

**6-Bromo-3 : 4-dihydroxybenzaldehyde.**

See 6-Bromoprotocatechuic Aldehyde.

**5-Bromo-2 : 3-dihydroxybenzoic Acid**



$\text{C}_7\text{H}_5\text{O}_4\text{Br}$  MW, 233

Prisms +  $\text{H}_2\text{O}$  from  $\text{H}_2\text{O}$ . M.p. 187°. Pro-  
longed heating in  $\text{H}_2\text{O}$   $\rightarrow$  needles, m.p. 215°.  
Sol. EtOH, Et<sub>2</sub>O, AcOH. Spar. sol.  $\text{C}_6\text{H}_6$ .  
 $\text{FeCl}_3 \rightarrow$  blue col.

*Di-Me ether*: 5-bromo-*o*-veratric acid.  
 $\text{C}_9\text{H}_9\text{O}_4\text{Br}$ . MW, 261. Needles. M.p. 120°.

Himmelmayer, *Monatsh.*, 1912, 33, 972.

Davies, *J. Chem. Soc.*, 1923, 123,  
1587.

**6-Bromo-2 : 3-dihydroxybenzoic Acid.**

*Di-Me ether*: 6-bromo-*o*-veratric acid.  
 $\text{C}_9\text{H}_9\text{O}_4\text{Br}$ . MW, 261. Viscous brown oil.  
*Anilide*: needles from AcOEt-pet. ether. M.p.  
135-7°.

Sugasawa, *J. Chem. Soc.*, 1933, 1622.

**3-Bromo-2 : 4-dihydroxybenzoic Acid.**

See 3-Bromo-3-resorcylic Acid.

**5-Bromo-2 : 4-dihydroxybenzoic Acid.**

See 5-Bromo-3-resorcylic Acid.

**5-Bromo-3 : 4-dihydroxybenzoic Acid.**

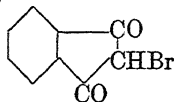
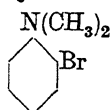
See 5-Bromoprotocatechuic Acid.

**4-Bromo-3 : 5-dihydroxybenzoic Acid.**See 4-Bromo- $\alpha$ -resorcylic Acid.**Bromo-2 : 5-dihydroxytoluene.**

See Bromotoluhydroquinone.

**5-Bromo-3 : 4-dihydroxytoluene.**

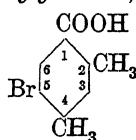
See 5-Bromohomocatechol.

**2-Bromo-3 : 5-dihydroxytoluene.**See 2-Bromo-*o*-cinol.**2-Bromo-1 : 3-diketohydrindene (2-Bromo-1 : 3-indandione)** $C_9H_5O_2Br$  MW, 225Yellowish needles. M.p. 119–20°. Sol. EtOH,  $C_6H_6$ , alkalis (red sols.).*Di-Me acetal*: cryst. from MeOH.Aq. M.p. 79°.*Di-Et acetal*: cryst. powder from EtOH.Aq. M.p. 60–1°.Flatow, *Ber.*, 1901, 34, 2146.**2-Bromodimethylaniline** $C_8H_{10}NBr$  MW, 200B.p. 107–8°/14 mm.  $D_{25}^{25}$  1.3880.  $n_D^{25}$  1.5748.*Picrate*: m.p. 150–1°.Auwers, *Ber.*, 1907, 40, 2530.Abbot, *Iowa State College Journal of Science*, 1943, 18, 3; *Chem. Abstracts*, 1944, 38, 62.**3-Bromodimethylaniline.**

M.p. 11°. B.p. 259°, 100–4°/2 mm.

*Picrate*: cryst. from EtOH. M.p. 134.8°.Schmidt, Schumacher, *Ber.*, 1921, 54, 1414.**4-Bromodimethylaniline.**

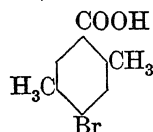
Leaflets. M.p. 55°. B.p. 264°.

Wurster, Beran, *Ber.*, 1879, 12, 1820.Fries, *Ann.*, 1906, 346, 187.Buu-Hoi, *Ann.*, 1946, 556, 1.**5-Bromo-2 : 4-dimethylbenzoic Acid (5-Bromo-unsym.-*m*-xylylic acid)** $C_9H_9O_2Br$ 

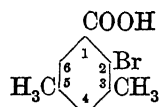
MW, 229

Needles from  $H_2O$ . M.p. 180–1° (174°). Sol. EtOH. Spar. sol.  $H_2O$ ,  $C_6H_6$ . Sublimes.*Amide*:  $C_9H_{10}ONBr$ . MW, 228. M.p. 197.5–8.5°.*Nitrile*:  $C_9H_8NBr$ . MW, 210. M.p. 88–9°.Fisher, Grant, *J. Am. Chem. Soc.*, 1935, 57, 718.Gunter, *Ber.*, 1884, 17, 1608.Sussenguth, *Ann.*, 1882, 215, 244.**6-Bromo-2 : 4-dimethylbenzoic Acid (6-Bromo-unsym.-*m*-xylylic acid).**

Needles from EtOH. M.p. 186° (183–4°, 162°).

*Me ester*:  $C_{10}H_{11}O_2Br$ . MW, 243. M.p. 174°.*Et ester*:  $C_{11}H_{13}O_2Br$ . MW, 257. M.p. 176°.*Propyl ester*:  $C_{12}H_{15}O_2Br$ . MW, 271. M.p. 178°.*Isobutyl ester*:  $C_{13}H_{17}O_2Br$ . MW, 285. M.p. 182°.*Amyl ester*:  $C_{14}H_{19}O_2Br$ . MW, 299. M.p. 181°.*Nitrile*:  $C_9H_8NBr$ . MW, 210. M.p. 218° (86–7°).*Amide*:  $C_9H_{10}ONBr$ . MW, 228. M.p. 178–9°.*Chloride*:  $C_9H_8OClBr$ . MW, 247.5. B.p. 150°/15 mm.Bureš, Mandel-Borgmannová, *Chem. Abstracts*, 1928, 22, 4503.Faber, Nauta, *Rec. trav. chim.*, 1943, 62, 469 (Bibl. of discrepancies).**4-Bromo-2 : 5-dimethylbenzoic Acid (4-Bromo-*p*-xylylic acid)** $C_9H_9O_2Br$  MW, 229

Cryst. from ligroin. M.p. 171.5–2.5°.

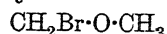
*Amide*: cryst. from MeOH.Aq. M.p. 209–10°.*Nitrile*: m.p. 103–4°.Fisher, Walling, *J. Am. Chem. Soc.*, 1935, 57, 1700.**2-Bromo-3 : 5-dimethylbenzoic Acid (2-Bromomesitylenic acid)** $C_9H_9O_2Br$  MW, 229Prisms from EtOH, needles from  $H_2O$ . M.p. 146–7°. Sol. EtOH, hot  $H_2O$ .Schmitz, *Ann.*, 1878, 193, 172, 176.

**4-Bromo-3 : 5-dimethylbenzoic Acid** (4-Bromomesitylenic acid).

Prisms from EtOH. M.p. 214–15°. Very spar. sol. hot H<sub>2</sub>O.

Fittig, Storer, *Ann.*, 1868, 147, 8.

Schmitz, *Ann.*, 1878, 193, 174.

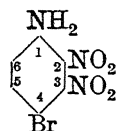
**Bromodimethyl Ether**

C<sub>2</sub>H<sub>5</sub>OBr MW, 125

B.p. 87°. D<sub>4</sub><sup>20</sup> 1.5976. n<sub>D</sub><sup>20</sup> 1.45623.

Henry, *Ber.*, 1893, 26, 933.

Karvonen, *Chem. Zentr.*, 1912, II, 1268.

**4-Bromo-2 : 3-dinitroaniline**

C<sub>6</sub>H<sub>4</sub>O<sub>4</sub>N<sub>3</sub>Br MW, 262

M.p. 158°.

N-Acetyl : 4-bromo-2 : 3-dinitroacetanilide. Needles from EtOH. M.p. 185°.

Blanksma, *Rec. trav. chim.*, 1909, 28, 101.

**6-Bromo-2 : 3-dinitroaniline.**

Red cryst. from EtOH. M.p. 158°.

Blanksma, *Rec. trav. chim.*, 1909, 28, 101.

**5-Bromo-2 : 4-dinitroaniline.**

Yellow needles. M.p. 178.4°.

N-Phenyl : see 5-Bromo-2 : 4-dinitrodiphenylamine.

Körner, Contardi, *Atti. accad. Lincei*, 1906, 15, ii, 588.

**6-Bromo-2 : 4-dinitroaniline.**

Yellow needles from AcOH or EtOH. M.p. 153–4°. Sublimes.

N-Me : 6-bromo-2 : 4-dinitromethylaniline. Yellow cryst. from AcOH. M.p. 147°.

I.G., D.R.P., 610,613, (*Chem. Abstracts*, 1935, 29, 5860).

Leymann, *Ber.*, 1882, 15, 1234.

**4-Bromo-2 : 5-dinitroaniline.**

Yellow cryst. from EtOH. M.p. 186°.

N-Acetyl : 4-bromo-2 : 5-dinitroacetanilide. Cryst. from EtOH. M.p. 152°.

N-Phenyl : see 4-Bromo-2 : 5-dinitrodiphenylamine.

Blanksma, *Rec. trav. chim.*, 1909, 28, 98.

**3-Bromo-2 : 6-dinitroaniline.**

M.p. 135°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O, ligroin.

de Monchy, *Rec. trav. chim.*, 1934, 53, 144.

**4-Bromo-2 : 6-dinitroaniline.**

Orange-red plates from EtOH. M.p. 160°.

N-Oxalyl : needles. M.p. 285–7°.

N-Benzoyl : needles. M.p. 221°.

N-Di-Me : 4-bromo-2 : 6-dinitrodimethylaniline. C<sub>8</sub>H<sub>8</sub>O<sub>4</sub>N<sub>3</sub>Br. MW, 290. M.p. 119°.

N-Phenyl : see 4-Bromo-2 : 6-dinitrodiphenylamine.

Austen, *Ber.*, 1876, 9, 919.

Meldola, Streatfeild, *J. Chem. Soc.*, 1898, 73, 688.

Joshi, Sane, *J. Indian Chem. Soc.*, 1933, 10, 459.

**6-Bromo-3 : 4-dinitroaniline.**

Yellow cryst. from EtOH. M.p. 186°.

N-Acetyl : 6-bromo-3 : 4-dinitroacetanilide. Cryst. from EtOH. M.p. 165°.

Blanksma, *Rec. trav. chim.*, 1909, 28, 102.

**2-Bromo-3 : 5-dinitroaniline.**

Yellow leaflets from EtOH. M.p. 180°.

Blanksma, *Rec. trav. chim.*, 1909, 28, 103.

**4-Bromo-3 : 5-dinitroaniline.**

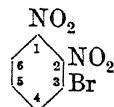
M.p. 207°.

N-Acetyl : 4-bromo-3 : 5-dinitroacetanilide. M.p. 263°.

Blanksma, *Rec. trav. chim.*, 1934, 53, 988.

**Bromodinitroanisole.**

See under Bromodinitrophenol.

**3-Bromo-1 : 2-dinitrobenzene** (3-Bromo-o-dinitrobenzene)

C<sub>6</sub>H<sub>3</sub>O<sub>4</sub>N<sub>2</sub>Br MW, 247

Pale yellow cryst. from EtOH. M.p. 101–2°. B.p. 320°. Sol. hot EtOH. Spar. sol. Et<sub>2</sub>O.

Wender, *Gazz. chim. ital.*, 1889, 19, 230.

**4-Bromo-1 : 2-dinitrobenzene** (4-Bromo-o-dinitrobenzene).

Cryst. from EtOH. M.p. 59–60°. An unstable modification has m.p. 34–5°. Alc. NH<sub>3</sub> → 5-bromo-2-nitro-aniline.

Körner, *Gazz. chim. ital.*, 1874, 4, 349.

Mangini, *Gazz. chim. ital.*, 1936, 66, 675.

**2-Bromo-1 : 3-dinitrobenzene** (2-Bromo-m-dinitrobenzene).

Yellow prisms. M.p. 107°.

Körner, Contardi, *Atti. accad. Lincei*, 1914, 23, ii, 469.

**4-Bromo-1 : 3-dinitrobenzene** (4-Bromo-m-dinitrobenzene).

Yellow cryst. from EtOH. M.p. 75°. Sol. hot EtOH. Conc. KOH, or AcONa in EtOH, → 2 : 4-dinitrophenol. Sn + HCl → m-phenylenediamine. Alc. NH<sub>3</sub> → 2 : 4-dinitroaniline.

Körner, *Gazz. chim. ital.*, 1874, 4, 322.

**5-Bromo-1 : 3-dinitrobenzene** (*5-Bromo-m-dinitrobenzene*).

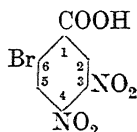
Yellow cryst. M.p. 77°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

Elion, *Rec. trav. chim.*, 1923, 42, 145.

**2-Bromo-1 : 4-dinitrobenzene** (*2-Bromo-p-dinitrobenzene*).

Needles or prisms. M.p. 70°.

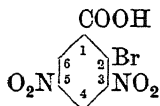
Körner, Contardi, *Atti. accad. Lincei*, 1914, 23, ii, 285.

**6-Bromo-3 : 4-dinitrobenzoic Acid**

C<sub>7</sub>H<sub>3</sub>O<sub>6</sub>N<sub>2</sub>Br MW, 291

M.p. 184°. The 4-NO<sub>2</sub> group is labile and can be replaced directly by other groups, e.g., NH<sub>2</sub>, OH, OMe.

Goldstein, Granola, *Helv. Chim. Acta*, 1943, 26, 173.

**2-Bromo-3 : 5-dinitrobenzoic Acid**

C<sub>7</sub>H<sub>3</sub>O<sub>6</sub>N<sub>2</sub>Br MW, 291

Yellow needles from H<sub>2</sub>O. M.p. 213°. Sol. EtOH, AcOH.

*Me ester*: C<sub>8</sub>H<sub>5</sub>O<sub>6</sub>N<sub>2</sub>Br. MW, 305. Needles from MeOH.Aq. M.p. 109°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>.

*Et ester*: C<sub>9</sub>H<sub>7</sub>O<sub>6</sub>N<sub>2</sub>Br. MW, 319. Needles from EtOH. M.p. 74°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>.

*Chloride*: C<sub>7</sub>H<sub>2</sub>O<sub>5</sub>N<sub>2</sub>ClBr. MW, 309.5. Needles from pet. ether. M.p. 80°.

*Amide*: C<sub>7</sub>H<sub>4</sub>O<sub>5</sub>N<sub>2</sub>Br. MW, 290. Pale yellow needles from EtOH.Aq. M.p. 216°. Sol. EtOH, Me<sub>2</sub>CO, AcOH. Spar. sol. Et<sub>2</sub>O, H<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

Meisenheimer, Zimmermann, Kummer, *Ann.*, 1926, 446, 205.

Blanksma, Verberg, *Rec. trav. chim.*, 1934, 53, 996.

**4-Bromo-3 : 5-dinitrobenzoic Acid.**

Needles from EtOH. M.p. 188°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, MeOH, AcOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O.

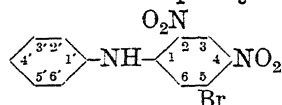
*Me ester*: needles from MeOH.Aq. M.p. 125°.

*Et ester*: needles from EtOH.Aq. M.p. 118°. Sol. C<sub>6</sub>H<sub>6</sub>.

*Chloride*: needles from pet. ether. M.p. 90°.

*Amide*: pale yellow needles from EtOH.Aq. M.p. 188°. Sol. EtOH, Me<sub>2</sub>CO, AcOH. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

Blanksma, Verberg, *Rec. trav. chim.*, 1934, 53, 990.

**5-Bromo-2 : 4-dinitrodiphenylamine**

C<sub>12</sub>H<sub>8</sub>O<sub>4</sub>N<sub>3</sub>Br MW, 338

Exists in yellow and red modifications. Yellow → red on cryst. from org. solvents. Red → yellow on heating to 135°. M.p. 157°. Sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, toluene. Spar. sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO.

Jackson, Cohoe, *Am. Chem. J.*, 1901, 26, 5.

**4'-Bromo-2 : 4-dinitrodiphenylamine.**

Yellow needles from AcOH. M.p. 158° (152-3°). Sol. Et<sub>2</sub>O, hot H<sub>2</sub>O, hot EtOH.

Willgerodt, *Ber.*, 1878, 11, 602.

van der Kam, *Rec. trav. chim.*, 1926, 45, 733.

**4-Bromo-2 : 5-dinitrodiphenylamine.**

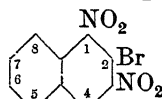
Orange-red prisms from EtOH-C<sub>6</sub>H<sub>6</sub>. M.p. 153-4°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, AcOH, C<sub>6</sub>H<sub>6</sub>. Spar. sol. EtOH. Very spar. sol. ligroin. Conc. H<sub>2</sub>SO<sub>4</sub> → violet col.

Jackson, Calhane, *Am. Chem. J.*, 1902, 28, 463.

**4-Bromo-2 : 6-dinitrodiphenylamine.**

Orange-red needles from EtOH. M.p. 120°.

Austen, *Ber.*, 1876, 9, 920.

**2-Bromo-1 : 3-dinitronaphthalene**

C<sub>10</sub>H<sub>5</sub>O<sub>4</sub>N<sub>2</sub>Br MW, 297

M.p. 183-4°.

Vesely, Chudozilov, *Bull. soc. chim.*, 1925, 37, 1443.

**4-Bromo-1 : 3-dinitronaphthalene.**

M.p. 160° (151-2°).

Vesely, Chudozilov, *Bull. soc. chim.*, 1925, 37, 1442.

Hodgson, Walker, *J. Chem. Soc.*, 1933, 1621.

**4-Bromo-1 : 5-dinitronaphthalene.**

Needles. M.p. 143°. Cryst. from EtOH or C<sub>6</sub>H<sub>6</sub>. HNO<sub>3</sub>.Aq. at 180° → 3-nitrophthalic acid.

Merz, Weith, *Ber.*, 1882, 15, 2710.

**4-Bromo-1 : 8-dinitronaphthalene.**

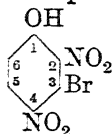
Yellow cryst. M.p. 170°. HNO<sub>3</sub>.Aq. at 180° → 3-nitrophthalic acid. Alc. NH<sub>3</sub> → 4 : 5-dinitro-1-naphthylamine.

Ullmann, Consonno, *Ber.*, 1902, 35, 2805.

**4-Bromo-2 : 6-dinitrophenetole.**

See under 4-Bromo-2 : 6-dinitrophenol.

## 3-Bromo-2 : 4-dinitrophenol



$C_6H_3O_5N_2Br$  MW, 263

Fine needles from  $H_2O$ . M.p.  $175^\circ$ .

Hodgson, Moore, *J. Chem. Soc.*, 1926, 155.

## 5-Bromo-2 : 4-dinitrophenol (3-Bromo-4:6-dinitrophenol).

Prisms. M.p.  $92^\circ$ . Sol. EtOH,  $Et_2O$ , conc.  $HNO_3$ . Volatile in steam. K salt forms yellow needles.

*Me ether*: 5-bromo-2 : 4-dinitroanisole.  $C_7H_5O_5N_2Br$ . MW, 277. M.p.  $110^\circ$ .

Hodgson, Moore, *J. Chem. Soc.*, 1926, 155.

## 6-Bromo-2 : 4-dinitrophenol.

Pale yellow needles or prisms. M.p.  $118-9^\circ$ . Sol.  $Et_2O$ . Mod. sol. hot EtOH. Spar. sol. hot  $H_2O$ . Spar. volatile in steam. Sublimes. Detonates if quickly heated. Forms add. comp. with  $2NH_3$ .

*Acetyl*: cryst. from  $C_6H_6-EtOH$ . M.p.  $104.5^\circ$ .

*Benzoyl*: cryst. from EtOH.Aq. M.p.  $94^\circ$ .

*p-Toluenesulphonyl*: m.p.  $157^\circ$ .

*Me ether*: 6-bromo-2 : 4-dinitroanisole.  $C_7H_5O_5N_2Br$ . MW, 277. Pale yellow prisms. M.p.  $48^\circ$ . Sol. EtOH,  $Et_2O$ . Insol.  $H_2O$ .

van Erp, *Rec. trav. chim.*, 1910, 29, 232.

## 3-Bromo-2 : 6-dinitrophenol.

Needles. M.p.  $131^\circ$ . Volatile in steam.

Hodgson, Moore, *J. Chem. Soc.*, 1926, 155.

## 4-Bromo-2 : 6-dinitrophenol.

Yellow or orange needles or prisms. M.p.  $78^\circ$ . Sol. EtOH,  $Et_2O$ ,  $CS_2$ , hot AcOH. Spar. sol. cold  $H_2O$ . Sublimes. Isomerises to 6-bromo-2 : 4-dinitrophenol with  $Br + H_2O$ . Fuming  $HNO_3 \rightarrow$  picric acid.

*Acetyl*: prisms from  $C_6H_6$ . M.p.  $110.5^\circ$ .

*Benzoyl*: needles from EtOH. M.p.  $154^\circ$ .

*p-Toluenesulphonyl*: cryst. from EtOH. M.p.  $136^\circ$ .

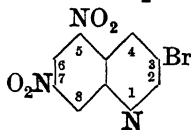
*Me ether*: 4-bromo-2 : 6-dinitroanisole.  $C_7H_5O_5N_2Br$ . MW, 277. Needles. M.p.  $88^\circ$ .

*Et ether*: 4-bromo-2 : 6-dinitrophenetole.  $C_8H_7O_5N_2Br$ . MW, 291. Needles. M.p.  $66^\circ$ . Very sol. EtOH, hot  $H_2O$ .

Fromm, Ebert, *J. prakt. Chem.*, 1924, 108, 75.

Contardi, Ciocca, *Gazz. chim. ital.*, 1933, 63, 881.

## 3-Bromo-5 : 7-dinitroquinoline



$C_9H_4O_4N_3Br$  MW, 298

Needles from EtOH. M.p.  $161^\circ$ . Sublimes.

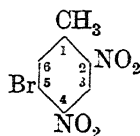
Claus, Hartmann, *J. prakt. Chem.*, 1896, 53, 209.

## 3-Bromo-6 : 8-dinitroquinoline.

Needles. M.p.  $120^\circ$ . Spar. sol. EtOH. Insol.  $H_2O$ .

Claus, Hartmann, *J. prakt. Chem.*, 1896, 53, 206.

## 5-Bromo-2 : 4-dinitrotoluene



$C_7H_5O_4N_2Br$  MW, 261

Yellowish cryst. from EtOH. M.p.  $114^\circ$  ( $103.5-4.5^\circ$ ). Alc.  $NH_3 \rightarrow$  4 : 6-dinitro-*m*-toluidine.

Lindemann, Pabst, *Ann.*, 1928, 462, 39.

Brady, Waller, *J. Chem. Soc.*, 1930, 1221.

Qvist, Moilanen, *Chem. Abstracts*, 1944, 38, 5206, 5491.

## 3-Bromo-2 : 6-dinitrotoluene.

Fine needles. M.p.  $86^\circ$ . Sol. EtOH. Volatile in steam.

Lindemann, Pabst, *Ann.*, 1928, 462, 42.

## 4-Bromo-2 : 6-dinitrotoluene.

Orange-yellow needles from EtOH. M.p.  $89-90^\circ$ .

Elson, Gibson, Johnson, *J. Chem. Soc.*, 1929, 2741.

## 2-Bromo-3 : 5-dinitrotoluene.

Yellowish cryst. from EtOH. M.p.  $95^\circ$ . Sol. EtOH, AcOH,  $C_6H_6$ . Alc.  $NH_3 \rightarrow$  3 : 5-dinitro-*o*-toluidine.

Körner, Contardi, *Chem. Abstracts*, 1915, 9, 3218.

## 4-Bromo-3 : 5-dinitrotoluene.

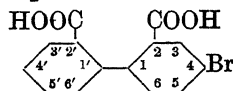
Yellow prisms. M.p.  $118.4^\circ$ .  $CrO_3 \rightarrow$  4-bromo-3 : 5-dinitrobenzoic acid.  $NH_3 \rightarrow$  3 : 5-dinitro-*p*-toluidine.

Körner, Contardi, *Chem. Abstracts*, 1915, 9, 1478.

 $\alpha$ -Bromodinitrotoluene.

See Dinitrobenzyl bromide.

## 4-Bromodiphenic Acid



$C_{14}H_9O_4Br$  MW, 321

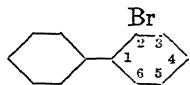
Plates from 50% EtOH. M.p.  $238-9^\circ$ . Sol. EtOH,  $Et_2O$ . Spar. sol.  $CHCl_3$ ,  $C_6H_6$ . Insol.  $H_2O$ .

Schmidt, Junghans, *Ber.*, 1904, 37, 3566.

**5-Bromodiphenic Acid.**

Needles from EtOH. M.p. 257° decomp.  
 $\text{KMnO}_4 + \text{H}_2\text{SO}_4 \longrightarrow p\text{-bromobenzoic acid.}$

Schmidt, Ladner, *Ber.*, 1904, 37, 3571.

**2-Bromodiphenyl (o-Bromodiphenyl)**

$\text{C}_{12}\text{H}_9\text{Br}$  MW, 233

B.p. 296–8°, 160°/11 mm.  $D^{26} 1.2175$ .  $\text{CrO}_3$   
 $\longrightarrow o\text{-bromobenzoic acid.}$

Schultz, Schmidt, Strasser, *Ann.*, 1881,  
 207, 353.

Zaheer, Fasech, *J. Indian Chem. Soc.*,  
 1944, 21, 27.

**3-Bromodiphenyl.**

B.p. 299–301°, 169–173°/17 mm.  $n_D^{25} 1.6390$ .  
 $n_D^{20} 1.6411$ .

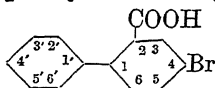
Huber *et al.*, *J. Am. Chem. Soc.*, 1946,  
 68, 1111.

**4-Bromodiphenyl (p-Bromodiphenyl).**

M.p. 89°. B.p. 310°. Sol.  $\text{Et}_2\text{O}$ ,  $\text{CS}_2$ ,  $\text{C}_6\text{H}_6$ .  
 Mod. sol. EtOH, AcOH.  $\text{CrO}_3 \longrightarrow p\text{-bromo-}$   
 benzoic acid

Gomberg, Bachmann, *Organic Syntheses*,  
 Collective Vol. I, 109.

Elks, Haworth, Hey, *J. Chem. Soc.*, 1940,  
 1284.

**4-Bromodiphenyl-2-carboxylic Acid**

$\text{C}_{13}\text{H}_9\text{O}_2\text{Br}$  MW, 277

M.p. 165°.

Courtot, *Ann. chim.*, 1930, 14, 146.

**5-Bromodiphenyl-2-carboxylic Acid.**

Needles from EtOH.Aq. M.p. 172°.

*Me ester*: oil. B.p. 185–95°/20 mm.

Heilbron, Hey, Wilkinson, *J. Chem. Soc.*,  
 1938, 113.

**2'-Bromodiphenyl-2-carboxylic Acid.**

Cryst. from 80% AcOH. M.p. 186–7°. Dar-  
 kens on standing.

Miller, Bachman, *J. Am. Chem. Soc.*,  
 1935, 57, 2446.

**4-Bromodiphenyl-3-carboxylic Acid (or 6-Bromodiphenyl-3-carboxylic acid).**

Plates from EtOH. M.p. 242°. Sublimes.  
 Sol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Mod. sol. EtOH. Spar. sol.  
 $\text{H}_2\text{O}$ .

*Me ester*:  $\text{C}_{14}\text{H}_{11}\text{O}_2\text{Br}$ . MW, 291. Prisms  
 from EtOH. M.p. 67°. Sol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Mod.  
 sol. EtOH.

Cooke, Cook, *J. Am. Chem. Soc.*, 1933,  
 55, 1215.

Oligiatti, *Ber.*, 1893, 27, 3387.

*Note.* Case, *J. Am. Chem. Soc.*, 1936, 58,  
 1251, describes 4-bromodiphenyl-3-carboxylic  
 acid as cryst. from  $\text{C}_6\text{H}_6$ . M.p. 194–5°.

**3-Bromodiphenyl-4-carboxylic Acid.**

Cryst. from MeOH–pet. ether. M.p. 179–80°.

Case, *J. Am. Chem. Soc.*, 1936, 58, 1251.

**2'-Bromodiphenyl-4-carboxylic Acid.**

Needles from AcOH. M.p. 242°. Sublimes.  
 Sol. dil.  $\text{NH}_3$ .

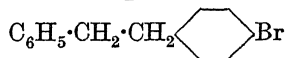
Gomberg, Pernert, *J. Am. Chem. Soc.*,  
 1926, 48, 1372.

**4'-Bromodiphenyl-4-carboxylic Acid.**

Fine needles from  $\text{PhNO}_2$ . M.p. 304°. Spar.  
 sol. org. solvents and cold alkalis.  $\text{CrO}_3 \longrightarrow$   
 $p\text{-bromobenzoic acid.}$

Gomberg, Pernert, *J. Am. Chem. Soc.*,  
 1926, 48, 1372.

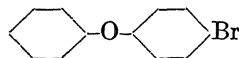
I.G., F.P., 735,846, (*Chem. Zentr.*, 1933,  
 I, 1999).

**4-Bromo-sym.-diphenylethane**

$\text{C}_{14}\text{H}_{13}\text{Br}$  MW, 261

M.p. 32°. B.p. 143°/3 mm.

Speer, Hill, *J. Org. Chem.*, 1937, 2, 139.

**p-Bromodiphenyl Ether**

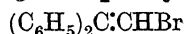
$\text{C}_{12}\text{H}_9\text{OBr}$  MW, 249

B.p. 124–8°/3–4 mm.  $n_D^{20} 1.6088$ .

Frank *et al.*, *J. Am. Chem. Soc.*, 1946, 68,  
 1365.

**Bromo-sym.-diphenylethylene.**

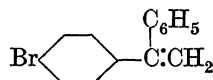
*See* Bromostilbene.

 **$\beta$ -Bromo-unsym.-diphenylethylene**

$\text{C}_{14}\text{H}_{11}\text{Br}$  MW, 259

Needles from  $\text{Et}_2\text{O}$ –EtOH. M.p. 50° (40°).  
 B.p. above 300°. Sol.  $\text{Et}_2\text{O}$ ,  $\text{Me}_2\text{CO}$ ,  $\text{CS}_2$ .  
 Spar. sol. cold EtOH. Does not combine with  
 Br.

Wittig, Kethur, *Ber.*, 1936, 69, 2078.

**4-Bromo-unsym.-diphenylethylene**

$\text{C}_{14}\text{H}_{11}\text{Br}$  MW, 259

B.p. 199–201°/19 mm.

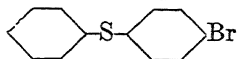
Stoermer, Simon, *Ber.*, 1904, 37, 4168.

 **$\alpha$ -Bromodiphenylmethane.**

*See* Diphenylmethyl bromide.



## 4-Bromodiphenyl sulphide

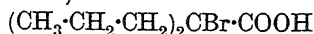


$C_{12}H_9SBr$  MW, 265

Cryst. from pet. ether. M.p.  $25.7^\circ$  ( $24.5^\circ$ ).  
B.p.  $206^\circ/24.5$  mm.,  $196^\circ/18$  mm.,  $187.5^\circ/14$  mm.

Bourgeois, Fouassin, *Bull. soc. chim.*,  
1911, 9, 941.

Böeseken, Waterman, *Rec. trav. chim.*,  
1910, 29, 321.

1-Bromodipropylacetic Acid (*Dipropylbromoacetic acid*)

$C_8H_{15}O_2Br$  MW, 223

B.p.  $228-30^\circ$ .

*Et ester*:  $C_{10}H_{19}O_2Br$ . MW, 251. B.p.  $100^\circ/9$  mm.

*Amide*:  $C_8H_{16}ONBr$ . MW, 222. M.p.  $59-60^\circ$ . Spar. sol.  $H_2O$ .

*Nitrile*:  $C_8H_{14}NBr$ . MW, 204. B.p.  $209^\circ$ ,  $103-4^\circ/18$  mm.

Kalle, D.R.P., 175,585, (*Chem. Zentr.*,  
1906, II, 1693).

## 1-Bromodocosane.

See Docosyl bromide.

## 1-Bromododecane.

See Dodecyl bromide.

## Bromoethane.

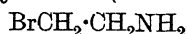
See Ethyl bromide.

## Bromoethoxyacetanilide.

See under Bromophenetidine.

## 2-Bromoethyl Alcohol.

See Ethylene bromohydrin.

2-Bromoethylamine (*Aminoethyl bromide*)

$C_2H_6NBr$  MW, 124

Unstable oil. Sol.  $C_6H_6$ .

*B.HBr*: rhombic cryst. M.p.  $172-3^\circ$ . Sol.  $H_2O$ .

*Benzoyl*:  $\beta$ -bromoethylbenzamide. M.p.  $105-6^\circ$ .

*Picrate*: needles +  $\frac{1}{2}H_2O$ . M.p.  $99^\circ$ , anhyd.  $130-1^\circ$ .

Cortese, *J. Am. Chem. Soc.*, 1936, 58, 191.  
I.G., B.P., 468,387, (*Chem. Abstracts*,  
1937, 31, 8545).

Desseigne, *Bull. soc. chim.*, 1942, 9, 786.  
Masters, Bogert, *J. Am. Chem. Soc.*, 1942,  
64, 2709.

 $\beta$ -Bromoethylbenzamide.

See under 2-Bromoethylamine.

 $\alpha$ -Bromoethylbenzene ( $\alpha$ -Phenylethyl bromide)

$C_8H_9Br$  MW, 185

*d.*

B.p.  $86-8^\circ/15-16$  mm.  $[\alpha]_{D_{5461}}^{25} + 0.10^\circ$ .  $n_D^{25}$   
1.5595.

*dl.*

B.p.  $202-3^\circ$ ,  $85^\circ/13$  mm.,  $78-82^\circ/10$  mm.  
 $D_4^{20}$  1.3605.  $n_D^{20}$  1.5612.

Copenhaver, Roy, Marvel, *J. Am. Chem. Soc.*, 1935, 57, 1311.

Société des usines chimique Rhône-Poulenc, B.P., 438,820, (*Chem. Abstracts*, 1936, 30, 2993).

Ross *et al.*, *Ind. Eng. Chem.*, 1942, 34, 924.

Reppe *et al.*, *Ann.*, 1948, 560, 1.

 $\beta$ -Bromoethylbenzene ( $\beta$ -Phenylethyl bromide)

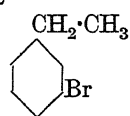
$C_8H_9Br$  MW, 185

B.p.  $217-18^\circ/734$  mm. slight decomp.,  $92^\circ/11$  mm.  $D_4^{25}$  1.3535.  $n_D^{25}$  1.5543.

Perlman, Davidson, Bogert, *J. Org. Chem.*, 1936, 1, 288.

Slotta, Altnier, *Ber.*, 1931, 64, 1515.

Société des usines chimique Rhône-Poulenc, B.P., 438,820, (*Chem. Abstracts*, 1936, 30, 2993).

*m*-Bromoethylbenzene

$C_8H_9Br$  MW, 185

B.p.  $200-8^\circ$ ,  $85-6^\circ/20$  mm.  $D_4^{20}$  1.3493.  $n_D^{20}$   
1.5465.

Brown, Marvel, *J. Am. Chem. Soc.*, 1937,  
59, 1178.

*p*-Bromoethylbenzene.

B.p.  $188-9^\circ$ .

Varma, Sahay, Subramonium, *J. Indian Chem. Soc.*, 1937, 14, 157.

## 1-Bromo-1-ethylbutyrylurea.

See Adalin.

## Bromoethylene.

See Vinyl bromide.

## Bromoethylnaphthalene.

See Naphthylethyl bromide.

2-Bromoethyl phenyl Ether ( $\beta$ -Bromophenetole)

$C_8H_9OBr$  MW, 201

M.p.  $39^\circ$ . B.p.  $240-50^\circ$  decomp.,  $144^\circ/40$  mm.,  $114-17^\circ/10$  mm. Sol. EtOH, Et<sub>2</sub>O. Prac. insol.  $H_2O$ .

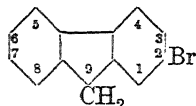
Marvel, Tanenbaum, *Organic Syntheses*,  
Collective Vol. I, 426.

## 1-Bromoethyl phenyl Ketone.

See  $\beta$ -Bromopropiophenone.

N-2-Bromoethylphthalimide (*Phthaliminoethyl bromide*).

See under Phthalimide.

**2-Bromofluorene**

$C_{13}H_9Br$  MW, 245

Plates from EtOH. M.p. 110–111.5°.

Miller, Bachman, *J. Am. Chem. Soc.*, 1935, 57, 2448.

**3-Bromofluorene.**

Needles from EtOH. M.p. 90–1°.

Miller, Bachman, *J. Am. Chem. Soc.*, 1935, 57, 2448.

**4-Bromofluorene.**

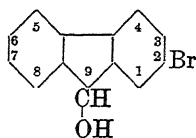
Needles from EtOH. M.p. 165°.

Miller, Bachman, *J. Am. Chem. Soc.*, 1935, 57, 2449.

**9-Bromofluorene.**

Cryst. from ligroin. M.p. 104°.

Staudinger, *Ber.*, 1906, 39, 3061.  
Wittig, Fellettschinn, *Ann.*, 1944, 555, 133.

**2-Bromo-9-fluorenol**

$C_{13}H_9OBr$  MW, 261

Needles. M.p. 130°.

Miller, Bachman, *J. Am. Chem. Soc.*, 1935, 57, 2447.

**3-Bromo-9-fluorenol.**

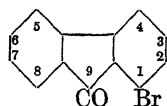
Plates. M.p. 142–5°.  $HI + P \rightarrow$  fluorene.

Miller, Bachman, *J. Am. Chem. Soc.*, 1935, 57, 2447.

**4-Bromo-9-fluorenol.**

Feathery needles. M.p. 149–50°.

Miller, Bachman, *J. Am. Chem. Soc.*, 1935, 57, 2447.

**1-Bromofluorenone**

$C_{13}H_7OBr$  MW, 259

Yellow cryst. M.p. 135°. B.p. 395° decomp.

Montagne, Charante, *Rec. trav. chim.*, 1913, 32, 164.

Huntress, Pfister, *J. Am. Chem. Soc.*, 1942, 62, 2845.

**2-Bromofluorenone.**

Yellow needles. M.p. 149°. Sol.  $CHCl_3$ ,  $C_6H_6$ . Mod. sol. EtOH,  $Et_2O$ , AcOH. Brown sol. in conc.  $H_2SO_4$ .

*Oxime*: m.p. 194–5°.

*Semicarbazone*: m.p. 235°.

Courtot, Vignati, *Bull. soc. chim.*, 1927, 41, 58.

**3-Bromofluorenone.**

Needles. M.p. 165–6°. Sublimes under reduced pressure.

Montagne, Charante, *Rec. trav. chim.*, 1913, 32, 164.

Miller, Bachman, *J. Am. Chem. Soc.*, 1935, 57, 2443.

**4-Bromofluorenone.**

Yellow. M.p. 125–6°.

Huntress, Pfister, *J. Am. Chem. Soc.*, 1942, 64, 2845.

Note: A compound, m.p. 190°, is also described. See Miller, Bachman, *J. Am. Chem. Soc.*, 1935, 57, 2443; Bellavita, *Chem. Abstracts*, 1944, 38, 3634.

**Bromoform (Tribromomethane)**

MW, 253

$CHBr_3$

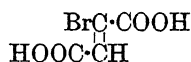
F.p. 8°. B.p. 149.5°. Sol. EtOH. Spar. sol.  $H_2O$ .  $D_{15}^{25}$  2.902.  $n_D^{15}$  1.6005. Stabilised by addition of 4% EtOH.

Timmermans, Martin, *J. chim. phys.*, 1928, 25, 411.

Soroos, Hinkamp, *J. Am. Chem. Soc.*, 1945, 67, 1642.

**Bromoformanilide.**

See under Bromoaniline.

**Bromofumaric Acid**

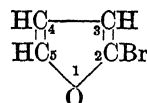
$C_4H_3O_4Br$  MW, 195

Prisms from AcOEt. M.p. 185–6°. Sol.  $H_2O$ . Decomp. at 200° to bromomaleic anhydride.

*Di-Me ester*:  $C_6H_7O_4Br$ . MW, 223. M.p. 30°.  $D_4^{25}$  1.5381.  $n_D^{25}$  1.47935.

*Di-Et ester*:  $C_8H_{11}O_4Br$ . MW, 251.  $D_4^{14}$  1.4174.  $n_D^{14}$  1.48194.

Michael, *J. prakt. Chem.*, 1895, 52, 301.

**2-Bromofuran**

$C_4H_3OBr$  MW, 147

B.p. 102°/744 mm.  $D_4^{20}$  1.6500.  $n_D^{20}$  1.49805.

Shepard, Winslow, Johnson, *J. Am. Chem. Soc.*, 1930, 52, 2083.

**3-Bromofuran.**

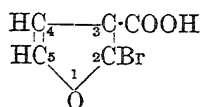
B.p. 103°.  $D_4^{20}$  1.6606.  $n_D^{20}$  1.49575.

Shepard, Winslow, Johnson, *J. Am. Chem. Soc.*, 1930, 52, 2083.

**Bromofuran-carboxylic Acid.**

See Bromo- $\beta$ -furoic Acid and Bromopyromucic Acid.

**2-Bromo- $\beta$ -furoic Acid** (2-Bromofuran-3-carboxylic acid)



$\text{C}_5\text{H}_7\text{O}_3\text{Br}$  MW, 191

Cryst. from  $\text{H}_2\text{O}$ . M.p. 158°.

Gilman, Burtner, *J. Am. Chem. Soc.*, 1933, 55, 2907.

**5-Bromo- $\beta$ -furoic Acid.**

Cryst. from  $\text{H}_2\text{O}$ . M.p. 130°.

Gilman, Burtner, *J. Am. Chem. Soc.*, 1933, 55, 2907.

**2-Bromoglutaric Acid**

$\text{C}_5\text{H}_7\text{O}_4\text{Br}$  MW, 211

M.p. anhyd. 139–40° (137°). Warming neutral sol. of Na salt  $\rightarrow$  vinylacetic acid.

*Di*-active-*amyl ester*: b.p. 185–7° corr.

Wislicenus, *Ber.*, 1899, 32, 2047.

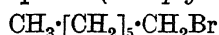
Ssamenoff, *Chem. Zentr.*, 1899, II, 28.

**Bromoguaiacol.**

See under Bromocatechol.

**1-Bromoheptadecane.**

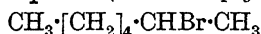
See Heptadecyl bromide.

**1-Bromoheptane** (*n*-Heptyl bromide)

$\text{C}_7\text{H}_{15}\text{Br}$  MW, 179

M.p. — 58.1°. B.p. 180°, 70.6°/19 mm.  $D_4^{15}$  1.14526.  $n_D^{25}$  1.4480.

Reid, Ruhoff, Burnett, *Organic Syntheses*, 1935, XV, 24.

**2-Bromoheptane** (*sec*-*n*-Heptyl bromide)

$\text{C}_7\text{H}_{15}\text{Br}$  MW, 179

B.p. 165–7° slight decomp., 84.5°/50 mm., 66.2°/24 mm.  $D_4^{15}$  1.1333.  $n_D^{25}$  1.4476.

Wheeler, *J. Am. Chem. Soc.*, 1903, 25, 532.

Sherrill, *J. Am. Chem. Soc.*, 1930, 52, 1982.

**3-Bromoheptane**

$\text{C}_7\text{H}_{15}\text{Br}$  MW, 179

B.p. 84–5°/74 mm., 62°/18 mm.  $D_4^{15}$  1.1418.  $n_D^{25}$  1.4507.

Dillon, Lucas, *J. Am. Chem. Soc.*, 1928, 50, 1711.

Sherrill, *J. Am. Chem. Soc.*, 1930, 52, 1982.

**4-Bromoheptane**

$\text{C}_7\text{H}_{15}\text{Br}$  MW, 179

B.p. 84–6°/72 mm., 75°/38 mm., 60°/18 mm.  $D_4^{15}$  1.1404.  $n_D^{25}$  1.4506.

Shonle, Waldo, Keltch, Coles, *J. Am. Chem. Soc.*, 1936, 58, 586.

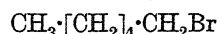
Sherrill, *J. Am. Chem. Soc.*, 1930, 52, 1982.

**1-Bromohexadecane.**

See Cetyl bromide.

**Bromohexahydrobenzoic Acid.**

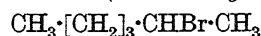
See Bromocyclohexane-carboxylic Acid.

**1-Bromohexane** (*n*-Hexyl bromide)

$\text{C}_6\text{H}_{13}\text{Br}$  MW, 165

B.p. 155.5°/743.8 mm. (153.2–153.5°/766.3 mm.), 87.8–88.2°/90 mm.  $D_4^{20}$  1.1992 (1.19807),  $D_4^{25}$  1.1763,  $D_4^{25}$  1.16899.  $n_D^{20}$  1.44778,  $n_D^{25}$  1.4452.

Lieben, Janecek, *Ann.*, 1877, 187, 137.

**2-Bromohexane** (*sec*-*n*-Hexyl bromide)

$\text{C}_6\text{H}_{13}\text{Br}$  MW, 165

B.p. 144°/749 mm., 78°/90 mm.  $D_4^{20}$  1.1658.  $n_D^{25}$  1.4832.

Olivier, *Rec. trav. chim.*, 1936, 55, 1027.

Ellis, Reid, *J. Am. Chem. Soc.*, 1932, 54, 1674.

**3-Bromohexane**

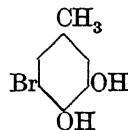
$\text{C}_6\text{H}_{13}\text{Br}$  MW, 165

B.p. 140–1°/748 mm.  $D_4^{20}$  1.1799.  $n_D^{25}$  1.4486.

Petrov, Kaplan, *Chem. Abstracts*, 1943, 37, 1985.

**Bromohexanone.**

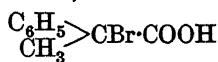
See Methyl bromobutyl Ketone.

**5-Bromohomocatechol** (5-Bromo-3:4-dihydroxytoluene)

$\text{C}_7\text{H}_7\text{O}_2\text{Br}$  MW, 203

Needles from EtOH. M.p. 80°. Sol.  $\text{H}_2\text{O}$ , EtOH, Et<sub>2</sub>O. Excess  $\text{FeCl}_3 \rightarrow$  green col.

Bayer, *Chem. Zentr.*, 1912, II, 655.

 **$\alpha$ -Bromohydratropic Acid** (1-Bromo-1-phenylpropionic acid)

$\text{C}_9\text{H}_9\text{O}_2\text{Br}$  MW, 229

*dl.*

M.p. 93–4° (90–1°). Sol. CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin. Insol. H<sub>2</sub>O. Decomp. above m.p. Hot aq. carbonates or NH<sub>3</sub> → atrolactic acid.

*d.*

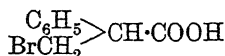
M.p. 86–7°. [ $\alpha$ ]<sub>D</sub> + 1.52° in EtOH.

Merling, *Ann.*, 1881, 209, 13.

Fittig, Wurster, *Ann.*, 1879, 195, 151.

Salkind, Peschekerowa, *Chem. Zentr.*, 1914, II, 1269.

$\alpha$ -Bromohydratropic Acid (2-Bromo-1-phenylpropionic acid)

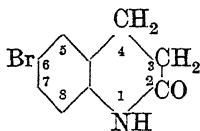


C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Br MW, 229

M.p. 93–4°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O. Hot aq. carbonates → tropic acid.

Merling, *Ann.*, 1881, 209, 13.

6-Bromohydrocarbostyryl (6-Bromo-3:4-dihydro-2-hydroxyquinoline, lactam of 5-bromo-2-aminohydrocinnamic acid)



C<sub>9</sub>H<sub>8</sub>ONBr MW, 226

M.p. 170–1°.

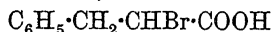
Uyeda, *J. Chem. Soc. Japan*, 1944, 65, 200.

7-Bromohydrocarbostyryl (7-Bromo-3:4-dihydro-2-hydroxyquinoline, lactam of 4-bromo-2-aminohydrocinnamic acid).

M.p. 178°. Sol. EtOH, AcOH, C<sub>6</sub>H<sub>6</sub>.

Gabriel, Zimmermann, *Ber.*, 1880, 13, 1683.

$\alpha$ -Bromohydrocinnamic Acid (1-Bromo-2-phenylpropionic acid)



C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Br MW, 229

*dl.*

Needles. M.p. 52°. B.p. 150–2°/13 mm., 138–41°/0.2 mm. Volatile. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>, Me<sub>2</sub>CO, AcOEt. Mod. sol. Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O, pet. ether. NaOH → cinnamic acid. D<sub>20</sub> 1.48.  $k = 1.72 \times 10^{-3}$  at 25°.

*Et ester*: C<sub>11</sub>H<sub>13</sub>O<sub>2</sub>Br. MW, 243. B.p. 169°/14–15 mm.

*Chloride*: C<sub>9</sub>H<sub>8</sub>OClBr. MW, 247.5. B.p. 132°/12 mm.

*d.*

Liq. [ $\alpha$ ]<sub>D</sub><sup>20</sup> + 7.9° (+ 10.2°).

*l.*

Liq. [ $\alpha$ ]<sub>D</sub><sup>20</sup> – 8.3°.

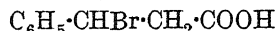
Clough, *J. Chem. Soc.*, 1926, 1674.

Fischer, Carl, *Ber.*, 1906, 39, 4002.

Marvel, *Organic Syntheses*, 1941, XXI, 99.

Greive, *Ber.*, 1943, 76, 1076.

$\beta$ -Bromohydrocinnamic Acid (2-Bromo-2-phenylpropionic acid)



C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Br MW, 229

*dl.*

Monoclinic prisms. M.p. 137°. Sol. EtOH, Et<sub>2</sub>O. Decomp. above m.p. to cinnamic acid. Decomp. by boiling H<sub>2</sub>O. Alkali carbonates → styrene.

*Me ester*: C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>Br, MW, 243. M.p. 38°.

*Et ester*: C<sub>11</sub>H<sub>13</sub>O<sub>2</sub>Br. MW, 257. Liq. D<sub>4</sub><sup>20</sup> 1.3559.  $n_D^{20}$  1.5425.

*d.*

[ $\alpha$ ]<sub>D</sub> + 96° in EtOH.

*l.*

*Et ester*: b.p. 82–4°/0.1 mm.  $n_D^{17}$  1.5424.

Senter, Ward, *J. Chem. Soc.*, 1924, 125, 2137.

Fourneau, Billeter, *Bull. soc. chim.*, 1940, 7, 593.

*o*-Bromohydrocinnamic Acid (*o*-Bromo-2-phenylpropionic acid)



C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Br MW, 229

M.p. 98°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, AcOH, C<sub>6</sub>H<sub>6</sub>.

*Chloride*: C<sub>9</sub>H<sub>8</sub>OClBr. MW, 247.5. B.p. 160–5°/18 mm.

Mayer, Philipps, Ruppert, Schmitt, *Ber.*, 1928, 61, 1966.

*m*-Bromohydrocinnamic Acid (*m*-Bromo-2-phenylpropionic acid).

Prisms. M.p. 75°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>.

Gabriel, *Ber.*, 1882, 15, 2294, 2298.

*p*-Bromohydrocinnamic Acid (*p*-Bromo-2-phenylpropionic acid).

Needles. M.p. 136°. Sol. EtOH, Et<sub>2</sub>O, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>. Ox. → *p*-bromobenzoic acid.

*Me ester*: C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>Br. MW, 243. B.p. 154–5°/16 mm.

Gabriel, Zimmermann, *Ber.*, 1880, 13, 1683.

Bromohydroquinone (*Adurol*) $C_6H_5O_2Br$ 

MW, 189

Leaflets. M.p. 110–11° (113–5°). Sublimes. Sol.  $H_2O$ , EtOH, Et<sub>2</sub>O,  $C_6H_6$ , AcOH. Mod. sol.  $CHCl_3$ , ligroin.  $FeCl_3 \rightarrow$  bromo-*p*-benzoquinone.

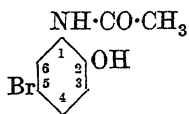
*Di-Me ether*:  $C_8H_9O_2Br$ . MW, 217. B.p. 262–3°. Insol.  $H_2O$ . Sol. most ord. org. solvents.  $D^{15} 1.445$ .

*Diacetyl*: m.p. 71–3°.

Dakin, *Am. Chem. J.*, 1909, 42, 491.

Kirchhof, *Astrowa, Chem. Zentr.*, 1932, II, 2451.

Sarauw, *Ann.*, 1881, 209, 105.

5-Bromo-2-hydroxyacetanilide (*p*-Bromo-*o*-acetylaminophenol) $C_8H_8O_2NBr$ 

MW, 230

Needles. M.p. 177–9°. Spar. sol.  $H_2O$ . Sol. EtOH,  $C_6H_6$ , alkalis.

*Et ether*: see under 4-Bromo-*o*-phenetidine.

Schütt, *J. prakt. Chem.*, 1885, 32, 63.

4-Bromo-3-hydroxyacetanilide (6-Bromo-*m*-acetylaminophenol).

Needles from AcOH.Aq. M.p. 209–13°. Sol. EtOH,  $Me_2CO$ , hot AcOH. Spar. sol.  $CHCl_3$ ,  $C_6H_6$ , ligroin.

Jacobs, Heidelberger, Rolf, *J. Am. Chem. Soc.*, 1919, 41, 464.

3-Bromo-4-hydroxyacetanilide (*o*-Bromo-*p*-acetylaminophenol).

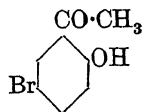
Needles. M.p. 157° (155°). Sol. EtOH,  $C_6H_6$ , alkalis.

*Me ether*: see under 2-Bromo-*p*-anisidine.

*Et ether*: see under 2-Bromo-*p*-phenetidine.

Hodurek, *Ber.*, 1897, 30, 477.

## 5-Bromo-2-hydroxyacetophenone

 $C_8H_7O_2Br$ 

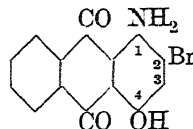
MW, 215

Cryst. from EtOH.Aq. M.p. 62°. EtOH sol. +  $FeCl_3 \rightarrow$  violet col. The Na salt is yellow and is spar. sol.  $H_2O$ .

*Me ether*: m.p. 39°. B.p. 173°; 24 mm. *Semicarbazone*: m.p. 205°.

Kostanecki, Ludwig, *Ber.*, 1898, 31, 2953.  
Quelet, Golse, *Compt. rend.*, 1946, 223, 159.

## 2-Bromo-4-hydroxy-1-aminoanthraquinone

 $C_{14}H_8O_3NBr$ 

MW, 318

Violet cryst. powder. M.p. 243° decomp. Sol. conc.  $H_2SO_4$  to yellow sol.; in  $H_2SO_4$  + boric acid, bluish-red. Sol. Py.

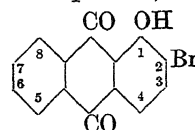
Bayer, B.P., 28,104/1907; D.R.P., 203,083; F.P., 385,358. *Chem. Zentr.*, 1908, II, 1659.

## 3-Bromo-1-hydroxy-2-aminoanthraquinone.

Reddish-brown needles from chlorobenzene. M.p. 269°. Sol. alkalis with violet-blue col. Sol. hot xylene. Spar. sol. hot  $C_6H_6$ .

Ullmann, Junghans, *Ann.*, 1913, 399, 330.

## 2-Bromo-1-hydroxyanthraquinone (2-Bromoerythroxyanthraquinone)

 $C_{14}H_7O_3Br$ 

MW, 303

Yellow needles. M.p. 197–200°.

I.G., D.R.P., 484,665, (*Chem. Zentr.*, 1930, I, 588).

## 4-Bromo-1-hydroxyanthraquinone (4-Bromoerythroxyanthraquinone).

Orange-yellow needles from AcOH. M.p. 197–8°. Sol. AcOH,  $C_6H_6$ . Spar. sol. EtOH. Na salt is red, spar. sol.  $H_2O$ .

*Me ether*:  $C_{15}H_9O_3Br$ . MW, 317. Pale yellow needles from AcOH. M.p. 195°. Mod. sol. AcOH. Spar. sol. EtOH. Sol. conc.  $H_2SO_4$  with reddish-yellow col.

Fries, Schürmann, *Ber.*, 1919, 52, 2185, 2190; D.R.P., 293,694, (*Chem. Zentr.*, 1916, II, 533).

## 1-Bromo-2-hydroxyanthraquinone.

Yellow cubes from EtOH. M.p. 185–7°.

*Acetyl*: yellow cryst. from  $Me_2CO$ . M.p. 182–3°.

*Benzoyl*: yellow needles from  $C_6H_6$ . M.p. 229–30°.

*Me ether*:  $C_{15}H_9O_3Br$ . MW, 317. Needles. M.p. 247°.

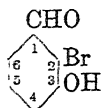
Hardacre, Perkin, *J. Chem. Soc.*, 1929, 186.

**3-Bromo-2-hydroxyanthraquinone.**

Cryst. from AcOH. M.p. 267-8°.

I.G., D.R.P., 484,665, (*Chem. Zentr.*, 1930, I, 588).**Bromo-2-hydroxybenzaldehyde.**

See Bromosalicylaldehyde.

**2-Bromo-3-hydroxybenzaldehyde** $C_7H_5O_2Br$  MW, 201

M.p. 141-2°.

*Me ether*:  $C_8H_7O_2Br$ . MW, 215. M.p. 45-6°.*Oxime*: m.p. 148°. *p*-Nitrophenylhydrazone: m.p. 206-8°.*Oxime*: m.p. 148°.*p*-Nitrophenylhydrazone: m.p. 241°.Hodgson, Beard, *J. Chem. Soc.*, 1925, 127, 875.**4-Bromo-3-hydroxybenzaldehyde.**

M.p. 131-2°.

*Me ether*:  $C_8H_7O_2Br$ . MW, 215. M.p. 74°.*Oxime*: m.p. 94-5°. *p*-Nitrophenylhydrazone: m.p. 246°.*Oxime*: m.p. 173-4°.*p*-Nitrophenylhydrazone: m.p. 210-12°.Hodgson, Beard, *J. Chem. Soc.*, 1925, 127, 875.**6-Bromo-3-hydroxybenzaldehyde.**

Needles. M.p. 133°. Sol. most org. solvents.

*Me ether*:  $C_8H_7O_2Br$ . MW, 215. M.p. 75-6°.*Oxime*: needles from EtOH.Aq. M.p. 117°.*Semicarbazone*: decomp. at 251°. *p*-Nitrophenylhydrazone: m.p. 225°.*Oxime*: m.p. 157°.*Semicarbazone*: m.p. 253°.*p*-Nitrophenylhydrazone: m.p. 240-3°.Hodgson, Beard, *J. Chem. Soc.*, 1925, 127, 875.**2-Bromo-4-hydroxybenzaldehyde.**

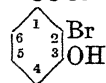
Pale yellow needles. M.p. 159-60°.

*Me ether*: 2-bromoanisaldehyde.  $C_8H_7O_2Br$ . MW, 215. M.p. 77°. *Oxime*: m.p. 93°. *Semicarbazone*: m.p. 232°. *p*-Nitrophenylhydrazone: m.p. 250° decomp.*Et ether*:  $C_9H_9O_2Br$ . MW, 229. Needles. M.p. 69-70°.*Oxime*: m.p. 128-5° (184°).*Semicarbazone*: m.p. 212°.*p*-Nitrophenylhydrazone: m.p. 274° decomp.Gattermann, *Ann.*, 1908, 357, 335.Hodgson, Jenkinson, *J. Chem. Soc.*, 1927, 3041.**3-Bromo-4-hydroxybenzaldehyde.**Leaflets. M.p. 124°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, AcOH, aq. alkalis. Mod. sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>. Spar. sol. cold H<sub>2</sub>O, ligroin.*Me ether*: 3-bromoanisaldehyde. Cryst. from Et<sub>2</sub>O. M.p. 54°.*Oxime*: m.p. 135°.*Semicarbazone*: m.p. 195-6°.*Phenylhydrazone*: prisms from EtOH.Aq. M.p. 105°.*Anil*: m.p. 135°.*p*-Thiocyanophenylhydrazone: m.p. 186-7°.Paal, *Ber.*, 1895, 28, 2409.Sen, Ray, *J. Indian Chem. Soc.*, 1932, 9, 173.**Bromo-*o*-hydroxybenzoic Acid.**

See Bromosalicylic Acid.

**2-Bromo-*m*-hydroxybenzoic Acid**

COOH

 $C_7H_5O_3Br$  MW, 217M.p. 160-1°. Sol. Et<sub>2</sub>O, hot H<sub>2</sub>O.*Me ether*:  $C_8H_7O_3Br$ . MW, 231. Needles from H<sub>2</sub>O. M.p. 157-8°. Sol. EtOH, Me<sub>2</sub>CO, CHCl<sub>3</sub>.Beijer, *Rec. trav. chim.*, 1929, 48, 1010.**4-Bromo-*m*-hydroxybenzoic Acid.**

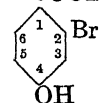
M.p. 226°.

*Me ester*:  $C_8H_7O_3Br$ . MW, 231. Needles. M.p. 126°.*Et ester*:  $C_9H_9O_3Br$ . MW, 245. M.p. 94°.*Me ether*:  $C_8H_7O_3Br$ . MW, 231. Needles from H<sub>2</sub>O. M.p. 219-20°.Beyer, *Rec. trav. chim.*, 1921, 40, 621.Buehler, Harris, Shacklett, Block, *J. Am. Chem. Soc.*, 1946, 68, 574.**6-Bromo-*m*-hydroxybenzoic Acid.**

M.p. 185° decomp.

*Me ether*:  $C_8H_7O_3Br$ . MW, 231. Needles from H<sub>2</sub>O. M.p. 161-2°.Beyer, *Rec. trav. chim.*, 1921, 40, 621.**2-Bromo-*p*-hydroxybenzoic Acid**

COOH

 $C_7H_5O_3Br$  MW, 217Needles. M.p. 151°. FeCl<sub>3</sub> → pink col.*Me ether*: see 2-Bromoanisic Acid.Hodgson, Jenkinson, *J. Chem. Soc.*, 1927, 3042.**3-Bromo-*p*-hydroxybenzoic Acid.**Needles. M.p. 148° (177°). Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O.*Me ester*:  $C_8H_7O_3Br$ . MW, 231. M.p. 107°. B.p. 163-6°/16 mm. Sol. EtOH.*Et ester*:  $C_9H_9O_3Br$ . MW, 245. M.p. 103°. B.p. 270-4° decomp.

*Butyl ester*:  $C_{10}H_{13}O_3Br$ . MW, 273. Needles from EtOH. M.p.  $83-4^\circ$ .

*Nitrile*:  $C_7H_4ONBr$ . MW, 198. Needles. M.p.  $155^\circ$ . Sol. EtOH. *Acetyl*: needles from ligroin. M.p.  $100-1^\circ$ .

*Me ether*: see 3-Bromoanisic Acid.

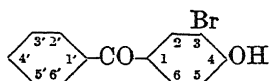
*Acetyl*: m.p.  $155^\circ$ .

Paal, *Ber.*, 1895, 28, 2411.

Leulier, Pinet, *Bull. soc. chim.*, 1927, 41, 1369.

Cavill, *J. Soc. Chem. Ind.*, 1945, 64, 212.

### 3-Bromo-4-hydroxybenzophenone



$C_{13}H_9O_2Br$  MW, 277

Needles. M.p.  $180-1^\circ$  ( $183^\circ$ ). Sol. alkalis. Forms yellow K salt.

*Me ether*:  $C_{14}H_{11}O_2Br$ . MW, 291. Needles from EtOH. M.p.  $94^\circ$  ( $79-80^\circ$ ). *Oxime*: two forms: ( $\alpha$ -) Plates from EtOH. M.p.  $164^\circ$ . ( $\beta$ -) Needles. M.p.  $111-5^\circ$ .

*Et ether*:  $C_{15}H_{13}O_2Br$ . MW, 305. M.p.  $102^\circ$ .

Montagne, *Rec. trav. chim.*, 1922, 41, 711.

Blakey, Jones, Scarborough, *J. Chem. Soc.*, 1927, 2868.

### 2'-Bromo-4-hydroxybenzophenone.

M.p.  $114^\circ$  (rapid heat.).

*Me ether*:  $C_{14}H_{11}O_2Br$ . MW, 291. Cryst. from EtOH. M.p.  $96^\circ$ .

*Et ether*:  $C_{15}H_{13}O_2Br$ . MW, 305. M.p.  $79-5^\circ$ . B.p.  $247^\circ/18$  mm. *Oxime*: m.p.  $161-3^\circ$ .

Montagne, *Rec. trav. chim.*, 1923, 42, 501.

### 3'-Bromo-4-hydroxybenzophenone.

Cryst. from EtOH.Aq. M.p.  $171^\circ$ .

*Et ether*:  $C_{15}H_{13}O_2Br$ . MW, 305. M.p.  $79-5^\circ$ . B.p.  $232^\circ/11$  mm.

Montagne, *Rec. trav. chim.*, 1922, 41, 711.

### 4'-Bromo-4-hydroxybenzophenone.

Needles from  $C_6H_6$ . M.p.  $191^\circ$ .

*Me ether*:  $C_{14}H_{11}O_2Br$ . MW, 291. M.p.  $160-1^\circ$ .

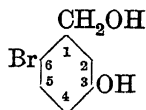
*Et ether*:  $C_{15}H_{13}O_2Br$ . MW, 305. Cryst. from EtOH. M.p.  $132^\circ$ .

Montagne, *Chem. Zentr.*, 1917, II, 290.

### Bromo-2-hydroxybenzyl Alcohol.

See Bromosaligenin.

### 6-Bromo-3-hydroxybenzyl Alcohol



$C_7H_7O_2Br$

MW, 203

Needles. M.p.  $142^\circ$ . Sol. hot  $H_2O$ , hot  $CHCl_3$ , hot  $C_6H_6$ , hot toluene.  $FeCl_3 \rightarrow$  violet-blue col.

Lock, *Ber.*, 1929, 62, 1183.

### 2-Bromo-4-hydroxybenzyl Alcohol.

Needles. M.p.  $137-8^\circ$ . Sol. EtOH,  $Et_2O$ , AcOH, hot  $C_6H_6$ . Insol. ligroin.

Auwers, Strecker, *Ann.*, 1904, 334, 330.

### 3-Bromo-4-hydroxybenzyl Alcohol.

M.p.  $128^\circ$ . Sol.  $H_2O$  to 0.78%.

Dunning, Dunning, Reid, *J. Am. Chem. Soc.*, 1936, 58, 1567.

### Bromohydroxybutane.

See Bromo-sec.n-butyl Alcohol.

### 2-Bromo-1-hydroxy-2-butylene.

See 2-Bromocrotyl Alcohol.

### 2-Bromo-1-hydroxybutyric Acid

$CH_3 \cdot CHBr \cdot CH(OH) \cdot COOH$

$C_4H_7O_3Br$  MW, 183

Prisms. M.p.  $97^\circ$  ( $90^\circ$ ).

Melikow, *Ann.*, 1886, 234, 207.

### 1-Bromo-2-hydroxybutyric Acid

$CH_3 \cdot CH(OH) \cdot CHBr \cdot COOH$

$C_4H_7O_3Br$  MW, 183

Prisms. M.p.  $87^\circ$ . Hot conc.  $H_2SO_4 \rightarrow$  1-bromocrotonic acid.

*Me ether*:  $C_5H_9O_3Br$ . MW, 197. M.p.  $62-3^\circ$ . B.p.  $115-20^\circ/1.4$  mm.

*Et ether*:  $C_6H_{11}O_3Br$ . MW, 211. M.p.  $75^\circ$ .

Melikow, *J. prakt. Chem.*, 1900, 61, 556.

West, Carter, *J. Biol. Chem.*, 1937, 119, 103.

Kögl, Velostra, van der Laan, *Ann.*, 1942, 552, 1.

Polgar, Robinson, *J. Chem. Soc.*, 1945, 389.

### 3-Bromo-2-hydroxybutyric Acid

$BrCH_2 \cdot CH(OH) \cdot CH_2 \cdot COOH$

$C_4H_7O_3Br$  MW, 183

*Et ester*:  $C_6H_{11}O_3Br$ . MW, 211. B.p.  $94-6^\circ/2$  mm. *Phenyl ether*: b.p.  $199-200^\circ/16$  mm.

*Nitrile*:  $C_4H_6ONBr$ . MW, 164. B.p.  $158-9^\circ/18$  mm.,  $117-18^\circ/2$  mm.

Braun, *J. Am. Chem. Soc.*, 1930, 52, 3173.

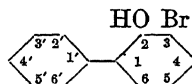
Lespieau, *Compt. rend.*, 1903, 136, 1265.

### 1-Bromo-3-hydroxybutyric Acid.

$\gamma$ -Lactone: b.p.  $130-1^\circ/8$  mm.  $D_{25}^{25}$  1.5094.

Livak et al., *J. Am. Chem. Soc.*, 1945, 67, 2218.

### 3-Bromo-2-hydroxydiphenyl



$C_{12}H_9OBr$

MW, 249

B.p. 173–8°, 12 mm.

Christiansen, Moness, Harris, U.S.P. 1,989,081, (*Chem. Abstracts*, 1935, 29, 1942).

Chem. Fabrik von Heyden, D.R.P. 616,848, (*Chem. Zentr.*, 1936, I, 884).

### 5-Bromo-2-hydroxydiphenyl.

Cryst. from pet. ether. M.p. 53–4°. B.p. 180–2°/12 mm. Strong bactericide.

Acetyl: m.p. 66–7°.

Christiansen, Moness, Harris, U.S.P. 1,989,081, (*Chem. Abstracts*, 1935, 29, 1942).

Chem. Fabrik von Heyden, D.R.P. 616,848, (*Chem. Zentr.*, 1936, I, 884).

### 5-Bromo-3-hydroxydiphenyl.

B.p. 208–10°/11 mm.

*Et ether*: C<sub>14</sub>H<sub>13</sub>OBr. MW, 277. M.p. 70–1°.

*Benzoyl*: needles from EtOH. M.p. 108°.

Hinkel, Hey, *J. Chem. Soc.*, 1928, 1203.

### 3-Bromo-4-hydroxydiphenyl.

Cryst. from light petroleum. M.p. 93·5–94·5°.

*Acetyl*: hexagonal plates from ligroin or MeOH. M.p. 74–5°.

*Benzoyl*: cryst. from EtOH. M.p. 93–4°.

*Benzenesulphonyl*: cryst. from MeOH. Aq. M.p. 102–3°.

Hazlet, Alliger, Tiede, *J. Am. Chem. Soc.*, 1939, 61, 1448.

### 4-Bromo-4-hydroxydiphenyl.

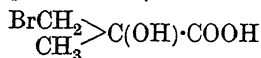
Plates from EtOH. M.p. 164–6° (155–6°).

Bell, Robinson, *J. Chem. Soc.*, 1927, 1131.

### β-Bromo-α-hydroxyethylbenzene.

See Styrene bromohydrin.

### 2-Bromo-1-hydroxyisobutyric Acid (β-Bromo-α-methyl-lactic acid)



C<sub>4</sub>H<sub>7</sub>O<sub>3</sub>Br MW, 183

*d.*

Cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 114°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO. [α]<sub>D</sub><sup>20</sup> +7·40° in H<sub>2</sub>O.

*dl.*

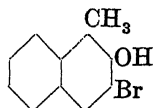
M.p. 102–3°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, hot C<sub>6</sub>H<sub>6</sub>. Insol. CHCl<sub>3</sub>, CS<sub>2</sub>. Non-volatile in steam.

Kay, *J. Chem. Soc.*, 1909, 95, 561.

### Bromo-hydroxy-methoxybenzaldehyde.

See Bromovanillin and under Bromodihydroxybenzaldehyde.

### 3-Bromo-2-hydroxy-1-methylnaphthalene (3-Bromo-1-methyl-2-naphthol)



C<sub>11</sub>H<sub>9</sub>OBr

MW, 237

Needles. M.p. 76°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>.

*Acetyl*: m.p. 77°.

Fries, Schimmelschmidt, *Ann.*, 1930, 484, 276.

### 6-Bromo-2-hydroxy-1-methylnaphthalene (6-Bromo-1-methyl-2-naphthol).

Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 129°. Sol. EtOH, Et<sub>2</sub>O, AcOH, CHCl<sub>3</sub>. Mod. sol. C<sub>6</sub>H<sub>6</sub>. Spar. sol. pet. ether.

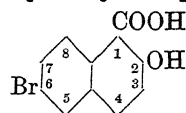
*Me ether*: C<sub>12</sub>H<sub>11</sub>OBr. MW, 251. Needles from AcOEt. M.p. 65–6°.

*Et ether*: C<sub>13</sub>H<sub>13</sub>OBr. MW, 265. Needles from EtOH. M.p. 66°.

*Acetyl*: needles from pet. ether. M.p. 88°.

Fries, Hübner, *Ber.*, 1906, 39, 442.

### 6-Bromo-2-hydroxy-1-naphthoic Acid



C<sub>11</sub>H<sub>7</sub>O<sub>3</sub>Br MW, 267

*Me ether*: m.p. 176–7°. *Me ester*: m.p. 112·5°.

Warren, Gindy, Baddar, *J. Chem. Soc.*, 1941, 687.

### 4-Bromo-3-hydroxy-1-naphthoic Acid.

Cryst. from AcOH. M.p. 231–2°.

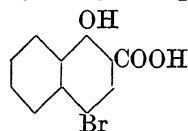
Lesser, Gad, *Ber.*, 1925, 58, 2551.

### 3-Bromo-4-hydroxy-1-naphthoic Acid.

M.p. 208°.

Akram, Desai, *Chem. Abstracts*, 1940, 34, 5436.

### 4-Bromo-1-hydroxy-2-naphthoic Acid



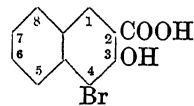
C<sub>11</sub>H<sub>7</sub>O<sub>3</sub>Br MW, 267

Needles from EtOH. M.p. 245–6° (238°).

Schmitt, Burkard, *Ber.*, 1887, 20, 2700.

Desai, Hamid, Shroff, *Proc. Indian Acad. Sci.*, 1941, 13A, 33, 184.

### 4-Bromo-3-hydroxy-2-naphthoic Acid (4-Bromo-β-hydroxynaphthoic acid)



C<sub>11</sub>H<sub>7</sub>O<sub>3</sub>Br MW, 267

Yellow needles from EtOH–AcOH. M.p. 233–5° decomp.

*Acetyl*: m.p. 183°.

*Anilide*: m.p. 161–2°.

Gradenwitz, *Ber.*, 1894, 27, 2622.



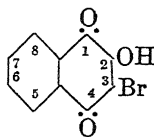
**6-Bromo-3-hydroxy-2-naphthoic Acid**  
(6-Bromo-3-hydroxynaphthoic acid).  
Cryst. from AcOH. M.p. 265-6°.

I.G., D.R.P., 564,128, (*Chem. Zentr.*, 1933, II, 446).

**7-Bromo-3-hydroxy-2-naphthoic Acid**  
(7-Bromo-3-hydroxynaphthoic acid).  
M.p. 262°.

I.G., B.P., 381,947, (*Chem. Zentr.*, 1933, I, 507).

**3-Bromo-2-hydroxy-1:4-naphthoquinone**



$C_{10}H_5O_3Br$  MW, 253

Yellow prisms from EtOH. M.p. 202°. Sublimes. Sol. 95% EtOH to 2% at 25°. Spar. sol.  $H_2O$ ,  $Et_2O$ ,  $C_6H_6$ . Sol. alkalis with red col. *Anil*: brownish-red needles from EtOH. M.p. 233°.

*Et ether*:  $C_{12}H_9O_3Br$ . MW, 281. Yellow needles from EtOH. M.p. 118°.

Fries, Schimmelschmidt, *Ann.*, 1930, 484, 266.

Dimroth, Schultze, *Ann.*, 1916, 411, 345.

**6-Bromo-2-hydroxy-1:4-naphthoquinone.**  
Needles. M.p. 203°. Forms deep red alkali salts.

*Anil*: red prisms from xylene. M.p. 276°.

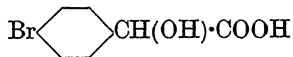
Fries, Schimmelschmidt, *Ann.*, 1930, 484, 276.

**2-Bromo-5-hydroxy-1:4-naphthoquinone.**

*Me ether*: yellow. M.p. 134°.

Carter, Race, Rowe, *J. Chem. Soc.*, 1942, 236.

**4-Bromo- $\alpha$ -hydroxyphenylacetic Acid**



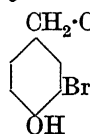
$C_8H_7O_3Br$  MW, 231

Needles from  $C_6H_6$ . M.p. 118°. Sol.  $H_2O$ , EtOH,  $Et_2O$ , hot  $CHCl_3$ .

Collet, *Bull. soc. chim.*, 1899, 21, 68.

Söderbaum, *Ber.*, 1892, 25, 3467.

**3-Bromo-4-hydroxyphenylacetic Acid**  
(3-Bromo-4-hydroxy- $\alpha$ -toluic acid)



$C_8H_7O_3Br$  MW, 231

Needles. M.p. 107°. Sol. MeOH, EtOH,  $Et_2O$ ,  $Me_2CO$ . Spar. sol.  $H_2O$ ,  $CHCl_3$ ,  $C_6H_6$ . Insol. pet. ether.

*Me ester*:  $C_9H_5O_3Br$ . MW, 245. M.p. 41°.

*Me ether*:  $C_9H_5O_3Br$ . MW, 245. M.p. 118°.

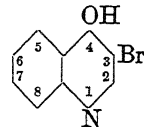
*Me ester*:  $C_{10}H_{11}O_3Br$ . MW, 259. M.p. 48-5°.

Kondo, Uyeo, *J. pharm. Soc. Japan*, 1933, 53, 92.

**Bromo-2-hydroxyquinoline.**

See Bromocarbostyryl.

**3-Bromo-4-hydroxyquinoline** (3-Bromo-kynurine, 3-bromo-4-quinolinol).



$C_9H_6ONBr$  MW, 224

Leaflets. M.p. 282° (288-9°). Sol. EtOH,  $Me_2CO$ , AcOH. Spar. sol.  $H_2O$ .

Niementowski, Sucharda, *J. prakt. Chem.*, 1916, 94, 226.

Riegel *et al.*, *J. Am. Chem. Soc.*, 1946, 68, 1229.

Surrey, Cutler, *ibid.*, 2570.

**7-Bromo-4-hydroxyquinoline** (7-Bromo-4-quinolinol).

M.p. 100-5-1.5°.

Surrey, Hamer, *J. Am. Chem. Soc.*, 1946, 68, 113.

**6-Bromo-5-hydroxyquinoline** (6-Bromo-5-quinolinol).

Needles. M.p. 162°.

Claus, Cäsar, *J. prakt. Chem.*, 1896, 53, 338.

**8-Bromo-5-hydroxyquinoline** (8-Bromo-5-quinolinol).

Needles. M.p. 190° decomp. Sol. EtOH.

Claus, *J. prakt. Chem.*, 1896, 53, 335.

**4-Bromo-6-hydroxyquinoline** (4-Bromo-6-quinolinol).

Pale yellow needles from 70% EtOH. M.p. 253°. Sol. EtOH,  $Et_2O$ ,  $Me_2CO$ . Spar. sol.  $C_6H_6$ .

*Me ether*:  $C_{10}H_8ONBr$ . MW, 238. Cryst. from EtOH. M.p. 106°. Sol. MeOH, EtOH,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ . Spar. sol. pet. ether.

John, Andraschko, *J. prakt. Chem.*, 1930, 128, 213.

**5-Bromo-6-hydroxyquinoline** (5-Bromo-6-quinolinol).

Needles from EtOH.Aq. M.p. 186°.  $KMnO_4$   $\rightarrow$  quinolinic acid.

*Methochloride*: yellow needles. M.p. 212-15°.

*Methiodide*: yellow needles from  $H_2O$ . M.p. 156-8° decomp.

*Me ether*:  $C_{10}H_8ONBr$ . MW, 238. Needles from EtOH. M.p. 94–5°. *Methiodide*: yellow needles from  $H_2O$ . M.p. 220° decomp.

*Et ether*:  $C_{11}H_9ONBr$ . MW, 252. Needles from EtOH. M.p. 81–2°. *Methiodide*: yellow needles from  $H_2O$ . M.p. 215° decomp.

Claus, Kaufmann, *J. prakt. Chem.*, 1897, 55, 523.

**8-Bromo-7-hydroxyquinoline** (8-*Bromo-7-quinolinol*).

*B,HBr*: cryst. M.p. 272–3°. Aq. EtOH sol. → brownish-red col. with  $FeCl_3$ .

Skraup, *Monatsh.*, 1882, 3, 565.

**5-Bromo-8-hydroxyquinoline** (5-*Bromo-8-quinolinol*).

Needles from EtOH. M.p. 124°. Sol. hot  $H_2O$ . Sublimes. Volatile in steam.

*Methiodide*: golden leaflets +  $1H_2O$ . M.p. 157°.

*Me ether*:  $C_{10}H_8ONBr$ . MW, 238. Needles from EtOH.Aq. M.p. 82°. *Methiodide*: brown cryst. from  $H_2O$ . M.p. 161°.

*Et ether*:  $C_{11}H_{10}ONBr$ . MW, 252. Needles from EtOH.Aq. M.p. 55°.  $B_2H_2PtCl_6, H_2O$ : m.p. 218–220° decomp.

Rosenmund, Döring, *Arch. Pharm.*, 1928, 266, 277.

Claus, Howitz, *J. prakt. Chem.*, 1891, 44, 444.

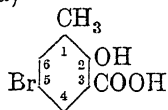
**7-Bromo-8-hydroxyquinoline** (7-*Bromo-8-quinolinol*).

Needles. M.p. 138°. Sublimes.

*Me ether*: needles from EtOH.Aq. M.p. 78°. *Methiodide*: reddish-brown needles from  $H_2O$ . M.p. 154° decomp.

Claus, Giwartovsky, *J. prakt. Chem.*, 1896, 54, 379.

**5-Bromo-2-hydroxy-*m*-toluic Acid** (5-*Bromo-o-cresotinic acid*, 2-*hydroxy-3-methyl-5-bromobenzoic acid*)



$C_8H_7O_3Br$  MW, 231

Needles. M.p. 236°. Spar. sol.  $CHCl_3$ ,  $C_6H_6$ . Insol.  $H_2O$ , pet. ether.

*Me ester*:  $C_9H_9O_3Br$ . MW, 245. Needles. M.p. 109°.

*Et ester*:  $C_{10}H_{11}O_3Br$ . MW, 259. Needles. M.p. 75°.

*Chloride*:  $C_8H_6O_2ClBr$ . MW, 249.5. M.p. 80–5°.

*Amide*:  $C_8H_8O_2NBr$ . MW, 230. M.p. 75–8°.

*Anilide*: cryst. from EtOH.Aq. M.p. 125°.

2-*Acetyl*: m.p. 155°.

Borsche, Bolser, *Ber.*, 1901, 34, 2102.

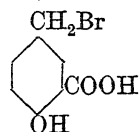
**5-Bromo-4-hydroxy-*m*-toluic Acid** (5-*Bromo-p-cresotinic acid*).

Needles from EtOH.Aq. M.p. 204–5°.  $FeCl_3$  → violet col.

Einhorn, Ehret, *Ann.*, 1897, 295, 185.

Einhorn, D.R.P. 90,556, (*Chem. Zentr.*, 1897, I, 1006).

**$\omega$ -Bromo-4-hydroxy-*m*-toluic Acid** ( $\omega$ -*Bromo-p-cresotinic acid*)



$C_8H_7O_3Br$  MW, 231

Plates. M.p. 187°.

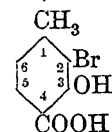
Bayer, D.R.P., 113,723, (*Chem. Zentr.*, 1900, II, 795).

**5-Bromo-6-hydroxy-*m*-toluic Acid** (3-*Methyl-4-hydroxy-5-bromobenzoic acid*).

Needles. M.p. 227°. Sol. MeOH.

Robertson, *J. Chem. Soc.*, 1908, 93, 788.

**2-Bromo-3-hydroxy-*p*-toluic Acid** (2-*Bromo-m-cresotinic acid*)



$C_8H_7O_3Br$  MW, 231

M.p. 211°.

*Me ether*:  $C_9H_9O_3Br$ . MW, 245. M.p. 137–8°.

Meldrum, Bamji, *J. Indian Chem. Soc.*, 1936, 13, 641.

**6-Bromo-3-hydroxy-*p*-toluic Acid** (6-*Bromo-m-cresotinic acid*).

Cryst. from  $CCl_4$ . M.p. 221°. Sol. EtOH,  $Et_2O$ , hot  $H_2O$ . Spar. sol.  $CHCl_3$ , ligroin,  $C_6H_6$ ,  $CCl_4$ .  $FeCl_3$  → bluish-violet col.

*Me ester*:  $C_9H_9O_3Br$ . MW, 245. Needles from MeOH. M.p. 48°. Sol. common org. solvents. Insol. cold  $H_2O$ . Volatile in steam.

*Me ether*:  $C_{10}H_{11}O_3Br$ . MW, 259. Plates from MeOH.Aq. M.p. 45–6°. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ . Insol. cold  $H_2O$ . Volatile in steam.

3-*Acetyl*: leaflets. M.p. 155°.

Walther, Zipper, *J. prakt. Chem.*, 1915, 91, 388.

**3-Bromo-4-hydroxy- $\alpha$ -toluic Acid**.

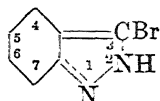
See 3-Bromo-4-hydroxyphenylacetic Acid.

**Bromo-hydroxyxylene**.

See Bromoxylenol.

**2-Bromo-1 : 3-indandione**.

See 2-Bromo-1 : 3-diketohydrindene.

**3-Bromoindazole (3-Bromobenz-1:2-diazole)**

$C_7H_5N_2Br$  MW, 197

Needles from hot  $H_2O$  or ligroin. M.p.  $144^\circ$ .  
Mod. sol. hot  $H_2O$ .

2-N-Me:  $C_8H_7N_2Br$ . MW, 211. Needles  
from EtOH.Aq. M.p.  $82-3^\circ$ .

Acetyl deriv.: needles from EtOH. M.p.  $83-4^\circ$ .

Auwers, Lange, *Ber.*, 1922, 55, 1164.

**5-Bromoindazole (5-Bromobenz-1:2-diazole)**

Exists in stereoisomeric forms. Needles from  
hot EtOH.Aq. M.p.  $124-5^\circ$  and  $132-3^\circ$ . Sub-  
limes below  $100^\circ$ . Mod. volatile in steam.

*B.HCl*: m.p.  $167-70^\circ$ .

1-N-Me: leaflets from pet. ether. M.p.  
 $111-12^\circ$ . Picrate: m.p.  $124-6^\circ$ .

2-N-Me: needles from pet. ether. M.p.  $97^\circ$ .  
Picrate: m.p.  $163-5^\circ$ .

1-N-Et: cryst. M.p.  $48^\circ$ . Volatile in steam.

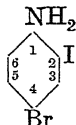
Acetyl deriv.: (1) stable form. Needles,  
m.p.  $143-4^\circ$ . (2) Labile form, m.p.  $137-8^\circ$ .  
Heat  $\rightarrow$  stable form.

Picrate: yellow needles from  $Et_2O$ . M.p.  
 $195-6^\circ$ .

Auwers, *Ber.*, 1922, 55, 1139.

**Bromiodoacetanilide.**

See under Bromiodoaniline.

**4-Bromo-2-iodoaniline**

$C_6H_5NBrI$  MW, 298

Needles from EtOH.Aq. M.p.  $71^\circ$ .

*B.HCl*: m.p.  $205-6^\circ$ .

N-Acetyl: 4-bromo-2-iodoacetanilide. Cryst.  
from EtOH. M.p.  $148^\circ$ .

N-Benzoyl: cryst. from EtOH. M.p.  $152^\circ$ .

Dains, Vaughan, Janney, *J. Am. Chem.*  
*Soc.*, 1918, 40, 930.

**4-Bromo-3-iodoaniline.**

N-Acetyl: 4-bromo-3-iodoacetanilide. M.p.  
 $141^\circ$ .

Elbs, Volk, *J. prakt. Chem.*, 1919, 99, 272.

**2-Bromo-4-iodoaniline.**

M.p.  $75-6^\circ$ .

N-Acetyl: 2-bromo-4-iodoacetanilide. M.p.  
 $143^\circ$ .

Bradfield, Orton, Roberts, *J. Chem. Soc.*,  
1928, 782.

**3-Bromo-4-iodoaniline.**

M.p.  $56^\circ$ .

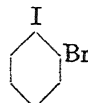
*B.HCl*: m.p.  $192^\circ$ .

Dict. of Org. Comp—I.

N-Acetyl: 3-bromo-4-iodoacetanilide. M.p.  
 $199^\circ$ .

Dains, Vaughan, Janney, *J. Am. Chem.*  
*Soc.*, 1918, 40, 932.

Dains, Magers, *J. Am. Chem. Soc.*, 1930,  
52, 1572.

**2-Bromo-1-iodobenzene**

$C_6H_4BrI$  MW, 283

M.p.  $2^\circ$ . B.p.  $257^\circ/754$  mm.  $D_4^{25}$  2.2571.  
 $n_D^{25}$  1.6618. Turns red on standing.

Narbutt, *Ber.*, 1919, 52, 1028.

Körner, *Gazz. chim. ital.*, 1874, 4, 340.

**3-Bromo-1-iodobenzene.**

M.p.  $-9.3^\circ$ . B.p.  $252^\circ/754$  mm.,  $120^\circ/18$   
mm. Turns red on standing.

Narbutt, *Ber.*, 1919, 52, 1028.

Körner, *Gazz. chim. ital.*, 1874, 4, 340.

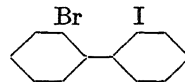
**4-Bromo-1-iodobenzene.**

Cryst. M.p.  $92^\circ$ . B.p.  $251^\circ/754$  mm. Sol.  
 $Et_2O$ . Spar. sol. cold EtOH.

Hirtz, *Ber.*, 1896, 29, 1405.

Narbutt, *Ber.*, 1919, 52, 1028.

Körner, *Gazz. chim. ital.*, 1874, 4, 340.

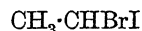
**2'-Bromo-2-iododiphenyl**

$C_{12}H_8BrI$  MW, 359

Cryst. from EtOH. M.p.  $90^\circ$ .

Mascarelli, Gatti, *Gazz. chim. ital.*, 1931,  
61, 796.

**1-Bromo-1-iodoethane (Ethylidene bromo-  
iodide)**

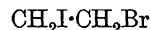


$C_2H_4BrI$  MW, 235

B.p.  $142-3^\circ$ .  $D^{16}$  2.452. Alc. KOH  $\rightarrow$  vinyl  
bromide.

Lagermark, *Ber.*, 1874, 7, 912.

**2-Bromo-1-iodoethane (Ethylene bromo-  
iodide)**



$C_2H_4BrI$  MW, 235

Needles. M.p.  $28^\circ$ . B.p.  $163^\circ$ . Sol. hot  
EtOH.  $D^{29}$  2.516. Cold alc. KOH  $\rightarrow$  vinyl  
iodide, hot  $\rightarrow$  acetylene.

Gagarin, *Ber.*, 1874, 7, 733.

**Bromiodomethane (Methylene bromiodide)**



$CH_2BrI$  MW, 221

B.p.  $138-40^\circ$ .  $D^{17}$  2.926.

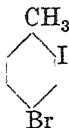
Henry, *J. prakt. Chem.*, 1885, 32, 431.

**Bromo- $\omega$ -iodotoluene.**

See Bromobenzyl iodide.

 **$\omega$ -Bromo-iodotoluene.**

See Iodobenzyl bromide.

**4-Bromo-2-iodotoluene** $C_7H_6BrI$  MW, 297

B.p. 262–7°.

Varma, Sreenivasmurthyachar, *J. Indian Chem. Soc.*, 1936, 13, 187.**5-Bromo-2-iodotoluene.**B.p. 262–5°.  $n_D^{20}$  1.6484.Holleman, *Rec. trav. chim.*, 1912, 31, 270.**6-Bromo-2-iodotoluene.**B.p. 135–40°/15 mm.  $D_4^{20}$  2.044.Cohen, Miller, *J. Chem. Soc.*, 1904, 85, 1627.**4-Bromo-3-iodotoluene.**

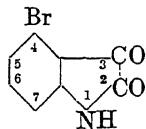
B.p. 145–50°/20 mm.

Stoughton, Adams, *J. Am. Chem. Soc.*, 1932, 54, 4426.**5-Bromo-3-iodotoluene.**

M.p. 23°. B.p. 150°/29 mm.

McAlister, Kenner, *J. Chem. Soc.*, 1928 1913.**2-Bromo-4-iodotoluene.**

B.p. 266–7°.

Hirz, *Ber.*, 1896, 29, 1405.**3-Bromo-4-iodotoluene.**B.p. 265–7°.  $D^{20}$  2.044.Wroblevsky, *Ann.*, 1873, 168, 159.**4-Bromoisatin** $C_8H_4O_2NBr$  MW, 226

Plates. M.p. 258–9°.

Ettinger, Friedländer, *Ber.*, 1912, 45, 2081.**5-Bromoisatin.**

Prisms from EtOH. M.p. 255°.

3-Oxime: pale yellow needles from EtOH. Decomp. at 240°. Benzyl ether: yellow needles. M.p. 200°.

2-Phenylhydrazone: red cryst. from amyl alcohol. M.p. 242–3°.

3-Phenylhydrazone: yellow needles from EtOH. M.p. 271–2°.

N-Acetyl: pale yellow prisms from  $C_6H_6$ . M.p. 170–2°. 3-Phenylhydrazone: pale yellow needles. M.p. 224°.N-Me: orange-red needles. M.p. 172–3°  
3-Oxime: cryst. from EtOH. M.p. 228°. 3-Phenylhydrazone: orange-yellow cryst. from AcOH. M.p. 164°.

N-Et: red cryst. M.p. 144°. 3-Phenylhydrazone: yellow needles. M.p. 124°.

Borsche, Jacobs, *Ber.*, 1914, 47, 360.Heller, *Ber.*, 1920, 53, 1545.**6-Bromoisatin.**

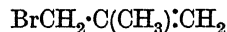
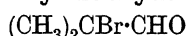
Needles. M.p. 263–4° decomp.

Ettinger, Friedländer, *Ber.*, 1912, 45, 2081.Majima, Kotake, *Ber.*, 1930, 63, 2237.**7-Bromoisatin.**

Reddish-yellow needles. M.p. 192°.

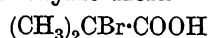
Friedländer, Bruckner, *Deutsch, Ann.*, 1912, 388, 38.**Bromoisobutane.**

See Isobutyl bromide and tert.-Butyl bromide.

**1-Bromoisobutylene (1-Bromo-2-methylpropylene-1, isocrotyl bromide)** $C_4H_7Br$  MW, 135B.p. 98–9° (90–1°).  $D_4^{23}$  1.320.  $n_D^{20}$  1.4625.Adds HBr.  $CrO_3 \rightarrow$  acetone.Krestinsky, *Ber.*, 1922, 55, 2754.Farrel, Bachman, *J. Am. Chem. Soc.*, 1935, 57, 1282.**3-Bromoisobutylene (3-Bromo-2-methylpropylene)** $C_4H_7Br$  MW, 135B.p. 94–5°/774 mm.  $D_4^{20}$  1.3133.  $n_D^{20}$  1.46886.Merejkowsky, *Bull. soc. chim.*, 1925, 37, 711.**1-Bromoisobutyraldehyde** $C_4H_7OBr$  MW, 151B.p. 113°.  $D_4^{25}$  1.383.  $n_D^{25}$  1.4518. Reduces $NH_3, AgNO_3$ . Decomp. by  $H_2O$ .Di-Me acetal: b.p. 52–4°/10 mm.  $D_4^{25}$  1.2792.  $n_D^{25}$  1.4480.

Di-Et acetal: b.p. 89°/18 mm.

2:4-Dinitrophenylhydrazone: m.p. 116°.

Franke, *Monatsh.*, 1900, 21, 210.Bedoukian, *J. Am. Chem. Soc.*, 1944, 66, 1325.Hamer, Rathbone, *J. Chem. Soc.*, 1945, 595.**1-Bromoisobutyric Acid** $C_4H_7O_2Br$  MW, 167

M.p. 48–9°. B.p. 198–200°, 115°/24 mm.

 $H_2O$  or alkalis  $\rightarrow$  1-hydroxyisobutyric acid. 25% KOH  $\rightarrow$  methacrylic acid.Me ester:  $C_5H_9O_2Br$ . MW, 181. B.p. 51–2°/19 mm.

*Et ester*:  $C_6H_{11}O_2Br$ . MW, 195. B.p. 162-4°, 92°/74 mm., 70°/20 mm.  $D_{20}^{20}$  1.3287.

*Isobutyl ester*:  $C_8H_{15}O_2Br$ . MW, 223. B.p. 83-5°/16 mm.

*Isoamyl ester*:  $C_9H_{17}O_2Br$ . MW, 237. B.p. 107-8°/25 mm.

*Bromide*:  $C_4H_6OBr_2$ . MW, 230. B.p. 162-4°.

*Anhydride*:  $C_3H_5O_3Br_2$ . MW, 316. M.p. 63-5°. B.p. 135-40°/35 mm. Sol.  $CHCl_3$ ,  $C_6H_6$ .

*Amide*:  $C_4H_8ONBr$ . MW, 166. Prisms. M.p. 148°. B.p. 145°/17 mm.

*Anilide*: prisms from EtOH.Aq. M.p. 83°.

*N-Methylanilide*: cryst. from ligroin. M.p. 44°.

*N-Ethylanilide*: cryst. from Et<sub>2</sub>O. M.p. 80°.

*m-Nitroanilide*: prisms. M.p. 99°.

*p-Nitroanilide*: needles. M.p. 123°.

*o-Toluidide*: m.p. 63°.

*m-Toluidide*: m.p. 91°.

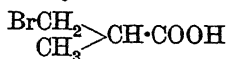
*p-Toluidide*: prisms from EtOH. M.p. 92-5°.

$\alpha$ -*Naphthylamide*: m.p. 116°.

$\beta$ -*Naphthylamide*: m.p. 135°.

Michael, *Ber.*, 1901, **34**, 4043.

## 2-Bromoisobutyric Acid



$C_4H_7O_2Br$  MW, 167

M.p. 22°. Alkalis  $\rightarrow$  methylacrylic acid.

*Me ester*:  $C_5H_9O_2Br$ . MW, 181. B.p. 75°/22 mm., 63-5°/13 mm. (91-3°/19 mm.).

Fittig, Engelhorn, *Ann.*, 1880, **200**, 65.

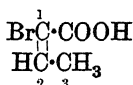
Rydon, *J. Chem. Soc.*, 1936, 1447.

Clemo, Melrose, *J. Chem. Soc.*, 1942, 424.

Larson, *Chem. Abstracts*, 1945, **39**, 2488.

Pickard, Lochte, *J. Am. Chem. Soc.*, 1947, **69**, 14.

## 1-Bromoisocrotonic Acid



$C_4H_5O_2Br$  MW, 165

Needles from  $H_2O$ . M.p. 92°. Sol. EtOH, Et<sub>2</sub>O,  $CS_2$ . Mod. sol. hot  $H_2O$ . NaHg in EtOH  $\rightarrow$  crotonic acid. Py  $\rightarrow$  1-bromocrotonic acid. EtOH +  $H_2SO_4$   $\rightarrow$  Et ester of 1-bromocrotonic acid.

Michael, Schulthess, *J. prakt. Chem.*, 1892, **46**, 257.

James, *J. Chem. Soc.*, 1910, **97**, 1572.

Mokhnach, Stolyarov, *Chem. Abstracts*, 1937, **31**, 5249.

## 2-Bromoisocrotonic Acid.

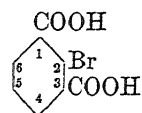
M.p. 80-1°.

Mokhnach, Stolyarov, *Chem. Abstracts*, 1937, **31**, 5249.

## Bromoisopentane.

See active Amyl bromide, tert.-Amyl bromide, sec.-Isoamyl bromide, and Isoamyl bromide.

## 2-Bromoisophthalic Acid (2-Bromobenzene-1:3-dicarboxylic acid)



$C_8H_5O_4Br$  MW, 245

M.p. 218°.

*Di-Me ester*:  $C_{10}H_9O_4Br$ . MW, 273. B.p. 190-1°/22 mm.

Coulson, *J. Chem. Soc.*, 1937, 1305.

## 4-Bromoisophthalic Acid (4-Bromobenzene-1:3-dicarboxylic acid).

Needles. M.p. 287° (283°).

*Di-Et ester*:  $C_{12}H_{13}O_4Br$ . MW, 301. B.p. 320-5°/365 mm.

*3-Nitrile*: 4-bromo-3-cyanobenzoic acid.  $C_8H_4O_2NBr$ . MW, 226. Needles. M.p. 186°. Sublimes. Sol. EtOH. hot  $H_2O$ .

Claus, *J. prakt. Chem.*, 1891, **43**, 359.

Schöpf, *Ber.*, 1891, **24**, 3777.

## 1-Bromoisopropyl Alcohol (Propylene bromohydrin)



$C_3H_7OBr$  MW, 139

dl.

B.p. 145-8°.

*Acetyl*: b.p. 161-5°/750 mm., 65°/18 mm.

*Benzoyl*: b.p. 152°/15 mm.

d.

$[\alpha]_D^{20} + 1.15^\circ$ .

l.

B.p. 144°, 45°/12 mm.  $[\alpha]_D^{20} - 2.87^\circ$ .

Levene, Walti, *J. Biol. Chem.*, 1926, **68**, 415.

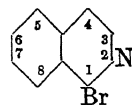
Abderhalden, Eichwald, *Ber.*, 1918, **51**, 1320.

Markownikow, *Z. Chem.*, 1870, 423.

## 1-Bromo-1-isopropylbutyramide.

See Neodorme.

## 1-Bromoisoquinoline



$C_9H_6NBr$  MW, 208

Cryst. from pet. ether. M.p. 42°.

Jansen, Wibaut, *Rec. trav. chim.*, 1937, **56**, 699.

## 4-Bromoisoquinoline.

Cryst. from Et<sub>2</sub>O. M.p. 40°. B.p. 280-5°. Triboluminescent. Volatile in steam.

*Methochloride*: needles from  $H_2O$ . M.p. 82°.

*Methiodide*: yellow cryst. M.p. 233°.

Edinger, Bossung, *J. prakt. Chem.*, 1891, 43, 191.

Ukai, *Chem. Zentr.*, 1931, II, 2330.

Craig, Cass, *J. Am. Chem. Soc.*, 1942, 64, 783.

### 8-Bromoisoquinoline.

Needles. M.p. 80.5°. Volatile in steam.

*B, HNO<sub>3</sub>*: m.p. 193°.

*Methiodide*: yellow cryst. M.p. 274°.

Claus, Hoffmann, *J. prakt. Chem.*, 1893, 47, 252.

### 1-Bromoisovaleric Acid



$\text{C}_5\text{H}_9\text{O}_2\text{Br}$  MW, 181  
*dl.*

Prisms. M.p. 44°. B.p. 230° slight decomp., 150°/40 mm. Spar. sol.  $\text{H}_2\text{O}$ . Hypnotic.

*Me ester*:  $\text{C}_6\text{H}_{11}\text{O}_2\text{Br}$ . MW, 195. B.p. 174°.

*Et ester*:  $\text{C}_7\text{H}_{13}\text{O}_2\text{Br}$ . MW, 209. B.p. 186°, 110–15°/40 mm.  $D_{13}^{25}$  1.2776.

*Propyl ester*:  $\text{C}_8\text{H}_{15}\text{O}_2\text{Br}$ . MW, 223. B.p. 115°/37 mm.

*Isopropyl ester*: b.p. 104°/33 mm.

*Chloride*:  $\text{C}_5\text{H}_8\text{OClBr}$ . MW, 199.5. B.p. 59°/15 mm.

*Bromide*:  $\text{C}_5\text{H}_8\text{OBr}_2$ . MW, 244. B.p. 184–94°.

*Amide*:  $\text{C}_5\text{H}_{10}\text{ONBr}$ . MW, 180. Leaflets from  $\text{C}_6\text{H}_6$ . M.p. 133°.

*N-Methylamide*: needles from 50% MeOH. M.p. 103°.

*N-Ethylamide*: m.p. 120°.

*Nitrile*:  $\text{C}_5\text{H}_8\text{NBr}$ . MW, 162. B.p. 175–80° (decomp.).

*Anilide*: m.p. 116°.

*o-Nitroanilide*: needles. M.p. 107°.

*p-Nitroanilide*: needles. M.p. 183°.

*o-Toluidide*: m.p. 125°.

*m-Toluidide*: m.p. 135°.

*p-Toluidide*: m.p. 124°.

*α-Naphthylamide*: m.p. 172°.

*β-Naphthylamide*: m.p. 145°.

*Benzylamide*: needles from EtOH.Aq. M.p. 98°.

*d.*

M.p. 43.5°. B.p. 95–100°/2 mm. Spar. sol.  $\text{H}_2\text{O}$ .  $[\alpha]_D^{20} + 22.8$  in  $\text{C}_6\text{H}_6$ .

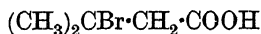
*Chloride*: b.p. 54–5°/13 mm.

Fischer, Scheibler, *Ber.*, 1908, 41, 890.

Berlingozzi, Furia, *Gazz. chim. ital.*, 1926, 56, 82.

Marvel, du Vigneaud, *Organic Syntheses*, 1931, XI, 20.

### 2-Bromoisovaleric Acid



$\text{C}_5\text{H}_9\text{O}_2\text{Br}$  MW, 181

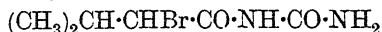
Needles. M.p. 73.5°. Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ .

*Et ester*:  $\text{C}_7\text{H}_{13}\text{O}_2\text{Br}$ . MW, 209. B.p. 78–80°/16 mm.

*Chloride*:  $\text{C}_5\text{H}_8\text{OClBr}$ . MW, 199.5. B.p. 60–90°/18 mm. decomp.

Auwers, *Ber.*, 1895, 28, 1133.

**1-Bromoisovalerylurea** (*Uvaleral*, *Brom-ural*, *Dormigene*)



$\text{C}_6\text{H}_{11}\text{O}_2\text{N}_2\text{Br}$  MW, 223

White cryst. M.p. 154°. Sol. EtOH,  $\text{Et}_2\text{O}$ . Spar. sol. cold  $\text{H}_2\text{O}$ . Hypnotic.

Yoshitomi, Watanabe, *Chem. Abstracts*, 1921, 15, 2152.

Ichikawa, *J. pharm. Soc. Japan*, 1935, 55, 727.

### Bromoisoivanillin.

See under Bromoprocatechuic Aldehyde.

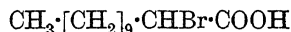
### Bromokynurine.

See 3-Bromo-4-hydroxyquinoline.

### Bromol.

See 2 : 4 : 6-Tribromophenol.

### 1-Bromolauric Acid



$\text{C}_{12}\text{H}_{23}\text{O}_2\text{Br}$  MW, 279

M.p. 32°. Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ , ligroin.

*Me ester*:  $\text{C}_{13}\text{H}_{25}\text{O}_2\text{Br}$ . MW, 293. B.p. 169–71°/12 mm., 135–7°/3 mm.  $D_4^{25}$  1.113.  $n_D^{25}$  1.4572.

*Et ester*:  $\text{C}_{14}\text{H}_{27}\text{O}_2\text{Br}$ . MW, 307. B.p. 175–7°/12 mm., 144–6°/3 mm.  $D_4^{25}$  1.088.  $n_D^{25}$  1.4547.

*Propyl ester*:  $\text{C}_{15}\text{H}_{29}\text{O}_2\text{Br}$ . MW, 321. B.p. 184–6°/12 mm., 149–51°/3 mm.  $D_4^{25}$  1.047.  $n_D^{25}$  1.4549.

*Isopropyl ester*: b.p. 179–81°/12 mm., 146–8°/3 mm.  $D_4^{25}$  1.056.  $n_D^{25}$  1.4502.

*Butyl ester*:  $\text{C}_{16}\text{H}_{31}\text{O}_2\text{Br}$ . MW, 335. B.p. 193–5°/12 mm., 154–6°/3 mm.  $D_4^{25}$  1.061.  $n_D^{25}$  1.4552.

*Isobutyl ester*: b.p. 188–90°/12 mm., 152–4°/3 mm.  $D_4^{25}$  1.051.  $n_D^{25}$  1.4530.

*Isoamyl ester*:  $\text{C}_{17}\text{H}_{33}\text{O}_2\text{Br}$ . MW, 349. B.p. 197–9°/12 mm., 158–60°/3 mm.  $D_4^{25}$  1.050.  $n_D^{25}$  1.4551.

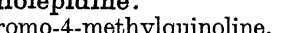
Auwers, Bernhardt, *Ber.*, 1891, 24, 2224.

Guérin, *Bull. soc. chim.*, 1903, 29, 1123.

### 3-Bromolepidine.

See 3-Bromo-4-methylquinoline.

**1-Bromolevulinic Acid** (*1-Bromo-2-acetopropionic acid*)



$\text{C}_5\text{H}_7\text{O}_3\text{Br}$  MW, 195

Cryst. from  $\text{CS}_2$ . M.p. 80°. Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ . Spar. sol. ligroin. Hot  $\text{H}_2\text{O}$  →

1-hydroxylevulinic acid.

*Me ester*:  $C_6H_9O_3Br$ . MW, 209. B.p.  $86-8^\circ/12$  mm.

Wolff, *Ann.*, 1891, 264, 256.

**2-Bromolevulinic Acid (2-Bromo-2-acetopropionic acid)**

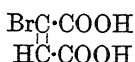


$C_5H_7O_3Br$  MW, 195  
Needles from  $CS_2$ . M.p.  $59^\circ$ . Sol.  $H_2O$ , EtOH,  $Et_2O$ .

*Et ester*:  $C_7H_{11}O_3Br$ . MW, 223. B.p.  $240^\circ$  decomp. Decomp. by boiling  $H_2O$ .

Wolff, *Ann.*, 1891, 264, 256.

**Bromomaleic Acid**



$C_4H_3O_4Br$  MW, 195

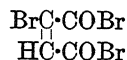
M.p.  $140-1^\circ$  (rapid heat.),  $136-8^\circ$  (slow heat.). Sol.  $H_2O$ , EtOH,  $Et_2O$ . Dist.  $\rightarrow$  anhydride. HCl or HBr.Aq.  $\rightarrow$  bromofumaric acid.  $k$  (first) =  $3.48 \times 10^{-2}$ ;  $k$  (second) =  $2.51 \times 10^{-5}$ .

*Di-Me ester*:  $C_6H_7O_4Br$ . MW, 223. B.p.  $237-8^\circ$ ,  $126-9^\circ/40$  mm.  $D_4^{20}$  1.5497.  $n_{D,20}^{25}$  1.48756. Warm with I  $\rightarrow$  bromofumaric acid dimethyl ester.

*Di-Et ester*:  $C_8H_{11}O_4Br$ . MW, 251. B.p.  $256^\circ$ ,  $140^\circ/12$  mm.

*Anhydride*:  $C_4HO_3Br$ . MW, 177. B.p.  $215^\circ$ . Adds HBr.

*Dibromide*:



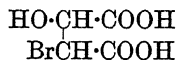
$C_4HO_2Br_3$ . MW, 321. Needles from ligroin. M.p.  $55^\circ$ . B.p.  $124-5^\circ/17$  mm.

Michael, *J. prakt. Chem.*, 1895, 52, 289.

Hill, Cornelson, *Am. Chem. J.*, 1894, 16, 188.

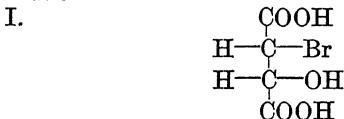
Walden, *Ber.*, 1897, 30, 2886.

**2-Bromomalic Acid (2-Bromo-1-hydroxy-succinic acid)**



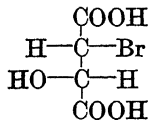
$C_4H_5O_5Br$  MW, 213

*dl.*



Cryst. from  $CHCl_3-Et_2O$ . M.p.  $136^\circ$  ( $134^\circ$ ). Sol.  $H_2O$ , EtOH,  $Et_2O$ . Insol.  $CHCl_3$ ,  $C_6H_6$ , pet. ether. Forms a hydrate, m.p.  $63-5^\circ$ .

II.



M.p.  $136^\circ$ . Reacts with alkalis ( $-HBr$ ) much more rapidly than I.

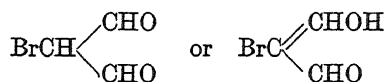
*l.*

*Di-Et ester*:  $C_8H_{13}O_3Br$ . MW, 269. B.p.  $165-8^\circ/12-15$  mm.  $D_4^{20}$  1.4330.  $[\alpha]_D -2.44^\circ$ .

Lossen, *Ann.*, 1906, 348, 285.

Kuhn, Ebel, *Ber.*, 1925, 58, 919.

**Bromomalondialdehyde**



$C_3H_3O_2Br$  MW, 151

M.p.  $140^\circ$ . Sol.  $H_2O$ , EtOH,  $Et_2O$ .

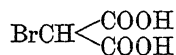
*Anilino deriv.*:  $C_6H_5NH \cdot CH \cdot CBr \cdot CHO$ .  $C_9H_8ONBr$ . MW, 226. M.p.  $184^\circ$  decomp. ( $164^\circ$ ).

*Anilino-anil*:  $C_6H_5NH \cdot CH \cdot CBr \cdot CH \cdot NC_6H_5$ .  $C_{15}H_{13}N_2Br$ . MW, 301. M.p.  $145^\circ$  decomp. *Hydrobromide* + 1 EtOH: m.p.  $217^\circ$  decomp.

Dieckmann, Platz, *Ber.*, 1904, 37, 4638.

Grard, *Compt. rend.*, 1930, 190, 187.

**Bromomalonic Acid**



$C_3H_3O_4Br$  MW, 183

M.p.  $113^\circ$  decomp. Sol. EtOH,  $Et_2O$ .  $NH_3$  in MeOH  $\rightarrow$  aminomalonic acid.

*Di-Me ester*:  $C_5H_7O_4Br$ . MW, 211. B.p.  $215-25^\circ$ ,  $113^\circ/15$  mm.

*Di-Et ester*:  $C_7H_{11}O_4Br$ . MW, 239. B.p.  $233-5^\circ$  decomp.,  $132-6^\circ/33$  mm.,  $121-5^\circ/16$  mm.  $D_{15}^{20}$  1.426.

*Et ester-nitrile*: bromocyanoacetic ester.  $C_5H_6O_2NBr$ . MW, 192. B.p.  $195-200^\circ$ ,  $110-112^\circ/18$  mm.

*Diamide*:  $C_3H_5O_2N_2Br$ . MW, 181. Prisms from EtOH. M.p.  $181^\circ$ .

*Di-methylamide*: prisms from EtOH. M.p.  $164^\circ$ .

*Mono-ethylamide*: needles from EtOH- $C_6H_6$ . M.p.  $161^\circ$ .

*Di-ethylamide*: prisms from EtOH. M.p.  $160^\circ$ .

*Di-nitrile*: bromodicyanomethane.  $C_3HN_2Br$ . MW, 145. M.p.  $65-6^\circ$ .

*Mono-p-toluidide*: needles from AcOH.Aq. M.p.  $202^\circ$ .

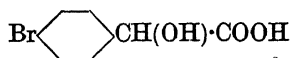
*Di-p-toluidide*: plates from AcOH. M.p.  $217^\circ$ .

Palmer, McWherter, *Organic Syntheses*, Collective Vol. I, 240.

Conrad, Reinbach, *Ber.*, 1902, 35, 1813.

West, *J. Chem. Soc.*, 1925, 127, 748.

**p-Bromomandelic Acid (p-Bromophenylhydroxyacetic acid)**



$C_8H_7O_3Br$

MW, 231

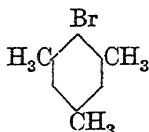
Needles from  $C_6H_6$ . M.p.  $118^\circ$ . Sol.  $H_2O$ ,  $EtOH$ ,  $Et_2O$ , hot  $CHCl_3$ , hot  $C_6H_6$ .

Collet, *Bull. soc. chim.*, 1899, 21, 68.

### Bromomenthane.

See Menthyl bromide.

**Bromomesitylene** (2-Bromo-1:3:5-trimethylbenzene, mesityl bromide)



$C_9H_{11}Br$

MW, 199

M.p.  $-1^\circ$ . B.p.  $225^\circ$ ,  $105-7^\circ/16$  mm. Volatile in steam.

Smith, *Organic Syntheses*, 1931, XI, 24.

Varma, Subrahmanian, *J. Indian Chem. Soc.*, 1936, 13, 192.

### $\omega$ -Bromomesitylene.

See Dimethylbenzyl bromide.

### Bromomethacrylic Acid.

See Bromomethylacrylic Acid.

### Bromomethane.

See Methyl bromide.

### 3-Bromo-4-methoxyacetanilide.

See under 2-Bromo-*p*-anisidine.

**2-Bromo-1-methylacrylic Acid** (2-Bromo-methacrylic acid)



$C_4H_5O_2Br$

MW, 165

Two isomeric forms.

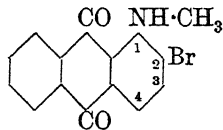
(1) Needles. M.p.  $64^\circ$  ( $62-3^\circ$ ). B.p.  $228-30^\circ$ . Sol. hot  $H_2O$ .

*Et ester*:  $C_6H_9O_2Br$ . MW, 193. B.p.  $192-3^\circ$ .

(2) Iso-2-bromo-1-methylacrylic acid. Leaflets. M.p.  $65-6^\circ$ . Volatile in steam.

Lossen, Morschöck, Dorno, *Ann.*, 1905, 342, 163.

### 2-Bromo-1-methylaminoanthraquinone



$C_{15}H_{10}O_2NBr$

MW, 316

Red cryst. M.p.  $170-2^\circ$ . Cryst. from  $AcOH$  in brown needles. Spar. sol.  $EtOH$ . Sol. hot  $Py$ . Brownish-yellow sol. in 40% oleum.

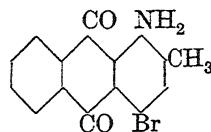
Bayer, D.R.P.s, 236,604 and 288,825, (*Chem. Zentr.*, 1911, II, 318; 1916, I, 85).

### 4-Bromo-1-methylaminoanthraquinone.

Reddish-brown needles. M.p.  $194^\circ$ . Deep blue in 40% oleum.

Bayer, D.R.P., 164,791, (*Chem. Zentr.*, 1905, II, 1757).

### 4-Bromo-2-methyl-1-aminoanthraquinone



$C_{15}H_{10}O_2NBr$

MW, 316

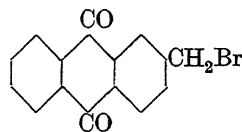
Reddish-brown needles from toluene. M.p.  $346-7^\circ$ . Sol. hot  $PhNO_2$ . Mod. sol.  $AcOH$ . Spar. sol.  $EtOH$ ,  $Et_2O$ . Sol. conc.  $H_2SO_4$  with greenish-yellow col.

*N-Acetyl*: m.p.  $212-13^\circ$ .

Locher, Fierz, *Helv. Chim. Acta*, 1927, 10, 650.

du Pont, U.S.P., 1,906,581, (*Chem. Abstracts*, 1933, 27, 3485).

### 2-Bromomethyl-anthraquinone



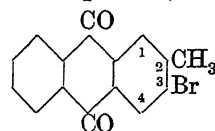
$C_{15}H_9O_2Br$

MW, 301

Cryst. from  $AcOH$ . M.p.  $200-2^\circ$ .

Badische, D.R.P., 199,756, (*Chem. Zentr.*, 1908, II, 460); D.R.P., 216,715, (*Chem. Zentr.*, 1910, I, 213).

### 3-Bromo-2-methylanthraquinone (3-Bromo- $\beta$ -methylanthraquinone)



$C_{15}H_9O_2Br$

MW, 301

Pale yellow needles from  $AcOH$ . M.p.  $219-20^\circ$ . Sol. hot  $CHCl_3$ .

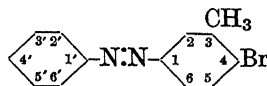
Heller, *Ber.*, 1912, 45, 792.

### 4-Bromo-2-methylanthraquinone (4-Bromo- $\beta$ -methylanthraquinone).

M.p.  $199-200^\circ$ . Sol.  $Py$ , hot amyl alcohol.

Ruggli, Merz, *Helv. Chim. Acta*, 1929, 12, 87.

### 4-Bromo-3-methylazobenzene (Benzeneazo-*m*-2-bromotoluene)



$C_{13}H_{11}N_2Br$

MW, 275

Yellow needles from dil.  $EtOH$ . M.p.  $69^\circ$ .

Burns, McCombie, Scarborough, *J. Chem. Soc.*, 1928, 2932.



**3-Bromo-4-methylazobenzene** (*Benzeneazo-p-2-bromotoluene*).

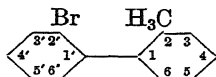
Yellow needles from EtOH. M.p. 84°.

Burns, McCombie, Scarborough, *J. Chem. Soc.*, 1928, 2931.**4'-Bromo-4-methylazobenzene** (*Bromo-benzeneazo-p-toluene*).

Orange needles from EtOH. M.p. 152°.

Burns, McCombie, Scarborough, *J. Chem. Soc.*, 1928, 2931.**Bromomethyl-benzoic Acid.**See  $\omega$ -Bromotoluic Acid.**Bromo-methylbenzoquinone.**

See Bromotoluquinone.

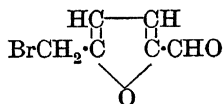
**2'-Bromo-2-methyldiphenyl** $C_{13}H_{11}Br$ 

MW, 247

B.p. 285–6° decomp., 156–7°/27 mm.

Mascarelli, Gatti, *Atti accad. Lincei*, 1932, 15, 89.**4-Bromo-3-methyldiphenyl.**B.p. 318–23°.  $n_D^{25}$  1.6358.Cook, Cook, *J. Am. Chem. Soc.*, 1933, 55, 1217.**6-Bromo-3-methyldiphenyl.**Yellow oil. B.p. 304–8°/740 mm.  $D_4^{25}$  1.358.  $n_D^{25}$  1.6150.Cook, Cook, *J. Am. Chem. Soc.*, 1933, 55, 1216.**3-Bromo-4-methyldiphenyl.**

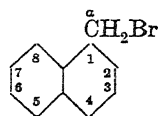
M.p. 9°. B.p. 123–123.5°/2 mm.

Schoepfle, Truesdail, *J. Am. Chem. Soc.*, 1937, 59, 375.**4'-Bromo-4-methyldiphenyl.**Cryst. from EtOH or  $C_6H_6$ . M.p. 133°. B.p. 314–15°.  $CrO_3 \rightarrow$  4'-bromodiphenyl-4-carboxylic acid.Gomberg, Pernert, *J. Am. Chem. Soc.*, 1926, 48, 1378.**Bromomethylfurfural** $C_6H_5O_2Br$ 

MW, 189

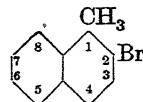
Orange prisms. M.p. 61°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Insol. cold H<sub>2</sub>O. Reduces Fehling's and NH<sub>3</sub>.AgNO<sub>3</sub>.Hibbert, Hill, *J. Am. Chem. Soc.*, 1923, 45, 176. **$\beta$ -Bromo- $\alpha$ -methyl-lactic Acid.**

See 2-Bromo-1-hydroxyisobutyric Acid.

**1-Bromomethyl-naphthalene** ( $\alpha$ -Bromo-1-methylnaphthalene, 1-naphthylmethyl bromide,  $\alpha$ -menaphthyl bromide) $C_{11}H_9Br$ 

MW, 221

Cryst. with penetrating odour. M.p. 56° (45°). B.p. 183°/18 mm., 175°/10 mm., 145–50°/1 mm.

Schmidlin, Massini, *Ber.*, 1909, 42, 2389.Wislicenus, Elvert, *Ber.*, 1916, 49, 2822.King, Henshall, *J. Chem. Soc.*, 1945, 417.Buu-Hoi, Lecocq, *J. Chem. Soc.*, 1946, 830.**2-Bromo-1-methylnaphthalene** $C_{11}H_9Br$ 

MW, 221

Yellow plates from pet. ether. M.p. 35–6°.

*Picrate*: orange-yellow needles. M.p. 105–6°.Vesely, Štursa, Olejníček, Rein, *Chem. Abstracts*, 1930, 24, 3009.**3-Bromo-1-methylnaphthalene.**

M.p. 46–7°.

*Picrate*: orange-yellow needles. M.p. 83–4°.Vesely, Štursa, Olejníček, Rein, *Chem. Abstracts*, 1930, 24, 3009.**5-Bromo-1-methylnaphthalene.**

M.p. 63–4°.

*Picrate*: m.p. 110–11°.Vesely, Štursa, Olejníček, Rein, *Chem. Abstracts*, 1930, 24, 3009.**7-Bromo-1-methylnaphthalene.**

B.p. 124–5°/3 mm.

*Picrate*: yellow. M.p. 92.5–3.5°.sym.-*Trinitrobenzene add. comp.*: yellow. M.p. 92.5–3°.Fieser, Seligman, *J. Am. Chem. Soc.*, 1938, 60, 170.Fieser, Hershberg, *J. Am. Chem. Soc.*, 1940, 62, 49.**8-Bromo-1-methylnaphthalene.**

Plates from EtOH. M.p. 80°.

*Picrate*: m.p. 152–3°.Vesely, Štursa, Olejníček, Rein, *Chem. Abstracts*, 1930, 24, 3009.**4-Bromo-2-methylnaphthalene.***Picrate*: m.p. 90–1°.Vesely, Kapp, *Chem. Abstracts*, 1925, 19, 2487.

**5-Bromo-2-methylnaphthalene.**

Picrate: m.p. 91-2°.

Vesely, Kapp, *Chem. Abstracts*, 1925, 19, 2487.**8-Bromo-2-methylnaphthalene.**

B.p. 144.5-46°/12 mm.

Picrate: m.p. 101-2°.

Ruzicka, Morgeli, *Helv. Chim. Acta*, 1936, 19, 382.**2-Bromo-2-methylpentanone-4.**

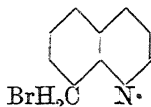
See Methyl 2-bromoisobutyl Ketone.

**Bromomethylphenylcarbinol.**

See Styrene bromohydrin.

**Bromomethyl phenyl Ketone.**

See Phenacyl bromide.

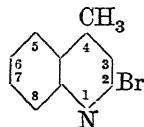
**8-Bromomethyl-quinoline** $C_{10}H_8NBr$ 

MW, 222

Needles or prisms from pet. ether. M.p. 84°.

*B.HBr*: needles. M.p. above 320°.Howitz, Nöther, *Ber.*, 1906, 39, 2709.**Bromo-2-methylquinoline.**

See Bromoquinaldine.

**2-Bromo-4-methylquinoline (2-Bromo-lepidine)** $C_{10}H_8NBr$ 

MW, 222

M.p. 81.0-81.5°. B.p. 125-6°/1 mm.

Kaslow, Marsh, *J. Org. Chem.*, 1947, 12, 456.**3-Bromo-4-methylquinoline (3-Bromo-lepidine).**

M.p. 58.5-59.5°. Sol. min. acids.

Picrate: m.p. 214-15° decomp.

Magnanini, *Ber.*, 1887, 20, 2613.**2-Bromo-6-methylquinoline.**Prisms from  $Et_2O$ . M.p. 126°. Volatile in steam. Sol. most org. solvents and hot  $H_2O$ .*HgCl\_2* double salt: needles. M.p. 169°.Fischer, Guthmann, *J. prakt. Chem.*, 1916, 93, 380.**8-Bromo-6-methylquinoline.**

M.p. 51°.

Ukai, *J. Pharm. Soc. Japan*, 1931, 51, 73.**5-Bromo-8-methylquinoline.**

M.p. 37-8°.

*B.HCl*: m.p. 102-3°.*Dichromate*: decomp. at 117-19°.Ukai, Hashimoto, Higashi, *J. Pharm. Soc. Japan*, 1928, 48, 74.**6-Bromo-8-methylquinoline.**Needles from  $EtOH$ . M.p. 59°. B.p. 289-90°. Sol.  $EtOH$ ,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ ,  $CS_2$ .

Picrate: lemon-yellow needles. M.p. 224°.

Alt, *Ann.*, 1889, 252, 322.**7-Bromo-8-methylquinoline.**

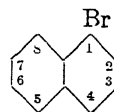
M.p. 47-48.5°.

*B.HCl*: m.p. 223-4°.*Dichromate*: decomp. at 198-210°.Ukai, Hashimoto, Higashi, *J. Pharm. Soc. Japan*, 1928, 48, 74.**Bromomethylstyrene.**

See Bromophenylpropylene.

**Bromomethyl p-tolyl Ketone.**

See p-Methylphenacyl bromide.

**1-Bromonaphthalene ( $\alpha$ -Bromonaphthalene)** $C_{10}H_7Br$ 

MW, 207

Two forms. M.ps 6.2° and 0.2-0.7°. B.p. 281°, 139°/16 mm. Misc. with  $EtOH$ ,  $Et_2O$ ,  $C_6H_6$ . Mod. sol.  $H_2O$ . Volatile in steam.  $D_4^{16.5}$  1.48875.  $n_D^{15.5}$  1.66011. Br  $\rightarrow$  1:4-dibromonaphthalene.  $HNO_3$   $\rightarrow$  4-nitro deriv.  $H_2SO_4$   $\rightarrow$  4-sulphonic acid.*Picrate*: lemon-yellow needles. M.p. 134-5°.Sol. 18 parts 92%  $EtOH$  at 19°.sym.-*Trinitrobenzene add. comp.*: lemon-yellow

needles. M.p. 137°.

Clarke, Brethen, *Organic Syntheses*, Collective Vol. I, 116.**2-Bromonaphthalene ( $\beta$ -Bromonaphthalene).**

Leaflets. M.p. 59° (56-7°). B.p. 281-2°.

Sol.  $EtOH$ ,  $Et_2O$ ,  $CS_2$ ,  $CHCl_3$ ,  $C_6H_6$ .  $D^0$  1.605.*Picrate*: yellow needles. M.p. 86° (79°). Sol. 17 parts 92%  $EtOH$  at 20°.Schwechten, *Ber.*, 1932, 65, 1607.Sah, *Rec. trav. chim.*, 1940, 59, 461.Newman, Wise, *J. Am. Chem. Soc.*, 1941, 63, 2847.**3-Bromonaphthalic Acid**

HOOC COOH

 $C_{12}H_7O_4Br$ 

MW, 295

*Anhydride*:  $C_{12}H_5O_3Br$ . MW, 277. M.p. 244°.*Imide*: m.p. 316°.*Di-Me ester*: m.p. 105°.Rule, Thompson, *J. Chem. Soc.*, 1937, 1764.**4-Bromonaphthalic Acid.**M.p. 220-1°. Insol.  $H_2O$ . Readily converted to anhydride.

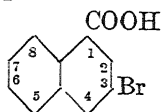
*Anhydride*: needles. M.p. 210°.

Dziwoński, *Ber.*, 1903, 36, 3770.

Graebe, Guinsbourg, *Ann.*, 1903, 327, 86.

Fazi, *Gazz. chim. ital.*, 1923, 53, 499.

### 3-Bromo-1-naphthoic Acid



$C_{11}H_7O_2Br$  MW, 251

M.p. 237-8°.

*Di-Me ester*: m.p. 59°.

Rule, Thompson, *J. Chem. Soc.*, 1937, 1764.

### 4-Bromo-1-naphthoic Acid.

Needles. M.p. 212° (217-20°).

*Me ester*:  $C_{12}H_9O_2Br$ . MW, 265. Needles. M.p. 42°. B.p. 195-200°/15 mm.

*Et ester*:  $C_{13}H_{11}O_2Br$ . MW, 279. M.p. 42-3°.

*Nitrile*: 4-bromo- $\alpha$ -naphthonitrile, 4-bromo-1-cyanonaphthalene.  $C_{11}H_6NBr$ . MW, 232. M.p. 102-3°. Sol.  $C_6H_6$ , hot EtOH.

Gomberg, Blicke, *J. Am. Chem. Soc.*, 1923, 45, 1765.

Mayer, Sieglitz, *Ber.*, 1922, 55, 1841.

### 5-Bromo-1-naphthoic Acid.

Needles. M.p. 261° (256°). Sol.  $C_6H_6$ . Spar. sol. EtOH,  $Et_2O$ , AcOH. Insol.  $H_2O$ . Sublimes.

*Et ester*:  $C_{13}H_{11}O_2Br$ . MW, 279. M.p. 48-9°.  
*p-Bromophenacyl ester*:  $C_{19}H_{12}O_3Br_2$ . MW, 447. Needles from EtOH. M.p. 131-2°.

*Amide*:  $C_{11}H_8ONBr$ . MW, 250. Needles. M.p. 241°.

*Anilide*:  $C_{17}H_{12}OBr$ . MW, 326. Leaflets from AcOH. M.p. 216-7°.

*Nitrile*: 5-bromo- $\alpha$ -naphthonitrile, 5-bromo-1-cyanonaphthalene.  $C_{11}H_6NBr$ . MW, 232. Needles. M.p. 147°. Sol.  $C_6H_6$ . Sublimes.

Whitmore, Fox, *J. Am. Chem. Soc.*, 1929, 51, 3363.

Kerkhof, *Rec. trav. chim.*, 1932, 51, 747.

Ruggli, Preuss, *Helv. Chim. Acta*, 1941, 24, 1345.

### 7-Bromo-1-naphthoic Acid.

Needles from 60% EtOH. M.p. 237° corr. Very sol. EtOH, AcOH. Sol.  $Et_2O$ ,  $C_6H_6$ .

*Me ester*: needles from 60% MeOH. M.p. 55° corr.

*Et ester*: needles. M.p. 46°.

*Chloride*:  $C_{11}H_8OClBr$ . MW, 269.5. Yellow cryst. from pet. ether. M.p. 106° corr.

*Amide*: needles from 50% EtOH. M.p. 247° corr.

*Anilide*: needles from EtOH.Aq. M.p. 202° corr.

Goldstein, Fischer, *Helv. Chim. Acta*, 1938, 21, 1521.

### 8-Bromo-1-naphthoic Acid.

Cryst. from  $C_6H_6$ . M.p. 178°. Sol. EtOH, AcOH,  $C_6H_6$ . Spar. sol. hot  $H_2O$ .

*Me ester*: cryst. from pet. ether. M.p. 33°.

*Et ester*: plates from pet. ether. M.p. 52°.

*Amide*: m.p. 179-80°. Sol. EtOH. Mod. sol.  $C_6H_6$ , hot  $H_2O$ . Spar. sol. ligroin.

*Anilide*: cryst. from EtOH. M.p. 151°.

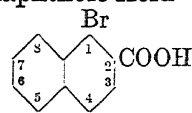
Rule, Pursell, Brown, *J. Chem. Soc.*, 1934, 170.

Rule, Barnett, *J. Chem. Soc.*, 1932, 175.

Goldstein, Francey, *Helv. Chim. Acta*, 1932, 15, 1362.

Corbellini, Swiss P., 209,332; *Chem. Abstracts*, 1942, 36, 2869.

### 1-Bromo-2-naphthoic Acid



$C_{11}H_7O_2Br$  MW, 251

Needles. M.p. 186°. Sol. AcOH.

Mayer, Sieglitz, *Ber.*, 1922, 55, 1859.

Kerkhof, *Rec. trav. chim.*, 1932, 51, 748.

### 3-Bromo-2-naphthoic Acid.

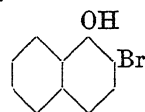
Needles. M.p. 220°.

*Me ester*:  $C_{12}H_9O_2Br$ . MW, 265. M.p. 67°.

*Hydrazide*: needles. M.p. 218°.

Wynne, *Proc. Chem. Soc.*, 1914, 30, 204.

### 2-Bromo-1-naphthol



$C_{10}H_7OBr$  MW, 223

M.p. 45°.

Hodgson, Hathway, *J. Chem. Soc.*, 1944, 538.

### 3-Bromo-1-naphthol.

Needles from EtOH. M.p. 61°.

Hodgson, Elliott, *J. Chem. Soc.*, 1934, 1707.

### 4-Bromo-1-naphthol.

Needles. M.p. 127-8° (121°).

*Acetyl*: 4-bromo-1-naphthyl acetate. M.p. 51°.

*Carbonate*:  $C_{21}H_{12}O_3Br_2$ . MW, 472. M.p. 214°. Sol.  $C_6H_6$ .

*Et ether*:  $C_{12}H_{11}OBr$ . MW, 251. M.p. 48°. Sol.  $Et_2O$ ,  $CS_2$ .

*Picrate*: m.p. 169° (167°).

Reverdin, Kauffmann, *Ber.*, 1895, 28, 3054.

### 5-Bromo-1-naphthol.

M.p. 137°.

*Me ether*:  $C_{11}H_9OBr$ . MW, 237. M.p. 67-8°.

Fuson, *J. Am. Chem. Soc.*, 1924, 46, 2779.

**6-Bromo-1-naphthol.**

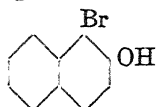
M.p. 129-30°.

Fuson, *J. Am. Chem. Soc.*, 1925, **47**, 516.**7-Bromo-1-naphthol.**

M.p. 106°.

Fuson, *J. Am. Chem. Soc.*, 1924, **46**, 2779.**8-Bromo-1-naphthol.**

Plates from pet. ether. M.p. 61°.

Meldola, Streatfeild, *J. Chem. Soc.*, 1893  
**63**, 1058.**1-Bromo-2-naphthol** $C_{10}H_7OBr$ 

MW, 223

Cryst. from  $C_6H_6$ -ligroin. M.p. 84°. De-  
comp. at 130°.  $KMnO_4 \rightarrow$  phthalic acid.*Acetyl*: 1-bromo-2-naphthyl acetate. Cryst.  
from EtOH. M.p. 56°. B.p. 215°/20 mm.*Carbonate*:  $C_{21}H_{12}O_3Br_2$ . MW, 472. M.p.  
188-9°.*Benzoyl*: cryst. from MeOH. M.p. 98-9°.*Me ether*:  $C_{11}H_9OBr$ . MW, 237. M.p. 84-  
85° (82.5°).*Et ether*:  $C_{12}H_{11}OBr$ . MW, 251. M.p. 66°.*Propyl ether*:  $C_{13}H_{13}OBr$ . MW, 265. M.p.  
35-6°.Franzen, Stäuble, *J. prakt. Chem.*, 1922,  
**103**, 352.Dziewoński, Loewenhof, *Chem. Abstracts*,  
1928, **22**, 2560.Varma, Mozumdar, Rajah, *J. Indian*  
*Chem. Soc.*, 1933, **10**, 595.Hazlet, *J. Am. Chem. Soc.*, 1940, **62**, 2157.**3-Bromo-2-naphthol.**

Needles. M.p. 84-5°. Sol. ord. org. solvents.

*Acetyl*: 3-bromo-2-naphthyl acetate. M.p.  
94°.*Me ether*:  $C_{11}H_9OBr$ . MW, 237. M.p. 77-8°.Marschalk, *Bull. soc. chim.*, 1928, **43**, 1361.Clemo, Spence, *J. Chem. Soc.*, 1928, 2811.Fries, Schimmelschmidt, *Ann.*, 1930, **484**,  
268.**4-Bromo-2-naphthol.**

Needles. M.p. 122°.

*Acetyl*: m.p. 61°.*Me ether*: m.p. 64°.Fries, Schimmelschmidt, *Ann.*, 1930, **484**,  
268.Hodgson, Birtwell, *J. Chem. Soc.*, 1943,  
468.**5- (or 8-) Bromo-2-naphthol.**Needles. M.p. 105°. Ox.  $\rightarrow$  3-bromo-  
phthalic acid.Braun, Hahn, Seemann, *Ber.*, 1922, **55**,  
1687.**6-Bromo-2-naphthol.**

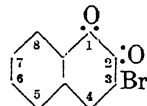
Needles. M.p. 127°.

*Acetyl*: 6-bromo-2-naphthyl acetate. M.p.  
103°.*Me ether*:  $C_{11}H_9OBr$ . MW, 237. Needles or  
plates. M.p. 105° (108°).*Et ether*:  $C_{12}H_{11}OBr$ . MW, 251. Plates.  
M.p. 80°.*Propyl ether*:  $C_{13}H_{13}OBr$ . MW, 265. M.p.  
63.5°.Franzen, Stäuble, *J. prakt. Chem.*, 1922,  
**103**, 352.Jakeš, *Chem. Abstracts*, 1929, **23**, 4466.I.G., D.R.P., 570,676, (*Chem. Abstracts*,  
1933, **27**, 4254).**7-Bromo-2-naphthol.**

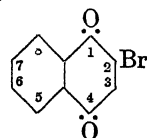
M.p. 133°.

Jakeš, *Chem. Abstracts*, 1929, **23**, 4466.**8-Bromo-2-naphthol.**

See 5-Bromo-2-naphthol.

**3-Bromo-1 : 2-naphthoquinone (3-Bromo- $\beta$ -naphthoquinone)** $C_{10}H_5O_2Br$ 

MW, 237

Red cryst. M.p. 178°. Mod. sol. EtOH,  
AcOH,  $C_6H_6$ . Insol. alk. carbonates. Sublimes.*1-Oxime*: 3-bromo-1-nitroso-2-naphthol.  
Yellow needles. M.p. 172°.*2-Oxime*: 3-bromo-2-nitroso-1-naphthol.  
Deep yellow cryst. M.p. 175°. Sol. EtOH,  
 $Et_2O$ , AcOH,  $C_6H_6$ ,  $CHCl_3$ .Zincke, Schmidt, *Ber.*, 1894, **27**, 738.Fries, Schimmelschmidt, *Ann.*, 1930, **484**,  
265.**4-Bromo-1 : 2-naphthoquinone.**Red needles. M.p. 154°. Sol. AcOH,  $C_6H_6$ .  
Mod. sol. EtOH.Fries, Schimmelschmidt, *Ann.*, 1930, **484**,  
270.**6-Bromo-1 : 2-naphthoquinone.**Yellow cryst. M.p. 168° decomp. (150°, 145°).  
Mod. sol. EtOH,  $Et_2O$ , AcOH, ligroin.Claus, Philipson, *J. prakt. Chem.*, 1891,  
**43**, 54.Fries, Schimmelschmidt, *Ann.*, 1930, **484**,  
271.Fieser, Hartwell, *J. Am. Chem. Soc.*, 1935,  
**57**, 1481.**2-Bromo-1 : 4-naphthoquinone ( $\beta$ -Bromo- $\alpha$ -naphthoquinone)** $C_{10}H_5O_2Br$ 

MW, 237

Yellow needles. M.p. 130°. Sol. Me<sub>2</sub>CO, CHCl<sub>3</sub>, AcOH, hot EtOH. Spar. sol. Et<sub>2</sub>O.

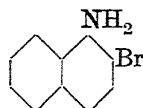
Liebermann, Schlossberg, *Ber.*, 1899, 32, 2097.

### 5-Bromo-1 : 4-naphthoquinone.

Yellow prisms. M.p. 160°. Sol. C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Less sol. EtOH, AcOH.

Fries, Köhler, *Ber.*, 1924, 57, 496.

**2-Bromo-1-naphthylamine** (*2-Bromo-1-aminonaphthalene, 2-bromo-α-naphthylamine*)



C<sub>10</sub>H<sub>8</sub>NBr

MW, 222

M.p. 65°.

*N*-Acetyl : m.p. 198°.

*N*-Benzoyl : m.p. 179°.

Hodgson, Hathway, *J. Chem. Soc.*, 1944, 538.

### 3-Bromo-1-naphthylamine.

Needles from EtOH. M.p. 70°.

*B, HCl* : plates from HCl. M.p. 247°.

*N*-Acetyl : 3-bromo-1-acetnaphthalide. C<sub>12</sub>H<sub>10</sub>ONBr. MW, 264. Needles from AcOH. M.p. 174°.

*N*-Benzoyl : needles from 90% formic acid. M.p. 166°.

Hodgson, Elliott, *J. Chem. Soc.*, 1934, 1706.

### 4-Bromo-1-naphthylamine.

Needles. M.p. 102° (94-5°). Volatile in steam.

*N*-Formyl : m.p. 172°.

*N*-Acetyl : 4-bromo-1-acetnaphthalide. M.p. 193°.

*sym*-*T*-trinitrobenzene *add. comp.* : red needles. M.p. 196°.

Morgan, Micklethwait, Winfield, *J. Chem. Soc.*, 1904, 85, 750.

Zincke, Schütz, *Ber.*, 1912, 45, 477.

### 5-Bromo-1-naphthylamine.

M.p. 69° (63-4°). Volatile in steam.

*N*-Acetyl : 5-bromo-1-acetnaphthalide. M.p. 215°.

Ullmann, Consonno, *Ber.*, 1902, 35, 2802.

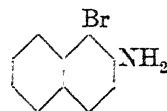
### 8-Bromo-1-naphthylamine.

Needles. M.p. 89-90°.

*N*-Acetyl : 8-bromo-1-acetnaphthalide. M.p. 138-9°.

Meldola, Streatfeild, *J. Chem. Soc.*, 1893, 63, 1057.

**1-Bromo-2-naphthylamine** (*α-Bromo-β-naphthylamine, 1-bromo-2-aminonaphthalene*)



C<sub>10</sub>H<sub>8</sub>NBr

MW, 222

Needles. M.p. 63°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Spar. sol. hot H<sub>2</sub>O. Volatile in steam. Dil. HNO<sub>3</sub> → phthalic acid.

*N*-Acetyl : 1-bromo-2-acetnaphthalide. C<sub>12</sub>H<sub>10</sub>ONBr. MW, 264. M.p. 140°.

*N*-Diacyl : plates from EtOH. M.p. 105°.

*N*-Propionyl : m.p. 139°.

*N*-Butyryl : m.p. 139°.

*N*-Benzylidene : prisms from pet. ether. M.p. 93-4°.

*sym*-*T*-trinitrobenzene *add. comp.* : red needles from EtOH. M.p. 192°.

Franzen, Stäuble, *J. prakt. Chem.*, 1921, 101, 66.

Senier, Austin, *J. Chem. Soc.*, 1908, 93, 65.

### 3-Bromo-2-naphthylamine.

Plates. M.p. 168°.

*B, HCl* : needles. M.p. 170°.

*N*-Acetyl : 3-bromo-2-acetnaphthalide. Plates. M.p. 172°.

*N*-Benzoyl : m.p. 176°.

Wynne, *Proc. Chem. Soc.*, 1914, 30, 204.

Hodgson, Hathway, *J. Chem. Soc.*, 1945, 842.

### 4-Bromo-2-naphthylamine.

Needles. M.p. 71.5°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O.

*N*-Acetyl : 4-bromo-2-acetnaphthalide. M.p. 189°.

Armstrong, Rossiter, *Chem. News*, 1892, 65, 59.

Fries, Schimmelschmidt, *Ann.*, 1930, 484, 269.

### 5-Bromo-2-naphthylamine.

Cryst. M.p. 38°. B.p. 207-10°/16 mm. Sol. most org. solvents.

*B, HCl* : m.p. 265°.

*N*-Acetyl : 5-bromo-2-acetnaphthalide. C<sub>12</sub>H<sub>10</sub>ONBr. MW, 264. Colourless needles from EtOH. M.p. 165°.

*N*-Benzoyl : m.p. 109°.

*N*-Benzylidene : m.p. 63°.

*Picrate* : m.p. 216°.

Goldstein, Stern, *Helv. Chim. Acta*, 1940, 23, 820.

### 6-Bromo-2-naphthylamine.

Leaflets. M.p. 123°. Sol. hot EtOH.

*B, HCl* : m.p. 267° decomp.

*N*-Acetyl: 6-bromo-2-acetnaphthalide.  
M.p. 192°.

*N*-Benzoyl: m.p. 218°.

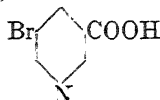
Franzen, Stäuble, *J. prakt. Chem.*, 1921,  
101, 69.

### 7-Bromo-2-naphthylamine.

M.p. 130°.

Hodgson, Ward, *J. Chem. Soc.*, 1947, 327.

### 5-Bromonicotinic Acid (5-Bromopyridine-3-carboxylic acid)



$C_6H_4O_2NBr$  MW, 202

Needles + 2H<sub>2</sub>O. M.p. anhyd. 183°. Sublimes. Sol. EtOH, Et<sub>2</sub>O. Mod. sol. boiling H<sub>2</sub>O.

*B*,*H*Br: needles. M.p. 243°.

*Hydrazide*: m.p. 193-4°.

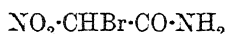
*Azide*: m.p. 88-9°.

Claus, Pychlau, *J. prakt. Chem.*, 1893,  
47, 414.

Claus, Howitz, *J. prakt. Chem.*, 1894, 50,  
237.

Graf *et al.*, *J. prakt. Chem.*, 1933, 138, 248.

### Bromonitroacetamide



$C_2H_3O_3N_2Br$  MW, 183

Needles. M.p. 80-1°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, H<sub>2</sub>O. Aq. sol. has acid reaction. Gives K, NH<sub>4</sub>, Pb and Ag salts.

Ratz, *Monatsh.*, 1905, 26, 1527.

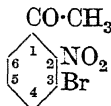
### Bromonitroacetanilide.

See under Bromonitroaniline.

### ω-Bromonitroacetophenone.

See Nitrophenacyl bromide.

### 3-Bromo-2-nitroacetophenone



$C_8H_6O_3NBr$  MW, 244

Yellow leaflets from EtOH.Aq. M.p. 97-8°.

Simpson *et al.*, *J. Chem. Soc.*, 1945, 646.

### 5-Bromo-2-nitroacetophenone.

Needles from EtOH. M.p. 98°. Na hypobromite → 5-bromo-2-nitrobenzoic acid.

Elson, Gibson, Johnson, *J. Chem. Soc.*,  
1930, 1132.

### 4-Bromo-3-nitroacetophenone.

Yellow needles from MeOH. M.p. 116.5°.

*Phenylhydrazone*: m.p. 144-6°.

Borsche, Stackmann, Makaroff-Semljanski, *Ber.*, 1916, 49, 2235.

### 6-Bromo-3-nitroacetophenone.

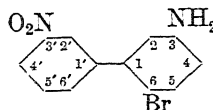
M.p. 88-9°.

2:4-Dinitrophenylhydrazone: orange leaflets.  
M.p. 211°.

Meisenheimer, Zimmermann, Kummer,  
*Ann.*, 1925, 446, 205.

Borsche, Herbert, *Ann.*, 1941, 546, 293.

### 6-Bromo-3'-nitro-3-aminodiphenyl



$C_{12}H_9O_2N_2Br$  MW, 293

Cryst. from EtOH.Aq. M.p. 112-13°.

*N*-Acetyl: m.p. 193-4°.

Case, Schock, *J. Am. Chem. Soc.*, 1943,  
65, 2086.

### 5-Bromo-3-nitro-4-aminodiphenyl.

Orange needles from MeOH. M.p. 100°.

*N*-Acetyl: colourless needles from AcOH.  
M.p. 223°.

Hinkel, Hey, *J. Chem. Soc.*, 1928, 1839.

### 4'-Bromo-3-nitro-4-aminodiphenyl.

Scarlet needles from Me<sub>2</sub>CO.Aq. M.p. 175°.

*Acetyl*: yellow plates from Me<sub>2</sub>CO. M.p.  
207-8°.

Scarborough, Waters, *J. Chem. Soc.*, 1927,  
1139.

Le Fèvre, Turner, *J. Chem. Soc.*, 1926,  
2045.

### 3-Bromo-2'-nitro-4-aminodiphenyl.

Cryst. from Et<sub>2</sub>O-pet. ether. M.p. 83-4°.

*Acetyl*: cryst. from EtOH. M.p. 169-70°.

Case, *J. Am. Chem. Soc.*, 1939, 61, 769.

### 3-Bromo-3'-nitro-4-aminodiphenyl.

Cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 110-11°.

*Acetyl*: cryst. from MeOH. M.p. 164-5°.

Case, *J. Am. Chem. Soc.*, 1939, 61, 769.

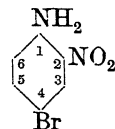
### 3-Bromo-4'-nitro-4-aminodiphenyl.

Cryst. from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 118-19°.

*Acetyl*: cryst. from AcOH. M.p. 236-7°.

Case, *J. Am. Chem. Soc.*, 1938, 60, 426.

### 4-Bromo-2-nitroaniline



$C_6H_5O_2N_2Br$  MW, 217

Orange needles. M.p. 111.5°. Sol. EtOH. Spar. sol. H<sub>2</sub>O. Sublimes. Volatile in steam.

*N*-Acetyl: 4-bromo-2-nitroacetanilide.

$C_8H_7O_2N_2Br$  MW, 259. M.p. 104° (102°).

*N*-Benzoyl: 4-bromo-2-nitrobenzanilide.

$C_{13}H_9O_3N_2Br$  MW, 321. M.p. 137-8°.

*N*-Me: 4-bromo-2-nitro-methylaniline.  
 $C_7H_7O_2N_2Br$  MW, 231. M.p. 101-2°.

*N-Et*: 4-bromo-2-nitro-ethylaniline.  
 $C_8H_9O_2N_2Br$ . MW, 245. M.p.  $91^\circ$ .  
 Chattaway, Orton, Evans, *Ber.*, 1900, 33,  
 3059.  
 Hübner, *Ann.*, 1881, 209, 357.

**5-Bromo-2-nitroaniline.**

Reddish-yellow needles. M.p.  $151.5^\circ$ .  
*N-Acetyl*: 5-bromo-2-nitroacetanilide.  
 M.p.  $139^\circ$ .  
*N-Me*: 5-bromo-2-nitro-methylaniline. M.p.  
 $115^\circ$ .  
*N-Et*: 5-bromo-2-nitro-ethylaniline.  
 M.p.  $90^\circ$ .  
*N-Phenyl*: 5-bromo-2-nitrodiphenylamine.  
 M.p.  $116^\circ$ .

Blanksma, *Rec. trav. chim.*, 1902, 21, 413.  
 Mangini, *Gazz. chim. ital.*, 1936, 66, 343.

**6-Bromo-2-nitroaniline.**

Orange or yellow needles. M.p.  $73-4^\circ$ . Sol.  
 EtOH. Volatile in steam.  
*N-Acetyl*: 6-bromo-2-nitroacetanilide.  
 $C_8H_7O_3N_2Br$ . MW, 259. M.p.  $190^\circ$ .  
 Franzen, Engel *J. prakt. Chem.*, 1921,  
 102, 181.

**4-Bromo-3-nitroaniline.**

Needles from EtOH. M.p.  $131-2^\circ$ . Sol.  
 EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, AcOH.  
*N-Acetyl*: 4-bromo-3-nitroacetanilide.  
 M.p.  $146^\circ$  ( $143^\circ$ ).  
*N-Di-Me*: 4-bromo-3-nitrodimethylaniline.  
 $C_8H_9O_2N_2Br$ . MW, 245. M.p.  $72^\circ$ .  
 James, Judd, *J. Chem. Soc.*, 1914, 105,  
 1432.

**6-Bromo-3-nitroaniline.**

Pale yellow needles. M.p.  $141^\circ$ . Sol.  
 Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Mod. sol. EtOH. Spar.  
 sol. ligroin. Volatile in steam.  
*N-Acetyl*: 6-bromo-3-nitroacetanilide.  
 M.p.  $180^\circ$  ( $183^\circ$ ).  
 Körner, Contardi, *J. Chem. Soc.*, 1908,  
 94, i, 523.

**2-Bromo-4-nitroaniline.**

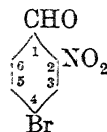
Yellow needles. M.p.  $104.5^\circ$ .  
*N-Acetyl*: 2-bromo-4-nitroacetanilide.  
 M.p.  $129^\circ$ .  
*N-Benzoyl*: 2-bromo-4-nitrobenzanilide.  
 $C_{12}H_9O_3N_2Br$ . MW, 321. M.p.  $160^\circ$ .  
*N-Me*: 2-bromo-4-nitro-methylaniline.  
 $C_7H_7O_2N_2Br$ . MW, 231. M.p.  $118^\circ$ .  
*N-Et*: 2-bromo-4-nitro-ethylaniline.  
 $C_8H_9O_2N_2Br$ . MW, 245. Yellow prisms from  
 EtOH. M.p.  $65-6^\circ$ .  
 James, Judd, *J. Chem. Soc.*, 1914, 105, 1433.

**3-Bromo-4-nitroaniline.**

Yellow cryst. from EtOH. M.p.  $172^\circ$ . Insol.  
 CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, ligroin.  
 Claus, Scheulen, *J. prakt. Chem.*, 1891,  
 43, 201.

**Bromonitroanisole.**

See under Bromonitrophenol.  
**4-Bromo-2-nitrobenzaldehyde**



$C_7H_4O_3NBr$  MW, 230  
 Cryst. from EtOH. M.p.  $97-8^\circ$ .  
*Oxime*: m.p.  $164^\circ$ .  
*Semicarbazone*: m.p.  $276^\circ$ .  
*Phenylhydrazone*: brownish-red cryst. M.p.  
 $181-2^\circ$ .

Sachs, Sichel, *Ber.*, 1904, 37, 1867.  
 Barber, Stickings, *J. Chem. Soc.*, 1945,  
 167.

**5-Bromo-2-nitrobenzaldehyde.**

Cryst. from C<sub>6</sub>H<sub>6</sub> or EtOH.Aq. M.p.  $73-4^\circ$ .  
 Sol. EtOH, C<sub>6</sub>H<sub>6</sub>, Et<sub>2</sub>O, hot H<sub>2</sub>O. Volatile in  
 steam.  
*Oxime*: yellow needles. M.p.  $113^\circ$ .  
*Phenylhydrazone*: red needles from EtOH.  
 M.p.  $180^\circ$  decomp.

Mettler, *Ber.*, 1905, 38, 2811.

**6-Bromo-2-nitrobenzaldehyde.**

M.p.  $82^\circ$ .  
*Phenylhydrazone*: two forms. (1) Red needles,  
 m.p.  $146^\circ$ ; (2) yellow needles, m.p.  $142^\circ$ .  
 Reich, Turkus, *Bull. soc. chim.*, 1917, 21,  
 107.

**4-Bromo-3-nitrobenzaldehyde.**

Needles. M.p.  $106^\circ$ . Cryst. from EtOH.  
 Volatile in steam.  
*Oxime*: yellow needles. M.p.  $154^\circ$ .  
*Phenylhydrazone*: yellow form, m.p.  $146-7^\circ$ ;  
 red form, m.p.  $148-9^\circ$ .  
*p-Nitrophenylhydrazone*: m.p.  $282-3^\circ$ .  
*Semicarbazone*: m.p.  $254-5^\circ$  decomp.  
*Azine*: m.p.  $245-6^\circ$ .

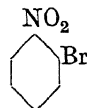
Hodgson, Beard, *J. Chem. Soc.*, 1927, 24.

**5-Bromo-3-nitrobenzaldehyde.**

Pale yellow cryst. M.p.  $100^\circ$ .  $KMnO_4 \rightarrow$   
 5-bromo-3-nitrobenzoic acid.  
 Blanksma, *Chem. Abstracts*, 1913, 7,  
 769.

**Bromonitrobenzanilide.**

See under Bromonitroaniline.  
**o-Bromonitrobenzene** (*2-Bromo-1-nitro-*  
*benzene*)



$C_6H_4O_2NBr$

MW, 202

Pale yellow cryst. M.p. 42° (39°). B.p. 261°. Sol. EtOH. C<sub>6</sub>H<sub>6</sub>. D<sub>4</sub><sup>20</sup> 1.6245. Red. → o-bromoaniline.

Dobbie, Marsden, *J. Chem. Soc.*, 1898, 73, 254.

Holleman, *Rec. trav. chim.*, 1900, 19, 367.

**m-Bromonitrobenzene.**

Rhombic cryst. M.p. 56°. B.p. 256.5°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 1.7036. n<sub>D</sub><sup>20</sup> 1.5979. Red. → m-bromoaniline.

Johnson, Gauerke, *Organic Syntheses*, Collective Vol. I, 118.

**p-Bromonitrobenzene.**

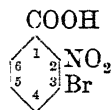
Prisms. M.p. 127°. B.p. 256°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>. Red. → p-bromoaniline.

Hantzsch, Blagden, *Ber.*, 1900, 33, 2553.

Holleman, *Rec. trav. chim.*, 1900, 19, 367.

Hodgson, Sibbald, *J. Chem. Soc.*, 1945, 819.

**3-Bromo-2-nitrobenzoic Acid**



C<sub>7</sub>H<sub>4</sub>O<sub>4</sub>NBr MW, 246

M.p. 250°. Cryst. from Et<sub>2</sub>O. Sol. EtOH. Spar. sol. H<sub>2</sub>O. *k* = 0.34 × 10<sup>-3</sup> at 25°. Sn + HCl → 3-bromoanthranilic (and anthranilic) acid.

*Et ester*: C<sub>9</sub>H<sub>6</sub>O<sub>4</sub>NBr. MW, 274. M.p. 80° (132°). Sol. EtOH, Et<sub>2</sub>O.

Burton, Hammond, Kenner, *J. Chem. Soc.*, 1926, 1802.

Holleman, *Rec. trav. chim.*, 1901, 20, 215.

**4-Bromo-2-nitrobenzoic Acid.**

Needles. M.p. 163°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Mod. sol. boiling H<sub>2</sub>O.

*Nitrile*: C<sub>7</sub>H<sub>3</sub>O<sub>3</sub>N<sub>2</sub>Br. MW, 227. Needles. M.p. 99°. Sol. EtOH, Et<sub>2</sub>O. Mod. sol. hot H<sub>2</sub>O. Sublimes. Volatile in steam.

Claus, Scheulen, *J. prakt. Chem.*, 1891, 43, 203.

Frejka, Vymetal, *Chem. Abstracts*, 1936, 30, 1371.

Burton, Hammond, Kenner, *J. Chem. Soc.*, 1926, 1802.

**5-Bromo-2-nitrobenzoic Acid.**

M.p. 140°. Cryst. from C<sub>6</sub>H<sub>6</sub> or toluene, with C<sub>6</sub>H<sub>6</sub> or toluene of cryst. D<sub>4</sub><sup>18</sup> 1.92. *k* = 1.4 × 10<sup>-2</sup> at 25°. Sn + HCl → 5-bromoanthranilic (and anthranilic) acid.

*Me ester*: C<sub>9</sub>H<sub>6</sub>O<sub>4</sub>NBr. MW, 260. M.p. 70°.

*Et ester*: C<sub>9</sub>H<sub>8</sub>O<sub>4</sub>NBr. MW, 274. M.p. 55°.

Holleman, de Bruyn, *Rec. trav. chim.*, 1901, 20, 216.

**2-Bromo-3-nitrobenzoic Acid.**

M.p. 191°. *k* = 1.16 × 10<sup>-2</sup> at 25°.

*Me ester*: C<sub>8</sub>H<sub>6</sub>O<sub>4</sub>NBr. MW, 260. M.p. 78°.

Whitmore, Culhane, *J. Am. Chem. Soc.*, 1929, 51, 602.

Culhane, *Organic Syntheses*, Collective Vol. I, 120.

**4-Bromo-3-nitrobenzoic Acid.**

Needles. M.p. 203-4°. Sol. EtOH, hot H<sub>2</sub>O. Sublimes. Sn + HCl → 4-bromo-3-amino-benzoic acid.

*Me ester*: C<sub>8</sub>H<sub>6</sub>O<sub>4</sub>NBr. MW, 260. Needles. M.p. 104°.

*Et ester*: C<sub>9</sub>H<sub>8</sub>O<sub>4</sub>NBr. MW, 274. M.p. 74°.

*Chloride*: C<sub>7</sub>H<sub>3</sub>O<sub>3</sub>NClBr. MW, 264.5. M.p. 51-3°. B.p. 178°/14 mm.

*Amide*: C<sub>7</sub>H<sub>5</sub>O<sub>3</sub>N<sub>2</sub>Br. MW, 245. Needles. M.p. 156°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO. Insol. C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>.

*Nitrile*: C<sub>7</sub>H<sub>3</sub>O<sub>2</sub>N<sub>2</sub>Br. MW, 227. M.p. 120°. Sol. EtOH, Me<sub>2</sub>CO, hot H<sub>2</sub>O.

*Anilide*: orange-yellow plates from EtOH. M.p. 156°.

Hübner, *Ann.*, 1884, 222, 177.

Schöpf, *Ber.*, 1890, 23, 3439.

**5-Bromo-3-nitrobenzoic Acid.**

Needles or plates. M.p. 161°. Sol. EtOH, Et<sub>2</sub>O, AcOH. Mod. sol. CHCl<sub>3</sub>, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. cold H<sub>2</sub>O.

*Me ester*: cryst. from EtOH. M.p. 70°. Spar. sol. pet. ether.

*Et ester*: m.p. 44°.

Hübner, *Ann.*, 1884, 222, 166.

Blanksma, *Chem. Abstracts*, 1913, 7, 769.

**6-Bromo-3-nitrobenzoic Acid.**

Needles. M.p. 180°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Mod. sol. hot H<sub>2</sub>O. Sublimes. *k* = 9.1 × 10<sup>-3</sup> at 25°.

*Me ester*: C<sub>8</sub>H<sub>6</sub>O<sub>4</sub>NBr. MW, 260. Needles. M.p. 82°.

*Et ester*: C<sub>9</sub>H<sub>8</sub>O<sub>4</sub>NBr. MW, 274. M.p. 66°.

*Chloride*: C<sub>7</sub>H<sub>3</sub>O<sub>3</sub>NClBr. MW, 264.5. M.p. 63°.

*Amide*: C<sub>7</sub>H<sub>5</sub>O<sub>3</sub>N<sub>2</sub>Br. MW, 245. Needles. M.p. 197-8°. Sol. EtOH, Me<sub>2</sub>CO.

*Nitrile*: C<sub>7</sub>H<sub>3</sub>O<sub>2</sub>N<sub>2</sub>Br. MW, 227. Needles. M.p. 117°. Sublimes. Volatile in steam.

*Anilide*: needles from EtOH. M.p. 166°.

Holleman, de Bruyn, *Rec. trav. chim.*, 1901, 20, 211.

Grohmann, *Ber.*, 1891, 24, 3808.

**2-Bromo-4-nitrobenzoic Acid.**

Needles. M.p. 164°. Sol. Et<sub>2</sub>O, EtOH, hot H<sub>2</sub>O. Sublimes.

Scheufelen, *Ann.*, 1885, 231, 172.

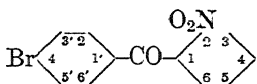


**3-Bromo-4-nitrobenzoic Acid.**

Needles. M.p. 197°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Spar. sol. cold H<sub>2</sub>O.

*Nitrile*: needles. M.p. 104°.

Claus, Scheulen, *J. prakt. Chem.*, 1891, 43, 202.

**4'-Bromo-2-nitrobenzophenone**

C<sub>13</sub>H<sub>9</sub>O<sub>3</sub>NBr MW, 306  
Cryst. from EtOH. M.p. 156°. B.p. 248°/11 mm.

Montagne, *Ber.*, 1916, 49, 2265.

**2'(?)-Bromo-3-nitrobenzophenone.**

Cryst. from EtOH. M.p. 81.5°.

Montagne, *Ber.*, 1916, 49, 2266.

**4-Bromo-3-nitrobenzophenone.**

Leaflets from EtOH. M.p. 124° (112-13°). B.p. 251°/16 mm. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, Me<sub>2</sub>CO, AcOH, C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin.

Montagne, *Ber.*, 1916, 49, 2273.

Schöpf, *Ber.*, 1891, 24, 3771.

**4'-Bromo-3-nitrobenzophenone.**

Cryst. from EtOH. M.p. 109.5°. B.p. 254°/11 mm.

Montagne, *Ber.*, 1916, 49, 2266.

**6-Bromo-3-nitrobenzophenone.**

Pale brown needles. M.p. 121°. Sol. Me<sub>2</sub>CO, AcOH, C<sub>6</sub>H<sub>6</sub>. Spar. sol. EtOH.

*Oxime*: pale yellow cryst. from EtOH. M.p. 195-6°.

Meisenheimer, *Ann.*, 1925, 446, 217.

**2'(?)-Bromo-4-nitrobenzophenone.**

Cryst. from EtOH. M.p. 109.5°. B.p. 239°/10 mm.

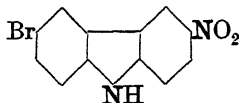
Montagne, *Ber.*, 1916, 49, 2266.

**4'-Bromo-4-nitrobenzophenone.**

Cryst. from EtOH. M.p. 134° (125°). B.p. 264°/16 mm.

Montagne, *Ber.*, 1916, 49, 2267.

Böeseken, *Rec. trav. chim.*, 1904, 23, 108.

**6-Bromo-3-nitrocarbazole**

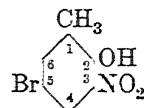
C<sub>12</sub>H<sub>7</sub>O<sub>2</sub>N<sub>2</sub>Br MW, 291

Dark yellow needles from AcOH. M.p. 288-9°. Sublimes above 225°. Spar. sol. EtOH, Et<sub>2</sub>O.

*N-Acetyl*: reddish-yellow cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 236-7°.

*N-Benzoyl*: yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 267-8°. Insol. EtOH, ligroin.

Mazzara, Leonardi, *Gazz. chim. ital.*, 1892, 22, ii, 574.

**5-Bromo-3-nitro-*o*-cresol**

C<sub>7</sub>H<sub>6</sub>O<sub>3</sub>NBr MW, 232

Yellow needles. M.p. 90-91°. Sol. EtOH, Et<sub>2</sub>O, AcOH, C<sub>6</sub>H<sub>6</sub>. Sublimes. Volatile in steam.

Bureš, *Chem. Abstracts*, 1928, 22, 63.

Raiford, *J. Am. Chem. Soc.*, 1922, 44, 158.

**6-Bromo-3-nitro-*o*-cresol.**

Yellow leaflets. M.p. 64°. Sol. hot EtOH. Volatile in steam.

Nölting, *Ber.*, 1904, 37, 1023.

**α-Bromo-4-nitro-*o*-cresol.**

See 4-Nitro-*o*-hydroxybenzyl bromide.

**3-Bromo-5-nitro-*o*-cresol.**

Pale yellow prisms or needles. M.p. 120° decomp. Cryst. from AcOH or ligroin. Non-volatile in steam.

*Acetyl*: 3-bromo-5-nitro-*o*-tolyl acetate. M.p. 137°.

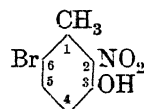
Kehrmann, *Ber.*, 1915, 48, 2021.

Raiford, *J. Am. Chem. Soc.*, 1922, 44, 158.

**6-Bromo-5-nitro-*o*-cresol.**

Cryst. M.p. 145-6°. Non-volatile in steam.

Nölting, *Ber.*, 1904, 37, 1023.

**6-Bromo-2-nitro-*m*-cresol**

C<sub>7</sub>H<sub>6</sub>O<sub>3</sub>NBr MW, 232

M.p. 105°.

Gibbs, Robertson, *J. Chem. Soc.*, 1914, 105, 1885.

**6-Bromo-4-nitro-*m*-cresol.**

Dark yellow or greenish-yellow needles. M.p. 127°. Mod. sol. H<sub>2</sub>O. Volatile in steam.

*Et ether*: C<sub>9</sub>H<sub>10</sub>O<sub>3</sub>NBr. MW, 260. Cryst. from EtOH or ligroin. M.p. 124°.

Gibbs, Robertson, *J. Chem. Soc.*, 1914, 105, 1885.

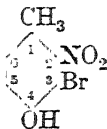
Walther, Demmelmeyer, *J. prakt. Chem.*, 1915, 92, 122.

**4-Bromo-6-nitro-*m*-cresol.**

Pale yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 146°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, dil. NaOH. Mod. sol. hot C<sub>6</sub>H<sub>6</sub>, dil. KOH. Spar. sol. hot ligroin.

*Me ether*: C<sub>8</sub>H<sub>8</sub>O<sub>3</sub>NBr. MW, 246. Needles from pet. ether. M.p. 110-11°.

Kermack, Wight, *J. Chem. Soc.*, 1935, 1423.

**3-Bromo-2-nitro-*p*-cresol**

$C_7H_6O_3NBr$  MW, 232

Yellow prismatic needles from  $H_2O$ . M.p. 77°. Alc.  $FeCl_3 \rightarrow$  pale greenish-brown col.

*Me ether*:  $C_8H_8O_3NBr$ . MW, 246. Yellow needles from xylene. M.p. 74°.

*Acetyl*: 3-bromo-2-nitro-*p*-tolyl acetate. Plates. M.p. 81°.

Kermack, Spragg, *J. Chem. Soc.*, 1932, 2947.

**5-Bromo-2-nitro-*p*-cresol**

Pale yellow needles from  $H_2O$ . M.p. 104°. Alc.  $FeCl_3 \rightarrow$  dark greenish-brown col.

*Me ether*: pale yellow needles from  $Et_2O$ . M.p. 94°.

*Acetyl*: 5-bromo-2-nitro-*p*-tolyl acetate. Plates. M.p. 121°.

Kermack, Spragg, *J. Chem. Soc.*, 1932, 2947.

**5-Bromo-3-nitro-*p*-cresol**

Yellow needles. M.p. 69°. Sol.  $EtOH$ ,  $Et_2O$ ,  $AcOH$ ,  $C_6H_6$ .

*Acetyl*: 5-bromo-3-nitro-*p*-tolyl acetate. M.p. 110–11°.

Zincke, Emmerich, *Ann.*, 1905, 341, 310.

Raiford, *J. Am. Chem. Soc.*, 1919, 41, 2072.

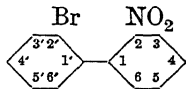
**6-Bromo-3-nitro-*p*-cresol**

Yellow cryst. M.p. 62°. Volatile in steam. Na salt forms red plates from  $EtOH.Aq$ .

Griffith, *J. Chem. Soc.*, 1924, 125, 2625

**Bromonitro-*N*-dimethylaniline.**

*See under* Bromonitroaniline.

**2'-Bromo-2-nitrodiphenyl**

$C_{12}H_8O_2NBr$  MW, 278

Cryst. from ligroin. M.p. 66–7°.

Mascarelli, Gatti, *Gazz. chim. ital.*, 1931, 61, 790.

Mascarelli, Gatti, Longo, *Gazz. chim. ital.*, 1933, 63, 661.

**3'-Bromo-2-nitrodiphenyl.**

Pale yellow prisms from  $EtOH$ . M.p. 53–4° corr.

Lesslie, Turner, *J. Chem. Soc.*, 1933, 1591.

**4'-Bromo-2-nitrodiphenyl.**

Cryst. M.p. 65°. Dist. about 300° undecomp.  $CrO_3 \rightarrow$  *p*-bromobenzoic acid.

Le Fèvre, Turner, *J. Chem. Soc.*, 1926, 2043.

**4-Bromo-3-nitrodiphenyl.**

B.p. 210–15°/6 mm.

Case, *J. Am. Chem. Soc.*, 1936, 58, 1250.

**6-Bromo-3-nitrodiphenyl.**

Cryst. from  $C_6H_6$ -pet. ether. M.p. 80–81°. B.p. 190–215°/10 mm.

Case, *J. Am. Chem. Soc.*, 1936, 58, 1250.

**2'-Bromo-3-nitrodiphenyl.**

M.p. 78–9°.

Case, *J. Am. Chem. Soc.*, 1938, 60, 424.

**3'-Bromo-3-nitrodiphenyl.**

Yellow needles from  $EtOH$ . M.p. 92°. Sol. most org. solvents.

Mascarelli, Gatti, *Gazz. chim. ital.*, 1931, 61, 323.

**4'-Bromo-3-nitrodiphenyl.**

Plates from  $EtOH$ . M.p. 95°.

Blakey, Scarborough, *J. Chem. Soc.*, 1927, 3004.

**2'-Bromo-4-nitrodiphenyl.**

Yellow needles from  $EtOH$ . M.p. 82–5°.

Scarborough, Waters, *J. Chem. Soc.*, 1927, 96.

**3'-Bromo-4-nitrodiphenyl.**

Cryst. from  $MeOH$ . M.p. 94–5°.

Case, *J. Am. Chem. Soc.*, 1938, 60, 424.

**4'-Bromo-4-nitrodiphenyl.**

Brown needles from  $AcOH$ . M.p. 173°. Distils undecomp. above 360°. Mod. sol. toluene. Spar. sol. hot  $EtOH$ .  $CrO_3 \rightarrow$  *p*-bromo- and *p*-nitro-benzoic acids.

Codolosa, *Chem. Abstracts*, 1934, 28, 3069.

Guglielmelli, Franco, *Chem. Zentr.*, 1932, 11, 2455.

Le Fèvre, Turner, *J. Chem. Soc.*, 1926, 2045.

**Bromonitrodiphenylamine.**

*See under* Bromonitroaniline.

**1-Bromo-1-nitroethane**

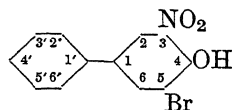
$C_2H_4O_2NBr$  MW, 154

B.p. 146–7°. Insol.  $H_2O$ .

Tscherniak, *Ann.*, 1876, 180, 126.

**Bromonitro-*N*-ethylaniline.**

*See under* Bromonitroaniline.

**5-Bromo-3-nitro-4-hydroxydiphenyl**

$C_{12}H_8O_3NBr$  MW, 294

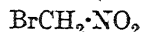
Golden yellow needles. M.p. 76°.

Bell, Robinson, *J. Chem. Soc.*, 1927, 1133.

**3-Bromo-4'-nitro-4-hydroxydiphenyl.**

Yellow powder from dil.  $AcOH$ . M.p. 132°.

Bell, Robinson, *J. Chem. Soc.*, 1927, 1133.

**Bromonitromethane** (*Nitromethyl bromide*)

$\text{CH}_2\text{O}_2\text{NBr}$  MW, 140

B.p. 148–9°/742 mm., 70–2°/40–50 mm.  
Insol.  $\text{H}_2\text{O}$ . Sol. alkalis.

Sherrill, *J. Am. Chem. Soc.*, 1924, **46**, 2753.

**Bromonitro-N-methylaniline.**

See under Bromonitroaniline.

**2-Bromo-1-nitronaphthalene** (*β-Bromo-α-nitronaphthalene*)

$\text{C}_{10}\text{H}_6\text{O}_2\text{NBr}$  MW, 252

Reddish-yellow needles. M.p. 102–3° (80°).  
Distills above 360°. Sol. EtOH, Et<sub>2</sub>O, AcOH,  
 $\text{C}_6\text{H}_6$ .

Vesely, Chudozilov, *Chem. Abstracts*, 1925, **19**, 3486.

Contardi, Mor, *ibid.*, 827.

Vesely, *Ber.*, 1905, **38**, 138.

**3-Bromo-1-nitronaphthalene.**

M.p. 97–8°.

Vesely, Chudozilov, *Chem. Abstracts*, 1925, **19**, 3486.

**4-Bromo-1-nitronaphthalene.**

Yellow needles. M.p. 85°.

Jolin, *Bull. soc. chim.*, 1877, **28**, 515.

**5-Bromo-1-nitronaphthalene.**

Yellow needles. M.p. 122.5°. Sol. Et<sub>2</sub>O,  
 $\text{CHCl}_3$ ,  $\text{CCl}_4$ , AcOH,  $\text{C}_6\text{H}_6$ . Spar. sol. cold EtOH.  
 $\text{Zn} + \text{HCl} \rightarrow$  5-bromo-1-naphthylamine.

McLeish, Campbell, *J. Chem. Soc.*, 1937, 1106.

**7-Bromo-1-nitronaphthalene.**

Cryst. from hot 80% AcOH. M.p. 110–11°.

Zal'kind, Filinov, *Chem. Abstracts*, 1935, **29**, 2161.

**8-Bromo-1-nitronaphthalene.**

Yellow needles from EtOH.Aq. M.p. 100°.

Meldola, Streatfeild, *J. Chem. Soc.*, 1893, **63**, 1057.

**1-Bromo-2-nitronaphthalene** (*α-Bromo-β-nitronaphthalene*).

Yellow needles from EtOH. M.p. 97°.

Hodgson, Kilner, *J. Chem. Soc.*, 1926, 7.

**3-Bromo-2-nitronaphthalene.**

Yellow needles from EtOH. M.p. 84°.

McLeish, Campbell, *J. Chem. Soc.*, 1937, 1106.

Hodgson, *J. Chem. Soc.*, 1936, 1153.

Dict. of Org. Comp.—I.

**4-Bromo-2-nitronaphthalene.**

Pale yellow needles. M.p. 131–2°. Sol.  
EtOH, Et<sub>2</sub>O. Sublimes.  $\text{Zn} + \text{AcOH} \rightarrow$   
4-bromo-2-naphthylamine.

Armstrong, Rossiter, *Chem. News*, 1892, **65**, 59.

Vesely, Chudozilov, *Chem. Abstracts*, 1925, **19**, 3486.

**5-(or 8-)Bromo-2-nitronaphthalene.**

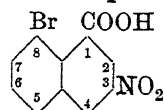
Yellow needles from EtOH. M.p. 131°.  
Sol.  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ .

v. Braun, Hahn, Seemann, *Ber.*, 1922, **55**, 1698.

**6-Bromo-2-nitronaphthalene.**

Brownish-yellow needles from AcOH. M.p. 190°.

McLeish, Campbell, *J. Chem. Soc.*, 1937, 1107.

**8-Bromo-3-nitro-1-naphthoic Acid**

$\text{C}_{11}\text{H}_6\text{O}_4\text{NBr}$  MW, 296

Plates from AcOH. M.p. 240–2°.

*Me ester*:  $\text{C}_{12}\text{H}_8\text{O}_4\text{NBr}$ . MW, 310. Cryst.  
from ligroin. M.p. 173°. Spar. sol. Et<sub>2</sub>O,  $\text{C}_6\text{H}_6$ .

*Et ester*:  $\text{C}_{13}\text{H}_{10}\text{O}_4\text{NBr}$ . MW, 322. Cryst.  
from ligroin. M.p. 155–6°.

Rule, Brown, *J. Chem. Soc.*, 1934, 171.

**8-Bromo-5-nitro-1-naphthoic Acid.**

Yellow solid. M.p. 245°. Sol. EtOH,  $\text{Me}_2\text{CO}$ .  
Very spar. sol.  $\text{C}_6\text{H}_6$ , ligroin.

*Me ester*: cryst. from pet. ether. M.p. 97°.

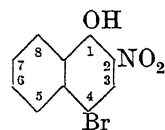
*Et ester*: prisms from  $\text{Me}_2\text{CO}$ . M.p. 103°.

Rule, Pursell, Brown, *J. Chem. Soc.*, 1934, 168.

**5-Bromo-8-nitro-1-naphthoic Acid.**

Yellowish prisms from EtOH. M.p. 260°.

Ekstrand, *J. prakt. Chem.*, 1888, **38**, 173.

**4-Bromo-2-nitro-1-naphthol** (*4-Bromo-β-nitro-α-naphthol*)

$\text{C}_{10}\text{H}_6\text{O}_3\text{NBr}$  MW, 268

Yellow needles. M.p. 142°.

*Me ether*:  $\text{C}_{11}\text{H}_8\text{O}_3\text{NBr}$ . MW, 282. Pale  
yellow needles. M.p. 115°.

*Et ether*:  $\text{C}_{12}\text{H}_{10}\text{O}_3\text{NBr}$ . MW, 296. Yellow-  
ish needles. M.p. 80°.

Meldola, Lane, *J. Chem. Soc.*, 1904, **85**, 1605.

**5-Bromo-2-nitro-1-naphthol.**

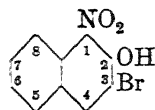
Golden-yellow leaflets from AcOH. M.p. 142°.

Fries, Kohler, *Ber.*, 1924, 57, 496.

**2-Bromo-4-nitro-1-naphthol.**

Pale yellow needles from EtOH. M.p. 236°.

Hodgson, Elliott, *J. Chem. Soc.*, 1935, 1852.

**3-Bromo-1-nitro-2-naphthol (3-Bromo- $\alpha$ -nitro- $\beta$ -naphthol)**

$C_{10}H_6O_3NBr$

MW, 268

Yellow plates from EtOH. M.p. 131° decomp.

Conden, Kenyon, *J. Chem. Soc.*, 1935, 1595.

**6-Bromo-1-nitro-2-naphthol.**

Yellow needles. M.p. 122-3°. Sol. Et<sub>2</sub>O, AcOH, C<sub>6</sub>H<sub>6</sub>.

*Acetyl*: 6-bromo-1-nitro-2-naphthyl acetate. Yellow needles. M.p. 115-7°.

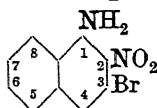
*p-Toluenesulphonyl*: m.p. 145°.

*Me ether*: C<sub>11</sub>H<sub>8</sub>O<sub>3</sub>NBr. MW, 282. M.p. 152°.

*Et ether*: C<sub>12</sub>H<sub>10</sub>O<sub>3</sub>NBr. MW, 296. M.p. 146°.

Dahmer, *Ann.*, 1904, 333, 369.

Davis, *Chem. News*, 1896, 74, 302.

**3-Bromo-2-nitro-1-naphthylamine**

$C_{10}H_7O_2N_2Br$

MW, 267

Yellow needles from EtOH. M.p. 166°.

*N-Acetyl*: needles from AcOH. M.p. 235°.

Hodgson, Elliot, *J. Chem. Soc.*, 1936, 1153.

**4-Bromo-2-nitro-1-naphthylamine.**

Orange cryst. from toluene. M.p. 200° (197°). Sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, hot EtOH. Spar. sol. CS<sub>2</sub>. Hot. conc. HNO<sub>3</sub> → phthalic acid.

*N-Acetyl*: yellow needles from EtOH. M.p. 232°.

*N-Benzenesulphonyl*: needles from EtOH. M.p. 198°.

*N-Benzyl*: red needles from EtOH. M.p. 126-7°. *N-Acetyl*: prisms from EtOH. M.p. 128°. *N-Nitroso*: needles from EtOH. M.p. 98°.

Meldola, *J. Chem. Soc.*, 1885, 47, 500.

Liebermann, *Ann.*, 1876, 183, 260.

**5-Bromo-2-nitro-1-naphthylamine.**

Orange-red needles. M.p. 223°. Sol. AcOH. Spar. sol. pet. ether.

*N-Acetyl*: yellow needles. M.p. 240°.

*N-Diacetyl*: yellow needles from AcOH. M.p. 133°.

Fries, Köhler, *Ber.*, 1924, 57, 506.

**4-Bromo-3-nitro-1-naphthylamine.**

Red solid. M.p. 132°.

*N-Acetyl*: yellow cryst. M.p. 223°.

Panizzon-Favre, *Gazz. chim. ital.*, 1924, 54, 839.

**2-Bromo-4-nitro-1-naphthylamine.**

Yellow needles from AcOH. M.p. 250°.

Hodgson, Elliot, *J. Chem. Soc.*, 1934, 1705.

**5-Bromo-4-nitro-1-naphthylamine.**

Reddish-brown needles or prisms from EtOH. M.p. 192°. Sol. Me<sub>2</sub>CO, AcOH, PhNO<sub>2</sub>. Spar. sol. pet. ether.

*N-Acetyl*: yellow needles from AcOH. M.p. 225°.

*N-Diacetyl*: brown plates from EtOH. M.p. 170°.

Fries, Köhler, *Ber.*, 1924, 57, 501.

**4-Bromo-8-nitro-1-naphthylamine.**

Red needles from ligroin. M.p. 116°. Sol. EtOH, AcOH.

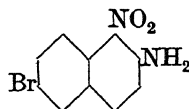
*B,HCl*: needles from EtOH. M.p. 185°.

*B,HBr*: needles from EtOH. M.p. 209°.

*N-Acetyl*: plates from AcOH. M.p. 202°.

*N-Benzoyl*: needles from AcOH. M.p. 218°.

Hodgson, Crooks, *J. Chem. Soc.*, 1936, 1338.

**6-Bromo-1-nitro-2-naphthylamine**

$C_{10}H_7O_2N_2Br$

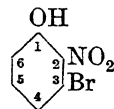
MW, 267

Yellow cryst. M.p. 190°.

Davis, *Chem. News*, 1896, 74, 302.

**Bromonitrophenetole.**

See under Bromonitrophenol.

**3-Bromo-2-nitrophenol (m-Bromo-o-nitrophenol)**

$C_6H_4O_3NBr$

MW, 218

Colourless needles from H<sub>2</sub>O, m.p. 35° (? hydrate). Bright yellow needles from pet. ether, m.p. (anhyd.) 65-7°. Sol. NaOH.Aq. → red sol. from which min. acids in the cold → colourless variety of cryst.

*Me ether*: 3-bromo-2-nitroanisole. C<sub>7</sub>H<sub>8</sub>O<sub>3</sub>NBr. MW, 232. M.p. 73°.

*Benzoyl*: C<sub>13</sub>H<sub>9</sub>O<sub>4</sub>NBr. MW, 322. Feathery needles. M.p. 133°.

*p-Toluenesulphonyl*: plates from EtOH. M.p. 136.5-137.5°.

Hodgson, Moore, *J. Chem. Soc.*, 1926, 158.

**4-Bromo-2-nitrophenol** (*p*-Bromo-*o*-nitrophenol).

Yellow leaflets or needles. M.p. 89°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Spar. sol. cold H<sub>2</sub>O. Sublimes. Volatile in steam.

*Me ether*: 4-bromo-2-nitroanisole. C<sub>7</sub>H<sub>6</sub>O<sub>3</sub>NBr. MW, 232. M.p. 88° (85°). Sol. Et<sub>2</sub>O, hot EtOH.

*Et ether*: 4-bromo-2-nitrophenetole. C<sub>8</sub>H<sub>8</sub>O<sub>3</sub>NBr. MW, 246. M.p. 47° (43°). Sol. EtOH, Et<sub>2</sub>O.

*Acetyl*: m.p. 75°.

*Benzenesulphonyl*: m.p. 83-4°.

van Erp, *Rec. trav. chim.*, 1910, 29, 187.

**5-Bromo-2-nitrophenol** (*5*-Bromo-*o*-nitrophenol).

Yellow needles or prisms. M.p. 44°. Sol. EtOH, Et<sub>2</sub>O, ligroin. Volatile in steam.

*Et ether*: 5-bromo-2-nitrophenetole. C<sub>8</sub>H<sub>8</sub>O<sub>3</sub>NBr. MW, 246. Cryst. from EtOH. M.p. 79.5-80.5°.

Auwers, *Fortschritte der Chemie, Physik und physikalischen Chemie*, 1924, 18, 62. Laubenheimer, *Ber.*, 1878, 11, 1160.

Mangini, *Gazz. chim. ital.*, 1936, 66, 675.

**6-Bromo-2-nitrophenol** (*6*-Bromo-*o*-nitrophenol).

Pale yellow needles. M.p. 68°.

*Me ether*: 6-bromo-2-nitroanisole. C<sub>7</sub>H<sub>6</sub>O<sub>3</sub>NBr. MW, 232. Leaflets. M.p. 67°.

*Acetyl*: m.p. 39.5-40°.

van Erp, *Rec. trav. chim.*, 1910, 29, 196.

**2-Bromo-3-nitrophenol** (*o*-Bromo-*m*-nitrophenol).

Yellow needles. M.p. 147°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. ligroin, CS<sub>2</sub>, hot H<sub>2</sub>O. Sublimes.

*Me ether*: 2-bromo-3-nitroanisole. C<sub>7</sub>H<sub>6</sub>O<sub>3</sub>NBr. MW, 232. Needles. M.p. 103-4°. Sol. EtOH, Et<sub>2</sub>O.

*Et ether*: 2-bromo-3-nitrophenetole. C<sub>8</sub>H<sub>8</sub>O<sub>3</sub>NBr. MW, 246. Pale yellow prisms. M.p. 57°.

Schliefer, *Ber.*, 1892, 25, 552.

**4-Bromo-3-nitrophenol** (*p*-Bromo-*m*-nitrophenol).

Yellow needles. M.p. 147°.

*Me ether*: 4-bromo-3-nitroanisole. C<sub>7</sub>H<sub>6</sub>O<sub>3</sub>NBr. MW, 232. Yellow needles from EtOH. M.p. 32°. Volatile in steam.

Hodgson, Dyson, *J. Chem. Soc.*, 1935, 947.

Henley, Turner, *J. Chem. Soc.*, 1930, 937.

**5-Bromo-3-nitrophenol** (*5*-Bromo-*m*-nitrophenol).

M.p. 145°. Sol. EtOH. Spar. sol. C<sub>6</sub>H<sub>6</sub>.

*Me ether*: 5-bromo-3-nitroanisole. C<sub>7</sub>H<sub>6</sub>O<sub>3</sub>NBr. MW, 232. M.p. 88°.

*Acetyl*: m.p. 99°.

Hodgson, Wignall, *J. Chem. Soc.*, 1926, 2077.

Heller, Kammann, *Ber.*, 1909, 42, 2195.

**6-Bromo-3-nitrophenol** (*6*-Bromo-*m*-nitrophenol).

Cryst. from H<sub>2</sub>O or pet. ether. M.p. 118.5-121°. Sol. usual org. solvents except pet. ether.

*Me ether*: 6-bromo-3-nitroanisole. C<sub>7</sub>H<sub>6</sub>O<sub>3</sub>NBr. MW, 232. Cryst. from EtOH. M.p. 104°. Volatile in steam.

*p-Toluenesulphonyl*: plates from EtOH. M.p. 131.5-132.5°.

Henley, Turner, *J. Chem. Soc.*, 1930, 938.

Hanford, Adams, *J. Am. Chem. Soc.*, 1935, 57, 1593.

**2-Bromo-4-nitrophenol** (*o*-Bromo-*p*-nitrophenol).

Needles. M.p. 114°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. hot H<sub>2</sub>O.

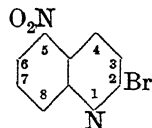
*Me ether*: 2-bromo-4-nitroanisole. C<sub>7</sub>H<sub>6</sub>O<sub>3</sub>NBr. MW, 232. Needles. M.p. 106°. Sol. hot EtOH, Et<sub>2</sub>O.

*Et ether*: 2-bromo-4-nitrophenetole. C<sub>8</sub>H<sub>8</sub>O<sub>3</sub>NBr. MW, 246. Pale yellow needles. M.p. 98°. Sol. EtOH, Et<sub>2</sub>O.

*Acetyl*: m.p. 62°.

*Benzoyl*: m.p. 131-2°.

van Erp, *Rec. trav. chim.*, 1910, 29, 218.

**2-Bromo-5-nitroquinoline**

C<sub>9</sub>H<sub>5</sub>O<sub>2</sub>N<sub>2</sub>Br

MW, 253

Yellow leaflets and needles from EtOH. M.p. 111°. Does not form methiodide.

Claus, Pollitz, *J. prakt. Chem.*, 1890, 41, 44.

Decker, *J. prakt. Chem.*, 1901, 64, 91.

**3-Bromo-5-nitroquinoline.**

Needles from EtOH. M.p. 136-7°. B.p. 320-30°, slight decomp. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, hot EtOH. Spar. sol. hot H<sub>2</sub>O.

B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>: yellow prisms. Decomp. at 280-300°.

HgCl<sub>2</sub> comp.: m.p. 185°.

*Methochloride*: needles. Decomp. at 204°.

*Methiodide*: red leaflets from H<sub>2</sub>O. M.p. 205-10° decomp. Insol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Methonitrate*: yellow leaflets from EtOH. M.p. 159° decomp.

Claus, Decker, *J. prakt. Chem.*, 1889, 39, 301.

Claus, Setzer, *J. prakt. Chem.*, 1896, 53, 392.

**6-Bromo-5-nitroquinoline.**

Needles from EtOH. M.p. 130°. Sublimes undecomp. Sol. Et<sub>2</sub>O, hot EtOH. Spar. sol. hot H<sub>2</sub>O.

*Methochloride*: yellow prisms from H<sub>2</sub>O. M.p. 203°.

*Methiodide*: red needles. M.p. 265° decomp.

Claus, Zuschlag, *J. prakt. Chem.*, 1889, 40, 462.

La Cost, *Ber.*, 1882, 15, 1918.

Claus, Reinhard, *J. prakt. Chem.*, 1894, 49, 526.

**8-Bromo-5-nitroquinoline.**

Needles from EtOH. M.p. 137–8°. Sublimes. Does not form methiodide.

$B_2, H_2PtCl_6$ : orange-yellow needles from HCl. M.p. 272° decomp. Hyd. by H<sub>2</sub>O.

Claus, Howitz, *J. prakt. Chem.*, 1893, 48, 153.

**3-Bromo-6-nitroquinoline.**

Needles from H<sub>2</sub>O. M.p. 165°. Sublimes.

*Methiodide*: red needles and prisms from H<sub>2</sub>O. M.p. 235°.

Claus, Schnell, *J. prakt. Chem.*, 1896, 53, 109.

**5-Bromo-6-nitroquinoline.**

Needles. M.p. 126°.

$B_2, H_2PtCl_6$ : decomp. about 220°.

Claus, Vis, *J. prakt. Chem.*, 1888, 38, 393.

**8-Bromo-6-nitroquinoline.**

Leaflets. M.p. 164°.

Claus, Hartmann, *J. prakt. Chem.*, 1896, 53, 207.

**2-Bromo-8-nitroquinoline.**

Prisms or plates. M.p. 146°. B.p. about 225–8°.

Claus, Pollitz, *J. prakt. Chem.*, 1890, 41, 44.

Decker, *J. prakt. Chem.*, 1901, 64, 94.

**3-Bromo-8-nitroquinoline.**

Prisms from Et<sub>2</sub>O–EtOH. M.p. 124°.

*Methiodide*: red needles from EtOH. M.p. about 145° with loss of methyl iodide.

Claus, Decker, *J. prakt. Chem.*, 1889, 39, 303.

**5-Bromo-8-nitroquinoline.**

Needles. M.p. 146°.

$B_2, H_2PtCl_6$ : decomp. at 255°.

Claus, Vis, *J. prakt. Chem.*, 1888, 38, 392.

Dikshoorn, *Rec. trav. chim.*, 1929, 48, 550.

**6-Bromo-8-nitroquinoline.**

Needles from EtOH. M.p. 170° (170–7°).  $B_2, H_2PtCl_6$ : yellow prisms from HCl. M.p. 265–8°.

*Methiodide*: reddish-brown needles from EtOH. Decomp. at 185–6°.

Claus, Reinhardt, *J. prakt. Chem.*, 1894, 49, 527.

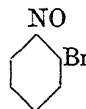
Decker, Kaufmann, *J. prakt. Chem.*, 1911, 84, 446.

**7-Bromo-8-nitroquinoline.**

Prisms from Et<sub>2</sub>O. M.p. 192°.

$B_2, H_2PtCl_6$ : red prisms. Decomp. at 240°.

Claus, Vis, *J. prakt. Chem.*, 1888, 38, 389.

**o-Bromonitrosobenzene (2-Bromo-1-nitrosobenzene)**

$C_6H_4ONBr$  MW, 186

Colourless needles. M.p. 98°. Sols. and liq. are green. Sol.  $CHCl_3$ ,  $C_6H_6$ .

Bamberger, Büsdorf, Sand, *Ber.*, 1898, 31, 1519.

**m-Bromonitrosobenzene (3-Bromo-1-nitrosobenzene).**

M.p. 78°.

Haworth, Lapworth, *J. Chem. Soc.*, 1921, 119, 773.

**p-Bromonitrosobenzene (4-Bromo-1-nitrosobenzene).**

Colourless needles. M.p. 92.5° (95°). Sol.  $CHCl_3$ ,  $C_6H_6$ , hot EtOH, hot ligroin. Volatile in steam. Sols. and liq. are green.

Ingold, *J. Chem. Soc.*, 1925, 127, 516.

Le Fèvre, *J. Chem. Soc.*, 1931, 813.

**Bromonitrosocarvacrol.**

See under 6-Bromothymoquinone.

**Bromonitrosonaphthol.**

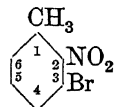
See under Bromonaphthoquinone.

**Bromonitrosophenol.**

See under Bromo-p-benzoquinone.

**Bromonitrosothymol.**

See under 3-Bromothymoquinone.

**3-Bromo-2-nitrotoluene (m-Bromo-o-nitrotoluene)**

$C_7H_6O_2NBr$  MW, 216

Pale yellow needles. M.p. 27.9°. B.p. 152–4°/30 mm., 129–30°/10 mm. Mod. sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

Geerling, Wibaut, *Rec. trav. chim.*, 1934, 53, 1015.

Elson, Gibson, Johnson, *J. Chem. Soc.*, 1929, 2741.

**4-Bromo-2-nitrotoluene** (*p*-Bromo-*o*-nitrotoluene).

Pale yellow cryst. M.p. 47°. B.p. 256°.

Gibson, Johnson, *J. Chem. Soc.*, 1929, 1246.**5-Bromo-2-nitrotoluene** (*5*-Bromo-*o*-nitrotoluene).

M.p. 56°. B.p. 267°, 143°/10 mm.

Gibson, Johnson, *J. Chem. Soc.*, 1929, 1229.Geerling, Wibaut, *Rec. trav. chim.*, 1934, 53, 1014.**6-Bromo-2-nitrotoluene** (*6*-Bromo-*o*-nitrotoluene).

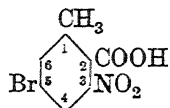
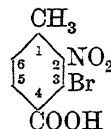
Yellowish needles. M.p. 42°. B.p. 143°/22 mm.

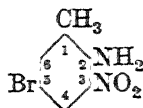
Gibson, Johnson, *J. Chem. Soc.*, 1929, 1245.**2-Bromo-3-nitrotoluene** (*o*-Bromo-*m*-nitrotoluene).Yellow solid. M.p. 41–2°. B.p. 157°/22 mm., 135–6°/8 mm. Sol. EtOH. Insol. H<sub>2</sub>O.Gibson, Johnson, *J. Chem. Soc.*, 1929, 1243.**4-Bromo-3-nitrotoluene** (*p*-Bromo-*m*-nitrotoluene).

Pale yellow needles. M.p. 34°.

Gibson, Johnson, *J. Chem. Soc.*, 1929, 1243.**5-Bromo-3-nitrotoluene** (*5*-Bromo-*m*-nitrotoluene).

Prisms. M.p. 83°. B.p. 269°.

Gibson, Johnson, *J. Chem. Soc.*, 1929, 1245.**6-Bromo-3-nitrotoluene** (*6*-Bromo-*m*-nitrotoluene).M.p. 78° (75–6°). B.p. 140–3°/17 mm. Sol. Et<sub>2</sub>O, CS<sub>2</sub>, hot EtOH.Gibson, Johnson, *J. Chem. Soc.*, 1929, 1244.**2-Bromo-4-nitrotoluene** (*o*-Bromo-*p*-nitrotoluene).Needles. M.p. 77° (76°, 74–5°). B.p. 150–1°/20 mm. Sol. Et<sub>2</sub>O, CS<sub>2</sub>, hot EtOH.Higginbottom, Hill, Short, *J. Chem. Soc.*, 1937, 264.Gibson, Johnson, *J. Chem. Soc.*, 1929, 1244.**3-Bromo-4-nitrotoluene** (*m*-Bromo-*p*-nitrotoluene).Yellow needles. M.p. 37°. B.p. 154–5°/20 mm. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.Geerling, Wibaut, *Rec. trav. chim.*, 1934, 53, 1014.Gibson, Johnson, *J. Chem. Soc.*, 1929, 2739.**5-Bromo-3-nitro-*o*-toluic Acid**C<sub>8</sub>H<sub>6</sub>O<sub>4</sub>NBr MW, 260Needles. M.p. 226°. Sol. EtOH, Et<sub>2</sub>O, pet. ether, hot H<sub>2</sub>O. Sublimes.*Amide*: C<sub>8</sub>H<sub>7</sub>O<sub>3</sub>N<sub>2</sub>Br. MW, 259. M.p. 235°.*Nitrile*: C<sub>8</sub>H<sub>5</sub>O<sub>2</sub>N<sub>2</sub>Br. MW, 241. M.p. 106–7°. Sublimes. Spar. volatile in steam.Claus, Beck, *Ann.*, 1892, 269, 208.**5-Bromo-4-nitro-*o*-toluic Acid.**Needles. M.p. 200°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Spar. sol. H<sub>2</sub>O. Sublimes.Claus, Beck, *Ann.*, 1892, 269, 208.**5-Bromo-6-nitro-*o*-toluic Acid.**M.p. 220°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Mod. sol. hot H<sub>2</sub>O. Sublimes.Claus, Beck, *Ann.*, 1892, 269, 208.**3-Bromo-2-nitro-*p*-toluic Acid**C<sub>8</sub>H<sub>6</sub>O<sub>4</sub>NBr MW, 260Needles. M.p. 214°. Sol. EtOH, Et<sub>2</sub>O. Sublimes. Non-volatile in steam.Claus, Herbabny, *Ann.*, 1891, 265, 364.**5-Bromo-2-nitro-*p*-toluic Acid.**M.p. 203° (200°). Sol. EtOH, hot C<sub>6</sub>H<sub>6</sub>. Sublimes. Non-volatile in steam.*Et ester*: C<sub>10</sub>H<sub>10</sub>O<sub>4</sub>NBr. MW, 288. M.p. 61°.*Chloride*: C<sub>8</sub>H<sub>5</sub>O<sub>3</sub>NClBr. MW, 278.5. M.p. 60°.*Amide*: C<sub>8</sub>H<sub>7</sub>O<sub>3</sub>N<sub>2</sub>Br. MW, 259. M.p. 191°.*Nitrile*: C<sub>8</sub>H<sub>5</sub>O<sub>2</sub>N<sub>2</sub>Br. MW, 241. M.p. 132°. Non-volatile in steam.Claus, Herbabny, *Ann.*, 1891, 265, 364.**6-Bromo-2-nitro-*p*-toluic Acid.**M.p. 181°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Prac. insol. cold H<sub>2</sub>O.Claus, Beysen, *Ann.*, 1891, 266, 237.**5-Bromo-3-nitro-*p*-toluic Acid.**M.p. 206°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Prac. insol. cold H<sub>2</sub>O. Sublimes.*Amide*: C<sub>8</sub>H<sub>7</sub>O<sub>3</sub>N<sub>2</sub>Br. MW, 259. Needles. M.p. 171°.*Nitrile*: C<sub>8</sub>H<sub>5</sub>O<sub>2</sub>N<sub>2</sub>Br. MW, 241. M.p. 130°. Sublimes. Spar. volatile in steam.Claus, Herbabny, *Ann.*, 1891, 265, 370.**6-Bromo-3-nitro-*p*-toluic Acid.**Needles. M.p. 181°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, hot H<sub>2</sub>O. Sublimes.Claus, Beysen, *Ann.*, 1891, 266, 234.

5-Bromo-3-nitro-*o*-toluidine $C_7H_7O_2N_2Br$ 

MW, 231

Orange prisms. M.p. 143° (139°). Volatile in steam.

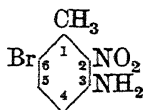
N-Acetyl: needles from AcOH. M.p. 206°. Very spar. sol.  $C_6H_6$ .Wroblewski, *Ann.*, 1878, 192, 206.Nevile, Winther, *Ber.*, 1880, 13, 969.6-Bromo-3-nitro-*o*-toluidine.

Orange-yellow cryst. from EtOH. M.p. 144°. Sol. hot EtOH.

N-Acetyl: yellow cryst. from EtOH. M.p. 199°.

Blanksma, *Chem. Zentr.*, 1913, I, 393.3-Bromo-5-nitro-*o*-toluidine.

M.p. 180.3–181.3°.

Nevile, Winther, *Ber.*, 1880, 13, 964.6-Bromo-2-nitro-*m*-toluidine $C_7H_7O_2N_2Br$ 

MW, 231

Cryst. from EtOH. M.p. 102–3°.

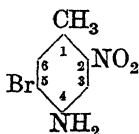
Cohen, Dutt, *J. Chem. Soc.*, 1914, 105, 513.6-Bromo-4-nitro-*m*-toluidine.

Reddish-brown needles from EtOH. M.p. 179–81°.

N-Acetyl: cryst. from EtOH. M.p. 125–125.5° (126–7°).

Cohen, Dutt, *J. Chem. Soc.*, 1914, 105, 513.5-Bromo-6-nitro-*m*-toluidine.

M.p. 87–8°. Volatile in steam.

Nevile, Winther, *Ber.*, 1880, 13, 1945.5-Bromo-2-nitro-*p*-toluidine $C_7H_7O_2N_2Br$ 

MW, 231

Yellow needles from AcOH or EtOH. M.p. 121°.

N-Di-Me:  $C_9H_{11}O_2N_2Br$ . MW, 259. Yellow needles from EtOH. M.p. 38°.Claus, Herbabny, *Ann.*, 1891, 265, 367.Morgan, Clayton, *J. Chem. Soc.*, 1905, 87, 948.5-Bromo-3-nitro-*p*-toluidine.

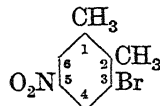
Orange-red needles from AcOH. M.p. 64.5°.

N-Acetyl: needles from EtOH. M.p. 210.5°.

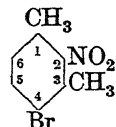
N-Diacetyl: greenish-yellow prisms from  $C_6H_6$ -ligroin. M.p. 79°.Wroblewski, *Ann.*, 1878, 192, 208.2-Bromo-5-nitro-*p*-toluidine.

Orange-red needles. M.p. 165°.

N-Acetyl: yellow needles from EtOH. M.p. 120°.

Blanksma, *Chem. Abstracts*, 1913, 7, 982.3-Bromo-5-nitro-*o*-xylene $C_8H_8O_2NBr$ 

MW, 230

Needles from EtOH. M.p. 101°. Sol.  $CHCl_3$ ,  $C_6H_6$ . Sol. warm EtOH, warm  $Me_2CO$ .Crossley, Bartlett, *J. Chem. Soc.*, 1913, 103, 1297.4-Bromo-2-nitro-*m*-xylene $C_8H_8O_2NBr$ 

MW, 230

Needles. M.p. 71°. Sol. EtOH,  $Et_2O$ . Volatile in steam.Auwers, Markovits, *Ber.*, 1908, 41, 2337.Nölting, Braun, Thesmar, *Ber.*, 1901, 34, 2261.2-Bromo-4-nitro-*m*-xylene.

Pale yellow needles from EtOH. M.p. 57–8°.

Nölting, Braun, Thesmar, *Ber.*, 1901, 34, 2257.5-Bromo-4-nitro-*m*-xylene.

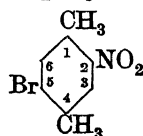
Yellowish needles from EtOH. M.p. 40°.

Nölting, Braun, Thesmar, *Ber.*, 1901, 34, 2257.6-Bromo-4-nitro-*m*-xylene.

Needles from EtOH. M.p. 57°. Volatile in steam.

Bamberger, Reber, *Ber.*, 1913, 46, 812.Varma, Raman, *J. Indian Chem. Soc.*, 1935, 12, 540.4-Bromo-5-nitro-*m*-xylene.

Colourless cryst. M.p. 56°.

Blanksma, *Chem. Zentr.*, 1906, II, 30.5-Bromo-2-nitro-*p*-xylene $C_8H_8O_2NBr$ 

MW, 230



Colourless cryst. M.p. 70°. Sol. boiling EtOH. Insol. H<sub>2</sub>O.

Blanksma, *Chem. Zentr.*, 1913, I, 1108.

Varma, Raman, *J. Indian Chem. Soc.*, 1935, 12, 540.

#### 6-Bromo-2-nitro-*p*-xylene.

Pale yellow cryst. M.p. 38°.

Blanksma, *Chem. Zentr.*, 1913, I, 1108.

#### 6-Bromo-3-nitro-*p*-xylene.

Colourless cryst. M.p. 70°.

Blanksma, *Chem. Zentr.*, 1913, I, 1108.

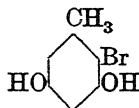
#### Bromo-octadecane.

See Octadecyl bromide.

#### Bromo-octane.

See Octyl bromide.

#### 2-Bromo-*o*-rcinol (2-Bromo-3 : 5-dihydroxy-toluene)



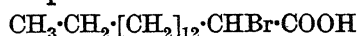
C<sub>7</sub>H<sub>7</sub>O<sub>2</sub>Br MW, 203

Cryst. M.p. 135°. Sublimes. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.

*Di-Me ether*: C<sub>9</sub>H<sub>11</sub>O<sub>2</sub>Br. MW, 231. Plates from EtOH. M.p. 57°. B.p. 150°/10 mm.

Lamparter, *Ann.*, 1865, 134, 258.

#### 1-Bromopalmitic Acid



C<sub>16</sub>H<sub>31</sub>O<sub>2</sub>Br MW, 335

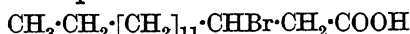
Cryst. from ligroin. M.p. 53°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>, ligroin.

*Et ester*: C<sub>18</sub>H<sub>35</sub>O<sub>2</sub>Br. MW, 363. B.p. 242°/40 mm.

Jones, *J. Am. Chem. Soc.*, 1915, 37, 586.

Robinet, *Bull. soc. chim. Belg.*, 1931, 40, 710.

#### 2-Bromopalmitic Acid

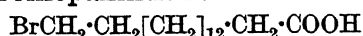


C<sub>16</sub>H<sub>31</sub>O<sub>2</sub>Br MW, 335

Leaflets from Et<sub>2</sub>O-pet. ether. M.p. 44°.

Robinet, *Bull. soc. chim. Belg.*, 1931, 40, 710.

#### 15-Bromopalmitic Acid

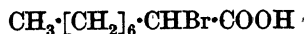


C<sub>16</sub>H<sub>31</sub>O<sub>2</sub>Br MW, 335

Cryst. from pet. ether. M.p. 70-70.5°. B.p. 214-17°/1 mm.

Chuit, Hausser, *Helv. Chim. Acta*, 1929, 12, 486.

#### 1-Bromopelargonic Acid (1-Bromononoic acid)



C<sub>9</sub>H<sub>17</sub>O<sub>2</sub>Br NW, 237,

B.p. 160°/17 mm.

*Et ester*: C<sub>11</sub>H<sub>21</sub>O<sub>2</sub>Br. MW, 265. B.p. 149-54°/20 mm.

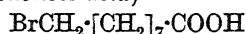
*Chloride*: C<sub>9</sub>H<sub>16</sub>OClBr. MW, 255.5. B.p. 118-25°/15 mm., 108-10°/9 mm.

Blaise, *Bull. soc. chim.*, 1904, 31, 491.

Hopwood, Weizmann, *J. Chem. Soc.*, 1911, 99, 1577.

Darapsky, *J. prakt. Chem.*, 1936, 146, 219.

#### 8-Bromopelargonic Acid (8-Bromononoic acid, ω-bromononoic acid)



C<sub>9</sub>H<sub>17</sub>O<sub>2</sub>Br MW, 237

M.p. 36-36.5°. B.p. 160-1°/2 mm. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>.

Chuit, Hausser, *Helv. Chim. Acta*, 1929, 12, 469.

#### 1-Bromopentane.

See *n*-Amyl bromide.

#### 2-Bromopentane (sec. *n*-Amyl bromide)



C<sub>5</sub>H<sub>11</sub>Br MW, 151

*dl.*

B.p. 58.4-58.8°/100 mm., 117-18°/746 mm.  $n_D^{20}$  1.4412.

*d.*

B.p. 116-18°.  $n_D^{20}$  1.4420.  $[\alpha]_D^{25} + 29.9^\circ$ .

*l.*

B.p. 116-18°.  $n_D^{20}$  1.4418.  $[\alpha]_D^{25} - 29.0^\circ$ .

Kharasch, Walling, Mayo, *J. Am. Chem. Soc.*, 1939, 61, 1560.

Sherrill, Baldwin, Haas, *J. Am. Chem. Soc.*, 1929, 51, 3036.

Kleiderer, Shonle, *J. Am. Chem. Soc.*, 1934, 56, 1773.

#### 3-Bromopentane



C<sub>5</sub>H<sub>11</sub>Br MW, 151

B.p. 59.0-59.5°/100 mm.  $D_4^{20}$  1.2171.  $n_D^{20}$  1.4444.

Kharasch, Walling, Mayo, *J. Am. Chem. Soc.*, 1939, 61, 1561.

Sherrill, Otto, Pickett, *J. Am. Chem. Soc.*, 1929, 51, 3027.

#### Bromopentanone.

See Methyl bromopropyl Ketone.

#### Bromophenacetin.

See under Bromo-*p*-phenetidine.

#### *m*-Bromophenacyl bromide (3 : ω-Di-bromoacetophenone)



C<sub>8</sub>H<sub>6</sub>OBr<sub>2</sub> MW, 278

Needles from ligroin. M.p. 51°. B.p. 172-4°/14 mm. NaOBr → *m*-bromobenzoic acid.

*Semicarbazone*: needles from EtOH. M.p. 163–4° decomp.

Elson, Gibson, Johnson, *J. Chem. Soc.*, 1930, 1132.

**p-Bromophenacyl bromide** (4:ω-Dibromoacetophenone).

Needles from EtOH. M.p. 108–9° (109–109.5°, 110°). Sol. hot EtOH. Alk. KMnO<sub>4</sub> → p-bromobenzoic acid.

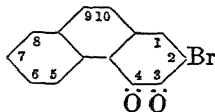
*Oxime*: needles. M.p. 115°.

Langley, *Organic Syntheses*, Collective Vol. I, 122.

Judefind, Reid, *J. Am. Chem. Soc.*, 1920, 42, 1045.

Reimer, Tobin, *J. Am. Chem. Soc.*, 1941, 63, 2490–3.

### 2-Bromo-3:4-phenanthraquinone

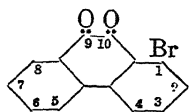


C<sub>14</sub>H<sub>7</sub>O<sub>2</sub>Br MW, 287

Crimson needles from AcOH or CHCl<sub>3</sub>. M.p. 212–13°. Mod. sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, AcOH, dioxan. Spar. sol. EtOH, Et<sub>2</sub>O.

Fieser, Dunn, *J. Am. Chem. Soc.*, 1937, 59, 1026.

### 1-Bromo-9:10-phenanthraquinone



C<sub>14</sub>H<sub>7</sub>O<sub>2</sub>Br MW, 287

Golden needles or leaflets. M.p. 233–4°.

*Monoxime*: m.p. 213° decomp.

Sandqvist, *Ber.*, 1915, 48, 1146.

### 2-Bromo-9:10-phenanthraquinone.

Reddish-yellow cryst. from AcOH. M.p. 233–4°. Spar. sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. CrO<sub>3</sub> → 4-bromodiphenic acid.

*Monoxime*: orange needles. M.p. 163–4°.

Schmidt, Junghans, *Ber.*, 1904, 37, 3558.

### 3-Bromo-9:10-phenanthraquinone.

Dark yellow needles from AcOH. M.p. 268°. Mod. sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. EtOH, Et<sub>2</sub>O, AcOH, MeOH. CrO<sub>3</sub> → 5-bromodiphenic acid.

*Monoxime*: m.p. 198°.

*Dioxime*: green cryst. M.p. 212° decomp.

*Oxime-semicarbazone*: m.p. 274–5°.

*Mono-semicarbazone*: m.p. 242° decomp.

*Mono-phenylhydrazone*: red cryst. M.p. 177°.

Schmidt, *Ber.*, 1910, 43, 423, 1805.

Sandqvist, *Ber.*, 1920, 53, 171.

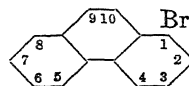
Schmidt, Eitel, *J. prakt. Chem.*, 1932, 134, 171.

### 4-Bromo-9:10-phenanthraquinone.

M.p. 126°. Sol. hot EtOH, hot AcOH. Spar. sol. Et<sub>2</sub>O.

Schmidt, *Ber.*, 1904, 37, 3554.

### 1-Bromophenanthrene



C<sub>14</sub>H<sub>9</sub>Br MW, 257

Needles or plates from EtOH. M.p. 109.5–110°.

Bachmann, Boatner, *J. Am. Chem. Soc.*, 1936, 58, 2194.

### 2-Bromophenanthrene.

Plates from EtOH. M.p. 95–6°.

Bachmann, Boatner, *J. Am. Chem. Soc.*, 1936, 58, 2194.

### 3-Bromophenanthrene.

Needles from EtOH. M.p. 83–4°.

Bachmann, Boatner, *J. Am. Chem. Soc.*, 1936, 58, 2194.

### 9-Bromophenanthrene.

Prisms. M.p. 63°. B.p. 190°/1.2 mm. Sublimes. Distills undecomp. above 360°. Sol. AcOH, CS<sub>2</sub>. D<sub>4</sub><sup>20</sup> 1.4093. CrO<sub>3</sub> + AcOH → phenanthraquinone.

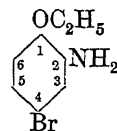
*Picrate*: m.p. 118°.

Schmidt, Mezger, *Ber.*, 1907, 40, 4562.

Austin, *J. Chem. Soc.*, 1908, 93, 1763.

Buu-Hoï, *Ann.*, 1944, 556, 1–9.

### 4-Bromo-o-phenetidine (p-Bromo-o-amino-phenyl ethyl ether, p-bromo-o-aminophenetole)



C<sub>8</sub>H<sub>10</sub>ONBr MW, 216

Needles. M.p. 57° (53°). Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Volatile in steam.

*N-Acetyl*: 5-bromo-2-ethoxyacetanilide. C<sub>10</sub>H<sub>12</sub>O<sub>2</sub>NBr. MW, 258. Leaflets from EtOH.Aq. M.p. 133°. Mod. sol. EtOH.

*Picrate*: m.p. 135–7°.

Reverdin, Düring, *Ber.*, 1899, 32, 159.

### 5-Bromo-o-phenetidine.

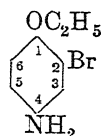
*B,HCl*: needles. M.p. 199–200° decomp.

*Picrate*: yellow needles. M.p. 172–3° decomp.

*N-Acetyl*: 4-bromo-2-ethoxyacetanilide. Pale pink needles. M.p. 118–19°.

Mangini, *Gazz. chim. ital.*, 1936, 66, 680.

**2-Bromo-*p*-phenetidine** (*o*-Bromo-*p*-amino-phenyl ethyl ether, *o*-bromo-*p*-aminophenetole)



$C_8H_{10}ONBr$  MW, 216

M.p. 47°. B.p. 189°/20 mm. Sol. EtOH, Et<sub>2</sub>O. Volatile in steam.

*B.HCl*: m.p. 256–7° decomp.

*N-Acetyl*: 3-bromo-4-ethoxyacetanilide, 2-bromophenacetin.  $C_{10}H_{12}O_2NBr$ . MW, 258. M.p. 114°. Sol. EtOH. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O.

*Picrate*: m.p. 178–9°.

Reverdin, Düring, *Ber.*, 1899, 32, 158.

**3-Bromo-*p*-phenetidine** (*m*-Bromo-*p*-amino-phenyl ethyl ether, *m*-bromo-*p*-aminophenetole).

B.p. 160°/23 mm., 150°/12 mm.

*N-Acetyl*: 2-bromo-4-ethoxyacetanilide, 3-bromophenacetin.  $C_{10}H_{12}O_2NBr$ . MW, 258. M.p. 97°.

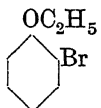
I.G., D.R.P., 621,710, (*Chem. Zentr.*, 1936, I, 3021).

I.C.I., F.P., 738,157, (*Chem. Abstracts*, 1933, 27, 1640): B.P. 379,741.

**β-Bromophenetole.**

See 2-Bromoethyl phenyl Ether.

***o*-Bromophenetole** (*o*-Bromophenyl ethyl ether)



$C_8H_9OBr$  MW, 201

B.p. 218° (222–6°). Sol. EtOH, Et<sub>2</sub>O.

Hodurek, *Ber.*, 1897, 30, 479.

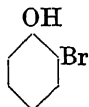
***p*-Bromophenetole** (4-Bromophenyl ethyl ether).

M.p. 4°. B.p. 233° (230–2°).

Buu-Hoi, *Ann.*, 1944, 556, 1.

Reverdin, Düring, *Ber.*, 1899, 32, 160.

***o*-Bromophenol**



$C_6H_5OBr$  MW, 173

B.p. 194°. KOH fusion → resorcinol.

*Me ether*: see *o*-Bromoanisole.

*Et ether*: see *o*-Bromophenetole.

*Acetyl*: b.p. 150°/39 mm.,  $D_4^{20}$  1.4924.

*Benzoyl*: m.p. 86°.

*o*-Bromobenzoyl: m.p. 39°. B.p. 246–7°/26 mm.

*Benzenesulphonyl*: m.p. 54–6°.

*p*-Toluenesulphonyl: m.p. 64–6°.

*p*-Iodophenylurethane: m.p. 155–6°.

Meldola, Streatfeild, *J. Chem. Soc.*, 1898, 73, 681.

Merck, D.R.P. 76,597; *Ber.*, 1894, 27B, 957.

Huston, Ballard, *Organic Syntheses*, 1934, XIV, 14.

***m*-Bromophenol.**

M.p. 33°. B.p. 236°, 135–40°/12 mm., 124–7°/22 mm.

*Me ether*: see *m*-Bromoanisole.

*Acetyl*: b.p. 149°/40 mm.  $D_4^{20}$  1.5478.

*Benzenesulphonyl*: b.p. 217–18°/10.5 mm.

*p*-Toluenesulphonyl: m.p. 52.4°.

*p*-Iodophenylurethane: m.p. 149–50°.

Diels, Bunzl, *Ber.*, 1905, 38, 1495.

B.D.C., B.P., 200,714, (*Chem. Abstracts*, 1924, 18, 274).

***p*-Bromophenol.**

M.p. 64° (66.4°). B.p. 235–6° (238°). Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, AcOH.

*Me ether*: see *p*-Bromoanisole.

*Et ether*: see *p*-Bromophenetole.

*Acetyl*: m.p. 21.5°. B.p. 235–40°, 130–5°/30 mm., 129–30°/15 mm.

*Propionyl*: b.p. 113°/3 mm.

*Butyryl*: b.p. 112°/2 mm.

*Valeryl*: b.p. 134–8°/4 mm.

*Benzoyl*: m.p. 104°.

*p*-Bromobenzoyl: m.p. 180–1°.

*Benzenesulphonyl*: m.p. 50–5°.

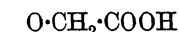
*p*-Toluenesulphonyl: m.p. 178.5–179.5°.

*p*-Iodophenylurethane: m.p. 230–1°.

*Phosphate tri-ester*: m.p. 109°.  $D^{25}$  1.964.

Adams, Marvel, *Organic Syntheses*, Collective Vol. I, 123.

**2-Bromophenoxyacetic Acid**



$C_8H_7O_3Br$  MW, 231

Needles from EtOH. M.p. 142.5°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, AcOEt.

*Et ester*:  $C_{10}H_{11}O_3Br$ . MW, 259. B.p. 160–70°/16 mm.

*Amide*:  $C_8H_8O_3NBr$ . MW, 230. Plates from EtOH. M.p. 151°.

Auwers, Haymann, *Ber.*, 1894, 27, 2800.

**3-Bromophenoxyacetic Acid.**

M.p. 107–8°.

Koelsch, *J. Am. Chem. Soc.*, 1931, 53, 304.

**4-Bromophenoxyacetic Acid.**

Prisms from EtOH. M.p. 153–4°. Sol. EtOH, Et<sub>2</sub>O. Very spar. sol. H<sub>2</sub>O.

*Et ester*: C<sub>10</sub>H<sub>11</sub>O<sub>3</sub>Br. MW, 259. Plates from EtOH. M.p. 59°.

*Phenyl ester*: C<sub>14</sub>H<sub>11</sub>O<sub>3</sub>Br. MW, 307. Cryst. from EtOH. M.p. 73°.

*Chloride*: C<sub>8</sub>H<sub>6</sub>O<sub>2</sub>ClBr. MW, 249.5. M.p. about 42°. B.p. 259°.

Fritzsche, *J. prakt. Chem.*, 1879, 20, 295.

$\alpha$ -Bromophenylacetic Acid (*Phenylbromoacetic acid*)



C<sub>8</sub>H<sub>7</sub>O<sub>2</sub>Br MW, 215  
*dl.*

M.p. 86° (84°). Hot NaOH → mandelic acid. NaHg in EtOH → phenylacetic acid.

*Et ester*: C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>Br. MW, 243. B.p. 175°/25 mm., 145°/15 mm. D<sub>4</sub><sup>20</sup> 1.4153.

*Chloride*: C<sub>8</sub>H<sub>6</sub>OClBr. MW, 233.5. B.p. 117-8°/18 mm.

*Bromide*: C<sub>8</sub>H<sub>6</sub>OBr<sub>2</sub>. MW, 278. B.p. 138°/40 mm.

*Amide*: C<sub>8</sub>H<sub>8</sub>ONBr. MW, 214. M.p. 148° (144°). Sol. EtOH, hot H<sub>2</sub>O, hot C<sub>6</sub>H<sub>6</sub>. Insol. Et<sub>2</sub>O.

*Nitrile*: see  $\alpha$ -Bromobenzyl cyanide.

Opolski, Weinbaum, *Ber.*, 1914, 47, 1560.  
Darapsky, *J. prakt. Chem.*, 1917, 96, 285, 290.

Ivanov, Spasov, *Chem. Abstracts*, 1934, 28, 6711.

*d.*

M.p. 76-8°. [ $\alpha$ ]<sub>D</sub> + 45.4° in C<sub>6</sub>H<sub>6</sub>.

*Me ester*: C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Br. MW, 229. B.p. 172°/53 mm. D<sub>4</sub><sup>20</sup> 1.4421. [ $\alpha$ ]<sub>D</sub> + 30°.

*Et ester*: C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>Br. MW, 243. B.p. 164°/20 mm. n<sub>D</sub><sup>20</sup> 1.5401. [ $\alpha$ ]<sub>D</sub> + 16.56°.

*Propyl ester*: C<sub>11</sub>H<sub>13</sub>O<sub>2</sub>Br. MW, 257. B.p. 165°/20 mm. [ $\alpha$ ]<sub>D</sub> + 7.4°.

*Isobutyl ester*: C<sub>12</sub>H<sub>15</sub>O<sub>2</sub>Br. MW, 271. B.p. 167-8°/19 mm. D<sub>4</sub><sup>20</sup> 1.2892. n<sub>D</sub><sup>20</sup> 1.5210. [ $\alpha$ ]<sub>D</sub> + 9.77°.

*Bromide*: C<sub>8</sub>H<sub>6</sub>OBr<sub>2</sub>. MW, 278. B.p. 145-147°/24 mm. D<sub>4</sub><sup>20</sup> 1.8527. n<sub>D</sub><sup>20</sup> 1.6030. [ $\alpha$ ]<sub>D</sub> + 44.53°.

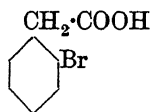
Walden, *Ber.*, 1895, 28, 1296.

*l.*

M.p. 87-8°. [ $\alpha$ ]<sub>D</sub><sup>20</sup> - 178.5°.

Senter, Tucker, *J. Chem. Soc.*, 1918, 113, 145.

*o*-Bromophenylacetic Acid (*o*-Bromo- $\alpha$ -toluic acid)



C<sub>8</sub>H<sub>7</sub>O<sub>2</sub>Br MW, 215

M.p. 103-4°. Sol. EtOH, Et<sub>2</sub>O, CS<sub>2</sub>, hot ligroin. KMnO<sub>4</sub> → *o*-bromobenzoic acid.

*Et ester*: m.p. 35-6°. B.p. 114°/4 mm.

*Amide*: C<sub>8</sub>H<sub>8</sub>ONBr. MW, 214. M.p. 186-7°. Sol. hot EtOH hot C<sub>6</sub>H<sub>6</sub>.

*Nitrile*: *o*-bromobenzyl cyanide. C<sub>8</sub>H<sub>6</sub>NBr. MW, 196. B.p. 145-7°/14 mm.

Bedson, *J. Chem. Soc.*, 1880, 37, 94.

*m*-Bromophenylacetic Acid (*m*-Bromo- $\alpha$ -toluic acid).

Needles. M.p. 100° (97°).

Mauthner, *J. prakt. Chem.*, 1917, 95, 62.

Berger, *J. prakt. Chem.*, 1932, 133, 345.

*p*-Bromophenylacetic Acid (*p*-Bromo- $\alpha$ -toluic acid).

Needles. M.p. 114°. Sol. EtOH, Et<sub>2</sub>O, CS<sub>2</sub>. Mod. sol. hot H<sub>2</sub>O. Sublimes.

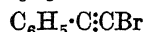
*Et ester*: C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>Br. MW, 243. M.p. 30°. B.p. 142-4°/12-14 mm.

*Amide*: C<sub>8</sub>H<sub>8</sub>ONBr. MW, 214. Leaflets. M.p. 192-4°.

*Nitrile*: *p*-bromobenzyl cyanide. C<sub>8</sub>H<sub>6</sub>NBr. MW, 196. M.p. 46-7°. Sol. C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>. Mod. sol. EtOH. Insol. H<sub>2</sub>O.

Bedson, *J. Chem. Soc.*, 1880, 37, 94.

$\omega$ -Bromophenylacetylene (*Phenyl-bromoacetylene, phenylethylnyl bromide*)



C<sub>8</sub>H<sub>5</sub>Br MW, 181

B.p. 96°/15 mm., 88-90°/13 mm., 68-9°/3 mm. D<sub>24</sub><sup>2</sup> 1.456. Polymerises on heating.

Nef, *Ann.*, 1899, 308, 311.

Murray, Cleveland, *J. Chem. Physics*, 1944, 12, 156.

*o*-Bromophenylacetylene



C<sub>8</sub>H<sub>5</sub>Br MW, 181

B.p. 92-3°/20 mm. D<sub>25</sub><sup>26</sup> 1.4434. n<sub>D</sub><sup>25</sup> 1.5962. *Hg comp.*: m.p. 184-5°.

Otto, *J. Am. Chem. Soc.*, 1934, 56, 1393.

*m*-Bromophenylacetylene.

B.p. 85-6°/16 mm. D<sub>25</sub><sup>25</sup> 1.4466. n<sub>D</sub><sup>25</sup> 1.5896. *Hg comp.*: m.p. 143-4°.

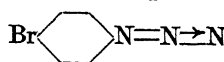
Otto, *J. Am. Chem. Soc.*, 1934, 56, 1393.

*p*-Bromophenylacetylene.

M.p. 64-5°. B.p. 88-90°/16 mm. *Hg comp.*: m.p. 256-7°.

Otto, *J. Am. Chem. Soc.*, 1934, 56, 1393.  
Dufraisse, Duquesne, *Bull. soc. chim.*, 1931, 49, 1880.

*p*-Bromophenyl azide (*p*-Bromoazidobenzene)



C<sub>6</sub>H<sub>4</sub>N<sub>3</sub>Br

MW, 198

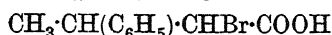
Leaflets. M.p. 20°. B.p. 118°/23 mm., 105°/10 mm. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. EtOH. Insol. H<sub>2</sub>O. Volatile in steam.

Dimroth, Pfister, *Ber.*, 1910, 43, 2757.  
Ponzio, Canuto, *Gazz. chim. ital.*, 1915, 45, ii, 29.  
Bamberger, *Ann.*, 1925, 443, 192.

2-*p*-Bromophenyl-2-bromopropionic Acid.

See β : 4-Dibromohydrocinnamic Acid.

1-Bromo-2-phenylbutyric Acid

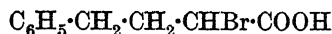


C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>Br MW, 243

Leaflets from H<sub>2</sub>O. M.p. 188-90°. Sol. EtOH, Et<sub>2</sub>O, hot C<sub>6</sub>H<sub>6</sub>. Spar. sol. hot H<sub>2</sub>O.

Fischer, Schmitz, *Ber.*, 1906, 39, 354, 2213.

1-Bromo-3-phenylbutyric Acid



C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>Br MW, 243

Viscous oil. B.p. about 150°/0.5 mm. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, pet. ether. Spar. sol. H<sub>2</sub>O.  
*Et ester*: C<sub>12</sub>H<sub>15</sub>O<sub>2</sub>Br. MW, 271. Yellow oil. B.p. 157°/14 mm.

Fischer, Schmitz, *Ber.*, 1906, 39, 2213.

2-Bromo-3-phenylbutyric Acid

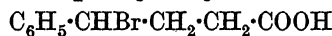


C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>Br MW, 243

Prisms from ligroin. M.p. 54°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. cold ligroin.

Fittig, Luib, *Ann.*, 1894, 283, 303.

3-Bromo-3-phenylbutyric Acid

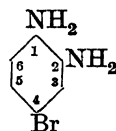


C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>Br MW, 243

Cryst. M.p. 69°. Loses HBr at 60°.

Fittig, Morris, *Ann.*, 1889, 256, 158.

4-Bromo-*o*-phenylenediamine (4-Bromo-1 : 2-diaminobenzene)



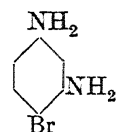
C<sub>6</sub>H<sub>7</sub>N<sub>2</sub>Br MW, 187

Needles. M.p. 63°. Sol. H<sub>2</sub>O, EtOH, CHCl<sub>3</sub>, Et<sub>2</sub>O.

1-*N*-*Di-Me*: C<sub>8</sub>H<sub>11</sub>N<sub>2</sub>Br. MW, 215. B.p. 165°/23 mm. 2-*N*-*Acetyl*: m.p. 111°.

Hübner, *Ann.*, 1881, 209, 359.

4-Bromo-*m*-phenylenediamine (4-Bromo-1 : 3-diaminobenzene)



C<sub>6</sub>H<sub>7</sub>N<sub>2</sub>Br MW, 187

Prisms from C<sub>6</sub>H<sub>6</sub>. M.p. 112°. Sol. hot H<sub>2</sub>O. Oxidises rapidly in air.

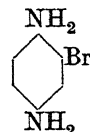
Morgan, *J. Chem. Soc.*, 1900, 77, 1204.

5-Bromo-*m*-phenylenediamine.

Prisms. M.p. 93-4°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, CHCl<sub>3</sub>. Spar. sol. CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>. Insol. ligroin.

Jackson, Bigelow, *Am. Chem. J.*, 1911, 46, 569.

Bromo-*p*-phenylenediamine (2-Bromo-1 : 4-diaminobenzene)



C<sub>6</sub>H<sub>7</sub>N<sub>2</sub>Br MW, 187

M.p. 76°.

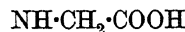
*N* : *N'*-*Diacetyl*: m.p. 200°.

*N* : *N'*-*Dibenzoyl*: m.p. 235°.

Nicolet, Ray, *J. Am. Chem. Soc.*, 1927, 49, 1805.

Bigiavi, Albanese, Poggi, *Gazz. chim. ital.*, 1931, 61, 392.

*o*-Bromophenylglycine (2-Bromophenyl-aminoacetic acid)



C<sub>8</sub>H<sub>8</sub>O<sub>2</sub>NBr MW, 230

Cryst. M.p. 157°.

*Et ester*: C<sub>10</sub>H<sub>12</sub>O<sub>2</sub>NBr. MW, 258. Needles. M.p. 82-3°.

Schwalbe, Schulz, Jochheim, *Ber.*, 1908, 41, 3795.

*p*-Bromophenylglycine.

M.p. 150° (98°). Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O.

*Et ester*: C<sub>10</sub>H<sub>12</sub>O<sub>2</sub>NBr. MW, 258. Needles. M.p. 97°. Sol. Et<sub>2</sub>O, hot EtOH.

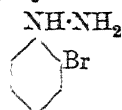
Dennstedt, *Ber.*, 1880, 13, 236.

Schwalbe, Schulz, Jochheim, *Ber.*, 1908, 41, 3795.

Bromophenylglyoxylic Acid.

See Bromobenzoylformic Acid.

## o-Bromophenylhydrazine



$\text{C}_6\text{H}_7\text{N}_2\text{Br}$  MW, 187  
Needles. M.p. 48°.

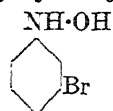
Busch, Meussdörfer, *J. prakt. Chem.*, 1907, 75, 137.

## p-Bromophenylhydrazine.

Needles or leaflets. M.p. 106°.

Humphries, Bloom, Evans, *J. Chem. Soc.*, 1923, 123, 1766.

## m-Bromophenylhydroxylamine



$\text{C}_6\text{H}_6\text{ONBr}$  MW, 188  
Leaflets. M.p. 66.5°.

Bamberger, Knecht, *Ber.*, 1896, 29, 864.  
Bamberger, *Ann.*, 1921, 424, 308.

## p-Bromophenylhydroxylamine.

Leaflets. M.p. 91-2° (89°). Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, hot H<sub>2</sub>O. Insol. ligroin.

Bamberger, *Ann.*, 1921, 424, 262, 307.  
Haworth, Lapworth, *J. Chem. Soc.*, 1925, 127, 2970.

## Bromophenyl Mercaptan.

See Bromothiophenol.

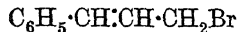
## 1-Bromo-2-phenylpropane.

See β-Bromocumene.

## Bromophenylpropionic Acid.

See Bromohydratropic Acid and Bromohydrocinnamic Acid.

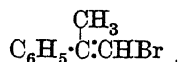
**3-Bromo-1-phenylpropylene** (*Cinnamyl bromide*, *γ-bromopropenylbenzene*, *β-bromomethylstyrene*)



$\text{C}_9\text{H}_9\text{Br}$  MW, 197  
Needles from EtOH. M.p. 31-2°. B.p. 130°/10 mm., 106-8°/4 mm.  $D^{20}$  1.3428.  $n_D^{20}$  1.6157.

v. Braun, Köhler, *Ber.*, 1918, 51, 82.  
Gredy, *Bull. soc. chim.*, 1936, 3, 1098.  
Bouis, *Ann. chim.*, 1928, 9, 446.

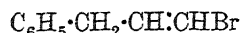
**1-Bromo-2-phenylpropylene** (*β-Bromo-α-methylstyrene*, *α-methylstyryl bromide*)



$\text{C}_9\text{H}_9\text{Br}$  MW, 197  
B.p. 225-8°, 105-6°/9 mm.  $D^0$  1.366.  
 $\text{KMnO}_4 \rightarrow$  acetophenone.

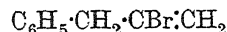
Tiffeneau, *Ann. chim. phys.*, 1907, 10, 169.

**1-Bromo-3-phenylpropylene** (*γ-Bromoallylbenzene*)



$\text{C}_9\text{H}_9\text{Br}$  MW, 197  
B.p. 106-8°/12 mm.  $D^{18}$  1.3418.  $n_D^{18}$  1.5629.  
Kirmann, *Bull. soc. chim.*, 1926, 41, 321.

**2-Bromo-3-phenylpropylene** (*β-Bromoallylbenzene*)



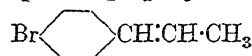
$\text{C}_9\text{H}_9\text{Br}$  MW, 197  
M.p. -12.5°. B.p. 102°/17 mm.  $D^0$  1.39.  
Lespieau, *Bull. soc. chim.*, 1921, 29, 531.

**3-Bromo-3-phenylpropylene** (*α-Bromoallylbenzene*)



$\text{C}_9\text{H}_9\text{Br}$  MW, 197  
Oil. Solidifies to cryst. at 0°.  
Klages, Klenk, *Ber.*, 1906, 39, 2555.

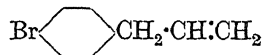
**1-p-Bromophenylpropylene** (*p-Bromo-β-methylstyrene*, *p-bromopropenylbenzene*)



$\text{C}_9\text{H}_9\text{Br}$  MW, 197  
Solid with odour resembling aniseed. M.p. 35°. B.p. 238-9°, 110°/12 mm.  $D_4^{25}$  1.332.  $n_D^{35}$  1.590.

Ziegler, Tiemann, *Ber.*, 1922, 55, 3415.  
Quelet, *Bull. soc. chim.*, 1929, 45, 92.

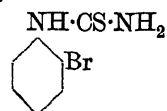
**3-p-Bromophenylpropylene** (*p-Bromoallylbenzene*)



$\text{C}_9\text{H}_9\text{Br}$  MW, 197  
B.p. 222-3°/730 mm., 96°/12 mm.  $D_4^{15}$  1.324.  $n_D^{15}$  1.559.

Quelet, *Bull. soc. chim.*, 1929, 45, 76, 79.

## o-Bromophenylthiourea



$\text{C}_7\text{H}_7\text{N}_2\text{BrS}$  MW, 231  
Prisms. M.p. 125°.

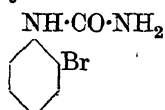
Dyson, George, Hunter, *J. Chem. Soc.*, 1927, 443.

## p-Bromophenylthiourea.

Needles. M.p. 183°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

Dennstedt, *Ber.*, 1880, 13, 231.

## o-Bromophenylurea



$\text{C}_7\text{H}_7\text{ON}_2\text{Br}$  MW, 215

Needles from EtOH. M.p. 202°. Sol. C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Spar. sol. EtOH. Insol. H<sub>2</sub>O.

Pierron, *Ann. chim. phys.*, 1908, 15 [8], 171.

***m*-Bromophenylurea.**

Needles. M.p. 164–5°. Sol. EtOH.

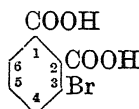
Folin, *Am. Chem. J.*, 1897, 19, 340.

***p*-Bromophenylurea.**

Silvery needles. M.p. 270° decomp. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin.

Dains, Wertheim, *J. Am. Chem. Soc.*, 1920, 42, 2303.

**3-Bromophthalic Acid**



C<sub>8</sub>H<sub>5</sub>O<sub>4</sub>Br MW, 245

Needles. M.p. 188° (178–9°) → anhydride. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Insol. CHCl<sub>3</sub>.

*Di-Me ester*: C<sub>10</sub>H<sub>9</sub>O<sub>4</sub>Br. MW, 273. M.p. 81–2°. B.p. 141–5°/5 mm.

*Mono-Et ester*: C<sub>10</sub>H<sub>9</sub>O<sub>4</sub>Br. MW, 273. M.p. 127–8°.

*Anhydride*: C<sub>8</sub>H<sub>3</sub>O<sub>3</sub>Br. MW, 227. Needles. M.p. 132–4°.

Braun, *Ber.*, 1923, 56, 2332.

**4-Bromophthalic Acid.**

M.p. 173–5° (166°). Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.

*Di-Me ester*: C<sub>10</sub>H<sub>9</sub>O<sub>4</sub>Br. MW, 273. Cryst. from pet. ether. M.p. 40°. B.p. 303–6°.

*Di-Et ester*: C<sub>12</sub>H<sub>13</sub>O<sub>4</sub>Br. MW, 301. B.p. 225°/60 mm. 190–1°/16 mm. (194–5°/16 mm.).

*Dichloride*: C<sub>8</sub>H<sub>3</sub>O<sub>2</sub>Cl<sub>2</sub>Br. MW, 282. Needles from H<sub>2</sub>O. M.p. 168°.

*Anhydride*: C<sub>8</sub>H<sub>3</sub>O<sub>3</sub>Br. MW, 227. Needles. M.p. 113° (109°). B.p. 297–301° (290–293°/750 mm.). Sublimes.

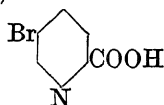
Baker, *J. Chem. Soc.*, 1928, 2829.

Blicke, Smith, *J. Am. Chem. Soc.*, 1929, 51, 1865.

Waldmann, *J. prakt. Chem.*, 1930, 126, 66.

Braun, *Ber.*, 1923, 56, 2332.

**5-Bromopicolinic Acid (5-Bromopyridine-2-carboxylic acid)**

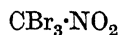


C<sub>6</sub>H<sub>4</sub>O<sub>2</sub>NBr MW, 202

Needles from H<sub>2</sub>O. M.p. 175°.

Graf, *J. prakt. Chem.*, 1932, 133, 33.

**Bromopicrin (Tribromonitromethane, nitro-bromoform)**



CO<sub>2</sub>NBr<sub>3</sub> MW, 298

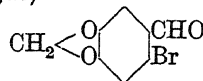
Prisms. M.p. 10°. B.p. 127°/118 mm. De-comp. at 140°. D<sub>4</sub><sup>20</sup> 2.811. Volatile in steam. Lachrymator and lung irritant.

Will, *Ber.*, 1914, 47, 961.

Lei, Sah, *Sci. Repts. Natl. Tsinghua Univ.*, 1933, A, 2, 129.

Bolas, Groves, *Ann.*, 1870, 155, 253.

**6-Bromopiperonal (6-Bromo-3:4-methylene-dioxybenzaldehyde)**



C<sub>8</sub>H<sub>5</sub>O<sub>3</sub>Br MW, 229

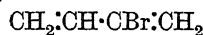
Needles or plates. M.p. 129°. Sol. hot EtOH, hot C<sub>6</sub>H<sub>6</sub>. Spar sol. cold EtOH. Insol. H<sub>2</sub>O. Volatile in steam. NaHg → piperonal.

*Semicarbazone*: m.p. 230° decomp.

*p-Nitrophenylhydrazone*: m.p. 253° decomp.

Parijs, *Rec. trav. chim.*, 1930, 49, 27.

**Bromoprene (2-Bromo-1:3-butadiene, 2-bromoerythrene)**



C<sub>4</sub>H<sub>5</sub>Br MW, 133

Faintly greenish-yellow oil. B.p. 42–3°/165 mm. D<sub>4</sub><sup>20</sup> 1.397. n<sub>D</sub><sup>20</sup> 1.4988. Readily polymerises to products having rubber-like properties.

Carothers, Collins, Kirby, *J. Am. Chem. Soc.*, 1933, 55, 786.

**Bromopropane.**

See Propyl bromide and Isopropyl bromide.

**Bromopropenylbenzene.**

See Bromophenylpropylene.

**1-Bromopropionaldehyde**



C<sub>3</sub>H<sub>5</sub>OBr MW, 137

Lachrymatory, mobile liq. with penetrating odour. B.p. 109–110°, 52–4°/80 mm. D<sub>4</sub><sup>20</sup> 1.592. n<sub>D</sub><sup>20</sup> 1.4813. Reduces cold Fehling's. Tollens reagent → Ag + AgBr.

*Di-Me acetal*: C<sub>5</sub>H<sub>11</sub>O<sub>2</sub>Br. MW, 183. B.p. 52°/12 mm.

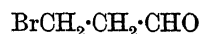
*Di-Et acetal*: C<sub>7</sub>H<sub>15</sub>O<sub>2</sub>Br. MW, 211. B.p. 74–5°/16 mm., 69°/9 mm.

Kirmann, *Ann. chim.*, 1929, 11, 269.

Franke, *Ann.*, 1907, 351, 423.

Nef, *Ann.*, 1904, 335, 264.

**2-Bromopropionaldehyde**



C<sub>3</sub>H<sub>5</sub>OBr MW, 137

Viscous unstable oil. B.p. 40–5°/18 mm.

*Di-Me acetal*: b.p. 58–60°/17 mm. D<sub>4</sub><sup>18</sup> 1.341. n<sub>D</sub><sup>18</sup> 1.4475.

*Di-Et acetal*: b.p. 80–90°/20 mm.

Nef, *Ann.*, 1904, 335, 263.

Lederer, *J. prakt. Chem.*, 1890, 42, 384.

## 1-Bromopropionic Acid



$\text{C}_3\text{H}_5\text{O}_2\text{Br}$  MW, 153

*dl.*

Prisms. M.p. 25.7°. B.p. 203.5°, 168°/250 mm., 96°/10 mm.  $D_4^{20}$  1.7000.  $k = 1.08 \times 10^{-3}$  at 25°. Cooling to -30° → a labile form, m.p. -3.9°. Hot alkali → lactic acid. NaHg → propionic acid. Alc.NH<sub>3</sub> → α-alanine.

*Me ester*:  $\text{C}_4\text{H}_7\text{O}_2\text{Br}$ . MW, 167. B.p. 145-50°, 52°/19 mm.  $D_4^{21}$  1.4966.

*Et ester*:  $\text{C}_5\text{H}_9\text{O}_2\text{Br}$ . MW, 181. B.p. 159-60° part decomp., 124°/250 mm., 56-8°/14 mm.  $D_4^{21}$  1.4127.  $n_D^{20}$  1.4469.

*Isopropyl ester*:  $\text{C}_6\text{H}_{11}\text{O}_2\text{Br}$ . MW, 195. B.p. 163-5°.

*n-Butyl ester*:  $\text{C}_7\text{H}_{13}\text{O}_2\text{Br}$ . MW, 209. B.p. 192-6°.

*Isobutyl ester*: b.p. 79-80°/14 mm.

*Isoamyl ester*:  $\text{C}_8\text{H}_{15}\text{O}_2\text{Br}$ . MW, 223. B.p. 99-100°/16 mm.

*Allyl ester*:  $\text{C}_6\text{H}_9\text{O}_2\text{Br}$ . MW, 193. B.p. 173-7°.

*Phenyl ester*:  $\text{C}_9\text{H}_9\text{O}_2\text{Br}$ . MW, 229. B.p. 135°/17 mm.

*Chloride*:  $\text{C}_3\text{H}_4\text{OClBr}$ . MW, 171.5. B.p. 131-3°.  $D^{11}$  1.697.

*Bromide*:  $\text{C}_3\text{H}_4\text{OBr}_2$ . MW, 216. B.p. 154-5°.  $D_4^{18}$  2.0612.

*Anhydride*:  $\text{C}_6\text{H}_8\text{O}_3\text{Br}_2$ . MW, 288. B.p. 123-4°/10 mm., 120°/5 mm.

*Amide*:  $\text{C}_3\text{H}_6\text{ONBr}$ . MW, 152. M.p. 123°.

*d.*

*Me ester*: b.p. 62°/36 mm.  $D_4^{17}$  1.482.  $[\alpha]_D^{15} + 42.65^\circ$ .

*Et ester*: b.p. 71°/36 mm.  $D^{20}$  1.3895.  $[\alpha]_D^{20} + 35.5^\circ$  (minimum).

*l.*

$D_4^{20}$  1.7000.  $[\alpha]_D^{20} - 29.0^\circ$ ,  $[\alpha]_D^{25} - 13.79^\circ$ .

*Et ester*: b.p. 87°/56-9 mm., 66°/27 mm.  $D_4^{19}$  1.386.  $n_D^{17}$  1.4432.  $[\alpha]_D^{16} - 42.1^\circ$ .

*Propyl ester*: b.p. 84-6°/28-32 mm.  $D_4^{14}$  1.315.  $[\alpha]_D - 21.98^\circ$ .

*Chloride*: b.p. 27°/12 mm.,  $[\alpha]_D^{20} - 11.7^\circ$ .

*Amide*:  $[\alpha]_D^{24} - 12.9^\circ$  in  $\text{C}_6\text{H}_6$ .

Fischer, Raske, *Ber.*, 1906, 39, 3995.

Freudenberg, Markert, *Ber.*, 1927, 60, 2447.

## 2-Bromopropionic Acid



$\text{C}_3\text{H}_5\text{O}_2\text{Br}$  MW, 153

Plates. M.p. 62.5°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.  $k = 9.8 \times 10^{-5}$  at 25°. Dil. alkali → hydroacrylic acid.

*Me ester*:  $\text{C}_4\text{H}_7\text{O}_2\text{Br}$ . MW, 167. B.p. 80°/27 mm.  $D^{15}$  1.4897.

*Et ester*:  $\text{C}_5\text{H}_9\text{O}_2\text{Br}$ . MW, 181. B.p. 136°/50 mm., 112°/44 mm., 70°/12 mm.  $D^{15}$  1.2609.

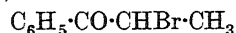
*Isoamyl ester*:  $\text{C}_8\text{H}_{15}\text{O}_2\text{Br}$ . MW, 223. B.p. 110-1°/11 mm.  $D^{15}$  1.2217.

*Guaiacol ester*: b.p. 164-8°/9 mm.

Kendall, McKenzie, *Organic Syntheses*, Collective Vol. I, 126.

Mozingo, Patterson, *Organic Syntheses*, 1940, XX, 64.

5-Bromopropiophenone (1-Bromoethylphenyl ketone)

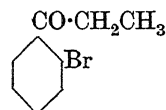


$\text{C}_9\text{H}_9\text{OBr}$  MW, 213

B.p. 245-50°, 138-9°/20 mm., 134-5°/18 mm., 125-30°/10 mm.  $D_4^0$  1.454.  $D_4^{25}$  1.405.  $n_D^{25}$  1.5686. NH<sub>2</sub>OH → methylphenylglyoxime. Ox. → benzoic acid.

Kotchergine, *Bull. soc. chim.*, 1928, 43, 573.

o-Bromopropiophenone (Ethyl o-bromophenyl ketone)



$\text{C}_9\text{H}_9\text{OBr}$  MW, 213

B.p. 116-18°/10-11 mm.

*Semicarbazone*: m.p. 178-9°.

Zenitz, Hartung, *J. Org. Chem.*, 1946, 11, 444.

m-Bromopropiophenone (Ethyl m-bromophenyl ketone).

M.p. 37.5-40°.

*Semicarbazone*: m.p. 182-3°.

Zenitz, Hartung, *J. Org. Chem.*, 1946, 11, 444.

p-Bromopropiophenone.

Needles. M.p. 48° (45-46°). B.p. 169°/15 mm., 137-40°/2 mm. Sol. EtOH, CS<sub>2</sub>. Ox. → p-bromobenzoic acid.

*Oxime*: m.p. 90-1° (89°).

*Semicarbazone*: m.p. 170-1°.

Collet, *Compt. rend.*, 1898, 126, 1577.

Zenitz, Hartung, *J. Org. Chem.*, 1946, 11, 444.

3-Bromopropyl Alcohol (Trimethylene bromohydrin, 3-bromopropanol-1)



$\text{C}_3\text{H}_7\text{OBr}$  MW, 139

B.p. 98-112°/185 mm., 62°/5 mm. Sol. to 17% in cold H<sub>2</sub>O.  $D^{20}$  1.5374.

*Me ether*: methyl 3-bromopropyl ether.  $\text{C}_4\text{H}_9\text{OBr}$ . MW, 153. B.p. 132°.

*Et ether*: ethyl 3-bromopropyl ether.  $\text{C}_5\text{H}_{11}\text{OBr}$ . MW, 167. B.p. 147-8° (150-1°).  $D^0$  1.2597.



*Acetyl*: b.p. 88–90°/22 mm.

*Benzoyl*: b.p. 162–4°/14 mm.

Karvonen, *Chem. Abstracts*, 1920, 14, 2175.

Allen, Hibbert, *J. Am. Chem. Soc.*, 1934, 56, 1399.

### Bromopropylene.

See Propenyl bromide, Isopropenyl bromide and Allyl bromide.

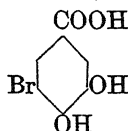
### 3-Bromopropylene Glycol.

See under Glycerol.

### 3-Bromopropylene oxide.

See  $\alpha$ -Epibromohydrin.

### 5-Bromoprotocatechuic Acid (5-Bromo-3:4-dihydroxybenzoic acid)



$C_7H_5O_4Br$  MW, 233

M.p. 224° (227–9°).

*Me ester*:  $C_8H_7O_4Br$ . MW, 247. M.p. 201–2°.

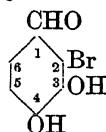
3:4-Diacetyl: m.p. 187°.

3-*Me ether*: see 5-Bromovanillic Acid.

Di-*Me ether*: see 5-Bromoveratric Acid.

Pschorr, *Ann.*, 1912, 391, 32.

### 2-Bromoprotocatechuic Aldehyde (2-Bromo-3:4-dihydroxybenzaldehyde)



$C_7H_5O_3Br$  MW, 217

4-*Me ether*: 2-bromoisovanillin,  $C_8H_7O_3Br$ . MW, 231. Needles from EtOH. M.p. 211–12°.

Henry, Sharp, *J. Chem. Soc.*, 1930, 2279.

Lock, *Monatsh.*, 1934, 64, 341.

### 5-Bromoprotocatechuic Aldehyde.

Needles from EtOH.Aq. M.p. 230° corr.

3:4-Diacetyl: prisms from MeOH. M.p. 82–4°.

3-*Me ether*: see 5-Bromovanillin.

Di-*Me ether*: see 5-Bromoveratric Aldehyde.

*Phenylhydrazone*: m.p. 138–40°.

Pschorr, *Ann.*, 1912, 391, 29.

### 6-Bromoprotocatechuic Aldehyde.

Pale yellow cryst. from 20% EtOH. M.p. 220°.  $FeCl_3$   $\rightarrow$  dark green col.

3-*Me ether*: see 6-Bromovanillin.

4-*Me ether*: 6-bromoisovanillin. Needles +  $1H_2O$  from 50% EtOH. M.p. 112–14° corr.

Di-*Me ether*: see 6-Bromoveratric Aldehyde.

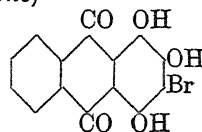
*Semicarbazone*: m.p. 239° decomp.

*Nitrophenylhydrazone*: m.p. 243° decomp.

Parijs, *Rec. trav. chim.*, 1930, 49, 38.

Henry, Sharp, *J. Chem. Soc.*, 1930, 2279.

### 3-Bromopurpurin (3-Bromo-1:2:4-trihydroxyanthraquinone)



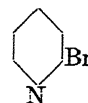
$C_{14}H_7O_5Br$  MW, 335

Deep red needles. M.p. 276°. Sublimes almost undecomp. Less sol. in AcOH and EtOH than purpurin.

Plath, *Ber.*, 1877, 10, 615.

Schunk, Römer, *ibid.*, 554.

### 2-Bromopyridine ( $\alpha$ -Bromopyridine)



$C_5H_4NBr$  MW, 158

B.p. 193–4°, 74–5°/13 mm. Mod. sol.  $H_2O$ .  $D_4^{15}$  1.657.

$B_2HAuCl_4$ : m.p. 173°.

$B_2HgCl_2$ : needles from EtOH.Aq. M.p. 184–5°.

Tschitschibabin, Rjasanzew, *Chem. Zentr.*, 1916, II, 228.

Craig, *J. Am. Chem. Soc.*, 1934, 56, 232.

den Hertog, Wibaut, *Rec. trav. chim.*, 1932, 51, 381.

Allen, Thirtle, *Organic Syntheses*, 1946, XXVI, 16.

### 3-Bromopyridine ( $\beta$ -Bromopyridine).

B.p. 169–70° (173°), 68–70°/18 mm. Mod. sol.  $H_2O$ .  $D_4^{20}$  1.645.  $n_D^{20}$  1.5694. Strong alk. reaction.

$B_2HCl$ : m.p. 158–9°. B.p. 175–90°/20–5 mm.

$B_2H_2PtCl_6$ : m.p. 175° decomp.

$B_2HgCl_2$ : needles from EtOH. M.p. 201–5–202–5°.

Englert, McElvain, *J. Am. Chem. Soc.*, 1929, 51, 863.

Maier-Bode, *Ber.*, 1936, 69, 1535.

den Hertog, Wibaut, *Rec. trav. chim.*, 1932, 51, 381.

### 4-Bromopyridine ( $\gamma$ -Bromopyridine).

Cryst. M.p. 0–1°. B.p. 27.5–30°/0.3–0.5 mm.  $n_D^{20}$  1.5679. Readily decomp. to yellowish-brown solid on standing.

*Picrate*: yellow cryst. Decomp. at 223°.

Wibaut, Overhoff, Geldof, *Rec. trav. chim.*, 1935, 54, 807.

Chem. Fabr. v. Heyden, D.R.P., 596,729, (*Chem. Abstracts*, 1934, 28, 5083).

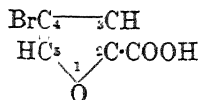
### Bromopyridine-carboxylic Acid.

See Bromonicotinic Acid and Bromopicolinic Acid.

### Bromopyridine-dicarboxylic Acid.

See Bromocinchomeronic Acid and Bromoquinolinic Acid.

**4-Bromopyromucic Acid** (*3-Bromopyromucic acid*, *4-bromofuran-2-carboxylic acid*, *4-bromo- $\alpha$ -furoic acid*. Note: this compound is often described as *3-bromopyromucic acid*)



$C_5H_3O_3Br$  MW, 191

Needles. M.p. 129°. Sol. EtOH, Et<sub>2</sub>O. Mod. sol. H<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. CS<sub>2</sub>, ligroin.

*Et ester*: C<sub>7</sub>H<sub>7</sub>O<sub>3</sub>Br. MW, 219. Prisms. M.p. 29°. B.p. 235–6°.

*Amide*: C<sub>5</sub>H<sub>4</sub>O<sub>2</sub>NBr. MW, 190. Needles. M.p. 155–6°. Sol. EtOH.

Wal, *Chem. Abstracts*, 1937, 31, 2207.

Shepard, Winslow, Johnson, *J. Am. Chem. Soc.*, 1930, 52, 2086.

Hill, Sanger, *Ann.*, 1886, 232, 58.

### 5-Bromopyromucic Acid.

Pearly leaflets from H<sub>2</sub>O. M.p. 186° (190–1°). Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Insol. ligroin.

*Et ester*: prisms. M.p. 17°. B.p. 234°, 134–6°/34 mm. D<sup>20</sup> 1.528.

*Chloride*: m.p. 54–6°. B.p. 89°/8 mm.

*Amide*: needles. M.p. 144–5°. Sol. EtOH, Et<sub>2</sub>O.

*Anilide*: m.p. 145°.

*Hydrazide*: m.p. 135.5–136°.

*Azide*: m.p. 66–7°.

Whittaker, *Rec. trav. chim.*, 1933, 52, 352.

Shepard, Winslow, Johnson, *J. Am. Chem. Soc.*, 1930, 52, 2086.

Hill, Sanger, *Ann.*, 1886, 232, 46.

Raiford, Huey, *J. Org. Chem.*, 1941, 6, 858.

### Bromopyruvic Nitrile.

See Bromoacetyl cyanide.

**3-Bromoquinaldine** (*3-Bromo-2-methyl-quinoline*)



$C_{10}H_8NBr$  MW, 222

Needles from EtOH.Aq. M.p. 78°.

*Picrate*: m.p. 224.5°.

Magnanini, *Ber.*, 1887, 20, 2610.

**6-Bromoquinaldine** (*6-Bromo-2-methyl-quinoline*).

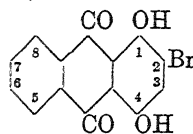
Cryst. M.p. 96–7°. Volatile in steam. Darkens on standing.

*Methiodide*: m.p. 237° decomp.

*Ethiodide*: m.p. 218°.

Johnson, Adams, *J. Am. Chem. Soc.*, 1921, 43, 2257.

**2-Bromoquinizarin** (*2-Bromo-1:4-dihydroxyanthraquinone*)



$C_{14}H_7O_4Br$  MW, 319

Brownish-red leaflets with metallic lustre. M.p. 265–8°. Sublimes in a vacuum at about 300°. Sol. hot PhNO<sub>2</sub>, hot Py. Sol. conc. H<sub>2</sub>SO<sub>4</sub> to yellowish-red sol., turning violet on addn. of boric acid. Sol. caustic alkalis to blue sols.

*1:4-Diacetyl*: yellow. M.p. 226–9°.

Bayer, D.R.P., 114,199, (*Chem. Zentr.*, 1900, II, 884).

Tanaka, *Chem. Abstracts*, 1927, 21, 3192.

### 5-Bromoquinizarin.

Red needles from AcOH. M.p. 212°. Alkalis → violet-blue sols. Conc. H<sub>2</sub>SO<sub>4</sub> → red sol.

Waldmann, *J. prakt. Chem.*, 1931, 130, 102.

### 6-Bromoquinizarin.

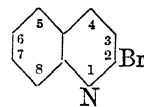
Reddish-brown plates from C<sub>6</sub>H<sub>6</sub>. M.p. 185.5°. Sol. hot AcOH, C<sub>6</sub>H<sub>6</sub>, toluene. Conc. H<sub>2</sub>SO<sub>4</sub> → red sol. Alkalis → reddish-violet sols.

*Di-Me ether*: C<sub>16</sub>H<sub>11</sub>O<sub>4</sub>Br. MW, 347. Orange-yellow needles from EtOH. M.p. 176.5°. Sol. hot EtOH, AcOH. Conc. H<sub>2</sub>SO<sub>4</sub> → violet-red sol.

*1:4-Diacetyl*: yellow rhombohedra from EtOH. M.p. 220.5°.

Waldmann, *J. prakt. Chem.*, 1930, 126, 256.

**2-Bromoquinoline** ( *$\alpha$ -Bromoquinoline*)



$C_9H_6NBr$  MW, 208

Needles from EtOH. M.p. 48–9°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Hot min. acids → carbostyryl. Volatile in steam.

*Methiodide*: decomp. at 210°.

Fischer, *Ber.*, 1899, 32, 1304.

Jansen, Wibaut, *Rec. trav. chim.*, 1937, 56, 705.

**3-Bromoquinoline** ( *$\beta$ -Bromoquinoline*).

M.p. 12.5°. B.p. 274–6°, 95°/0.5 mm.

*Oxalate*: prisms from H<sub>2</sub>O. M.p. 107°.

*Picrate*: yellow needles. M.p. 190°.

Jansen, Wibaut, *Rec. trav. chim.*, 1937, 56, 704.

**4-Bromoquinoline** ( $\gamma$ -Bromoquinoline).

M.p. 29–30° (25°). B.p. 270° decomp.  
*Methiodide*: m.p. 265–70°.

Claus, Frobenius, *J. prakt. Chem.*, 1897, 56, 191.

**5-Bromoquinoline.**

Needles. M.p. 48° (52°). B.p. 280°/756 mm.  
 Volatile in steam.

*B, HCl, H<sub>2</sub>O*: m.p. 225° decomp.

*B, HNO<sub>3</sub>*: m.p. 185° decomp.

*Methiodide*: m.p. 205°.

*Picrate*: m.p. 152°.

*Dichromate*: m.p. 134° decomp.

Dikshoorn, *Rec. trav. chim.*, 1929, 48, 550.

**6-Bromoquinoline.**

M.p. 24° (18–19°). B.p. 278°.

*B, HCl, H<sub>2</sub>O*: m.p. 213° decomp.

*B, HBr*: m.p. 256° (rapid heat.).

*B, HNO<sub>3</sub>*: m.p. 182°.

*B, H<sub>2</sub>SO<sub>4</sub>, H<sub>2</sub>O*: m.p. 176°.

*Picrate*: m.p. 216–17°.

*Methiodide*: reddish-yellow needles. M.p. 278°.

Claus, Tornier, *Ber.*, 1887, 20, 2874.

**7-Bromoquinoline.**

Needles. M.p. 52° (34°, 35°). B.p. 290°, 288°/753 mm.

*B, HCl, H<sub>2</sub>O*: m.p. 213° decomp.

*B, HNO<sub>3</sub>*: m.p. 190° decomp.

*Methiodide*: yellow cryst. M.p. 240°.

*Picrate*: m.p. 238°.

*Oxalate*: m.p. 168°.

Claus, Uis, *J. prakt. Chem.*, 1888, 38, 389.

**8-Bromoquinoline.**

B.p. 302–4° (305–10° slight decomp.), 165–6°/18 mm.

*B, HCl, 2H<sub>2</sub>O*: m.p. 79–80°, anhyd. 170°.

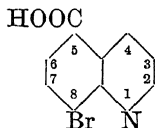
*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>, 2H<sub>2</sub>O*: m.p. 230° decomp.

*B, HAuCl<sub>4</sub>*: m.p. 241–2°.

*Methiodide*: m.p. 281° decomp.

Ukai, *Chem. Abstracts*, 1928, 22, 785.

Dikshoorn, *Rec. trav. chim.*, 1929, 48, 550.

**8-Bromoquinoline-5-carboxylic Acid**

$C_{10}H_6O_2NBr$  MW, 252

Cryst. powder from AcOH. M.p. 275°. Sol. AcOH, hot EtOH. Prac. insol.  $H_2O$ ,  $Et_2O$ ,  $CHCl_3$ .

Lellmann, *Ann.*, 1887, 237, 313.

**3-Bromoquinoline-6-carboxylic Acid.**

Needles from EtOH. M.p. 245°. Sol. hot EtOH. Spar. sol.  $H_2O$ .

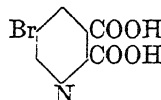
Howitz, Philipp, *Ann.*, 1913, 396, 37.

Dict. of Org. Comp.—I.

**3-Bromoquinoline-8-carboxylic Acid.**

Needles from EtOH.Aq. M.p. 206–7°. Spar. sol. boiling  $H_2O$ . Sublimes undecomp.

Howitz, Schwenk, *Ber.*, 1905, 38, 1287.

**5-Bromoquinolinic Acid** (5-Bromopyridine-2:3-dicarboxylic acid)

$C_7H_4O_4NBr$  MW, 246

M.p. 165°  $\rightarrow$  bromonicotinic acid +  $CO_2$ . Cryst. from  $H_2O$  with  $1H_2O$ . Sol. EtOH,  $Et_2O$ ,  $Me_2CO$ .

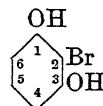
*Anhydride*:  $C_7H_2O_3NBr$ . MW, 228. M.p. 134–6°.

Ugai, Izumi, *J. pharm. Soc. Japan*, 1935, 55, 13.

Claus, Küttner, *Ber.*, 1886, 19, 2884.

**Bromoquinone.**

See Bromo-*p*-benzoquinone.

**2-Bromoresorcinol**

$C_6H_5O_2Br$  MW, 189

Needles. M.p. 102–3°. Sol.  $Et_2O$ ,  $CHCl_3$ .

Rice, *J. Am. Chem. Soc.*, 1926, 48, 3125.

**4-Bromoresorcinol.**

M.p. 103°. Sol.  $H_2O$ ,  $Et_2O$ . Spar. sol.  $EtOH$ ,  $CHCl_3$ ,  $C_6H_6$ .

1-*Me ether*:  $C_7H_7O_2Br$ . MW, 203. B.p. 152°/25 mm.

3-*Me ether*: needles from  $C_6H_6$ . M.p. 84°.

Di-*Me ether*:  $C_8H_9O_2Br$ . MW, 217. B.p. 135°/18 mm.

*Diacetyl*: m.p. 49–50°.

1-*Benzoyl*: needles from EtOH. M.p. 169°.

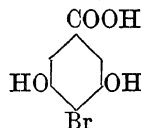
*Dibenzoyl*: m.p. 74°.

Sandin, McKee, *Organic Syntheses*, 1937, XVII, 23.

**5-Bromoresorcinol.**

Needles from  $C_6H_6$ , m.p. 87°. Prisms +  $1H_2O$  from  $H_2O$ , m.p. about 79°.

Hodgson, Wignall, *J. Chem. Soc.*, 1926, 2826.

**4-Bromo- $\alpha$ -resorcylic Acid** (4-Bromo-3:5-dihydroxybenzoic acid)

$C_7H_5O_4Br$

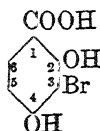
MW, 233

24

Needles +  $1\text{H}_2\text{O}$  from  $\text{H}_2\text{O}$ . M.p. anhyd.  $256^\circ$  ( $253^\circ$ ). Sol. conc.  $\text{H}_2\text{SO}_4$  with intense red col.  $\text{FeCl}_3 \rightarrow$  yellowish-brown col.

Barth, Senhofer, *Ann.*, 1872, 164, 115.

**3-Bromo- $\beta$ -resorcylic Acid** (3-Bromo-2:4-dihydroxybenzoic acid)



$\text{C}_7\text{H}_5\text{O}_4\text{Br}$  MW, 233

Brown or yellow needles from  $\text{H}_2\text{O}$ . M.p.  $202^\circ$ .  $\text{FeCl}_3 \rightarrow$  reddish-violet col.

Himmelmayer, *Monatsh.*, 1914, 35, 4.

**5-Bromo- $\beta$ -resorcylic Acid** (5-Bromo-2:4-dihydroxybenzoic acid).

Prisms. M.p.  $212^\circ$  ( $204^\circ$ ). Spar. sol.  $\text{H}_2\text{O}$ .

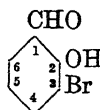
4-*Me ether*: *Me ester*.  $\text{C}_9\text{H}_9\text{O}_4\text{Br}$ . MW, 261. Needles from  $\text{CHCl}_3\text{-MeOH}$ . M.p.  $143^\circ$ .

*Di-Me ether*:  $\text{C}_9\text{H}_9\text{O}_4\text{Br}$ . MW, 261. Cryst. from  $\text{Me}_2\text{CO}$ . M.p.  $197^\circ$  ( $198\text{--}200^\circ$ ). Spar. sol.  $\text{H}_2\text{O}$ ,  $\text{MeOH}$ ,  $\text{CHCl}_3$ . *Me ester*:  $\text{C}_{10}\text{H}_{11}\text{O}_4\text{Br}$ . MW, 275. Needles from  $\text{MeOH}$ . M.p.  $117^\circ$ .

Rice, *J. Am. Chem. Soc.*, 1926, 48, 3126.

Himmelmayer, *Monatsh.*, 1912, 33, 976.

**3-Bromosalicylaldehyde** (3-Bromo-2-hydroxybenzaldehyde)



$\text{C}_7\text{H}_5\text{O}_2\text{Br}$  MW, 201

Needles. M.p.  $49^\circ$ . Sol. most ord. org. solvents. Sol. aq. alkalis. Spar. sol.  $\text{H}_2\text{O}$ .  $\text{FeCl}_3 \rightarrow$  purple col.

*Oxime*: m.p.  $165^\circ$ .

*Semicarbazone*: m.p.  $266^\circ$ .

*Phenylhydrazone*: m.p.  $100^\circ$ .

Müller, *Ber.*, 1909, 42, 3695.

**4-Bromosalicylaldehyde.**

Needles. M.p.  $52^\circ$ . Sol. most ord. org. solvents. Sol. caustic alkalis. Spar. sol.  $\text{H}_2\text{O}$ . Volatile in steam.  $\text{FeCl}_3 \rightarrow$  purple col.

*Acetyl*: needles from  $\text{EtOH.Aq}$ . M.p.  $92^\circ$ . *Oxime*: needles. M.p.  $133^\circ$ .

*Benzoyl*: needles. M.p.  $115^\circ$ .

*Me ether*:  $\text{C}_8\text{H}_7\text{O}_3\text{Br}$ . MW, 215. M.p.  $71^\circ$ . *Oxime*: m.p.  $132^\circ$ . *Semicarbazone*: m.p.  $224^\circ$ .

*Oxime*: m.p.  $168^\circ$ .

*p-Nitrophenylhydrazone*: orange-yellow needles. M.p.  $258^\circ$  decomp.

*Semicarbazone*: m.p.  $212^\circ$ .

Hodgson, Jenkinson, *J. Chem. Soc.*, 1927, 3041.

Müller, *Ber.*, 1909, 42, 3695.

**5-Bromosalicylaldehyde.**

M.p.  $105^\circ$  ( $105\text{--}6^\circ$ ). Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ , caustic alkalis. Insol.  $\text{H}_2\text{O}$ .  $\text{FeCl}_3 \rightarrow$  blue col. Forms bisulphite comp.

*Benzoyl*: m.p.  $73\text{--}4^\circ$ .

*Me ether*:  $\text{C}_8\text{H}_7\text{O}_3\text{Br}$ . MW, 215. Prisms. M.p.  $114^\circ$  ( $116\text{--}4^\circ$ ). Sol. hot  $\text{EtOH}$ .

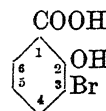
*Et ether*:  $\text{C}_9\text{H}_9\text{O}_3\text{Br}$ . MW, 229. Prisms. M.p.  $67\text{--}8^\circ$ .

*Oxime*: m.p.  $126^\circ$ .

*Semicarbazone*: m.p.  $297^\circ$  decomp.

Auwers, Bürger, *Ber.*, 1904, 37, 3934.

**3-Bromosalicylic Acid** (3-Bromo-2-hydroxybenzoic acid)



$\text{C}_7\text{H}_5\text{O}_3\text{Br}$  MW, 217

Needles. M.p.  $184^\circ$ .  $\text{FeCl}_3 \rightarrow$  violet col.

*Me ester*: m.p.  $62^\circ$ .

*Amide*:  $\text{C}_7\text{H}_6\text{O}_2\text{NBr}$ . MW, 216. Needles. M.p.  $165^\circ$ .

*Nitrile*:  $\text{C}_7\text{H}_4\text{ONBr}$ . MW, 198. *Acetyl*: needles. M.p.  $49\text{--}50^\circ$ .

Müller, *Ber.*, 1909, 42, 3695.

Kanvinde, Kothare, Nadkarny, *Current Science*, 1942, 11, 397.

**4-Bromosalicylic Acid.**

Plates. M.p.  $214^\circ$ .  $\text{FeCl}_3 \rightarrow$  violet col.

*Me ether*:  $\text{C}_8\text{H}_7\text{O}_3\text{Br}$ . MW, 231. M.p.  $155^\circ$ .

Hodgson, Jenkinson, *J. Chem. Soc.*, 1927, 3041.

**5-Bromosalicylic Acid.**

Needles. M.p.  $165^\circ$  ( $165\text{--}6^\circ$ ). Cryst. from hot  $\text{H}_2\text{O}$ .  $k = 2.41 \times 10^{-3}$  at  $25^\circ$ .  $\text{FeCl}_3 \rightarrow$  violet col.

*Me ester*:  $\text{C}_8\text{H}_7\text{O}_3\text{Br}$ . MW, 231. Plates. M.p.  $61^\circ$ . B.p.  $264\text{--}6^\circ$ . *Acetyl*: m.p.  $33\text{--}5^\circ$ .

$\alpha$ -*Toluy*: m.p.  $68\text{--}70^\circ$ . *Et ester*:  $\text{C}_9\text{H}_9\text{O}_3\text{Br}$ . MW, 245. Needles. M.p.  $50^\circ$ .

*Phenyl ester*: bromosalol.  $\text{C}_{13}\text{H}_9\text{O}_3\text{Br}$ . MW, 293. M.p.  $112^\circ$ .

*Amide*:  $\text{C}_7\text{H}_6\text{O}_2\text{NBr}$ . MW, 216. Leaflets. M.p.  $232^\circ$ .

*Nitrile*:  $\text{C}_7\text{H}_4\text{ONBr}$ . MW, 198. M.p.  $158\text{--}9^\circ$ . *Anilide*: needles. M.p.  $222^\circ$ .

*Acetyl*: m.p.  $60^\circ$ .

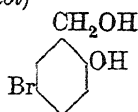
*Me ether*:  $\text{C}_8\text{H}_7\text{O}_3\text{Br}$ . MW, 231. Needles from  $\text{H}_2\text{O}$ . M.p.  $119^\circ$  ( $119\text{--}20^\circ$ ). *Me ester*:  $\text{C}_9\text{H}_9\text{O}_3\text{Br}$ . MW, 245. M.p.  $39\text{--}40^\circ$ . B.p.  $295\text{--}6^\circ$ .

*Et ether*:  $\text{C}_9\text{H}_9\text{O}_3\text{Br}$ . MW, 245. Leaflets. M.p.  $131^\circ$ . *Me ester*:  $\text{C}_{10}\text{H}_{11}\text{O}_3\text{Br}$ . MW, 259. M.p.  $49^\circ$ . B.p.  $300\text{--}2^\circ$ .

Hand, *Ann.*, 1886, 234, 133.

Kauschke, *J. prakt. Chem.*, 1895, 51, 210.

**5-Bromosaligenin** (5-Bromo-2-hydroxybenzyl alcohol, Bromsalizol)



$C_7H_7O_2Br$  MW, 203

Leaflets. M.p. 107-9°. Sol. EtOH, Et<sub>2</sub>O, AcOEt, hot H<sub>2</sub>O. Mod. sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, cold H<sub>2</sub>O. FeCl<sub>3</sub> → blue col. K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> + H<sub>2</sub>SO<sub>4</sub> → 5-bromosalicylaldehyde.

*Me ether*: C<sub>8</sub>H<sub>9</sub>O<sub>2</sub>Br. MW, 217. M.p. 75°.

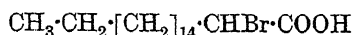
Auwers, Büttner, *Ann.*, 1898, 302, 138.

Dunning, Dunning, Reid, *J. Am. Chem. Soc.*, 1936, 58, 1567.

### Bromosalol.

See under 5-Bromosalicylic Acid.

### 1-Bromostearic Acid



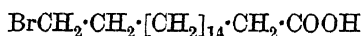
$C_{18}H_{35}O_2Br$  MW, 363

Cryst. from ligroin. M.p. 60°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, CS<sub>2</sub>.

*Et ester*: C<sub>20</sub>H<sub>39</sub>O<sub>2</sub>Br. MW, 391. M.p. 35-6°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, ligroin.

Radcliffe, Gibson, *J. Soc. Dyers Colourists*, 1923, 39, 4.

### 17-Bromostearic Acid

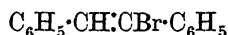


$C_{18}H_{35}O_2Br$  MW, 363

Cryst. from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 75.2-75.8°. B.p. 240-41°/4 mm. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Mod. sol. hot pet. ether.

Chuit, Hausser, *Helv. Chim. Acta*, 1929, 12, 489.

**α-Bromostilbene** (α-Bromo-sym.-diphenylethylene)



$C_{14}H_{11}Br$  MW, 259

*Cis*:

M.p. 19°.

*Trans*:

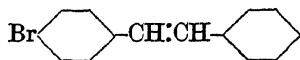
Cryst. from EtOH. M.p. 31°. Unstable.

Pfeiffer, *Ber.*, 1912, 45, 1818.

Wislicenus, Seeler, *Ber.*, 1895, 28, 2699.

Limpricht, Schwanert, *Ann.*, 1870, 155, 71.

**p-Bromostilbene** (4-Bromo-αβ-diphenylethylene)



$C_{14}H_{11}Br$  MW, 259

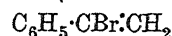
M.p. 135°.

*Dibromide*: α : β : 4-tribromodiphenylethane.

M.p. 199°.

Anschutz, *Ber.*, 1927, 60, 1322.

**α-Bromostyrene** (1-Bromo-1-phenylethylene)

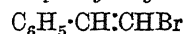


$C_8H_7Br$  MW, 183

M.p. -44°. B.p. 71°/8 mm.  $D_4^{25}$  1.410.  $n_D^{20}$  1.5881.

Dufraisse, *Ann. chim.*, 1922, 17, 164.

**β-Bromostyrene** (ω-Bromostyrene, styryl bromide, 1-bromo-2-phenylethylene)



$C_8H_7Br$  MW, 183

Two isomers.

(1) M.p. 7°. B.p. 219° slight decomp., 108°/20 mm.  $D_4^{25}$  1.4269.  $n_D^{20}$  1.6094. Na + CO<sub>2</sub> in Et<sub>2</sub>O → phenylpropionic acid.

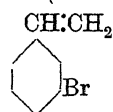
(2) M.p. -8 to -7°. B.p. 71°/6 mm.  $D_4^{25}$  1.4322.  $n_D^{20}$  1.5990.

Lewinsohn, *Chem. Abstracts*, 1924, 18, 2222.

Shorugin, Isagulyantz, Guseva, *Chem. Abstracts*, 1932, 26, 2441.

Dufraisse, *Ann. chim.*, 1922, 17, 164.

**m-Bromostyrene** (m-Bromophenylethylene)



$C_8H_7Br$  MW, 183

B.p. 90-4°.  $D_4^{20}$  1.4059.  $n_D^{20}$  1.5855. Polymerises readily.

Brown, Marvel, *J. Am. Chem. Soc.*, 1937, 59, 1177.

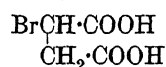
**p-Bromostyrene.**

B.p. 88°/13 mm.  $D_4^{20}$  1.400.  $n_D^{20}$  1.5933. Polymerises readily.

v. Braun, Nelles, *Ber.*, 1933, 66, 1468.

Quelet, *Bull. soc. chim.*, 1929, 45, 86.

**Bromosuccinic Acid**



$C_4H_5O_4Br$  MW, 197

*dl.*

M.p. 161°. Sol. H<sub>2</sub>O.  $k$  (first) =  $2.78 \times 10^{-3}$  at 25°; (second) =  $3.9 \times 10^{-5}$  at 25°. Heat above m.p. → fumaric acid.

*Di-Me ester*: C<sub>8</sub>H<sub>9</sub>O<sub>4</sub>Br. MW, 225. B.p. 110°/10 mm. Dist. at ord. press. → fumaric dimethyl ester.

*Di-Et ester*: C<sub>8</sub>H<sub>13</sub>O<sub>4</sub>Br. MW, 253. B.p. 225-6° decomp., 150-60°/50 mm., 125-8°/24 mm.

*d.*

*Di-Me ester*: b.p. 129°/23 mm.  $D_4^{20}$  1.505.  $[\alpha]_D^{20} + 64.7^\circ$  in C<sub>6</sub>H<sub>6</sub>.

*Di-Et ester*: b.p. 143°/30 mm.  $D_4^{20}$  1.355.  $n_D^{20}$  1.455.  $[\alpha]_D^{18} + 45^\circ$  in C<sub>6</sub>H<sub>6</sub>.

*l.*

M.p. 179° decomp. Sol. H<sub>2</sub>O.  $k = 2.6 \times 10^{-3}$  at 25°.  $[\alpha]_D^{20} - 70.2^\circ$  in AcOEt.

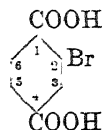
*Di-Me ester*: b.p. 79°/1 mm.  $D^{20}$  1.513.

*Dichloride*:  $C_8H_6O_2Cl_2Br$ . MW, 234. B.p. 56°/1 mm.  $D^{20}$  1.796.

Freudenberg, Lux, *Ber.*, 1928, 61, 1083.

Ölander, *Chem. Abstracts*, 1930, 24, 2722.

## Bromoterephthalic Acid



$C_8H_5O_4Br$  MW, 245

Needles. M.p. 299°. Sol. EtOH, hot  $H_2O$ . Insol.  $Et_2O$ ,  $C_6H_6$ .  $k$  (first) =  $6.2 \times 10^{-3}$  at 25°; (second) =  $7.6 \times 10^{-5}$  at 25°.

*1-Me ester*:  $C_9H_7O_4Br$ . MW, 259. Needles. M.p. 145°. B.p. 235°/37 mm.  $k = 3.71 \times 10^{-4}$  at 25°.

*4-Me ester*: yellowish needles. M.p. 164°. B.p. 233°/19 mm.  $k = 5.0 \times 10^{-3}$  at 25°.

*Di-Me ester*:  $C_{10}H_9O_4Br$ . MW, 273. Needles. M.p. 54°.

*Dichloride*:  $C_8H_6O_2Cl_2Br$ . MW, 282. B.p. 304.5–305.5°.

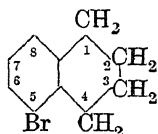
*Diamide*:  $C_8H_7O_2N_2Br$ . MW, 243. Needles. M.p. 270°.

I. G., F.P. 663, 791, (*Chem. Zentr.*, 1929, II, 2732).

Fischli, *Ber.*, 1879, 12, 619.

Wegscheider, Bittner, *Monatsh.*, 1900, 21, 643.

## 5-Bromotetrahydronaphthalene (5-Bromotetralin)



$C_{10}H_{11}Br$  MW, 211

B.p. 255–7°. Sol. most ord. org. solvents. Volatile in steam.

Morgan, Micklethwait, Winfield, *J. Chem. Soc.*, 1904, 85, 746.

Vesely, Štursa, *Chem. Abstracts*, 1934, 28, 5815.

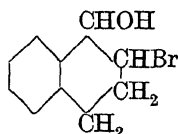
## 6-Bromotetrahydronaphthalene.

B.p. 238–9°.

Smith, *J. Chem. Soc.*, 1904, 85, 729.

Vesely, Štursa, *Chem. Abstracts*, 1934, 23, 5815.

## 2-Bromo-1 : 2 : 3 : 4-tetrahydro-1-naphthol



$C_{10}H_{11}OBr$  MW, 227

Needles from  $C_6H_6$ -pet. ether or EtOH. Aq. M.p. 111–12°.

*Me ether*:  $C_{11}H_{13}OBr$ . MW, 241. B.p. 151–2°/13 mm.

*Et ether*:  $C_{12}H_{15}OBr$ . MW, 255. B.p. 171–2°/21 mm.

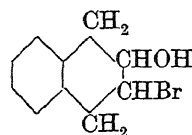
*Amyl ether*:  $C_{15}H_{21}OBr$ . MW, 297. B.p. 175–80°/15 mm.

*Allyl ether*:  $C_{13}H_{15}OBr$ . MW, 267. B.p. 171°/11 mm.

Strauss, Rohrbadher, *Ber.*, 1921, 54, 53.

Braun, Kirschbaum, *Ber.*, 1921, 54, 600.

## 3-Bromo-1 : 2 : 3 : 4-tetrahydro-2-naphthol



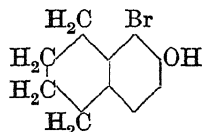
$C_{10}H_{11}OBr$  MW, 227

Prisms from  $Me_2CO$ . M.p. 107° (112°).

Bamberger, Lodter, *Ann.*, 1895, 288, 94.

Leroux, *Ann. chim. phys.*, 1910, 21, 482.

## 1-Bromo-5 : 6 : 7 : 8-tetrahydro-2-naphthol

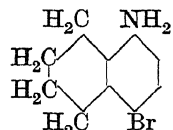


$C_{10}H_{11}OBr$  MW, 227

M.p. 74°. B.p. 160°/13 mm.

Schroeter, *Ann.*, 1922, 426, 92.

## 4-Bromo-5 : 6 : 7 : 8-tetrahydro-1-naphthylamine



$C_{10}H_{12}NBr$  MW, 226

Needles from  $C_6H_6$ -pet. ether. M.p. 42°. Sol. ord. org. solvents except pet. ether.

*N-Formyl*: plates from  $C_6H_6$  or EtOH. M.p. 164.5°.

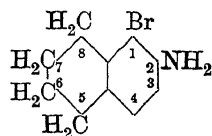
*N-Acetyl*: needles from  $C_6H_6$  or AcOEt. M.p. 181°.

*N-Propionyl*: needles from  $CHCl_3$ . M.p. 185–6°.

*N-Benzoyl*: needles from EtOH. M.p. 202–3°.

Morgan, Micklethwait, Winfield, *J. Chem. Soc.*, 1904, 85, 745.

## 1-Bromo-5 : 6 : 7 : 8-tetrahydro-2-naphthylamine



$C_{10}H_{12}NBr$  MW, 226

Needles from pet. ether. M.p. 52·5°. Sol. EtOH, AcOEt. Mod. sol. hot H<sub>2</sub>O. Dil. KMnO<sub>4</sub> → adipic acid.

N-Acetyl: cryst. from EtOH. M.p. 125·5°.  
Smith, *J. Chem. Soc.*, 1904, 85, 730.

#### 4-Bromo-5 : 6 : 7 : 8-tetrahydro-2-naphthylamine.

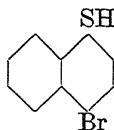
Needles from pet. ether. M.p. 62°. Sol. EtOH, AcOEt. Mod. sol. hot H<sub>2</sub>O, pet. ether. KMnO<sub>4</sub> → adipic acid.

N-Acetyl: needles from EtOH. M.p. 151°.  
Smith, *J. Chem. Soc.*, 1904, 85, 731.

#### Bromothioanisole.

See under Bromothiophenol.

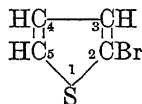
#### 4-Bromo-1-thionaphthol



C<sub>10</sub>H<sub>7</sub>BrS MW, 239  
Plates from EtOH-Et<sub>2</sub>O. M.p. 55-6°.

Taboury, *Ann. chim. phys.*, 1908, 15, 19.

#### 2-Bromothiophene



C<sub>4</sub>H<sub>3</sub>BrS MW, 163  
B.p. 42-6°/13 mm.

Gattermann, *Ann.*, 1912, 293, 230.

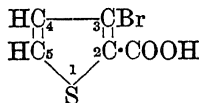
Kraus, *Renwanz, Ber.*, 1929, 62, 1710.

#### 3-Bromothiophene.

B.p. 157-8°.

Steinkopf, Jacob, Penz, *Ann.*, 1934, 512, 154.

#### 3-Bromo- $\alpha$ -thiophenic Acid (3-Bromothiophene-2-carboxylic acid)



C<sub>5</sub>H<sub>3</sub>O<sub>2</sub>BrS MW, 207  
M.p. 190°.

Steinkopf, Jacob, Penz, *Ann.*, 1934, 512, 154.

#### 4-Bromo- $\alpha$ -thiophenic Acid (4-Bromothiophene-2-carboxylic acid).

M.p. 141-2°.

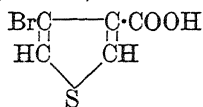
Steinkopf, Jacob, Penz, *Ann.*, 1934, 512, 154.

#### 5-Bromo- $\alpha$ -thiophenic Acid (5-Bromothiophene-2-carboxylic acid).

Needles from H<sub>2</sub>O. M.p. 139·5°. Sol. EtOH, Et<sub>2</sub>O. Prac. insol. cold H<sub>2</sub>O. Sublimes.

Gattermann, Römer, *Ber.*, 1886, 19, 690.

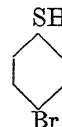
#### 4-Bromo- $\beta$ -thiophenic Acid (4-Bromothiophene-3-carboxylic acid)



C<sub>5</sub>H<sub>3</sub>O<sub>2</sub>BrS MW, 207  
M.p. 150-2°.

Steinkopf, Jacob, Penz, *Ann.*, 1934, 512, 160.

#### p-Bromothiophenol (4-Bromophenyl mercaptan)



C<sub>6</sub>H<sub>5</sub>BrS MW, 189

Leaflets. M.p. 75°. B.p. 231°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, hot EtOH. Spar. sol. hot H<sub>2</sub>O, cold EtOH. Volatile in steam. Oxidises in air.

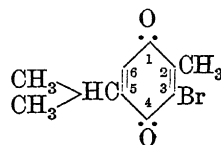
Me ether: methyl p-bromophenyl sulphide, p-bromothioanisole. C<sub>7</sub>H<sub>7</sub>BrS. MW, 203.  
Cryst. from EtOH. M.p. 38°.

Hübner, Alsborg, *Ann.*, 1870, 156, 327.

Taboury, *Ann. chim.*, 1908, 15, 18.

Bourgeois, Abraham, *Rec. trav. chim.*, 1911, 30, 422.

#### 3-Bromothymoquinone (3-Bromo-2-methyl-5-isopropyl-1 : 4-benzoquinone. Note: by alternative numbering this compound is 6-bromo-2-isopropyl-5-methyl-1 : 4-benzoquinone or 6-bromothymoquinone)



C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>Br MW, 243  
Yellow prisms. M.p. 46-7°.

1-Oxime: 2-bromo-6-nitroso-3-hydroxy-1-methyl-4-isopropylbenzene, 2-bromo-6-nitroso-thymol. Yellow cryst. Decomp. at 148-52°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, AcOH.

Kehrmann, *Ann.*, 1900, 310, 100.

Chechik, *Chem. Abstracts*, 1933, 27, 5316.

#### 6-Bromothymoquinone (6-Bromo-2-methyl-5-isopropyl-1 : 4-benzoquinone, or 3-bromothymoquinone). See Note under 3-Bromothymoquinone).

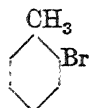
Orange plates. M.p. 53-4°. Sublimes. Sol. EtOH, Et<sub>2</sub>O, AcOH, C<sub>6</sub>H<sub>6</sub>. Volatile in steam.

4-Oxime: 3-bromo-5-nitrosocarvacrol. Yellow prisms. M.p. 166-8°, (decomp. at 157-8°).

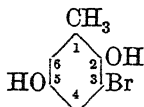
Kehrmann, *Ann.*, 1900, 310, 92.

$\alpha$ -Bromotoluene.  
See Benzyl bromide.

## o-Bromotoluene

C<sub>7</sub>H<sub>7</sub>Br MW, 171M.p. -26°. B.p. 181°. D<sub>4</sub><sup>20</sup> 1.4309. Dil. HNO<sub>3</sub> → *o*-bromobenzoic acid.Bigelow, *Organic Syntheses*, Collective Vol. I, 130.*m*-Bromotoluene.M.p. -40°. B.p. 184°. D<sub>4</sub><sup>20</sup> 1.4099. CrO<sub>3</sub> → *m*-bromobenzoic acid.Bigelow, Johnson, Sandborn, *Organic Syntheses*, Collective Vol. I, 128.*p*-Bromotoluene.Cryst. M.p. 28.5°. B.p. 184°. D<sub>4</sub><sup>20</sup> 1.3898. Dil. HNO<sub>3</sub> → *p*-bromobenzoic acid.Bigelow, *Organic Syntheses*, Collective Vol. I, 131.

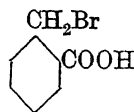
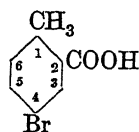
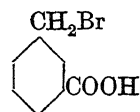
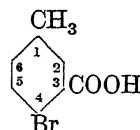
## 3-Bromotoluhydroquinone (3-Bromo-2 : 5-dihydroxytoluene)

C<sub>7</sub>H<sub>7</sub>O<sub>2</sub>Br MW, 203Plates from EtOH. M.p. 112°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>.

Acetyl deriv. : m.p. 57°.

Claus, Jackson, *J. prakt. Chem.*, 1888, 38, 327.

## 4-Bromotoluhydroquinone.

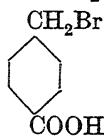
Plates from H<sub>2</sub>O. M.p. 179° decomp.Schniter, *Ber.*, 1887, 20, 2286.Clark, *Am. Chem. J.*, 1892, 14, 569.ω-Bromo-*o*-toluic Acid (*o*-Bromomethylbenzoic acid, benzyl bromide *o*-carboxylic acid)C<sub>8</sub>H<sub>7</sub>O<sub>2</sub>Br MW, 215Prisms. M.p. 147°. Sol. Et<sub>2</sub>O, Me<sub>2</sub>CO. Spar. sol. ligroin. Insol. H<sub>2</sub>O.Nitrile : see *o*-Cyanobenzyl bromide.Salkind, *Chem. Zentr.*, 1914, II, 1271.4-Bromo-*o*-toluic AcidC<sub>8</sub>H<sub>7</sub>O<sub>2</sub>Br MW, 215Needles. M.p. 170° (167°). Sol. EtOH, Et<sub>2</sub>O. Spar. sol. hot H<sub>2</sub>O. Volatile in steam.Methyl ester : C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Br. MW, 229. M.p. 47-8°.Keuning, Evenhuis, *Rec. trav. chim.*, 1935, 54, 73.Auwers, Harres, *Z. physik. Chem.*, 1929, 143, 17.5-Bromo-*o*-toluic Acid.Needles. M.p. 187° (178°). Sol. EtOH. Spar. sol. hot H<sub>2</sub>O. Sublimes. KMnO<sub>4</sub> → 4-bromophthalic acid.Amide : C<sub>9</sub>H<sub>9</sub>ONBr. MW, 214. Leaflets. M.p. 180°.Nitrile : C<sub>8</sub>H<sub>8</sub>NBr. MW, 196. M.p. 70°. Volatile in steam.Nourrisson, *Ber.*, 1887, 20, 1016.Keuning, Evenhuis, *Rec. trav. chim.*, 1935, 54, 74.ω-Bromo-*m*-toluic Acid (*m*-Bromomethylbenzoic acid, benzyl bromide *m*-carboxylic acid)C<sub>8</sub>H<sub>7</sub>O<sub>2</sub>Br MW, 215Cryst. from EtOH. M.p. 151-2°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO. Insol. H<sub>2</sub>O.Ethyl ester : C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>Br. MW, 243. B.p. 160-1°/10 mm.Nitrile : see *m*-Cyanobenzyl bromide.Salkind, Ssamenow, *Chem. Zentr.*, 1914, II, 1271.4-Bromo-*m*-toluic AcidC<sub>8</sub>H<sub>7</sub>O<sub>2</sub>Br MW, 215Needles. M.p. 154-5°. Cryst. from EtOH. Spar. sol. AcOH, hot H<sub>2</sub>O. Ox. → 4-bromoisophthalic acid.Claus, *J. prakt. Chem.*, 1892, 46, 22.5-Bromo-*m*-toluic Acid.

M.p. 178°.

Bureš, Mandel-Borgmannová, *Chem. Abstracts*, 1928, 22, 4503.6-Bromo-*m*-toluic Acid.Needles. M.p. 209° (212-12.5°). Sol. hot EtOH. Spar. sol. hot H<sub>2</sub>O.Ethyl ester : C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>Br. MW, 243. B.p. 270-5°.Claus, *J. prakt. Chem.*, 1891, 43, 359.Mailhe, *Bull. soc. chim.*, 1921, 29, 293.



ω-Bromo-p-toluic Acid (*p*-Bromomethylbenzoic acid, benzyl bromide *p*-carboxylic acid)



$C_8H_7O_2Br$  MW, 215

Leaflets from  $Me_2CO$ . M.p. 223°. Sol. most org. solvents. Bitter taste.

*Me ester*:  $C_9H_9O_2Br$ . MW, 229. Needles from pet. ether. M.p. 53-53.5°. B.p. 160-1°/17 mm.

*Et ester*:  $C_{10}H_{11}O_2Br$ . MW, 243. Needles. M.p. 35-6°. B.p. 165°/18 mm.

*Chloride*:  $C_8H_6OClBr$ . MW, 233.5. Cryst. from  $C_6H_6$ -ligroin. M.p. 56°. B.p. 155-6°/20 mm.

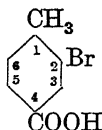
*Bromide*:  $C_8H_6OBr_2$ . MW, 278. M.p. 56°. B.p. 170-1°/20 mm.

*Nitrile*: see *p*-Cyanobenzyl bromide.

Salkind, *Chem. Zentr.*, 1914, II, 1271.

Titely, *J. Chem. Soc.*, 1928, 2581.

2-Bromo-p-toluic Acid



$C_8H_7O_2Br$  MW, 215

Needles. M.p. 204°. Sol. EtOH,  $Et_2O$ . Spar. sol. hot  $H_2O$ . Sublimes. Volatile in steam.

*Nitrile*:  $C_8H_6NBr$ . MW, 196. M.p. 44°.

Claus, Kunath, *J. prakt. Chem.*, 1889, 39, 487.

3-Bromo-p-toluic Acid.

Needles. M.p. 140°. Spar. sol.  $H_2O$

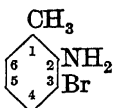
*Chloride*:  $C_8H_6OClBr$ . MW, 233.5. Needles from  $CHCl_3$ . M.p. 120°.

*Amide*:  $C_8H_8ONBr$ . MW, 214. Needles. M.p. 137°. Sublimes.

*Nitrile*: needles. M.p. 47°. Sol. EtOH,  $Et_2O$ . Volatile in steam.

Claus, Kunath, *J. prakt. Chem.*, 1889, 39, 487.

3-Bromo-o-toluidine



$C_7H_8NBr$  MW, 186

*N-Acetyl*: 3-bromo-*o*-acet-toluidide.  $C_9H_{10}ONBr$ . MW, 228. Needles from  $C_6H_6$ . M.p. 166°.

Burton, Hammond, Kenner, *J. Chem. Soc.*, 1926, 1802.

4-Bromo-o-toluidine.

Leaflets. M.p. 32° (33°). B.p. 253-5° part. decomp., 139°/17 mm. Volatile in steam.

*N-Acetyl*: 4-bromo-*o*-acet-toluidide. Needles. M.p. 165°.

Janney, *Ann.*, 1913, 398, 359.

5-Bromo-o-toluidine.

M.p. 59°. B.p. 240°. Cryst. from EtOH. Volatile in steam.

*B, HNO3*: needles. M.p. 183°.

*N-Acetyl*: 5-bromo-*o*-acet-toluidide. M.p. 156-7°.

*N-Benzoyl*: m.p. 115°.

*N-Me*: b.p. 165°/25 mm.

*N-Di-Me*: b.p. 245°.

Ressy, Ortodocsu, *Bull. soc. chim.*, 1923, 33, 637.

Cohen, Dutt, *J. Chem. Soc.*, 1914, 105, 511.

du Pont, B.P. 414,667, (*Chem. Abstracts*, 1935, 29, 475).

6-Bromo-o-toluidine.

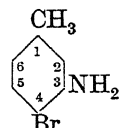
B.p. 253-5°. Volatile in steam.

*N-Acetyl*: 6-bromo-*o*-acet-toluidide. Needles. M.p. 163°.

*N-Benzoyl*: m.p. 176-7°.

Friedländer, Bruckner, Deutsch, *Ann.*, 1912, 388, 29.

4-Bromo-m-toluidine



$C_7H_8NBr$  MW, 186

B.p. 129-30°/16 mm.  $D_{25}^{25}$  1.474.  $n_D^{25}$  1.5990.

*N-Acetyl*: 4-bromo-*m*-acet-toluidide.  $C_9H_{10}ONBr$ . MW, 228. M.p. 120-1° (114°, 164°).

Cook, Cook, *J. Am. Chem. Soc.*, 1933, 55, 1215.

5-Bromo-m-toluidine.

M.p. 36°. B.p. 255-60°.  $D^{19}$  1.1442.

*N-Acetyl*: 5-bromo-*m*-acet-toluidide. M.p. 171-2°.

Wroblewsky, *Ann.*, 1878, 192, 203.

Nevile, Winther, *Ber.*, 1880, 13, 964.

6-Bromo-m-toluidine.

M.p. 81°. B.p. 240°.

*N-Acetyl*: 6-bromo-*m*-acet-toluidide. Needles. M.p. 103-4°.  $KMnO_4 \rightarrow$  6-bromo-3-acetylamino benzoic acid.

*N-Di-Me*: m.p. 55°. B.p. 146-8°/17 mm.

Bamberger, *Ber.*, 1924, 57, 2088.

v. Braun, Kruber, *Ber.*, 1913, 46, 3468.

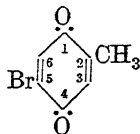
2-Bromo-*p*-toluidine $C_7H_8NBr$ 

MW, 186

M.p. 25–6°. B.p. 254–7°.

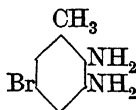
*N*-Acetyl: 2-bromo-*p*-acet-toluidide. $C_9H_{10}ONBr$ . MW, 228. M.p. 113°.*N*-Benzoyl: m.p. 132°.Hafner, *Ber.*, 1889, 22, 2903.Blanksma, *Chem. Zentr.*, 1910, I, 261.Higginbottom, Hill, Short, *J. Chem. Soc.*, 1937, 264.3-Bromo-*p*-toluidine.Leaflets. M.p. 26°. B.p. 240°, 120–2°/30 mm., 92–4°/3 mm.  $D^{20} 1.51$ . Volatile in steam.*B*, *HCl*: m.p. 221°.*B*,  $HNO_3$ : m.p. 182°.*N*-Acetyl: 3-bromo-*p*-acet-toluidide.

M.p. 117–8°.

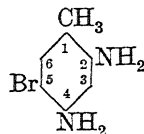
*N*-Benzoyl: m.p. 148–9°.*N*-*Di*-*Me*: b.p. 244°.Johnson, Sandborn, *Organic Syntheses*, Collective Vol. I, 106.5-Bromotoluquinone (5-Bromo-2-methyl-*p*-benzoquinone) $C_7H_5O_2Br$ 

MW, 201

Yellow leaflets. M.p. 105–6°.

*Monoxime*: two forms. (1) Decomp. at 186°. *Acetyl deriv.*: m.p. 166–7°. (2) Decomp. at 178–80°. *Acetyl deriv.*: m.p. 131–2°.Kehrmann, *Ann.*, 1898, 303, 24.6-Bromotoluquinone (6-Bromo-2-methyl-*p*-benzoquinone).Yellow prisms. M.p. 94–5°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Spar. sol. H<sub>2</sub>O. Sublimes.*Monoxime*: *acetyl deriv.*, m.p. 74°.Kehrmann, *Ber.*, 1915, 48, 2021.5-Bromo-2:3-tolylenediamine (5-Bromo-*o*-tolylenediamine, 5-bromo-2:3-diaminotoluene) $C_7H_9N_2Br$ 

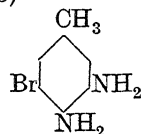
MW, 201

Needles. M.p. 59°. Sol. H<sub>2</sub>O, EtOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.Hübner, Schüpphaus, *Ber.*, 1884, 17, 776.5-Bromo-2:4-tolylenediamine (5-Bromo-*m*-tolylenediamine, 5-bromo-2:4-diaminotoluene) $C_7H_9N_2Br$ 

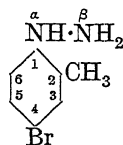
MW, 201

M.p. 104–7° decomp. Sol. EtOH, Et<sub>2</sub>O, CS<sub>2</sub>. Spar. sol. H<sub>2</sub>O.2:4-*N*-Diacetyl: needles. M.p. above 240°.2:4-*N*-Dibenzoyl: needles from EtOH. M.p. 214°.Morgan, Clayton, *J. Chem. Soc.*, 1905, 87, 949.

## 5-Bromo-3:4-tolylenediamine (5-Bromo-3:4-diaminotoluene)

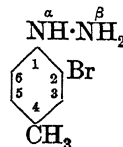
 $C_7H_9N_2Br$ 

MW, 201

Needles. M.p. 82°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O. Insol. ligroin.3:4-*N*-Diacetyl: needles from H<sub>2</sub>O. M.p. 222–3°.3:4-*N*-Dibenzoyl: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 244°.Bistrzycki, *Ber.*, 1890, 23, 1045.4-Bromo-*o*-tolylhydrazine $C_7H_9N_2Br$ 

MW, 201

Prisms. M.p. 104°. Sol. EtOH. Spar. sol. ligroin.

*B*, *HCl*: pearly leaflets. M.p. 183–4°. $\beta$ -*N*-Acetyl: m.p. 172°. $\beta$ -*N*-Benzoyl: needles from EtOH. M.p. 172–3°. $\beta$ -*N*-*o*-Nitrobenzoyl: m.p. 179°. $\beta$ -*N*-*p*-Nitrobenzoyl: m.p. 199° decomp.Chattaway, Hodgson, *J. Chem. Soc.*, 1916, 109, 582.2-Bromo-*p*-tolylhydrazine $C_7H_9N_2Br$ 

MW, 201

Needles. M.p. 94°.

*B, HCl*: m.p. 190° decomp.

*B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>*: m.p. 201°.

*β-N-Acetyl*: prisms. M.p. 130-1°.

*β-N-Benzoyl*: prisms. M.p. 144°.

*β-N-o-Nitrobenzoyl*: m.p. 177°.

*β-N-m-Nitrobenzoyl*: m.p. 171°.

*β-N-p-Nitrobenzoyl*: m.p. 159-60°.

Chattaway, Hodgson, *J. Chem. Soc.*, 1916,  
109, 582.

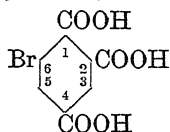
#### 4-Bromo-1 : 2 : 3-trihydroxyanthraquin- one.

See 4-Bromoanthragallol.

#### 3-Bromo-1 : 2 : 4-trihydroxyanthraquin- one.

See 3-Bromopurpurin.

#### 6-Bromotrimellitic Acid (*Bromobenzene- 2 : 3 : 5-tricarboxylic acid*)



$C_9H_5O_6Br$  MW, 289

M.p. 237°. Solidifies and re-melts at 200°. Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O. Prac. insol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

*2 : 4-Di-Me ester*: C<sub>11</sub>H<sub>9</sub>O<sub>6</sub>Br. MW, 317. Needles from H<sub>2</sub>O. M.p. 130-1°.

*Tri-Me ester*: C<sub>13</sub>H<sub>11</sub>O<sub>6</sub>Br. MW, 331. Needles from MeOH. M.p. 110°. Sol. Me<sub>2</sub>CO, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

Zincke, Francke, *Ann.*, 1896, 293, 149.

#### Bromotrimethylbenzene.

See Bromo-*ψ*-cumene and Bromomesitylene.

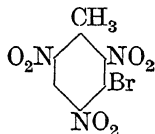
#### Bromotrimethylene Glycol.

See under Glycerol.

#### 2-Bromo-1 : 3 : 5-trinitrobenzene.

See Picryl bromide.

#### 3-Bromo-2 : 4 : 6-trinitrotoluene



$C_7H_4O_6N_3Br$  MW, 306

Needles from EtOH. M.p. 143° (144-4.5°, 145-5.5°). Spar. sol. EtOH. Insol. ligroin.

Bentley, Warren, *Am. Chem. J.*, 1890,  
12, 4.

Körner, Contardi, *Gazz. chim. ital.*, 1917,  
47, i, 230.

#### *α*-Bromotriphenylmethane.

See Triphenylmethyl bromide.

#### 1-Bromo-*n*-valeric Acid

$CH_3 \cdot CH_2 \cdot CH_2 \cdot CHBr \cdot COOH$   
 $C_5H_9O_2Br$  MW, 181

B.p. 109.5-110.5°/6.5 mm.

*Et ester*: C<sub>7</sub>H<sub>13</sub>O<sub>2</sub>Br. MW, 209. B.p. 190-2°,  
84-6°/16 mm. *D*<sub>4</sub><sup>25</sup> 1.226.

Justin, *Ber.*, 1884, 17, 2504.

Slimmer, *Ber.*, 1902, 35, 404.

Favorskii, Moknach, *Chem. Abstracts*,  
1936, 30, 3405.

#### 2-Bromo-*n*-valeric Acid

$CH_3 \cdot CH_2 \cdot CHBr \cdot CH_2 \cdot COOH$   
 $C_5H_9O_2Br$  MW, 181  
*d*l-.

Prisms. M.p. 60°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, CS<sub>2</sub>. Spar. sol. C<sub>6</sub>H<sub>6</sub>, ligroin. Insol. cold H<sub>2</sub>O.

*d*l-.

M.p. 30°. B.p. 117-9°/10 mm. [*α*]<sub>D</sub><sup>20</sup> +11.0°  
in 35% EtOH.

*Et ester*: C<sub>7</sub>H<sub>13</sub>O<sub>2</sub>Br. MW, 209. B.p. 74-  
76°/10 mm. [*α*]<sub>D</sub><sup>20</sup> +10.8° in Et<sub>2</sub>O.

Levene, Mori, *J. Biol. Chem.*, 1928, 78, 1.  
Fittig, Spenser, *Ann.*, 1894, 283, 73.

#### 3-Bromo-*n*-valeric Acid

$CH_3 \cdot CHBr \cdot CH_2 \cdot CH_2 \cdot COOH$   
 $C_5H_9O_2Br$  MW, 181  
M.p. 21°.

*Et ester*: C<sub>7</sub>H<sub>13</sub>O<sub>2</sub>Br. MW, 209. B.p. 89-  
91°/12 mm., 52-4°/2 mm. *D*<sub>25</sub><sup>25</sup> 1.2330. *n*<sub>D</sub><sup>25</sup>  
1.4497.

*Chloride*: C<sub>5</sub>H<sub>8</sub>OClBr. MW, 199.5. B.p.  
79-80°/11 mm.

*Anhydride*: C<sub>10</sub>H<sub>16</sub>O<sub>3</sub>Br<sub>2</sub>. MW, 344. B.p.  
189-90°/13 mm.

Wohlgemuth, *Compt. rend.*, 1914, 158,  
1577.

Kharasch, McNab, *Chemistry and Indus-  
try*, 1935, 989.

#### 4-Bromo-*n*-valeric Acid

$BrCH_2 \cdot CH_2 \cdot CH_2 \cdot CH_2 \cdot COOH$   
 $C_5H_9O_2Br$  MW, 181

Prisms from pet. ether. *k* = 1.91 × 10<sup>-5</sup> at  
25°. M.p. 40°. B.p. 142-5°/13 mm.

*Me ester*: C<sub>6</sub>H<sub>11</sub>O<sub>2</sub>Br. MW, 195. B.p.  
101.5°/14 mm., 75-80°/4 mm.

*Et ester*: C<sub>7</sub>H<sub>13</sub>O<sub>2</sub>Br. MW, 209. B.p. 94-  
7°/7 mm. *D*<sub>24</sub><sup>24</sup> 1.3191. *n*<sub>D</sub><sup>24</sup> 1.4580.

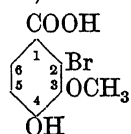
*Chloride*: C<sub>5</sub>H<sub>8</sub>OClBr. MW, 199.5. B.p.  
102-4°/15 mm. *D*<sub>4</sub><sup>17</sup> 1.5010. *n*<sub>D</sub><sup>20</sup> 1.4879.

Merchant, Wickert, Marvel, *J. Am. Chem.  
Soc.*, 1927, 49, 1828.

Kharasch, McNab, *Chemistry and Indus-  
try*, 1935, 989.

Linstead, Rydon, *ibid.*, 1009.

#### 2-Bromovanillic Acid (*2-Bromo-4-hydroxy- 3-methoxybenzoic acid*)



$C_8H_7O_4Br$  MW, 247

Needles from  $H_2O$ . M.p. 163–4°.  
*Nitrile*:  $C_8H_6O_2NBr$ . MW, 228. *O-Acetyl*:  
 needles from  $EtOH.Aq.$  M.p. 71–2°.

4-*Me ether*: see 2-Bromoveratric Acid.

Raiford, Potter, *J. Am. Chem. Soc.*, 1933,  
 55, 1684.

### 5-Bromovanillic Acid.

Needles from  $EtOH$ . M.p. 231–2° (236°).  
*Nitrile*: needles from  $EtOH$ . M.p. 144°.  
*O-Acetyl*: cryst. from  $EtOH$ . M.p. 110–11°.

4-*Me ether*: see 5-Bromoveratric Acid.

Raiford, Potter, *J. Am. Chem. Soc.*, 1933,  
 55, 1684.

Brady, Dunn, *J. Chem. Soc.*, 1915, 107,  
 1859.

### 6-Bromovanillic Acid.

Cryst. from  $EtOH.Aq.$  M.p. 190–1°. Very  
 sol.  $EtOH$ ,  $Et_2O$ . Sol.  $H_2O$ .  
*Nitrile*: *O-Acetyl*: cryst. from  $EtOH$ . M.p.  
 148–9°.

*O-Acetyl*: prisms from  $H_2O$  or  $EtOH.Aq.$   
 M.p. 165–7°. Sol.  $EtOH$ ,  $Et_2O$ . Spar. sol.  
 $H_2O$ .

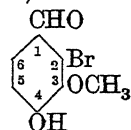
4-*Me ether*: see 6-Bromoveratric Acid.

Raiford, Stoesser, *J. Am. Chem. Soc.*,  
 1928, 50, 2559.

### 5-Bromo-o-vanillin.

See under 5-Bromo-2:3-dihydroxybenzaldehyde.

**2-Bromovanillin** (2-Bromo-4-hydroxy-3-methoxybenzaldehyde)



$C_8H_7O_3Br$  MW, 231  
 Needles. M.p. 154–5°.

*Semicarbazone*: m.p. 216–7°.

*p-Bromophenylhydrazone*: brown needles from  
 $EtOH.Aq.$  M.p. 157°.

*Me ether*: see 2-Bromoveratric Aldehyde.

Raiford, Stoesser, *J. Am. Chem. Soc.*,  
 1927, 49, 1077.

### 5-Bromovanillin.

Colourless cryst. M.p. 164°. Sol. hot  $EtOH$ .  
 Spar. sol. cold  $EtOH$ ,  $Et_2O$ ,  $C_6H_6$ . Insol.  $H_2O$ .  
 Turns yellow on standing.

*Acetyl*: m.p. 84°.

*Oxime*: m.p. 179°.

*Semicarbazone*: m.p. 185–6°.

*Phenylhydrazone*: m.p. 117°.

*p-Bromophenylhydrazone*: needles from  
 $AcOH.Aq.$  M.p. 153°.

*Me ether*: see 5-Bromoveratric Aldehyde.

Dakin, *Am. Chem. J.*, 1909, 42, 493.

Raiford, Hilman, *J. Am. Chem. Soc.*, 1927,  
 49, 1571.

Henry, Sharp, *J. Chem. Soc.*, 1930, 2288.

### 6-Bromovanillin.

Needles. M.p. 178°.

*Oxime*: m.p. 158–9°.

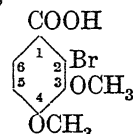
*Semicarbazone*: m.p. 231–2°.

*p-Bromophenylhydrazone*: needles from  $AcOH$ .  
 M.p. 176°.

*Me ether*: see 6-Bromoveratric Aldehyde.

Raiford, Stoesser, *J. Am. Chem. Soc.*,  
 1927, 49, 1077.

**2-Bromoveratric Acid** (2-Bromo-3:4-dimethoxybenzoic acid)



$C_9H_9O_4Br$  MW, 261

Needles from  $EtOH$ . M.p. 203–4° (205–6°,  
 206–8°). Sublimes slowly in vacuo at 120°.

*Me ester*:  $C_{10}H_{11}O_4Br$ . MW, 275. Needles  
 from pet. ether. M.p. 46°. Sol.  $EtOH$ . Spar.  
 sol. cold ligroin. Decomp. in  $Et_2O$ ,  $C_6H_6$ .

*Amide*: m.p. 197–8°.

Lock, *Monatsh.*, 1934, 64, 347.

Henry, Sharp, *J. Chem. Soc.*, 1930, 2285.

### 5-Bromoveratric Acid.

Needles from  $MeOH$  or  $AcOH$ . M.p. 191°  
 (192–3°). Sol.  $Et_2O$ ,  $CHCl_3$ ,  $Me_2CO$ . Spar. sol.  
 pet. ether.

*Me ester*: prisms from pet. ether. M.p.  
 71–2°. Sol.  $MeOH$ . Mod. sol. hot pet. ether.

*Et ester*: m.p. 50–1°.

*Amide*: yellow plates from  $C_6H_6$ . M.p. 157–  
 7·5°.

Zincke, Franke, *Ann.*, 1896, 293, 182.

Dakin, *Am. Chem. J.*, 1909, 42, 493.

Simonsen, Rau, *J. Chem. Soc.*, 1918, 113,  
 789.

### 6-Bromoveratric Acid.

Needles from  $H_2O$  or  $EtOH$ . M.p. 186°  
 (186–7°). Sol.  $EtOH$ ,  $Et_2O$ ,  $CHCl_3$ , hot  $C_6H_6$ .  
 Insol.  $H_2O$ , pet. ether.

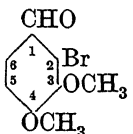
*Me ester*: m.p. 86–8°.

*Nitrile*:  $C_9H_8O_2NBr$ . MW, 242. Cryst. from  
 $MeOH$ . M.p. 118–19°.

Zincke, Francke, *Ann.*, 1896, 293, 186.

Pschorr, *Ann.*, 1912, 391, 33.

**2-Bromoveratric Aldehyde** (2-Bromo-3:4-dimethoxybenzaldehyde)



$C_9H_9O_3Br$  MW, 245

Needles from 50%  $EtOH$ . M.p. 86° (80°,  
 84–5°). Sublimes slowly at 70° in vacuo.

Lock, *Monatsh.*, 1934, 64, 346.

Henry, Sharp, *J. Chem. Soc.*, 1930, 2285.

**5-Bromoveratric Aldehyde.**

Needles from pet. ether, or 80% EtOH. M.p. 65–6°.

*syn-Oxime*: pale yellow. M.p. 199° (194°).  
*Acetyl deriv.*: m.p. 73°.

*anti-Oxime*: needles from EtOH.Aq. M.p. 83°.  
*Acetyl deriv.*: cryst. from EtOH.Aq. M.p. 77°.

*Semicarbazone*: needles. M.p. 202–3°.

Dakin, *Am. Chem. J.*, 1909, 42, 494.

Jones, Robinson, *J. Chem. Soc.*, 1912, 111, 921.

Pschorr, *Ann.*, 1912, 391, 30.

**6-Bromoveratric Aldehyde.**

Needles from MeOH.Aq. M.p. 149–51° (147°).  
*Oxime*: yellow. M.p. 167–8° (105°). *Acetyl deriv.*: m.p. 140°.

*Semicarbazone*: m.p. 241–3°.

2:4-Dinitrophenylhydrazone: m.p. 268–70°.

Rilliet, *Helv. Chim. Acta*, 1922, 5, 550.

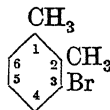
Pschorr, *Ann.*, 1912, 391, 32.

**Bromoveratrol.**

See under Bromocatechol.

 **$\omega$ -Bromoxylene.**

See Xylyl bromide.

**3-Bromo-*o*-xylene**

$C_8H_9Br$

MW, 185

B.p. 211–12°.  $D_4^{20}$  1.365.

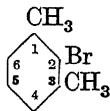
Auwers, *Ann.*, 1919, 419, 116.

**4-Bromo-*o*-xylene.**

M.p. –0.2°. B.p. 214.5°.  $D_{15}^{15}$  1.3693.

Datta, Chatterjee, *J. Am. Chem. Soc.*, 1916, 38, 2549.

Jacobsen, *Ber.*, 1884, 17, 2372.

**2-Bromo-*m*-xylene**

$C_8H_9Br$

MW, 185

B.p. 206°.

Jacobsen, Deike, *Ber.*, 1887, 20, 904.

**4-Bromo-*m*-xylene.**

B.p. 205°, 84°/13 mm.  $CrO_3 \rightarrow$  6-bromo-*m*-toluic acid.

Grignard, Bellet, Courtot, *Ann. chim.*, 1915, 4, 28.

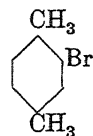
Datta, Chatterjee, *J. Am. Chem. Soc.*, 1916, 38, 2550.

Maxwell, Adams, *J. Am. Chem. Soc.*, 1930, 52, 2962.

**5-Bromo-*m*-xylene.**

B.p. 204°.  $D^{20}$  1.362.

Fischer, Windaus, *Ber.*, 1900, 33, 1973.

**2-Bromo-*p*-xylene**

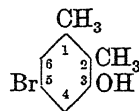
$C_8H_9Br$

MW, 185

Leaflets. M.p. 9°. B.p. 199–200°.

Datta, Chatterjee, *J. Am. Chem. Soc.*, 1916, 38, 2550.

Jannasch, *Ber.*, 1884, 17, 2710.

**5-Bromo-*o*-3-xyleneol (5-Bromo-3-hydroxy-*o*-xylene)**

$C_8H_9OBr$

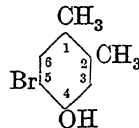
MW, 201

Needles from pet. ether. M.p. 84°.

*Benzoyl*: plates. M.p. 98°.

*o*-Nitrobenzoyl: m.p. 128°.

Crossley, *J. Chem. Soc.*, 1913, 103, 2179.

**5-Bromo-*o*-4-xyleneol (5-Bromo-4-hydroxy-*o*-xylene)**

$C_8H_9OBr$

MW, 201

Cryst. from pet. ether. M.p. 80°. Sol. most ord. org. solvents.

*Benzoyl*: plates. M.p. 51°.

*o*-Nitrobenzoyl: m.p. 151–2°.

Crossley, Bartlett, *J. Chem. Soc.*, 1913, 103, 1297.

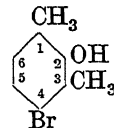
**6-Bromo-*o*-4-xyleneol (6-Bromo-4-hydroxy-*o*-xylene).**

Cryst. from ligroin. M.p. 103°. Sol. EtOH,  $CHCl_3$ ,  $Me_2CO$ . Mod. sol.  $C_6H_6$ .

*Benzoyl*: plates. M.p. 85°.

*o*-Nitrobenzoyl: m.p. 132°.

Crossley, Bartlett, *J. Chem. Soc.*, 1913, 103, 1297.

**4-Bromo-*m*-2-xyleneol (4-Bromo-2-hydroxy-*m*-xylene)**

$C_8H_9OBr$

MW, 201

Needles from ligroin. M.p. 60–1°. Sol. EtOH,  $Et_2O$ , AcOH,  $C_6H_6$ .

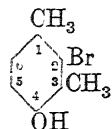
Auwers, Markovits, *Ber.*, 1908, 41, 2338.

5-Bromo-*m*-2-xylenol (5-Bromo-2-hydroxy-*m*-xylene).

Silky needles. M.p. 79.5°. Sol. EtOH, Et<sub>2</sub>O, AcOH, C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>.

Auwers, Markovits, *Ber.*, 1908, 41, 2338.

2-Bromo-*m*-4-xylenol (2-Bromo-4-hydroxy-*m*-xylene)



C<sub>8</sub>H<sub>9</sub>OBr MW, 201

Pale yellow needles. M.p. 68°.

Nölting, Braun, Thesmar, *Ber.*, 1901, 34, 2255.

5-Bromo-*m*-4-xylenol (5-Bromo-4-hydroxy-*m*-xylene).

M.p. 8-9°. B.p. 231°, 112°/20 mm. 105-6°/14 mm. D<sub>4</sub><sup>16</sup> 1.4392. n<sub>D</sub><sup>18</sup> 1.5642.

*Me ether*: C<sub>9</sub>H<sub>11</sub>OBr. MW, 215. B.p. 232°.

*Et ether*: C<sub>10</sub>H<sub>13</sub>OBr. MW, 229. B.p. 246°.

*Acetyl*: b.p. 257-8°. D<sub>4</sub><sup>25</sup> 1.3684. n<sub>D</sub><sup>25</sup> 1.5312.

*Benzoyl*: m.p. 54°. B.p. 216°/15 mm.

Wheeler, Thomas, *J. Am. Chem. Soc.*, 1928, 50, 2286.

Palfray, Duboc, *Compt. rend.*, 1927, 185, 1479.

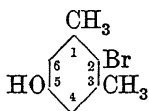
6-Bromo-*m*-4-xylenol (6-Bromo-4-hydroxy-*m*-xylene).

Needles. M.p. 76°. FeCl<sub>3</sub> → olive-green col.

Nölting, Braun, Thesmar, *Ber.*, 1901, 34, 2254.

Bamberger, Reber, *Ber.*, 1913, 46, 810.

2-Bromo-*m*-5-xylenol (2-Bromo-5-hydroxy-*m*-xylene)



C<sub>8</sub>H<sub>9</sub>OBr MW, 201

Cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 116°. Volatile in steam.

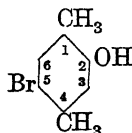
Auwers, *Ber.*, 1921, 54, 1310.

4-Bromo-*m*-5-xylenol (4-Bromo-5-hydroxy-*m*-xylene).

Prisms from pet. ether. M.p. 54°. B.p. 126°/33 mm.

Auwers, *Ber.*, 1921, 54, 1310.

5-Bromo-*p*-2-xylenol (5-Bromo-2-hydroxy-*p*-xylene)

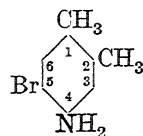


C<sub>8</sub>H<sub>9</sub>OBr MW, 201

Needles. M.p. 87°.

Auwers, Ercklentz, *Ann.*, 1898, 302, 113.

5-Bromo-*o*-4-xylylidine (5-Bromo-4-amino-*o*-xylene)



C<sub>8</sub>H<sub>10</sub>NBr MW, 200

Cryst. from pet. ether. M.p. 84.5°.

*N-Acetyl*: cryst. from H<sub>2</sub>O. M.p. 164°.

Mills, Nixon, *J. Chem. Soc.*, 1930, 2524.

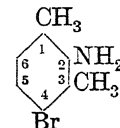
6-Bromo-*o*-4-xylylidine (6-Bromo-4-amino-*o*-xylene).

Silky needles from dil. EtOH. M.p. 82°. Sol. most ord. org. solvents except pet. ether.

*N-Acetyl*: m.p. 205-6°.

Crossley, Bartlett, *J. Chem. Soc.*, 1913, 103, 1297.

4-Bromo-*m*-2-xylylidine (4-Bromo-2-amino-*m*-xylene)



C<sub>8</sub>H<sub>10</sub>NBr MW, 200

Needles. M.p. 21.5°. B.p. 146-7°/15 mm.

*N-Acetyl*: m.p. 136°.

Nölting, Braun, Thesmar, *Ber.*, 1901, 34, 2259.

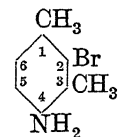
5-Bromo-*m*-2-xylylidine (5-Bromo-2-amino-*m*-xylene).

Prisms from ligroin. M.p. 49-50°.

*N-Acetyl*: m.p. 197°.

Nölting, Braun, Thesmar, *Ber.*, 1901, 34, 2259.

2-Bromo-*m*-4-xylylidine (2-Bromo-4-amino-*m*-xylene)



C<sub>8</sub>H<sub>10</sub>NBr MW, 200

Silky needles. M.p. 47-8°.

*N-Acetyl*: m.p. 151-2°.

Nölting, Braun, Thesmar, *Ber.*, 1901, 34, 2254.

5-Bromo-*m*-4-xylylidine (5-Bromo-4-amino-*m*-xylene).

M.p. 49-50°.

*N-Acetyl*: m.p. 196-7°.

*N-Benzoyl*: m.p. 186°.

*Picrate*: m.p. 122°.

Wheeler, Thomas, *J. Am. Chem. Soc.*, 1928, 50, 2286.

Bureš, Borgmannová, *Chem. Abstracts*, 1928, 22, 4503.

**6-Bromo-*m*-4-xylylidine** (6-Bromo-4-amino-*m*-xylene).

M.p. 99–100°.

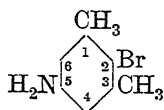
*N*-Acetyl: m.p. 168–9°.

*N*-Diacyl: plates. M.p. 70°.

Bamberger, Reber, *Ber.*, 1913, 46, 812.

Fries, *Ann.*, 1906, 346, 167.

**2-Bromo-*m*-5-xylylidine** (2-Bromo-5-amino-*m*-xylene)



$C_8H_{10}NBr$  MW, 200

M.p. 66–7°.

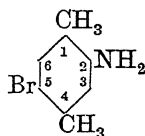
I.G., F.P., 663,683, (*Chem. Abstracts*, 1930, 24, 730).

**4-Bromo-*m*-5-xylylidine** (4-Bromo-5-amino-*m*-xylene).

M.p. 27–8°. B.p. 261–3°.

I.G., F.P. 663,683 (*Chem. Abstracts*, 1930, 24, 730).

**5-Bromo-*p*-2-xylylidine** (2-Bromo-5-amino-*p*-xylene)



$C_8H_{10}NBr$  MW, 200

Needles from ligroin. M.p. 96°. Sol.

EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*B*,*H*Br: needles. M.p. 255° (decomp.).

*N*-Formyl: m.p. 150°.

*N*-Acetyl: needles from EtOH. M.p. 187°.

Wheeler, Constable, *J. Am. Chem. Soc.*, 1923, 45, 1999.

du Pont, B.P. 414,667, (*Chem. Abstracts*, 1935, 29, 475).

**Bromsalizol.**

See 5-Bromosaligenin.

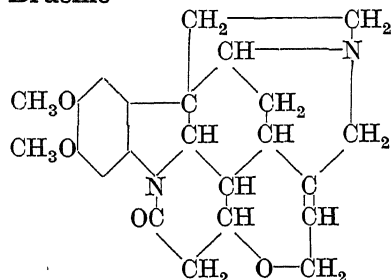
**Bromural.**

See 1-Bromoisovalerylurea.

**Bröner Acid.**

See 2-Naphthylamine-6-sulphonic Acid.

**Brucine**



$C_{23}H_{26}O_4N_2$  MW, 394

Alkaloid in *Strychnos nux-vomica*, Linn., *Ignatia amara*, Linn., *Strychnos ligustrina*, Blume,

*S. Rheedei*, Clarke, *S. aculeata*, Solered. White prisms + 4H<sub>2</sub>O. M.p. 105°, anhyd. 178°. [ $\alpha$ ]<sub>D</sub><sup>20</sup> – 149.5°, [ $\alpha$ ]<sub>D</sub><sup>19.5</sup> – 120.5° ( $c = 1$  in dry CHCl<sub>3</sub>). Sol. to 0.1% in H<sub>2</sub>O, 45% in EtOH at 25°, 0.75% in Et<sub>2</sub>O, 11.6% in CHCl<sub>3</sub> at 25°. HNO<sub>3</sub> → deep red col., addition of SnCl<sub>2</sub> → violet col.  $k$  (first) = 7.2 × 10<sup>-4</sup> at 15°, (second) = 2.5 × 10<sup>-11</sup> at 15°.

*B*, HNO<sub>3</sub>, 2H<sub>2</sub>O: m.p. 230° decomp. Sol. H<sub>2</sub>O, EtOH.

Menon, Perkin, Robinson, *J. Chem. Soc.*, 1930, 833.

Späth, Bretschneider, *Ber.*, 1930, 63, 3005.

Leuchs, Kröhnke, *Ber.*, 1931, 64, 455.

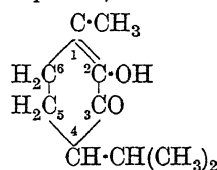
Leuchs, *Ber.*, 1932, 65, 1230.

Robinson, *Ann. Rev. Biochem.*, 1935, 4, 512.

Woodward, *J. Am. Chem. Soc.*, 1948, 70, 2107.

Kaesar, *J. Chem. Soc.*, 1950, 2098.

**Buchu-camphor** (*Buccocamphor*,  $\Delta^1$ -*p*-menthenol-2-one-3, *diosphenol*)



$C_{10}H_{16}O_2$  MW, 168

From the oil of buchu (*Barosma*) leaves. M.p. 83–4°. B.p. 233° decomp., 110°/10 mm. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, CS<sub>2</sub>. Mod. sol. EtOH. Spar. sol. H<sub>2</sub>O. Sublimes. Optically inactive. Reduces Fehling's and NH<sub>3</sub>. AgNO<sub>3</sub>. FeCl<sub>3</sub> → green col.

*Oxime*: m.p. 125°.

*Dioxime*: m.p. 197°.

*Me ether*: C<sub>11</sub>H<sub>18</sub>O<sub>2</sub>. MW, 182. B.p. 232–5°.

*Et ether*: C<sub>12</sub>H<sub>20</sub>O<sub>2</sub>. MW, 196. B.p. 270–2°.

*Acetyl deriv.*: b.p. 138–43°/13 mm.

Wallach, *Chem. Zentr.*, 1924, I, 1774.

**Bufagin**

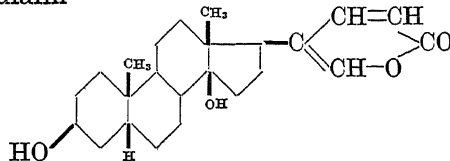
$C_{24}H_{32}O_5$  MW, 400

Constituent of *Ch'an Su* (Senso) and other toad poisons. M.p. 212–13°. H<sub>2</sub> → tetrahydrobufagin. NaOH → bufaginic acid + H·COOH.

*Monacetyl deriv.*: m.p. 203–4°.

Jensen, Evans, *J. Biol. Chem.*, 1934, 104, 307.

**Bufalin**



Probable structure

$C_{24}H_{34}O_4$  MW, 386

Occurs in the poisonous matter of *Bufo japonicus* and other toads. M.p. 235-6° (from AcOEt). Conc. HCl → anhydrobufalin.

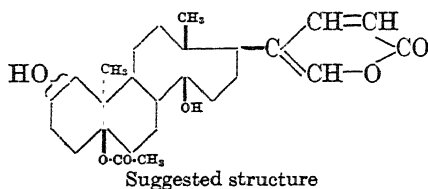
*Monoacetyl deriv.*: m.p. 229-31°.

Kotake, Kuwada, *Chem. Abstracts*, 1939, 33, 7304; 1947, 41, 6296.

Kuwada, *J. Chem. Soc. Japan*, 1939, 60, 335.

Meyer, *Experientia*, 1948, 4, 385; *Helv. Chim. Acta*, 1949, 32, 1238.

**Bufotalin**



$C_{26}H_{36}O_6$  MW, 444

Present in poisonous secretion of toads (*Bufo vulgaris*). Cryst. + 1EtOH from EtOH. M.p. 223° decomp. (sinters at 150°). Absorption max. at 300  $\mu$ .

Wieland, Hesse, Hüttel, *Ann.*, 1936, 524, 211.

Wieland, Behringer, *Ann.*, 1941, 549, 209.

Fieser, Fieser, *Natural Products Related to Phenanthrene*, 3rd Ed., (Reinhold Publishing Corporation, New York), 565.

**Bufotalinin**

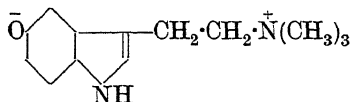
$C_{24}H_{30}O_6$  MW, 414

Constituent of poisonous secretion of toads (*Bufo vulgaris*). Cryst. from AcOEt or  $C_6H_6$ . Decomp. above 100°. Very sol.  $CHCl_3$ . Spar. sol. other org. solvents.  $[\alpha]_D^{25} + 14.14^\circ$ . Reduces Tollen's reagent in Py.

*Monoacetyl*: cryst. from EtOH. M.p. 247°.

Wieland, Hesse, Hüttel, *Ann.*, 1936, 524, 217.

**Bufotenidine**



$C_{13}H_{18}ON_2$  MW, 218

Present in *Ch'an Su* and other toad poisons. Amorph.

*B.HI*: m.p. 209° (from MeOH).

*Picrate*: bright red needles. M.p. 198°.

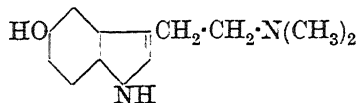
*Picrolonate*: yellow. M.p. 120-1°.

*Flavianate*: red prisms. Decomp. above 198°.

Wieland, Konz, Mittasch, *Ann.*, 1934, 513, 1.

Jensen, *J. Biol. Chem.*, 1936, 116, 87.

**Bufotenine**



$C_{12}H_{16}ON_2$  MW, 204

Constituent of poisonous secretion of toads (*Bufo vulgaris*). Prisms from  $Me_2CO-Et_2O$ . M.p. 146-7°. B.p. 320°/0.1 mm. Very sol. MeOH, EtOH. Mod. sol.  $Me_2CO$ . Spar. sol.  $Et_2O$ . Insol.  $H_2O$ . Sol. dil. acids and alkalis.  $FeCl_3 \rightarrow$  bluish-green col.

*Oxalate*: needles + 1 $H_2O$  from  $Et_2O$ . M.p. 96-5°.

*Dipicrate*: red prisms from MeOH. M.p. 177-8°.

*Picrolonate*: yellow. M.p. 120-1°.

*Methiodide*: prisms from MeOH. M.p. 210°.

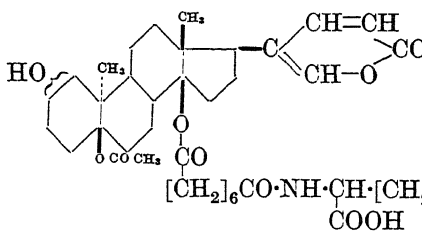
*Me ether*:  $C_{13}H_{18}ON_2$ . MW, 218. M.p. 66-7°. B.p. 208-10°/4 mm. *Picrate*: m.p. 176-7°.

*Et ether*:  $C_{14}H_{20}ON_2$ . MW, 232. B.p. 230-2°/5 mm. *Monopicrate*: yellow prisms from MeOH. M.p. 144-5°. *Dipicrate*: red needles. M.p. 124-5°.

Wieland, Konz, Mittasch, *Ann.*, 1934, 513, 10.

Hoshino, Shimodaira, *Ann.*, 1935, 520, 28; *Bull. Chem. Soc. Japan*, 1936, 11, 221.

**Bufotoxin**



$C_{40}H_{60}O_{10}N_4$  MW, 756

Constituent of poisonous secretion of toads (*Bufo vulgaris*). Needles + 1EtOH from EtOH.Aq. In air → monohydrate. M.p. 204-5° decomp. Sol. MeOH, Py. Spar. sol. EtOH. Insol.  $Et_2O$ ,  $Me_2CO$ , AcOEt,  $CHCl_3$ , pet. ether.  $[\alpha]_D^{24} + 3.9^\circ$ ,  $[\alpha]_D^{25} + 3.6^\circ$  in MeOH. Absorption max. at 300  $\mu$ .

Wieland, Alles, *Ber.*, 1922, 55, 1793.

Wieland *et al.*, *Ann.*, 1941, 549, 209.

Fieser, Fieser, *Natural Products Related to Phenanthrene*, 3rd Ed., (Reinhold Publishing Corporation, New York), 568.

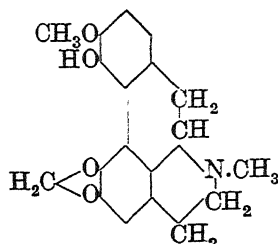
**Bufovarín.**

Poison of the toad ovary. M.p. 146°. Sol. most org. solvents. Very spar. sol.  $H_2O$ .

Mineshita, *Journal of Oriental Medicine*, 1937, 27, 125.



## Bulbocapnine

 $C_{19}H_{19}O_4N$ 

MW, 325

From root of *Bulbocapnos cavus*, Bernh. Prisms from EtOH. M.p. 199°. Sol.  $CHCl_3$ .

*d*-Me ether:  $C_{20}H_{21}O_4N$ . MW, 339. Yellow cryst. from  $Et_2O$ . M.p. 135°. *B,HI*: m.p. 250° decomp. *Methiodide*: m.p. 243°. *Picrate*: m.p. 213–14° decomp.

*d*-Me ether: cryst. from pet. ether. M.p. 128–9°.  $[\alpha]_D^{20} + 259.5^\circ$ .

Gulland, Haworth, *J. Chem. Soc.*, 1928, 1132.

Späth, Hromatka, *Ber.*, 1928, 61, 1334.

## Bulnesol

 $C_{15}H_{26}O$ 

MW, 222

Sesquiterpene alcohol present in oil of guaiacwood and *Bulnesia sarmienti*. M.p. 69–70°. B.p. 136–8°/4 mm.  $D_4^{20}$  0.9389.  $n_D^{20}$  1.48915.  $H/Pd \rightarrow$  dihydrobulnesol.  $H/Zn \rightarrow$  bulnesene.

Wienhaus, Scholz, *Chem. Abstracts*, 1930, 24, 1933.

Guenther, *American Perfumer*, 1944, 46, No. 3, 44.

## Buphanitine

 $C_{23}H_{24}O_6N_2$ 

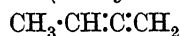
MW, 424

Obtained from *Buphane disticha*, Herb. Prisms from EtOH. M.p. 240°. Sol.  $CHCl_3$ , AcOEt. Mod. sol. hot EtOH, hot  $H_2O$ .

*B,HCl*: m.p. 265–8°.

*Methiodide*: m.p. 278°.

Tutin, *J. Chem. Soc.*, 1911, 99, 1240.

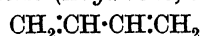
1 : 2-Butadiene (*Methylallene*) $C_4H_6$ 

MW, 54

B.p. 10.3° (17–18°).  $D_4^{20}$  0.676.  $n_D$  1.4205. Readily polymerised by heat. KOH–EtOH at 170°  $\rightarrow$  dimethylacetylene.

Hurd, Meinert, *J. Am. Chem. Soc.*, 1931, 53, 293.

Slobodin, *J. Gen. Chem. U.S.S.R.*, 1935, 5, 48.

1 : 3-Butadiene (*Erythrene, divinyl*) $C_4H_6$ 

MW, 54

Gas. B.p. –2.6°. Heated 10 days at 110–20°  $\rightarrow$  butadiene caoutchouc (synthetic rubber, artificial rubber).

Thiele, *Ann.*, 1899, 308, 337.

Harries, *Ann.*, 1911, 383, 179.

Leyes, B.P. 329,748, (*Chem. Zentr.*, 1930, II, 133).

Ostromysslenski, Kjelbasinski, *Chem. Zentr.*, 1916, I, 875.

I.G., B.P. 307,945, (*Chem. Zentr.*, 1929, II, 217).

I.G., B.P. 291,748, (*Chem. Zentr.*, 1930, I, 1049).

I.G. B.P. 315,595, *ibid.*, 2161.

Goodrich, U.S.P., 2,174,280, (*Chem. Abstracts*, 1940, 34, 780).

Universal Oil Products, U.S.P., 2,178,584, (*Chem. Abstracts*, 1940, 34, 1332).

Williams, Hurd, *J. Org. Chem.*, 1940, 5, 122.

## 1 : 3-Butadiene-1-carboxylic Acid.

See 2-Vinylacrylic Acid.

## 1 : 3-Butadiene-1 : 4-dicarboxylic Acid.

See Muconic Acid.

## Butadiene tetrabromide.

See 1 : 2 : 3 : 4-Tetrabromobutane.

## Butadiene tetrachloride.

See 1 : 2 : 3 : 4-Tetrachlorobutane.

## Butadienylhexane.

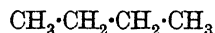
See Heptoprene.

## 1 : 3-Butadi-yne.

See Diacetylene.

## Butanalone.

See Acetoacetaldehyde.

*n*-Butane $C_4H_{10}$ 

MW, 58

Gas at ord. temps. M.p. –135°. B.p. –0.5°.  $D_4^{20}$  0.60 (liq.). 1 vol. of  $H_2O$  diss. 0.15 vol. of gas at 17° and 772 mm. 1 vol. of EtOH diss. 18–13 vols. at 14° and 745 mm.

Coffin, Maass, *J. Am. Chem. Soc.*, 1928, 50, 1427.

Bermejo, Blas, *Chem. Abstracts*, 1930, 24, 4226.

N.-V. de Bataafsche Petroleum Maatschappij, U.S.P., 1,851,607, (*Chem. Abstracts*, 1932, 26, 3093).

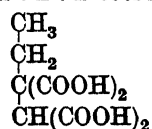
## Butane-dicarboxylic Acids.

See Adipic, 1-Methylglutaric, Propylmalonic, Ethylsuccinic, Methyl ethylmalonic and 1 : 2-Dimethylsuccinic Acids.

## Butane diethyl disulphone.

See Methylsulphonal.

## Butane-1 : 1 : 2 : 2-tetracarboxylic Acid

 $C_8H_{10}O_8$ 

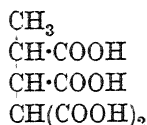
MW, 234

Butane-1 : 1 : 2 : 3-tetracarboxylic Acid 384 Butane-1 : 2 : 3 : 4-tetracarboxylic Acid

*Tetra-Et ester*:  $C_{16}H_{26}O_8$ . MW, 346. Viscous liq. B.p.  $200^\circ/150$  mm.

Bischoff, *Rach, Ber.*, 1884, 17, 2785.

Butane-1 : 1 : 2 : 3-tetracarboxylic Acid



$C_8H_{10}O_8$  MW, 234

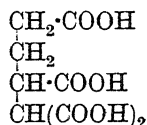
Cryst. from  $Et_2O$ -ligroin. M.p.  $176^\circ$ .

*Tetra-Me ester*:  $C_{12}H_{18}O_8$ . MW, 290. B.p.  $207^\circ/20$  mm.,  $201^\circ/12$  mm.  $D_{20}^{25}$  1.1153.

*Tetra-amide*:  $C_8H_{14}O_4N_4$ . MW, 230. Cryst. from hot  $H_2O$ . M.p.  $267^\circ$  decomp.

Michael, Ross, *J. Am. Chem. Soc.*, 1931, 53, 1163.

Butane-1 : 1 : 2 : 4-tetracarboxylic Acid

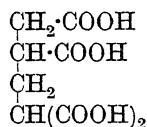


$C_8H_{10}O_8$  MW, 234

*Tetra-Et ester*:  $C_{16}H_{26}O_8$ . MW, 346. B.p.  $240^\circ/50$  mm.  $HCl \rightarrow$  butane-1 : 2 : 4-tricarboxylic acid.

Haworth, King, *J. Chem. Soc.*, 1914, 105, 1350.

Butane-1 : 1 : 3 : 4-tetracarboxylic Acid



$C_8H_{10}O_8$  MW, 234

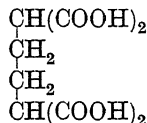
*Tetra-Et ester*:  $C_{16}H_{26}O_8$ . MW, 346. B.p.  $209-11^\circ/15$  mm.  $HCl \rightarrow$  butane-1 : 2 : 4-tricarboxylic acid.

*Tetra-amide*:  $C_8H_{14}O_4N_4$ . MW, 230. Cryst. from  $H_2O$ . M.p.  $250^\circ$ .

Michael, Schulthess, *J. prakt. Chem.*, 1892, 45, 59.

Hope, *J. Chem. Soc.*, 1912, 102, 903.

Butane-1 : 1 : 4 : 4-tetracarboxylic Acid



$C_8H_{10}O_8$  MW, 234

Syrup. Very sol.  $H_2O$ . At  $200^\circ \rightarrow$  adipic acid +  $CO_2$ .

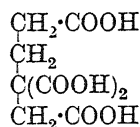
*Tetra-Et ester*:  $C_{16}H_{26}O_8$ . MW, 346. B.p.  $193-5^\circ/15$  mm.  $D_{20}^{25}$  1.1305.  $n_D^{25}$  1.4470.

1 : 4-Dinitrile-1 : 4-di-Et ester:  $C_{12}H_{16}O_4N_2$ . MW, 252. Needles from  $EtOH.Aq$ . M.p.  $104^\circ$ . B.p.  $208-10^\circ/15$  mm.

Perkin, *J. Chem. Soc.*, 1887, 51, 20.

Meincke, Cox, McElvain, *J. Am. Chem. Soc.*, 1935, 57, 1134.

Butane-1 : 2 : 2 : 4-tetracarboxylic Acid



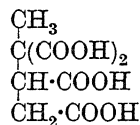
$C_8H_{10}O_8$  MW, 234

*Tetra-Et ester*:  $C_{16}H_{26}O_8$ . MW, 346. B.p.  $200-3^\circ/12$  mm.,  $166-8^\circ/0.2$  mm.  $HCl \rightarrow$  butane-1 : 2 : 4-tricarboxylic acid.

Kay, Perkin, *J. Chem. Soc.*, 1906, 89, 1643.

Ruzicka, de Almeida, Brack, *Helv. Chim. Acta*, 1934, 17, 189.

Butane-1 : 2 : 3 : 3-tetracarboxylic Acid



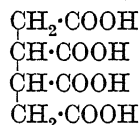
$C_8H_{10}O_8$  MW, 234

Cryst. from  $Et_2O$ . M.p.  $170^\circ$ .

*Tetra-Et ester*:  $C_{16}H_{26}O_8$ . MW, 346. B.p.  $180^\circ/3$  mm.

Michael, Ross, *J. Am. Chem. Soc.*, 1931, 53, 1163.

Butane-1 : 2 : 3 : 4-tetracarboxylic Acid



$C_8H_{10}O_8$  MW, 234

Exists in two forms.

*High-melting form*:

Leaflets from  $H_2O$ . M.p.  $236-7^\circ$  (slow heat.). Very sol.  $EtOH$ . Spar. sol.  $Et_2O$ ,  $CHCl_3$ . Insol.  $C_6H_6$ , ligroin.  $k = 4.1 \times 10^{-4}$  at  $25^\circ$ .

*Tetra-Me ester*:  $C_{12}H_{18}O_8$ . MW, 290. Needles from ligroin. M.p.  $63-4^\circ$ .

*Diamide*:  $C_8H_{12}O_6N_2$ . MW, 232. M.p.  $169^\circ$  decomp. Spar. sol. ord. solvents.

*Monoanhydride*:  $C_8H_8O_7$ . MW, 216. Leaflets from  $Me_2CO-CHCl_3$ . M.p.  $232^\circ$  decomp.

*Dianhydride*:  $C_8H_6O_6$ . M.p. 198. Leaflets from  $Me_2CO$ . M.p.  $168^\circ$  (slow heat.).

*Dianilide*:  $C_{20}H_{20}O_6N_2$ . MW, 384. Needles from  $EtOH.Aq$ . M.p.  $167^\circ$ .

*Di-imide*:  $C_8H_8O_4N_2$ . MW, 224. Leaflets or needles from  $H_2O$ . Decomp. at  $320^\circ$ .

*Low-melting form*:

Needles or prisms from  $H_2O$ . M.p.  $189^\circ \rightarrow$  mono-anhydride of high-melting form.  $k = 4 \times 10^{-4}$  at  $25^\circ$ .

*Tetra-Me ester*: prisms or plates from H<sub>2</sub>O. M.p. 75–6°.

*Di-Et ester*: C<sub>12</sub>H<sub>18</sub>O<sub>8</sub>. MW, 290. Needles from H<sub>2</sub>O. M.p. 168°.

*Tetra-Et ester*: C<sub>16</sub>H<sub>26</sub>O<sub>8</sub>. MW, 346. B.p. 201°/13 mm.

*Dipropyl ester*: C<sub>14</sub>H<sub>22</sub>O<sub>8</sub>. MW, 318. Prisms from CHCl<sub>3</sub>-ligroin. M.p. 129°.

*Diamide*: plates from dil. H<sub>2</sub>SO<sub>4</sub>. M.p. 181° decomp.

*Tetra-amide*: C<sub>8</sub>H<sub>14</sub>O<sub>4</sub>N<sub>4</sub>. MW, 230. Leaflets from H<sub>2</sub>O. Decomp. about 310°.

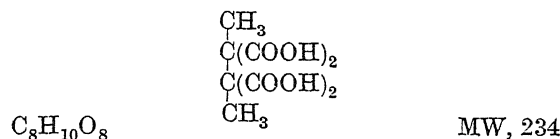
*Dianhydride*: cryst. from Ac<sub>2</sub>O. M.p. 248° decomp.

*Dianilide*: needles from EtOH.Aq. M.p. 187° (rapid heat.).

Auwers, Jacob, *Ber.*, 1894, 27, 1119.

Ingold, *J. Chem. Soc.*, 1921, 119, 348.

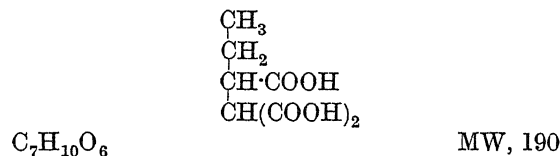
### Butane-2 : 2 : 3 : 3-tetracarboxylic Acid



*Tetra-Et ester*: C<sub>16</sub>H<sub>26</sub>O<sub>8</sub>. MW, 346. B.p. 310–15°, 245°/170 mm. D<sub>15</sub><sup>20</sup> 1.114.

Bischoff, Rach, *Ann.*, 1886, 234, 63, 70.

### Butane-1 : 1 : 2-tricarboxylic Acid



Cryst. from Me<sub>2</sub>CO. M.p. 141° decomp. Very sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO. Spar. sol. CHCl<sub>3</sub>. *k* (first) = 3.07 × 10<sup>-3</sup>. Heat → ethylsuccinic acid.

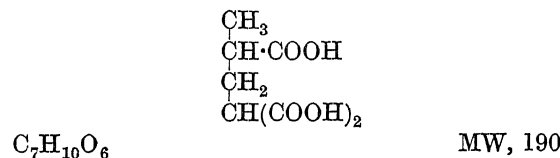
*Tri-Et ester*: C<sub>13</sub>H<sub>22</sub>O<sub>6</sub>. MW, 274. B.p. 278° (corr.), 143°/6 mm. D<sub>4</sub><sup>20</sup> 1.0583. n<sub>D</sub><sup>20</sup> 1.4321.

1-*Nitrile-1 : 2-di-Et ester*: C<sub>11</sub>H<sub>17</sub>O<sub>4</sub>N. MW, 227. B.p. 167–8°/20 mm. D<sub>15</sub><sup>15</sup> 1.0647.

Bischoff, Hjelt, *Ber.*, 1888, 21, 2091.

Preobrashenski, Schtschukina, Wompe, *Ber.*, 1936, 69, 1618.

### Butane-1 : 1 : 3-tricarboxylic Acid



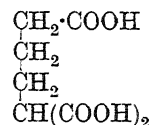
M.p. 161° decomp.

*Tri-Et ester*: C<sub>13</sub>H<sub>22</sub>O<sub>6</sub>. MW, 274. B.p. 165–6°/22 mm.

Vocke, *Z. physiol. Chem.*, 1930, 191, 84.

Dict of Org. Comp.—I.

### Butane-1 : 1 : 4-tricarboxylic Acid



C<sub>7</sub>H<sub>10</sub>O<sub>6</sub> MW, 190

Needles from C<sub>6</sub>H<sub>6</sub>-AcOEt. M.p. 139–40°. Very sol. AcOEt. Insol. C<sub>6</sub>H<sub>6</sub>. Above 140° → adipic acid + CO<sub>2</sub>.

*Tri-Et ester*: C<sub>13</sub>H<sub>22</sub>O<sub>6</sub>. MW, 274. B.p. 200–5°/40 mm., 192–3°/26 mm., 175–6°/18 mm., 172–4°/13 mm. D<sub>15</sub><sup>15</sup> 1.0726.

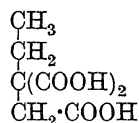
4-*Nitrile-1 : 1-di-Et ester*: C<sub>11</sub>H<sub>17</sub>O<sub>4</sub>N. MW, 227. B.p. 290–5°, 175°/12 mm.

*Monoanilide*: needles from H<sub>2</sub>O. M.p. 177°.

Montemartini, *Gazz. chim. ital.*, 1896, 26, ii, 261.

Wislicenus, Schwanhäusser, *Ann.*, 1897, 297, 111.

### Butane-1 : 2 : 2-tricarboxylic Acid



C<sub>7</sub>H<sub>10</sub>O<sub>6</sub> MW, 190

*Tri-Et ester*: C<sub>13</sub>H<sub>22</sub>O<sub>6</sub>. MW, 274. B.p. 281.6°, 187°/50 mm., 153–5°/9 mm. D<sub>4</sub><sup>20</sup> 1.0673. n<sub>D</sub><sup>20</sup> 1.4340. H<sub>2</sub>SO<sub>4</sub> → ethylsuccinic acid.

2-*Nitrile-1 : 2-di-Et ester*: C<sub>11</sub>H<sub>17</sub>O<sub>4</sub>N. MW, 227. B.p. 170–80°/30 mm.

*Trianilide*: m.p. 217°.

*Tri-p-toluidide*: m.p. 186°.

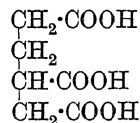
*Trihydrazide*: m.p. 167°. *Picrate*: m.p. 185°.

Bischoff, Kuhlberg, *Ber.*, 1890, 23, 638.

### Butane-1 : 2 : 3-tricarboxylic Acid.

See 1-Methyltricarballic Acid.

### Butane-1 : 2 : 4-tricarboxylic Acid



C<sub>7</sub>H<sub>10</sub>O<sub>6</sub> MW, 190

Cryst. from H<sub>2</sub>O. M.p. 123°. Very sol. H<sub>2</sub>O, EtOH. Spar. sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Heat → adipic acid + CO<sub>2</sub>.

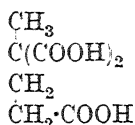
*Tri-Me ester*: C<sub>10</sub>H<sub>16</sub>O<sub>6</sub>. MW, 232. B.p. 168°/16 mm., 110–14°/0.2 mm.

*Tri-Et ester*: C<sub>13</sub>H<sub>22</sub>O<sub>6</sub>. MW, 274. B.p. 183–5°/20 mm., 110–12°/0.1 mm.

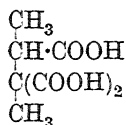
1 : 2-*Dinitrile-4-amide*: C<sub>7</sub>H<sub>9</sub>ON<sub>3</sub>. MW, 151. Plates from AcOEt. M.p. 90–1° corr.

Ruzicka, de Almeida, Brack, *Helv. Chim. Acta*, 1934, 17, 189.

## Butane-1 : 3 : 3-tricarboxylic Acid

C<sub>7</sub>H<sub>10</sub>O<sub>6</sub> MW, 190Tri-Et ester : C<sub>13</sub>H<sub>22</sub>O<sub>6</sub>. MW, 274. Viscous liq. B.p. 165°/15 mm. D<sub>16</sub><sup>25</sup> 1.074.Auwers, *Ann.*, 1896, 292, 209.Mellor, *J. Chem. Soc.*, 1901, 128.

## Butane-2 : 2 : 3-tricarboxylic Acid

C<sub>7</sub>H<sub>10</sub>O<sub>6</sub> MW, 190Cryst. from Et<sub>2</sub>O. M.p. 156-8° decomp. Very sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.  $k = 5.03 \times 10^{-3}$  at 25°.Tri-Et ester : C<sub>13</sub>H<sub>22</sub>O<sub>6</sub>. MW, 274. B.p. 268-71°. D<sub>4</sub><sup>20</sup> 1.0661.  $n_D^{20}$  1.4332.2-Nitrile-2 : 3-di-Et ester : C<sub>11</sub>H<sub>17</sub>O<sub>4</sub>N. MW, 227. B.p. 272-3°, 162-3°/20 mm. D<sub>4</sub><sup>20</sup> 1.0791.  $n_D$  1.4368.2 : 3-Dinitrile-2-Et ester : C<sub>9</sub>H<sub>12</sub>O<sub>2</sub>N<sub>2</sub>. MW, 180. B.p. 152°/23 mm.Leuckart, *Ber.*, 1885, 18, 2346.Bischoff, *Rach, Ann.*, 1886, 234, 54.

## Butanol.

See Butyl Alcohol.

## 2-Butanolal.

See Aldol.

## Butanolamine.

See 4-Amino-*n*-butyl Alcohol.

## Butanolone.

See Acetoin, Propionylcarbinol and 3-Keto-*n*-butyl Alcohol.

## Butanone.

See Methyl ethyl Ketone.

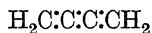
## 2-Butanone-4 : 4-dicarboxylic Acid.

See Acetylmalonic Acid.

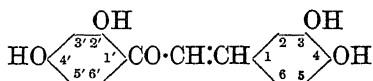
## Butantriol.

See Trihydroxybutane.

## Butatriene

C<sub>4</sub>H<sub>4</sub> MW, 52

Low boiling liq. Solidifies at temp. of liquid nitrogen. Polymerizes at room temp. U.V. absorption maximum at 241 mμ in 95% EtOH.

Schubert, Liddicoet, Lanka, *J. Am. Chem. Soc.*, 1952, 74, 569.**Butein** (2 : 4-Dihydroxyphenyl 3 : 4-dihydroxystyryl ketone, 3 : 4 : 2' : 4'-tetrahydroxychalkone)C<sub>15</sub>H<sub>12</sub>O<sub>5</sub> MW, 272Orange-yellow needles + 1H<sub>2</sub>O from dil EtOH. M.p. 213-15° (198°). Sol. EtOH Mod. sol. Et<sub>2</sub>O. Spar. sol. hot H<sub>2</sub>O. Alkal fusion → resorcinol + protocatechuic acid.3 : 4 : 4'-Tri-Me ether : C<sub>18</sub>H<sub>18</sub>O<sub>3</sub>. MW, 314 Yellow leaflets. M.p. 156-8°.

Tetra-acetyl : m.p. 129-31°.

4'-Glucoside : yellow needles. M.p. 185-6°.

4'-Tetra-acetylglucoside : reddish-brown needles M.p. 193-4°.

Göschke, Tambor, *Ber.*, 1911, 44, 3502.Perkin, Hummel, *J. Chem. Soc.*, 1904 85, 1459.Shinoda, Sato, Kawagoe, *J. Pharm. Soc. Japan*, 1929, 49, 123.Reichel, Burkhart, Müller, *Ann.*, 1942 550, 146.Mauthner, *J. prakt. Chem.*, 1943, 161 280.Rao, Seshadri, *Proc. Indian Acad. Sci.* 1941, 14A, 29.

## 1-Butenediol-3 : 4.

See Erythrol.

## 1-Butenol-3.

See Methylvinylcarbinol.

## 1-Butenol-4.

See Allylcarbinol.

## 1-Butenone-3.

See Methyl vinyl Ketone.

## Butenylacetone.

See Heptenone.

## Butenylbenzene.

See Phenylbutylene.

3-γ-Butenyl-*n*-butyl Alcohol.

See 5-Methyl-1-heptenol-7.

## α-Butenylcarbinol.

See 2-Propylidene-ethyl Alcohol.

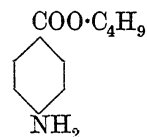
## 1-α-Butenylpropionic Acid.

See 1-Methylhydroxosorbic Acid.

## 1-Buten-3-yne.

See Vinylacetylene.

## Butesin (Butyl p-aminobenzoate)

C<sub>11</sub>H<sub>15</sub>O<sub>2</sub>N MW, 193

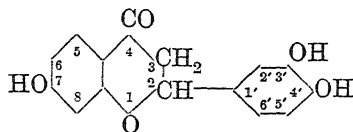
Cryst. from EtOH. M.p. 58°. B.p. 173-4°/8 mm. Anaesthetic.

B.HCl : needles. M.p. 198°.

Picrate : m.p. 109-10°.

Brill, *J. Am. Chem. Soc.*, 1921, 43, 1322.Soc. chimiques des usines du Rhône, Swiss P., 90,590, (*Chem. Abstracts*, 1923, 17, 1243).Abbott Laboratories, B.P. 252,870, (*Chem. Abstracts*, 1927, 21, 2478).

## Butin (7 : 3' : 4'-Trihydroxyflavanone)



$C_{15}H_{12}O_5$  MW, 272

Needles from EtOH. M.p. 224–6°. Sol. EtOH, Et<sub>2</sub>O, AcOH, Spar. sol. hot H<sub>2</sub>O. Insol. C<sub>6</sub>H<sub>6</sub>. Orange-red sol. in dil. KOH.

*Tri-Me ether*: C<sub>18</sub>H<sub>18</sub>O<sub>5</sub>. MW, 314. Plates from CS<sub>2</sub>. M.p. 120–1°.

*Triacetyl*: leaflets from EtOH–Me<sub>2</sub>CO. M.p. 123–5°.

*Tribenzoyl*: needles from C<sub>6</sub>H<sub>6</sub>–EtOH. M.p. 155–7°.

Perkin, Hummel, *J. Chem. Soc.*, 1904, 85, 1460.

Shinoda, Sato, Kawagoe, *J. Pharm. Soc. Japan*, 1929, 49, 123.

## Butrin

$C_{27}H_{32}O_{15}$  MW, 596

Bioside of butin present in flowers of *Butea frondosa*, Roxb. Very hygroscopic → dihydrate. Sol. H<sub>2</sub>O, MeOH, AcOH, Py, hot EtOH.  $[\alpha]_D^{30} - 81.7^\circ$  in Py. Mg + HCl → violet col. HCl → 2 mols. glucose + 1 mol. butin.

*Dihydrate*: cryst. from EtOH.Aq. M.p. 193–5°.  $[\alpha]_D^{25} - 73.27^\circ$  in H<sub>2</sub>O.

*Deca-acetyl*: yellow leaflets + 1H<sub>2</sub>O from MeOH. M.p. 119–20°.  $[\alpha]_D^{30}$  (anhyd.) – 79.86° in Py.

*Carbethoxyl*: m.p. 83–4°.

*Tetra-p-nitrobenzoyl*: needles + H<sub>2</sub>O from Py.Aq. M.p. 154°.  $[\alpha]_D^{30}$  (anhyd.) – 44.30° in Py.

*Nonabenzoyl*: cryst. + H<sub>2</sub>O from EtOH. M.p. 141°.  $[\alpha]_D^{30}$  (anhyd.) + 77.28°.

*Monoxime*: leaflets + 2H<sub>2</sub>O from EtOH. M.p. 180°.

*Di-Me ether*: C<sub>29</sub>H<sub>36</sub>O<sub>15</sub>. MW, 624. Needles + 7½H<sub>2</sub>O from H<sub>2</sub>O. M.p. 224°. Spar. sol. MeOH, EtOH.

*Di-Et ether*: C<sub>31</sub>H<sub>40</sub>O<sub>15</sub>. MW, 652. Needles + 7½H<sub>2</sub>O from H<sub>2</sub>O. M.p. 238°.

Lal, Dutt, *J. Indian Chem. Soc.*, 1935, 12, 262.

Lal, *J. Chem. Soc.*, 1937, 1563.

**N-tert.-Butylacetamide** (*Acetyl-tert.-butylamine, acet-tert.-butylamide*)



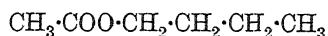
$C_6H_{13}ON$  MW, 115

Needles. M.p. 98°. B.p. 194°. Sol. EtOH, Et<sub>2</sub>O, etc. Sublimes. Volatile in steam.

Scholl, *Ann.*, 1905, 338, 16.

## Butylacetanilide.

See under Butylaniline.

*n*-Butyl acetate

$C_6H_{12}O_2$  MW, 116

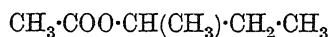
B.p. 124–5°.  $D_4^0$  0.9016.

Lieben, Rossi, *Ann.*, 1871, 158, 169.

Turova, Balandin, Merkurova, Guseva, *Chem. Abstracts*, 1935, 29, 5814.

Standard Oil Development, U.S.P. 1,951,747, (*Chem. Abstracts*, 1934, 28, 3417).

du Pont, U.S.P. 1,949,267, (*Chem. Abstracts*, 1934, 28, 2725).

*sec*.-Butyl acetate

$C_6H_{12}O_2$  MW, 116

*d*l.

B.p. 111.5–113°.  $D_4^{25}$  0.8648,  $D_4^{16}$  0.8583.  $n_D^{25}$  1.3866,  $n_D^{16}$  1.3945.

*d*.

B.p. 112°.  $D_4^{15}$  0.8758.  $n_D^{20}$  1.3877,  $n_D^{18}$  1.3870.  $[\alpha]_{D461}^{18} + 10.5^\circ$ ,  $[\alpha]_D^{20} + 25.4^\circ$ .

*l*.

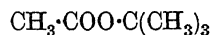
B.p. 116–17°.  $D_4^{19}$  0.873.  $n_D^{18}$  1.3899.  $[\alpha]_{D461}^{19} - 20.2^\circ$ .

Pickard, Kenyon, *J. Chem. Soc.*, 1914, 105, 852, 885.

Norris, Green, *Am. Chem. J.*, 1901, 26, 312.

Standard Development, U.S.P. 1,726,945, (*Chem. Abstracts*, 1929, 23, 5196).

Kenyon *et al.*, *J. Chem. Soc.*, 1935, 1079.

*tert*.-Butyl acetate

$C_6H_{12}O_2$  MW, 116

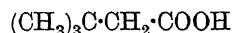
B.p. 97–8°.  $D_4^{25}$  0.8620.  $n_D^{25}$  1.38480.

Bryant, Smith, *J. Am. Chem. Soc.*, 1936, 58, 1016.

*sec*.-Butylacetic Acid.

See 2-Methylvaleric Acid.

***tert*.-Butylacetic Acid** (2 : 2-Dimethylbutyric acid, 2 : 2 : 2-trimethylpropionic acid)



$C_6H_{12}O_2$  MW, 116

M.p. –11°. B.p. 190°.

*Me ester*: C<sub>7</sub>H<sub>14</sub>O<sub>2</sub>. MW, 130. B.p. 126°.

*Amide*: C<sub>6</sub>H<sub>13</sub>ON. MW, 115. Leaflets. M.p. 132°.

Delacre, *Chem. Zentr.*, 1906, I, 1233.

**n-Butylacetylene.**

See 1-Hexyne.

**sec.-Butylacetylene (3-Methyl-1-pentyne)**

$\text{CH}_3$   
 $\text{CH}_3 \cdot \text{CH}_2 \cdot \text{CH} \cdot \text{C} \cdot \text{CH}$

$\text{C}_6\text{H}_{10}$  MW, 82  
 B.p. 65-70°, 770 mm.  
 Lespieau, Wiemann, *Compt. rend.*, 1929, 188, 998.

**tert.-Butylacetylene**

$(\text{CH}_3)_3\text{C} \cdot \text{C} \cdot \text{CH}$

$\text{C}_6\text{H}_{10}$  MW, 82  
 B.p. 38-9°.  $D_4^{25}$  0.6737.  $n_D^{25}$  1.37725.  
 Delacre, *Bull. soc. chim.*, 1906, 35, 344.  
 Ivitzky, *Bull. soc. chim.*, 1924, 35, 357.

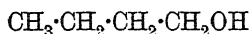
**2-Butylacrolein.**

See 1-Heptenal.

**1-sec.-Butylacrylic Acid.**

See 3-Methyl-1-hexenic Acid.

**n-Butyl Alcohol** (n-primary Butyl alcohol, 1-butanol, 1-hydroxybutane, n-propylcarbinol)



$\text{C}_4\text{H}_{10}\text{O}$  MW, 74  
 B.p. 117.4°. Sol. to 9% in cold  $\text{H}_2\text{O}$ .  $D_4^{20}$  0.80978.  $n_D^{20}$  1.39931. Heat of comb.  $\bar{C}_p$  643.2 Cal.,  $C_p$  644.4 Cal.  $\text{CrO}_3$  or  $\text{KMnO}_4 \rightarrow$  n-butyric acid.

Phenylurethane: m.p. 61°.

p-Iododiphenylurethane: m.p. 173-4°.

p-Nitrodiphenylurethane: m.p. 95.5°.

p-Phenylphenylurethane: m.p. 109°.

Buchner, Meisenheimer, *Ber.*, 1908, 41, 1411.Meerwein, *Ann.*, 1918, 419, 144.Fuchs, Querfurth, U.S.P. 2,050,788, (*Chem. Abstracts*, 1936, 30, 6758).Inoue, Tamura, Jap. P. 109,533, (*Chem. Abstracts*, 1935, 29, 4381).Kagan, Lyubarskii, Fedorov, *Chem. Abstracts*, 1935, 29, 452.

**sec.-Butyl Alcohol** (Methylethylcarbinol, 2-butanol, 2-hydroxybutane)

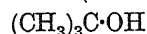


$\text{C}_4\text{H}_{10}\text{O}$  MW, 74  
*d.l.*  
 B.p. 100° Sol. to 12% in  $\text{H}_2\text{O}$  at 20°.  $D_4^{20}$  0.808.  $n_D^{20}$  1.3949. Ox.  $\rightarrow$  methyl ethyl ketone + acetic acid.

*d.*

B.p. 99°.  $D_4^{20}$  0.8080.  $n_D^{20}$  1.3954.  $[\alpha]_D^{20}$  + 13.87°.

p-Toluenesulphonyl: b.p. 95° / < 0.1 mm.  $D^{20}$  1.146.  $n_D^{20}$  1.5080.  $[\alpha]_{5461}^{20}$  + 12.98°.

Norris, Green, *Am. Chem. J.*, 1901, 26, 305.King, *J. Chem. Soc.*, 1919, 115, 1409.Pickard, Kenyon, *J. Chem. Soc.*, 1914, 105, 882; 1913, 103, 1935.Kenyon, Phillips, Pittman, *J. Chem. Soc.*, 1935, 1077.Lebedev, Krause, Volzhinskiï, Gorin, Neïmark, *Synthetic Rubber*, 1934, 68.I.G., U.S.P. 1,787,205, (*Chem. Abstracts*, 1931, 25, 963).**tert.-Butyl Alcohol (Trimethylcarbinol)**

$\text{C}_4\text{H}_{10}\text{O}$  MW, 74  
 Rhombic prisms or plates. M.p. 25.5°. B.p. 82.8°. Misc. with  $\text{H}_2\text{O}$  in all proportions.  $D_4^{20}$  0.7887.  $n_D^{20}$  1.38779. Heat of comb.  $C_p$  634 Cal.,  $C_v$  635 Cal. Forms constant boiling mixture with  $\text{H}_2\text{O}$  (21.76%  $\text{H}_2\text{O}$ ), b.p. 80°.

Grignard, *Compt. rend.*, 1901, 132, 338.Bayer, D.R.P. 166,899, (*Chem. Zentr.*, 1906, I, 720).Oddo, *Gazz. chim. ital.*, 1911, 41, 273.Dow, U.S.P. 1,984,725, (*Chem. Abstracts*, 1935, 29, 819).Shell Development, U.S.P. 2,042,212, (*Chem. Abstracts*, 1936, 30, 4870).Remiz, Frost, *Brit. Chem. Abstracts*, 1940, AII, 265.**n-Butylallene.**

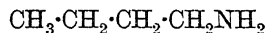
See 1:2-Heptadiene.

**2-n-Butylallyl Alcohol.**

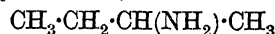
See 2-Heptenol-1.

**Butylallylcarbinol.**

See 1-Octenol-4.

**n-Butylamine (1-Aminobutane)**

$\text{C}_4\text{H}_{11}\text{N}$  MW, 73  
 B.p. 78°. Misc. with  $\text{H}_2\text{O}$ .  $D^{15}$  0.742. Heat of comb.  $C_p$  713.2 Cal.,  $C_v$  711.9 Cal.  
*B.HCl*: leaflets. M.p. 195°. Sol.  $\text{H}_2\text{O}$ , EtOH.

*Picrate*: m.p. 151°.*Picolonate*: m.p. 215-16°.Lycan, Puntambeker, Marvel, *Organic Syntheses*, XI, 60.I.G., U.S.P. 1,966,478, (*Chem. Abstracts*, 1934, 28, 5470).I.G., B.P. 334,579, (*Chem. Abstracts*, 1931, 25, 964).Brown, Jones, *J. Chem. Soc.*, 1946, 781.**sec.-Butylamine (2-Aminobutane)**

$\text{C}_4\text{H}_{11}\text{N}$  MW, 73

d.

B.p. 63°.  $D_4^{20}$  0.724.  $[\alpha]_D^{20} + 7.4^\circ$   
 $B_2, H_2PtCl_6$ : reddish prisms. M.p. 204–10°.

l.

B.p. 63°.  $D_4^{20}$  0.725.  $[\alpha]_D^{20} - 7.4^\circ$ .

dl.

B.p. 63°.  $D^{20}$  0.718.  $n_D^{20}$  1.39501.  $k = 4.4 \times 10^{-4}$  at 25°.

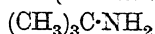
$B_2, H_2PtCl_6$ : m.p. 228° decomp.

*Picrate*: m.p. 139–40° (129–30°).

Sabatier, Mailhe, *Ann. chim.*, 1909, 16, 104.

Thomé, *Ber.*, 1903, 36, 582.

Lycan, Puntambeker, Marvel, *Organic Syntheses*, 1931, XI, 60.

**tert.-Butylamine (2-Aminoisobutane)**

$C_4H_{11}N$  MW, 73

B.p. 46.4° (43.8°, 42–3°).  $D^{15}$  0.7004.  $n_D^{15}$  1.37940. Heat of comb.  $C_v$  715.0 Cal.,  $C_p$  716.3 Cal.  $k = 3.4 \times 10^{-4}$  at 25°.

*B, HCl*: m.p. 270–80° (291° decomp.). Sol.  $H_2O$ , EtOH.

*B, HNO\_2*: leaflets. M.p. 126–7° decomp.

*N-Benzoyl*: m.p. 134°.

*Picrate*: m.p. 197–8°.

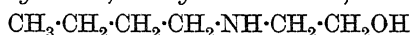
*Styphnate*: m.p. 248–50° decomp.

*Picronate*: m.p. 260° decomp.

Linnemann, Brauner, *Ann.*, 1878, 192, 72.

Brander, *Rec. trav. chim.*, 1918, 37, 67.

Brown, Jones, *J. Chem. Soc.*, 1946, 781.

**2-n-Butylaminoethyl Alcohol (2-Hydroxyethylbutylamine, n-butylethanolamine)**

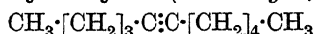
$C_6H_{15}ON$  MW, 117

B.p. 200°, 91–2°/11 mm. Sol.  $H_2O$ , EtOH, Et<sub>2</sub>O.  $D_4^{20}$  0.8907.  $n_D^{20}$  1.4437,  $n_D^{25}$  1.4427.

*Picrate*: m.p. 98° (86–8°).

Matthes, *Ann.*, 1901, 315, 112.

Cope, Hancock, *J. Am. Chem. Soc.*, 1942, 64, 1503.

**Butylamylacetylene (5-Undecyne, hendecyne)**

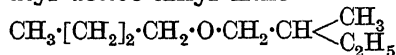
$C_{11}H_{20}$  MW, 152

B.p. 195–7°.  $D^{20}$  0.785.  $n_D^{20}$  1.437.

Truchet, *Ann. chim.*, 1931, 16, 399.

**tert.-Butyl-n-amylcarbinol.**

See 2:2-Dimethyloctanol-3.

**n-Butyl active-amyl Ether**

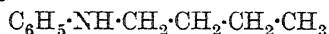
$C_9H_{20}O$  MW, 144

B.p. 148–52°/730 mm.  $D_4^{20}$  0.798.  $n_D^{20}$  1.4077.  $[\alpha]_D^{20} + 1.33^\circ$ .

Guye, Chavanne, *Bull. soc. chim.*, 1896, 15, 303.

**sec.-Butyl n-amyl Ketone.**

See 3-Methylnonanone-4.

**n-Butylaniline**

$C_{10}H_{15}N$  MW, 149

B.p. 240°/756 mm., 115–20°/15 mm., 68°/1 mm.  $D_4^{20}$  0.9358.  $n_D^{20}$  1.5381.

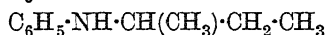
*B, HCl*: m.p. 114–15°.

*N-Acetyl*: *N-n*-butylacetanilide.  $C_{12}H_{17}ON$ . MW, 191. B.p. 273–5°/718 mm.

Reilly, Hickinbottom, *J. Chem. Soc.*, 1918, 113, 99.

Sekera, Marvel, *J. Am. Chem. Soc.*, 1933, 55, 348.

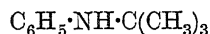
I.G., B.P. 421,596, (*Chem. Abstracts*, 1935, 29, 3681).

**sec.-Butylaniline**

$C_{10}H_{15}N$  MW, 149

B.p. 224–5°/765 mm.

Reilly, Hickinbottom, *J. Chem. Soc.*, 1920, 117, 121.

**tert.-Butylaniline**

$C_{10}H_{15}N$  MW, 149

B.p. 214–16°/753 mm. (208–10°), 92.5–98°/19.5 mm. Misc. with most org. solvents.

*N-Acetyl*: *N-tert.*-butylacetanilide. Prisms from pet. ether. M.p. 55–6°. B.p. 124–5°/22 mm. Sol. EtOH, pet. ether.

*N-m-Nitrobenzenesulphonyl*: needles from AcOH. M.p. 100–1°.

*N-p-Toluenesulphonyl*: needles from EtOH. M.p. 82–3°.

*Picrate*: golden-yellow cryst. from AcOEt-pet. ether. M.p. 191–2° decomp. Sol. EtOH, Me<sub>2</sub>CO, AcOEt. Mod. sol. Et<sub>2</sub>O. Spar. sol. pet. ether.

*N-Nitroso*: prisms from pet. ether. M.p. 61–2°.

Hickinbottom, *J. Chem. Soc.*, 1933, 947.

**Butylaniline.**

See also Amino-butylbenzene.

**Butylanisole.**

See under Butylphenol.

**n-Butylbenzene (1-Phenylbutane)**

$C_{10}H_{14}$  MW, 134

B.p. 183.1° (180°), 79°/23 mm.  $D_4^{13}$  0.875,  $D_4^{20}$  0.8608.  $n_D^{13}$  1.494,  $n_D^{20}$  1.4900.

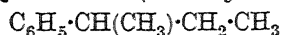
Radziszewski, *Ber.*, 1876, 9, 261.

Read, Foster, *J. Am. Chem. Soc.*, 1926, 48, 1606.

Hall, B.P. 406,385, (*Chem. Abstracts*, 1934, 28, 4743).

Hennion, Auspos, *J. Am. Chem. Soc.*, 1943, 65, 1603.

## sec.-Butylbenzene (2-Phenylbutane)



$\text{C}_{10}\text{H}_{14}$  MW, 134

*d.*

B.p. 63°/15 mm.  $D_4^{24}$  0.868.  $[\alpha]_D^{24} + 1.58^\circ$ .

*l.*

B.p. 70–6°/60 mm., 68°/20 mm., 61°/18 mm.  $D_4^{24}$  0.868.  $n_D^{19}$  1.5044,  $n_D^{20}$  1.4891.  $[\alpha]_{D_{461}}^{23}$  –21.65°,  $[\alpha]_D^{20}$  –0.16°.

*dl.*

B.p. 173–4° (170–1°), 69°/20 mm., 61°/18 mm.  $D_4^{24}$  0.8634.  $n_D^{21}$  1.4894.

Harrison, Kenyon, Shepherd, *J. Chem. Soc.*, 1926, 659.

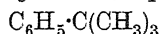
Levene, Marker, *J. Biol. Chem.*, 1931, 93, 749; 1932, 97, 582.

Kenyon, Phillips, Pittman, *J. Chem. Soc.*, 1935, 1080.

Ipatieff, Corson, Pines, *J. Am. Chem. Soc.*, 1936, 58, 919.

Hennion, Auspos, *J. Am. Chem. Soc.*, 1943, 65, 1603.

## tert.-Butylbenzene (Trimethyl-phenyl-methane, ω-trimethyltoluene, 2-phenylisobutane)



$\text{C}_{10}\text{H}_{14}$  MW, 134

B.p. 168° (165–8°), 70–5°/22 mm., 62°/16 mm., 52–4°/10 mm.  $D_4^{20}$  0.8686.  $D_4^{20}$  0.8658.  $n_D^{15}$  1.49724,  $n_D^{20}$  1.4914.

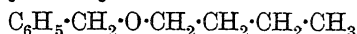
Shoesmith, Mackie, *J. Chem. Soc.*, 1928, 2336.

Grosse, Ipatieff, *J. Am. Chem. Soc.*, 1935, 57, 2416.

Ipatieff, Pines, *J. Am. Chem. Soc.*, 1936, 58, 1056.

Hennion, Auspos, *J. Am. Chem. Soc.*, 1943, 65, 1603.

## n-Butyl benzyl Ether

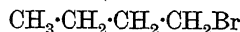


$\text{C}_{11}\text{H}_{16}\text{O}$  MW, 164

B.p. 220–1°/744 mm.  $D_4^0$  0.9310.

Senderens, *Compt. rend.*, 1924, 178, 1412.

## n-Butyl bromide (1-Bromobutane)



$\text{C}_4\text{H}_9\text{Br}$  MW, 137

F.p. –112.3°. B.p. 101.26°, 101°/760 mm.  $D_4^0$  1.2744,  $D_4^{25}$  1.2686.  $n_D^{20}$  1.43993.

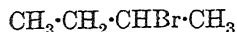
Kamm, Marvel, *Organic Syntheses*, Collective Vol. I, 2nd. Edit., 28.

Goshorn, Boyd, Degering, *Organic Syntheses*, Collective Vol. I, 2nd. Edit., 37.

Tseng, Hou, *J. Chinese Chem. Soc.*, 1934, 2, 57.

Skau, McCullough, *J. Am. Chem. Soc.*, 1935, 57, 2440.

## sec.-Butyl bromide (2-Bromobutane)



$\text{C}_4\text{H}_9\text{Br}$  MW, 137

*d.*

B.p. 91°.  $D_4^{25}$  1.251.  $[\alpha]_D^{25} + 10.81^\circ$ .

*l.*

B.p. 90–1°.  $D_4^{25}$  1.251.  $n_D^{19}$  1.4359.  $[\alpha]_{D_{589}}^{25}$  –12.24°.

*dl.*

F.p. –112.1°. B.p. 91.24°, 91°/764 mm.  $D_4^{25}$  1.2530,  $D_4^{20}$  1.2556.  $n_D^{20}$  1.43660.

Levene, Marker, *J. Biol. Chem.*, 1931, 91, 405.

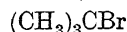
Kenyon, Phillips, Pittman, *J. Chem. Soc.*, 1935, 1080.

Franke, Dworzak, *Monatsh.*, 1923, 43, 661.

Skau, McCullough, *J. Am. Chem. Soc.*, 1935, 57, 2240.

Goshorn, Boyd, Degering, *Organic Syntheses*, Collective Vol. I, 2nd. Edit., 38.

## tert.-Butyl bromide (2-Bromoisobutane)



$\text{C}_4\text{H}_9\text{Br}$  MW, 137

B.p. 72°.  $D^{15}$  1.202. Isomerises at 210° to isobutyl bromide. Heat at 300° → isobutylene + HBr.

Faworsky, *Ann.*, 1907, 354, 345.

Brunel, *J. Am. Chem. Soc.*, 1917, 39, 1978.

Goshorn, Boyd, Degering, *Organic Syntheses*, Collective Vol. I, 2nd. Edit., 38.

## n-Butyl-tert.-butylcarbinol.

See 2 : 2-Dimethylheptanol-3.

## 1-sec.-Butylbutyric Acid.

See 3-Methylhexane-4-carboxylic Acid.

## n-Butylcarbamic Acid (n-Butylaminoformic acid).

*Me ester*:  $\text{CH}_3\cdot[\text{CH}_2]_2\cdot\text{CH}_2\cdot\text{NH}\cdot\text{CO}\cdot\text{OCH}_3$ .  $\text{C}_6\text{H}_{13}\text{O}_2\text{N}$ . MW, 131. M.p. –18°. B.p. 92°/15 mm.  $D_4^0$  0.9689.  $n_D^{20}$  1.42888.

*Et ester*: see n-Butylurethane.

van Erp, *Rec. trav. chim.*, 1895, 14, 17.

## sec.-Butylcarbamic Acid (sec.-Butylaminoformic acid).

*Me ester*:  $\text{CH}_3\cdot\text{CH}_2\cdot\text{CH}(\text{CH}_3)\cdot\text{NH}\cdot\text{CO}\cdot\text{OCH}_3$ .  $\text{C}_6\text{H}_{13}\text{O}_2\text{N}$ . MW, 131. B.p. 83°/16 mm.  $D^{25}$  0.9651.  $n_D^{25}$  1.42625.

*Et ester*: see sec.-Butylurethane.

van Erp, *Rec. trav. chim.*, 1895, 14, 17.

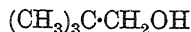
## tert.-Butylcarbamic Acid (tert.-Butylaminoformic acid).

*Me ester*:  $(\text{CH}_3)_3\text{C}\cdot\text{NH}\cdot\text{CO}\cdot\text{OCH}_3$ .  $\text{C}_6\text{H}_{13}\text{O}_2\text{N}$ . MW, 131. M.p. 27°. B.p. 63.3°/17 mm.  $D^{15}$  0.966.

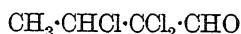
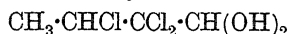
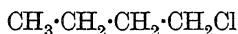
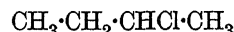
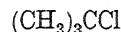
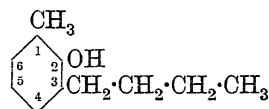
*Et ester*: see tert.-Butylurethane.

van Erp, *Rec. trav. chim.*, 1895, 14, 17.



**Butylcarbinol.***See n*-Amyl Alcohol.**sec.-Butylcarbinol.***See active* Amyl Alcohol.**tert.-Butylcarbinol** (2 : 2 - *Dimethyl* - 1 - *propanol*, 2 : 2 - *dimethyl-n-propyl alcohol*, *neopentyl alcohol*) $\text{C}_5\text{H}_{12}\text{O}$  MW, 88

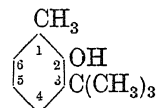
M.p. 52-3° (48°). B.p. 113°.

Samec, *Ann.*, 1907, 351, 256.**Butylchloral** (1 : 1 : 2 - *Trichlorobutyraldehyde*) $\text{C}_4\text{H}_5\text{OCl}_3$  MW, 175.5B.p. 164-5°/750 mm.  $D_4^{20}$  1.3956.  $n_D^{20}$  1.47554. Conc.  $\text{HNO}_3 \rightarrow$  1 : 1 : 2 - trichlorobutyric acid.*Oxime*: m.p. 65°.*Cyanhydrin*: *see under* 2 : 2 : 3 - Trichloro-1 - hydroxyvaleric Acid.Chattaway, Kellett, *J. Chem. Soc.*, 1928, 2713.**Butylchloral Hydrate** (1 : 1 - *Dihydroxy* - 2 : 2 : 3 - *trichlorobutane*) $\text{C}_4\text{H}_7\text{O}_2\text{Cl}_3$  MW, 193.5Leaflets from  $\text{H}_2\text{O}$ . M.p. 78°. Spar. sol. cold  $\text{H}_2\text{O}$ . Sol.  $\text{EtOH}$ , hot  $\text{H}_2\text{O}$ . Dist.  $\rightarrow$  butylchloral.  $\text{HNO}_3 \rightarrow$  1 : 1 : 2 - trichlorobutyric acid. Alkalis  $\rightarrow$   $\text{CH}_3\cdot\text{CCl}\cdot\text{CHCl} + \text{H}\cdot\text{COOH}$ .Pinner, *Ann.*, 1875, 179, 38.***n*-Butyl chloride** (1 - *Chlorobutane*) $\text{C}_4\text{H}_9\text{Cl}$  MW, 92.5F.p. -123.1°. B.p. 78-50°, 77°/769 mm.  $D_4^{15}$  0.89197,  $D_4^{20}$  0.8859.  $n_D^{15}$  1.40499,  $n_D^{20}$  1.40159.Wacher, D.R.P. 462,993, (*Chem. Abstracts*, 1928, 22, 4133).Norris, *Organic Syntheses*, Collective Vol. I, 137.Soc. Richard Allenet, U.S.P. 1,852,063, (*Chem. Abstracts*, 1932, 26, 2989).**sec.-Butyl chloride** (2 - *Chlorobutane*) $\text{C}_4\text{H}_9\text{Cl}$  MW, 92.5B.p. 68°/761 mm.  $D_4^{20}$  0.8707,  $D_4^{20}$  0.8740.  $n_D^{20}$  1.39709,  $n_D^{25}$  1.3953.Norris, Taylor, *J. Am. Chem. Soc.*, 1924, 46, 753.Dobryanskiĭ, Rudkovskiĭ, *Chem. Abstracts*, 1936, 30, 6702.**tert.-Butyl chloride** (2 - *Chloroisobutane*) $\text{C}_4\text{H}_9\text{Cl}$  MW, 92.5B.p. 52°, 49.5°/738 mm.  $D_4^{15}$  0.847,  $D_4^{20}$  0.8457.  $n_D^{15}$  1.38686,  $n_D^{20}$  1.38564. Boiling  $\text{H}_2\text{O} \rightarrow$  *tert.*-butyl alcohol.Norris, Olmsted, *Organic Syntheses*, Collective Vol. I, 138.Dobryanskiĭ, Rudkovskiĭ, *Chem. Abstracts*, 1936, 30, 6702.Dow, U.S.P. 1,993,719, (*Chem. Abstracts*, 1935, 29, 2549).**3-*n*-Butyl-*o*-cresol** $\text{C}_{11}\text{H}_{16}\text{O}$  MW, 164

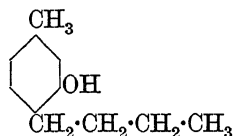
M.p. 14°. B.p. 117-19°/15 mm.

Coulthard, Marshall, Pyman, *J. Chem. Soc.*, 1930, 291.**5-*n*-Butyl-*o*-cresol.**

M.p. 124°. B.p. 127-29°/15 mm. (127-30°/12 mm.).

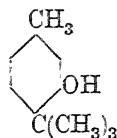
*Acetyl*: b.p. 268-70°.Coulthard, Marshall, Pyman, *J. Chem. Soc.*, 1930, 291.Auwers, Janssen, *Ann.*, 1930, 483, 44.**3-*tert.*-Butyl-*o*-cresol** $\text{C}_{11}\text{H}_{16}\text{O}$  MW, 164

M.p. 27°. B.p. 122-5°/14 mm.

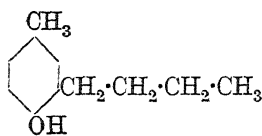
Tschitschibabin, *Compt. rend.*, 1934, 198, 1239.**6-*tert.*-Butyl-*o*-cresol.**Yellowish liq. B.p. 235-7°. Forms add. comp. with  $\text{KI}_3$ , "Europhene," used in pharmacy.Baur, *Ber.*, 1894, 27, 1615.**4-*n*-Butyl-*m*-cresol** $\text{C}_{11}\text{H}_{16}\text{O}$  MW, 164

M.p. 18°. B.p. 132-4°/15 mm.

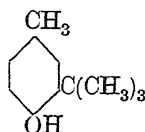
Coulthard, Marshall, Pyman, *J. Chem. Soc.*, 1930, 291.

4-*tert.*-Butyl-*m*-cresolC<sub>11</sub>H<sub>16</sub>O MW, 164

M.p. 23°. B.p. 121-2°/15 mm.

Tschitschibabin, *Compt. rend.*, 1934, 198, 1239.3-*n*-Butyl-*p*-cresolC<sub>11</sub>H<sub>16</sub>O MW, 164

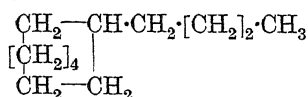
M.p. 19°. B.p. 124-6°/15 mm.

Coulthard, Marshall, Pyman, *J. Chem. Soc.*, 1930, 291.3-*tert.*-Butyl-*p*-cresolC<sub>11</sub>H<sub>16</sub>O MW, 164

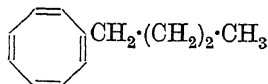
M.p. 44°. B.p. 118-19°/14 mm.

Tschitschibabin, *Compt. rend.*, 1934, 198, 1239.

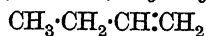
## Butylcyclo-octane

C<sub>12</sub>H<sub>24</sub> MW, 168Oil. B.p. 90-1°/10 mm. D<sub>4</sub><sup>25</sup> 0.8261. n<sub>D</sub><sup>25</sup> 1.4585.Cope, Van Orden, *J. Am. Chem. Soc.*, 1952, 74, 175.

## Butylcyclo-octatetraene

C<sub>12</sub>H<sub>16</sub> MW, 160Yellow oil. B.p. 98°/20 mm. D<sub>4</sub><sup>25</sup> 0.8876. n<sub>D</sub><sup>25</sup> 1.5083.Cope, Van Orden, *J. Am. Chem. Soc.*, 1952, 74, 175.

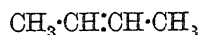
## 1-Butylene (1-Butene, ethylethylene, α-butylene)

C<sub>4</sub>H<sub>8</sub> MW, 56

Gas at ord. temps. Liquefies in freezing mixture. Liq. b.p. -6.1°.

Coffin, Maass, *J. Am. Chem. Soc.*, 1928, 50, 1427.Matignon, Moureu, Dodé, *Bull. soc. chim.*, 1935, 2, 1169, 1181.Dutt, F.P. 677,338, (*Chem. Abstracts*, 1930, 24, 2956).

## 2-Butylene (2-Butene, sym.-dimethylethylene, β-butylene)

C<sub>4</sub>H<sub>8</sub> MW, 56

Gas at ord. temps. B.p. +1°/741 mm.

Coffin, Maass, *J. Am. Chem. Soc.*, 1928, 50, 1427.Heisig, *J. Am. Chem. Soc.*, 1931, 53, 3258.Weston, Hass, *J. Am. Chem. Soc.*, 1932, 54, 3337.Matignon, Moureu, Dodé, *Bull. soc. chim.*, 1935, 2, 1169.I.G., U.S.P. 1,914,674, (*Chem. Abstracts*, 1933, 27, 4252).

## 1-Butylene-1-carboxylic Acid.

See 2-Ethylacrylic Acid.

## 1-Butylene-2-carboxylic Acid.

See 1-Ethylacrylic Acid.

## 1-Butylene-4-carboxylic Acid.

See Allylacetic Acid.

## 2-Butylene-1-carboxylic Acid.

See 2-Ethylidenepropionic Acid.

## Butylene dibromide.

See Dibromobutane.

## 1-Butylene-1 : 2-dicarboxylic Acid.

See Ethylmaleic Acid and Ethylfumaric Acid.

## 1-Butylene-1 : 3-dicarboxylic Acid.

See α-Methylglutaconic Acid.

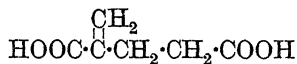
## 1-Butylene-1 : 4-dicarboxylic Acid.

See Δ<sup>1</sup>-Dihydromuconic Acid.

## 1-Butylene-2 : 3-dicarboxylic Acid.

See 3-Methylitaconic Acid.

## 1-Butylene-2 : 4-dicarboxylic Acid (1-Methyleneglutaric acid)

C<sub>8</sub>H<sub>8</sub>O<sub>4</sub> MW, 144M.p. 130-1° (133.5°). Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O. k = 6.7 × 10<sup>-5</sup> at 25°. Dil. HNO<sub>3</sub> → succinic acid. NaHg → 1-methylglutaric acid.von Pechmann, Roehm, *Ber.*, 1901, 34, 428.

## 1-Butylene-4 : 4-dicarboxylic Acid.

See Allylmalonic Acid.

## 2-Butylene-1 : 2-dicarboxylic Acid.

See Ethylidenesuccinic Acid.

## 2-Butylene-1 : 4-dicarboxylic Acid.

See Δ<sup>2</sup>-Dihydromuconic Acid.

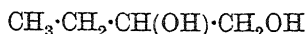
**2-Butylene-2 : 3-dicarboxylic Acid.**

See Dimethylmaleic Acid and Dimethylfumaric Acid.

**Butylene dichloride.**

See Dichlorobutane.

**$\alpha$ -Butylene Glycol** (1 : 2-Dihydroxybutane, ethylethylene glycol, butandiol-1 : 2, 1 : 2-butylene glycol)



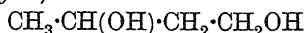
$\text{C}_4\text{H}_{10}\text{O}_2$  MW, 90

Liq. with sweet taste. B.p. 192-4°. Sol.  $\text{H}_2\text{O}$ , EtOH.  $D_4^0$  1.0189. Dil.  $\text{HNO}_3 \rightarrow$  glycollic + glyoxylic acids.

*Diacetyl*: b.p. 196-9°.

Grabowsky, Saizew, *Ann.*, 1875, 179, 332.

**$\beta$ -Butylene Glycol** (1 : 3-Dihydroxybutane, 1-methyltrimethylene glycol, butandiol-1 : 2, 1 : 3-butylene glycol)



$\text{C}_4\text{H}_{10}\text{O}_2$  MW, 90

Viscous liq. Sweet taste. Sol.  $\text{H}_2\text{O}$ , EtOH. Insol. Et<sub>2</sub>O.

*d.*

B.p. 60-5°/0.8 mm.  $[\alpha]_D^{25} + 7.5^\circ$  in EtOH.

*Phenylurethane*: m.p. 115-6°.  $[\alpha]_D^{25} + 20^\circ$  in EtOH.

*l.*

B.p. 107-10°/23 mm.  $[\alpha]_D^{25} - 18.8^\circ$  in EtOH.

*Di-phenylurethane*: m.p. 127-8°.  $[\alpha]_D^{25} - 51.5^\circ$  in EtOH.

*dl.*

B.p. 204°, 114°/20 mm., 103-4°/8 mm.  $D_4^0$  1.0053.  $n_D^{19}$  1.4418.

*1-Acetyl*: b.p. 87-9°/13 mm.  $D^{25}$  1.005.  $n_D^{25}$  1.4182.

*Diacetyl*: b.p. 92-4°/13 mm.  $D^{25}$  1.028.  $n_D^{25}$  1.4145.

*1-Benzoyl*: b.p. 132-3°/3 mm.  $n_D^{20}$  1.5130.

*1-Acetyl-3-benzoyl*: b.p. 135-7°/2 mm.  $D^{25}$  1.0695.  $n_D^{25}$  1.5045.

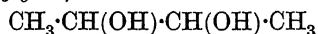
Carothers, Adams, *J. Am. Chem. Soc.*, 1924, 46, 1675.

Levene, Walti, *J. Biol. Chem.*, 1931, 94, 361.

Bergmann, Mickleley, Lippmann, *Ber.*, 1929, 62, 1474.

I.G., D.R.P. 558,645, (*Chem. Abstracts*, 1933, 27, 512).

**$\psi$ -Butylene Glycol** (*Butandiol-2 : 3*, 2 : 3-dihydroxybutane, 2 : 3-butylene glycol, dimethylene glycol)



$\text{C}_4\text{H}_{10}\text{O}_2$  MW, 90

*dl.*

B.p. 182.5°. Misc. with  $\text{H}_2\text{O}$  and EtOH in all proportions.  $D_4^0$  1.0033.  $n_D^{25}$  1.43637.

*Diacetyl*: b.p. 82°/10 mm.

*Borate*:  $\text{C}_4\text{H}_9\text{O}_3\text{B}$ . B.p. 112-7°/below 1 mm.

*d.*

M.p. 25°.  $D^{25}$  0.9872.  $n_D^{25}$  1.4306, 1.4384.  $[\alpha]_D^{25}$  1.0°. Forms a pentahydrate, m.p. 16.8°.

*l.*

M.p. 19°.  $D^{25}$  0.9869.  $n_D^{25}$  1.4307.  $[\alpha]_D^{25}$  -13.0°.

*Meso.*

$D^{25}$  0.9939.  $n_D^{25}$  1.4324.

Verhaue, B.P. 315,263, (*Chem. Abstracts*, 1930, 24, 1652).

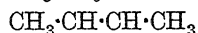
Fulmer, Christensen, Kendall, *Ind. Eng. Chem.*, 1933, 25, 789.

Kluyver, Scheffer, U.S.P. 1,899,156, (*Chem. Abstracts*, 1933, 27, 3029).

Batalin, Ugryumov, *Chem. Abstracts*, 1936, 30, 6701.

Ward, Pettijohn, Lockwood, Coghill, *J. Am. Chem. Soc.*, 1944, 66, 541.

**$\beta$ -Butylene Oxide** (2 : 3-Dimethylethylene oxide, sym.-dimethylethylene oxide)



$\text{C}_4\text{H}_8\text{O}$  MW, 72

B.p. 56-7°.  $D_4^0$  0.8306.  $\text{H}_2\text{O}$  at 100°  $\rightarrow$   $\psi$ -butylene glycol.

Krassuski, *Compt. rend.*, 1907, 145, 762.

Batalin, Ugryumov, *Chem. Abstracts*, 1936, 30, 6701.

***n*-Butylethanolamine.**

See *n*-Butylaminoethyl Alcohol.

***n*-Butylethylene.**

See 1-Hexene.

**sec.-*n*-Butylethylene.**

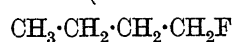
See 3-Methyl-1-pentene.

**tert.-Butylethylene.**

See 3 : 3-Dimethyl-1-butylene.

**Butylethylene Glycol.**

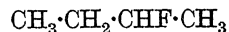
See Hexandiol-1 : 2.

***n*-Butyl fluoride** (1-Fluorobutane)

$\text{C}_4\text{H}_9\text{F}$  MW, 76

B.p. 31.95-31.98°/745.8 mm.  $D_4^0$  0.7761.  $n_D^{15}$  1.3419.

Desreux, *Chem. Zentr.*, 1934, II, 2516.

**sec.-Butyl fluoride** (2-Fluorobutane)

$\text{C}_4\text{H}_9\text{F}$  MW, 76

M.p. -121.4°. B.p. 25.1°.  $D_4^0$  0.7559.

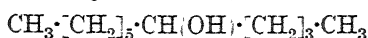
Grosse et al., *J. Phys. Chem.*, 1940, 44, 275.

**1-*n*-Butylglycerol.**

See Heptantriol-1 : 2 : 3.

**tert.-Butylglyoxylic Acid.**

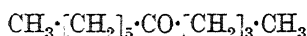
See Trimethylpyruvic Acid.

**Butyl-*n*-hexylcarbinol** (*Undecanol-5*)

$\text{C}_{11}\text{H}_{24}\text{O}$  MW, 172

f.p.  $-3.5^\circ$ . B.p.  $229-230.5^\circ$ .  $D_4^{20}$  0.8300. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

Byrtschenko, *Chem. Zentr.*, 1910, II, 1744.

**Butyl *n*-hexyl Ketone** (*Undecanone-5*)

$\text{C}_{11}\text{H}_{22}\text{O}$  MW, 170

M.p.  $2^\circ$ . B.p.  $105-6^\circ/12$  mm. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.  $D_4^{20}$  0.8278.  $n_D^{20}$  1.4275.

*Oxime*: b.p.  $143^\circ/14$  mm.

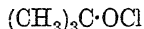
*Semicarbazone*: cryst. from MeOH. M.p.  $75^\circ$ .

Braun, Kröper, *Ber.*, 1929, 62, 2884.

**Butyl *p*-hydroxyphenyl sulphide.**

See under Thiohydroquinone.

**tert.-Butyl hypochlorite** (tert.-*Butyl oxychloride*)



$\text{C}_4\text{H}_9\text{OCl}$  MW, 108.5

B.p.  $79.6^\circ/750$  mm.  $D_4^{25}$  0.9583.

Chattaway, Backeberg, *J. Chem. Soc.*, 1923, 123, 2999.

Taylor, Macmillan, Gammal, *J. Am. Chem. Soc.*, 1925, 47, 395.

**Butylideneacetone.**

See 3-Heptenone-2.

**Butylidene chloride.**

See 1 : 1-Dichlorobutane.

**Butylidene-ethylene.**

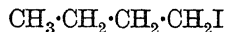
See 1 : 2-Hexadiene.

**1-Butylidenepropionic Acid.**

See 1-Methyl-1-hexenic Acid.

**2-Butylidenepropionic Acid.**

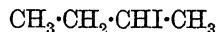
See 2-Heptenic Acid.

***n*-Butyl iodide** (1-*Iodobutane*)

$\text{C}_4\text{H}_9\text{I}$  MW, 184

B.p.  $131^\circ$ ,  $130.3^\circ/771$  mm.,  $129^\circ/756$  mm.  $D_4^{20}$  1.6166,  $D_4^{20}$  1.609.  $n_D^{20}$  1.50006.

Adams, Voorhees, *J. Am. Chem. Soc.*, 1919, 41, 789.

**sec.-Butyl iodide** (2-*Iodobutane*)

$\text{C}_4\text{H}_9\text{I}$  MW, 184

*dl.*

B.p.  $119-120^\circ$ ,  $119^\circ/769$  mm.,  $117.5^\circ/750$  mm.,  $33^\circ/45$  mm.  $D_4^0$  1.6263,  $D_4^{20}$  1.5920.  $n_D^{20}$  1.49909.

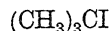
*l.*

B.p.  $111-18^\circ$  ( $121-2^\circ$ ).  $D_4^{20}$  1.585.  $n_D^{19}$  1.4945.  $[\alpha]_D^{20}$   $-2.14^\circ$ .

Norris, *Am. Chem. J.*, 1907, 38, 640.

Levene, Rothen, Kuna, *J. Biol. Chem.*, 1936, 115, 415.

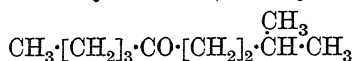
Kenyon, Phillips, Pittman, *J. Chem. Soc.*, 1935, 1080.

**tert.-Butyl iodide** (2-*Iodoisobutane*)

$\text{C}_4\text{H}_9\text{I}$  MW, 184

B.p.  $100^\circ$  part. decomp.  $D_4^0$  1.571. Easily decomp. to isobutylene and HI. Cold H<sub>2</sub>O  $\longrightarrow$  *tert.*-butyl alcohol and HI.

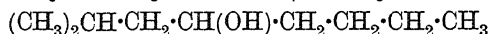
Norris, *Am. Chem. J.*, 1907, 38, 640.

***n*-Butylisoamyl Ketone** (2-*Methylnonanone-5*)

$\text{C}_{10}\text{H}_{20}\text{O}$  MW, 156

B.p.  $203-4^\circ$ .  $D_4^{20}$  0.8213.  $n_D^{20}$  1.4239.

Powell, Hagemann, *J. Am. Chem. Soc.*, 1944, 66, 372.

**Butylisobutylcarbinol** (2-*Methyloctanol-4*)

$\text{C}_9\text{H}_{20}\text{O}$  MW, 144

*l.*

B.p.  $87^\circ/20$  mm.  $n_D^{25}$  1.4258.  $[\alpha]_D^{25}$   $-9.48^\circ$ .

*Acid phthalate*:  $[\alpha]_D^{30}$   $-8.1^\circ$ .

*dl.*

B.p.  $184^\circ/766$  mm.  $D_4^{20}$  0.815.

Levene, Marker, *J. Biol. Chem.*, 1931, 90, 669.

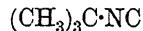
Malengreau, *Chem. Zentr.*, 1907, I, 1399.

Tuot, *Compt. rend.*, 1936, 202, 1339.

**Butylisobutylethylene.**

See 2-Methyl-4-octene.

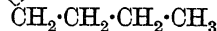
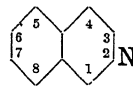
**tert.-Butyl isocyanide** (tert.-*Butyl carbylamine*)



$\text{C}_5\text{H}_9\text{N}$  MW, 83

B.p.  $91^\circ/37.5$  mm. Very unpleasant odour. Decomp. by conc. HCl to *tert.*-butylamine and formic acid

Nef, *Ann.*, 1899, 309, 154.

**1-*n*-Butylisoquinoline**

$\text{C}_{13}\text{H}_{15}\text{N}$  MW, 185

B.p.  $283-4^\circ$ ,  $154-7^\circ/14$  mm.

*Picrate*: m.p.  $185.5^\circ$ .

Späth, Berger, Kuntara, *Ber.*, 1930, 63, 138.

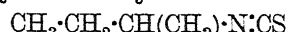
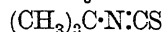
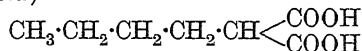
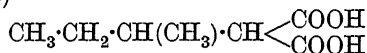
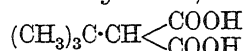
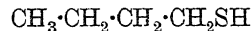
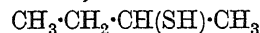
Zeigler, Zeiser, *Ann.*, 1931, 485, 187.

**3-*n*-Butylisoquinoline.**

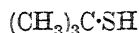
B.p. 278°/745 mm.

Lehmkuhl, *Ber.*, 1897, 30, 897.***n*-Butyl isothiocyanate (Butyl mustard oil)**C<sub>5</sub>H<sub>9</sub>NS MW, 115

B.p. 167°.

Hofmann, *Ber.*, 1874, 7, 512.**sec.-Butyl isothiocyanate**C<sub>5</sub>H<sub>9</sub>NS MW, 115*d.*B.p. 159°. D<sub>4</sub><sup>20</sup> 0.943. [α]<sub>D</sub><sup>20</sup> + 61.88°.*l.*B.p. 159°. D<sub>4</sub><sup>20</sup> 0.942. [α]<sub>D</sub><sup>20</sup> - 61.8°.*dl.*B.p. 159.5°. D<sup>13</sup> 0.944.*d.*, and *l.*, Thomé, *Ber.*, 1903, 36, 584.*dl.*, Hofmann, *Ber.*, 1874, 7, 513.**tert.-Butyl isothiocyanate**C<sub>5</sub>H<sub>9</sub>NS MW, 115M.p. 10.5°. B.p. 140°/770 mm. D<sub>4</sub><sup>24</sup> 0.9003.Rudnew, *Ber.*, 1879, 12, 1023.***n*-Butylmalonic Acid (Pentane-1:1-dicarboxylic acid)**C<sub>7</sub>H<sub>12</sub>O<sub>4</sub> MW, 160Prisms. M.p. 101° (98-9°). Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. *k* = 1.03 × 10<sup>-3</sup> at 25°. At 150° → caproic acid. Reddish-violet sol. in conc. H<sub>2</sub>SO<sub>4</sub>.*Di-Et ester*: C<sub>11</sub>H<sub>20</sub>O<sub>4</sub>. MW, 216. B.p. 235-40°, 140-5°/40 mm., 130-5°/20 mm. *n*<sub>D</sub><sup>20</sup> 1.4250.*Mononitrile*: 1-cyanocaproic acid, C<sub>7</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 141. Needles from H<sub>2</sub>O. M.p. 122.5-6.5°. Sublimes.*Diamide*: C<sub>7</sub>H<sub>14</sub>O<sub>2</sub>N<sub>2</sub>. MW, 158. M.p. 200°.*Dianilide*: m.p. 193°.*Dihydrazide*: m.p. 141-2°.Adams, Kamm, *Organic Syntheses*, Collective Vol. I, 245.Morton, Hechenbleikner, *J. Am. Chem. Soc.*, 1936, 58, 1025.Morton, Le Fèvre, Hechenbleikner, *J. Am. Chem. Soc.*, 1936, 58, 754.**sec.-Butylmalonic Acid (2-Methyl-*n*-butane-1:1-dicarboxylic acid, isopentane-1:1-dicarboxylic acid)**C<sub>7</sub>H<sub>12</sub>O<sub>4</sub> MW, 160Plates. M.p. 76°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, hot C<sub>6</sub>H<sub>6</sub>. Heat → 2-methyl-*n*-valeric acid.*Di-Me ester*: C<sub>9</sub>H<sub>16</sub>O<sub>4</sub>. MW, 188. B.p. 217-8°/748 mm.*Di-Et ester*: C<sub>11</sub>H<sub>20</sub>O<sub>4</sub>. MW, 216. B.p. 245-50°/762 mm., 234-6°/755 mm. (224-5°).*Di-sec-butyl ester*: b.p. 115°, 3 mm., 92-6°/1-2 mm. *n*<sub>D</sub><sup>20</sup> 1.4282.*Diamide*: C<sub>7</sub>H<sub>14</sub>O<sub>2</sub>N<sub>2</sub>. MW, 158. M.p. 242°.Dox, Yoder, *J. Am. Chem. Soc.*, 1922, 44, 1564.Ehrlich, *Ber.*, 1908, 41, 1455.Schonle, Keltch, Swanson, *J. Am. Chem. Soc.*, 1930, 52, 2440.**tert.-Butylmalonic Acid (2,2-Dimethylpropane-1,1-dicarboxylic acid)**C<sub>7</sub>H<sub>12</sub>O<sub>4</sub> MW, 160Needles. M.p. 152-3°. Sol. H<sub>2</sub>O. Spar. sol. hot C<sub>6</sub>H<sub>6</sub>.*Mono-Et ester*: C<sub>9</sub>H<sub>16</sub>O<sub>4</sub>. MW, 188. B.p. 93-5°/17 mm.*Di-Et ester*: C<sub>11</sub>H<sub>20</sub>O<sub>4</sub>. MW, 216. B.p. 205-10°/750 mm, 102-4°/11 mm. D<sub>25</sub><sup>25</sup> 1.0144.*n*<sub>D</sub><sup>20</sup> 1.4180.Dox, Bywater, *J. Am. Chem. Soc.*, 1936, 58, 731.Hauser, Abramovitch, Adams, *J. Am. Chem. Soc.*, 1942, 64, 2714.Widequist, *Chem. Abstracts*, 1947, 1615.***n*-Butyl Mercaptan (Thiobutyl alcohol, 1-butanethiol)**C<sub>4</sub>H<sub>10</sub>S MW, 90M.p. -119 to -115°. B.p. 97-8°. D<sub>4</sub><sup>20</sup> 0.86006, D<sub>4</sub><sup>20</sup> 0.8337. *n*<sub>D</sub><sup>20</sup> 1.44402.*Benzoyl*: b.p. 160°/23 mm. D<sub>25</sub><sup>25</sup> 1.0514.Gray, Gutekunst, *J. Am. Chem. Soc.*, 1920, 42, 856.Kimball, Reid, *J. Am. Chem. Soc.*, 1916, 38, 2757.Bezzi, *Gazz. chim. ital.*, 1935, 65, 693.**sec.-Butyl Mercaptan (sec.-Butyl thioalcohol, 2-butanethiol)**C<sub>4</sub>H<sub>10</sub>S MW, 90*dl.*B.p. 84-5°. D<sub>4</sub><sup>25</sup> 0.82459. *n*<sub>D</sub><sup>25</sup> 1.4338.*Benzoyl*: b.p. 150°/20 mm. D<sub>25</sub><sup>25</sup> 1.0457.*d.*[α]<sub>D</sub><sup>20</sup> + 15.71°. Ox. with HNO<sub>3</sub> → *d*-butane-2-sulphonic acid.*l.*B.p. 83-5°. D<sub>4</sub><sup>17</sup> 0.830. [α]<sub>D</sub><sup>17</sup> - 17.35°.Kimball, Reid, *J. Am. Chem. Soc.*, 1916, 38, 2757.Levene, Mikeska, *J. Biol. Chem.*, 1925, 63, 85.Ellis, Reid, *J. Am. Chem. Soc.*, 1932, 54, 1674.Kenyon, Phillips, Pittman, *J. Chem. Soc.*, 1935, 1078.

tert.-Butyl Mercaptan tert.-Butyl thioalcohol)



$\text{C}_4\text{H}_{10}\text{S}$  MW, 90

M.p.  $-0.5^\circ$ . B.p.  $63.7-64.2^\circ/760$  mm. Very stable to oxidising agents.

S.-Me: methyl tert.-butyl sulphide.  $\text{C}_5\text{H}_{12}\text{S}$ . MW, 104. B.p.  $101-2^\circ$ .

S.-Et: ethyl tert.-butyl sulphide.  $\text{C}_6\text{H}_{14}\text{S}$ . MW, 118. B.p.  $56-7^\circ/109$  mm.

Benzoyl: b.p.  $110^\circ/28$  mm.  $D_{25}^{25}$  1.0468.

Rheinboldt, Mott, Motzkus, *J. prakt. Chem.*, 1932, 134, 257.

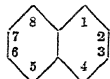
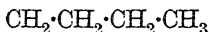
Lee, U.S.P. 2,020,421, (*Chem. Abstracts*, 1936, 30, 489).

Shell Development, U.S.P. 2,051,806, (*Chem. Abstracts*, 1936, 30, 6760).

Butyl *p*-methoxyphenyl sulphide.

See under Thiohydroquinone.

1-*n*-Butylnaphthalene (1- $\alpha$ -Naphthylbutane)



$\text{C}_{14}\text{H}_{16}$  MW, 184

B.p.  $281-3^\circ$ ,  $151-2^\circ/14$  mm.

Picrate: orange-yellow needles. M.p.  $104-5^\circ$ .

Bargellini, Melacini, *Gazz. chim. ital.*, 1908, 38, ii, 571.

Mayer, Sieglitz, *Ber.*, 1922, 55, 1843.

2-*n*-Butylnaphthalene (1- $\beta$ -Naphthylbutane).

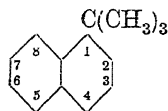
B.p.  $283-5^\circ$ ,  $125-30^\circ/13$  mm.

Picrate: orange-yellow needles. M.p.  $71-3^\circ$ .

Bargellini, Melacini, *Gazz. chim. ital.*, 1908, 38, ii, 571.

Mayer, Sieglitz, *Ber.*, 1922, 55, 1854.

1-tert.-Butylnaphthalene (2- $\alpha$ -Naphthylisobutane)



$\text{C}_{14}\text{H}_{16}$  MW, 184

B.p.  $287-9^\circ$  ( $278-87^\circ$ ).  $D_4^{20}$  0.9629.  $n_D^{20}$  1.5726.

Picrate: yellow needles. M.p.  $96^\circ$  ( $93^\circ$ ).

Späth, *Monatsh.*, 1913, 34, 2013.

Tsukervanik, Terent'eva, *J. Gen. Chem. U.S.S.R.*, 1937, 7, 637.

2-tert.-Butylnaphthalene (2- $\beta$ -Naphthylisobutane).

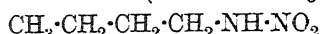
F.p.  $-4^\circ$ . B.p.  $274-7^\circ/756$  mm.,  $137-9^\circ/17$  mm.,  $115^\circ/6$  mm.,  $125^\circ/4$  mm.  $D_4^{20}$  0.9687.  $n_D^{20}$  1.5768.

Picrate: m.p.  $84-5^\circ$  ( $102-3^\circ$ ).

Barbot, *Bull. soc. chim.*, 1930, 47, 1314.

Tsukervanik, Terent'eva, *J. Gen. Chem. U.S.S.R.*, 1937, 7, 637.

*n*-Butylnitramine (N-Nitro-*n*-butylamine)

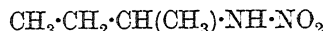


$\text{C}_4\text{H}_{10}\text{O}_2\text{N}_2$  MW, 118

M.p.  $0^\circ$ . Spar. sol.  $\text{H}_2\text{O}$ . Sol. EtOH.  $D^{15}$  1.066.  $n_D^{15}$  1.46039.

van Erp, *Rec. trav. chim.*, 1895, 14, 26.

sec.-Butylnitramine (N-Nitro-sec.-butylamine)

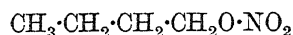


$\text{C}_4\text{H}_{10}\text{O}_2\text{N}_2$  MW, 118

M.p.  $-34.5^\circ$ . Sol. EtOH,  $\text{Et}_2\text{O}$ . Spar. sol.  $\text{H}_2\text{O}$ .  $D_4^{20}$  1.0566.  $n_D^{20}$  1.4581.

van Erp, *Rec. trav. chim.*, 1895, 14, 26.

*n*-Butyl nitrate

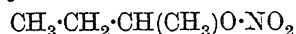


$\text{C}_4\text{H}_9\text{O}_3\text{N}$  MW, 119

B.p.  $136^\circ$ .  $D^0$  1.048.

Bertoni, *Gazz. chim. ital.*, 1890, 20, 374.

sec.-Butyl nitrate

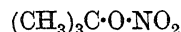


$\text{C}_4\text{H}_9\text{O}_3\text{N}$  MW, 119

B.p.  $124^\circ$ .  $D^0$  1.0382.

Bertoni, *Gazz. chim. ital.*, 1890, 20, 374.

tert.-Butyl nitrate



$\text{C}_4\text{H}_9\text{O}_3\text{N}$  MW, 119

B.p.  $23-4^\circ/4-5$  mm.  $D_4^{20}$  1.014.

Michael, Carlson, *J. Am. Chem. Soc.*, 1935, 57, 1271.

*n*-Butyl nitrite



$\text{C}_4\text{H}_9\text{O}_2\text{N}$  MW, 103

B.p.  $75-6^\circ$ .  $D^0$  0.9114.

Noyes, *Organic Syntheses*, 1936, XVI, 7.

sec.-Butyl nitrite

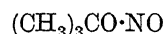


$\text{C}_4\text{H}_9\text{O}_2\text{N}$  MW, 103

B.p.  $68^\circ$ .  $D^0$  0.8981.

Bertoni, *Gazz. chim. ital.*, 1888, 18, 434.

tert.-Butyl nitrite



$\text{C}_4\text{H}_9\text{O}_2\text{N}$  MW, 103

B.p.  $63^\circ$ . Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ ,  $\text{CS}_2$ . Spar. sol.  $\text{H}_2\text{O}$ .  $D^0$  0.8941.

Bertoni, *Gazz. chim. ital.*, 1885, 15, 358.

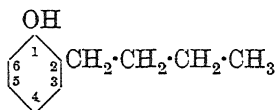
4-*n*-Butyl-2-pentene.

See 4-Methyl-2-octene.

Butylphenetole.

See under Butylphenol.

## o-n-Butylphenol (2-Hydroxy-1-n-butylbenzene)



$C_{10}H_{14}O$  MW, 150  
B.p. 234-7°, 113-15°/14 mm.  $D_4^{20}$  0.975.  $n_D^{25}$  1.5180.

*Et ether*: o-n-butylphenetole.  $C_{12}H_{18}O$ .  
MW, 178. B.p. 124-5°/19 mm.  $D_4^{22}$  0.9226.  
 $n_D^{15}$  1.496.

*Acetyl*: m.p. 105.5°.

Read, Mullin, *J. Am. Chem. Soc.*, 1928, 50, 1763.

Sandulesco, Girard, *Bull. soc. chim.*, 1930, 47, 1300.

Smith, *J. Am. Chem. Soc.*, 1934, 56, 1419.

## m-n-Butylphenol (3-Hydroxy-1-n-butylbenzene).

B.p. 247-8°/758 mm.  $D_4^{20}$  0.974.

*Me ether*: m-n-butylanisole.  $C_{11}H_{16}O$ .  
MW, 164. B.p. 115-6°/19 mm.  $D_4^{22}$  0.9393.  
 $n_D^{15}$  1.5035.

Reid, Mullin, *J. Am. Chem. Soc.*, 1928, 50, 1763.

## p-n-Butylphenol (4-Hydroxy-1-n-butylbenzene).

M.p. 22°. B.p. 248°, 138-9°/18 mm., 125-6°/11 mm.  $D_4^{22}$  0.976.  $n_D^{25}$  1.5165.

*Me ether*: p-n-butylanisole.  $C_{11}H_{16}O$ .  
MW, 164. B.p. 120°/19 mm.  $D_4^{22}$  0.9372.  $n_D^{15}$  1.5027.

*Benzoyl*: m.p. 27°.  $n_D^{25}$  1.5082.

p-Nitrobenzoyl: m.p. 67-8°.

von Braun, *Ann.*, 1929, 472, 74.

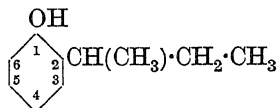
Sandulesco, Girard, *Bull. soc. chim.*, 1930, 47, 1300.

Baranger, *Bull. soc. chim.*, 1931, 49, 1213.

Smith, *J. Am. Chem. Soc.*, 1934, 56, 1419.

Rice, Harden, *J. Am. Pharm. Assoc.*, 1936, 25, 7.

## o-sec.-Butylphenol (2-Hydroxy-1-sec-butylbenzene)



$C_{10}H_{14}O$  MW, 150  
B.p. 227-8°, 116°/21 mm.

Read, Hewitt, Pike, *J. Am. Chem. Soc.*, 1932, 54, 1194.

Sharpe, Dohme, U.S.P. 1,887,662, (*Chem. Abstracts*, 1933, 27, 1453).

## p-sec.-Butylphenol (4-Hydroxy-1-sec-butylbenzene).

Needles. M.p. 53-4° (59°). B.p. 240°/751 mm., 239-40°/745 mm. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. Volatile in steam.  $D_4^{21}$  0.986.  $n_D^{21}$  1.5182.

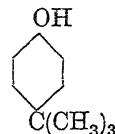
*Me ether*: p-sec-butylanisole.  $C_{11}H_{16}O$ .  
MW, 164. B.p. 106-8°/16 mm.  $D_4^{21}$  0.9434.  
 $n_D^{20}$  1.5062.

*Acetyl*: b.p. 255.5°/744 mm. (244-6°).

Reilly, Hickinbottom, *J. Chem. Soc.*, 1920, 117, 122.

Smith, *J. Am. Chem. Soc.*, 1933, 55, 3718.

## p-tert.-Butylphenol (4-Hydroxy-1-tert-butylbenzene)



$C_{10}H_{14}O$  MW, 150  
Needles. M.p. 99° (97.5°). B.p. 236-8°. Volatile in steam.

*Me ether*: p-tert-butylanisole.  $C_{11}H_{16}O$ .  
MW, 164. B.p. 215-16° (222°/730 mm.).

*Et ether*: p-tert-butylphenetole.  $C_{12}H_{18}O$ .  
MW, 178. B.p. 233-4°/730 mm.

*Acetyl*: b.p. 245°.

*Benzoyl*: m.p. 81-2°.

*Benzenesulphonyl*: m.p. 70-1°.

p-Toluenesulphonyl: m.p. 109-10°.

Isagulyants, Bagryantseva, *Chem. Abstracts*, 1939, 33, 8183.

Smith, *J. Am. Chem. Soc.*, 1933, 55, 3718.

Natelson, *J. Am. Chem. Soc.*, 1934, 56, 1583.

Huston, Hsieh, *J. Am. Chem. Soc.*, 1936, 58, 439.

Dow, U.S.P. 2,039,344, (*Chem. Abstracts*, 1936, 30, 4176).

## n-Butylphenylcarbinol.

See 1-Phenyl-n-amyl Alcohol.

## sec.-Butylphenylcarbinol (2-Methyl-1-phenylbutanol-1, 2-methyl-1-phenylbutyl alcohol)

MW, 164  
B.p. 120°/13 mm. Misc. with EtOH, Et<sub>2</sub>O,  
 $C_6H_6$ . Insol. H<sub>2</sub>O.

*Acetyl*: b.p. 123°/10 mm.

Dumesnil, *Ann. chim.*, 1917, 8, 78.

## n-Butyl phenyl Ketone.

See Valerophenone.

## sec.-Butyl phenyl Ketone (ω-Methyl-ω-ethylacetophenone)

$C_6H_5 \cdot CO \cdot CH(CH_3) \cdot CH_2 \cdot CH_3$  MW, 162  
B.p. 105-7°/10 mm.

Haller, Bauer, *Compt. rend.*, 1909, 148, 73.

## tert.-Butyl phenyl Ketone (ω-Trimethylacetophenone, pivalophenone)

$C_6H_5 \cdot CO \cdot C(CH_3)_3$  MW, 162  
 $C_{11}H_{14}O$

B.p. 219–21°, 97–8°/16 mm. (104°/13 mm.).  
D<sub>25</sub><sup>26</sup> 0.963. n<sub>D</sub><sup>15</sup> 1.5086.

Oxime: needles M.p. 167°.

Semicarbazone: m.p. 150° (168°).

2:4-Dinitrophenylhydrazone: m.p. 194–5°.

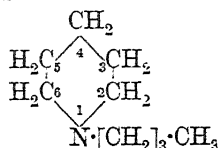
Haller, Bauer, *Compt. rend.*, 1909, 148, 73.

Favorskii, Zalesskaya, Rozanov, Chelintzev, *Bull. soc. chim.*, 1936, 3, 239.

Tsatsas, *Ann. chim.*, 1936, 1, 342.

Huston, Barrett, *J. Org. Chem.*, 1946, 11, 657.

### N-n-Butylpiperidine



C<sub>9</sub>H<sub>19</sub>N MW, 141

B.p. 175–6°, 171–2°/740 mm. D<sub>25</sub><sup>25</sup> 0.8210.  
n<sub>D</sub><sup>25</sup> 1.4442.

B, HCl: cryst. from EtOH–Et<sub>2</sub>O. M.p. 239–40°.

B, HBr: cryst. from EtOH–Et<sub>2</sub>O. M.p. 224°.

Picrate: yellow cryst. from EtOH. M.p. 132° (134°).

Braun, *Ber.*, 1907, 40, 3930.

Winans, Adkins, *J. Am. Chem. Soc.*, 1932, 54, 310.

### 2-n-Butylpiperidine.

dl.

B.p. 191–3°, 75°/14 mm. D<sub>4</sub><sup>15</sup> 0.8529.

B, HCl: plates from EtOH. M.p. 191° (186°).

B, HBr: m.p. 196–7°.

B, HClO<sub>4</sub>: needles from AcOEt. M.p. 114°.

B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>: yellowish-brown needles. M.p. 137–40°.

Picrolonate: yellow prisms from MeOH. M.p. 204° (190°).

N-Me: C<sub>10</sub>H<sub>21</sub>N. MW, 155. B.p. 75–80°/15 mm. Picrate: m.p. 88°.

d.

[α]<sub>D</sub> + 15.7°.

B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>: m.p. 131–2°.

l.

[α]<sub>D</sub> – 18.7°.

B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>: m.p. 131–2°.

Tartrate: needles + 2H<sub>2</sub>O. M.p. 41–2°.

Löffler, Plöckner, *Ber.*, 1907, 40, 1322.

Clemo, Ramage, Raper, *J. Chem. Soc.*, 1932, 2964.

Diels, Schrum, *Ann.*, 1937, 530, 80.

### 3-n-Butylpiperidine.

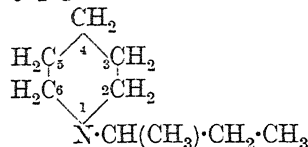
B.p. 196–7°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Insol. H<sub>2</sub>O.

B, HCl: cryst. from H<sub>2</sub>O. M.p. 102° (148°).

Picrate: m.p. 124°.

Maass, Zablinksi, *Ber.*, 1914, 47, 1172.

### N-sec.-Butylpiperidine



C<sub>9</sub>H<sub>19</sub>N MW, 141

B.p. 175°/768 mm., 169–70°/740 mm. D<sub>25</sub><sup>25</sup> 0.8334. n<sub>D</sub><sup>20</sup> 1.4506.

B, HCl: cryst. from EtOH–Et<sub>2</sub>O. M.p. 208–9°.

Chloroplatinate: m.p. 197–8°.

Picrate: m.p. 100°.

Methiodide: m.p. 210–12° decomp.

Bruylants, *Bull. soc. chim. Belg.*, 1924, 33, 467.

Kenyon, Phillips, Pittman, *J. Chem. Soc.*, 1935, 1078.

### 2-sec.-Butylpiperidine.

B.p. 179–81°.

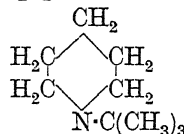
B, HCl: m.p. 188–9°.

Picrolonate: m.p. 209°.

Diels, Alder, *Ann.*, 1933, 505, 150.

Diels, Schrum, *Ann.*, 1937, 530, 81.

### N-tert.-Butylpiperidine



C<sub>9</sub>H<sub>19</sub>N MW, 141

B.p. 166°/763 mm. D<sub>20</sub><sup>20</sup> 0.8465. n<sub>D</sub><sup>20</sup> 1.4532.

B, HCl: m.p. 268–9° decomp.

Chloroplatinate: m.p. 235°.

Velghe, *Bull. sci. acad. roy. Belg.*, 1925, 11, 301.

### Butylpropenylacetylene.

See 2-Nonen-4-yne.

### n-Butylpropenylcarbinol.

See 2-Octenol-4.

### sec.-n-Butylpropenylcarbinol.

See 5-Methyl-2-heptenol-4.

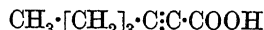
### tert.-Butylpropenylcarbinol.

See 5:5-Dimethyl-2-hexenol-4.

### sec.-Butyl propenyl Ketone.

See 5-Methyl-2-heptenone-4.

### n-Butylpropionic Acid (1-Hexyne-1-carboxylic acid)



C<sub>7</sub>H<sub>10</sub>O<sub>2</sub> MW, 126

B.p. 140–2°/24 mm., 135°/20mm., 122°/10 mm. D<sub>20</sub><sup>20</sup> 0.978. n<sub>D</sub><sup>20</sup> 1.4619. Heat → butylacetylene + CO<sub>2</sub>.

Me ester: C<sub>8</sub>H<sub>12</sub>O<sub>2</sub>. MW, 140. B.p. 91–3°/19 mm., 72°/10 mm. D<sub>20</sub><sup>20</sup> 0.937, D<sub>0</sub><sup>0</sup> 0.953. n<sub>D</sub><sup>20</sup> 1.4455.

Et ester: C<sub>9</sub>H<sub>14</sub>O<sub>2</sub>. MW, 154. B.p. 106–8°/24 mm. D<sub>0</sub><sup>0</sup> 0.9385.



Chloride : C<sub>7</sub>H<sub>9</sub>OCl. MW, 144.5. B.p. 65°/13 mm. D<sub>4</sub><sup>20</sup> 1.0609. n<sub>D</sub><sup>20</sup> 1.4695.

Amide : C<sub>7</sub>H<sub>11</sub>ON. MW, 125. Cryst. from EtOH. M.p. 68-9°.

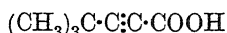
Nitrile : C<sub>7</sub>H<sub>9</sub>N. MW, 107. B.p. 70°/25 mm. D<sub>4</sub><sup>25</sup> 0.8412. n<sub>D</sub><sup>25</sup> 1.4467.

Moureu, Delange, *Compt. rend.*, 1903, 136, 553.

Koehl, Wenzke, *J. Am. Chem. Soc.*, 1937, 59, 1418.

Zoss, Hennion, *J. Am. Chem. Soc.*, 1941, 63, 1152.

**tert.-Butylpropionic Acid** (*Trimethyltetrolac acid*)



C<sub>7</sub>H<sub>10</sub>O<sub>2</sub> MW, 126

Cryst. M.p. 48-9°. B.p. 110°/10 mm. Heat → *tert.*-butylacetylene + CO<sub>2</sub>.

Me ester : C<sub>8</sub>H<sub>12</sub>O<sub>2</sub>. MW, 140. B.p. 66°/13 mm. D<sub>4</sub><sup>0</sup> 0.9292.

Et ester : C<sub>9</sub>H<sub>14</sub>O<sub>2</sub>. MW, 154. B.p. 75°/15 mm. D<sub>4</sub><sup>0</sup> 0.9209.

Chloride : C<sub>7</sub>H<sub>9</sub>OCl. MW, 144.5. B.p. 52°/20 mm. D<sub>4</sub><sup>0</sup> 0.9745. n<sub>D</sub><sup>20</sup> 1.4443.

Moureu, Delange, *Compt. rend.*, 1903, 136, 553.

Ivitzky, *Bull. soc. chim.*, 1924, 35, 359.

**n-Butyl propionate**



C<sub>7</sub>H<sub>14</sub>O<sub>2</sub> MW, 130

B.p. 145.5°. D<sub>4</sub><sup>0</sup> 0.8953.

Gartenmeister, *Ann.*, 1886, 233, 265.

**sec.-Butyl propionate**



C<sub>7</sub>H<sub>14</sub>O<sub>2</sub> MW, 130

B.p. 132°. D<sub>4</sub><sup>20</sup> 0.8657. n<sub>D</sub><sup>25</sup> 1.3938.

Norris, Green, *Am. Chem. J.*, 1901, 26, 293.

**1-Butylpropionic Acid.**

See 1-Methylcaproic Acid.

**2-Butylpropylene.**

See 2-Methyl-1-hexene.

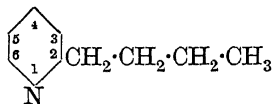
**1-sec.-Butylpropylene.**

See 4-Methyl-2-hexene.

**tert.-Butylpropylene.**

See 4 : 4-Dimethyl-1-pentene and 4 : 4-Dimethyl-2-pentene.

**2-n-Butylpyridine**



C<sub>9</sub>H<sub>13</sub>N MW, 135

B.p. 191-3°. Very sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. D<sub>4</sub><sup>25</sup> 0.9135. Volatile in steam.

B<sub>2</sub>H<sub>2</sub>AuCl<sub>4</sub> : m.p. 85°.

B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub> : reddish-brown plates + 1H<sub>2</sub>O. M.p. 146-7°.

HgCl<sub>2</sub> double salt : m.p. 104°.

Picrate : yellow needles from EtOH. M.p. 94°.

Ziegler, Zeiser, *Ber.*, 1930, 63, 1850.

**3-n-Butylpyridine.**

B.p. 205-8°. Insol. H<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 0.9797.

B<sub>2</sub>HCl : cryst. from H<sub>2</sub>O. M.p. 126°.

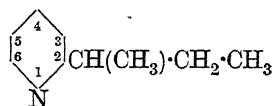
B<sub>2</sub>H<sub>2</sub>AuCl<sub>4</sub> : m.p. 95°.

B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub> : m.p. 187-8° decomp.

Picrate : cryst. from EtOH. M.p. 89-90°.

Maas, Zablinki, *Ber.*, 1914, 47, 1171.

**2-sec.-Butylpyridine**



C<sub>9</sub>H<sub>13</sub>N MW, 135

B.p. 174-5°.

B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub> : m.p. 166°.

Diels, Alder, *Ann.*, 1933, 505, 150.

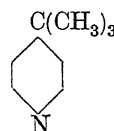
**4-sec.-Butylpyridine.**

B.p. 187°.

Picrate : m.p. 142°.

Tschitschibabin, *Bull. soc. chim.*, 1936, 3, 1607.

**4-tert.-Butylpyridine**



C<sub>9</sub>H<sub>13</sub>N MW, 135

B.p. 196-7°. Very spar. sol. H<sub>2</sub>O.

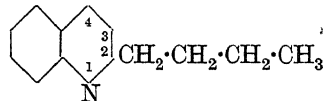
B<sub>2</sub>H<sub>2</sub>AuCl<sub>4</sub> : cryst. from dil. HCl. M.p. 184°.

B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub> : needles from dil. HCl. M.p. 212-13° decomp.

Picrate : m.p. 121-1.5°.

Koenigs, Happe, *Ber.*, 1903, 36, 2911.

**2-n-Butylquinoline**



C<sub>13</sub>H<sub>15</sub>N MW, 185

B.p. 153°/14 mm. D<sub>4</sub><sup>20</sup> 1.003. n<sub>D</sub><sup>20</sup> 1.5699.

Chloroplatinate : m.p. 163.5°.

Picrate : cryst. from EtOH. M.p. 162-3° (143°).

Ziegler, Zeiser, *Ann.*, 1931, 485, 184.

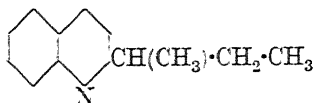
Delaby, Hiron, *Compt. rend.*, 1930, 191, 847.

**4-n-Butylquinoline.**

Picrate : m.p. 185-9° decomp.

Kenner, Stratham, *Ber.*, 1936, 69, 16.

## 2-sec.-Butylquinoline



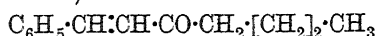
$C_{13}H_{15}N$  MW, 185

B.p. 118–21°/3–5 mm.

Picrate: m.p. 164–5° corr.

Bergstrom, *J. Am. Chem. Soc.*, 1931, 53, 4075.

**n-Butyl styryl Ketone** (*Benzylidenemethyl n-butyl ketone*)



$C_{13}H_{16}O$  MW, 188

M.p. 38–9° (40°). B.p. 159–67°/11 mm.

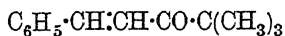
Phenylhydrazone: yellow cryst. M.p. 98°.

Dimeride:  $C_{26}H_{32}O_2$ . MW, 376. Needles. M.p. 175–6°.

Auwers, Voss, *Ber.*, 1909, 42, 4421.

Heilbron, Irving, *J. Chem. Soc.*, 1929, 933.

**tert.-Butyl styryl Ketone** (*Benzylidene-pinacolin*)



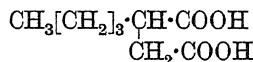
$C_{13}H_{16}O$  MW, 188

Prisms. M.p. 41° (43°). B.p. 154°/25 mm., 144–5°/10 mm. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, pet. ether. Spar. sol. H<sub>2</sub>O. Mod. volatile in steam.

Hill, Spear, Lachowicz, *J. Am. Chem. Soc.*, 1923, 45, 1557.

Vorländer, Kalkow, *Ber.*, 1897, 30, 2268.

**n-Butylsuccinic Acid** (*Hexane-1 : 2-dicarboxylic acid*)



$C_8H_{14}O_4$  MW, 174

d.

From ice/H<sub>2</sub>O. M.p. 82.5–3.5°.  $[\alpha]_D^{25} + 22.6^\circ$  in H<sub>2</sub>O.  $[\alpha]_D^{25} + 26.5^\circ$  in EtOH.

l.

M.p. 82.5–3.5°.  $[\alpha]_D^{25} - 22.5^\circ$  in H<sub>2</sub>O.

dl.

M.p. 82.5–3.5°.

Fittig, Fichter, *Ann.*, 1899, 304, 254.

Scheibler, Rettig, *Ber.*, 1926, 59, 1195.

Fleury, Courtois, *Compt. rend.*, 1946, 223, 63.

## n-Butylthiourea

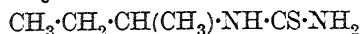


$C_5H_{12}N_2S$  MW, 132

M.p. 79°.

Hofmann, *Ber.*, 1874, 7, 512.

## sec.-Butylthiourea



$C_5H_{12}N_2S$  MW, 132

d.

M.p. 136–7°. Spar. sol. cold H<sub>2</sub>O.  $[\alpha]_D^{20} + 22.77^\circ$  in 94% EtOH.

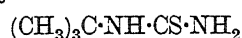
dl.

M.p. 128° (133°).

d., Urban, *J. Chem. Soc.*, 1904, 86, i, 375.

dl., Dixon, *J. Chem. Soc.*, 1895, 67, 559.

## tert.-Butylthiourea

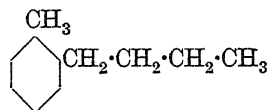


$C_5H_{12}N_2S$  MW, 132

M.p. 165°.

Rudnew, *Ber.*, 1879, 12, 1023.

## o-n-Butyltoluene (1-o-Tolylbutane)



$C_{11}H_{16}$  MW, 148

B.p. 201°.  $D_4^{18}$  0.87023.  $n_D^{20}$  1.49662.

Niemczycki, *Chem. Zentr.*, 1900, II, 468.

## m-n-Butyltoluene (1-m-Tolylbutane).

B.p. 197–8°, 84°/19 mm.  $D_4^{18}$  0.8624.  $n_D^{20}$  1.49315.

Capeller, *Helv. Chim. Acta*, 1928, 11, 168.

Niemczycki, *Chem. Zentr.*, 1900, II, 468.

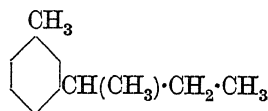
## p-n-Butyltoluene (1-p-Tolylbutane).

B.p. 198–9°. 82.7–83.3°/13 mm.  $D_4^{20}$  0.8586.  $n_D^{20}$  1.4916.

Niemczycki, *Chem. Zentr.*, 1900, II, 468.

Schmidt, Schoeller, *Ber.*, 1941, 74, 258.

## m-sec.-Butyltoluene (2-m-Tolylbutane)



$C_{11}H_{16}$  MW, 148

B.p. 194–8°.

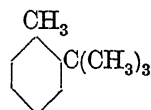
Shoosmith, McGechen, *J. Chem. Soc.*, 1930, 2235.

## p-sec.-Butyltoluene (2-p-Tolylbutane).

B.p. 195–7° (200–5°).

Shoosmith, McGechen, *J. Chem. Soc.*, 1930, 2235.

## o-tert.-Butyltoluene



$C_{11}H_{16}$  MW, 148

B.p. 170–1°/743 mm.  $n_D^{20}$  1.49423.  
Kozak, *Chem. Zentr.*, 1907, I, 1787.

***m*-tert.-Butyltoluene.**

B.p. 186–8° (191–3°). HNO<sub>3</sub> → trinitro deriv. (artificial musk, Musk Baur).

Baur, *Ber.*, 1891, 24, 2833.  
Shoosmith, McGechen, *J. Chem. Soc.*, 1930, 2232.

***p*-tert.-Butyltoluene.**

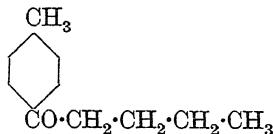
B.p. 192–3° (190°), 94°/25 mm.  $D_4^{20}$  0.8614.  $n_D^{20}$  1.493565. Volatile in steam.

Lacourt, *Chem. Abstracts*, 1929, 23, 2431.  
Shoosmith, McGechen, *J. Chem. Soc.*, 1930, 2232.

**Butyl tolyl Ether.**

See under Cresol

**Butyl *p*-tolyl Ketone** (*p*-Methylvalerophenone, 4-*n*-valeryltoluene)



$\text{C}_{12}\text{H}_{16}\text{O}$  MW, 176

Prisms. M.p. 22°. B.p. 266–7°, 166°/40 mm. Sol. usual org. solvents.

Oxime: b.p. 180°/25 mm., 168°/13 mm.

Semicarbazone: needles from boiling EtOH. M.p. 212° (206°).

Blaise, *Compt. rend.*, 1901, 133, 1218.  
Laybaud, *Bull. soc. chim.*, 1906, 35, 227.

***n*-Butylurea**

$\text{CH}_3\cdot[\text{CH}_2]_2\cdot\text{CH}_2\cdot\text{NH}\cdot\text{CO}\cdot\text{NH}_2$   
 $\text{C}_5\text{H}_{12}\text{ON}_2$  MW, 116

Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 96°. Sol. H<sub>2</sub>O.

Davis, Blanchard, *J. Am. Chem. Soc.*, 1929, 51, 1797.

**sec.-Butylurea**

$\text{CH}_3\cdot\text{CH}_2\cdot\text{CH}(\text{CH}_3)\cdot\text{NH}\cdot\text{CO}\cdot\text{NH}_2$   
 $\text{C}_5\text{H}_{12}\text{ON}_2$  MW, 116

*d*-. Needles. M.p. 166°.  $[\alpha]_D^{20} +24.1^\circ$  in EtOH.

*dl*-. Prisms. M.p. 169–70°.

*d*-, Urban, *J. Chem. Soc.*, 1904, 86, i, 375.

*dl*-, Dixon, *J. Chem. Soc.*, 1895, 67, 560.

**tert.-Butylurea**

$(\text{CH}_3)_3\text{C}\cdot\text{NH}\cdot\text{CO}\cdot\text{NH}_2$   
 $\text{C}_5\text{H}_{12}\text{ON}_2$  MW, 116  
Needles. M.p. 172° decomp. (183° decomp.). Sol. H<sub>2</sub>O, EtOH.

Brander, *Rec. trav. chim.*, 1917, 37, 67.  
Schneegans, *J. Chem. Soc.*, 1894, 56, i, 405.

Dict. of Org. Comp.—I.

***n*-Butylurethane** (*n*-Butylaminoformic ethyl ester)

$\text{CH}_3\cdot[\text{CH}_2]_2\cdot\text{CH}_2\cdot\text{NH}\cdot\text{COO}\cdot\text{C}_2\text{H}_5$   
 $\text{C}_7\text{H}_{15}\text{O}_2\text{N}$  MW, 145

M.p. –22°. B.p. 202–3°/765.5 mm., 100°/15 mm.  $D_4^{20}$  0.9434.  $n_D^{20}$  1.42784.

van Erp, *Rec. trav. chim.*, 1895, 14, 18.  
Werner, *J. Chem. Soc.*, 1919, 115, 1013.

**sec.-Butylurethane** (*sec*-Butylaminoformic ethyl ester)

$\text{CH}_3\cdot\text{CH}_2\cdot\text{CH}(\text{CH}_3)\cdot\text{NH}\cdot\text{COO}\cdot\text{C}_2\text{H}_5$   
 $\text{C}_7\text{H}_{15}\text{O}_2\text{N}$  MW, 145

M.p. –14 to –13°. B.p. 193–5°, 90°/15 mm.  $D_4^{20}$  0.9404.  $n_D^{20}$  1.42666.

Marvel, Noyes, *J. Am. Chem. Soc.*, 1920, 42, 2276.

Dixon, *J. Chem. Soc.*, 1895, 67, 561.  
van Erp, *Rec. trav. chim.*, 1895, 14, 18.

**tert.-Butylurethane** (*tert*-Butylaminoformic ethyl ester)

$(\text{CH}_3)_3\text{C}\cdot\text{NH}\cdot\text{COO}\cdot\text{C}_2\text{H}_5$   
 $\text{C}_7\text{H}_{15}\text{O}_2\text{N}$  MW, 145

M.p. 21–2°. B.p. 72°/16 mm.  $D_1^{20}$  0.943.

van Erp, *Rec. trav. chim.*, 1895, 14, 17.

***n*-Butylvinylcarbinol.**

See 1-Heptenol-3.

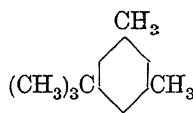
**Butyl vinyl Ether**

$\text{CH}_3\cdot\text{CH}_2\cdot\text{CH}_2\cdot\text{CH}_2\cdot\text{O}\cdot\text{CH}:\text{CH}_2$   
 $\text{C}_6\text{H}_{12}\text{O}$  MW, 100

B.p. 93.3°.  $D_4^{20}$  0.7888.  $n_D^{20}$  1.4026.

Favorskiĭ, Shostakovskii, *J. Gen. Chem. U.S.S.R.*, 1943, 13, 1.

**5-tert.-Butyl-*m*-xylene**



$\text{C}_{12}\text{H}_{18}$  MW, 162

B.p. 200–2°/747 mm. HNO<sub>3</sub> → trinitro deriv. (artificial musk, Xylene Musk).

Nörling, *Ber.*, 1892, 25, 791.  
A.G.F.A., D.R.P. 184,230, (*Chem. Zentr.*, 1907, II, 366).

Fichter, Meyer, *Helv. Chim. Acta*, 1934, 17, 535.

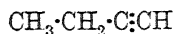
**Butyn** (*Sulphate of  $\gamma$ -di-*n*-butylaminopropyl *p*-aminobenzoate*)

$\left[ \begin{array}{c} \text{COO}\cdot\text{CH}_2\cdot[\text{CH}_2]_2\cdot\text{N}([\text{CH}_2]_3\cdot\text{CH}_3)_2 \\ \text{C}_6\text{H}_4 \\ \text{NH}_2 \end{array} \right]_2 \text{H}_2\text{SO}_4$   
 $(\text{C}_{18}\text{H}_{30}\text{O}_2\text{N}_2)_2\cdot\text{H}_2\text{SO}_4$  MW, 710  
26

Cryst. powder. M.p. 100°. Local anaesthetic, particularly for surface anaesthesia.

Abbott Laboratories, B.P. 191,122,  
(*Chem. Zentr.*, 1923, IV, 771).

**1-Butyne** (*Ethylacetylene*, *1-butine*)



$\text{C}_4\text{H}_6$  MW, 54  
F.p. -137°. B.p. 8.3°.  $D_0^{20}$  0.668.  $n_D^{20}$  1.3962.  
Forms Cu deriv.

Lai, *Bull. soc. chim.*, 1933, 53, 687.

Vaughan, Danehy, *Chem. Abstracts*, 1936,  
30, 429.

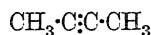
Dutt, F.P. 677,338, (*Chem. Abstracts*,  
1930, 24, 2956).

I.G., D.R.P. 562,010, (*Chem. Abstracts*,  
1933, 27, 736).

Stollé, Rouvé, *Helv. chim. Acta*, 1938, 21,  
1544.

Hurd, Drake, *J. Am. Chem. Soc.*, 1939,  
61, 1945.

**2-Butyne** (*Dimethylacetylene*, *crotonylene*, *2-butine*)



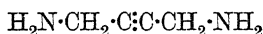
$\text{C}_4\text{H}_6$  MW, 54  
M.p. -32.8° (-32.32°). B.p. 27.2-27.6°,  
26.99°/760 mm.  $D_4^{20}$  0.715,  $D_4^{20}$  0.6913.  $n_D^{25}$   
1.3893,  $n_D^{20}$  1.3921.  $\text{H}_2\text{SO}_4 \rightarrow$  hexamethyl-  
benzene. Does not react with ammoniacal Cu  
or Ag sols.

Heisig, Davis, *J. Am. Chem. Soc.*, 1935,  
57, 339.

Wislicenus, Schmidt, *Ann.*, 1900, 313, 220.

Henne, Greenlee, *J. Am. Chem. Soc.*, 1945,  
67, 484.

**2-Butyne-1 : 4-diamine** (*Diaminodimethyl-  
acetylene*)

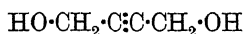


$\text{C}_4\text{H}_8\text{N}_2$  MW, 84  
Colourless cryst. M.p. 42-6°. B.p. 60-  
80°/11 mm. Sol.  $\text{H}_2\text{O}$ , MeOH, EtOH. Absorbs  
 $\text{CO}_2$  from the air.

*Dipicrate* : yellow needles from water. M.p.  
230-2° decomp.

Johnson, *J. Chem. Soc.*, 1946, 1009.

**2-Butyne-1 : 4-diol** (*Dihydroxydimethyl-  
acetylene*)



$\text{C}_4\text{H}_6\text{O}_2$  MW, 86  
Colourless plates from AcOEt or  $\text{C}_6\text{H}_6$ .  
M.p. 55°. B.p. 145°/15 mm. Very sol.  $\text{H}_2\text{O}$ ,  
MeOH, EtOH. Spar. sol.  $\text{CHCl}_3$ ,  $\text{Et}_2\text{O}$ .

*Diacetyl* : b.p. 122-3°/10 mm.  $n_D^{20}$  1.4611.

*Dibenzoyl* : m.p. 76-7° (from MeOH).

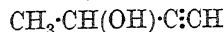
*Di-3 : 5-dinitrobenzoyl* : yellow plates from  
 $\text{EtOCH}_2 \cdot \text{CH}_2\text{OH}$ . M.p. 189-91°.

*Di-phenylurethane* : plates from  $\text{C}_6\text{H}_6$ . M.p.  
130-2°.

Lespieau, *Ann. chim.*, 1912, 27, 137.

Johnson, *J. Chem. Soc.*, 1946, 1009.

**1-Butyne-3-ol** (*Methylethynylcarbinol*)



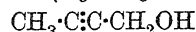
$\text{C}_4\text{H}_6\text{O}$  MW, 70  
B.p. 106.5-107.5°.  $D_4^{20}$  0.8858.  $n_D^{20}$  1.4265.

Kreimeier, U.S.P. 2,106,181, (*Chem. Ab-  
stracts*, 1938, 32, 2547).

McCallum, U.S.P. 2,125,384, (*Chem.  
Zentr.*, 1938, II, 3005).

Lespieau, *Bull. soc. chim.*, 1926, 39, 991.

**2-Butyne-1-ol** (*Hydroxydimethylacetylene*)



$\text{C}_4\text{H}_6\text{O}$  MW, 70  
B.p. 117-20°.

Reppe, Keyssner, D.R.P., 740,987.

**1-Butyne-3-one** (*Acetoacetylene*, *acetyl-  
acetylene*, *methyl acetylenyl ketone*, *methyl ethynyl  
ketone*)



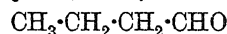
$\text{C}_4\text{H}_4\text{O}$  MW, 68  
B.p. 84°/752 mm.  $D_4^{25}$  0.8860.  $n_D^{20}$  1.4070.

*2 : 4-Dinitrophenylhydrazone* : yellow. M.p.  
181°.

Petrov, *J. Gen. Chem. U.S.S.R.*, 1940, 10,  
1682.

Bowden, Heilbron, Jones, Weedon, *J.  
Chem. Soc.*, 1946, 39.

**Butyraldehyde** (*n-Butyric aldehyde*, *butanal*)



$\text{C}_4\text{H}_8\text{O}$  MW, 72  
B.p. 75°. Sol. to 4% in  $\text{H}_2\text{O}$ .  $D_4^{20}$  0.8170.

$n_D^{20}$  1.38433. Forms bisulphite comp.

*Di-Me acetal* : b.p. 114°.  $D_4^{25}$  0.847.  $n_D^{21}$   
1.3900.

*Me-Et acetal* : b.p. 44-5°/11 mm.  $n_D^{20}$  1.3989.  
 $D_4^{20}$  0.9374.

*Di-Et acetal* : b.p. 55-6°/11 mm.  $n_D^{20}$  1.4022.  
 $D_4^{20}$  0.9211.

*Et-propyl acetal* : b.p. 67.8-9°/11 mm.  $n_D^{20}$   
1.4060  $D_4^{20}$  0.9131.

*Et-butyl acetal* : b.p. 80-1°/11 mm.  $n_D^{20}$   
1.4101.  $D_4^{20}$  0.9013.

*Oxime* : b.p. 152°/715 mm.

*Semicarbazone* : m.p. 77°.

*Phenylsemicarbazone* : m.p. 134-6°.

*2 : 4-Dinitrophenylsemicarbazone* : m.p. 196°  
decomp.

*o-Tolylsemicarbazone* : m.p. 96-8°.

*p-Tolylsemicarbazone* : m.p. 128-30°.

*Phenylhydrazone* : b.p. 190-95°/80 mm.

*p-Nitrophenylhydrazone* : yellow needles from  
EtOH. M.p. 91-2°.

*2 : 4-Dinitrophenylhydrazone* : cryst. from  
EtOH. M.p. 123°.

p-Iodophenylhydrazone : m.p. 152°.

Aldehyde-ammonia :

$\text{CH}_3 \cdot \text{CH}_2 \cdot \text{CH}_2 \cdot \text{CH}(\text{NH}_2) \cdot \text{OH} \cdot 3\frac{1}{2} \text{H}_2\text{O}$ . Cryst.  
M.p. 30–31°. Unstable above 4°. Sol. EtOH.

Cyanhydrin : see under 1-Hydroxy-n-valeric Acid.

Lipp, *Ann.*, 1882, 211, 355.

I.G., D.R.P. 539,177, (*Chem. Abstracts*, 1932, 26, 1624).

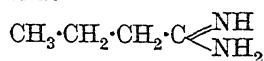
I.C.I., B.P. 371,051, (*Chem. Abstracts*, 1933, 27, 3724).

Kagan, Lyubarskiĭ, Fedorov, *Chem. Abstracts*, 1935, 29, 452.

### Butyramide.

See under n-Butyric Acid.

### Butyramidine



$\text{C}_4\text{H}_{10}\text{N}_2$  MW, 86

B,HCl : m.p. 94–6° (107–8°). Sol.  $\text{H}_2\text{O}$ . Volatile.

B,HNO<sub>3</sub> : m.p. 153°. Sol.  $\text{H}_2\text{O}$ . Non-volatile.

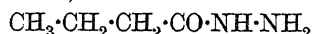
Picrate : m.p. 200–1°.

B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub> : m.p. 204° decomp.

Stutz, Grieshaber, *Chem. Zentr.*, 1913, I, 1271.

Drozdov, Bekhli, *J. Gen. Chem. U.S.S.R.*, 1944, 14, 280.

**Butyrylhydrazide** (*Butyric acid hydrazide, butyrylhydrazine*)



$\text{C}_4\text{H}_{10}\text{ON}_2$  MW, 102

Needles. M.p. 44°. B.p. 120°/10 mm. Sol.  $\text{H}_2\text{O}$ , EtOH, Et<sub>2</sub>O. Hygroscopic. Reduces  $\text{NH}_3$ ,  $\text{AgNO}_3$  in cold.

B,HCl : m.p. 148°. Sol.  $\text{H}_2\text{O}$ , EtOH.

Stollé, Zinsser, *J. prakt. Chem.*, 1904, 69, 486.

### n-Butyric Acid



$\text{C}_4\text{H}_8\text{O}_2$  MW, 88

F.p. –19°. M.p. –8°. B.p. 162°. Misc. with  $\text{H}_2\text{O}$ , EtOH, Et<sub>2</sub>O.  $D_4^{20}$  0.9587.  $n_D^{20}$  1.39906. Volatile in steam.  $k = 1.5 \times 10^{-5}$  at 25°. Mol. b.p. elevation, 39.4°. Heat of comb. 524.4 Cal. Na,  $\text{NH}_4$  and Ca salts sol.  $\text{H}_2\text{O}$ .

Me ester : see Methyl butyrate.

Et ester : see Ethyl butyrate.

Propyl ester :  $\text{C}_7\text{H}_{14}\text{O}_2$ . MW, 130. B.p. 143°.  $D_4^{15}$  0.8789.

Isopropyl ester : b.p. 128°.  $D_0$  0.8787.

n-Butyl ester :  $\text{C}_8\text{H}_{16}\text{O}_2$ . MW, 144. B.p. 165°.  $D_0$  0.8885.

Isobutyl ester : b.p. 157°.  $D_0$  0.8798.

Amyl ester : see Amyl butyrate and Isoamyl butyrate.

Allyl ester :  $\text{C}_7\text{H}_{12}\text{O}_2$ . MW, 128. B.p. 142.5–3°/772 mm.

1-Glycerol ester : α-monobutyryn.  $\text{C}_7\text{H}_{14}\text{O}_4$ . MW, 162. B.p. 269–71°, 163°/16 mm.

1:2-Glycerol dibutyrate : β-dibutyryn. B.p. 273–5°, 166–7°/19 mm.

1:3-Glycerol dibutyrate : α-dibutyryn.  $\text{C}_{11}\text{H}_{20}\text{O}_5$ . MW, 232. B.p. 279–82°, 173–6°/19 mm.

Glycerol tributyrate : see Tributyrin.

Phenyl ester :  $\text{C}_{10}\text{H}_{12}\text{O}_2$ . MW, 164. B.p. 227–8°.  $D_4^1$  1.0363.

Benzyl ester :  $\text{C}_{11}\text{H}_{14}\text{O}_2$ . MW, 178. B.p. 238–40°.

p-Phenylphenacyl ester : m.p. 97°.

β-Naphthyl ester :  $\text{C}_{14}\text{H}_{15}\text{O}_2$ . MW, 215. B.p. 164–5°/3 mm.

Anhydride :  $\text{C}_8\text{H}_{14}\text{O}_3$ . MW, 158. B.p. 198°.

Chloride : butyryl chloride.  $\text{C}_4\text{H}_7\text{OCl}$ . MW, 106.5. B.p. 101–2°.  $D_4^{20}$  1.0277.  $n_D^{20}$  1.41209.

Bromide : butyryl bromide.  $\text{C}_4\text{H}_7\text{OBr}$ . MW, 167. B.p. 128°.

Iodide : butyryl iodide.  $\text{C}_4\text{H}_7\text{OI}$ . MW, 214. B.p. 146–8°.

Amide : butyramide.  $\text{C}_4\text{H}_9\text{ON}$ . MW, 87. Leaflets. M.p. 115–16°. B.p. 216°.  $D$  1.032. Sol.  $\text{H}_2\text{O}$ .

Nitrile : butyronitrile, propyl cyanide.  $\text{C}_4\text{H}_7\text{N}$ . MW, 69. B.p. 117°.  $D^{15}$  0.796.  $n_D^{24}$  1.3816.

Hydrazide : see Butyrylhydrazide.

Anilide : butyranilide.  $\text{C}_{10}\text{H}_{13}\text{ON}$ . MW, 163. M.p. 96°.

o-Toluidide : m.p. 79–80°.

p-Toluidide : needles from  $\text{H}_2\text{O}$ . M.p. 74–5°.

Grillone, *Ann.*, 1873, 165, 128.

Langwell, Ricard, Burton, B.P. 271,254, (*Chem. Abstracts*, 1928, 22, 1650).

Lefranc, B.P. 276,617, (*Chem. Abstracts*, 1928, 22, 2378).

Mitchel, Reid, *J. Am. Chem. Soc.*, 1931, 53, 321, 1879.

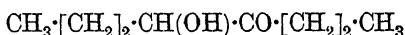
Abe, *Chem. Abstracts*, 1933, 27, 3193.

I.G., U.S.P. 1,792,163, (*Chem. Abstracts*, 1931, 25, 1843).

Carbide and Chemical Corp., F.P. 790,213, (*Chem. Abstracts*, 1936, 30, 2992).

du Pont, U.S.Ps. 2,020,689, 2,039,722, (*Chem. Abstracts*, 1936, 30, 491, 4179).

**Butyroin** (5-Hydroxyoctanone-4, 5-octanone-4)



$\text{C}_8\text{H}_{16}\text{O}_2$  MW, 144

B.p. 180–90°, 85°/10 mm.  $D_4^0$  0.9367.  $n_D^{15}$  1.43455. Reduces Fehling's.

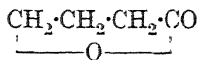
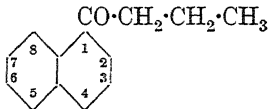
Oxime : b.p. 143°/10 mm.

Bouveault, Locquin, *Compt. rend.*, 1905, 140, 1594.

Snell, McElvain, *Organic Syntheses*, 1933, XIII, 24.

**Butyrolactam.**

See 2-Pyrrolidone.

**Butyrolactone** ( $\gamma$ -Butyrolactone, 3-hydroxybutyric acid lactone) $\text{C}_4\text{H}_6\text{O}_2$  MW, 86B.p. 203-4° (206°), 89°/12 mm. Misc. with  $\text{H}_2\text{O}$ . Sol. EtOH,  $\text{Et}_2\text{O}$ .  $D_4^{20}$  1.441. Volatile in steam. Reduces  $\text{NH}_3 \cdot \text{AgNO}_3$ . Hyd. by hot alkalis.  $\text{CrO}_3 \rightarrow$  succinic acid.Sircar, *J. Chem. Soc.*, 1928, 898.**1-Butyronaphthone** (Propyl 1-naphthyl ketone) $\text{C}_{14}\text{H}_{14}\text{O}$  MW, 198Yellow oil. B.p. 316-18°, 178-9°/12 mm. Very sol. most org. solvents.  $D_4^{20}$  1.0861.  $n_D^{27}$  1.596.

Oxime : b.p. 206-8°/13 mm.

Rousset, *Bull. soc. chim.*, 1896, 15, 65.Nunn, Henze, *J. Org. Chem.*, 1947, 12, 540.**2-Butyronaphthone** (Propyl 2-naphthyl ketone).

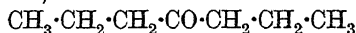
Prisms or needles. M.p. 52° (53°). B.p. 322-4°, 184-5°/16 mm.

Oxime : needles. M.p. 89°.

Semicarbazone : prisms from EtOH. M.p. 185-6°.

Azine : yellow needles. M.p. 130°.

Picrate : needles. M.p. 68-9°.

Comp. with  $\text{AlCl}_3$  : dark green needles. M.p. 92-5°.Barbot, *Bull. soc. chim.*, 1930, 47, 1314.Perrier, *Bull. soc. chim.*, 1896, 15, 322.Rousset, *Bull. soc. chim.*, 1896, 15, 66.Buu-Hoi, Cagniant, *Bull. soc. chim.*, 1945, 12, 307.**Butyrene** (Di-n-propyl ketone, 4-ketoheptane, heptanone-4) $\text{C}_7\text{H}_{14}\text{O}$  MW, 114B.p. 144°.  $D_4^{20}$  0.8205.  $n_D^{20}$  1.40732. Forms no bisulphite or ammonia comp.  $\text{CrO}_3 \rightarrow$  propionic and butyric acids.Oxime : b.p. 196°/772 mm.  $D_4^{20}$  0.8924.

2 : 4-Dinitrophenylhydrazone : m.p. 75°.

I.G., F.P. 706,805, (*Chem. Abstracts*, 1932, 26, 479).Commercial Solvents Corp., U.S.P. 1,978,404, (*Chem. Abstracts*, 1935, 29, 177).Ivanov, *Bull. soc. chim.*, 1928, 43, 441.**Butyronitrile.**

See under n-Butyric Acid.

**Butyrophenone** (Butyrylbenzene, n-propyl phenyl ketone) $\text{C}_{10}\text{H}_{12}\text{O}$  MW, 148B.p. 218-21° (228-9°), 130-45°/25 mm., 110°/10 mm. Misc. with EtOH,  $\text{Et}_2\text{O}$ .  $D_{20}^{20}$  0.988.  $n_D^{20}$  1.532.  $\text{CrO}_3 \rightarrow$  benzoic and propionic acids. Does not form bisulphite comp.

Oxime : needles. M.p. 50°.

Semicarbazone : prisms. M.p. 188° (182°).

Carswell, Adkins, *J. Am. Chem. Soc.*, 1928, 50, 239.Shriner, Turner, *J. Am. Chem. Soc.*, 1930, 52, 1267.**Butyrophenone- $\gamma$ -carboxylic Acid.**

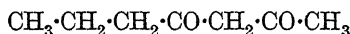
See 2-Benzoylisobutyric Acid.

**Butyrophenone- $\omega$ -carboxylic Acid.**

See 3-Benzoylbutyric Acid.

**Butyrospermol** $\text{C}_{30}\text{H}_{50}\text{O}$  MW, 426Constituent of shea nut fat. M.p. 111-13°.  $[\alpha]_D^{19} - 12^\circ$  in  $\text{CHCl}_3$ .Acetyl : m.p. 146.5-147.5°.  $[\alpha]_D^{20} + 11 \pm 2^\circ$  in  $\text{CHCl}_3$ .Benzoyl : m.p. 130-3°.  $[\alpha]_D^{19} + 33.5^\circ$  in  $\text{CHCl}_3$ .Dihydro deriv. : m.p. 114-16°.  $[\alpha]_D^{19} - 14^\circ$  in  $\text{CHCl}_3$ . Acetyl : m.p. 136-9°.  $[\alpha]_D^{19} + 14^\circ$  in  $\text{CHCl}_3$ . Benzoyl : m.p. 138-9°.  $[\alpha]_D^{19} + 30.5^\circ$  in  $\text{CHCl}_3$ .Heilbron, Jones, Robins, *J. Chem. Soc.*, 1949, 444.**Butyrylacetic Acid.**

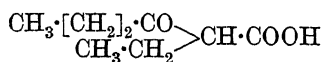
See 2-Keto-n-caproic Acid.

**Butyrylacetone** (Acetylbutyrylmethane, 2 : 4-diketoheptane, heptandione-2 : 4) $\text{C}_7\text{H}_{12}\text{O}_2$  MW, 128B.p. 174-5°, 70°/20 mm.  $D_{15}^{15}$  0.9411. Volatile in steam. Reacts acid to litmus.  $\text{FeCl}_3 \rightarrow$  red col.Na deriv. : white cryst. M.p. 152°. Hygroscopic. Sol.  $\text{Et}_2\text{O}$ .

Cu deriv. : pale blue cryst. M.p. 161°.

Weygand, Baumgärtel, *Ber.*, 1929, 62, 577.Malachowski, Wanezura, *Chem. Abstracts*, 1934, 28, 4421.**Butyrylanisole.**

See under p-Hydroxybutyrophenone.

**1-Butyrylbutyric Acid** (2-Keto-1-ethylcaproic acid) $\text{C}_8\text{H}_{14}\text{O}_3$  MW, 158

*Me ester*: b.p. 101–4°/20 mm.  $n_D^{20}$  1.429.  
*Et ester*:  $C_{10}H_{18}O_3$ . MW, 186. B.p. 222.8–223.4°/755 mm., 126–7°/34 mm., 94–102°/12 mm.  $D_4^0$  0.9713.  $n_D^{20}$  1.4224–1.4226.  
*tert.-Butyl ester*: b.p. 102.5–5°/10 mm.  
*Isoamyl ester*:  $C_{13}H_{24}O_3$ . MW, 222. B.p. 127–7°/9 mm.

Zeltner, *Ber.*, 1908, 41, 591.

McElvain, *J. Am. Chem. Soc.*, 1929, 51, 3124.

### 3-Butyrylbutyric Acid.

*See* 4-Keto-*n*-caprylic Acid.

### 7-Butyrylcapyrylic Acid.

*See* 8-Ketolauric Acid.

### Butyrylcarbinol.

*See* 1-Pentanolone-2.

### Butyrylcresol.

*See* Hydroxy-methylbutyrophenone.

### Butyrylcyclohexane.

*See* Hexahydrobutyrophenone.

### Butyrylethylene.

*See* 1-Hexenone-3.

### Butyrylformic Acid.

*See* 1-Keto-*n*-valeric Acid.

### Butyrylhydrazine.

*See* Butyrylhydrazide.

**1-Butyrylisobutyric Acid** (2-Keto-1:1-di-methylcaproic acid)



$C_8H_{14}O_3$  MW, 158

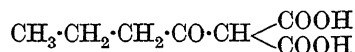
*Et ester*:  $C_{10}H_{18}O_3$ . MW, 186. B.p. 108–10°/29 mm.

Blaise, *Compt. rend.*, 1901, 132, 479.

### 1-Butyrylisohehexane.

*See* 4-Methylnonanone-6.

### *n*-Butyrylmalonic Acid



$C_7H_{10}O_5$  MW, 174

*Di-Et ester*:  $C_{11}H_{18}O_5$ . MW, 230. B.p. 247–52°, 135°/13 mm.  $D_4^{20}$  1.056.  $n_D^{20}$  1.4451.

*Me ester nitrile*:  $C_8H_{11}O_3N$ . MW, 169. B.p. 135°/25 mm.  $D_4^{20}$  1.0933.  $n_D^{20}$  1.4763.

*Et ester nitrile*:  $C_9H_{13}O_3N$ . MW, 183. B.p. 235°.  $D_4^{20}$  1.0561.  $n_D^{20}$  1.4614.

Auwers, Jacobsen, *Ann.*, 1922, 426, 220.

### Butyrylnaphthol.

*See* Hydroxybutyronaphthone.

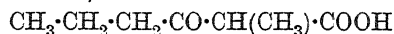
### Butyrylphenetole.

*See under* Hydroxybutyrophenone.

### Butyrylphenol.

*See* Hydroxybutyrophenone.

**1-Butyrylpropionic Acid** (2-Keto-1-methyl-caproic acid)



$C_7H_{12}O_3$  MW, 144

*Me ester*:  $C_8H_{14}O_3$ . MW, 158. B.p. 89–90°/16 mm.  $D_4^0$  1.005.

Bouveault, Bougert, *Bull. soc. chim.*, 1902, 27, 1101.

### 2-Butyrylpropionic Acid.

*See* 3-Keto-*n*-heptylic Acid.

### 1-Butyrylpropylene.

*See* 2-Heptenone-4.

### Butyrylpyridine.

*See* Propyl pyridyl Ketone.

### Butyrylpyrogallol.

*See* Trihydroxybutyrophenone.

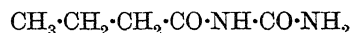
### Butyrylpyrrole.

*See* Propyl pyrrol Ketone.

### Butyrylresorcinol.

*See* Resobutyrophenone.

### Butyrylurea

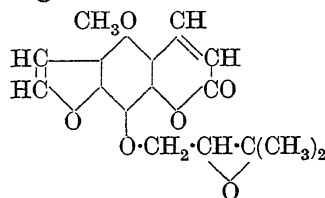


$C_5H_{10}O_2N_2$  MW, 130

Leaflets. M.p. 176°.

Moldenhauer, *Ann.*, 1855, 94, 101.

### Byak-angelicol



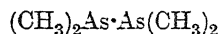
$C_{17}H_{16}O_6$  MW, 316

Constituent of Japanese drug (byakusi) obtained from roots of *Angelica glabra* Makino. Pale yellow tablets. M.p. 106°.  $[\alpha]_D + 35.8^\circ$  in Py. Alk.  $H_2O_2 \rightarrow$  furan-2:3-dicarboxylic acid.

Noguchi, Kawanami, *Ber.*, 1939, 72, 483; 1938, 71, 344.

## C

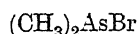
**Cacodyl** (*Arsenic dimethyl, diarsenic tetramethyl*)



$\text{C}_4\text{H}_{12}\text{As}_2$  MW, 210  
F.p.  $-6^\circ$ . B.p.  $170^\circ$ . Spar. sol.  $\text{H}_2\text{O}$ .  
 $\text{O} \longrightarrow$  cacodyl oxide.

Dehn, Wilcox, *Am. Chem. J.*, 1906, 35, 2.  
Paneth, Loleit, *J. Chem. Soc.*, 1935, 366.

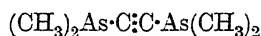
**Cacodyl bromide**



$\text{C}_2\text{H}_6\text{BrAs}$  MW, 185  
Yellow oil. B.p.  $130^\circ$ .

Lee, Thing, Dehn, *J. Am. Chem. Soc.*,  
1923, 45, 2996.

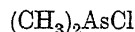
**Cacodyl carbide**



$\text{C}_6\text{H}_{12}\text{As}_2$  MW, 234  
Yellow oil. B.p.  $84-5^\circ/14$  mm. Explodes  
with  $\text{HNO}_3$ .

Wieland, *Ann.*, 1923, 431, 39.

**Cacodyl chloride**

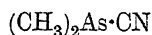


$\text{C}_2\text{H}_6\text{ClAs}$  MW, 140.5  
B.p.  $109^\circ$ . Sol. EtOH. Insol.  $\text{H}_2\text{O}$ ,  $\text{Et}_2\text{O}$ .  
Inflammable.

Valeur, Gailliot, *Bull. soc. chim.*, 1927,  
41, 1481.

Lee, Thing, Dehn, *J. Am. Chem. Soc.*,  
1923, 45, 2996.

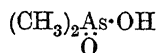
**Cacodyl cyanide**



$\text{C}_3\text{H}_6\text{NAs}$  MW, 131  
B.p.  $138^\circ$ .

Lee, Thing, Dehn, *J. Am. Chem. Soc.*,  
1923, 45, 2996.

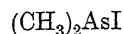
**Cacodylic Acid** (*Dimethylarsinic acid*)



$\text{C}_2\text{H}_7\text{O}_2\text{As}$  MW, 138  
Cryst. M.p.  $200^\circ$ . Very sol.  $\text{H}_2\text{O}$ . Sol.  
EtOH. Insol.  $\text{Et}_2\text{O}$ .  $\text{H}_2\text{S} \longrightarrow$  cacodyl sulphide.  
Very stable. Reacts acid to phenolphthalein,  
neutral to methyl orange.

Valeur, Gailliot, *Bull. soc. chim.*, 1927,  
41, 1318.

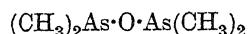
**Cacodyl iodide**



$\text{C}_2\text{H}_6\text{IAs}$  MW, 232  
Yellowish oil. B.p.  $155-60^\circ$ . Sol. EtOH,  
 $\text{Et}_2\text{O}$ . Insol.  $\text{H}_2\text{O}$ . Volatile in steam.

Lee, Thing, Dehn, *J. Am. Chem. Soc.*,  
1923, 45, 2996.

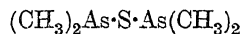
**Cacodyl oxide** (*Dicacodyl oxide*)



$\text{C}_4\text{H}_{12}\text{OAs}_2$  MW, 226  
F.p.  $-25^\circ$ . B.p.  $149-51^\circ$ . Sol. EtOH,  
 $\text{Et}_2\text{O}$ . Spar. sol.  $\text{H}_2\text{O}$ .  $D_{15}^{20}$  1.486.  $\text{O} \longrightarrow$   
cacodylic acid. Reduces  $\text{Ag}_2\text{O}$ . Pure comp.  
is not spontaneously inflammable.

Valeur, Gailliot, *Bull. soc. chim.*, 1927,  
41, 1481.

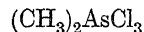
**Cacodyl sulphide** (*Dicacodyl sulphide*)



$\text{C}_4\text{H}_{12}\text{SAs}_2$  MW, 242  
B.p.  $211^\circ$ . Sol. EtOH,  $\text{Et}_2\text{O}$ . Spar. sol.  
 $\text{H}_2\text{O}$ . Volatile in steam.

Dehn, Wilcox, *Am. Chem. J.*, 1906, 35,  
37.

**Cacodyl trichloride**



$\text{C}_2\text{H}_6\text{Cl}_3\text{As}$  MW, 211.5  
Cryst. from  $\text{Et}_2\text{O}$ . Decomp. at  $50^\circ$ .  $\text{H}_2\text{O}$   
 $\longrightarrow$  cacodylic acid.

Baeyer, *Ann.*, 1858, 107, 267.

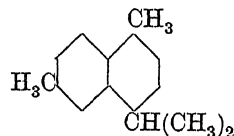
**Cacogenin**

$\text{C}_{27}\text{H}_{42}\text{O}_6$  MW, 462

M.p.  $278^\circ$ .  
*Triacetyl deriv.*: m.p.  $248^\circ$ .

Marker, *J. Am. Chem. Soc.*, 1947, 69,  
2399.

**Cadalene** (1 : 6-Dimethyl-4-isopropyl-naphthalene)



$\text{C}_{15}\text{H}_{18}$  MW, 198  
B.p.  $291-2^\circ/720$  mm.,  $157-8^\circ/12$  mm.,  
 $106^\circ/3$  mm.  $D_{19}^{20}$  0.9792.  $n_D^{20}$  1.5851. Heat of  
comb. 1993.4 cal.

*Picrate*: orange needles. M.p.  $115^\circ$ .

*Styphnate*: yellow needles. M.p.  $139^\circ$ .



*Trinitrobenzoate*: m.p. 113°.

Ruzicka, Seidel, *Helv. Chim. Acta*, 1922, 5, 369.

Dev, Guha, *J. Indian Chem. Soc.*, 1948, 25, 13, (*Chem. Abstracts*, 1948, 42, 8182).

Downes, Gill, Lions, *Australian Journal of Science*, 1948, 10, 147, (*Chem. Abstracts*, 1948, 42, 7257).

**Cadaverine** (1:5-Diaminopentane, pentamethylenediamine)



$\text{C}_5\text{H}_{14}\text{N}_2$  MW, 102

Syrupy, fuming liq. B.p. 178—80°. Sol.  $\text{H}_2\text{O}$ , EtOH. Spar. sol.  $\text{Et}_2\text{O}$ .  $D_4^{20}$  0.9174.  $k = 7.3 \times 10^{-4}$  at 25°. Free base is poisonous, but the salts are not.

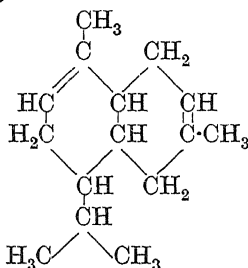
*N*-Benzoyl: hydrochloride, m.p. 159—60°.

*N*:*N*-Dibenzoyl: m.p. 135°.

*Flavinate*: decomp. at 260—4°.

Putokhin, *Ber.*, 1926, 59, 625; cf. *Chem. Abstracts*, 1929, 23, 2938.

### Cadinene



$\text{C}_{15}\text{H}_{24}$  MW, 204

Sesquiterpene contained in cadinum, cubebs, galbanum, and other oils. B.p. 274—5°, 148—9°/20 mm., 134—6°/12 mm., 127—8°/6 mm.  $D_4^{20}$  0.9189.  $n_D^{20}$  1.5079.  $[\alpha]_D^{20}$  —130°. The constants differ somewhat according to the source of the cadinene.

*Dihydrochloride*: m.p. 118—19°.

*Dihydrobromide*: m.p. 125°.

*Dihydriodide*: m.p. 105—6°.

Henderson, Robertson, *J. Chem. Soc.*, 1924, 125, 1992; 1926, 2811.

Ruzicka, *Helv. Chim. Acta*, 1924, 7, 84.

Cf. Kimura, Mizoshita, *Chem. Abstracts*, 1932, 26, 719.

Campbell, Soffer, *J. Am. Chem. Soc.*, 1942, 64, 417.

### Cafestol (Cafesterol)

$\text{C}_{20}\text{H}_{28}\text{O}_3$  MW, 316

Chief constituent of unsaponifiable fraction of coffee bean oil. Cryst. from pet. ether. M.p. 155—7° (160—2° decomp.). Sol. MeOH, EtOH,  $\text{Et}_2\text{O}$ ,  $\text{Me}_2\text{CO}$ ,  $\text{CHCl}_3$ . Less sol.  $\text{C}_6\text{H}_6$ . Spar. sol. cyclohexane. Insol.  $\text{H}_2\text{O}$ .  $[\alpha]_D^{20}$  —137.9°, —107 ± 2° in  $\text{CHCl}_3$ .

*Monoacetyl*: m.p. 163.5—165° (169—71°, 173—5°).  $[\alpha]_D^{20}$  —134.6°, —91 ± 2°, —89° in  $\text{CHCl}_3$ .  $[\alpha]_D^{25}$  —100 ± 2° in  $\text{CHCl}_3$ .

*Tetrahydro deriv.*: m.p. 154.5—157°.

*Maleic anhydride add. comp.*: m.p. 190—2°.

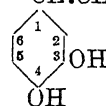
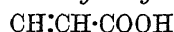
Wettstein *et al.*, *Helv. Chim. Acta.*, 1945, 28, 1004; 1943, 26, 631; 1941, 24, 332.

Slotta, Neisser, *Ber.*, 1938, 71, 1991, 2342.

Hauptmann, França, *Z. physiol. Chem.*, 1939, 259, 245.

Chakravorty, Wesner, Levin, *J. Am. Chem. Soc.*, 1943, 65, 929.

### Caffeic Acid (3:4-Dihydroxycinnamic acid)



$\text{C}_9\text{H}_8\text{O}_4$  MW, 180

Yellow cryst. M.p. 195°. Cryst. +  $1\text{H}_2\text{O}$  from dil. aq. sol., anhyd. from conc. aq. sol. Sol. EtOH.  $\text{FeCl}_3$  on aq. sol. → green col. Reduces warm  $\text{NH}_3$ ,  $\text{AgNO}_3$ , but not Fehling's.  $\text{NaHg}$  → hydrocaffeic acid.  $\text{KOH}$  fusion → protocatechuic acid. Dry dist. → catechol.

*Dicarbomethoxyl*: m.p. 146°. *Et ester*:  $\text{C}_{15}\text{H}_{16}\text{O}_8$ . MW, 324. M.p. 98°. *Chloride*:  $\text{C}_{13}\text{H}_{11}\text{O}_7\text{Cl}$ . MW, 314.5 M.p. 108—9°.

*3-Acetyl*: m.p. 179—80°. *4-Benzoyl*: m.p. 164°.

*4-Acetyl*: m.p. 150°. *3-Benzoyl*: m.p. 223°.

*Diacetyl*: m.p. 198°.

*Dibenzoyl*: m.p. 204—6°. *Et ester*:  $\text{C}_{25}\text{H}_{20}\text{O}_6$ . MW, 416. M.p. 104—5°.

*Me ester*:  $\text{C}_{10}\text{H}_{10}\text{O}_4$ . MW, 194. M.p. 152—3°. *Diacetyl*: m.p. 119—20°.

*3-Me ether*: see Ferulic Acid.

*4-Me ether*: see Isoferulic Acid.

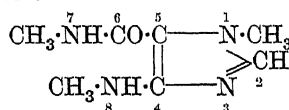
*Di-Me ether*:  $\text{C}_{11}\text{H}_{12}\text{O}_4$ . MW, 208. Needles from  $\text{H}_2\text{O}$ , pale yellow powder from AcOH.Aq. M.p. 179.5—180.5° (181°). *Me ester*:  $\text{C}_{12}\text{H}_{14}\text{O}_4$ . MW, 222. Prisms. M.p. 64°. *Et ester*:  $\text{C}_{15}\text{H}_{16}\text{O}_4$ . MW, 236. Plates from pet. ether. M.p. 59°. B.p. 196—7°/13 mm. Spar. sol. pet. ether. *Chloride*: m.p. 80—2°.

Fischer, Oetker, *Ber.*, 1913, 46, 4029.

Pacsu, Stieber, *Ber.*, 1929, 62, 2974.

Mauthner, *J. prakt. Chem.*, 1935, 142, 33.

### Caffeidine



$\text{C}_7\text{H}_{12}\text{ON}_4$  MW, 168

Prisms from  $\text{Et}_2\text{O}$  or pet. ether. M.p. 93°. Sol.  $\text{H}_2\text{O}$  and most org. solvents.

*B, HCl*: m.p. 215° decomp.

*B, HClO<sub>4</sub>*: m.p. 220—1° decomp.

$B, HNO_3$ : prisms. M.p. 215° decomp.  
Benzoyl deriv.: plates from AcOEt. M.p. 174°.

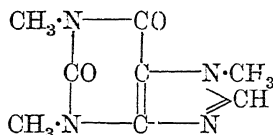
Nitroso deriv.: m.p. 155°.

8-N-Me:  $C_8H_{14}ON_4$ . MW, 182. Cryst. from pet. ether. M.p. 98-9°. B, HI: m.p. 166° decomp. B,  $HClO_4$ : m.p. 173°. Picrate: m.p. 153°.

Biltz, Rakett, *Ber.*, 1928, 61, 1409; 1931, 64, 1970.

Heymons, *Ber.*, 1933, 66, 1017.

Caffeine (1 : 3 : 7-Trimethylxanthine, theine)



$C_8H_{10}O_2N_4$  MW, 194

Alkaloid contained in coffee, tea and cocoa. Cryst. +  $H_2O$  from  $H_2O$ . M.p. anhyd. 235°. Sol. to 2% in  $H_2O$ , 2% in EtOH, 0.3% in Et<sub>2</sub>O, 12.5% in  $CHCl_3$ . Sublimes at 178°. Decomp. by hot alkalis → caffeine. Weak base, forming unstable salts.

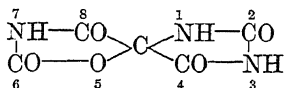
B,  $HAuCl_4$ : m.p. 248°.

Styphmate: m.p. 199°.

Rodionov, *Bull. soc. chim.*, 1926, 39, 305.

Biltz, Beck, *J. prakt. Chem.*, 1928, 118, 198.

Caffolide



$C_5H_5O_5N_3$  MW, 185

Needs from Et<sub>2</sub>O-pet. ether. Decomp. at 220°. Sol. most org. solvents.

1-N-Me:  $C_6H_5O_5N_3$ . MW, 199. M.p. 218-19° decomp.

3-N-Me: m.p. 220° decomp.

1 : 3-N-Di-Me:  $C_7H_7O_5N_3$ . MW, 213. Cryst. from  $CHCl_3$ . M.p. 164° decomp. Sol. EtOH, AcOH, Me<sub>2</sub>CO, hot  $H_2O$ . Spar. sol. Et<sub>2</sub>O,  $CHCl_3$ ,  $C_6H_6$ , ligroin.

1 : 7-N-Di-Me: see Apocaffeine.

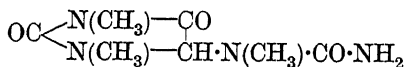
3 : 7-N-Di-Me: isoapocaffeine. Plates. M.p. 165° decomp. 1-N-Acetyl: cryst. from MeOH. M.p. 115°.

1 : 3 : 7-N-Tri-Me: allocaffeine.  $C_8H_9O_5N_3$ . MW, 227. Cryst. from EtOH. M.p. 205° decomp.

Biltz, Heyn, *Ann.*, 1917, 413, 56.

Biltz, Loewe, *Ber.*, 1931, 64, 1014.

Caffoline (1 : 3 : 6-Trimethyl-allantoin)

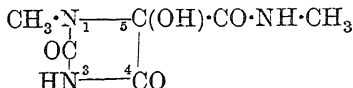


$C_7H_{12}O_3N_4$  MW, 200

Fine needles. M.p. 197°. Sol.  $H_2O$ , AcOH. Mod sol. EtOH,  $CHCl_3$ . Spar. sol.  $C_6H_6$ , Et<sub>2</sub>O, Me<sub>2</sub>CO, AcOH.

Biltz, *Ber.*, 1911, 44, 298.

Caffuric Acid (1-Methyl-5-hydroxyhydantoyl-methylamide)



$C_6H_9O_4N_3$  MW, 187

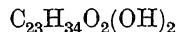
Sinters at 210°, m.p. 219-21°. Sol. warm  $H_2O$ , EtOH, MeOH, AcOH. Mod. sol. Me<sub>2</sub>CO. Spar sol. Et<sub>2</sub>O,  $C_6H_6$ ,  $CHCl_3$ .

3-N-Me: allocaffuric acid. M.p. 170° (after fusion). Sol.  $H_2O$ , EtOH, Me<sub>2</sub>CO. Spar. sol. Et<sub>2</sub>O, AcOEt,  $CHCl_3$ ,  $CS_2$ ,  $C_6H_6$ . 5-Acetyl: prisms. M.p. 195°. Me ether: prisms. M.p. 121-2°. Et ether: prisms. M.p. 112-13°.

Et ether:  $C_5H_{13}O_4N_3$ . MW, 215. Prisms. M.p. 220-1°.

Biltz, *Ber.*, 1910, 43, 1609, 1627.

Calabarol



$C_{23}H_{34}O_2(OH)_2$  MW, 376

Dihydric alcohol found in Calabar beans. M.p. 245°.

Dibenzoyl deriv.: m.p. 195-6°.

Salway, *J. Chem. Soc.*, 1911, 99, 2148.

Calameone

$C_{15}H_{26}O_2$  MW, 238

Constituent of essential oil of sweetflag. M.p. 168°.

Šorm, Herout, *Collection Czechoslovak Chemical Communications*, 1948, 13, 177, (*Chem. Abstracts*, 1949, 43, 3807).

Calamone

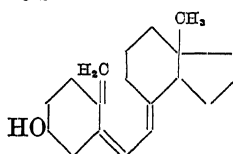
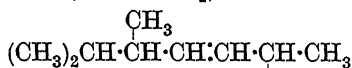
$C_{15}H_{26}O$  MW, 222

Constituent of essential oil of sweetflag. B.p. 96-99°/44 mm.

Semicarbazone: m.p. 185-7°.

Šorm, Herout, *Collection Czechoslovak Chemical Communications*, 1948, 13, 177, (*Chem. Abstracts*, 1949, 43, 3807).

Calciferol (Vitamin-D<sub>2</sub>)



$C_{28}H_{44}O$  MW, 396

Anti-rachitic vitamin obtained by irradiation of ergosterol. Prisms from  $\text{Me}_2\text{CO}$ . M.p. 115–16° (114.5–117°).  $[\alpha]_{\text{D}}^{20} + 102.5^\circ$  in  $\text{EtOH}$ ,  $+ 81^\circ$  ( $+ 82.6^\circ$ ) in  $\text{Me}_2\text{CO}$ .  $[\alpha]_{\text{D}}^{20} + 122^\circ$  in  $\text{EtOH}$ ,  $+ 98.5^\circ$  in  $\text{Me}_2\text{CO}$ . Absorption band at 265  $\mu$  in hexane or  $\text{Et}_2\text{O}$ .  $\text{SbCl}_5$  in  $\text{CHCl}_3 \rightarrow$  deep yellow col. Tortelli-Jaffé  $\rightarrow$  blue col.

*p*-Nitrobenzoyl: pale yellow cryst. M.p. 90–3°.  $[\alpha]_{\text{D}}^{20} + 65^\circ$  in  $\text{C}_6\text{H}_6$ .

3:5-Dinitrobenzoyl: yellow prisms from  $\text{Me}_2\text{CO}$ . M.p. 148–9°.  $[\alpha]_{\text{D}}^{20} + 55^\circ$  in  $\text{C}_6\text{H}_6$ .  $[\alpha]_{\text{D}}^{18} + 79.5^\circ$  in  $\text{Me}_2\text{CO}$ .  $[\alpha]_{\text{D}}^{20} + 69^\circ$  (71°) in  $\text{C}_6\text{H}_6$ ,  $+ 104^\circ$  in  $\text{Me}_2\text{CO}$ .

2-Chloro-3:5-dinitrobenzoyl: m.p. 132°.  $[\alpha]_{\text{D}}^{22} + 60^\circ$  in  $\text{Me}_2\text{CO}$ .

3:5-Dinitro-*p*-toluyl: m.p. 115–16°.  $[\alpha]_{\text{D}}^{22} + 91^\circ$  in  $\text{Me}_2\text{CO}$ .

Anisoyl: prisms from  $\text{Me}_2\text{CO}$ . M.p. 99.5–101°.  $[\alpha]_{\text{D}}^{21} + 120^\circ$ .

Allophanate: needles. M.p. 194–5°.  $[\alpha]_{\text{D}}^{20} + 50.4^\circ$  in  $\text{CHCl}_3$ .

Phenylurethane: needles from  $\text{Me}_2\text{CO}$ . M.p. 122°.  $[\alpha]_{\text{D}}^{19} + 49.2^\circ$ .

Windaus, Grundmann, *Ann.*, 1936, 524, 295.

Heilbron, Jones, Samant, Spring, *J. Chem. Soc.*, 1936, 905.

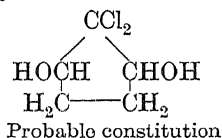
Windaus, Thiele, *Ann.*, 1936, 521, 160.

Windaus, Linsert, Luttringhaus, Weidlich, *Ann.*, 1932, 492, 226.

Askew, Bourdillon, Bruce, Callow, Philpot, Webster, *Proc. Roy. Soc., B.*, 1932, 109, 488.

Brockmann, *Ergebnisse der Vitamin- und Hormonforschung*, (Akademische Verlag, Leipzig), 1939, 2, 55.

### Caldariomycin



$\text{C}_5\text{H}_8\text{O}_2\text{Cl}_2$  MW, 171

Metabolic product of *Caldariomyces fumago*. Needles from  $\text{CHCl}_3$ . M.p. 121°. Sol.  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ . Mod. sol. pet. ether.  $[\alpha]_{\text{D}}^{20} + 59.2^\circ$  in  $\text{H}_2\text{O}$ . Reduces cold Fehling's.  $\text{H}_2\text{SO}_4 \rightarrow$  reddish-brown sol. with green fluor.

Clutterbuck, Mukhopadhyay, Oxford, Raistrick, *Biochem. J.*, 1940, 34, 664.

### Calebassine



$\text{C}_{20}\text{H}_{25}\text{ON}_2$  MW, 309

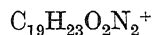
Calabash alkaloid.

Chloride trihydrate: needles from  $\text{MeOH-Et}_2\text{O}$ . Warm in high vac.  $\rightarrow$  sesquihydrate. Conc.  $\text{HNO}_3 \rightarrow$  crimson col.

Picrate: plates. M.p. 216–18° decomp.

Karrer, Schmid, *Helv. Chim. Acta*, 1947, 30, 2081; 1946, 29, 1853.

### Calebassinine



$\text{C}_{19}\text{H}_{23}\text{O}_2\text{N}_2$  MW, 311

Calabash alkaloid.

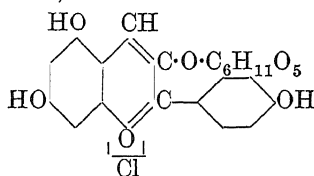
Chloride:  $[\alpha]_{\text{D}} + 63^\circ$ .

Iodide: needles from  $\text{MeOH-Et}_2\text{O}$ .

Picrate: m.p. 260°.

Schmid Karrer, *Helv. Chim. Acta*, 1947, 30, 2081.

Callistephin (chloride) (3-Glucoside of pelargonidin chloride)



$\text{C}_{21}\text{H}_{21}\text{O}_{10}\text{Cl}$  MW, 468.5

Anthocyanin from purple-red aster (*Callistephus chinensis*, Nees). Fine orange-red needles. Sol.  $\text{H}_2\text{O}$  to yellowish-red sol. which on dilution becomes more violet and then colourless. Boil with  $\text{HCl} \rightarrow$  pelargonidin chloride.

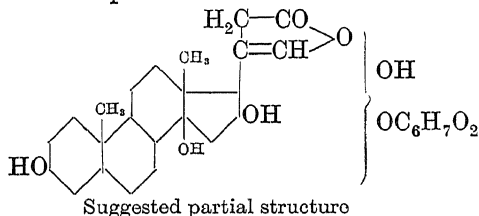
Robertson, Robinson, *J. Chem. Soc.*, 1928, 1460.

Willstätter, Burdick, *Ann.*, 1916, 412, 149.

### Callitrol.

See under Citronellic Acid.

### Calotropin



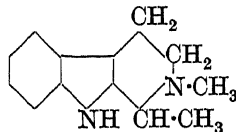
$\text{C}_{29}\text{H}_{40}\text{O}_9$  MW, 532

African arrow poison, extracted from leaves and stalks of *Calotropis procera*. M.p. 221° decomp. Forms monohydrate. Rapidly decomp. by alkalis. Activity as heart aglycone same as ouabain.

Hesse, Reicheneder, *Ann.*, 1936, 526, 252.

Hesse, Reicheneder, Eysenbach, *Ann.*, 1938, 537, 67.

### Calycanthidine



$\text{C}_{13}\text{H}_{16}\text{N}_2$

MW, 200

Alkaloid present in seeds of *Calycanthus floridus*. M.p. 142°.  $[\alpha]_D^{20}$  -285.1° in MeOH.

*Hydriodide*: m.p. 182°.

*Perchlorate*: m.p. 158°.

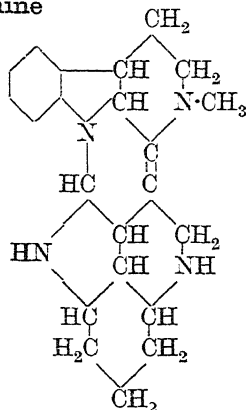
*Platinichloride*: m.p. 198-200°.

*Picrate*: m.p. 192°.

*Methiodide*: m.p. 180-215°.

Barger, Jacob, Madinaveitia, *Rec. trav. chim.*, 1938, 57, 548.

### Calycanthine



Suggested structure

$C_{22}H_{28}N_4$

MW, 348

Alkaloid from various species of *Calycanthus*. Cryst. from  $Me_2CO$ . Aq. M.p. 219-20°, anhyd. 245°. Soda-lime dist.  $\rightarrow$  N-methyl-tryptamine. P + HI  $\rightarrow$  quinoline.

*Phenylcarbamyl deriv.*: m.p. 252°.

Manske, *J. Am. Chem. Soc.*, 1929, 51, 1836; *Chem. Zentr.*, 1931, I, 3689.

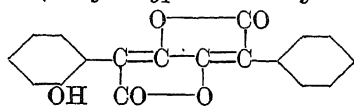
Späth, Stroh, *Ber.*, 1925, 58, 2131.

Marion, Manske, *Brit. Chem. Abstracts*, 1940, A II, 29; 1939, A II, 190;

*Can. J. Research*, 1939, 17, 293.

Barger, Madinaveitia, Streuli, *J. Chem. Soc.*, 1939, 510.

### Calycin (o-Hydroxypulvinic anhydride)



$C_{18}H_{10}O_5$

MW, 306

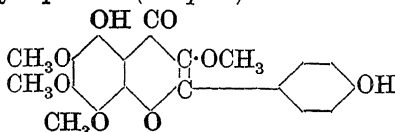
Found in lichens (*Lepra candelaris*, Schaerer, *Sticta aurata*, etc.). Orange-red needles from AcOH. M.p. 244-5°.

*Acetyl deriv.*: yellow needles from EtOH. M.p. 178°.

Hesse, *J. prakt. Chem.*, 1900, 62, 338.

Asano, Kameda, *Ber.*, 1935, 68, 1568.

### Calycopterin (Thapsin)



$C_{19}H_{18}O_8$

MW, 374

Occurs in Spanish fox-glove (*Digitalis thapsi*, Linn.), and leaves of *Calycopterus floribunda*, Lamk. Yellow prisms from AcOH, needles from  $Et_2O$ . M.p. 225-6°. Very sol.  $CHCl_3$ ,  $Me_2CO$ . Sol. EtOH. Spar. sol.  $Et_2O$ . Insol.  $H_2O$ , pet. ether. Alkalis  $\rightarrow$  yellow sols.  $FeCl_3 \rightarrow$  green col. HI  $\rightarrow$  calycopteretin. KOH fusion  $\rightarrow$  p-hydroxybenzoic acid.

*Di-Me ether*:  $C_{21}H_{22}O_8$ . MW, 402. Yellow prisms or rhombohedra from EtOH. M.p. 130°.

*Di-Et ether*:  $C_{23}H_{26}O_8$ . MW, 430. Yellow cryst. from EtOH. M.p. 130°.

*Dibenzyl ether*: yellow needles. M.p. 185°.

*Diacetyl*: colourless plates or needles from EtOH. M.p. 129°.

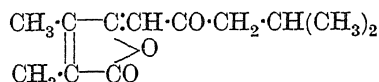
*Dibenzoyl*: m.p. 165°.

Karrer, Venkataraman, *Nature*, 1935, 135, 878.

Ratnagiriswaran, Sehra, Venkataraman, *Biochem. J.*, 1934, 28, 1964.

Karrer, *Helv. Chim. Acta*, 1934, 17, 1560.

### Calythrone



$C_{12}H_{16}O_3$

MW, 208

Isolated from essential oil of *Calythrix tetragona*. Pale yellow mobile oil with unpleasant odour. B.p. 142°/14 mm.  $D_4^{25}$  1.0531.  $n_D^{25}$  1.5203. Acid to litmus. Alk. NaOBr  $\rightarrow$   $CHBr_3$  + isovaleric acid + dimethylmaleic anhydride.

*Na salt*: orange needles +  $H_2O$  from  $H_2O$ . M.p. 110-11°, anhyd. 196°.

*Cu deriv.*: green needles from  $C_6H_6$ . M.p. 208-10°.

*Dioxime-anhydride*: needles from  $H_2O$ . M.p. 135°.

Penfold, Simonsen, *J. Chem. Soc.*, 1940, 412.

### Camazulene

$C_{15}H_{18}$

MW, 198

Blue pigment isolated from yarrow and camomile oils. B.p. 161°/12 mm.  $D_4^{20}$  0.9883. Absorption bands in  $Et_2O$ : 662, 632, 603, 581, 556 m $\mu$ .

*Picrate*: cryst. from MeOH. M.p. 115°.

*Styphnate*: black cryst. from MeOH. M.p. 95-6°.

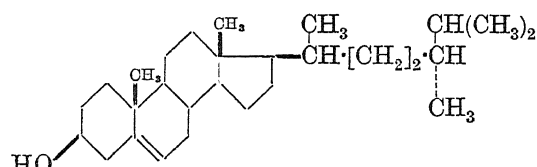
sym.-*Trinitrobenzene add. comp.*: m.p. 132°.

Ruzicka, Rudolph, *Helv. Chim. Acta*, 1926, 9, 118.

Ruzicka, Haagen-Smit, *Helv. Chim. Acta*, 1931, 14, 1104, 1122.

Willstaedt, *Ber.*, 1935, 58, 333; 1936, 69, 997.

## Campesterol

 $C_{28}H_{48}O$ 

MW, 400

Minor steroid constituent of rapeseed, soya bean and wheat germ oils. Cryst. from  $Me_2CO$ . M.p. 157-8°.  $[\alpha]_D^{25} - 33^\circ$  in  $CHCl_3$ .

*Acetyl*: cryst. from EtOH. M.p. 137-8° (138.5-9°).  $[\alpha]_D^{25} - 43.7^\circ$ ,  $[\alpha]_D^{25} - 35^\circ$  in  $CHCl_3$ .

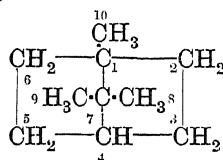
*Benzoyl*: cryst. from EtOH- $C_6H_6$ . M.p. 158-60°.  $[\alpha]_D^{25} - 8.6^\circ$  in  $CHCl_3$ .

1: 3-*Dinitrobenzoyl*: needles from EtOH- $C_6H_6$ . M.p. 202-3°.  $[\alpha]_D^{25} - 6.0^\circ$  in  $CHCl_3$ .

Fernholz, MacPhillamy, *J. Am. Chem. Soc.*, 1941, 63, 1155.

Fernholz, Ruigh, *ibid.*, 1157.

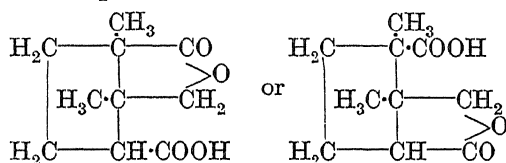
## Camphane

 $C_{10}H_{18}$ 

MW, 138

Hexagonal plates or prisms. M.p. 158-9°. Sol.  $Et_2O$ , AcOEt. Mod. sol. hot EtOH, hot MeOH. Volatile in steam. Sublimes readily. Very stable to heat and oxidising agents.

Aschan, *Ber.*, 1912, 45, 2395.

 $\pi$ -Camphanic Acid $C_{10}H_{14}O_4$ 

MW, 198

*d*-“*trans*”:

Cryst. +  $1H_2O$  from  $H_2O$ . M.p. anhyd. 164-5°. Sol. ord. org. solvents except pet. ether.  $[\alpha]_D^{20} + 9.85^\circ$  in EtOH.

*Anhydride*: plates from  $CHCl_3$ . M.p. 230° decomp. (rapid heat.). Sol. boiling  $C_6H_6$ . Insol.  $Et_2O$ .

*Amide*: prisms from  $CHCl_3$ . M.p. 108°. Sol.  $CHCl_3$ ,  $C_6H_6$ , hot  $H_2O$ .

*Inactive “trans”*:

Cryst. +  $1H_2O$  from  $H_2O$ . M.p. anhyd. 164-5°.

*l*-“*cis*”:

Plates from  $H_2O$ . M.p. 226°. Sublimes. Spar. sol.  $C_6H_6$ , cold EtOH.  $[\alpha]_D^{40} - 47.7^\circ$  in EtOH.

*Me ester*: prisms from  $Et_2O$ -pet. ether. M.p. 75°. Sol.  $CHCl_3$ ,  $C_6H_6$ .

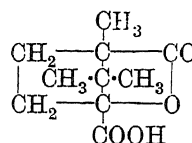
*Anhydride*: prisms from  $C_6H_6$ . M.p. 165°. Sol.  $CHCl_3$ ,  $C_6H_6$ . Insol.  $Et_2O$ .

*Inactive “cis”*:

M.p. 226°.

Kipping, *J. Chem. Soc.*, 1896, 69, 916.

Kipping, Pope, *J. Chem. Soc.*, 1897, 71, 983.

 $\omega$ -Camphanic Acid $C_{10}H_{14}O_4$ 

MW, 198

*d*-

M.p. 200°.

*Amide*:  $C_{10}H_{15}O_3N$ . MW, 197. Plates from EtOH. M.p. 196°.

*l*-

Cryst. from  $H_2O$ . M.p. 201°. Sol. EtOH,  $Et_2O$ . Sublimes at 110°. Volatile in steam. Decomp. on dist.  $CrO_3 \rightarrow$  camphoric acid.

*Et ester*:  $C_{12}H_{18}O_4$ . MW, 226. M.p. 63°. B.p. 196°. Sublimes at 100°. Sol. EtOH,  $Et_2O$ .

*Amide*: needles from  $H_2O$ . M.p. 208°. Sublimes.

*Methylamide*: prisms from  $H_2O$ . M.p. 133°.

*Anilide*: plates from EtOH. M.p. 126°.

*Nitrile*:  $C_{10}H_{13}O_2N$ . MW, 179. Cryst. from ligroin. M.p. 139-41°.

*Phenylhydrazide*: needles. M.p. 193°.

*dl*-

M.p. 201-2°. Sol. EtOH,  $Et_2O$ , hot  $H_2O$ .

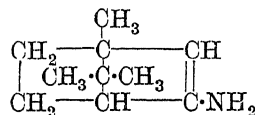
*Me ester*:  $C_{11}H_{16}O_4$ . MW, 212. M.p. 109°.

*Amide*: needles. M.p. 196°.

Aschan, *Ber.*, 1895, 28R, 922.

Bredt, *Ann.*, 1913, 395, 39.

## Camphenamine

 $C_{10}H_{17}N$ 

MW, 151

B.p. 205-7°/748 mm., 160°/200 mm.  $D_{20}^{20} 0.9399$ .  $n_D^{20} 1.4935$ .  $[\alpha]_D^{18} - 4.9^\circ$  in MeOH. Absorbs  $CO_2$ .

*B, HCl*: m.p. 250°. Sol.  $H_2O$ . Sublimes.

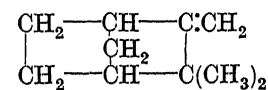
*N-Acetyl*: m.p. 100°.

*B, H, AuCl\_4*: needles. M.p. 157-8°.

*Picrate*: m.p. 214-15° decomp.

Duden, Macintyre, *Ann.*, 1900, 313, 70.

## Camphene

 $C_{10}H_{16}$ 

MW, 136

Occurs in many essential oils, *e.g.* turpentine, citronella, neroli, ginger, valerian, and spike oils.

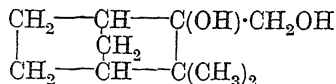
*d*-.  
M.p. 51° (48°). B.p. 160–2°, 52°/17 mm.  
Sol. Et<sub>2</sub>O. Spar. sol. EtOH. Insol. H<sub>2</sub>O.  
[α]<sub>D</sub><sup>20</sup> +103.9° in Et<sub>2</sub>O.

*l*-.  
Cryst. M.p. 42–52°, according to the source.  
B.p. 158–60°. Sol. Et<sub>2</sub>O. [α]<sub>D</sub><sup>20</sup> –52° to –94°, according to source. *n*<sub>D</sub><sup>20</sup> 1.45514.

*dl*-.  
M.p. 50°. B.p. 159–60°.

Pariselle, *Compt. rend.*, 1925, 180, 1832.  
Wallach, Gutmann, *Ann.*, 1907, 357, 79.  
Moycho, Zienkowski, *Ann.*, 1905, 340, 27.

### Camphene Glycol

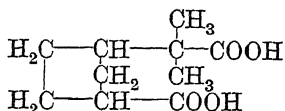


C<sub>10</sub>H<sub>18</sub>O<sub>2</sub> MW, 170

M.p. 200°. Sublimes. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, CS<sub>2</sub>. Spar. sol. C<sub>6</sub>H<sub>6</sub>, ligroin, hot H<sub>2</sub>O.  
*Monobenzoyl deriv.*: m.p. 88°.

Wagner, *Ber.*, 1890, 23, 2311.  
Aschan, *Ann.*, 1911, 383, 44.

### Camphenic Acid (*Camphenecamphoric acid*)



C<sub>10</sub>H<sub>16</sub>O<sub>4</sub> MW, 200

*Cis*:

*d*-.  
Plates. M.p. 144°. [α]<sub>D</sub><sup>20</sup> +1.87° in EtOH.

*l*-.  
Plates from EtOH.Aq. M.p. 144°. [α]<sub>D</sub><sup>20</sup> –1.88° in EtOH.

*dl*-.  
Cryst. M.p. 135–7°. Sol. EtOH, CHCl<sub>3</sub>, hot H<sub>2</sub>O. Mod. sol. C<sub>6</sub>H<sub>6</sub>. Insol. ligroin, CS<sub>2</sub>.

*Di-Et ester*: C<sub>14</sub>H<sub>24</sub>O<sub>4</sub>. MW, 256. B.p. 141–2°/5 mm. *D*<sub>4</sub><sup>20</sup> 1.0221. *n*<sub>D</sub><sup>20</sup> 1.4537.

*Dichloride*: C<sub>10</sub>H<sub>14</sub>O<sub>2</sub>Cl<sub>2</sub>. MW, 237. B.p. 150–2°/11 mm.

*Diamide*: C<sub>10</sub>H<sub>18</sub>O<sub>2</sub>N<sub>2</sub>. MW, 198. Plates from H<sub>2</sub>O. M.p. 225°.

*Dianilide*: m.p. 212°.

*Trans*:  
*dl*-.  
Prisms from AcOH. M.p. 122–3°.

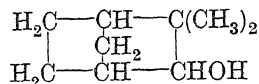
*Diamide*: plates from AcOH. M.p. 231–2°.

*Dianilide*: prisms from AcOH. M.p. 165°.

Lipp, *Ber.*, 1914, 47, 871.

Aschan, *Ann.*, 1911, 383, 62.

### Camphenilol (2:2-Dimethylbicyclo-[1,2,2]-heptanol-3)



C<sub>9</sub>H<sub>16</sub>O MW, 140

Cryst. from EtOH.Aq. M.p. 91.5–92° (84°).  
B.p. 196–7°/740 mm., 88.5–9°/11 mm. CrO<sub>3</sub>  
→ camphenilone. KHSO<sub>4</sub> → santene.

*Acetyl*: b.p. 95–7°/17 mm. *D*<sub>4</sub><sup>20</sup> 0.9974. *n*<sub>D</sub><sup>20</sup> 1.4628.

*Benzoyl*: b.p. 172°/15 mm. *D*<sub>4</sub><sup>20</sup> 1.080. *n*<sub>D</sub><sup>20</sup> 1.531.

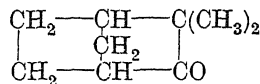
*Acid phthalate*: m.p. 148.5–9°.

*Phenylurethane*: needles. M.p. 99.5°.

Komppa, Hinttika, *Ann.*, 1922, 429, 181;  
1912, 387, 299.

Jagelki, *Ber.*, 1899, 32, 1503.

### Camphenilone (2:2-Dimethylbicyclo-[1,2,2]-heptanone-3)



C<sub>9</sub>H<sub>14</sub>O MW, 138

*d*-.  
M.p. 41° (36°). B.p. 191–2°, 75–6°/12 mm.

[α]<sub>D</sub><sup>20</sup> +49.17° in EtOH.

*l*-.  
M.p. 37–38.5°. B.p. 76–7°/16 mm. [α]<sub>D</sub><sup>19</sup> –61.2° in C<sub>6</sub>H<sub>6</sub>, –58.65° in AcOH.

*Semicarbazone*: m.p. 222–4°.

*dl*-.  
M.p. 40°. B.p. 193–4°, 63–8°/15 mm.

(75°/10 mm.). *D*<sub>38</sub><sup>20</sup> 0.9705. Volatile in steam.  
*Oxime*: m.p. 105–6° (109–10°). B.p. 129°/14 mm. Sol. EtOH, Et<sub>2</sub>O. Volatile in steam.

*Semicarbazone*: m.p. 224°.

*Hydrazone*: m.p. 29–31°. B.p. 236–8°, 119–20°/17 mm. *Acetyl deriv.*: m.p. 149°.

*Azine*: prisms from C<sub>6</sub>H<sub>6</sub>. M.p. 148.5°.

Nametkin, Alexandroff, *Ann.*, 1928, 467, 196.

Bredt, Pinten, *J. prakt. Chem.*, 1928, 119, 81.

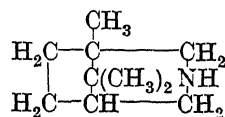
Lipp, *Ann.*, 1913, 399, 250.

Nametkin, Chuchvikowa, *Ann.*, 1924, 438, 193.

*Campheride*.  
See Kaempferide.

*Campherol*.  
See Kaempferol.

*Camphidine*



C<sub>10</sub>H<sub>19</sub>N MW, 153

Cryst. solid with odour resembling camphor. M.p. 188°. B.p. 209°/755 mm. Spar. sol. hot H<sub>2</sub>O. [ $\alpha$ ]<sub>D</sub><sup>20</sup> + 23.9° in C<sub>6</sub>H<sub>6</sub>. Volatile in steam.

B.HNO<sub>3</sub>: needles from EtOH. M.p. 199° decomp.

N-Acetyl: cryst. M.p. 30–40°. B.p. 290–1°.

N-Benzoyl: m.p. 61°. B.p. 217–20°/11 mm.

Tafel, Eckstein, *Ber.*, 1901, 34, 3283.

Boehringer, Söhne, D.R.P. 126,196,

(*Chem. Zentr.*, 1901, II, 1286.)

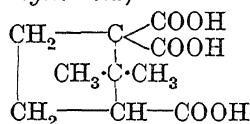
### Camphoceans.

See 1 : 1 : 2-Trimethylcyclopentane.

### Camphoceanic Acid.

See Lauronic Acid.

Campholic Acid (2 : 2-Dimethylcyclopentane-1 : 1 : 3-tricarboxylic acid)



C<sub>10</sub>H<sub>14</sub>O<sub>6</sub> MW, 230

M.p. 199–200° decomp. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Heat above m.p. → apocamphoric acid.

Mono-NH<sub>4</sub> salt: prisms from H<sub>2</sub>O. M.p. 213–14° decomp.

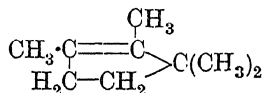
Tri-NH<sub>4</sub> salt: m.p. 198–9°.

Marsh, Gardner, *J. Chem. Soc.*, 1896, 69, 74.

Bredt, *Chem.-Ztg.*, 1896, 20, 842.

Lipp, *Ann.*, 1911, 382, 278, 298.

Campholene (1 : 2 : 3 : 3-Tetramethylcyclopentene)



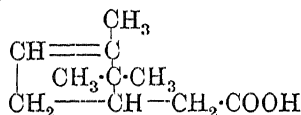
C<sub>9</sub>H<sub>16</sub> MW, 124

B.p. 134–5°. Sol. EtOH, Et<sub>2</sub>O, CS<sub>2</sub>, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, ligroin. Insol. H<sub>2</sub>O. D<sub>4</sub><sup>15</sup> 0.8035. n<sub>D</sub><sup>20</sup> 1.44406. Changes to a resinous product by absorption of O.

Blanc, *Compt. rend.*, 1907, 145, 681.

Tiemann, *Ber.*, 1897, 30, 594.

### α-Campholenic Acid



C<sub>10</sub>H<sub>16</sub>O<sub>2</sub> MW, 168

d.-

B.p. 258–61°, 157°/15 mm. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. D<sup>0</sup> 1.0092. n<sub>D</sub><sup>15</sup> 1.47125. [ $\alpha$ ]<sub>D</sub><sup>15</sup> + 10.9°.

NH<sub>4</sub> salt: m.p. 126°. Insol. H<sub>2</sub>O.

Et ester: C<sub>12</sub>H<sub>20</sub>O<sub>2</sub>. MW, 196. B.p. 222–4°. D<sup>0</sup> 0.9491.

Amide: C<sub>10</sub>H<sub>17</sub>ON. MW, 167. M.p. 131–2°. Sol. EtOH, Et<sub>2</sub>O, hot C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O. [ $\alpha$ ]<sub>D</sub><sup>15</sup> –4.1° in EtOH.

Nitrile: C<sub>10</sub>H<sub>15</sub>N. MW, 149. B.p. 226–7°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. D<sup>20</sup> 0.91. n<sub>D</sub><sup>20</sup> 1.46648. [ $\alpha$ ]<sub>D</sub><sup>20</sup> + 7.5°.

l.-

B.p. 155°/20 mm.

Nitrile: b.p. 153°/100 mm.

dl.-

B.p. 169°/40 mm., 158°/20 mm. D<sub>6</sub><sup>15</sup> 1.009. n<sub>D</sub><sup>15</sup> 1.4746.

Amide: m.p. 122°.

Nitrile: b.p. 228°, 114°/18 mm.

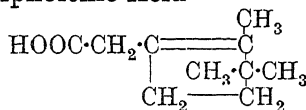
Perkin, Tittley, *J. Chem. Soc.*, 1921, 119, 1089.

Kregten, *Rec. trav. chim.*, 1916, 36, 64.

Tiemann, *Ber.*, 1896, 29, 3007.

Béhal, *Bull. soc. chim.*, 1895, 13, 842.

### β-Campholenic Acid



C<sub>10</sub>H<sub>16</sub>O<sub>2</sub> MW, 168

Needles. M.p. 53.5°. B.p. 245°, 185°/120 mm. Sol. EtOH, Et<sub>2</sub>O. Mod. sol. hot H<sub>2</sub>O.

Et ester: C<sub>12</sub>H<sub>20</sub>O<sub>2</sub>. MW, 196. B.p. 222–5°. D<sup>0</sup> 0.9491.

Amide: C<sub>10</sub>H<sub>17</sub>ON. MW, 167. M.p. 86°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>. Spar. sol. hot H<sub>2</sub>O.

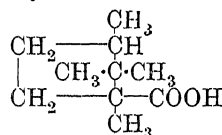
Nitrile: C<sub>10</sub>H<sub>15</sub>N. MW, 149. B.p. 225°. D<sup>20</sup> 0.9093. Insol. H<sub>2</sub>O.

Kregten, *Rec. trav. chim.*, 1916, 36, 64.

Béhal, *Bull. soc. chim.*, 1895, 13, 842.

Tiemann, *Ber.*, 1897, 30, 243.

Campholic Acid (1 : 2 : 2 : 3-Tetramethylcyclopentane-1-carboxylic acid)



C<sub>10</sub>H<sub>18</sub>O<sub>2</sub> MW, 170

d.-

Prisms. M.p. 106°. B.p. 255°, 146°/12 mm. Sol. EtOH, hot H<sub>2</sub>O. Mod. volatile in steam. [ $\alpha$ ]<sub>D</sub><sup>15</sup> + 49.8° in EtOH. Heat of comb. C<sub>v</sub> 1410.1 Cal. k = 4 × 10<sup>-6</sup> at 25°.

Me ester: C<sub>11</sub>H<sub>20</sub>O<sub>2</sub>. MW, 184. B.p. 208°. D<sup>0</sup> 0.9723.

Et ester: C<sub>12</sub>H<sub>22</sub>O<sub>2</sub>. MW, 198. B.p. 220°, 105°/12 mm.

Phenyl ester: C<sub>16</sub>H<sub>22</sub>O<sub>2</sub>. MW, 246. M.p. 20°. B.p. 305°.

Anhydride: C<sub>20</sub>H<sub>34</sub>O<sub>3</sub>. MW, 322. M.p. 56°. B.p. 209–10°. Sol. C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>.

Chloride: C<sub>10</sub>H<sub>17</sub>OCl. MW, 188.5. B.p. 220–2°, 110°/12 mm.

Amide: C<sub>10</sub>H<sub>19</sub>ON. MW, 169. M.p. 80°. Sol. EtOH, hot H<sub>2</sub>O.

*Anilide*: needles from EtOH. M.p. 91°. *Nitrile*: C<sub>10</sub>H<sub>17</sub>N. MW, 151. M.p. 73°. B.p. 217-19°. Volatile in steam.

*l*-. Prisms. M.p. 106-7°. B.p. 250°. Sol. EtOH. [α]<sub>D</sub><sup>25</sup> -49.1° in EtOH.

*Me ester*: b.p. 211°.

*Et ester*: b.p. 228°.

*Chloride*: b.p. 222°.

*Anhydride*: m.p. 57-8°. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Amide*: m.p. 78-9°. Sol. EtOH, Et<sub>2</sub>O. Volatile in steam.

*dl*-. M.p. 109°.

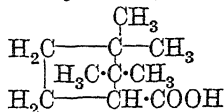
*Anhydride*: m.p. 66°.

*Amide*: m.p. 90°.

Rupe, Kloppenburg, *Helv. Chim. Acta*, 1919, 2, 363.

Guerbet, *Compt. rend.*, 1909, 148, 98, 721.

β-Campholic Acid (2:2:3:3-Tetramethylcyclopentane-1-carboxylic acid)



C<sub>10</sub>H<sub>18</sub>O<sub>2</sub> MW, 170  
M.p. 65-66.5°.

*Me ester*: C<sub>11</sub>H<sub>20</sub>O<sub>2</sub>. MW, 184. B.p. 96-7°/15 mm.

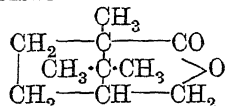
*Et ester*: C<sub>12</sub>H<sub>22</sub>O<sub>2</sub>. MW, 198. B.p. 115-16°/20 mm.

*Amide*: C<sub>10</sub>H<sub>19</sub>ON. MW, 169. M.p. 124-5°.

*Nitrile*: C<sub>10</sub>H<sub>17</sub>N. MW, 151. M.p. 119-20°.

Salmon-Legagneur, *Compt. rend.*, 1938, 208, 1021.

α-Campholide

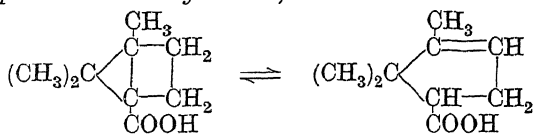


C<sub>10</sub>H<sub>16</sub>O<sub>2</sub> MW, 168  
Needles. M.p. 210-11°. Sol. EtOH, Et<sub>2</sub>O,

C<sub>6</sub>H<sub>6</sub>, ligroin. [α]<sub>D</sub><sup>20</sup> -20.2°.

Rupe, Jäggi, *Helv. Chim. Acta*, 1920, 3, 654.

α-Campholytic Acid (1:5:5-Trimethylcyclopentene-4-carboxylic acid)



C<sub>9</sub>H<sub>14</sub>O<sub>2</sub> MW, 154

*d*-. D<sub>25</sub><sup>25</sup> 1.006. [α]<sub>D</sub><sup>25</sup> + 66.35°. Volatile in steam.

*l*-. B.p. 240-3° (235°), 140°/15 mm. D<sub>15</sub><sup>15</sup> 1.0145. n<sub>D</sub><sup>17</sup> 1.47116. [α]<sub>D</sub><sup>15</sup> -60.4°. Volatile in steam. k = 9.8 × 10<sup>-6</sup> at 25°.

*dl*-. M.p. 40.5°. B.p. 162-4°/45 mm.

*Me ester*: C<sub>10</sub>H<sub>16</sub>O<sub>2</sub>. MW, 168. B.p. 200°.

*Amide*: C<sub>9</sub>H<sub>15</sub>ON. MW, 153. Leaflets from H<sub>2</sub>O. M.p. 103.5°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>.

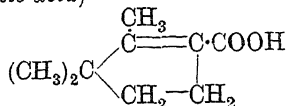
*Nitrile*: C<sub>9</sub>H<sub>13</sub>N. MW, 135. B.p. 200-5°.

Chandrasena, Ingold, Thorpe, *J. Chem. Soc.*, 1922, 121, 1542; 1925, 127, 1677.

Noyes, Nickell, *J. Am. Chem. Soc.*, 1914, 36, 125.

Noyes, Potter, *J. Am. Chem. Soc.*, 1912, 34, 1077.

β-Campholytic Acid (1:5:5-Trimethylcyclopentene-2-carboxylic acid, isolauronic acid, isolaurolenic acid)



C<sub>9</sub>H<sub>14</sub>O<sub>2</sub> MW, 154  
M.p. 135°. B.p. 247-9° (255-6°). Sol. EtOH, Et<sub>2</sub>O. Very spar. sol. H<sub>2</sub>O. Volatile in steam. k = 8.6 × 10<sup>-6</sup> at 25°. Dimorphous.

*Me ester*: C<sub>10</sub>H<sub>16</sub>O<sub>2</sub>. MW, 168. B.P. 203-4°, 67-70°/8 mm. D<sub>4</sub><sup>20</sup> 0.9656. n<sub>D</sub> 1.45714.

*Et ester*: C<sub>11</sub>H<sub>18</sub>O<sub>2</sub>. MW, 182. B.p. 214°. D<sub>15</sub><sup>15</sup> 0.9613.

*Phenyl ester*: C<sub>15</sub>H<sub>18</sub>O<sub>2</sub>. MW, 230. Needles. M.p. 24.5°. B.p. 300°.

α-Naphthyl ester: C<sub>19</sub>H<sub>20</sub>O<sub>2</sub>. MW, 280. Needles from EtOH.Aq. M.p. 82°.

β-Naphthyl ester: m.p. 82°.

*Chloride*: C<sub>9</sub>H<sub>13</sub>OCl. MW, 172.5. B.p. 100-102°/30 mm.

*Amide*: C<sub>9</sub>H<sub>15</sub>ON. MW, 153. M.p. 130°. Sol. EtOH, Et<sub>2</sub>O.

*Anhydride*: C<sub>18</sub>H<sub>26</sub>O<sub>3</sub>. MW, 290. B.p. 210-215°/13 mm.

*Nitrile*: C<sub>9</sub>H<sub>13</sub>N. MW, 135. B.p. 205°. D<sub>15</sub><sup>15</sup> 0.9127.

*Anilide*: prisms from EtOH.Aq. M.p. 104°.

o-Toluidide: m.p. 114°.

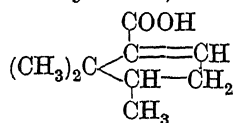
p-Toluidide: m.p. 114°.

α-Naphthylamide: needles from EtOH.Aq. M.p. 148-9°.

β-Naphthylamide: m.p. 148-9°.

Zelinsky, Lepeschkin, *Ann.*, 1901, 319, 303. Noyes, *Am. Chem. J.*, 1899, 18, 690.

Δ<sup>5</sup>-Campholytic Acid (4:5:5-Trimethylcyclopentene-1-carboxylic acid)



C<sub>9</sub>H<sub>14</sub>O<sub>2</sub> MW, 154

M.p. 91°. Spar. sol. H<sub>2</sub>O.

*Amide*: C<sub>9</sub>H<sub>15</sub>ON. MW, 153. Plates from ligroin. M.p. 90°.

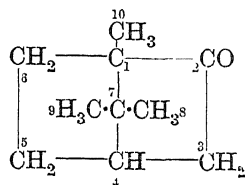
Noyes, Potter, *J. Am. Chem. Soc.*, 1912, 34, 1080.



**Camphopyric Acid.**

See Apocamphoric Acid.

**d-Camphor** (*Japan camphor*, ordinary camphor, 1 : 7 : 7-trimethylbicyclo-[1, 2, 2]-heptanone-2. Note: positions 3 and 8 are sometimes designated  $\alpha$  and  $\pi$  respectively.)

 $C_{10}H_{16}O$ 

MW, 152

Chief constituent of the oil of *Cinnamomum Camphora*, T. Colourless cryst. M.p. 179.75°. B.p. 204°. Sol. to 0.1% in  $H_2O$ , 100% in EtOH, 173% in  $Et_2O$ , 300% in  $CHCl_3$ . Sol.  $CS_2$ ,  $C_6H_6$ , MeOH, AcOH,  $Me_2CO$ .  $D_4^{20}$  1.000.  $[\alpha]_D^{20} + 44.26^\circ$  in EtOH. Sublimes. Volatile in steam. Heat of comb.  $C_v$  1402.2 Cal. Strong oxidising agents oxidise to camphoric acid and other products. Forms a Na deriv. Forms mol. comps. with HI,  $HNO_3$ ,  $H_3PO_4$ , and Br.

*Oxime*: needles or prisms. M.p. 118°. B.p. 249–54° decomp. Sol. EtOH,  $Et_2O$ , min. acids.  $[\alpha]_D^{20} - 42.4^\circ$  in EtOH. Triboluminescent. *Hydrochloride*: m.p. 162° decomp. Spar. sol.  $H_2O$ . *Hydrobromide*: needles from  $Me_2CO$ . M.p. 174°.  $[\alpha]_D^{20} - 35.8^\circ$  in EtOH. *Me ether*: b.p. 182°/357 mm., 98°/16 mm.  $D_4^{20}$  0.9605.  $n_D^{25}$  1.47665. Volatile in steam. *Et ether*: b.p. 208–10°, 103°/15 mm.  $D_4^{17}$  0.9473.  $n_D^{17}$  1.47853.

*Semicarbazone*: needles. M.p. 247–8°. Sol. hot EtOH.

4-m-Nitrophenylsemicarbazone: m.p. 240–2°.

4- $\alpha$ -Naphthylsemicarbazone: m.p. 172.5°.

*Hydrazone*: m.p. 55°. B.p. 240–2°, 119–20°/13 mm.  $[\alpha]_D - 40.81^\circ$  in  $Et_2O$ . *N-Acetyl*: needles from EtOH. M.p. 206°.

*Phenylhydrazone*: b.p. 210°/17 mm. Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ . Insol.  $H_2O$ . *Picrate*: yellow needles. M.p. 137°. *Styphnate*: green needles. M.p. 151°.

*p-Bromophenylhydrazone*: yellow plates from EtOH. M.p. 101°.

2 : 4-Dinitrophenylhydrazone: orange cryst. M.p. 175°.

*Azine*: cryst. from EtOH. M.p. 182°.  $[\alpha]_D - 37.3^\circ$  in MeOH,  $- 90.1^\circ$  in  $Et_2O$ .

Drobbeg *et al.*, *J. Soc. Chem. Ind.*, 1907, 26, 381.

Mulany, Watson, *Chem. Abstracts*, 1927, 21, 1981.

Komppa, *Ann.*, 1909, 370, 209.

Meyer, *Pharm. Ztg.*, 1937, 82, 73, 191; 1936, 81, 1181 (*Review*).

**l-Camphor** (*Matricaria camphor*, optical isomer of d-camphor).

In *Matricaria parthenium*, Linn., *Artemisia*,

and other oils. M.p. 178–6°. B.p. 204°. Sublimes.  $D^{18}$  0.9853.  $[\alpha]_D^{18} - 44.2^\circ$  in EtOH.

*Oxime*: prisms. M.p. 115°.  $[\alpha]_D^{20} + 42.5^\circ$  in EtOH.

*Semicarbazone*: m.p. 238°.

Meyer, *Pharm. Ztg.*, 1937, 82, 73, 191; 1936, 81, 1181 (*Review*).

Asahina, Ishidate, Momose, *Ber.*, 1934, 67, 1432.

**dl-Camphor.**

M.p. 178.8°. Sublimes.

*Oxime*: m.p. 118°.

*Semicarbazone*: prisms from MeOH. M.p. 238°.

4-Phenylsemicarbazone: m.p. 171–2°.

$\alpha$ -Naphthylsemicarbazone: m.p. 180°.

See references under d-Camphor.

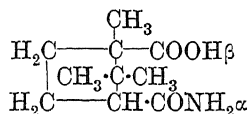
 **$\beta$ -Camphor.**

See Epi-camphor.

**Camphoraldehyde.**

See 3-Hydroxymethylenecamphor.

**$\alpha$ -Camphoramic Acid** (*Camphoric acid*  $\alpha$ -monoamide)

 $C_{10}H_{17}O_3N$ 

MW, 199

d-.

Leaflets from  $H_2O$ . M.p. 176–7°. Sol. hot  $H_2O$ , hot EtOH, hot  $Me_2CO$ . Spar. sol.  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ . Above m.p.  $\rightarrow$  camphoric anhydride.  $[\alpha]_D + 25^\circ$  in EtOH.

*Me ester*:  $C_{11}H_{19}O_3N$ . MW, 213. Prisms from  $C_6H_6$ . M.p. 154–5°. Sol. EtOH. Spar. sol.  $H_2O$ ,  $Et_2O$ .  $[\alpha]_D^{25} + 23.33^\circ$  in EtOH.

*Nitrile*:  $C_{10}H_{16}ON_2$ . MW 180. Prisms from  $H_2O$ . M.p. 194–6°.

*N-Me*:  $C_{11}H_{19}O_3N$ . MW, 213. Prisms from  $Me_2CO$ . Aq. M.p. 225°.  $[\alpha]_D^{20} + 33.2^\circ$  in  $Me_2CO$ .

*Me ester*:  $C_{12}H_{21}O_3N$ . MW, 227. M.p. 135–6°.

*N-Di-Me*:  $C_{12}H_{21}O_3N$ . MW, 227. Prisms from AcOEt. M.p. 186–7°.

*N-Et*:  $C_{12}H_{21}O_3N$ . MW, 227. Plates from  $Me_2CO$ . Aq. M.p. 173–5°.  $[\alpha]_D^{20} + 17.1^\circ$  in  $Me_2CO$ .

*N-Di-Et*:  $C_{14}H_{25}O_3N$ . MW, 255. Needles. M.p. 169–70°.  $[\alpha]_D^{20} + 19.3^\circ$  in EtOH.

*N-Propyl*:  $C_{13}H_{23}O_3N$ . MW, 241. Plates from  $Me_2CO$ . Aq. M.p. 187–8°.  $[\alpha]_D^{20} + 18.5^\circ$  in  $Me_2CO$ .

dl-.

M.p. 198°.

Wootton, *J. Chem. Soc.*, 1910, 97, 407.

Noyes, Taveau, *Am. Chem. J.*, 1904, 32, 287.

Hoogewerff, van Dorp, *Rec. trav. chim.*, 1895, 14, 259.

van der Meulen, *Rec. trav. chim.*, 1896, 15, 323.

β-Camphoramic Acid (*Camphoric acid β-monoamide*)

C<sub>10</sub>H<sub>17</sub>O<sub>3</sub>N MW, 199  
d.

M.p. 182–3°. Sol. EtOH, Me<sub>2</sub>CO, hot H<sub>2</sub>O. Spar. sol. cold H<sub>2</sub>O, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. [α]<sub>D</sub> +74° in EtOH.

Me ester: C<sub>11</sub>H<sub>19</sub>O<sub>3</sub>N. MW, 213. M.p. 139°. Sol. EtOH. [α]<sub>D</sub><sup>27</sup> +57.25° in EtOH.

Et ester: C<sub>12</sub>H<sub>21</sub>O<sub>3</sub>N. MW, 227. M.p. 94° Sol. EtOH, Et<sub>2</sub>O.

Nitrile: C<sub>10</sub>H<sub>16</sub>ON<sub>2</sub>. MW, 180. Needles from H<sub>2</sub>O. M.p. 130–2°.

N-Me: C<sub>11</sub>H<sub>19</sub>O<sub>3</sub>N. MW, 213. Plates + 1H<sub>2</sub>O. M.p. 177–8°. [α]<sub>D</sub> +65.9° in EtOH.

Me ester: C<sub>12</sub>H<sub>21</sub>O<sub>3</sub>N. MW, 227. M.p. 68°.

dl.

Needles. M.p. 178°.

Hoogewerff, van Dorp, *Rec. trav. chim.*, 1895, 14, 265.

Noyes, *Am. Chem. J.*, 1894, 16, 310, 503.

Rupe, Splittgerber, *Ber.*, 1907, 40, 4315.

α-Camphoranilic Acid (*Camphoric acid α-monoanilide*)

C<sub>16</sub>H<sub>21</sub>O<sub>3</sub>N MW, 275

d.

Needles. M.p. 203–4°. Sol. EtOH, Et<sub>2</sub>O, AcOEt, Me<sub>2</sub>CO.

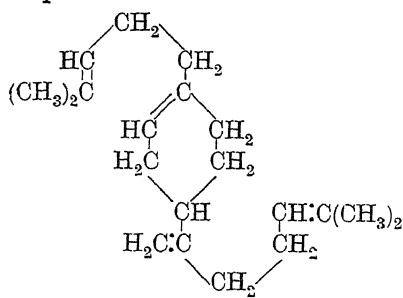
dl.

Needles. M.p. 214–5°. Sol. EtOH. Spar. sol. hot Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

Abati, Gallo, *Gazz. chim. ital.*, 1906, 36, ii, 822.

Komppa, *Ann.*, 1909, 370, 228.

α-Camphorene



C<sub>20</sub>H<sub>32</sub> MW, 272

Constituent of camphor oil. B.p. 190–2°/12 mm., 178°/4.5 mm. D<sub>4</sub><sup>21</sup> 0.8864. n<sub>D</sub><sup>21</sup> 1.4998.

Tetra-hydrochloride: m.p. 129–31°.

Tetra-hydrobromide: m.p. 133–4°.

Ruzicka, Stoll, *Helv. Chim. Acta*, 1924, 7, 271.

Kafuku, Oyamada, Nishi, *J. Chem. Soc., Japan*, 1933, 54, 364.

γ-Camphorene

C<sub>20</sub>H<sub>32</sub> MW, 272

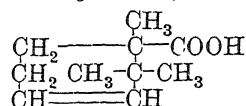
B.p. 176–8°/4.5 mm. D<sub>4</sub><sup>17</sup> 0.8875. n<sub>D</sub><sup>19</sup> 1.5030.

Tetra-hydrochloride: m.p. 96–8°.

Tetra-hydrobromide: m.p. 111–14°.

Kafuku, Oyamada, Nishi, *J. Chem. Soc., Japan*, 1933, 54, 364.

Camphorenic Acid (3:3:4-Trimethylcyclohexene-4-carboxylic acid)



C<sub>10</sub>H<sub>16</sub>O<sub>2</sub> MW, 168

Needles. M.p. 161°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Mod. sol. hot H<sub>2</sub>O. Sublimes. Volatile in steam. [α]<sub>D</sub><sup>18</sup> +179.4° in CHCl<sub>3</sub>.

Me ester: C<sub>11</sub>H<sub>18</sub>O<sub>2</sub>. MW, 182. B.p. 215°.

Anhydride: C<sub>20</sub>H<sub>30</sub>O<sub>3</sub>. MW, 318. Plates. M.p. 84–5°. Insol. H<sub>2</sub>O. Volatile in steam.

dl.

M.p. 165–6°.

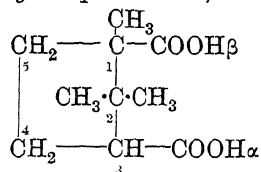
Dihydro: m.p. 179–80°.

Amide: m.p. 164–5°.

Forster, *J. Chem. Soc.*, 1896, 69, 52.

Shive, Crouch, Lochte, *J. Am. Chem. Soc.*, 1941, 63, 2979.

d-Camphoric Acid (1:2:2-Trimethylcyclopentane-1:3-dicarboxylic acid, cis-camphoric acid, ordinary camphoric acid)



C<sub>10</sub>H<sub>16</sub>O<sub>4</sub> MW, 200

Prisms or leaflets. M.p. 187°. Sol. EtOH, Me<sub>2</sub>CO. Spar. sol. H<sub>2</sub>O. Insol. CHCl<sub>3</sub>. D<sub>4</sub><sup>20</sup> 1.186. [α]<sub>D</sub><sup>20</sup> +47.7° in EtOH, +50.8° in Me<sub>2</sub>CO. Heat of comb. C<sub>v</sub> 1249.7 Cal. k (first) = 2.25 × 10<sup>-5</sup> at 25°; k (second) = 1.4 × 10<sup>-5</sup> at 25°. Triboluminescent. Boiling HNO<sub>3</sub> → camphoronic acid + acetic acid + CO<sub>2</sub>. Dist. → camphoric acid + acetic acid + CO<sub>2</sub>. Dist. → camphoric anhydride. Decomp. by caustic alkali fusion.

α-Me ester: C<sub>11</sub>H<sub>18</sub>O<sub>4</sub>. MW, 214. M.p. 77°. B.p. 199°/15 mm. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>, CHCl<sub>3</sub>. Spar. sol. cold H<sub>2</sub>O. [α]<sub>D</sub> +51.5°. k = 7.95 × 10<sup>-6</sup> at 25°.

β-Me ester: m.p. 86°. B.p. 193°/15 mm. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>, CHCl<sub>3</sub>, Me<sub>2</sub>CO. Spar. sol. H<sub>2</sub>O. [α]<sub>D</sub><sup>20</sup> +43.6° in EtOH. k = 1.08 × 10<sup>-5</sup> at 25°.

Di-Me ester: C<sub>12</sub>H<sub>20</sub>O<sub>4</sub>. MW, 228. B.p. 263–4°, 155°/15 mm. D<sub>4</sub><sup>21</sup> 1.0747. n<sub>D</sub><sup>21</sup> 1.46334. [α]<sub>D</sub> +49.07° in EtOH.

α-Et ester: C<sub>12</sub>H<sub>20</sub>O<sub>4</sub>. MW, 228. Prisms. M.p. 47–8°. Sol. EtOH, Et<sub>2</sub>O. Prac. insol. H<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 1.0998. n<sub>D</sub><sup>21</sup> 1.47372. Dist. → diethyl ester + camphoric anhydride.

*β*-Et ester: m.p. 57°. B.p. 196°/13 mm.  
*Di-Et ester*: C<sub>14</sub>H<sub>24</sub>O<sub>4</sub>. MW, 256. B.p. 285-6°, 164°/20 mm. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 1.0298. n<sub>D</sub><sup>20</sup> 1.45354.

*Di-guaiacol ester*: guacamphol. C<sub>24</sub>H<sub>28</sub>O<sub>6</sub>. MW, 412. M.p. 126-7°. Sol. hot EtOH, hot AcOH, CHCl<sub>3</sub>. Insol. H<sub>2</sub>O.

*Dichloride*: camphorylchloride. C<sub>10</sub>H<sub>14</sub>O<sub>2</sub>Cl<sub>2</sub>. MW, 237. Fuming liq. B.p. 140°/10 mm. De-comp. at 200°.

*Mono-amide*: see Camphoramidic Acid.

*Diamide*: C<sub>10</sub>H<sub>18</sub>O<sub>2</sub>N<sub>2</sub>. MW, 198. M.p. 192-3°. Sol. H<sub>2</sub>O, EtOH. Insol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*α-Anilide*: see *α*-Camphoranilic Acid.

*Di-anilide*: needles from AcOH. M.p. 226°.

*α-m-Nitroanilide*: plates from EtOH. M.p. 212-13° decomp. [α]<sub>D</sub> + 32° in Me<sub>2</sub>CO.

*α-o-Toluidide*: needles. M.p. 196-7°. [α]<sub>D</sub><sup>20</sup> + 33.9° in Me<sub>2</sub>CO.

*Di-o-toluidide*: m.p. 218°.

*α-m-Toluidide*: needles. M.p. 208-9°. [α]<sub>D</sub><sup>20</sup> + 31° in Me<sub>2</sub>CO.

*α-p-Toluidide*: m.p. 212-14°. D<sub>4</sub><sup>20</sup> 1.1704. [α]<sub>D</sub><sup>15</sup> + 49.5° in EtOH, + 37° in Me<sub>2</sub>CO.

*β-p-Toluidide*: m.p. 190-6°. D<sub>4</sub><sup>20</sup> 1.2637.

*l-β-Methylphenylethylamine salt*: [α]<sub>D</sub> - 12.9°.

*Imide*: see Camphorimide.

*α-Nitrile*: C<sub>10</sub>H<sub>15</sub>O<sub>2</sub>N. MW, 181. M.p. 152°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Mod. sol. H<sub>2</sub>O. [α]<sub>D</sub> + 67.5° in EtOH. *β-Me ester*: C<sub>11</sub>H<sub>17</sub>O<sub>2</sub>N. MW, 195. Prisms from pet. ether. M.p. 41-2°. B.p. 270°, 160-3°/27 mm., 143-5°/12 mm. [α]<sub>D</sub> + 65°. *Et ester*: C<sub>12</sub>H<sub>19</sub>O<sub>2</sub>N. MW, 209. M.p. 25-8°. B.p. 277-8°, 162°/18 mm.

*Phenyl ester*: C<sub>16</sub>H<sub>19</sub>O<sub>2</sub>N. MW, 257. M.p. 76-7°. B.p. 215-25°/18 mm. *Chloride*: C<sub>10</sub>H<sub>13</sub>ONCl. MW, 199.5. M.p. 99°. B.p. 153-5°/15 mm. *Anhydride*: C<sub>20</sub>H<sub>28</sub>O<sub>3</sub>N<sub>2</sub>. MW, 344. Plates from MeOH. M.p. 178°.

*β-Nitrile*: m.p. 109-10°. Mod. sol. H<sub>2</sub>O. [α]<sub>D</sub> + 18.2° in EtOH. *Chloride*: b.p. 153-5°/22 mm. *Anhydride*: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 182°.

*Anhydride*: see Camphoric Anhydride.

Noyes, *Am. Chem. J.*, 1894, 16, 501.

Bredt, *Ber.*, 1912, 45, 1419.

Wootton, *J. Chem. Soc.*, 1910, 97, 413.

Minguin, *Bloc, Compt. rend.*, 1914, 158, 1274.

**l-Camphoric Acid.**

M.p. 187°. Sol. Et<sub>2</sub>O, EtOH, MeOH, Me<sub>2</sub>CO. Spar. sol. H<sub>2</sub>O. *k* (first) = 2.28 × 10<sup>-5</sup> at 25°; *k* (second) = 0.7 × 10<sup>-6</sup> at 100°. [α]<sub>D</sub><sup>25</sup> - 48° in EtOH.

*Dianilide*: m.p. 226°.

Tschugajew, Budrick, *Ann.*, 1912, 388, 289.

Aschan, *Ber.*, 1895, 28R, 922.

Haller, *Compt. rend.*, 1886, 103, 64.

**dl-Camphoric Acid.**

M.p. 202° (208°). Sol. EtOH, Et<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 1.228.

Dict. of Org. Comp.—I.

*Di-Me ester*: C<sub>12</sub>H<sub>20</sub>O<sub>4</sub>. MW, 228. B.p. 147°/20 mm.

*α-Et ester*: C<sub>12</sub>H<sub>20</sub>O<sub>4</sub>. MW, 228. M.p. 69-70°.

*β-Et ester*: m.p. 95-6°.

*Di-Et ester*: C<sub>14</sub>H<sub>24</sub>O<sub>4</sub>. MW, 256. B.p. 270-5°.

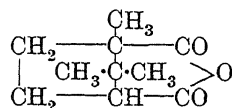
*Sulphanilamide*: m.p. 156-8°.

Aschan, *Ann.*, 1901, 316, 210.

Komppa, *Ber.*, 1903, 36, 4334.

Nametkin, *Chem. Zentr.*, 1916, I, 884.

**Camphoric Anhydride**



C<sub>10</sub>H<sub>14</sub>O<sub>3</sub> MW, 182

*l*-

From *d*-camphoric acid. B.p. above 270°. At 14° sol. in 123 parts 95% EtOH, 68 parts Et<sub>2</sub>O, 17 parts C<sub>6</sub>H<sub>6</sub>. D<sub>20</sub><sup>25</sup> 1.194. [α]<sub>D</sub> - 7.7° in C<sub>6</sub>H<sub>6</sub>.

*d*-

From *l*-camphoric acid. Cryst. from EtOH. M.p. 220-1° (223.5°). At 20° sol. to 6.26% in C<sub>6</sub>H<sub>6</sub>, 1.2% in 95% EtOH.

*dl*-

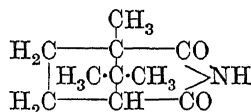
Cryst. from EtOH. M.p. 221°.

Edgerton, *Proc. Chem. Soc.*, 1909, 25, 149.

Perkin, Thorpe, *J. Chem. Soc.*, 1906, 89, 795.

Aschan, *Chem. Zentr.*, 1895, II, 971.

**Camphorimide**



C<sub>10</sub>H<sub>15</sub>O<sub>2</sub>N MW, 181

*d*-

Needles from AcOH.Aq. M.p. 248°. B.p. 300°. Sublimes above 120°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, hot H<sub>2</sub>O. Spar. sol. ligroin. [α]<sub>D</sub><sup>23</sup> + 1.6° in CHCl<sub>3</sub>.

*N-Me*: m.p. 40-2°. B.p. 270°. [α]<sub>D</sub><sup>20</sup> + 7.3° in Me<sub>2</sub>CO.

*N-Et*: cryst. from EtOH. M.p. 51-2°. B.p. 271-3°.

*N-Propyl*: m.p. 40-1°. [α]<sub>D</sub><sup>20</sup> + 10.9° in Me<sub>2</sub>CO.

*N-Butyl*: m.p. 61-2°. [α]<sub>D</sub><sup>20</sup> + 12.8° in Me<sub>2</sub>CO.

*N-Phenyl*: m.p. 117-18°.

*N-o-Tolyl*: m.p. 105-6°. [α]<sub>D</sub><sup>20</sup> + 15.7° in Me<sub>2</sub>CO.

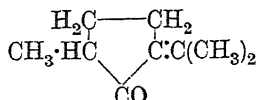
*N-m-Tolyl*: leaflets. M.p. 121-2°. [α]<sub>D</sub><sup>20</sup> + 17.6° in Me<sub>2</sub>CO.

*N-p-Tolyl*: prisms. M.p. 127-8°. [α]<sub>D</sub><sup>20</sup> + 12.7° in Me<sub>2</sub>CO.

*N-β-Naphthyl*: m.p. 171-2°.

*dl.*Needles from H<sub>2</sub>O. M.p. 249°.Wootton, *J. Chem. Soc.*, 1910, 97, 415.Evans, *J. Chem. Soc.*, 1910, 97, 2237.Singh, Puri, *J. Chem. Soc.*, 1926, 504.Noyes, Warren, *Am. Chem. J.*, 1902, 28, 484.

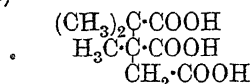
**Camphorone** (5-Methyl-2-isopropylidene-cyclopentanone)

C<sub>9</sub>H<sub>14</sub>O MW, 138B.p. 85°/15 mm. D<sub>20</sub><sup>20</sup> 0.9325, D<sub>4</sub><sup>20</sup> 0.9308.n<sub>D</sub><sup>20</sup> 1.48084, n<sub>D</sub><sup>25</sup> 1.49884.

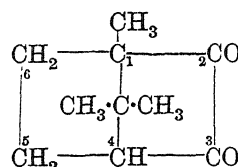
Semicarbazone: m.p. 197°.

Calas, *Compt. rend.*, 1937, 204, 984, 1374; *Bull. soc. chim.*, 1939, 6, 1485.

**Camphoronic Acid** (1:1:2-Trimethyltricarballic acid, 2:3-dimethylbutane-2:3:4-tricarboxylic acid)

C<sub>9</sub>H<sub>14</sub>O<sub>6</sub> MW, 218*d.*Needles from H<sub>2</sub>O. M.p. 158–9° decomp. Sol. H<sub>2</sub>O. [α]<sub>D</sub><sup>20</sup> +27.05° in H<sub>2</sub>O.*l.*Needles from H<sub>2</sub>O. M.p. 164–5° (rapid heat.). Very sol. EtOH (76% at 16°), CHCl<sub>3</sub> (30%). Sol. H<sub>2</sub>O. Mod. sol. Me<sub>2</sub>CO. Prac. insol. C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>, ligroin. [α]<sub>D</sub><sup>18</sup> –26.9° in H<sub>2</sub>O. k<sub>1</sub> = 2.95 × 10<sup>-4</sup>, k<sub>2</sub> = 1.05 × 10<sup>-5</sup>, k<sub>3</sub> = 0.037 × 10<sup>-6</sup>, all at 30°. Heat at 105°, or CH<sub>3</sub>COCl → anhydrocamphoronic acid. Decomp. by conc. H<sub>2</sub>SO<sub>4</sub>. KOH fusion → isobutyric acid.Mono-NH<sub>4</sub> salt: m.p. 128°. Sol. H<sub>2</sub>O. Di-NH<sub>4</sub> salt: m.p. 148° decomp.Mono-Me ester: C<sub>10</sub>H<sub>16</sub>O<sub>6</sub>. MW, 232. M.p. 142°. Sol. hot H<sub>2</sub>O.Tri-Me ester: C<sub>12</sub>H<sub>20</sub>O<sub>6</sub>. MW, 260. B.p. 155°/12 mm. D<sub>4</sub><sup>23.4</sup> 1.1373. n<sub>D</sub><sup>20</sup> 1.4461. [α]<sub>D</sub><sup>20</sup> –20.1° in MeOH.Mono-Et ester: C<sub>11</sub>H<sub>18</sub>O<sub>6</sub>. MW, 246. Cryst. from EtOH. M.p. 139–40°. [α]<sub>D</sub><sup>20</sup> –30.21° in EtOH.Tri-Et ester: C<sub>15</sub>H<sub>26</sub>O<sub>6</sub>. MW, 302. B.p. 302°, 172°/13 mm.*dl.*M.p. 172° decomp. (168°). Spar. sol. H<sub>2</sub>O.Goebel, Noyes, *J. Am. Chem. Soc.*, 1923, 45, 3064.Aschan, *Ber.*, 1895, 28, 17.Bredt, *Ann.*, 1896, 292, 75.Gaguly, *J. Indian Chem. Soc.*, 1943, 20, 101.

**Camphorquinone** (*Camphane-2:3-dione, camphoquinone*)

C<sub>10</sub>H<sub>14</sub>O<sub>2</sub> MW, 166Yellow needles. M.p. 199°. Sublimes. Sol. EtOH. Mod. sol. hot H<sub>2</sub>O. Volatile in steam. Strongly laevorotatory.

Monoxime: see Isonitrosocamphor.

Dioxime: exists in four stereoisomeric forms, α, β, γ, and δ.

α-form: rhombic prisms. M.p. 201° decomp. Sol. caustic alkalis. [α]<sub>D</sub><sup>20</sup> –63.6° in EtOH.

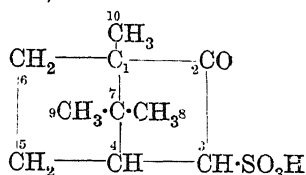
β-form: prisms. M.p. 248° decomp. Sol. caustic alkalis.

γ-form: needles. M.p. 136°. Sol. alkalis and boiling H<sub>2</sub>O. [α]<sub>D</sub><sup>20</sup> +22.4° in EtOH.δ-form: m.p. 194° decomp. Sol. caustic alkalis. [α]<sub>D</sub><sup>20</sup> +80.0° in EtOH.

3-Phenylhydrazone: exists in two stereoisomeric forms. α-Form: m.p. 183–90° according to rate of heating; β-form, m.p. 36°.

3-p-Bromophenylhydrazone: yellow cryst. from AcOH. M.p. 215–16°.

3-Hydrazone: α-form: prisms from EtOH. M.p. 206° (198°) decomp. [α]<sub>D</sub><sup>20</sup> +287.4° in CHCl<sub>3</sub>. At 180° → β-form. β-form: needles from EtOH. M.p. 103°. Volatile in steam. [α]<sub>D</sub><sup>20</sup> +231.3° in CHCl<sub>3</sub>.3:3'-Azine: m.p. 218° decomp. [α]<sub>D</sub><sup>20</sup> +174.5° in CHCl<sub>3</sub>.3-Semicarbazone: α-form: prisms from EtOH. M.p. 236° decomp. [α]<sub>D</sub><sup>20</sup> +277.6° in MeOH. β-Form: yellow prisms from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 147°. [α]<sub>D</sub><sup>20</sup> +200.9° in MeOH.3-[4-Phenyl]-semicarbazone: α-form: plates from MeOH. M.p. 211°. [α]<sub>D</sub><sup>20</sup> +229.3° in CHCl<sub>3</sub>. β-Form: yellow needles from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 161°. [α]<sub>D</sub><sup>20</sup> +191.9° in CHCl<sub>3</sub>.3-Thiosemicarbazone: cryst. from EtOH. M.p. 174°. [α]<sub>D</sub><sup>20</sup> +314.4° in CHCl<sub>3</sub>.3-Anil: m.p. 110–12°. [α]<sub>D</sub><sup>20</sup> +606.8° in MeOH.Bredt, *J. prakt. Chem.*, 1929, 121, 153; 1917, 95, 66.Forster, *J. Chem. Soc.*, 1913, 103, 662.Lapworth, *J. Chem. Soc.*, 1907, 91, 1134.Forster, Zimmerli, *J. Chem. Soc.*, 1910, 97, 2169.Evans, Ridgion, Simonsen, *J. Chem. Soc.*, 1934, 137.

**Camphor-3-sulphonic Acid** (*Camphor- $\alpha$ -sulphonic acid*)

$C_{10}H_{16}O_4S$  MW, 232

*Me ester*:  $C_{11}H_{18}O_4S$ . MW, 246. M.p. 77°. Sol. alkalis.  $[\alpha]_D^{20} + 98.6^\circ$  in  $CHCl_3$ .

*Chloride*:  $C_{10}H_{15}O_3ClS$ . MW, 250.5. M.p. 88°.

*Amide*:  $C_{10}H_{17}O_3NS$ . MW, 231. M.p. 143°.

*Anilide*: m.p. 124°. Levorotatory in neutral sol., dextrorotatory in alkalis.

*N-Et-anilide*: m.p. 89°.  $[\alpha]_{5461} - 8^\circ$  in  $CHCl_3$ ,  $- 68^\circ$  in  $C_6H_6$ .

*o-Toluidide*: m.p. 117°.  $[\alpha]_{5461} - 110.6^\circ$  in  $CHCl_3$ ,  $- 49.5^\circ$  in EtOH.

*p-Toluidide*: m.p. 196.7°.  $[\alpha]_{5461} - 146^\circ$  in  $CHCl_3$ ,  $- 52.5^\circ$  in EtOH.

*Benzylisothiuronium salt*: m.p. 209.7° (from 50% EtOH).

Frèrejacque, *Ann. chim.*, 1930, 14, 197.

**Camphor-8-sulphonic Acid** (*Camphor- $\pi$ -sulphonic acid*).

*d-*.

*Chloride*:  $C_{10}H_{15}O_3ClS$ . MW, 250.5. M.p. 137-8°. Sol.  $CHCl_3$ .  $[\alpha]_D^{14} + 128.7^\circ$  in  $CHCl_3$ .

*Bromide*:  $C_{10}H_{15}O_3BrS$ . MW, 295. M.p. 144-5°.  $[\alpha]_D^{15} + 145^\circ$  in  $CHCl_3$ .

*Amide*:  $C_{10}H_{17}O_3NS$ . MW, 231. M.p. 136-7°.  $[\alpha]_D^{15} + 93.6^\circ$  in EtOH.

*dl-*.

Leaflets. M.p. 56-8°. Sol.  $H_2O$ , EtOH.

*Chloride*: prisms. M.p. 106°.

*Amide*: m.p. 133-5°. Sol. hot  $H_2O$ .

Kipping, Pope, *J. Chem. Soc.*, 1893, 63, 549.

Pope, Reid, *J. Chem. Soc.*, 1910, 97, 989.

**Camphor- $\beta$ -sulphonic Acid** (*Camphor-10- (or 6)sulphonic acid, camphor- $\omega$ -sulphonic acid*).

*d-*.

Prisms from AcOH. M.p. 193° decomp. Sol.  $H_2O$ . Spar. sol. AcOH. Insol.  $Et_2O$ .  $[\alpha]_D^{20} + 24.0^\circ$  in  $H_2O$ ,  $+ 39.5^\circ$  in  $CHCl_3$ .

*Me ester*:  $C_{11}H_{18}O_4S$ . MW, 246. Needles from MeOH.Aq. M.p. 61°.  $[\alpha]_D^{20} + 43.4^\circ$  in  $CHCl_3$ .

*Et ester*:  $C_{12}H_{20}O_4S$ . MW, 260. Leaflets from MeOH.Aq. M.p. 47°.  $[\alpha]_D^{20} + 43.3^\circ$  in  $CHCl_3$ .

*Phenylester*:  $C_{16}H_{20}O_4S$ . MW, 308. Needles from pet. ether. M.p. 48°.  $[\alpha]_D^{20} + 40.6^\circ$  in  $CHCl_3$ .

*Chloride*:  $C_{10}H_{15}O_3ClS$ . MW, 250.5. Prisms from  $Et_2O$ . M.p. 67-8°.  $[\alpha]_D^{20} + 32.2^\circ$  in  $CHCl_3$ .

*Bromide*:  $C_{10}H_{15}O_3BrS$ . MW, 295. Leaflets from  $Et_2O$ . M.p. 93°.  $[\alpha]_D^{15} + 26.0^\circ$  in  $CHCl_3$ .

*Amide*:  $C_{10}H_{17}O_3NS$ . MW, 231. Prisms from EtOH. M.p. 132°.  $[\alpha]_D^{17} + 1.5^\circ$  in EtOH.

*Anilide*: prisms from EtOH. M.p. 119°.  $[\alpha]_D^{17} + 67.3^\circ$  in  $CHCl_3$ .

*p-Nitroanilide*: needles from EtOH.Aq. M.p. 145°.

*p-Toluidide*: m.p. 141°.  $[\alpha]_D^{21} + 68.3^\circ$  in  $CHCl_3$ .

*Oxime*: prisms. M.p. 58°.  $[\alpha]_D^{21} + 45.8^\circ$  in  $CHCl_3$ .

*Phenylhydrazone*: leaflets. M.p. 235° decomp.

*2:4-Dinitrophenylhydrazone*: *yellow form*: m.p. 215°.  $[\alpha]_D - 130^\circ$  in EtOH. *Red form*: m.p. 193-5°.

Reychler, *Bull. soc. chim.*, 1898, 19, 120.  
Burgess, Lowry, *J. Chem. Soc.*, 1925, 127, 279.

Burgess, Gibson, *J. Soc. Chem. Ind.*, 1925, 44, 496r.

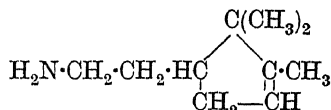
*l-*.

Cryst. from AcOH. M.p. 193-5° decomp.  $[\alpha]_D^{20} - 20.75^\circ$  in  $H_2O$ .

*dl-*.

Cryst. from AcOH. M.p. 202° decomp.

Rewald, *Ber.*, 1909, 42, 3136.

 **$\alpha$ -Camphylamine** (1:5:5-Trimethyl-4-( $\omega$ -aminoethyl)-cyclopentene)

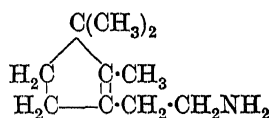
$C_{10}H_{19}N$  MW, 153

B.p. 194-6°, 95°/12 mm.  $D_4^{18} 0.8736$ .  $n_D^{18} 1.47284$ .  $[\alpha]_D + 6^\circ$ . Heat of comb.  $C_p 1536.9$  Cal.,  $C_p 1539.2$  Cal. Absorbs  $CO_2$ .

*N-Benzoyl*: prisms from ligroin. M.p. 75-7°. *Picrate*: pale yellow needles. Sinters at 190°. M.p. 194° decomp.

*N-Di-Me*:  $C_{12}H_{23}N$ . MW, 181. B.p. 215°. *Methiodide*: prisms. M.p. 285° decomp.

Tiemann, *Ber.*, 1896, 29, 3008.

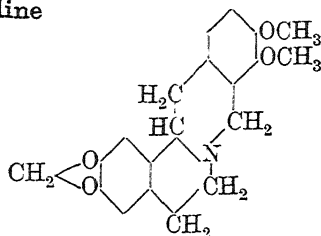
 **$\beta$ -Camphylamine** (1:5:5-Trimethyl-2-( $\omega$ -aminoethyl)-cyclopentene)

$C_{10}H_{19}N$  MW, 153

B.p. 196-8° (205-6°).  $D_3^{20} 0.8697$ .

Tiemann, *Ber.*, 1897, 30, 245.

## Canadine



$C_{20}H_{21}O_4N$  MW, 339

*d.*

Occurs in *Corydalis tuberosa*, D.C. M.p. 132°.  $[\alpha]_D^{25} + 299^\circ$  in  $CHCl_3$ .

*l.*

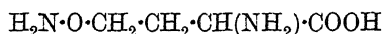
Constituent of *Hydrostis canadensis* and *Corydalis cheilanthifolia*, Linn. Needles. M.p. 134°. Sol.  $Et_2O$ ,  $CHCl_3$ . Insol.  $H_2O$ .  $[\alpha]_D - 299^\circ$  in  $CHCl_3$ .  $(AcO)_2Hg \rightarrow$  berberine.

Go, *Chem. Abstracts*, 1930, 24, 620.

Späth, Julian, *Ber.*, 1931, 64, 1131.

Manske, *Can. J. Research*, 1942, 20B, 53.

## Canaline



$C_4H_{10}O_3N_2$  MW, 134

Present in *Canavalia ensiformis* (Jackbean). Needles from EtOH. M.p. 214° decomp.  $[\alpha]_D^{21} - 8.31^\circ$ . Forms nitranilic acid salt, insol. EtOH.  $B, 2HCl$ : cryst. from EtOH. M.p. 166° decomp.

*l-N-Benzoyl*: m.p. 150° decomp.

*Dibenzoyl*: m.p. 99° decomp.

*Picrate*: m.p. 192-3° decomp.

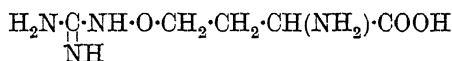
*Flavianate*: m.p. 211°.

Kitagawa, Yamada, *Chem. Zentr.*, 1933, I, 2559.

Kitagawa, *J. Biochem. Japan*, 1936, 24, 107.

Müller, *Z. physiol. Chem.*, 1941, 268, 245.

## Canavanine



$C_5H_{12}O_3N_4$  MW 176

Constituent of *Canavalia ensiformis* (Jackbean). Cryst. from EtOH. M.p. 184°.  $[\alpha]_D^{20} + 7.9^\circ$  in  $H_2O$ .

$B, H_2SO_4$ : cryst. from EtOH. M.p. 172° decomp.  $[\alpha]_D^{17} + 19.41^\circ$ .

*Cu salt*: m.p. 205-8° decomp.

*Tribenzoyl*: m.p. 86° decomp.

*Picrate*: m.p. 163-4°.

*Flavianate*: yellow needles from  $H_2O$ . M.p. 212°.

Kitagawa, Yamada, *Chem. Zentr.*, 1933, I, 2559.

Gulland, Morris, *J. Chem. Soc.*, 1935, 763.

Kitagawa, Takani, *Chem. Abstracts*, 1936, 30, 3409, 4818.

Cadden, *Proc. Soc. Exptl. Biol. Med.*, 1940, 45, 224.

## Candidulin

$C_{11}H_{15}O_3N$  MW, 209

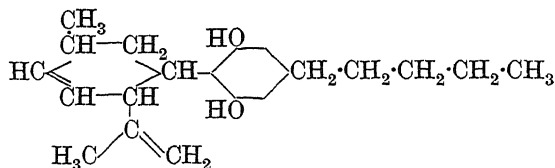
Antibiotic from *Aspergillus candidus*. Cryst. from hexane. M.p. 88-9°.  $[\alpha]_D^{24} + 15 \pm 2^\circ$  in  $CHCl_3$ . Sol. MeOH, EtOH,  $Me_2CO$ ,  $Et_2O$ ,  $CHCl_3$ . Spar. sol.  $C_6H_6$ ,  $CCl_4$ ,  $H_2O$ . Insol.  $N/HCl$ , 5%  $Na_2CO_3$ , cold hexane. Strongly active against acid-fast bacteria. Inactivated at pH 10.9.

Stansly, Ananenko, *Arch. Biochem.*, 1949, 23, 256.

## Cane sugar.

See Sucrose.

## Cannabidiol



Possible structure—position of cyclic double bond not established with certainty.\*

$C_{21}H_{30}O_2$  MW, 314

Isolated from Indian and Egyptian hashish and Minnesota wild hemp. Rods from pet. ether. M.p. 66-7°. B.p. 187-90°/2 mm. Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ ,  $CHCl_3$ . Insol.  $H_2O$ , 10% NaOH.  $KMnO_4 \rightarrow$  *n*-caproic acid.  $NH_3 \cdot AgNO_3$  and Fehling's slowly reduced in hot. Traces of acid  $\rightarrow$  tetrahydrocannabinol.

*Di-Me ether*: pale yellow oil. B.p. 175-7°/3 mm.  $D_4^{20} 0.9823$ .  $n_D^{20} 1.5254$ .

*Di-3:5-dinitrobenzoyl*: rods from MeOH-AcOMe. M.p. 106-7° corr.

*Di-m-nitrobenzenesulphonyl*: rods from EtOH. M.p. 119-20° corr.

*Di-p-carbomethoxybenzoyl*: b.p. 130-50°/10-3 mm.

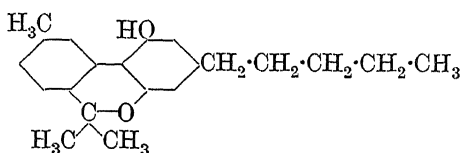
\*Adams, Wolff, Cain, Clark, *J. Am. Chem. Soc.*, 1940, 62, 2215.

Adams, Pease, Clark, *ibid.*, 2194.

Adams, Hunt, Clark, *ibid.*, 196.

Adams, Cain, McPhee, Wearn, *J. Am. Chem. Soc.*, 1941, 63, 2209.

## Cannabinol



$C_{21}H_{26}O_2$  MW, 310

Constituent of Indian and Egyptian hashish and Minnesota wild hemp. Plates or leaflets from pet. ether M.p. 76-7° corr. B.p. 185°/0.05 mm. Sol. MeOH, EtOH, alkalis. Insol.  $H_2O$ .  $[\alpha]_D^{20} - 148^\circ$  in EtOH.

*Acetyl*: needles from EtOH. M.p. 75–6° corr.  
*p-Aminobenzoyl*: needles from MeOH. M.p. 149–50°.

*p-Nitrobenzoyl*: yellow needles from EtOH. M.p. 165–6°.

*m-Nitrobenzenesulphonyl*: yellow prisms from C<sub>6</sub>H<sub>6</sub>-EtOH. M.p. 127–9° corr.

*p-Carbomethoxybenzoyl*: m.p. 195°.

*3:5-Dinitrophenylurethane*: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 221–2° decomp.

*Me ether*: C<sub>22</sub>H<sub>28</sub>O<sub>2</sub>. MW, 324. Plates from MeOH. M.p. 66°. B.p. 265°/32 mm. Sol. Et<sub>2</sub>O, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>, ligroin.

Adams, Pease, Clark, *J. Am. Chem. Soc.*, 1940, 62, 2194.

Adams, Baker, *ibid.*, 2401.

Adams, Baker, Wearn, *ibid.*, 2204.

Ghosh, Todd, Wilkinson, *J. Chem. Soc.*, 1940, 1393.

Ghosh, Todd, Wright, *J. Chem. Soc.*, 1941, 137.

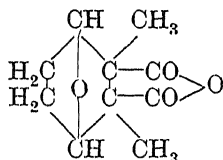
Work, Bergel, Todd, *Biochem. J.*, 1939, 33, 123.

Madinaventia, Russell, Todd, *J. Chem. Soc.*, 1942, 628.

### Cannabiscetin.

See Myricetin.

### Cantharidin



C<sub>10</sub>H<sub>12</sub>O<sub>4</sub>

MW, 196

Occurs in *Lytta vesicatoria* (Spanish Fly) and many other insects. Active principle of cantharides, which contains 0.4–1%. Colourless plates. M.p. 218°. Begins to sublime at 84°. Sol. AcOH, conc. H<sub>2</sub>SO<sub>4</sub>, alkalis. Spar. sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Prac. insol. H<sub>2</sub>O.

*Phenylhydrazone*: m.p. 238°.

Coffey, *Rec. trav. chim.*, 1923, 42, 1026.

Bruchhausen, Bersch, *Chem. Abstracts*, 1929, 23, 1647.

Iyer, Guha, *J. Indian Inst. Sci.*, 1931, 14A, 31.

Paranjape, Phalnikar, Bhide, Nargund, *Proc. Indian Acad. Sci.*, 1944, 19A, 385.

Ziegler, Schenk, Krockow, Siebert, Werz, Weber, *Ann.*, 1942, 551, 1.

### C.A.P.

See Phenacyl chloride.

**n-Capric Acid** (*n-Decylic acid*, *nonane-1-carboxylic acid*)



C<sub>10</sub>H<sub>20</sub>O<sub>2</sub>

MW, 172

Needles M.p. 31.5°. B.p. 268–70°, /200° 100 mm., 170°/25 mm., 148–50°/11 mm. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 0.8858. n<sub>D</sub><sup>20</sup> 1.42855. Heat of comb. 1458.3 Cal. Na and Mg salts sol. H<sub>2</sub>O. Ca, Ba, and Ag salts mod. sol. boiling H<sub>2</sub>O. Cu salt insol. H<sub>2</sub>O, EtOH.  
*Me ester*: C<sub>11</sub>H<sub>22</sub>O<sub>2</sub>. MW, 186. B.p. 224°, 114°/15 mm.

*Et ester*: C<sub>12</sub>H<sub>24</sub>O<sub>2</sub>. MW, 200. B.p. 243–5°.

*Glycerol esters*: (1) *Mono-ester*, *l-α-mono-caprin*. M.p. 44°. n<sub>D</sub><sup>20</sup> 1.5000 (supercooled). [α]<sub>D</sub><sup>20</sup> –5.55°. (2) *Tri-ester*, *tricaprin*. C<sub>33</sub>H<sub>62</sub>O<sub>6</sub>. MW, 554. M.p. 31°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, ligroin. D<sub>4</sub><sup>20</sup> 0.9205. n<sub>D</sub><sup>20</sup> 1.44461.

*p-Chlorophenacyl ester*: cryst. from EtOH. M.p. 61.6°.

*p-Bromophenacyl ester*: cryst. from EtOH. M.p. 67°.

*p-Iodophenacyl ester*: cryst. from EtOH. M.p. 82°.

*Chloride*: C<sub>10</sub>H<sub>19</sub>OCl. MW, 190.5. B.p. 114°/15 mm.

*Amide*: C<sub>10</sub>H<sub>21</sub>ON. MW, 171. M.p. 108° (98°).

*Anilide*: m.p. 70°.

*p-Bromoanilide*: m.p. 102°.

*o-Toluidide*: m.p. 76°.

*p-Toluidide*: m.p. 78° (80°).

*α-Naphthylamide*: m.p. 99°.

*β-Naphthylamide*: m.p. 104°.

*Amidine*: *hydrochloride*, m.p. 116°.

*Nitrile*: C<sub>10</sub>H<sub>19</sub>N. MW, 153. M.p. –17.9°. B.p. 243.7°. D<sub>4</sub><sup>20</sup> 0.82945. n<sub>D</sub><sup>20</sup> 1.4320.

*Anhydride*: C<sub>20</sub>H<sub>38</sub>O<sub>3</sub>. MW, 326. M.p. 23.9°. D<sub>4</sub><sup>20</sup> 0.8596. n<sub>D</sub><sup>20</sup> 1.4234.

Buisine, *Compt. rend.*, 1887, 105, 614.

Lukeš, *Chem. Abstracts*, 1929, 23, 4469.

Kao, Ma, *J. Chem. Soc.*, 1931, 2046.

Robertson, *J. Chem. Soc.*, 1919, 115, 1221.

**Capric Aldehyde** (*Caprinaldehyde*, *n-decylaldehyde*, *decanal*, *capraldehyde*)



C<sub>10</sub>H<sub>20</sub>O

MW, 156

Constituent of Cassia, Neroli, and other oils. B.p. 208–9°, 94°/12 mm, 81°/7 mm. D<sub>4</sub><sup>15</sup> 0.828. n<sub>D</sub><sup>15</sup> 1.42977. Polymerised by HCl.

*Oxime*: m.p. 69°.

*Semicarbazone*: m.p. 102°.

*Phenylsemicarbazone*: m.p. 107–8°.

*o-Tolylsemicarbazone*: m.p. 99–100°.

*p-Tolylsemicarbazone*: m.p. 137–8°.

*4-α-Naphthylsemicarbazone*: m.p. 118–19°.

*4-β-Naphthylsemicarbazone*: m.p. 149°.

*Thiosemicarbazone*: m.p. 99–100°.

*2:4-Dinitrophenylhydrazone*: yellow cryst. M.p. 104°.

*o-Nitrobenzoylhydrazone*: m.p. 103–4°.

*p-Iodobenzoylhydrazone*: m.p. 151–2° (from 50% EtOH).

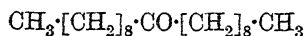
*Azine*: cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 34°.

*Dimedone deriv.*: m.p. 91-7°.

Pickard, Kenyon, *J. Chem. Soc.*, 1913, 103, 1947.

Bryusova, Shagalova, Novikova, *Khimicheskii Referativnyi Zhurnal*, 1940, 4, 11, (*Chem. Abstracts*, 1942, 36, 3781).

**Caprinone** (*Di-n-nonyl ketone, nonadecanone-10*)



$\text{C}_{19}\text{H}_{38}\text{O}$  MW, 282

Leaflets. M.p. 65-5° (58°). Sol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ , hot  $\text{EtOH}$ . Insol.  $\text{H}_2\text{O}$ .

Grimm, *Ann.*, 1871, 157, 270.

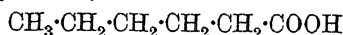
Briese, McElvain, *J. Am. Chem. Soc.*, 1933, 55, 1698.

Komarevsky, Coley, *J. Am. Chem. Soc.*, 1941, 63, 3269.

**Caproamidoacetaldehyde.**

See Amylpenilloaldehyde.

**n-Caproic Acid** (*n-Hexoic acid, n-pentane-1-carboxylic acid*)



$\text{C}_6\text{H}_{12}\text{O}_2$  MW, 116

F.p. -1.5° to -2°. B.p. 205°. Prac. insol.  $\text{H}_2\text{O}$ .  $D_4^{20}$  0.945,  $D_{20}^{20}$  0.9172.  $n_D^{20}$  1.41635. Heat of comb.  $C_p$  839.6 Cal. Ba salt mod. sol.  $\text{H}_2\text{O}$ .

*Ammonium salt*: m.p. 108°.

*Me ester*:  $\text{C}_7\text{H}_{14}\text{O}_2$ . MW, 130. B.p. 150°, 52°/15 mm.

*Et ester*:  $\text{C}_8\text{H}_{16}\text{O}_2$ . MW, 144. B.p. 166-7°.  $D_4^0$  0.8888. Na in  $\text{EtOH} \rightarrow$  *n*-hexyl alcohol.

*Propyl ester*:  $\text{C}_9\text{H}_{18}\text{O}_2$ . MW, 158. M.p. 68-7°. B.p. 185-6°.  $D_4^0$  0.8844.  $n_D^{25}$  1.4109.

*n-Butyl ester*:  $\text{C}_{10}\text{H}_{20}\text{O}_2$ . MW, 172. M.p. 64-3°. B.p. 204°.  $D_4^0$  0.8824.  $n_D^{25}$  1.4153.

*n-Amyl ester*: m.p. -47°. B.p. 116-6°/20 mm.  $D_4^0$  0.8801.  $n_D^{25}$  1.4202.

*Allyl ester*: b.p. 75-6°/15 mm.  $n_D^{20}$  1.4243.

*Glycerol ester*: tricaproin.  $\text{C}_{21}\text{H}_{38}\text{O}_6$ . MW, 386. F.p. -60°. Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ ,  $\text{CHCl}_3$ .  $D_4^{20}$  0.9867.  $n_D^{20}$  1.44265.

*p-Chlorophenyl ester*: b.p. 125-30°/2 mm. Germicide.

*p-Bromophenyl ester*: b.p. 139-40°/2 mm. Germicide.

*p-Chlorophenacyl ester*: cryst. from  $\text{EtOH}$ . M.p. 62°.

*p-Bromophenacyl ester*: plates from  $\text{EtOH}$ . M.p. 72°.

*p-Iodophenacyl ester*: plates from  $\text{EtOH}$ . Aq. M.p. 84°.

*p-Phenylphenacyl ester*: m.p. 69-70°.

*Anhydride*:  $\text{C}_{12}\text{H}_{22}\text{O}_3$ . MW, 214. B.p. 254-7°, 143°/14.5 mm.  $D_4^{20}$  0.92397. Stable to aq. carbonates.

*Chloride*:  $\text{C}_6\text{H}_{11}\text{OCl}$ . MW, 134.5. B.p. 151-3°.

*Bromide*:  $\text{C}_6\text{H}_{11}\text{OBr}$ . MW, 179. B.p. 175-6°.

*Amide*:  $\text{C}_6\text{H}_{13}\text{ON}$ . MW, 115. M.p. 100°. Mod. sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ , hot  $\text{H}_2\text{O}$ .

*Nitrile*:  $\text{C}_6\text{H}_{11}\text{N}$ . MW, 97. B.p. 160°. Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ . Insol.  $\text{H}_2\text{O}$ .  $D_{20}^{20}$  0.8093.  $n_D^{20}$  1.41154.

*Anilide*: m.p. 95°.

*p-Bromoanilide*: m.p. 105°.

*o-Toluidide*: m.p. 71°.

*p-Toluidide*: m.p. 75° (73°).

*Benzylamide*: m.p. 52-3°.

$\alpha$ -*Naphthylamide*: m.p. 112°.

$\beta$ -*Naphthylamide*: m.p. 107°.

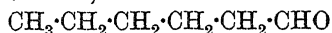
Hass, Marshall, *Ind. Eng. Chem.*, 1931, 23, 352.

Gartenmeister, *Ann.*, 1886, 233, 279.

Vliet, Marvel, Hsueh, *Organic Syntheses*, 1931, XI, 78.

Reid, Ruhoff, *Organic Syntheses*, 1936, XVI, 62.

**Caproic Aldehyde** (*Caproaldehyde, n-hexyl aldehyde, hexanal*)



$\text{C}_6\text{H}_{12}\text{O}$  MW, 100

B.p. 131°, 28°/12 mm.  $D^{20}$  0.8335. Oxidises rapidly in air. Polymerised by conc. min. acids.

*Oxime*: m.p. 51°.

*Semicarbazone*: m.p. 115° (106°).

*Phenylsemicarbazone*: m.p. 135-6°.

*o-Tolylsemicarbazone*: m.p. 111-13°.

*m-Tolylsemicarbazone*: m.p. 112-13°.

*p-Tolylsemicarbazone*: m.p. 139-40°.

*4- $\alpha$ -Naphthylsemicarbazone*: m.p. 112-13°.

*4- $\beta$ -Naphthylsemicarbazone*: m.p. 126-8°.

*2:4-Dinitrophenylhydrazone*: orange-yellow needles from  $\text{EtOH}$ . M.p. 104°.

*o-Nitrobenzoylhydrazone*: m.p. 119-20°.

*m-Nitrobenzoylhydrazone*: m.p. 115-16°.

*$\beta$ -Naphthoylhydrazone*: m.p. 96-7°.

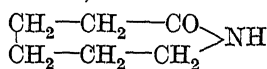
*p-Iodobenzoylhydrazone*: m.p. 148-9° from 50%  $\text{EtOH}$ .

*Dimedone deriv.*: m.p. 108°.

Bagard, *Bull. soc. chim.*, 1907, I, 307.

Dunbar, Arnold, *J. Org. Chem.*, 1945, 10, 501.

**Caprolactam** (*5-Aminocaproic lactam, cyclohexanone iso-oxime*)



$\text{C}_6\text{H}_{11}\text{ON}$  MW, 113

Leaflets from ligroin. M.p. 68-70°. B.p. 139°/12 mm. Readily forms nylon-like polymers and co-polymers.

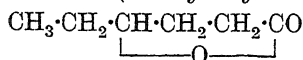
$\text{B}_2\text{H}_6\text{AuCl}_4$ : m.p. 75-6°.

Ruzicka, *Helv. Chim. Acta*, 1921, 4, 477.

Marvel, Eck, *Organic Syntheses*, 1937, XVII, 60.

Hoshino, Noissiki, Aikawa, *J. Chem. Soc. Japan*, 1942, 63, 1170.

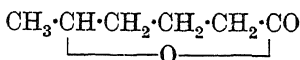


**3-Caprolactone (3-Ethylbutyrolactone)**

$\text{C}_6\text{H}_{10}\text{O}_2$  MW, 114

B.p. 215–6°. Sol.  $\text{H}_2\text{O}$ . Hyd. by alkalis. Hot dil.  $\text{HNO}_3 \rightarrow$  succinic acid.

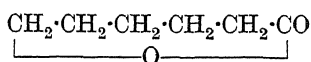
Windaus, Klänhardt, *Ber.*, 1921, 54, 586.

**4-Caprolactone**

$\text{C}_6\text{H}_{10}\text{O}_2$  MW, 114

Needles. M.p. 17–19°. B.p. 230–1°, 107°/14 mm. Misc. with  $\text{H}_2\text{O}$ . Sol. EtOH,  $\text{Et}_2\text{O}$ .  $D_4^{20}$  1.0443.  $n_D^{20}$  1.4451. Polymerises on standing. Slow dist. of polymer  $\rightarrow$  monomer.

Linstead, Rydon, *J. Chem. Soc.*, 1934, 2000.

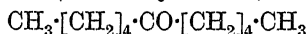
**5-Caprolactone**

$\text{C}_6\text{H}_{10}\text{O}_2$  MW, 114

B.p. 98–9°/2 mm.  $D_4^{20}$  1.0693.  $n_D^{25}$  1.4611. On heating  $\rightarrow$  dimer, m.p. 112°.

Natta, Hill, Carothers, *J. Am. Chem. Soc.*, 1934, 56, 455; 1936, 58, 183.

Stoll, Rouvé, *Helv. Chim. Acta*, 1935, 18, 1114.

**n-Caprone (Di-n-amyl ketone, undecanone-6)**

$\text{C}_{11}\text{H}_{22}\text{O}$  MW, 170

Leaflets. M.p. 14–5°. B.p. 226°.  $D^{20}$  0.8262. Does not form bisulphite comp.

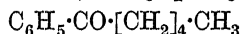
Sabatier, Mailhe, *Compt. rend.*, 1914, 158, 832.

**tert.-Caprone (Di-tert.-amyl ketone)**

$\text{C}_{11}\text{H}_{22}\text{O}$  MW, 170

B.p. 196–8°.

Haller, Bauer, *Ann. chim.*, 1913, 29, 339.

**Caprophenone (n-Amyl phenyl ketone)**

$\text{C}_{12}\text{H}_{16}\text{O}$  MW, 176

Leaflets. M.p. 24.7°. B.p. 265.2°, 122.4°/15 mm.  $D_D^{20}$  0.9576.

Semicarbazone: m.p. 132° (124°).

Tiffeneau, Levy, *Compt. rend.*, 1926, 183, 969.

Shriner, Turner, *J. Am. Chem. Soc.*, 1930, 52, 1267.

Ju, Shen, Wood, *J. Inst. Petroleum*, 1940, 26, 475.

**Caproylacetic Acid (2-Keto-octoic acid, 2-ketocaprylic acid)**

$\text{C}_8\text{H}_{14}\text{O}_3$  MW, 158

Leaflets. M.p. 74° decomp.  $\rightarrow$  methyl n-amyl ketone. Insol.  $\text{H}_2\text{O}$ .

*Me ester*:  $\text{C}_9\text{H}_{16}\text{O}_3$ . MW, 172. B.p. 118°/19 mm., 75°/1.9 mm.  $D_4^{20}$  0.9916. Cu deriv.: m.p. 113–14°.

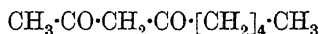
*Et ester*:  $\text{C}_{10}\text{H}_{18}\text{O}_3$ . MW, 186. B.p. 127°/19 mm.  $D_4^{20}$  0.9721.  $n_D^{20}$  1.4336. Cu deriv.: m.p. 107°.

*Amide*:  $\text{C}_8\text{H}_{15}\text{O}_2\text{N}$ . MW, 157. M.p. 100°. Sol. EtOH, hot  $\text{H}_2\text{O}$ , caustic alkalis.

*Nitrile*:  $\text{C}_8\text{H}_{13}\text{ON}$ . MW, 139. B.p. 127–8°/14 mm. Sol. alkalis.  $D^{15}$  0.9414.

Moureu, Delange, *Compt. rend.*, 1903, 136, 754.

Franke, Kroupa, Schmid, *Monatsh.*, 1935, 66, 412.

**Caproylaceton (Acetylcaproylmethane, 2:4-diketnonane, nonandione-2:4)**

$\text{C}_9\text{H}_{16}\text{O}_2$  MW, 156

M.p. –18°. B.p. 105–7°/22 mm.  $D^0$  0.938.

*Cu deriv.*: blue cryst. M.p. 136° (138°). Sol. ord. org. solvents.

Bongert, *Compt. rend.*, 1901, 133, 821.

Bouveault, Bongert, *Bull. soc. Chim.*, 1902, 27, 1086.

Levine, Corroy, Adams, Hauser, *J. Am. Chem. Soc.*, 1945, 67, 1510.

**3-Caproylbutyric Acid.**

See 4-Ketocapric Acid.

**Caproylcarbinol.**

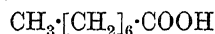
See 1-Heptanolone-2.

**2-Caproylpropionic Acid.**

See 3-Ketopelargonic Acid.

**Capryl Alcohol.**

See sec.-n-Octyl Alcohol.

**n-Caprylic Acid (n-Octoic acid, heptane-1-carboxylic acid)**

$\text{C}_8\text{H}_{16}\text{O}_2$  MW, 144

M.p. 16°. B.p. 237°, 124°/10 mm. Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Spar. sol. hot  $\text{H}_2\text{O}$ .  $D_4^{20}$  0.910.  $n_D^{20}$  1.4285. Heat of comb. 1139.9 Cal.

*Cu salt*: m.p. 264–6°. Spar. sol.  $\text{H}_2\text{O}$ .

*Zn salt*: m.p. 135–6°. Spar. sol.  $\text{H}_2\text{O}$ .

*Pb salt*: m.p. 83–4°. Prac. insol.  $\text{H}_2\text{O}$ .

*Me ester*:  $\text{C}_9\text{H}_{18}\text{O}_2$ . MW, 158. B.p. 193–4°, 83°/15 mm.  $D_4^{20}$  0.8942.

*Et ester*:  $\text{C}_{10}\text{H}_{20}\text{O}_2$ . MW, 172. B.p. 207–8°/753 mm.  $D_4^{20}$  0.87025.  $n_D^{15}$  1.41989.

*Propyl ester*:  $\text{C}_{11}\text{H}_{22}\text{O}_2$ . MW, 186. M.p. –45°. B.p. 225°.  $D_4^{20}$  0.8805.  $n_D^{25}$  1.4158.

*n-Butyl ester*:  $\text{C}_{12}\text{H}_{24}\text{O}_2$ . MW, 200. M.p. –43°. B.p. 240.5°.  $D_4^{20}$  0.8797.  $n_D^{25}$  1.4232.

*n-Amyl ester*: m.p. –34.5°.  $n_D^{25}$  1.4262.

*Glycerol ester*: tricaprylin.  $\text{C}_{27}\text{H}_{50}\text{O}_6$ . MW, 470. M.p. 8°. Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ ,  $\text{CHCl}_3$ , ligroin.  $D_4^{20}$  0.954.  $n_D^{20}$  1.44817.

p-Chlorophenyl ester: b.p. 154-6°/2 mm.  
Germicide.

p-Tolyl ester: b.p. 163-5°/10 mm.  $D_4^{25}$  0.957.  
 $n_D^{25}$  1.483.

p-Chlorophenacyl ester: m.p. 63°.

p-Bromophenacyl ester: m.p. 67.4°.

p-Iodophenacyl ester: m.p. 79.2°.

p-Phenylphenacyl ester: m.p. 139-40°. B.p.  
280°/15 mm.

Anhydride:  $C_{16}H_{30}O_3$ . MW, 270. M.p. -1°.  
B.p. 280-5°, 186°/15 mm.

Chloride:  $C_8H_{15}OCl$ . MW, 162.5. B.p.  
195-6°, 83°/15 mm.

Amide:  $C_8H_{11}ON$ . MW, 143. M.p. 110°  
(104°). Sol. EtOH, Et<sub>2</sub>O.

Nitrile:  $C_8H_{15}N$ . MW, 125. B.p. 198-200°  
(194-5°).  $D_4^{25}$  0.81725.  $n_D^{15}$  1.4224.

Anilide m.p. 57° (51.5°).

o-Toluidide: m.p. 69°.

p-Toluidide: m.p. 70°.

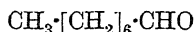
$\alpha$ -Naphthylamide: m.p. 95°.

$\beta$ -Naphthylamide: m.p. 103°.

Fehling, *Ann.*, 1845, 53, 400.

van Renesse, *Ann.*, 1874, 171, 380.

**Caprylic Aldehyde** (*Caprylaldehyde*, n-oct-  
*aldehyde*, *octanal*)



$C_8H_{16}O$  MW, 128

B.p. 81°/32 mm., 72°/20 mm., 60°/9 mm.  $D^{15}$   
0.827.  $n_D^{25}$  1.41667.

Oxime: m.p. 60°. B.p. 112°/9 mm.

Semicarbazone: cryst. from EtOH. M.p.  
101°.

4-Phenylsemicarbazone: m.p. 128-9°.

4-o-Tolylsemicarbazone: m.p. 125-6°.

4-m-Tolylsemicarbazone: m.p. 115-17°.

4-p-Tolylsemicarbazone: m.p. 138-9°.

4- $\alpha$ -Naphthylsemicarbazone: m.p. 103-5°.

4- $\beta$ -Naphthylsemicarbazone: m.p. 135-6°.

Thiosemicarbazone: m.p. 94-5°.

p-Nitrophenylhydrazone: yellow cryst. M.p.  
80°.

2·4-Dinitrophenylhydrazone: yellow cryst.  
from EtOH. M.p. 106°.

o-Nitrobenzoylhydrazone: m.p. 99°.

m-Nitrobenzoylhydrazone: m.p. 111-12°.

p-Iodobenzoylhydrazone: m.p. 155°.

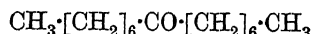
Dimedone deriv.: m.p. 89-8°.

Stephen, *J. Chem. Soc.*, 1925, 127, 1874.

**Caprylactone.**

See under Hydroxycaprylic Acid.

**Caprylone** (*Di-n-heptyl ketone*, *pentadecan-*  
*one-8*)



$C_{15}H_{30}O$  MW, 226

Cryst. from EtOH. M.p. 40°. B.p. 178°.

Oxime: m.p. 19.5-20°.

Semicarbazone: m.p. 40-2°.

Maihle, *Compt. rend.*, 1913, 157, 219.

Bries, McElvain, *J. Am. Chem. Soc.*, 1933,  
55, 1697.

Deffet, *Bull. soc. chim. Belg.*, 1931, 40,  
385.

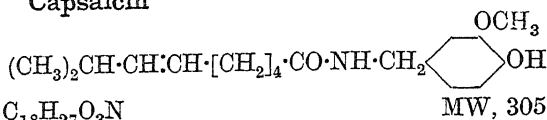
**Caprylylacetic Acid.**

See 2-Ketocaprylic Acid.

**2-Caprylylpropionic Acid.**

See 3-Ketoundecylic Acid.

**Capsaicin**



Pungent principle of fruit of various species  
of *Capsicum*. Pearly leaflets. M.p. 64-5°.  
B.p. 210-20°/0.01 mm. Spar. sol. conc. HCl.

Me ether:  $C_{19}H_{29}O_3N$ . MW, 319. M.p. 74°.

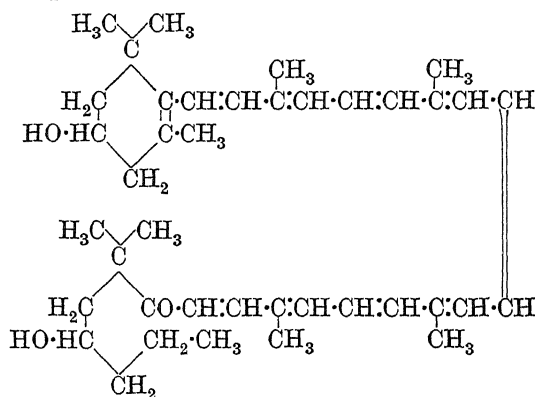
Lapworth, Royle, *J. Chem. Soc.*, 1919,  
115, 1109.

Nelson, Dawson, *J. Am. Chem. Soc.*,  
1923, 45, 2179.

Brodner, Sherrill, U.S.P. 1,503,631,  
(*Chem. Abstracts*, 1925, 19, 658).

Späth, Darling, *Ber.*, 1930, 63, 737.

**Capsanthin**



Suggested constitution

$C_{40}H_{58}O_3$  MW, 586

Occurs as ester along with carotene in fruit of  
*Capsicum annuum*, Linn. (paprika). Red needles  
from petrol ether. M.p. 175-6° corr. Sol. Me<sub>2</sub>CO,  
CHCl<sub>3</sub>. Mod. sol. EtOH. Spar. sol. Et<sub>2</sub>O, CS<sub>2</sub>,  
C<sub>6</sub>H<sub>6</sub>. Hypophasic. Conc. min. acids →  
blue col. Absorption maxima: CS<sub>2</sub>, 543,  
503.5 m $\mu$ ; C<sub>6</sub>H<sub>6</sub>, 519, 486 m $\mu$ ; petrol ether,  
505, 475 m $\mu$ .  $[\alpha]_{D}^{20} + 36^\circ$  in CHCl<sub>3</sub>.

Monoepoxide: m.p. 189°.

Diacetyl: cryst. from MeOH. M.p. 146.5° corr.

Dipropionyl: cryst. from EtOH. M.p. 140°.

Dibenzoyl: red needles. M.p. 121-2°.

Dicaproyl: violet-red cryst. M.p. 109° corr.  
 $[\alpha]_{D}^{20} - 61^\circ$  in hexane.

*Dipalmityl*: cryst. from MeOH-C<sub>6</sub>H<sub>6</sub>. M.p. 92° corr.

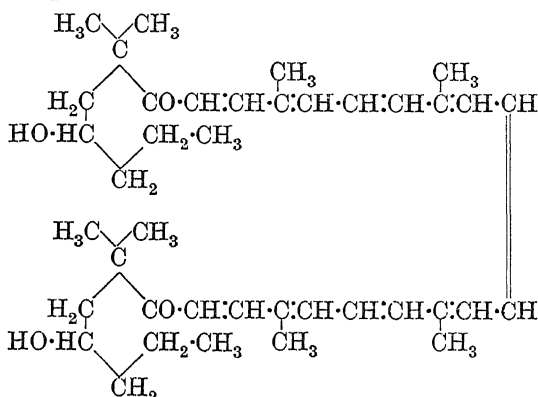
*Distearyl*: cryst. from C<sub>6</sub>H<sub>6</sub>-MeOH. M.p. 84°.

Zechmeister, Cholnoky, *Ann.*, 1936, 523, 101; 1935, 516, 30; 1934, 509, 269.

Karrer, Hübner, *Helv. Chim. Acta*, 1936, 19, 474.

Karrer, Jucker, *Helv. Chim. Acta*, 1945, 28, 1143.

## Capsorubin



Probable structure

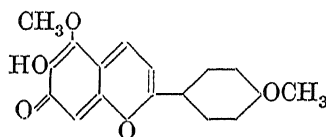
C<sub>40</sub>H<sub>60</sub>O<sub>4</sub> MW, 604

Pigment present in paprika. Violet-red plates from pet. ether. M.p. 201° corr. Sol. EtOH, Me<sub>2</sub>CO. Less sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>. Absorption bands in CS<sub>2</sub>, 541.5, 503 and 468 mμ.

*Diacyl*: plates from MeOH. M.p. 179° corr. (not sharp). Sol. MeOH, C<sub>6</sub>H<sub>6</sub>, pet. ether.

Zechmeister, Cholnoky, *Ann.*, 1934, 509, 269; 1935, 516, 30.

## Carajurin



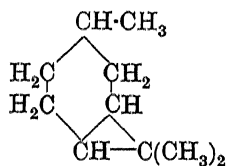
Probable structure

C<sub>17</sub>H<sub>14</sub>O<sub>5</sub> MW, 298

Pigment from *Bignonia chica*, Humb. and Bonpl. Garnet needles from C<sub>6</sub>H<sub>6</sub>-Py. M.p. 205-7°. Sol. Py. Spar. sol. EtOH, hot C<sub>6</sub>H<sub>6</sub>.

Chapman, Perkin, Robinson, *J. Chem. Soc.*, 1927, 3015.

## Carane



C<sub>10</sub>H<sub>18</sub>

MW, 138

*d.*

B.p. 169°. D<sub>20</sub> 0.841. n<sub>D</sub> 1.456. [α]<sub>D</sub> + 57°.

*l.*  
B.p. 169°, 49-50°/9 mm. D<sub>20</sub> 0.8411. n<sub>D</sub> 1.4569. [α]<sub>D</sub> - 47.06°.

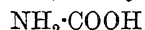
Semmler, Feldstein, *Ber.*, 1914, 47, 384.

Guha, Sankaran, *Ber.*, 1938, 71, 2673:

*Current Science*, 1938, 6, 606.

## Carbacetoacetic Acid.

See Isodehydracetic Acid.

Carbamic Acid (*Aminoformic acid*)

CH<sub>3</sub>O<sub>2</sub>N

MW, 61

Acid not known in the free state.

*NH<sub>4</sub> salt*: CH<sub>6</sub>O<sub>2</sub>N<sub>2</sub>. MW, 78. White mass. Decomp. at 60° → 2NH<sub>3</sub> + CO<sub>2</sub>. H<sub>2</sub>O → ammonium carbonate. Heat at 140° in sealed tube → urea + H<sub>2</sub>O.

*Me ester*: urethylan. C<sub>2</sub>H<sub>5</sub>O<sub>2</sub>N. MW, 75. M.p. 54°. B.p. 177°, 82°/14 mm. Very sol. H<sub>2</sub>O, EtOH. *N-Acetyl*: m.p. 93°.

*Et ester*: see Urethane.

*Trichloroethyl ester*: Voluntal. C<sub>3</sub>H<sub>4</sub>O<sub>2</sub>NCl<sub>3</sub>. MW, 192.5. Needles from ligroin. M.p. 64-5°. Soporific.

*Propyl ester*: C<sub>4</sub>H<sub>9</sub>O<sub>2</sub>N. MW, 103. M.p. 53° (60°). B.p. 195°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.

*Butyl ester*: C<sub>5</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 117. M.p. 51.6°. B.p. 203-4° part. decomp.

*Isobutyl ester*: m.p. 67°. B.p. 206°. Insol. H<sub>2</sub>O.

*Isoamyl ester*: C<sub>6</sub>H<sub>13</sub>O<sub>2</sub>N. MW, 131. M.p. 59°.

*tert.-Amyl ester*: m.p. 85-7°.

*Allyl ester*: C<sub>4</sub>H<sub>7</sub>O<sub>2</sub>N. MW, 101. M.p. 21°. B.p. 204°. *N-Acetyl*: m.p. 64°.

*Benzyl ester*: C<sub>8</sub>H<sub>9</sub>O<sub>2</sub>N. MW, 151. Leaflets. M.p. 86°. Decomp. at 220°. Sol. EtOH.

*Methyl-n-propylcarbinol ester*: Hedonal. C<sub>6</sub>H<sub>13</sub>O<sub>2</sub>N. MW, 131. M.p. 76°. B.p. 215°.

*Phenyl ester*: C<sub>7</sub>H<sub>7</sub>O<sub>2</sub>N. MW, 137. M.p. 141°. Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O.

*Chloride*: carbamyl chloride, chloroformamide, urea chloride. CH<sub>2</sub>ONCl. MW, 79.5. B.p. 61-2° decomp. Decomp. to cyanuric acid and HCl on standing. H<sub>2</sub>O → NH<sub>4</sub>Cl + CO<sub>2</sub>.

*Amide*: carbamide. See Urea.

*Azide*: needles from ligroin. M.p. 94°.

Matignon, Fréjacques, *Bull. soc. chim.*, 1922, 31, 307, 394.

Thiele, Dent, *Ann.*, 1898, 302, 249.

Gattermann, *Ann.*, 1888, 244, 30.

## Carbamide.

See Urea.

## Carbamideine.

See Guanidine.

## Carbamylacetic Acid.

See Malonic Acid.

**Carbamylalanine.**

See 1-Ureidopropionic Acid.

**Carbamylcarbamic Acid.**

See Allophanic Acid.

**Carbamyl chloride.**

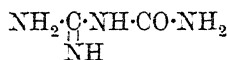
See under Carbamic Acid.

**Carbamylcholine chloride.**

See Doryl.

**Carbamylethanolamine.**See *N*-2-Hydroxyethylurea.**Carbamylglycine.**

See Hydantoic Acid.

**Carbamylguanidine** (*Guanylurea, dicyandi-*  
*amidine*)C<sub>2</sub>H<sub>6</sub>ON<sub>4</sub> MW, 102

Prisms. M.p. 105°. Decomp. at 160°. Sol. H<sub>2</sub>O, hot EtOH, Py. Insol. Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>. Forms stable salts with min. acids, and with acetic, oxalic etc., acids. Forms complex salts with metals.

*Benzoyl*: m.p. 187–8°.*Picrate*: yellow plates from H<sub>2</sub>O. M.p. 265°.*Picrotonate*: m.p. 253°.*Styphnate*: m.p. 224°.Söll, Stutzer, *Ber.*, 1909, 42, 4534.Grossmann, Mannheim, *Chem. Abstracts*, 1918, 12, 1372.**Carbamylhydroxylamine.**

See Hydroxyurea.

***N*-Carbamylmaleamic Acid.**

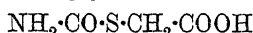
See Maleuric Acid.

***N*-Carbamylmalonamic Acid.**

See Malonuric Acid.

***m*-Carbamylphenylsemicarbazide.**

See Kryogenin.

**Carbamylthioglycollic Acid**C<sub>3</sub>H<sub>5</sub>O<sub>3</sub>NS MW, 135

M.p. 143° (136°) decomp. to thioglycollic + cyanic acids. Sol. EtOH, hot H<sub>2</sub>O. Spar. sol. Et<sub>2</sub>O. Decomp. by alkalis or boiling H<sub>2</sub>O to thioglycollic acid.  $k = 2.66 \times 10^{-4}$  at 25°.

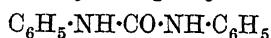
*Me ester*: C<sub>4</sub>H<sub>7</sub>O<sub>3</sub>NS. MW, 149. M.p. 75–80°.

Wheeler, Barnes, *Am. Chem. J.*, 1900, 24, 72.**Carbanil.**

See Phenyl isocyanate.

**Carbanilic Acid.**

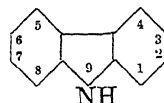
See Phenylcarbamic Acid.

**Carbanilide** (sym.-*Diphenylurea*)C<sub>13</sub>H<sub>12</sub>ON<sub>2</sub> MW, 212

Prisms. M.p. 238–9°. B.p. 260°. Sol. Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O. Heat of comb. C<sub>p</sub> 1612.8 Cal.

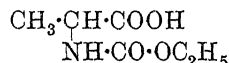
*Mono-N-acetyl*: m.p. 106°.Hentschel, *J. prakt. Chem.*, 1883, 27, 499.Nacurewicz, *Chem. Zentr.*, 1925, II, 540.Davis, Blanchard, *Organic Syntheses*, Collective Vol. I, 442.Sonn, *Ber.*, 1914, 47, 2440.**Carbazinic Acid.**

See Hydrazinoformic Acid.

**Carbazole** (*Dibenzpyrrole, diphenyleneimine*)C<sub>12</sub>H<sub>9</sub>N

MW, 167

Plates. M.p. 246°. B.p. 354.7° (351.5°), 250°/476 mm., 220°/215 mm., 200°/147 mm. Spar. sol. cold C<sub>6</sub>H<sub>6</sub>, toluene, AcOH, CHCl<sub>3</sub>, CS<sub>2</sub>, CCl<sub>4</sub>, EtOH. Sol. to 5% in C<sub>6</sub>H<sub>6</sub> at 50°, to 3% in toluene at 80°, to 3% in Et<sub>2</sub>O at 30°, to 4% in EtOH at 35°, to 6% in cold Me<sub>2</sub>CO, to 10% at 30°, and to 62% at 50°. Heat of comb. C<sub>p</sub> 1474.8 Cal. Sublimes easily. Exhibits practically no basic properties. Sol. cold conc. H<sub>2</sub>SO<sub>4</sub>, re-ppd unchanged by H<sub>2</sub>O. KMnO<sub>4</sub> in hot Me<sub>2</sub>CO → dicarbazyl. Forms *N*-potassium deriv. HNO<sub>2</sub> → nitroso deriv., m.p. 84°.

*N-Me*: m.p. 87°. *Picrate*: m.p. 141°.*N-Et*: m.p. 68°. *Picrate*: m.p. 97°.*N-Vinyl*: cryst. from EtOH. M.p. 63.5–66°.*Picrate*: m.p. 185°.*N-Allyl*: m.p. 56°. *Picrate*: m.p. 86°.*N-Phenyl*: see *N*-Phenylcarbazole.*N-Acetyl*: m.p. 69°.*N-Benzoyl*: m.p. 98.5° (95.5°).*p-Toluenesulphonyl*: m.p. 137–8°.*Picrate*: red prisms. M.p. 185.5°.*Styphnate*: m.p. 179°.Aristov, *Chem. Abstracts*, 1929, 23, 138.Altpeter, *ibid.*, 5183.Zelinsky, Titz, Gaverdowskaja, *Ber.*, 1926, 59, 2590.Hoshino, Takima, *Bull. Chem. Soc. Japan*, 1936, 11, 218.Storrie, Tucker, *J. Chem. Soc.*, 1931, 2260.**Carbethoxy-*dl*-alanine**C<sub>6</sub>H<sub>11</sub>O<sub>4</sub>N MW, 161

M.p. 84°. Sol. EtOH, Et<sub>2</sub>O. Insol. pet. ether. *Et ester*: C<sub>8</sub>H<sub>13</sub>O<sub>4</sub>N. MW, 189. Needles. M.p. 25°. B.p. 123°/10 mm. Sol. Et<sub>2</sub>O. Spar. sol. pet. ether.

*Phenyl ester*: C<sub>12</sub>H<sub>15</sub>O<sub>4</sub>N. MW, 237. Cryst. from MeOH.Aq. M.p. 70°.

*Amide*: C<sub>6</sub>H<sub>12</sub>O<sub>3</sub>N<sub>2</sub>. MW, 160. Needles. M.p. 121°. Sol. H<sub>2</sub>O, EtOH. Spar. sol. Et<sub>2</sub>O, pet. ether, AcOEt.

*Anilide*: cryst. from MeOH.Aq. M.p. 151°. Fischer, *Ann.*, 1905, **340**, 137.  
Freudenberg, Meister, *Ann.*, 1935, **518**, 86.

**Carbomethoxyglycine**

$\text{C}_5\text{H}_9\text{O}_4\text{N}$  MW, 147  
M.p. 75° (69°). Sol. EtOH, Et<sub>2</sub>O. Insol. C<sub>6</sub>H<sub>6</sub>, ligroin. Dissolves copper oxide when warm.

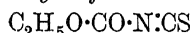
*Et ester*: C<sub>7</sub>H<sub>13</sub>O<sub>4</sub>N. MW, 175. M.p. 27–8°. B.p. 146°/22 mm. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Insol. pet. ether.

*Amide*: C<sub>5</sub>H<sub>10</sub>O<sub>3</sub>N<sub>2</sub>. MW, 146. M.p. 101–3°. Sol. H<sub>2</sub>O, EtOH, Me<sub>2</sub>CO, CHCl<sub>3</sub>. Spar. sol. Et<sub>2</sub>O.

*Nitrile*: C<sub>5</sub>H<sub>8</sub>O<sub>2</sub>N<sub>2</sub>. MW, 128. M.p. 48–50°. B.p. 175°/35 mm.

Fischer, Otto, *Ber.*, 1903, **36**, 2108.

**Carbomethoxyl isothiocyanate** (*Carbomethoxythiocarbimide, thiocyanofornic ethyl ester*)



$\text{C}_4\text{H}_5\text{O}_2\text{NS}$  MW, 131

B.p. 83°/30 mm., 43°/14 mm. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, toluene, pet. ether, D<sub>4</sub><sup>15</sup> 1.112. n<sub>D</sub><sup>15</sup> 1.47985. Slowly decomp. by H<sub>2</sub>O. Combines direct with NH<sub>3</sub>, amines, and alcohols.

Dixon, Taylor, *J. Chem. Soc.*, 1908, **93**, 697.

**Carbomethoxyphenylenediamine.**

See Aminophenylurethane.

**Carbomethoxyurethane** (*Iminodicarboxylic acid diethyl ester*)



$\text{C}_6\text{H}_{11}\text{O}_4\text{N}$  MW, 161

Prisms. M.p. 50°. B.p. 226°, 145°/20 mm. Sol. H<sub>2</sub>O. NH<sub>3</sub>.Aq at 100° → biuret + EtOH.

Wurtz, Henninger, *Bull. soc. chim.*, 1885, **44**, 30.

**Carbinol.**

See Methyl Alcohol.

**Carboceric Acid.**

See Heptacosanic Acid.

**Carbocholine.**

See Doryl.

**Carbolinichomeronic Acid.**

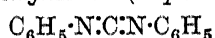
See Pyridine-2 : 3 : 4-tricarboxylic Acid and Pyridine-3 : 4 : 5-tricarboxylic Acid.

**Carbodiimide.**

See Cyanamide.

**Carbodinicotinic Acid.**

See Pyridine-2 : 3 : 5-tricarboxylic Acid.

**Carbodiphenylimide** (*Diphenylcarbodiimide*)

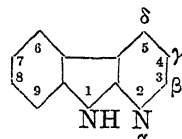
$\text{C}_{13}\text{H}_{10}\text{N}_2$  MW, 194

B.p. 331°, 218°/31 mm. Sol. C<sub>6</sub>H<sub>6</sub>. Alc. HCl → carbanilide. Aniline → triphenylguanidine.

*B, HCl*: m.p. 92–5° decomp.

*Trimerides*: m.ps. 168–70° and 196°.

Staudinger, Hauser, *Helv. Chim. Acta*, 1921, **4**, 861.

**α-Carboline** (*2-Carboline*)

$\text{C}_{11}\text{H}_8\text{N}_2$  MW, 168

Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 210°. Sol. EtOH, MeOH, Me<sub>2</sub>CO, AcOEt. Spar. sol. Et<sub>2</sub>O, hot H<sub>2</sub>O. C<sub>6</sub>H<sub>6</sub> sol. shows violet fluor. Salts show no fluor. in sol.

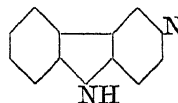
*Picrate*: m.p. 260–4°.

Lawson, Perkin, Robinson, *J. Chem. Soc.*, 1924, **125**, 626.

For nomenclature of the carbolines see Gulland, Robinson, Scott, Thornley, *J. Chem. Soc.*, 1929, 2926.

**β-Carboline.**

See Norharman.

**γ-Carboline** (*4-Carboline*)

$\text{C}_{11}\text{H}_8\text{N}_2$  MW, 168

Needles from MeOH. M.p. 225°. Sol. EtOH, MeOH. Spar. sol. C<sub>6</sub>H<sub>6</sub>, H<sub>2</sub>O.

*B, (COOH)<sub>2</sub>*: m.p. 226° decomp.

*Picrate*: m.p. 250°.

Robinson, Thornley, *J. Chem. Soc.*, 1924, **125**, 2169.

**Carbomethoxyglycine**

$\text{C}_4\text{H}_7\text{O}_4\text{N}$  MW, 133

M.p. 95–6°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Spar. sol. pet. ether.

*Et ester*: C<sub>6</sub>H<sub>11</sub>O<sub>4</sub>N. MW, 161. B.p. 127–9°/13 mm. Sol. most ord. org. solvents. Spar. sol. H<sub>2</sub>O, pet. ether.

Luechs, *Ber.*, 1906, **39**, 859.

**Carbomethoxyurethane** (*Iminodicarboxylic methyl ethyl ester*)



$\text{C}_5\text{H}_9\text{O}_4\text{N}$  MW, 147

M.p. 73°. Sinters at 68°. B.p. 122°/11 mm. Sol. H<sub>2</sub>O, EtOH, CHCl<sub>3</sub>, Me<sub>2</sub>CO, AcOH, hot Et<sub>2</sub>O, hot xylene. Spar. sol. cold Et<sub>2</sub>O.

Diels, Nawiasky, *Ber.*, 1904, **37**, 3673.

**Carbon dioxide** (*Carbonic anhydride*)CO<sub>2</sub> MW, 44

Colourless gas. B.p. — 78.2°. Liquefies at 20° under 50 atm. pressure. M.p. — 57° under 5 atm. D (air = 1) 1.52909. 1 vol. H<sub>2</sub>O dissolves 1 vol. gas at 14°, 2 vols. at 2 atm., 3 vols. at 3 atm. Aq. sol. acid to litmus. Heat of formation (C + O<sub>2</sub> = CO<sub>2</sub>) 96.96 Cal. Crit. temp. 30.9°. Crit. press. 77 atm. (72.9 atm.). Stable up to 2000° C.

Mellor, *Comprehensive Treatise on Inorganic Chemistry*, VI, 59, (Bibl.).

**Carbon disulphide** (*Carbon bisulphide*)CS<sub>2</sub> MW, 76

Colourless, highly refracting liq. F.p. — 111°. B.p. 46.3°, 40°/617 mm., 30°/431 mm., 20°/297 mm., 10°/198 mm., 0°/128 mm. 100 parts H<sub>2</sub>O dissolve 0.174 part by volume at 22°. 100 parts CS<sub>2</sub> dissolve 0.196 part by volume of H<sub>2</sub>O at 22°. Misc. in all proportions with EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. D<sub>4</sub><sup>20</sup> 1.2927. n<sub>D</sub><sup>20</sup> 1.6315. Sp. heat, 0.24 cal. at 30°. Latent heat of vap. 8381 cal. at 46°. Very inflammable and poisonous. Possesses disinfectant and insecticidal properties. Solvent for sulphur, phosphorus, iodine, bromine, and many organic comps. Forms hydrate, 2CS<sub>2</sub>·1 H<sub>2</sub>O, decomposing at —3°. Gives xanthogenates with alc. caustic alkalis · CS<sub>2</sub> + C<sub>2</sub>H<sub>5</sub>OK → C<sub>2</sub>H<sub>5</sub>O·CS·SK. Amines, more particularly strong secondary amines, yield dithiocarbamates: (C<sub>2</sub>H<sub>5</sub>)<sub>2</sub>NH + CS<sub>2</sub> + NaOH → (C<sub>2</sub>H<sub>5</sub>)<sub>2</sub>N·CS·SNa. With metallic sulphides, thiocarbonates are formed: CS<sub>2</sub> + CaS → CaCS<sub>3</sub>. With disulphides, perthiocarbonates are produced: CS<sub>2</sub> + Na<sub>2</sub>S<sub>2</sub> → Na<sub>2</sub>CS<sub>4</sub>.

Mellor, *Comprehensive Treatise on Inorganic Chemistry*, VI, 103, 116, (Bibl.).

**Carbon monoxide**

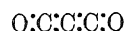
CO MW, 28

Colourless, odourless and tasteless gas. B.p. — 190°. M.p. — 213°. D (air = 1) 0.96716. 100 gms H<sub>2</sub>O dissolve 0.0044 gm of the gas at 0°, 0.0028 gm at 20°, 0.0010 gm at 80°, all at 760 mm. Sp. heat C<sub>p</sub> 0.2425, C<sub>v</sub> 0.2370–0.2399. Heat of comb. 69.9 Cal. (68.8). Crit. temp. — 141.1° (— 138.7°). Crit. press. 35.9 atm. Crit. density 0.311. Readily absorbed by conc. sols. of Cu<sub>2</sub>Cl<sub>2</sub> in NH<sub>3</sub>. Aq. or HCl. Strong reducing agent. Poisonous. Burns with blue flame. Cl → carbonyl chloride. S → carbonyl sulphide. Forms metal carbonyls, e.g. Ni(CO)<sub>4</sub>, Fe(CO)<sub>5</sub>.

Mellor, *Comprehensive Treatise on Inorganic Chemistry*, V, 921, 925, 945, (Bibl.).

**Carbon oxysulphide.**

See Carbonyl sulphide.

**Carbon suboxide** (*Malonic anhydride*)C<sub>3</sub>O<sub>2</sub> MW, 68

M.p. — 111.3° (— 107°). B.p. 7°. D<sub>4</sub><sup>0</sup> 1.114. Polymerises above 15° to red solid. Burns with blue, smoky flame. H<sub>2</sub>O → malonic acid. HCl → malonyl chloride. NH<sub>3</sub> → malonamide.

Mellor, *Comprehensive Treatise on Inorganic Chemistry*, V, 907, (Bibl.).

**Carbon tetrabromide** (*Tetrabromomethane*)CBr<sub>4</sub> MW, 332

*α*-Form: m.p. 90–1°. B.p. 189–90° slight decomp., 102°/50 mm. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Insol. H<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 2.9609. n<sub>D</sub><sup>20</sup> 1.59419.

*β*-Form: m.p. 94.3°.

Wallach, *Ann.*, 1893, 275, 149.

Schaum, *Ann.*, 1928, 462, 207.

Kendall, *J. Am. Chem. Soc.*, 1923, 45, 973.

Nuñez, Oliva, *Chem. Abstracts*, 1936, 30, 5556.

**Carbon tetrachloride** (*Tetrachloromethane*)CCl<sub>4</sub> MW, 154

B.p. 76.74°. Sol. EtOH, Et<sub>2</sub>O. Prac. insol. H<sub>2</sub>O. Freezes to trimorphous solid having m.ps. — 28.6°, — 23.8°, and — 21.2°. D<sub>4</sub><sup>0</sup> 1.63195. n<sub>D</sub><sup>15</sup> 1.46305. Sp. heat 0.207 at 20°. Heat of comb. C<sub>p</sub> 37.3 Cal. Crit. temp. 285°. Mol. b.p. elevation, 48.8°. Non-inflammable. Stable up to red heat. Excellent solvent for org. comps.

**Carbon tetrafluoride** (*Tetrafluoromethane*)CF<sub>4</sub> MW, 88

Gas, liquefying at — 15° and 1 atm. press.; at 20° and 4 atm. M.p. — 150°. D<sup>0</sup> 3.034. Spar. sol. H<sub>2</sub>O. CO → COF<sub>2</sub>.

Lebeau, Damiens, *Compt. rend.*, 1926, 182, 1340.

Simons, Bond, McArthur, *J. Am. Chem. Soc.*, 1940, 62, 3477.

**Carbon tetraiodide** (*Tetraiodomethane*)CI<sub>4</sub> MW, 520

Dark red cryst. Decomp. on heating. Sublimes undecomp. in a vacuum at 90–100°. D<sup>20</sup> 4.32.

Moissan, *Compt. rend.*, 1891, 113, 20.

Durand, *Bull. soc. chim.*, 1927, 41, 1251.

Soroos, Hinkamp, *J. Am. Chem. Soc.*, 1945, 67, 1642.

## Carbonyl bromide

COBr<sub>2</sub> MW, 188  
 Colourless, fuming liq. B.p. 64-5°. D<sup>15</sup>  
 2.52. H<sub>2</sub>O → HBr + CO<sub>2</sub>.  
 Schumacher, Lenher, *Ber.*, 1928, 61, 1671.

Carbonyl chloride (*Phosgene, chloroformyl chloride*)

COCl<sub>2</sub> MW, 99  
 M.p. -118°. B.p. 8.2°. Vap. press. 836  
 mm. at 10°, 1215 mm. at 20°, 1750 mm. at 30°.  
 Sol. C<sub>6</sub>H<sub>6</sub>, AcOH, toluene. Hyd. by H<sub>2</sub>O.  
 D<sub>4</sub><sup>0</sup> 1.432. Heat of comb. C<sub>p</sub> 41.8 Cal. Crit.  
 temp. 181.7°. Crit. press. 55.3 atm. Com-  
 pletely dissociated at 800° into CO and Cl<sub>2</sub>;  
 67% dissociated at 500°. EtOH → chloro-  
 formic ethyl ester. C<sub>6</sub>H<sub>6</sub> (+ AlCl<sub>3</sub>) → benzo-  
 phenone. Aniline → carbanilide. Dimethyl-  
 aniline → Michler's Ketone. Forms addition  
 products with AlCl<sub>3</sub>.

Berolzheimer, *Ind. Eng. Chem.*, 1919, 11,  
 263, (*Bibl.*).

Jacqué, *Chem. Abstracts*, 1928, 22, 1573.

Erdmann, *Ber.*, 1893, 26, 1993.

Sartori, *The War Gases*, 57. (London,  
 1940.)

## Carbonyl chlorobromide

COClBr MW, 143.5  
 Faintly yellow liq. B.p. 25°. D<sup>15</sup> 1.82.  
 Hygroscopic.

Bartal, *Ann.*, 1906, 345, 336, 343.

Carbonyl cyanide (*Mesoxalic dinitrile*)

NC-CO-CN MW, 80  
 Colourless liq. F.p. -36 to -35°. B.p.  
 65.5° corr./740 mm. D<sub>4</sub><sup>20</sup> 1.124. n<sub>D</sub><sup>20</sup> 1.3919.  
 Burns with bright violet flame. Has over-  
 powering odour reminiscent of HCN. Reacts  
 explosively with H<sub>2</sub>O, vigorously with alcohols.

Malachowski, Jurkiewicz, Wojtowicz,  
*Ber.*, 1937, 70, 1012.

Malachowski, Pisarska, *Ber.*, 1938, 71,  
 2239.

Carbonyl-diurea (*Carbonic acid diureide*)

NH<sub>2</sub>·CO·NH·CO·NH·CO·NH<sub>2</sub> MW, 146  
 C<sub>3</sub>H<sub>6</sub>O<sub>3</sub>N<sub>4</sub>  
 M.p. 232°. Sol. hot H<sub>2</sub>O, alkalis, conc.  
 H<sub>2</sub>SO<sub>4</sub>. Spar. sol. EtOH. Insol. Et<sub>2</sub>O, CHCl<sub>3</sub>,  
 CS<sub>2</sub>. Hot alkalis → cyanuric acid + NH<sub>3</sub>.

Schiff, *Ann.*, 1896, 291, 374.

Carbonyl-diurethane (*Dicarbethoxyurea*)

C<sub>2</sub>H<sub>5</sub>O·CO·NH·CO·NH·CO·OC<sub>2</sub>H<sub>5</sub> MW, 204  
 C<sub>7</sub>H<sub>12</sub>O<sub>5</sub>N<sub>2</sub>

M.p. 107°. Sol. hot H<sub>2</sub>O, most ord. org.  
 solvents, alkalis.

Dains, *J. Am. Chem. Soc.*, 1899, 21, 187.

## Carbonyl fluoride

COF<sub>2</sub> MW, 66  
 Gas at ord. temp. F.p. -114.0 ± 0.3°. B.p.  
 -83.1 ± 0.5°. D 1.809-0.00420T.  
 Easily decomp. by H<sub>2</sub>O.

Steinkopf, Herold, *J. prakt. Chem.*, 1920,  
 101, 79.

Ruff, Miltschitzky, *Z. anorg. allgem.  
 Chem.*, 1934, 221, 154.

Carbonyl sulphide (*Carbon oxysulphide, thiocarbonic anhydride*)

COS MW, 60  
 COS

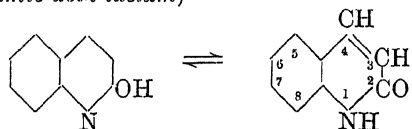
Inflammable gas, burning with blue flame.  
 M.p. -138°. B.p. -50.2° (-47.5°). D (air  
 = 1) 2.1046. D (liq. at -87°) 1.24. 100 c.cs  
 H<sub>2</sub>O dissolve 54 c.cs of the gas at 20°. 100  
 c.cs Py dissolve 4.4 c.cs at 13°. 100 c.cs abs.  
 EtOH dissolve 800 c.cs at 22°. 100 c.cs PhNO<sub>2</sub>  
 dissolve 12 c.cs at 13°. 100 c.cs toluene dissolve  
 1500 c.cs at 22°. Very sol. alc. KOH. Heat of  
 comb. C<sub>p</sub> 131.01 Cal. Crit. temp. 105°. Crit.  
 press. 60 atm. Slowly decomp. by H<sub>2</sub>O.

Mellor, *Comprehensive Treatise on Inor-  
 ganic Chemistry*, V, 971, (*Bibl.*).

Pearson, Robinson, Trotter, *J. Chem. Soc.*,  
 1932, 660.

## Carbopyrottritic Acid.

See 2:5-Dimethylfuran-3:4-dicarboxylic Acid.

Carbostyryl (*2-Hydroxyquinoline, o-amino-  
 cinnamic acid lactam*)

Lactim form  
 (α-Hydroxyquinoline)

Lactam form  
 (α-Quinolone)

C<sub>9</sub>H<sub>7</sub>ON MW, 145

Cryst. + 1H<sub>2</sub>O from dil. aq. sols. M.p. anhyd.  
 199-200°. Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O, HCl Aq.  
 Sublimes. PCl<sub>5</sub> → 2-chloroquinoline. Na  
 + EtOH → tetrahydroquinoline.

2-Me ether: C<sub>10</sub>H<sub>9</sub>ON. MW, 159. B.p.  
 246-7°. Picrate: m.p. 170-1°.

2-Et ether: C<sub>11</sub>H<sub>11</sub>ON. MW, 173. B.p.  
 266°. Volatile in steam. Picrate: m.p. 147°.

2-Phenyl ether: plates from MeOH.Aq. M.p.  
 68-9°. Sublimes.

N-Me: see N-Methyl-α-quinolone.

N-Ethyl-α-quinolone: C<sub>11</sub>H<sub>11</sub>ON. MW, 173.  
 M.p. 54°. B.p. 316-18°.

p-Toluenesulphonate: m.p. 82°.

Tschitschibabin, *Chem. Abstracts*, 1925,  
 19, 1572.

**Carbostyryl-carboxylic Acid.**

See 2-Hydroxyquinolinecarboxylic Acid and 2-Hydroxycinchoninic Acid.

**N-Carboxyanthranilic Acid.**

See Isatoic Acid.

**Carboxyanthrol.**

See Hydroxyanthracene-carboxylic Acid.

**Carboxybenzoylacenaphthene.**

See o-[5-Acenaphthoyl]-benzoic Acid.

**o-Carboxybenzoylformic Acid.**

See Phthalonic Acid.

**o-Carboxybenzoylnitromethane.**

See ω-Nitroacetophenone-2-carboxylic Acid.

**Carboxybenzyl bromide.**

See ω-Bromotoluic Acid.

**Carboxybenzyl chloride.**

See ω-Chlorotoluic Acid.

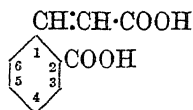
**o-Carboxybenzyl cyanide.**

See under Homophthalic Acid.

**Carboxybenzyl iodide.**

See ω-Iodotoluic Acid.

**o-Carboxycinnamic Acid** (2-Carboxycinnamic acid, β-2-carboxyphenylacrylic acid)



$\text{C}_{10}\text{H}_8\text{O}_4$

MW, 192

M.p.  $197^\circ$  ( $204-5^\circ$ )  $\rightarrow$  phthalide-acetic acid. Sol. EtOH. Spar. sol.  $\text{H}_2\text{O}$ ,  $\text{Et}_2\text{O}$ . Insol.  $\text{C}_6\text{H}_6$ . Alk.  $\text{KMnO}_4 \rightarrow$  o-phthalaldehydic acid.

2-Nitrile: o-cyanocinnamic acid.  $\text{C}_{10}\text{H}_7\text{O}_2\text{N}$ . MW, 173. M.p.  $256^\circ$ . Sol. EtOH, AcOH,  $\text{CHCl}_3$ . Et ester:  $\text{C}_{12}\text{H}_{11}\text{O}_2\text{N}$ . MW, 201. M.p.  $57^\circ$ . Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Chloride:  $\text{C}_{10}\text{H}_6\text{ONCl}$ . MW, 191.5. Needles from ligroin. M.p.  $94-6^\circ$ . Amide:  $\text{C}_{10}\text{H}_8\text{ON}_2$ . MW, 172. Needles from  $\text{H}_2\text{O}$ . M.p.  $203-4^\circ$ .

Isomeric-2-nitrile: o-cyano-allo-cinnamic acid. M.p.  $137^\circ$ . Chloride: m.p.  $50^\circ$ .

ω-Nitrile: o-carboxycinnamonitrile.  $\text{C}_8\text{H}_4(\text{COOH})\text{CH:CH}\cdot\text{CN}$ . M.p.  $169-72^\circ$ .

Davies, Poole, *J. Chem. Soc.*, 1927, 2661.

Titley, *J. Chem. Soc.*, 1928, 2576.

Böeseken, Slooff, *Rec. trav. chim.*, 1930, 49, 91.

**m-Carboxycinnamic Acid.**

Cryst. from  $\text{Me}_2\text{CO}$ -ligroin. M.p.  $275^\circ$  ( $264^\circ$ ). Sol. EtOH, AcOH. Spar. sol.  $\text{Et}_2\text{O}$ ,  $\text{H}_2\text{O}$ . Insol.  $\text{C}_6\text{H}_6$ ,  $\text{CHCl}_3$ . Adds Br with difficulty.

Simonis, *Ber.*, 1912, 45, 1587.

Titley, *J. Chem. Soc.*, 1928, 2581.

**p-Carboxycinnamic Acid.**

Sublimes partially above  $350^\circ$ . M.p.  $358^\circ$  decomp. Mod. sol. hot AcOH.

4-Et ester:  $\text{C}_{12}\text{H}_{12}\text{O}_4$ . MW, 220. M.p.  $220^\circ$ .

Di-Et ester:  $\text{C}_{14}\text{H}_{16}\text{O}_4$ . MW, 248. M.p.  $52^\circ$ .

4-Nitrile: p-cyanocinnamic acid.  $\text{C}_{10}\text{H}_7\text{O}_2\text{N}$ . MW. Prisms. M.p.  $248-9^\circ$ .

Titley, *J. Chem. Soc.*, 1928, 2581.

**3-Carboxycyclohexylacetic Acid.**

See Hexahydrohomisophthalic Acid.

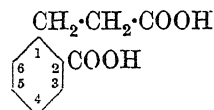
**3-Carboxycyclopentylacetic Acid.**

See Norhomocamphoric Acid.

**Carboxyethylarginine.**

See Iso-octopine.

**o-Carboxyhydrocinnamic Acid** (β-2-Carboxyphenylpropionic acid)



$\text{C}_{10}\text{H}_{10}\text{O}_4$

MW, 194

Needles. M.p.  $167^\circ$ . Sol.  $\text{H}_2\text{O}$ ,  $\text{Et}_2\text{O}$ . Dist.  $\rightarrow$  α-hydrindone.

Di-Et ester:  $\text{C}_{14}\text{H}_{18}\text{O}_4$ . MW, 250. B.p.  $182-3^\circ/14$  mm.

2-Nitrile: o-cyanohydrocinnamic acid.  $\text{C}_{10}\text{H}_9\text{O}_2\text{N}$ . MW, 175. Needles from  $\text{H}_2\text{O}$ . M.p.  $136^\circ$  ( $127^\circ$ ). Et ester: o-cyanohydrocinnamic ethyl ester.  $\text{C}_{12}\text{H}_{13}\text{O}_2\text{N}$ . MW, 203. Needles and plates from MeOH. M.p.  $98-9^\circ$ .

Mayer, Philipps, Ruppert, Schmitt, *Ber.*, 1928, 61, 1971.

Titley, *J. Chem. Soc.*, 1928, 2575.

**m-Carboxyhydrocinnamic Acid.**

M.p.  $177^\circ$ .

Di-Me ester:  $\text{C}_{12}\text{H}_{14}\text{O}_4$ . MW, 222. B.p.  $184-5^\circ/15$  mm.

Titley, *J. Chem. Soc.*, 1928, 2581.

**p-Carboxyhydrocinnamic Acid.**

Needles. M.p.  $294^\circ$ . Sol. hot  $\text{H}_2\text{O}$ , hot EtOH. Sublimes.

Di-Me ester:  $\text{C}_{12}\text{H}_{14}\text{O}_4$ . MW, 222. Prisms from  $\text{CHCl}_3$ . M.p.  $33^\circ$ .

4-Nitrile: p-cyanohydrocinnamic acid.  $\text{C}_{10}\text{H}_9\text{O}_2\text{N}$ . MW, 175. Prisms from  $\text{H}_2\text{O}$ . M.p.  $135-6^\circ$ .

Titley, *J. Chem. Soc.*, 1928, 2581.

Moses, *Ber.*, 1900, 33, 2625.

**2-Carboxymethyl-glutaric Acid.**

See Methane-triacetic Acid.

**3-Carboxymethylhexahydrobenzoic Acid.**

See Hexahydrohomisophthalic Acid.

**Carboxymethylhydantoin.**

See Hydantoinacetic Acid.

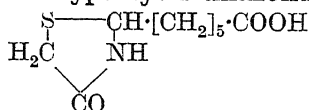
**6-Carboxymethylpiperidine-2-carboxylic Acid.**

See Granatic Acid.

**o-Carboxyoxanilic Acid.**

See Kynuric Acid.



2- $\omega$ -Carboxypentyl-4-thiazolidone

$C_9H_{15}O_3NS$  MW, 217

(-):

Antibiotic of *Streptomyces* sp. Needles from  $H_2O$ , MeOH or  $Me_2CO$ . M.p. 139–40°.  $[\alpha]_D^{25}$  -54° in MeOH. Sols. show blue fluor. in UV. light. Racemized by dil. alkalis. Active against *Mycobacteria* in vitro.

Me ester:  $C_{10}H_{17}O_3NS$ . MW, 231. Needles. M.p. 53–4°.  $[\alpha]_D^{25}$  -50.9° in MeOH.

Racemic form.

Occurs in two modifications. (i) Needles from  $H_2O$ . M.p. 122–3°. (ii) Needles from  $CHCl_3$ . M.p. 116–17°.

Sobin, *J. Am. Chem. Soc.*, 1952, 74, 2947.

McLamore *et al.*, *ibid.*, 2946.

## Carboxyphenylacetic Acid.

See Homophthalic Acid, Homoisophthalic Acid and Homoterephthalic Acid.

## o-Carboxyphenylcarbamic Acid.

See Isatoic Acid.

## Carboxyphenylethyl Alcohol.

See Hydroxymethylbenzoic Acid.

## Carboxy-2-phenylethylamine.

See  $\beta$ -Aminoethylbenzoic Acid.

## o-Carboxyphenyliminodiacetic Acid.

See Anthranilimodiacetic Acid.

## Carboxyphenyl-naphthalene.

See Naphthylbenzoic Acid and  $\alpha$ -Chrysenic Acid.

## Carboxyphenyl-naphthylamine.

See Naphthylanthranilic Acid.

## Carboxyphenylthioglycollic Acid.

See Phenylthioglycollic Acid carboxylic Acid.

## 2-[6-Carboxypiperidyl]-acetic Acid.

See Granatic Acid.

## N-Carboxyurea.

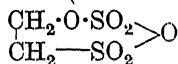
See Allophanic Acid.

## Carbuvinic Acid.

See 2:5-Dimethylfuran-3:4-dicarboxylic Acid.

## Carbyloxime.

See Fulminic Acid.

Carbyl sulphate (*Ethionic anhydride*)

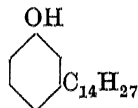
$C_2H_4O_6S_2$  MW, 188

Deliquescent cryst. M.p. 80°.

Regnault, *Ann.*, 1838, 25, 32.

I.G., D.R.P. 550,572, (*Chem. Zentr.*, 1932, II, 287).

## Cardanol



$C_{20}H_{32}O$  MW, 288

Isolated from cashew nutshell oil. Non-toxic. B.p. 225°/10 mm. Red.  $\rightarrow$  dihydro comp., m.p. 50.5°, b.p. 240°/10 mm.

Et ether: b.p. 235°/10 mm.

Benzoyl: b.p. 290°/7 mm.

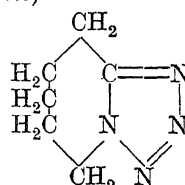
Harvey, Caplan, *Ind. Eng. Chem.*, 1940, 32, 1306.

Caplan, U.S.P. 2,181,119, (*Chem. Abstracts*, 1940, 34, 1992).

## Cardiamine.

See under Nicotinamide.

Cardiazole (1:5-Pentamethylene-1:2:3:4-tetrazole, metrazole)



$C_6H_{10}N_4$  MW, 138

Cryst. from  $C_6H_6$ -ligroin. M.p. 59°. Very sol.  $H_2O$ , org. solvents. Employed as analeptic. Pharmacological action very similar to that of camphor. Pyrolysis  $\rightarrow$  pyrrole.

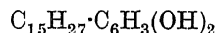
B,HgCl<sub>2</sub>: m.p. 175°. Sol. 800 parts  $H_2O$ .

Knoll, D.R.P. 543,025, (*Chem. Abstracts*, 1932, 26, 3263).

Schmidt, Hildebrandt, Krehl, *Chem. Abstracts*, 1926, 20, 448.

Chapman, McCombie, Saunders, *J. Chem. Soc.*, 1945, 1929.

## Cardol



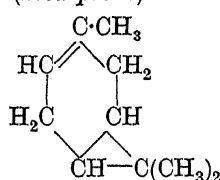
$C_{21}H_{32}O_2$  MW, 312

From latex of *Anacardium occidentale*, Linn. (cashew nut). Pale yellow oil. Sol. org. solvents. Insol.  $H_2O$ . Vesicant. Gives no colour with  $FeCl_3$ . Red.  $\rightarrow$  tetrahydrocardol, m.p. 95.5–6°.

Diacetyl: m.p. 55–5.5°.

Di-Me ether: b.p. 215–20°/3 mm.

Backer, Haack, *Rec. trav. chim.*, 1941, 60, 661.

d- $\Delta^3$ -Carene (*Isodiprene*)

$C_{10}H_{16}$  MW, 136

Occurs in essential oil from *Pinus longifolia*, Roxb. and in Finnish and Russian turpentine. B.p. 168–9°/705 mm., 123–4°/200 mm.  $D_{20}^{30}$  0.8586.  $n_D^{20}$  1.469.  $[\alpha]_D^{30}$  +7.69°.  $Ac_2O$  + conc.  $H_2SO_4$   $\rightarrow$  green col.

Nitrosate: decomp. at 141.5° (147°).

*Hydrochloride*: C<sub>10</sub>H<sub>16</sub>·HCl. B.p. 77–83°/7 mm.

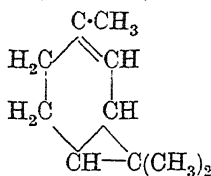
*Di-hydrochloride*: C<sub>10</sub>H<sub>16</sub>·2HCl is identical with sylvestrene hydrochloride.

Aschan, *Chem. Abstracts*, 1929, 23, 127; *Ann.*, 1928, 461, 1.

Simonsen, *J. Chem. Soc.*, 1920, 117, 570 : 1929, 305.

Padmanabhan, Jatkari, *J. Am. Chem. Soc.*, 1935, 57, 335.

**d-Δ<sup>4</sup>-Carene (Pinonene)**



C<sub>10</sub>H<sub>16</sub> MW, 136

Occurs in essential oil from *Andropogon Jwarancusa*, Roxb., and in Finnish turpentine. B.p. 165.5–167°/707 mm. D<sub>20</sub><sup>20</sup> 0.8552. n<sub>D</sub><sup>20</sup> 1.474. [α]<sub>D</sub><sup>20</sup> + 62.2°.

*Hydrochloride*: C<sub>10</sub>H<sub>16</sub>·HCl. B.p. 75–80°/10 mm.

Aschan, *Chem. Abstracts*, 1929, 23, 127; *Ann.*, 1928, 461, 1.

Simonsen, *J. Chem. Soc.*, 1922, 121, 2292.

Gibson, Simonsen, *J. Chem. Soc.*, 1929, 909.

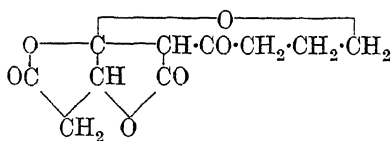
Padmanabhan, Jatkari, *J. Am. Chem. Soc.*, 1935, 57, 336.

Nares, Papazian, *Helv. Chim. Acta*, 1942, 25, 984.

**Caricaxanthin.**

See Kryptoxanthin.

**Carlic Acid**



C<sub>10</sub>H<sub>10</sub>O<sub>6</sub> MW, 226

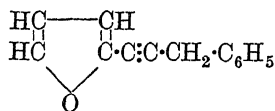
Product of metabolism of *Penicillium Charlesii*, G. Smith. Needles from EtOH. M.p. 176°. [α]<sub>D</sub><sup>20</sup> + 266, 230 mμ; in EtOH, 270 mμ.

Clutterbuck, Haworth, Raistrick, Smith, Stacey, *Biochem. J.*, 1934, 28, 94.

Clutterbuck, Raistrick, Reuter, *Biochem. J.*, 1935, 29, 871.

Herbert, Hirst, *Biochem. J.*, 1935, 29, 1881.

**Carlina oxide**



C<sub>13</sub>H<sub>10</sub>O

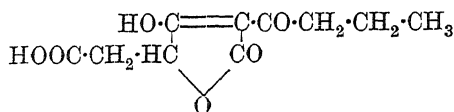
MW, 182

Present in the Carlina thistle. B.p. 167–8°/20 mm. D<sub>17</sub><sup>17</sup> 1.066. n<sub>D</sub> 1.586. KMnO<sub>4</sub> → benzoic acid.

St. Pfau, Pictet, Plattner, Susz, *Helv. Chim. Acta*, 1935, 18, 935.

Semmler, *Ber.*, 1906, 39, 726.

**Carlosic Acid**



C<sub>10</sub>H<sub>12</sub>O<sub>6</sub> MW, 228

Product of metabolism of *Penicillium Charlesii*, G. Smith. Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 181°. [α]<sub>D</sub><sup>20</sup> + 160° in H<sub>2</sub>O. Absorption maxima in H<sub>2</sub>O, 265, 230 mμ.

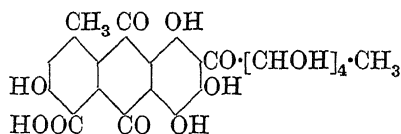
2 : 4-Dinitrophenylhydrazone : orange-yellow needles from EtOH. M.p. 182°.

Clutterbuck, Haworth, Raistrick, Smith, Stacey, *Biochem. J.*, 1934, 28, 94.

Clutterbuck, Raistrick, Reuter, *Biochem. J.*, 1935, 29, 871.

Herbert, Hirst, *Biochem. J.*, 1935, 29, 1881.

**Carmic Acid**



C<sub>22</sub>H<sub>20</sub>O<sub>13</sub> MW, 492

Occurs in cochineal. Red prisms. Sol. hot H<sub>2</sub>O. Mod. sol. EtOH. Spar. sol. Et<sub>2</sub>O. Insol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. [α]<sub>D</sub><sup>20</sup> + 51.6°.

*Tetra-acetyl deriv.* : decomp. at 155–70°.

*Hexa-acetyl deriv.* : yellowish-red cryst. De-comp. at 170°.

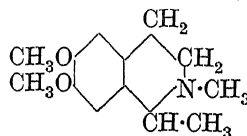
*Octa-acetyl deriv.* : m.p. 155–65°. [α]<sub>D</sub><sup>20</sup> + 80.55° in CHCl<sub>3</sub>.

*Anilide* : red prisms. M.p. 189–90° decomp.

Miyagama, *Chem. Abstracts*, 1927, 21, 1127.

Dimroth, Kämmerer, *Ber.*, 1920, 53, 471.

**Carnegine** (6 : 7-Dimethoxy-1 : 2-dimethyl-1 : 2 : 3 : 4-tetrahydroisoquinoline, pectenine)



C<sub>13</sub>H<sub>19</sub>O<sub>2</sub>N MW, 221

Alkaloid from *Carnegiea gigantea*, Britton, Rose. M.p. 262–3°. B.p. 170°/1 mm. [α]<sub>D</sub><sup>20</sup> + 20° in H<sub>2</sub>O.

*B.HCl* : m.p. 210–11° (207°).

*B.HBr* : m.p. 228°.

*Methiodide* : m.p. 210–11°.

*Picrate*: red cryst. M.p. 222–2.5° decomp. (212–13°).

Heyl, *Chem. Abstracts*, 1929, 23, 1211.

Späth, *Ber.*, 1929, 62, 1021, 2242.

Späth, Dengel, *Ber.*, 1938, 71, 113.

**Carnitine** ( $\beta$ -Hydroxy- $\gamma$ -butyrotrimethylbetaine, *Novain*)



$\text{C}_7\text{H}_{15}\text{O}_3\text{N}$  MW, 161

Constituent of striated muscle. Easily sol.  $\text{H}_2\text{O}$ . Aq. sol. reacts strongly alkaline. Lævoro-rotatory in HCl.Aq.

$B_2\text{H}_2\text{AuCl}_4$ : orange-yellow needles. M.p. 155°.

$B_2\text{HgCl}_2$ : needles. M.p. 204–5° decomp.

$B_2\text{H}_2\text{PtCl}_6$ : orange cryst. M.p. 214–18° decomp. (220°).

*Me ester*: *reineckate*: m.p. 136°.

*Et ester*:  $B_2\text{HCl}$ : needles from  $\text{Me}_2\text{CO}$ . M.p. 146°.  $B_2\text{H}_2\text{AuCl}_4$ : m.p. 105°.  $B_2\text{H}_2\text{PtCl}_6$ : m.p. 211–12°. *Reineckate*: m.p. 135–6°.

*Me ether*:  $\text{C}_8\text{H}_{17}\text{O}_3\text{N}$ . MW, 175.  $B_2\text{HCl}$ : prisms from  $\text{Me}_2\text{CO}$ . M.p. 178°.  $B_2\text{H}_2\text{AuCl}_4$ : yellow plates from dil. HCl. M.p. 108°.  $B_2\text{H}_2\text{PtCl}_6$ : yellow prisms from MeOH. M.p. 197–8° decomp.

*O-Acetyl*: cryst. from EtOH–Et<sub>2</sub>O. M.p. 145°.  $[\alpha]_D^{20} - 19.5^\circ$ . *Reineckate*: m.p. 154°.

*Reineckate*: m.p. 147°.

Gulevich, *Chem. Abstracts*, 1927, 21, 3391, (Bibl.).

Crawford, Kenyon, *J. Chem. Soc.*, 1927, 396.

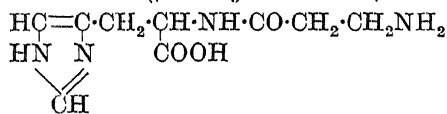
Tomita, Sendju, *Z. physiol. Chem.*, 1927, 169, 263.

Krimberg, Vittandt, *Biochem. Z.*, 1932, 25, 229.

Strack, Försterling, *Ber.*, 1938, 71, 1143.

Strack, Wördehoff, Schwaneberg, *Z. physiol. Chem.*, 1936, 238, 183.

***l*-Carnosine** ( $\beta$ -Alaninyl-*l*-histidine)



$\text{C}_9\text{H}_{14}\text{O}_3\text{N}_4$  MW, 226

Needles. M.p. 246–50° decomp. Sol.  $\text{H}_2\text{O}$ .  $[\alpha]_D + 21^\circ$ . Reacts strongly alkaline. Exerts depressor activity on blood pressure.

$B_2\text{HCl}$ : m.p. 245°.

$B_2\text{HNO}_3$ : needles. M.p. 219° decomp.

$B_2\text{H}_2\text{SO}_4$ : decomp. at 238–40°.

Gulevich, *Chem. Abstracts*, 1927, 21, 3391, (Bibl.).

Broude, *Z. physiol. Chem.*, 1926, 158, 22.

Barger, Tutin, *Biochem. J.*, 1918, 12, 402.

Sifferd, du Vigneaud, *J. Biol. Chem.*, 1935, 108, 753.

Abderhalden, Geidel, *Chem. Abstracts*, 1931, 25, 5180.

Dot. of Org Comp.—I.

***d*-Carnosine** ( $\beta$ -Alaninyl-*d*-histidine).

M.p. 260°.  $[\alpha]_D^{28} - 20.4^\circ$  in  $\text{H}_2\text{O}$ . No depressor activity on blood pressure.

$B_2\text{HCl}$ : m.p. 245°.

*Carbobenzoxy deriv.*: m.p. 161°.  $[\alpha]_D^{24} - 11^\circ$  in  $\text{H}_2\text{O}$ .

du Vigneaud, Hunt, *J. Biol. Chem.*, 1936, 115, 93.

***dl*-Carnosine** ( $\beta$ -Alaninyl-*dl*-histidine).

Has only half depressor activity of *l*-carnosine. Forms nitroanilic acid salt, insol. EtOH.

du Vigneaud, Hunt, *J. Biol. Chem.*, 1936, 115, 93.

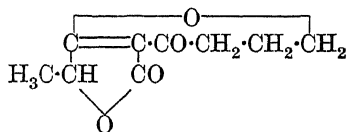
**Carnosol**

$\text{C}_{19}\text{H}_{26}\text{O}_4$  MW, 318

From *Salvia carnosae*, Dougl. Long white odourless needles. M.p. 219.5° decomp.  $[\alpha]_D - 66^\circ$ . Sol. MeOH, EtOH, Et<sub>2</sub>O,  $\text{CHCl}_3$ . Slightly sol. pet. ether. Coloured sols. (light orange-red  $\rightarrow$  deep brown  $\rightarrow$  blue black) in dil. alkalis. Sol. to yellow col. in conc.  $\text{H}_2\text{SO}_4$ . Insol.  $\text{H}_2\text{O}$ , dil. HCl, 5%  $\text{NaHCO}_3$ . Contains 2 phenolic OH groups and an ester group. Probably contains octahydrophenanthrene nucleus.

White, Jenkins, *J. Am. Pharm. Assoc.*, 1942, 31, 37.

**Carolinic Acid**



$\text{C}_9\text{H}_{10}\text{O}_4$  MW, 182

Product of metabolism of *Penicillium Charlesii*, G. Smith. Needles from EtOH. M.p. 132°.  $[\alpha]_{5461} + 84^\circ$ .  $\text{FeCl}_3 \rightarrow$  orange col. Absorption maxima in  $\text{H}_2\text{O}$ , 265, 230 m $\mu$ ; in EtOH, 272 m $\mu$ .

*Mono-2*: 4-dinitrophenylhydrazone: yellow needles. M.p. 176°.

*Di-2*: 4-dinitrophenylhydrazone: orange needles. M.p. 225° decomp.

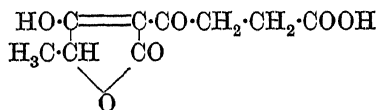
Clutterbuck, Raistrick, Reuter, *Biochem. J.*, 1935, 29, 300.

Clutterbuck, Haworth, Raistrick, Smith, Stacey, *Biochem. J.*, 1934, 28, 94.

Clutterbuck, Raistrick, Reuter, *Biochem. J.*, 1935, 29, 871.

Herbert, Hirst, *Biochem. J.*, 1935, 29, 1881.

**Carolinic Acid**

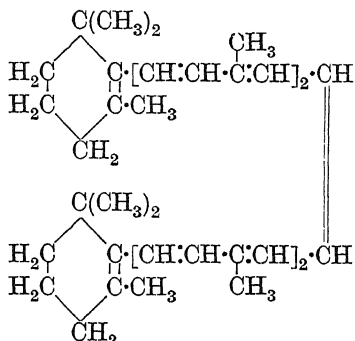


$\text{C}_9\text{H}_{10}\text{O}_6$

MW, 214  
28



β-Carotene



C<sub>40</sub>H<sub>56</sub>

MW, 536

Present in carrots, leaves, etc. Reddish-brown glistening cryst. M.p. 184°. Sol. CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>, pet. ether. Spar. sol. MeOH, EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Insol. H<sub>2</sub>O. Optically inactive. Absorption bands in CS<sub>2</sub>, 520 (513), 484, 452 mμ. Readily absorbs O. Ozone → geronic acid. SbCl<sub>5</sub> in CHCl<sub>3</sub> → blue col. with absorption band at 590 mμ. Possesses vitamin A activity. In sol. is gradually converted (more rapidly at 80° or in presence of I) to equilibrium mixture of β-carotene (70%) and ψ-α-carotene (30%). The latter resembles α-carotene in light absorption.

Karrer, Jucker, "Carotinoide," Basel, 1948. English translation, "Carotenoids," Amsterdam, 1950.

Karrer et al., *Helv. Chim. Acta*, 1929, 12, 1142; 1930, 13, 1084; 1931, 14, 1083.

Zechmeister, "Carotinoide," Berlin, 1934. Kuhn, Brockmann, *Ann.*, 1935, 516, 95; *Ber.*, 1934, 67, 885.

Strain, *J. Biol. Chem.*, 1934, 105, 523.

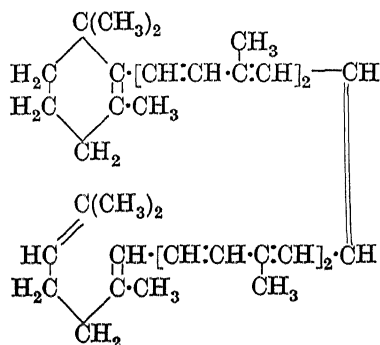
Zechmeister, Tuzson, *Ber.*, 1939, 72, 1340. Gillam, el Ridi, *Biochem. J.*, 1936, 30, 1735.

Carter, Gillam, *Biochem. J.*, 1939, 33, 1325.

Karrer, Eugster, *Helv. Chim. Acta*, 1950, 33, 1172, 1952.

Inhoffen et al., *Ann.*, 1951, 573, 1.

γ-Carotene



C<sub>40</sub>H<sub>56</sub>

MW, 536

Rind of fruit of *Gonocaryum pyriforme* is richest source. Violet prisms from C<sub>6</sub>H<sub>6</sub>-Et<sub>2</sub>O. M.p. 178°. Optically inactive. Absorption bands in CS<sub>2</sub>, 533.5, 496, 463 mμ; in C<sub>6</sub>H<sub>6</sub>, 510, 477, 477 mμ; in C<sub>6</sub>H<sub>14</sub>, 494, 462, 432 mμ. SbCl<sub>5</sub> in CHCl<sub>3</sub> gives blue col. (absorption band at 590 mμ). Possesses vitamin A activity.

Karrer, Jucker, "Carotinoide," Basel, 1948. English translation, "Carotenoids," Amsterdam, 1950.

Winterstein, *Z. physiol. Chem.*, 1933, 219, 249.

Kuhn, Brockmann, *Ber.*, 1933, 66, 407.

Emerson, Fox, *Proc. Roy. Soc.*, 1940, B, 128, 275.

Mackinney, *J. Biol. Chem.*, 1935, 112, 421.

δ-Carotene

C<sub>40</sub>H<sub>56</sub>

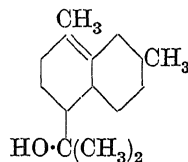
MW, 536

From *Gonocaryum pyriforme*. Small needles. M.p. 172°. Absorption bands in CS<sub>2</sub>, 526, 490, 457 mμ.

Karrer, Jucker, "Carotinoide," Basel, 1948. English translation, "Carotenoids," Amsterdam, 1950.

Winterstein, *Z. physiol. Chem.*, 1933, 219, 249.

Carotol



C<sub>15</sub>H<sub>26</sub>O

MW, 222

Sesquiterpene constituent of *Daucus carota*. D<sub>4</sub><sup>20</sup> 0.9702. n<sub>D</sub><sup>20</sup> 1.4997. [α]<sub>D</sub><sup>18</sup> + 6.9°.

*Dihydro deriv.* b.p. 131-3°/11 mm.

Šorm, Urbanek, *Chem. Abstracts*, 1948, 42, 7283; 1949, 43, 3807.

Carpesterol

C<sub>36</sub>H<sub>54</sub>O<sub>4</sub>

MW, 550

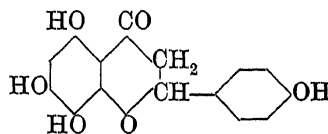
From seeds of *Solanum xanthocarpum*. Shining platelets. M.p. 248°. [α]<sub>D</sub><sup>20</sup> -80°.

*Acetyl*: m.p. 193-4°.

Saiyed, Kanga, *Proc. Ind. Acad. Sci.*, 1936, 4A, 255.

Gupta, Dutt, *J. Indian Chem. Soc.*, 1938, 15, 95.

Carthamidin (5 : 7 : 8 : 4'-Tetrahydroxyflavone)



C<sub>15</sub>H<sub>12</sub>O<sub>6</sub>

MW, 288

Yellow cryst.  $\div$   $1\text{H}_2\text{O}$ . M.p. 218°.

$\alpha$ -Acetyl deriv.: 5 : 7 : 8 : 4'-tetra-acetylcarthamin. M.p. 158°.

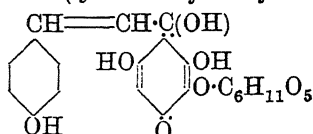
$\beta$ -Acetyl deriv.: 4 : 2' : 3' : 4' : 6'-penta-acetoxychalkone. M.p. 42°.

$\gamma$ -Acetyl deriv.: 5 : 7 : 8-triacetoxy-4'-[p-acetoxy]-styrylcoumarin. M.p. 178°.

$\beta$ -Pentamethyl ether: 4 : 2' : 3' : 4' : 6'-penta-methoxychalkone. M.p. 112°.

Kuroda, *J. Chem. Soc.*, 1930, 752, 766.

**Carthamin** (Quinonoid form of isocarthamin)



$\text{C}_{21}\text{H}_{22}\text{O}_{11}$

MW, 450

Glucoside from safflower, *Carthamus tinctorius*, Linn. Red needles from Py. Sol. EtOH. Alkalis to deep red sols. Spar. sol.  $\text{H}_2\text{O}$ . Insol.  $\text{Et}_2\text{O}$ .  $\text{H}_3\text{PO}_4 \rightarrow$  carthaminid.

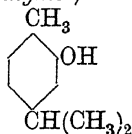
Kuroda, *J. Chem. Soc.*, 1930, 752, 766.

Bargellini, Zoras, *Gazz. chim. ital.*, 1934, 64, 202.

**Carubinose.**

See Mannose.

**Carvacrol** (2-Hydroxy-1-methyl-4-isopropylbenzene, 2-hydroxycymene, cymophenol, 4-isopropyl-o-cresol, isothymol)



$\text{C}_{10}\text{H}_{14}\text{O}$

MW, 150

Constituent of many essential oils. Colourless liq. Freezes to solid, m.p.  $+0.5^\circ$ . B.p.  $237-8^\circ$ ,  $113^\circ/10$  mm. Sol. EtOH,  $\text{Et}_2\text{O}$ , alkalis. Very spar. sol.  $\text{H}_2\text{O}$ . Volatile in steam.  $D_4^{20}$  0.976.  $n_D^{20}$  1.52295. Heat of comb.  $C_p$  1354.8. Cal. KOH fusion  $\rightarrow$  o-hydroxy-p-isopropylbenzoic acid.  $\text{KMnO}_4$ , or  $\text{CrO}_3$  in  $\text{H}_2\text{SO}_4 \rightarrow$  thymoquinone.  $\text{FeCl}_3$  in EtOH  $\rightarrow$  green col. Me ether:  $\text{C}_{11}\text{H}_{16}\text{O}$ . MW, 164. B.p.  $216-17^\circ$ .  $D^0$  0.9543.  $n_D^{20}$  1.50189.

Et ether:  $\text{C}_{12}\text{H}_{18}\text{O}$ . MW, 178. B.p.  $235^\circ$ .

Acetyl: b.p.  $245-8^\circ$ .  $D^{25}$  0.9896.  $n_D^{25}$  1.49128.

Cinnamoyl: m.p.  $65-6^\circ$ .

p-Nitrobenzoyl: m.p.  $50^\circ$ .

3 : 5-Dinitrobenzoyl: m.p.  $76-7^\circ$ .

Phenylurethane: cryst. from EtOH. M.p.  $138^\circ$ .

Sachs, *Chem. Abstracts*, 1926, 20, 2321.

Wagner, *Chem. Abstracts*, 1929, 23, 667.

Sabatier, Mailhe, *Compt. rend.*, 1914, 158, 610.

Gardner, Procotief, Jusov, Casselli, *Compt. rend.*, 1935, 200, 1114.

Lavoisier, F.Ps, 798, 849, 797, 815, (*Chem. Abstracts*, 1936, 30, 7588, 7128).

Dzirkal, *Chem. Abstracts*, 1942, 36, 2257.

**Carvacrol-carboxylic Acid.**

See Hydroxyisopropyl-m-toluic Acid.

**Carvacrotinic Acid.**

See Hydroxyisopropyl-m-toluic Acid.

**Carvacrotinic Aldehyde.**

See Hydroxyisopropyl-m-toluic Aldehyde.

**Carvacrylamine.**

See p-Cymidine.

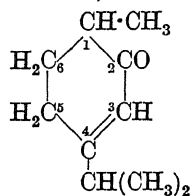
**Carvene.**

See d-Limonene.

**Carvenol.**

See  $\Delta^3$ -p-Menthenol-2.

**Carvenone** ( $\Delta^3$ -p-Menthenone-2, 4-methyl-1-isopropylcyclohexenone-3)



$\text{C}_{10}\text{H}_{16}\text{O}$

MW, 152

l.

B.p.  $232-4^\circ$ .  $D_0^{20}$  0.9290.  $n_D$  1.4805.  $[\alpha] - 2.1^\circ$ .

Semicarbazone: m.p.  $200-1^\circ$ .

dl.

B.p.  $233^\circ$ ,  $121^\circ/27$  mm.,  $104^\circ/10$  mm. Insol.  $\text{H}_2\text{O}$ .  $D_4^{20}$  0.9263.  $n_D^{19}$  1.48377.  $\text{P}_2\text{O}_5$  at  $180^\circ \rightarrow$  p-cymene.  $\text{FeCl}_3 \rightarrow$  carvacrol. 2%  $\text{KMnO}_4$ . Aq.  $\rightarrow$  1-methylglutaric acid.

Oxime: m.p.  $91-2^\circ$ . Hydrochloride: m.p.  $113-14^\circ$ .

Semicarbazone: two forms. (1) Leaflets from MeOH, m.p.  $202-5^\circ$  ( $202-3^\circ$ ); (2) prisms from MeOH, m.p.  $153-4^\circ$ .

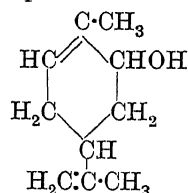
Bredt, Rochussen, Monheim, *Ann.*, 1900, 314, 387.

Kishner, *Chem. Zentr.*, 1912, I, 1713.

Klages, *Ber.*, 1899, 32, 1519.

Downes, Gill, Lions, *Australian Journal of Science*, 1948, 10, 147, (*Chem. Abstracts*, 1948, 42, 7257).

**Carveol** ( $\Delta^1$  8-p-Menthadienol-6)



$\text{C}_{10}\text{H}_{16}\text{O}$

MW, 152

d-Trans.

B.p.  $102.2-102.4^\circ/10$  mm.  $D_4^{25}$  0.9484.  $n_D^{25}$  1.4942.  $[\alpha]_D^{25} + 213.1^\circ$ .

Acetyl: b.p.  $106.0-106.5^\circ/9$  mm.  $n_D^{15}$  1.4770.  $[\alpha]_D^{15} + 177.5^\circ$ .

o-Nitrobenzoyl: syrup.  $[\alpha]_D + 110^\circ$  in  $\text{CHCl}_3$ . p-Nitrobenzoyl: m.p.  $77^\circ$ .  $[\alpha]_D + 264.4^\circ$  in  $\text{CHCl}_3$ .

3:5-Dinitrobenzoyl: m.p. 111.5°.  $[\alpha]_D^{16} + 232^\circ$  in  $\text{CHCl}_3$ .

*l-Trans*-.

$[\alpha]_D - 213^\circ$ . Other physical properties identical with *d-trans*-form.

3:5-Dinitrobenzoyl: m.p. 111.0–111.5°.  $[\alpha]_D - 230.7^\circ$  in  $\text{CHCl}_3$ .

*dl-Trans*-.

B.p. 108°/16 mm.  $D_4^{18} 0.9510$ .  $n_D^{19} 1.4956$ .

*p-Nitrobenzoyl*: m.p. 101°.

3:5-Dinitrobenzoyl: m.p. 119°.

*d-Cis*-.

M.p. 24–5°. B.p. 101.2–101.4°/10 mm.  $D_4^{25} 0.9521$ .  $n_D^{25} 1.4959$ .  $[\alpha]_D^{25} + 23.9^\circ$ .

*Acetyl*: b.p. 108–108.5°/10 mm.  $n_D^{25} 1.4779$ .  $[\alpha]_D^{25} + 46.4^\circ$ .

*p-Nitrobenzoyl*: m.p. 26.5–28°.  $[\alpha]_D - 57.4^\circ$  in  $\text{CHCl}_3$ .

3:5-Dinitrobenzoyl: m.p. 92–5°.  $[\alpha]_D - 43.8^\circ$  in  $\text{CHCl}_3$ .

*l-Cis*-.

$[\alpha]_D^{25} - 23.9^\circ$ . Other physical properties identical with *d-cis*-form.

3:5-Dinitrobenzoyl: m.p. 92.0–92.5°.  $[\alpha]_D + 44.2^\circ$  in  $\text{CHCl}_3$ .

*dl-Cis*-.

B.p. 108°/16 mm.  $n_D^{19} 1.4972$ .

*p-Nitrobenzoyl*: m.p. 94°.

3:5-Dinitrobenzoyl: m.p. 91.5°.

Johnston, Read, *J. Chem. Soc.*, 1934, 233.

### Carvestrene.

See Sylvestrene.

### Carviolacin

$\text{C}_{20}\text{H}_{16}\text{O}_7$

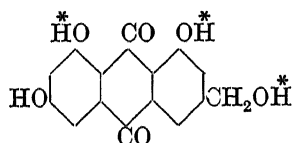
MW, 368

Pigment isolated from *Penicillium carminoviolaceum*, Biourge. Light brown needles from EtOH.Aq. M.p. 243° decomp. Spar. sol.  $\text{H}_2\text{O}$ , dil. HCl. Similar colour reactions to carviolin.

*Tri-Me ether*: yellow needles from EtOH. M.p. 214–5°.

Hind, *Biochem. J.*, 1940, 34, 67.

**Carviolin** ( $\omega$ -Hydroxyemodin methyl ether, 1:6:8-trihydroxy-3-hydroxymethyl-anthraquinone methyl ether)



\* One of these H atoms is replaced by  $\text{CH}_3$ .

$\text{C}_{16}\text{H}_{12}\text{O}_6$

MW, 300

Pigment isolated from *Penicillium carminoviolaceum*, Biourge. Yellow needles from AcOH. M.p. 286°. Alkalis  $\rightarrow$  bluish-red sols. Dil.  $\text{NH}_3 \rightarrow$  blood-red sol.  $\text{H}_2\text{SO}_4 \rightarrow$  red col.

*Tri-Me ether*: golden rods from EtOH.Aq. M.p. 186°.

*Triacetyl*: green needles from AcOH. M.p. 210°.

*Tribenzoyl*: cryst. from EtOH- $\text{CHCl}_3$ . M.p. 240°.

Hind, *Biochem. J.*, 1940, 34, 67, 577.

### Carvol.

See Carvone.

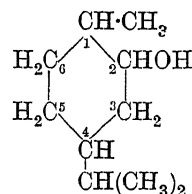
### Carvomenthene.

See  $\Delta^1$ -*p*-Menthene.

### Carvomenthenol.

See Piperitol.

**Carvomenthol** (*Hexahydrocarvacrol, tetrahydrocarveol*)



$\text{C}_{10}\text{H}_{20}\text{O}$

MW, 156

A large number of stereo- and optical isomers are possible. *Iso*- refers to stereo-isomerism about  $\text{C}_1$  and *Neo*- to stereoisomerism about  $\text{C}_2$ .

*d*-.

B.p. 101.8–102°/14 mm.  $D_4^{18} 0.9056$ .  $n_D^{19} 1.4629$ .  $n_D^{19} 1.4650$ .  $[\alpha]_D^{18} + 27.69^\circ$ .  $\text{CrO}_3 \rightarrow$  *l*-carvomenthone.

*p-Nitrobenzoyl*: prisms from EtOH. M.p. 60°.  $[\alpha]_D^{17} + 51.7^\circ$  in  $\text{CHCl}_3$ .

3:5-Dinitrobenzoyl: needles from EtOH-AcOEt. M.p. 107°.  $[\alpha]_D^{18} + 52.8^\circ$  in  $\text{CHCl}_3$ .

*Hydrogen phthalate*: leaflets from ligroin. M.p. 90–1°.  $[\alpha]_D + 57.8^\circ$  in EtOH.

*l-Neo*-.

B.p. 102°/18 mm.  $D_4^{19} 0.9012$ .  $n_D^{20} 1.4632$ .  $[\alpha]_D^{21} - 41.7^\circ$ .  $\text{CrO}_3 \rightarrow$  *l*-carvomenthone.

*p-Nitrobenzoyl*: m.p. 95°.  $[\alpha]_D - 22.8^\circ$  in  $\text{CHCl}_3$ .

3:5-Dinitrobenzoyl: m.p. 129°.  $[\alpha]_D^{20} - 22^\circ$  in  $\text{CHCl}_3$ .

*dl-Neo*-.

$n_D^{20} 1.4637$ .

*p-Nitrobenzoyl*: leaflets from EtOH. M.p. 91–2°.

3:5-Dinitrobenzoyl: leaflets from EtOH. M.p. 101°.

*l-Iso*-.

B.p. 106°/17 mm.  $D_4^{20} 0.9109$ .  $n_D^{14} 1.4683$ ,  $n_D^{20} 1.4662$ .  $[\alpha]_D^{15} - 17.72^\circ$ .  $\text{CrO}_3 \rightarrow$  *l*-isocarvomenthone.

*p-Nitrobenzoyl*: yellow needles. M.p. 64–5°.  $[\alpha]_D - 27.3^\circ$ .

3:5-Dinitrobenzoyl: yellow needles. M.p. 111°.  $[\alpha]_D - 26.7^\circ$ .

*dl*-Iso-

B.p. 110°/20 mm.  $D_4^{20}$  0.904.  $n_D^{18}$  1.4669.  
*p*-Nitrobenzoyl: yellow prisms. M.p. 85.5°.  
 3:5-Dinitrobenzoyl: leaflets. M.p. 94.5°.

*l*-Neo-iso-

$D_4^{20}$  0.9102.  $n_D^{20}$  1.4676.  $[\alpha]_D^{17}$  -34.7°.  
*p*-Nitrobenzoyl: needles. M.p. 54-5°.  $[\alpha]_D$   
 -23.7°.  
 3:5-Dinitrobenzoyl: yellow leaflets. M.p.  
 71-2°.  $[\alpha]_D$  -16°.

Johnston, Read, *J. Chem. Soc.*, 1935,  
 1138.

McNiven, Read, *J. Chem. Soc.*, 1952, 159.

**tert.-Carvomenthol.**

See *p*-Menthanol-1.

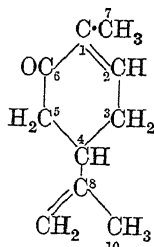
**Carvomenthone.**

See *p*-Menthanone-2.

**Carvomenthone-6-carboxylic Acid.**

See *p*-2-Menthanone-6-carboxylic Acid.

**Carvone** ( $\Delta^1, 8$ -*p*-Menthadienone-6, *carvol*)



$C_{10}H_{14}O$

MW, 150

*d*-

Constituent of dill and caraway oils. B.p.  
 230° (227-8°, 225°), 104°/11 mm. Very sol.  
 EtOH. Sol. EtOH.Aq. Sol. to 0-13% in boil-  
 ing  $H_2O$ .  $D_4^{20}$  0.9608.  $n_D^{18}$  1.49994.  $[\alpha]_D^{20}$  +69.1°  
 (61.7°).  $[\alpha]_{D_{461}}^{20}$  +71.7°.

*Oxime*: *d*-carvoxime. Two forms.  $\alpha$ -. Leaf-  
 lets from EtOH. M.p. 72°.  $[\alpha]_D^{17}$  +39.71° in  
 EtOH. Volatile in steam. *Acetyl*: needles  
 from EtOH. M.p. 63-4°. B.p. 156-61°/17  
 mm. Insol.  $H_2O$ .  $[\alpha]_D^{20}$  +43° in  $C_6H_6$ .  $\beta$ -  
 M.p. 56-7°. Levorotatory in EtOH.

*Semicarbazone*: two forms. (1) M.p. 162-3°.  
 $[\alpha]_D^{16}$  +151.7° in MeOH. (2) M.p. 141-2°.  
 $[\alpha]_D^{20}$  +113.3° in Py. At 175° or by boiling  
 in solvents  $\rightarrow$  (1) form.

*Phenylsemicarbazone*: needles. M.p. 176-  
 7°.

*Phenylhydrazone*: m.p. 109-10° (106°).

*m*-Nitrophenylhydrazone: orange-red needles  
 from MeOH.Aq. M.p. 105-6°.

*p*-Nitrophenylhydrazone: reddish-brown  
 needles. M.p. 174.5°.

2:4-Dinitrophenylhydrazone: m.p. 189°.

*m*-Nitrobenzoylhydrazone: m.p. 162-3°.

$\beta$ -Naphthylhydrazone: needles from EtOH.  
 M.p. 147°.

*Nitroschloride*: m.p. 105-5.5°  $[\alpha]_D^{20}$  -236.2°  
 in  $CHCl_3$ .

*l*-

Constituent of spearmint and kuromoji oils.  
 B.p. 231° (228°), 97-8°/9 mm.  $D_{15}^{15}$  0.9652.  $n_D^{20}$   
 1.4988.  $[\alpha]_D$  -62.46°.

*Oxime*: 1-carvoxime. Two forms.  $\alpha$ -. M.p.  
 72°.  $[\alpha]_D^{18}$  -39.34° in EtOH. Volatile in  
 steam.  $\beta$ -. Needles from EtOH.Aq. M.p. 57-  
 8°.  $[\alpha]_D$  +68.3° in  $C_6H_6$ .

*Semicarbazone*: m.p. 162-3°.

*dl*-

B.p. 231°, 85°/5 mm.  $D_{15}^{15}$  0.9645.  $n_D^{20}$  1.5003.  
 Catalytic red.  $\rightarrow$  carvotanacetone.

*Oxime*: *dl*-carvoxime. M.p. 93-4°.

*Semicarbazone*: m.p. 154-6°.

Wallach, Lohr, Lipczynski, *Ann.*, 1899,  
 305, 224.

Doeuvre, *Bull. soc. chim.*, 1934, 1, 198.

Challenger, *Industrial Chemist*, 1928, 4,  
 315, (*Bibl.*).

Naves, Bachmann, *Helv. Chim. Acta*,  
 1946, 29, 61.

**Carvone Hydrate.**

See  $\Delta^1, 8$ -*p*-Menthenolone-6.

**Carvopinone.**

See Pinocarvone.

**Carvotanacetol.**

See  $\Delta^6, p$ -Menthenol-2.

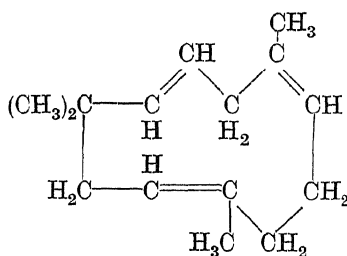
**Carvotanacetone.**

See  $\Delta^1, p$ -Menthenone-6.

**Carvoxime.**

See under Carvone.

$\alpha$ -Caryophyllene (*Didymocarpine*, *humulene*)



Suggested structure

$C_{15}H_{24}$

MW, 204

Constituent of clove and hop oil and oil of  
*Didymocarpus pedicellata*. B.p. 147-8°/12 mm.,  
 118-19°/10 mm.  $D_4^{24}$  0.8957,  $D_{20}^{20}$  0.8933.  $n_D^{29}$   
 1.4988,  $n_D^{20}$  1.5001.  $[\alpha]_D^{25}$  -3.7° in EtOH  
 (+1.7°).

*Nitroschloride*: m.p. 177° decomp.

*Nitrosite*: blue cryst. from  $CHCl_3$ -EtOH.  
 M.p. 116°. Benzylamine  $\rightarrow$  *nitrolbenzyl-*  
*amine deriv.*: m.p. 136°. Piperidine  $\rightarrow$  *nitrol-*  
*piperidide*: m.p. 153°.

*Nitrosate*: m.p. 161°.



“Nitroso bisnitrosite”: blue rods. M.p. 132–4°.

Chapman, *J. Chem. Soc.*, 1928, 785; 1929, 359.

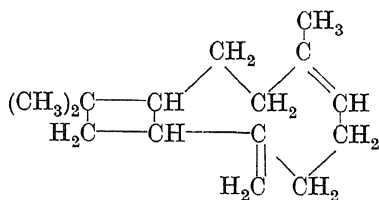
Deussen, *J. prakt. Chem.*, 1936, 145, 31.

Warsi, Siddiqui, *J. Indian Chem. Soc.*, 1939, 16, 423.

Klein, Lahey, *Chemistry and Industry*, 1951, 760.

Clemo, Harris, *J. Chem. Soc.*, 1950, 21; 1952, 665.

β-Caryophyllene



Suggested structure

C<sub>15</sub>H<sub>24</sub> MW, 204

Constituent of clove, cinnamon, pimento, copaiba etc., oils. B.p. 118–19°/9.7 mm. D<sub>4</sub><sup>17</sup> 0.9052. n<sub>D</sub><sup>17</sup> 1.5009.

Nitroschloride: m.p. 159°. decomp. [α]<sub>D</sub><sup>17</sup> –98.1° in C<sub>6</sub>H<sub>6</sub>.

Nitrosite: two forms. (1) Blue needles. M.p. 113°. [α]<sub>D</sub><sup>22</sup> +1880° in C<sub>6</sub>H<sub>6</sub>. (2) White needles from pet. ether. M.p. 139–139.5° decomp. [α]<sub>D</sub><sup>18</sup> +120° in C<sub>6</sub>H<sub>6</sub>.

Maleic anhydride add. comp.: colourless needles, m.p. 98°. [α]<sub>D</sub> +53.35° in CHCl<sub>3</sub>.

Ruzicka, Huber, Plattner, Deshapande, Studer, *Helv. Chim. Acta*, 1939, 22, 716.

Ramage, Simonsen, *J. Soc. Chem. Ind.*, 1939, 58, 447.

Ramage, Simonsen, *J. Chem. Soc.*, 1938, 1208; 1937, 73.

Ruzicka, Zimmermann, Huber, *Helv. Chim. Acta*, 1936, 19, 343.

Duessen, *J. prakt. Chem.*, 1936, 145, 31.

Rydon, *Chemistry and Industry*, 1938, 57, 123.

Naves, Perrottet, *Helv. Chim. Acta*, 1941, 74, 789.

Šorm, Dolejš, Pliva, *Collection Czechoslovak Chemical Communications*, 1950, 15, 186.

Dawson, Ramage, Wilson, *Chemistry and Industry*, 1951, 46.

Barton, Lindsey, *ibid.*, 313.

Barton, Bruun, Lindsey, *ibid.*, 910; 1952, 691.

Dawson, Ramage, Whitehead, *Chemistry and Industry*, 1952, 450.

γ-Caryophyllene (Isocaryophyllene)

C<sub>15</sub>H<sub>24</sub> MW, 204

Occurs with β-caryophyllene. B.p. 125°/14.5 mm. D<sub>4</sub><sup>19</sup> 0.89941. n<sub>D</sub><sup>19</sup> 1.49665. [α]<sub>D</sub><sup>19</sup> –26.2°.

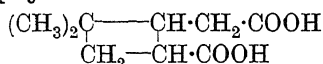
Nitroschloride: two forms. (1) Needles from Me<sub>2</sub>CO–EtOH. M.p. 123–4° decomp. [α]<sub>D</sub><sup>21</sup> +14.7° in CHCl<sub>3</sub>. Benzylamine → nitrolbenzylamine deriv.: m.p. 172–3°. (2) M.p. 147–8° decomp. [α]<sub>D</sub><sup>18</sup> –33.7° in CHCl<sub>3</sub>. Benzylamine → nitrolbenzylamine deriv.: m.p. 172–3°.

Ramage, Simonsen, *J. Chem. Soc.*, 1938, 1208.

Dawson, Ramage, Whitehead, *Chemistry and Industry*, 1952, 450.

Barton, Bruun, Lindsey, *ibid.*, 691.

Caryophyllenic Acid



C<sub>9</sub>H<sub>14</sub>O<sub>4</sub> MW, 186

Degradation product of γ-caryophyllene.

Cis-

Glassy prisms from H<sub>2</sub>O, needles from cyclohexane. M.p. 77–8° (78–9°, 80–81°). More readily sol. than trans form in org. solvents. [α]<sub>D</sub><sup>15,461</sup> –7.4° in CHCl<sub>3</sub>, [α]<sub>D</sub><sup>21</sup> –45.3° in C<sub>6</sub>H<sub>6</sub>.

Di-Me ester: b.p. 85°/0.5 mm. n<sub>D</sub><sup>20</sup> 1.4465 [α]<sub>D</sub><sup>20</sup> –36.3° in C<sub>6</sub>H<sub>6</sub>.

Dianilide: needles from EtOH.Aq. M.p. 198–9°. [α]<sub>D</sub><sup>20</sup> –161° in CHCl<sub>3</sub>.

Anhydride: b.p. 157–8°/12 mm.

Trans-

Cryst. from cyclohexane in rosettes of fine needles M.p. 81–2° sintering at 76°. Very sol. H<sub>2</sub>O and most org. solvents except ligroin and cyclohexane. [α]<sub>D</sub><sup>15,461</sup> +13.56°, [α]<sub>D</sub><sup>14</sup> +35.3° in C<sub>6</sub>H<sub>6</sub>.

Mono-Me ester: b.p. 130–4°/0.4 mm.

Di-Me ester: b.p. 119–119.5°/12 mm., 85°/0.5 mm. D<sub>4</sub><sup>23</sup> 1.041. n<sub>D</sub><sup>23</sup> 1.4439, n<sub>D</sub><sup>20</sup> 1.4442 [α]<sub>D</sub><sup>22</sup> +44.5° in MeOH, [α]<sub>D</sub><sup>20</sup> +47.9°.

Di-p-phenylphenacyl ester: balls of needles from EtOH. M.p. 121–2° with softening at 117°.

Dianilide: plates from cyclohexanone. M.p. 282°. Very spar. sol. EtOH, Me<sub>2</sub>CO. [α]<sub>D</sub><sup>21,5</sup> 22° in Py.

Chloride: b.p. 99–100°/12 mm.

Ramage, Simonsen, *J. Chem. Soc.*, 1936, 741.

Ruzicka, Plattner, Werner, *Helv. Chim. Acta*, 1943, 26, 966.

Deussen, *J. prakt. Chem.*, 1936, 145, 131.

Ruzicka, Zimmermann, *Helv. Chim. Acta*, 1935, 18, 219.

Dawson, Ramage, *J. Chem. Soc.*, 1950, 3523.

Campbell, Rydon, *Chemistry and Industry*, 1951, 16, 312.

Caryophyllenol

C<sub>15</sub>H<sub>24</sub>O MW, 220

B.p. 157–9°/20 mm. D<sub>15</sub> 0.880. n<sub>D</sub><sup>15</sup> 1.5173. [α]<sub>D</sub><sup>15</sup> –14.5°.

*Acetyl*: b.p. 170–80° 20 mm.  $D^{25}$  1.031.  
 $n_D$  1.509.

Treibs, *Ber.*, 1938, 71, 1794.

### Caryophyllin.

See Oleanolic Acid.

### Casein.

See Caseinogen.

### Caseinogen (Casein)

Nomenclature note: *In Britain* caseinogen is employed for principal protein of milk and casein for the sol. compound obtained from this by the action of rennin in absence of Ca ions. *In U.S.A.* the milk protein is designated casein and the sol. compound mentioned above is termed paracasein.

Phosphoprotein. Principal albumenoid of milk of mammalia, probably present as K salt. Cow's milk contains about 3%. Chief constituent of cheese. Caseinogens from different sources show some difference in properties. White, amorphous, tasteless and odourless powder. Per cent. composition, C, 53.13, H, 7.06, O, 22.40, N, 15.78, S, 0.77, P, 0.86. Very spar. sol.  $H_2O$ . Insol. EtOH,  $Et_2O$ . Sol. alkalis and min. acids. Freshly pptd caseinogen is isoelectric at pH 4.6, but dissolves readily at higher or lower values of pH. Not coagulated by heating. On drying, caseinogen undergoes some change which reduces its solubility in acids. Caseinogen is pptd when solutions are saturated with NaCl or  $MgSO_4$  or half-saturated with  $(NH_4)_2SO_4$ . Forms a clot when acted upon by the enzyme rennin in presence of soluble Ca salts, due to (1) conversion of caseinogen to soluble casein (probably hydrolytic), (2) formation of insol. Ca caseinate. Osmotic pressure determination in phenol indicates mol. wt. of 25,000. Believed to consist of complex aggregates, which, under the action of certain solvents, dissociate to less complex fractions of variable mol. wt.  $[\alpha]_{546}^{20} - 105.1^\circ$  in  $H_2O$ .

For amino-acid content see Shore, Jordan Lloyd, *Chemistry of the Proteins*, 1938.

Foreman, *Biochem. J.*, 1919, 13, 378.

Carpenter, *J. Am. Chem. Soc.*, 1931, 53, 1812.

Cohn, Hendry, *Organic Syntheses*, 1930, X, 16.

Richardson, Palmer, *J. Phys. Chem.*, 1929, 33, 557.

Troensegaard, Mygind, *Z. physiol. Chem.*, 1929, 184, 147.

### Cassaidine

$C_{24}H_{41}O_4N$  MW, 407

Alkaloid accompanying cassaine in bark of *Erythrophleum guineense*, G. Don. Cryst. from  $Me_2CO-Et_2O$ . M.p. 139.5°.  $[\alpha]_D^{20} - 98^\circ$  in EtOH.

*B.HCl*: needles from  $Et_2O-EtOH$ . M.p. 251° in high vac.

*B.H\_2SO\_4*: cryst. from EtOH- $Et_2O$ . M.p. 228° in high vac.

Ruzicka, Dalma, *Helv. Chim. Acta*, 1940, 23, 753.

### Cassaine

$C_{24}H_{39}O_4N$  MW, 405

Alkaloid isolated from bark of *Erythrophleum guineense*, G. Don. White leaflets from  $H_2O$ . M.p. 142.5°. B.p. 405°. Sol. EtOH,  $Et_2O$ ,  $Me_2CO$ , AcOEt,  $C_6H_6$ ,  $CHCl_3$ . Almost insol.  $H_2O$ , pet. ether.  $[\alpha]_D^{20} - 103^\circ$  in EtOH,  $-117^\circ$  in 0.1N HCl. Possesses heart stimulating properties and is strong antiseptic. Conc.  $H_2SO_4$   $\rightarrow$  yellow col. Molybdeno-sulphuric acid  $\rightarrow$  pale brown col.

*O-Mono-acetyl*: needles from  $Et_2O$ . M.p. 123–4°.

*Monoxime*: cryst. from  $Et_2O$ . M.p. 123–5°.

*B.HCl.H\_2O*: white cryst. powder from EtOH- $Et_2O$ . M.p. 212–13°.

Dalma, *Helv. Chim. Acta*, 1939, 22, 1497.

### Cassainic Acid

$C_{20}H_{30}O_4$  MW, 334

Degradation product of cassaine, coumagine and coumingidine. Cryst. from  $Me_2CO.Aq.$  or  $Et_2O$ . M.p. 223–4°.  $[\alpha]_D^{20} - 111.6^\circ$  in  $Me_2CO$ ,  $[\alpha]_D^{20} - 123^\circ$  ( $-126.3^\circ$ ) in EtOH.

*Me ester*: cryst. from MeOH.Aq. or  $Et_2O$ . M.p. 188–9° (185°).  $[\alpha]_D^{20} - 124^\circ$  in EtOH.

*Acetyl*: cryst. from MeOH.Aq. M.p. 150°.

*Semicarbazone*: m.p. 246–7°.

Faltis, Holzinger, *Ber.*, 1939, 72, 1443.

Dalma et al., *Helv. Chim. Acta*, 1939, 22, 1497; 1941, 24, 63.

Schlittler, *Helv. Chim. Acta*, 1941, 24, 319E.

### Cassanic Acid

$C_{20}H_{34}O_2$  MW, 306

Degradation product of coumagine. Cryst. from  $Et_2O$ -hexane. M.p. 224°.  $[\alpha]_D^{20} + 3^\circ$  in  $CHCl_3$ . Se  $\rightarrow$  1:7:8-trimethylphenanthrene.

*Me ester*: cryst. from MeOH.Aq. M.p. 44°.  $[\alpha]_D^{20} + 4^\circ$  in EtOH.

Ruzicka, Dalma, Scott, *Helv. Chim. Acta*, 1941, 24, 179E.

Ruzicka, Engel, Ronco, Berse, *Helv. Chim. Acta*, 1945, 28, 1038.

### Castanogenin

$C_{28}H_{42}(OH)_2(COOH)_2$

$C_{30}H_{46}O_6$  MW, 502

Sapogenin of *Castanospermum australe*. Prisms from MeOH. Needles from EtOH, dioxan or  $Et_2O$ . M.p. 380–2°.  $[\alpha]_D^{23} + 107^\circ$  in EtOH.

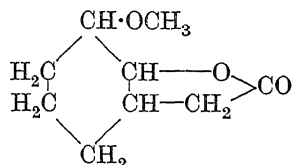
*Di-Me ester*: plates from MeOH. M.p. 224–5°.  $[\alpha]_D^{25} + 80^\circ \pm 4^\circ$  in  $\text{CHCl}_3$ . Sol. MeOH, EtOH, dioxan, Et<sub>2</sub>O.  $\text{C}(\text{NO}_2)_4 \rightarrow$  yellow col.

*Diacetyl deriv.*: plates from MeOH. M.p. 238.5–239°.  $[\alpha]_D^{25} + 90^\circ \pm 3^\circ$  in  $\text{CHCl}_3$ .

*Diacetyl deriv.*: plates from MeOH. M.p. 239–40°.  $[\alpha]_D^{25} + 75^\circ \pm 2^\circ$  in  $\text{CHCl}_3$ .

Simes, *J. Chem. Soc.*, 1950, 2868.

## Castelamarin



Suggested structure

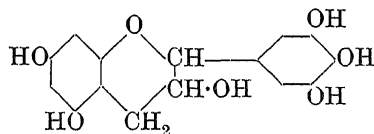
$\text{C}_9\text{H}_{14}\text{O}_2$  MW, 154

Isolated from *Castela Nicholsoni*. Cryst. from EtOH.Aq. M.p. 265–7°. Readily sol. dil. NaOH. Deep blue col. with conc.  $\text{H}_2\text{SO}_4$ .

Bosman, *J. Chem. Soc.*, 1923, 208.

Paranjape, Phalnikar, Nargund, *Chem. Abstracts*, 1945, 39, 2288.

## Casuarin



Suggested structure

$\text{C}_{15}\text{H}_{14}\text{O}_7$  MW, 306

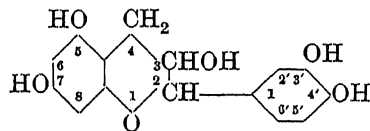
Found in the bark of *Casuarina equisetifolia*, Linn. Colourless needles. M.p. 181–3°.  $[\alpha]_D^{25} + 19.7^\circ$  in  $\text{Me}_2\text{CO}$ .

*Hexa-acetyl*: prisms. M.p. 127–8°.  $[\alpha]_D^{25} + 34.3^\circ$  in  $\text{Me}_2\text{CO}$ .

*Penta-Me ether*: needles. M.p. 156–8°.  $[\alpha]_D^{25} + 29.2^\circ$  in  $\text{Me}_2\text{CO}$ .

Osima, *Chem. Abstracts*, 1940, 34, 283.

**Catechin** (3 : 5 : 7 : 3' : 4' - *Pentahydroxy-flavan*)



$\text{C}_{15}\text{H}_{14}\text{O}_6$  MW, 290

Constituent of catechu (gambier, cutch), etc. Occurs in six isomeric forms.

*Cis*:

*d.*

Needles +  $4\text{H}_2\text{O}$ . M.p. 96°, anhyd. 177°. Sol. EtOH, hot  $\text{H}_2\text{O}$ .  $\text{FeCl}_3 \rightarrow$  dark green col. KOH fusion  $\rightarrow$  phloroglucinol + protocatechuic acid.  $[\alpha]_{5780} + 17.1^\circ$  in  $\text{Me}_2\text{CO}$ .

5 : 7 : 3' : 4' - *Tetra-Me ether*:  $\text{C}_{19}\text{H}_{22}\text{O}_6$ . MW, 346. Needles from EtOH. M.p. 144–6°.  $[\alpha]_{5780} - 13.4^\circ$ . 3-*Acetyl*: needles from EtOH.Aq. M.p. 95–6°.  $[\alpha]_{5780} + 6.8^\circ$ .

*Penta-Me ether*:  $\text{C}_{20}\text{H}_{24}\text{O}_6$ . MW, 360. Needles from EtOH. M.p. 95°.  $[\alpha]_{5780} + 8.3^\circ$ .

*Penta-acetyl*: cryst. from EtOH. M.p. 131–2°.  $[\alpha]_{5780} + 40.6^\circ$ .

*Penta-benzoyl*: needles. M.p. 170–2°.  $[\alpha]_{5780} + 56.7^\circ$ .

Clauser, *Ber.*, 1903, 37, 102.

Freudenberg, Purmann, *Ann.*, 1924, 437, 276.

*l.*

Same constants as those of *d*-form.  $[\alpha]_{5780} - 16.8^\circ$  in  $\text{Me}_2\text{CO}$ .Aq. Optically inactive in 96% EtOH.

*Tetra-Me ether*: m.p. 144–6°.  $[\alpha]_{5780} + 13.9^\circ$ .

3-*Acetyl*: m.p. 95–6°.  $[\alpha]_{5780} - 6.6^\circ$ .

*Penta-Me ether*: m.p. 95°.  $[\alpha]_{5780} - 7.9^\circ$ .

*Penta-acetyl*: m.p. 131–2°.  $[\alpha]_{5780} - 40.3^\circ$ .

*Penta-benzoyl*: m.p. 170–2°.  $[\alpha]_{5780} - 56.3^\circ$ .

Freudenberg, Purmann, *Ann.*, 1924, 437, 276.

*dl.*

Cryst. +  $3\text{H}_2\text{O}$ . M.p. 212–14°.

*Tetra-Me ether*: m.p. 142°. 3-*Acetyl*: needles from EtOH. M.p. 135–7°.

*Penta-Me ether*: m.p. 110–11°.

*Penta-acetyl*: needles from  $\text{Me}_2\text{CO}$ -EtOH. M.p. 164–5°.

*Penta-benzoyl*: needles. M.p. 181–3°.

Freudenberg, Purmann, *Ann.*, 1924, 437, 276.

*Trans* (Epicatechin):

*d.*

Cryst. +  $4\text{H}_2\text{O}$ . M.p. 235–7° (245° decomp.).  $[\alpha]_{5780} + 68.9^\circ$  in 96% EtOH, + 59.9° in  $\text{Me}_2\text{CO}$ .Aq.

*Tetra-Me ether*: m.p. 153–4°.  $[\alpha]_{5780} + 61.5^\circ$ .

3-*Acetyl*: m.p. 91–2°.  $[\alpha]_{5780} + 71.6^\circ$ .

*Penta-acetyl*: m.p. 151–2°.  $[\alpha]_{5780} + 15.5^\circ$ .

Freudenberg, Purmann, *Ann.*, 1924, 437, 276.

*l.*

Occurs in Formosan tea leaves. M.p. 242°.  $[\alpha]_{5780} - 68.2^\circ$  in 96% EtOH, - 59.0° in  $\text{Me}_2\text{CO}$ .Aq.

5 : 7 : 3' : 4' - *Tetra-Me ether*: needles from  $\text{Me}_2\text{CO}$ . M.p. 153–4°.  $[\alpha]_{5780} - 61.5^\circ$ .

3-*Acetyl*: m.p. 91–2°.  $[\alpha]_{5780} - 71.2^\circ$ .

*Penta-Me ether*: m.p. 93–4°.  $[\alpha]_{5780} - 93.8^\circ$ .

*Penta-acetyl*: m.p. 151–2°.  $[\alpha]_{5780} - 14.9^\circ$ .

Oshima, *Chem. Abstracts*, 1937, 31, 1902.

*dl.*

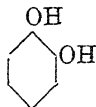
Prisms +  $4\text{H}_2\text{O}$  or needles +  $1\text{H}_2\text{O}$ . M.p. 224–6°.

*Tetra-Me ether*: m.p. 141–2°. 3-*Acetyl*: m.p. 160–1°.

*Penta-acetyl*: m.p. 109°.

Nierenstein, *Chemistry and Industry*, 1936, 1007.

**Catechol** (*Pyrocatechol*, 1 : 2 - *dihydroxybenzene*)



$C_6H_6O_2$

MW, 110

Colourless cryst. M.p. 105°. B.p. 240°. Sol.  $H_2O$ , EtOH,  $Et_2O$ ,  $C_6H_6$ , alkalis. Sublimes. Volatile in steam. Heat of comb.  $C_v$  684.9 Cal.  $k = 3.3 \times 10^{-10}$  at 18°. Sols. turn brown in air. Reduces  $NH_3 \cdot AgNO_3$  and Fehling's.  $Ag_2O$  in  $Et_2O \rightarrow o$ -benzoquinone. Forms add. products with  $CH_3NH_2$  and  $NH(CH_3)_2$ . Combines with boric acid to give catechol-boric acid which forms a series of well-defined salts.

*Acetyl*: m.p. 57-8°. B.p. 189-91°/102 mm.  $FeCl_3 \rightarrow$  green col. *Benzoyl*: m.p. 78°.

*Diacetyl*: needles. M.p. 63.5°. Insol.  $H_2O$ .

*Benzoyl*: needles. M.p. 131°.

*Dibenzoyl*: m.p. 84°.

*Mono-p-nitrobenzoyl*: m.p. 151-2°.

*Di-p-nitrobenzoyl*: m.p. 169° (162-5°).

*Me ether*: see Guaiacol.

*Di-Me ether*: see Veratrol.

*Et ether*: guäthol.  $C_8H_{10}O_2$  MW, 138. M.p. 29°. B.p. 217°. *Benzoyl*. m.p. 31°.

*1-Me*: 2-*Et ether*: see under Guaiacol.

*Di-Et ether*:  $C_{10}H_{14}O_2$ . MW, 166. M.p. 43-5°.

*Propyl ether*:  $C_9H_{12}O_2$ . MW, 152. B.p. 223-6°.

*n-Butyl ether*:  $C_{10}H_{14}O_2$ . MW, 166. B.p. 231-4°.

*Isoamyl ether*:  $C_{11}H_{16}O_2$ . MW, 180. B.p. 245-8°.

*Methylene ether*: benzodioxole, methylenedioxybenzene.  $C_7H_6O_2$ . MW, 122. B.p. 172-3°.  $D_4^{20}$  1.0640. Insol. acids.

*Ethylene ether*: see 1 : 4-Benzodioxan.

*Phenyl ether*: see 2-Hydroxydiphenyl Ether.

*Phenacyl ether*: see *o*-Hydroxyphenyl phenacyl Ether.

*Picrate*: orange needles. M.p. 122°.

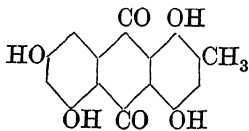
Green, *J. Chem. Soc.*, 1927, 500.

Dakin, *Organic Syntheses*, Collective Vol. I, 143.

### Catechol-4-carboxylic Acid.

See Protocatechuic Acid.

**Catenarin** (1 : 4 : 5 : 7-Tetrahydroxy-2-methyl-anthraquinone)



$C_{15}H_{10}O_6$

MW, 286

Isolated from *Helminthosporium gramineum*, Rabenhorst, and *H. catenarium*, Dreschler. Red plates from EtOH. M.p. 246°.

*7-Me ether*: erythroglaucin. Isolated from *Aspergillus ruber*. Red plates from AcOH. M.p. 205-6°. *Triacetyl*: yellow rods from EtOH. M.p. 230-1°.

*Tetra-Me ether*: yellow leaflets from  $Me_2CO$ . M.p. 190-1°.  $H_2SO_4 \rightarrow$  blue sol.

*Tetra-acetyl*: yellow rods from AcOH. M.p. 234-5°.

Anslow, Raistrick, *Biochem. J.*, 1941, 35, 1006

Raistrick, Robinson, Todd, *Biochem. J.*, 1934, 28, 559.

### Cathine.

See Nor- $\psi$ -ephedrine.

### Caticvic Acid

$C_{20}H_{34}O_2$

MW, 306

Main constituent of resin from *Prioria copanifera*, Griseb. Colourless viscous oil. B.p. 194-5°/1 mm.  $D^{23}_D$  0.9987.  $n^{24}_D$  1.5090. Sol. MeOH, EtOH,  $Et_2O$ ,  $Me_2CO$ , AcOEt. Insol.  $H_2O$ . Conc.  $H_2SO_4 + CHCl_3$  in AcOH  $\rightarrow$  red col.

*Me ester*:  $C_{21}H_{36}O_2$ . MW, 320. B.p. 200°/1 mm.  $D^{21}_D$  0.985.  $n$  1.4967.

*Et ester*:  $C_{22}H_{38}O_2$ . MW, 334. B.p. 206°/2.5 mm.  $D^{21}_D$  0.980.  $n$  1.4910.

*Butyl ester*:  $C_{24}H_{42}O_2$ . MW, 362. B.p. 208°/2.75 mm.  $D^{21}_D$  0.965.  $n$  1.4890.

*Isoamyl ester*:  $C_{25}H_{44}O_2$ . MW, 376. B.p. 221°/3.5 mm.  $D^{21}_D$  0.953.

Kalman, *J. Am. Chem. Soc.*, 1938, 60, 1423.

### Catuabob

$C_{25}H_{40}O$

MW, 236

Occurs in the bark of catuabach (*Trichilia* species). M.p. 200-1°. Very sol.  $CHCl_3$ ,  $C_6H_6$ , Py. Spar. sol. EtOH,  $Et_2O$ . Insol.  $H_2O$ .  $[\alpha]^{25}_D$  88.4° in  $CHCl_3$ .

*Acetyl*: m.p. 242-3°.  $[\alpha]^{19}_D$  88.3° in  $CHCl_3$ .

*Benzoyl*: m.p. 235-6°  $[\alpha]^{19}_D$  99.4°.

Janot, Cionga, *Compt. rend.*, 1938, 207, 798.

### Caulophylline.

See under Cytisine.

### Ceanothic Acid

$C_{29}H_{44}O_5$

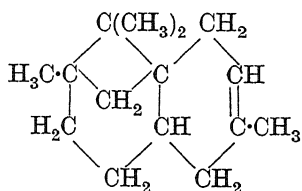
MW, 472

Dicarboxylic acid isolated from the root of *Ceanothus americanus* (Jersey Tea). Needles from  $Et_2O$ -petrol, or MeOH. M.p. 354° (339°).

*Di-Me ester*: cryst. from EtO-petrol. M.p. 223°. *Acetyl*: cryst. from pentane. M.p. 157°.

Julian, Pikel, Dawson, *J. Am. Chem. Soc.*, 1938, 60, 77.

**Cedrene**



Suggested structure

$C_{15}H_{24}$  MW, 204

Sesquiterpene from cedarwood oil. B.p. 262–3°, 124–6°/12 mm.  $D_{15}^{20}$  0.9359.  $n_D^{19}$  1.5001.  $[\alpha]_D - 52.6^\circ$ .

Ruzicka, van Melsen, *Ann.*, 1929, 471, 40.  
Blumann, Schulz, *Ber.*, 1931, 64, 1540.  
Treibs, *Ber.*, 1943, 76, 160.  
Naves, Papazian, Perrottet, *Helv. Chim. Acta*, 1943, 26, 302.

**Cedriret.**

See Cœrulignone.

**Cedrol (Cedrenol)**

$C_{15}H_{26}O$  MW, 222

Constituent of oleoresin of cypress and eastern red cedar (*Juniperus virginiana*, Linn.). Needles. M.p. 103.5–104° (87°). B.p. 290–4°, 150–5°/8 mm. Sol. EtOH. Very spar. sol.  $H_2O$ .  $[\alpha]_D$  (cypress) + 10° 5', (cedar) + 9° 31', in  $CHCl_3$ .

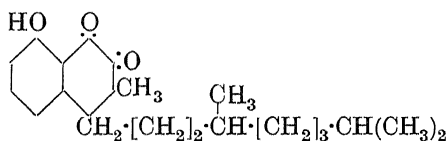
Also from *Dacrydium elatum*, Wall.  $[\alpha]_D$  + 8° 50' in xylene. *Phenylurethane*: m.p. 106–7°.

Etablissements A. Chiris, *Chem. Abstracts*, 1926, 20, 798.

Schimmel, *Chem. Zentr.*, 1904, II, 1469.

Ruzicka, Plattner, Kusserow, *Helv. Chim. Acta*, 1942, 25, 85.

**Celastrol (Tripterin)**



$C_{22}H_{30}O_3$  MW, 342

Isolated from the roots of *Celastrus scandens* and *Tripterium wilfordii*. Red cubes. M.p. 205° decomp. Sol. EtOH.

*Acetyl*: yellow. M.p. 241°.

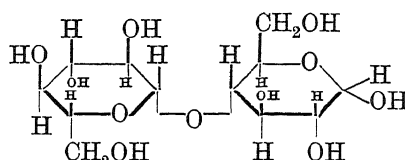
*Me ether*: orange needles. M.p. 218°.  
*Acetyl*: m.p. 132–3°.

Gisvold, *J. Am. Pharm. Assoc.*, 1939, 28, 440.

Schechter, Haller, *J. Am. Chem. Soc.*, 1942, 64, 182.

See also Bhargava, *Proc. Indian Acad. Sci.*, 1946, 24, 506, for another compound of this name.

**Cellobiose (Cellose, 4-[β-d-glucosido]-d-glucose)**



$C_{12}H_{22}O_{11}$  MW, 342

Microcryst. powder. Darkens at 180°, decomp. at 225°. Sol.  $H_2O$ . Prac. insol. EtOH, Et<sub>2</sub>O. Exhibits mutarotation.  $[\alpha]_D$  + 24.4° (initial) → + 35.2° (final) in  $H_2O$ . Heat of comb. 1350 Cal. Reduces Fehling's. Min. acids → *d*-glucose.  $HNO_3$  → saccharic acid. Unfermented by yeast, maltase or invertase. Emulsin → glucose.

*α-Me-cellobioside*:  $C_{13}H_{24}O_{11}$ . MW, 356. M.p. 144–5°.  $[\alpha]_D^{20}$  + 96.8° in  $CHCl_3$ .

*β-Me-cellobioside*:  $C_{13}H_{24}O_{11}$ . MW, 356. M.p. 193°.  $[\alpha]_D^{15}$  - 19.1° in  $H_2O$ .

*Hexa-Me ether*:  $C_{18}H_{34}O_{11}$ . MW, 426. M.p. 83–4°.  $[\alpha]_D^{18}$  - 7.7° in  $H_2O$ .

*Hepta-Me ether*:  $C_{19}H_{36}O_{11}$ . MW, 440. M.p. 86° (105–10°). B.p. 190–5°/0.4 mm.  $[\alpha]_{15780}^{18}$  - 15.5° in  $H_2O$  ( $[\alpha]_{15780}$  + 53° (initial) → + 40° (final)). *β-Me-cellobioside*: m.p. 86°.  $[\alpha]_D^{19}$  - 15.7° in  $H_2O$ , - 14.6° in  $CHCl_3$ , - 12.7° in  $C_6H_6$ .

*Hepta-Et ether Et-cellobioside*: m.p. 64–6°. B.p. 185–90°/0.5 mm.

*Hepta-acetyl deriv.*: m.p. 204°.  $[\alpha]_D$  - 2.4° (initial) → + 22.6° (final) in  $CHCl_3$ . Sol. MeOH, Me<sub>2</sub>CO,  $CHCl_3$ . Insol. pet. ether. *β-Me-cellobioside*: m.p. 187°.  $[\alpha]_D$  - 25° in  $CHCl_3$ . *α-Et-cellobioside*: m.p. 175°.  $[\alpha]_D$  + 57.2° in  $CHCl_3$ . *α-Isopropylcellobioside*: m.p. 209°.  $[\alpha]_D^{19}$  + 60.8° in  $CHCl_3$ . *Semicarbazone*: m.p. 207–8°.  $[\alpha]_D^{27}$  - 21° in  $CHCl_3$ . *β-Benzoyl deriv.*: m.p. 210°.  $[\alpha]_D^{20}$  - 30.5° in  $CHCl_3$ .

*α-Octa-acetyl deriv.*: m.p. 229.5°.  $[\alpha]_D^{20}$  + 42° in  $CHCl_3$ .

*β-Octa-acetyl deriv.*: m.p. 192° (202°).  $[\alpha]_D^{20}$  - 14.5° in  $CHCl_3$ .

*Hepta-benzoyl deriv.*: m.p. 202–4°.

*Oxime*: m.p. 123–5°.  $[\alpha]_D^{22}$  - 26.1°.

*Semicarbazone*: m.p. 183–5°.  $[\alpha]_D$  - 7.8° (initial) → - 5.2° (final) in  $H_2O$ .

*Thiosemicarbazone*: decomp. at 170°.

*Osazone*: yellow needles. M.p. 208–10° (198–200°).  $[\alpha]_D^{18}$  - 6.5°. *Hepta-acetate*: m.p. 90°.  $[\alpha]_D^{18}$  - 37° in  $CHCl_3$ .

Braun, *Organic Syntheses*, 1937, XVII, 34, 36.

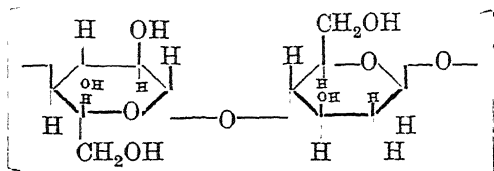
Hess, Dziengel, *Ber.*, 1935, 68, 1594.

Haworth, Long, Plant, *J. Chem. Soc.*, 1927, 2809.

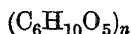
Gilbert, Smith, Stacey, *J. Chem. Soc.*, 1946, 622

**Cellulose.**

See Cellobiose.

**Cellulose**

Unit of structure (chain length unknown).



Chief constituent of the cellular tissue or fibre of plants. Cotton is the purest natural form and contains about 90%. Flax, hemp, ramie, etc., are less pure forms. Present in wood and straw (30–40%). The action of 17–18% NaOH distinguishes three celluloses, viz.  $\alpha$ -cellulose (insol),  $\beta$ -cellulose (sol. and re-pptd. by acids), and  $\gamma$ -cellulose (permanently sol.).  $\alpha$ -Cellulose is that normally referred to as pure cellulose. It is insol. in all ord. org. solvents, but dissolves in cold 70%  $H_2SO_4$  (re-pptd on dilution  $\rightarrow$  hydrocellulose), conc.  $ZnCl_2$ .Aq., ammoniacal copper hydroxide sol. (Schweizer's reagent), and in  $NaOH + CS_2$  (forms sodium xanthogenate). Does not react with phenylhydrazine or hydroxylamine.  $O_3$ ,  $HClO$ ,  $HNO_3$ ,  $H_2O_2$ ,  $CrO_3$ ,  $KMnO_4$ , etc.,  $\rightarrow$  oxycellulose.  $HBr$  in  $Et_2O$  or  $CHCl_3$   $\rightarrow$  bromomethylfurfural. Conc. min. acids  $\rightarrow$  glucose. Dil. aq. acids have no action in the cold. Viscosity measurements in Schweizer's reagent  $\rightarrow$  MW, 120,000 (on N free cotton). Osmotic pressure measurements  $\rightarrow$  MW, 45–50,000. Ultracentrifuge  $\rightarrow$  MW about 40,000.

*Trinitrate*:  $[C_6H_7O_5(NO_2)_3]_n$ . Sol.  $Me_2CO$ ,  $AcOEt$ , amyl acetate. Insol.  $Et_2O$ ,  $EtOH$ . Used as artificial (Chardonnet) silk and to prepare lacquers, plastics, celluloid, etc.

*Tri-Me ether*:  $[C_6H_7O_5(CH_3)_3]_n$ . Insol.  $MeOH$ ,  $EtOH$ ,  $Me_2CO$ ,  $Et_2O$ , hot  $H_2O$ .  $[\alpha]_D^{16}$   $-10^\circ$  in  $CHCl_3$ ,  $-24^\circ$  in  $C_6H_6$  and  $-25^\circ$  in  $H_2O$ .

*Tri-Et ether*:  $[C_6H_7O_5(C_2H_5)_3]_n$ . Insol.  $H_2O$ .  $[\alpha]_D^{20}$   $+26.1^\circ$  in  $C_6H_6$ ,  $+24.4^\circ$  in  $CHCl_3$ .

*Tri-acetyl deriv.*:  $[C_6H_7O_5(C_2H_3O)_3]_n$ . Sol.  $CHCl_3$ ,  $C_2H_4Cl_2$ ,  $AcOH$ ,  $PhNO_2$ ,  $Py$ .  $[\alpha]_D$   $-22.5^\circ$  in  $CHCl_3$ . Cellulose acetate used as artificial silk (acetate rayon) and many other ethers and esters find commercial application.

Hess, *Die Chemie der Cellulose und ihrer Begleiter* (Leipzig, 1928).

Haworth, *Chemistry and Industry*, 1935, 859; 1939, 917.

Hess, Neumann, *Ber.*, 1937, 70, 728.

Freudenberg, *Ber.*, 1936, 69, 1627.

Staudinger *et al.*, *Ber.*, 1930, 63, 2308 (Review), 2317, 2331.

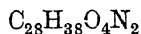
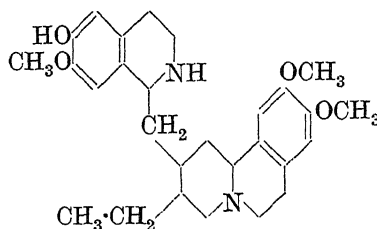
*Annual Reports on the Progress of Chemistry (Chemical Society)*, Hirst, Peat, 1936, 33, 256; 1935, 32, 284; 1934, 31, 188. Cox, 1939, 36, 271; 1937, 34, 189, (Reviews).

Leckzyek, *Ber.*, 1938, 71, 829.

Staudinger, *Zellstoff und Papier*, 1938, No. 8.

Steinmann, *Zellstoff und Papier*, 1939, 19, 123, 210, 329.

Staudinger, *Naturwissenschaften*, 1937, 42, 673.

**Cephæline (Cephaleine)**

MW, 466

Alkaloid of Ipecacuanha. Needles from  $Et_2O$ . M.p.  $107-8^\circ$ , anhyd.  $120-30^\circ$ . Sol.  $EtOH$ ,  $CHCl_3$ . Spar. sol.  $Et_2O$ . Insol.  $H_2O$ .  $[\alpha]_D$   $-43.4^\circ$  in  $CHCl_3$ ,  $-21.2^\circ$  in  $EtOH$ . Sol. alkalis.

*Dimethiodide*: m.p.  $225-8^\circ$ .

*Diacetyl deriv.*: m.p.  $116^\circ$ .

*Dibenzoyl deriv.*: m.p.  $128^\circ$ .

*Me ether*: see Emetine.

Brindley, Pyman, *J. Chem. Soc.*, 1927, 1067.

Späth, Leithe, *Ber.*, 1927, 60, 688.

Späth, Pailer, *Monatsh.*, 1948, 78, 348.

Pailer, *Monatsh.*, 1949, 79, 127.

Janot, *Bull. soc. chim.*, 1949, 185 (Bibl.).

Battersby, Openshaw, *J. Chem. Soc.*, 1949, *Suppl.*, 59.

**Cephalosporin P<sub>1</sub>.**

Antibiotic from *Cephalosporium* sp. Cryst. from  $MeOH$ .Aq. M.p.  $147^\circ$ . Sol. most org. solvents. Spar. sol. light petroleum,  $H_2O$ .  $[\alpha]_D$   $+28^\circ$ . Inactivated in aq. sol. at pH 8 (slowly), 9.6 (rapidly), and by penicillinase.

Burton, Abraham, *Biochem. J.*, 1952, 50, 168.

**Cephalosporin P<sub>2</sub>.**

Antibiotic from *Cephalosporium* sp. Cryst. from  $MeOH$ .Aq. M.p.  $151^\circ$ . Very sol.  $EtOH$ ,  $Me_2CO$ , butyl acetate. Spar. sol.  $C_6H_6$ , di-isopropyl ether. Inactivated by penicillinase.

Burton, Abraham, *Biochem. J.*, 1952, 50, 168.

**Cephalosporin P<sub>3</sub>.**

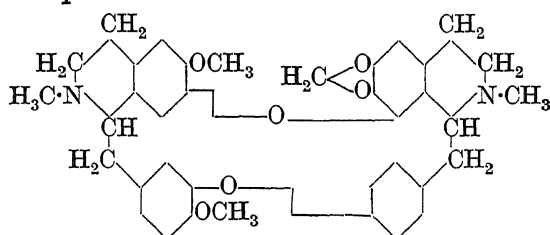
Antibiotic from *Cephalosporium* sp. Amorphous. Sol. most org. solvents. Insol. H<sub>2</sub>O. Inactivated by penicillinase.

Burton, Abraham, *Biochem. J.*, 1952, **50**, 168.

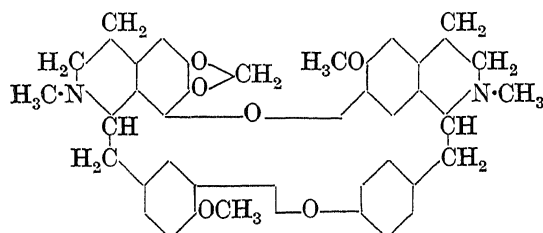
**Cephalosporin P<sub>4</sub>.**

Antibiotic from *Cephalosporium* sp. Fawn cryst. from MeOH.Aq. M.p. 220–30°. Sol. Me<sub>2</sub>CO. Spar. sol. Et<sub>2</sub>O, H<sub>2</sub>O. Inactivated by penicillinase.

Burton, Abraham, *Biochem. J.*, 1952, **50**, 168.

**Cepharanthine**

or



C<sub>37</sub>H<sub>38</sub>O<sub>6</sub>N<sub>2</sub> MW, 606

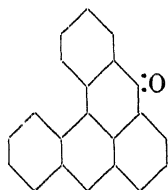
Constituent of *Stephania cepharantha*, Hayata. Needles + 1½ C<sub>6</sub>H<sub>6</sub> from Me<sub>2</sub>CO–C<sub>6</sub>H<sub>6</sub>. M.p. 103° decomp. Anhyd., yellow powder, m.p. 145–55°. Sol. most org. solvents. Spar. sol. pet. ether. Sol. min. acids. [α]<sub>D</sub><sup>20</sup> + 277° in CHCl<sub>3</sub>.

*Methiodide*: decomp. about 268°.

Kondo, Keimatsu, *Ber.*, 1938, **71**, 2553.

**Cerane.**

See Isohexacosane.

**Ceranthrone**

C<sub>21</sub>H<sub>12</sub>O MW, 280

Dark red needles from AcOH. M.p. 177–178.5°.

Bradsher, Vingiello, *J. Org. Chem.*, 1948, **13**, 786.

**Cerberin.**

See under Neriifolin.

**Cerberose.**

See under Thevetose.

**Cerebron (Phrenosin)**

C<sub>48</sub>H<sub>93</sub>O<sub>9</sub>N MW, 827

Isolated from brain. Cryst. from CHCl<sub>3</sub>–MeOH. Hyd. to galactose, cerebronic acid and sphingosine.

*Hexa-acetyl deriv.*: amorph. solid which liquefies at 40–1°. [α]<sub>D</sub><sup>20</sup> – 3°.

Thierfelder, *Z. physiol. Chem.*, 1914, **89**, 248.

Lapworth, *J. Chem. Soc.*, 1913, **103**, 1032.

Klenk, Leupold, *Z. physiol. Chem.*, 1944, **281**, 208.

**Cerebronic Acid (Phrenosinic acid, 1-hydroxytetraacosanoic acid)**

CH<sub>3</sub>·[CH<sub>2</sub>]<sub>21</sub>·CH(OH)·COOH

C<sub>24</sub>H<sub>48</sub>O<sub>3</sub> MW, 384

M.p. 100–101°. [α]<sub>D</sub><sup>20</sup> + 3.4° in Py, [α]<sub>D</sub><sup>20</sup> – 1.8° in CHCl<sub>3</sub>.

Klenk, *Z. physiol. Chem.*, 1928, **174**, 214; **179**, 312.

Levene, Taylor, *J. Biol. Chem.*, 1928, **80**, 227, 609.

Klenk, Clarenz, *Z. physiol. Chem.*, 1939, **257**, 268.

Muller, Binzer, *Ber.*, 1939, **72**, 615.

**Cerin**

C<sub>30</sub>H<sub>50</sub>O<sub>2</sub> MW, 442

Triterpene hydroxy-ketone from cork. Silky needles from C<sub>6</sub>H<sub>6</sub> or CHCl<sub>3</sub>. M.p. 247–51° decomp. [α]<sub>D</sub><sup>25</sup><sub>461</sub> – 44.5°.

*Me ether*: needles from C<sub>7</sub>H<sub>8</sub>–Me<sub>2</sub>CO. M.p. 265–70°. [α]<sub>D</sub><sup>26</sup><sub>461</sub> – 59° in CHCl<sub>3</sub>. *Oxime*: m.p. 258–62°.

*Acetyl*: needles from AcOEt. M.p. 259–61°.

*Oxime*: plates from EtOH. M.p. 266–72°.

2 : 4-*Dinitrophenylhydrazone*: orange needles from C<sub>6</sub>H<sub>6</sub>–EtOH. M.p. 253–5° decomp.

Drake, Jacobsen, *J. Am. Chem. Soc.*, 1935, **57**, 1570.

Drake, Shrader, *ibid.*, 1854.

Ruzicka, Jeger, Ringnes, *Helv. Chim. Acta*, 1944, **27**, 972.

**Cerotin.**

See Ceryl Alcohol.

**Ceryl Alcohol (Cerotin, hexacosyl alcohol, hexacosanol)**

CH<sub>3</sub>·[CH<sub>2</sub>]<sub>24</sub>·CH<sub>2</sub>OH

C<sub>26</sub>H<sub>54</sub>O MW, 382

Occurs as fatty acid esters notably in Chinese insect wax and in small quantities in many other waxes, also in cocks-foot and rye grass. M.p. 79°.

*Acetyl*: cryst. from ligroin. M.p. 65°.

Gottfried, Ulzer, *Chem. Abstracts*, 1926, **20**, 3444.

Damoy, *Chem. Abstracts*, 1924, **18**, 1645.

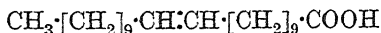
Rabate, *Bull. soc. chim. biol.*, 1930, **12**, 758.

**Ceryl iodide.**

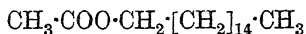
See Hexacosyl iodide.

**Cetane.**See *n*-Hexadecane.**Cetene.**

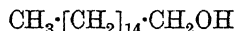
See 1-Hexadecylene.

**Cetolic Acid** (*Cetoleic acid*,  $\Delta^{10-11}$ -docosenoic acid) $\text{C}_{22}\text{H}_{42}\text{O}_2$  MW, 338

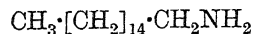
Esters occur commonly in oil from marine mammals and fish. M.p. 33.0–33.7°.

*p*-Chlorophenacyl ester: m.p. 54.5°.*p*-Bromophenacyl ester: m.p. 60.5°.*p*-Phenylphenacyl ester: m.p. 72.5°.Toyama, *J. Soc. Chem. Ind. Japan*, 1927, 30, 597, (*Chem. Abstracts*, 1928, 22, 575); 1926, 29, 531, (*Chem. Abstracts*, 1927, 21, 1719).**Cetyl acetate** $\text{C}_{18}\text{H}_{36}\text{O}_2$  MW, 284

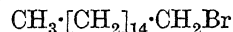
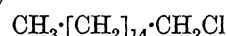
Dimorphous. M.p. 24.2°. B.p. 220–25°/205 mm., 200°/15 mm. Spar. sol. EtOH.

Krafft, *Ber.*, 1883, 16, 1721.Phillips, Mumford, *J. Chem. Soc.*, 1934, 1657.**Cetyl Alcohol** (*n*-Hexadecyl alcohol, *n*-hexadecanol) $\text{C}_{16}\text{H}_{34}\text{O}$  MW, 242Occurs chiefly in the form of esters in certain oils and waxes of which spermaceti (from the head oil of the sperm whale) is the most important. M.p. 49°. B.p. 190°/15 mm., 178–82°/12 mm.  $D_4^{20}$  0.8105. Decomp. on dist. at ord. press. Ox.  $\rightarrow$  palmitic acid. Finds application in the cosmetics industry. Sulphate used as detergent and wetting agent.*p*-Nitrobenzoyl: m.p. 68.4°.

2:4-Dinitrophenylcarbamate: yellowish-white powder from ligroin, m.p. 80°.

Urethane:  $\text{C}_{17}\text{H}_{35}\text{O}_2\text{N}$ . MW, 285. Soft needles, m.p. 93°.Allophanate:  $\text{C}_{18}\text{H}_{36}\text{O}_3\text{N}_2$ . MW, 328. M.p. 153°. Sol. EtOH.*Pseudosaccharate*: m.p. 69.5°.Ford, Marvel, *Organic Syntheses*, 1930, X, 62.Clark, Streight, *Trans. Roy. Soc. Canada*, 1929, 23, 77.Sekera, Marvel, *J. Am. Chem. Soc.*, 1933, 55, 345.Green, U.S.P. 2,080,419, (*Chem. Abstracts*, 1937, 31, 4989).Sandoz, Swiss P. 178,814, (*Chem. Abstracts*, 1936, 30, 3439).Delcourt, *Bull. soc. chim. Belg.*, 1931, 40, 284.John, Rathmann, *Ber.*, 1941. 74, 890.**Cetylamine** (1-Aminohexadecane, *n*-hexadecylamine) $\text{C}_{16}\text{H}_{35}\text{N}$  MW, 241Leaflets. M.p. 46° (78°). B.p. 330°, 187°/15 mm. Sol. EtOH,  $\text{Me}_2\text{CO}$ ,  $\text{CHCl}_3$ . Absorbs  $\text{CO}_2$  from the air.*B, HCl*: m.p. 178° (130–3°).*B, HI*: m.p. 171–2° decomp.*N-Et*: m.p. 27–8°. B.p. 342°, 195–6°/15 mm. *N-Di-Et*: m.p. 6–8°. B.p. 355°, 204–6°/15 mm.*N-Butyl*: m.p. 31–2°. B.p. 193–7°/6 mm.*N-Phenyl*: cetylaniline. M.p. 41–3°. *p-Toluenesulphonyl*: m.p. 64–5°.*N-Dicetyl*: tricetylamine. Needles. M.p. 39°.Hickinbottom, *J. Chem. Soc.*, 1937, 1119.Shinozaki, Kubo, *Chem. Abstracts*, 1937, 31, 3002.Theunissen, *Rec. trav. chim.*, 1927, 46, 208.**Cetylaniline.**

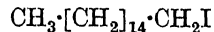
See under Cetylamine.

**Cetyl bromide** (1-Bromohexadecane, *n*-hexadecyl bromide) $\text{C}_{16}\text{H}_{33}\text{Br}$  MW, 305M.p. 15°. B.p. 193–6°/14 mm.  $D_4^{20}$  1.000.  $n_D^{20}$  1.462.Flaschenträger, Wannschaff, *Ber.*, 1934, 67, 1121.Norris, Watt, Thomas, *J. Am. Chem. Soc.*, 1916, 38, 1077.**Cetyl chloride** (1-Chlorohexadecane, *n*-hexadecyl chloride) $\text{C}_{16}\text{H}_{33}\text{Cl}$  MW, 260.5Exists in polymorphic forms. Transparent  $\alpha$ -form, m.p. 7.4°, white  $\beta$ -form, m.p. 12.1°. B.p. 289° decomp., 159–63°/2 mm.  $D^{20}$  0.8384.  $n_D^{20}$  1.45477.Norris, Taylor, *J. Am. Chem. Soc.*, 1924, 46, 753.Phillips, Mumford, *J. Chem. Soc.*, 1931, 1732.Clark, Streight, *Trans. Roy. Soc. Canada*, 1929, 23, 77.Hauser, Niles, *J. Phys. Chem.*, 1941, 45, 954.**Cetylene.**

See 1-Hexadecylene.

**Cetyl glyceryl Ether.**

See Chimyl Alcohol.

**Cetyl iodide** (1-Iodohexadecane, hexadecyl iodide) $\text{C}_{16}\text{H}_{33}\text{I}$  MW, 352.

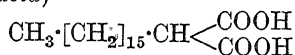


Leaflets from EtOH. M.p. 22°. B.p. 211°/15 mm.  $D_4^{20}$  1.12639,  $D_4^{80}$  1.07352.  $n_{D_5}^{20}$  1.48242.

Hartman, Byers, Dickey, *Organic Syntheses*, 1935, XV, 29.

Hauser, Niles, *J. Phys. Chem.*, 1941, 45, 954.

**Cetylmalonic Acid** (*Heptadecane-1:1-dicarboxylic acid*)



$\text{C}_{19}\text{H}_{36}\text{O}_4$  MW, 328

Plates from AcOH. M.p. 121.5–122°. Spar. sol. cold EtOH. Insol.  $\text{H}_2\text{O}$ , pet. ether.

*Di-Me ester*:  $\text{C}_{21}\text{H}_{40}\text{O}_4$ . MW, 356. Cryst. from  $\text{Et}_2\text{O}$ . M.p. 44°.

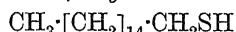
*Di-Et ester*:  $\text{C}_{23}\text{H}_{44}\text{O}_4$ . MW, 384. M.p. 22°. B.p. 238–40°/14 mm.

*Monoamide*:  $\text{C}_{19}\text{H}_{37}\text{O}_3\text{N}$ . MW, 327. Plates from ligroin–EtOH. Decomp. at 130–150° → stearamide +  $\text{CO}_2$ .

Hell, Sadomsky, *Ber.*, 1891, 24, 2781.

Guthzeit, *Ann.*, 1881, 206, 357.

**Cetyl Mercaptan** (*1-Hexadecanethiol, mercaptohexadecane, cetyl thioalcohol*)



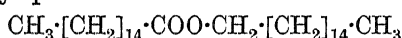
$\text{C}_{16}\text{H}_{34}\text{S}$  MW, 258

M.p. 18°. B.p. 123–8°/0.5 mm.

Flaschenträger, Wannschaff, *Ber.*, 1934, 67, 1121.

Frank, Smith, *J. Am. Chem. Soc.*, 1946, 68, 2103.

**Cetyl palmitate**

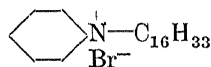


$\text{C}_{32}\text{H}_{64}\text{O}_2$  MW, 480

Constituent of spermaceti. Plates from  $\text{Et}_2\text{O}$  or AcOH. M.p. 51–2°. Sol.  $\text{Me}_2\text{CO}$ ,  $\text{CS}_2$ ,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ .  $n_D^{20}$  1.4398.

Whitby, *J. Chem. Soc.*, 1926, 1463.

**Cetylpyridinium bromide** (*Hexadecylpyridinium bromide*)



$\text{C}_{21}\text{H}_{38}\text{NBr}$  MW, 384

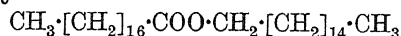
Plates. M.p. 61–2°. Sol. EtOH, dioxan. Insol. or spar. sol.  $\text{C}_6\text{H}_6$ , pet. ether, cold  $\text{Me}_2\text{CO}$ , AcOH. Spar. sol. cold  $\text{H}_2\text{O}$ , but solubility increases very rapidly at about 30°. Possesses surface-active and bactericidal properties.

Bhatt, Mehta, Thosar, *Chem. Abstracts*, 1946, 40, 7636.

Hauser, Niles, *J. Phys. Chem.*, 1941, 45, 954.

Adam, Pankhurst, *Trans. Faraday Soc.*, 1946, 42, 523.

**Cetyl stearate**

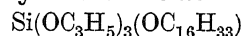


$\text{C}_{34}\text{H}_{68}\text{O}_2$  MW, 508

Plates from  $\text{Et}_2\text{O}$  or AcOH. M.p. 56–7°. Sol.  $\text{Me}_2\text{CO}$ ,  $\text{CS}_2$ ,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ .  $n_D^{20}$  1.4410.

Whitby, *J. Chem. Soc.*, 1926, 1463.

**Cetyl triallyl orthosilicate**



$\text{C}_{25}\text{H}_{48}\text{O}_4\text{Si}$  MW, 440

B.p. 225–8°/2 mm.  $n_D^{20}$  1.4440.

Peppard, Brown, Johnson, *J. Am. Chem. Soc.*, 1946, 68, 70.

**Cevadine** (*Veratrine*)

$\text{C}_{32}\text{H}_{49}\text{O}_9\text{N}$  MW, 591

Alkaloid of cevadilla (sabadilla) and green hellebore. Tiglic acid ester of the base cevine. Cryst. + 2EtOH from EtOH. M.p. 205° decomp. Spar. sol.  $\text{Et}_2\text{O}$ . Insol.  $\text{H}_2\text{O}$ .  $[\alpha]_D^{25}$  +12.5° in EtOH.

*B.HgCl*. yellow needles. M.p. 182° decomp. (190°).

*B.HgCl*, *HCl*: silvery plates. M.p. 172° decomp. Sol. EtOH. Spar. sol.  $\text{H}_2\text{O}$ .

*Benzoyl deriv.*: m.p. 255°.

*o-Nitrobenzoyl deriv.*: m.p. 236°.  $[\alpha]_D^{25}$  –37.5° in EtOH.

*Diluturate*: decomp at 220°.

Wright, Luff, *J. Chem. Soc.*, 1878, 33, 338.

Macbeth, Robinson, *J. Chem. Soc.*, 1922, 121, 1571.

Blount, *J. Chem. Soc.*, 1935, 124.

**Cevine**

$\text{C}_{27}\text{H}_{43}\text{O}_8\text{N}$  MW, 509

Alkaloid obtained from seeds of *Veratrum sabadilla*. M.p. anhyd. 165–72° decomp. Cryst. + 3½  $\text{H}_2\text{O}$  from EtOH.Aq. M.p. 110°.  $[\alpha]_D^{25}$  –17.52° in EtOH.

*Hydrochloride*: m.p. 247°.

*Chloroaurate*: m.p. 162° decomp.

*Monobenzoyl deriv.*: m.p. 195°.

*Dibenzoyl deriv.*: m.p. 195–6°.

*Di-o-nitrobenzoyl deriv.*: pale yellow cryst. from EtOH. M.p. 175°.

Macbeth, Robinson, *J. Chem. Soc.*, 1922, 1571.

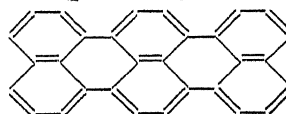
Hess, Mohr, *Ber.*, 1919, 52, 1984.

Freund, Schwartz, *Ber.*, 1899, 32, 800.

Ikawa *et al.*, *J. Biol. Chem.*, 1945, 159, 517.

Huebner, Jacobs, *J. Biol. Chem.*, 1947, 170, 181.

**Chalkacene** (*peri-Dinaphthylenenaphthalene*)



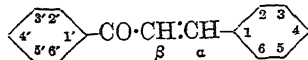
$\text{C}_{30}\text{H}_{16}$

MW, 376

Coppery-red needles or plates. M.p. 358–60°. Sol.  $C_6H_6$ . Quinonoid form is rhodacene.

Dziewoński, *Ber.*, 1920, 53, 2188.

**Chalkone** (*Benzylideneacetophenone, benzalacetophenone, phenyl styryl ketone*)



$C_{15}H_{12}O$  MW, 208

Pale yellow prisms. M.p. 58°. B.p. 345–8°, 219°/18 mm. Sol.  $Et_2O$ ,  $CS_2$ ,  $CHCl_3$ ,  $C_6H_6$ . Mod. sol.  $EtOH$ . Exists in other polymorphic forms, m.ps, 57°, 48°, 49° (unstable) and 30°. Irradiation  $\rightarrow$  dimerides. Sol. conc.  $H_2SO_4$  to deep yellow sol. Forms comp. with  $KHSO_3$ .  $Zn + AcOH \rightarrow$  benzylacetophenone.

*Dimerides*: four forms. (i) M.p. 124°. (ii) M.p. 225–6°. (iii) M.p. 178°. (iv) M.p. 195°.

*Oxime*: m.p. 115–16°.

*Semicarbazone*: three forms.  $\alpha$ -. Colourless needles from  $EtOH$ . M.p. 168°. Sol.  $CHCl_3$ , hot  $EtOH$ ,  $CS_2$ . Spar. sol.  $C_6H_6$ .  $\beta$ -. Yellow cryst. On recryst. or heating to 170°  $\rightarrow$   $\gamma$ -form.  $\gamma$ -. Colourless needles. M.p. 179–80° decomp. In light  $\rightarrow$   $\beta$ -form.

2:4-Dinitrophenylsemicarbazone: m.p. 226°.

Phenylhydrazone: m.p. 117–20°.

Picrate: m.p. 93–7°.

Kohler, Chadwell, *Organic Syntheses*, Collective Vol. I, 71.

Stobbe, Bremer, *J. prakt. Chem.*, 1929, 123, 1.

Le Fèvre, *J. Chem. Soc.*, 1937, 1037.

Auwers, Seyfried, *Ann.*, 1930, 484, 179.

Weygand, *Ber.*, 1929, 62, 2603.

Heilbron, Wilson, *J. Chem. Soc.*, 1912, 101, 1487.

### Chalkone-4-carboxylic Acid



$C_{16}H_{12}O_3$  MW, 252

*Me ester*:  $C_{17}H_{14}O_3$ . MW, 266. Needles from  $EtOH$ . M.p. 121–2°.

*Et ester*:  $C_{18}H_{16}O_3$ . MW, 280. Plates from  $EtOH$ . M.p. 83–4°.

*Nitrile*:  $C_{16}H_{11}ON$ . MW, 233. Needles. M.p. 156–7°.

MacLean, Widdows, *J. Chem. Soc.*, 1914, 105, 2171.

### Chalkone-4'-carboxylic Acid.

Pale yellow leaflets from  $EtOH$ . M.p. 234°.  $H_2SO_4 \rightarrow$  orange-red sol.

Pfeiffer, Kollbach, Haack, *Ann.*, 1928, 460, 147.

### Chalkone- $\alpha$ -carboxylic Acid.

*Trans*:-

Needles from  $Et_2O$ -pet. ether. M.p. 128°. Heat. with  $HCl$ - $AcOH$  or  $NaOH$ .Aq.  $\rightarrow$  *cis*-acid.

*Cis*:-

Needles from  $Et_2O$ -pet. ether. M.p. 124°.

Kohler, Goodwin, *J. Am. Chem. Soc.*, 1927, 49, 226.

Kohler, Peterson, Bickel, *J. Am. Chem. Soc.*, 1934, 56, 2008.

### Chalkone- $\beta$ -carboxylic Acid.

Leaflets from  $EtOH$ .Aq. M.p. 155–6°.

*Et ester*: cryst. from  $Et_2O$ . M.p. 98–9°.

1-Menthyl ester: leaflets from  $AcOH$ .Aq. M.p. 65°.  $[\alpha]_D^{20} - 78.6^\circ$  in  $C_6H_6$ .

*Nitrile*: cryst. from  $EtOH$ . M.p. 84°.

Perkin, *J. Chem. Soc.*, 1885, 47, 259.

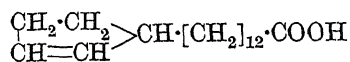
Ruhemann, *J. Chem. Soc.*, 1903, 83, 720.

Cruikshanks, *J. prakt. Chem.*, 1914, 89, 194.

### Champacol.

See Guaiol.

### Chaulmoogric Acid (*Hydnocarpylacetic acid*)



$C_{18}H_{32}O_2$  MW, 280

*d*-.

Constituent of chaulmoogra oil in form of glyceride and from oil of *Oncola echinata* and *Hydnocarpus alcala*. Leaflets. M.p. 68.5°. B.p. 247–8°/20 mm. Sol.  $Et_2O$ ,  $CHCl_3$ .  $[\alpha]_D + 62^\circ$  in  $CHCl_3$ . Derivs. used in leprosy treatment.

*Me ester*:  $C_{19}H_{34}O_2$ . MW, 294. M.p. 22°. B.p. 227°/20 mm.  $[\alpha]_D^{25} + 50^\circ$  in  $CHCl_3$ .

*Et ester*:  $C_{20}H_{36}O_2$ . MW, 308. B.p. 230°/20 mm.  $D_4^{25} 0.9064$ .  $[\alpha]_D^{20} + 50.7^\circ$ .

*n-Capryl ester*:  $C_{26}H_{48}O_2$ . MW, 392. B.p. 215°/high vac.

*Allyl ester*:  $C_{21}H_{36}O_2$ . MW, 320. B.p. 222°/5 mm.

*Phenyl ester*:  $C_{24}H_{36}O_2$ . MW, 356. M.p. 40°. B.p. 233°/high vac.

*o-Bromophenyl ester*: m.p. 52–3°.

*Tribromophenyl ester*: m.p. 54–6°.

*o-Chlorophenyl ester*: m.p. 48–50°.

*p-Chlorophenyl ester*: m.p. 53–5°.

*Benzyl ester*:  $C_{25}H_{38}O_2$ . MW, 370. B.p. 218°/10 mm.

*Cinnamyl ester*:  $C_{26}H_{38}O_2$ . MW, 382. B.p. 210–20°/0.05 mm.  $n_D^{25} 1.5200$ .

*Chaulmoogryl ester*:  $C_{36}H_{64}O_2$ . MW, 528. M.p. 42°.

*Amide*:  $C_{18}H_{33}ON$ . MW, 279. Cryst. from  $EtOH$ . M.p. 106°.  $[\alpha]_D^{25} + 57.3^\circ$  in  $CHCl_3$ .

*Chloride*:  $C_{18}H_{31}OCl$ . MW, 298.5. B.p. 170°/0.1 mm.

*Nitrile*:  $C_{18}H_{31}N$ . MW, 261. B.p. 158–60°/3–4 mm.  $D_4^{25} 0.8320$ .  $n_D^{25} 1.4666$ .  $[\alpha]_D^{25} + 55.2^\circ$  in  $CHCl_3$ .

*o-Phenetidide*: m.p. 280–3°.

*p-Phenetidide*: m.p. 115°.

*dl.*  
 M.p. 68-5°.  
*Nitrile*: b.p. 156-8°/25 mm.  $D_{25}^{25}$  0.8856.  
 $n_D^{25}$  1.4692.  
*Hydrazide*: m.p. 92°.

Batteke, West, *Chem. Abstracts*, 1927, 21, 572.

Perkins, Cruz, *J. Am. Chem. Soc.*, 1927, 49, 1070.

Naegeli, Stefanovitch, *Helv. Chim. Acta*, 1928, 11, 609.

Stanley, Adams, *J. Am. Chem. Soc.*, 1929, 51, 1515.

Cole, Cardoso, *J. Am. Chem. Soc.*, 1937, 59, 963.

Hinegardner, *J. Am. Chem. Soc.*, 1933, 55, 2831.

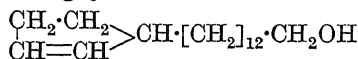
Burschkies, *Ber.*, 1938, 71, 233.

Barrowcliff, Power, *J. Chem. Soc.*, 1907, 91, 557.

Cole, Cardoso, *J. Am. Chem. Soc.*, 1937, 59, 963.

Buu Hoï, Cagniant, Janicaud, *Compt. rend.*, 1941, 212, 577.

### Chaulmoogryl Alcohol



$\text{C}_{18}\text{H}_{34}\text{O}$  MW, 266

Needles from MeOH. M.p. 36°. B.p. 150-60°/0.5 mm.  $n_D^{25}$  1.4709.  $[\alpha]_D^{25} + 58.5^\circ$  in  $\text{CHCl}_3$ .

*Palmityl*: m.p. 45-6°. B.p. 260-2°/0.02 mm.

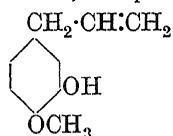
*Stearyl*: m.p. 51°. B.p. 260°/0.05 mm.

*Oleyl*: b.p. 268-70°/0.1 mm.  $n_D^{25}$  1.4689.

Dewar, *Chem. Abstracts*, 1928, 22, 3263.

Burschkies, *Ber.*, 1938, 71, 1855.

**Chavibetol** (3-Hydroxy-4-methoxy-1-allyl-benzene, 4-allylguaiacol, betelphenol)



$\text{C}_{10}\text{H}_{12}\text{O}_2$  MW, 164

Occurs in essential oil from leaves of *Piper betle*, Linn. M.p. 8-5°. B.p. 254-5°, 131-2°/12 mm.  $D_{16}^{16}$  1.0690.  $n_D^{20}$  1.54134. Heat of comb.  $\text{C}_p$  1286.9 Cal.,  $\text{C}_v$  1285.7 Cal.  $\text{FeCl}_3$  in EtOH sol.  $\rightarrow$  deep bluish-green col.

*Me ether*: see under Eugenol (Me ether).

*Allyl ether*: b.p. 142-3°/1.5 mm.  $n_D^{20}$  1.5345.

*Benzyl ether*: cryst. from MeOH. M.p. 48° (30-1°).

*Acetyl*: b.p. 275-7°.

*Benzoyl*: m.p. 49°.

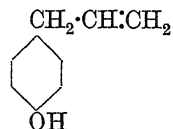
Bertram, Gildemeister, *J. prakt. Chem.*, 1889, 39, 349.

Hirao, *Bull. Chem. Soc. Japan*, 1936, 11, 179.

Schöpf, *Ann.*, 1940, 544, 30.

Dict. of Org. Comp.—I.

**Chavicol** (p-Allylphenol, 3-p-hydroxyphenyl-1-propylene)



$\text{C}_9\text{H}_{10}\text{O}$  MW, 134

Occurs in essential oil from leaves of *Piper betle*, Linn. M.p. 16°. B.p. 237°, 120°/12 mm. Misc. with EtOH,  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ , pet. ether.  $D_4^{18}$  1.033.  $n_D^{18}$  1.5441.  $\text{FeCl}_3$  in aq. sol.  $\rightarrow$  blue col.

*Me ether*: see Esdragol.

*Et ether*:  $\text{C}_{11}\text{H}_{14}\text{O}$ . MW, 162. B.p. 224-5°, 113-4°/20 mm.

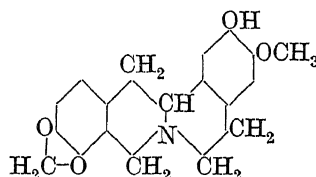
3:5-Dinitrobenzoyl: m.p. 104°.

Eykman, *Ber.*, 1889, 22, 2739.

Quelet, *Bull. soc. chim.*, 1929, 45, 265.

Palkin, Wells, *J. Am. Chem. Soc.*, 1933, 55, 1556.

### Cheilanthifoline



$\text{C}_{19}\text{H}_{19}\text{O}_4\text{N}$  MW, 325

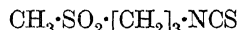
Alkaloid isolated from *Corydalis cheilanthifolia*, *C. scouleri* and *C. siberica*. M.p. 184°.  $[\alpha]_D^{20} - 311^\circ$  in MeOH.

*Me ether*: see Sinactine.

*Et ether*: m.p. 144°.

Manske, *Can. J. Research*, 1940, 18, 100.

**Cheiroline** (Methyl isothiocyanopropyl sulphone)



$\text{C}_5\text{H}_9\text{O}_2\text{NS}_2$  MW, 179

Occurs in seeds of wallflower, *Cheiranthus cheiri*, Linn. Rhombic prisms. M.p. 48°. B.p. 200°/3 mm. Sol. EtOH,  $\text{CHCl}_3$ , AcOEt. Sol. 70 parts  $\text{H}_2\text{O}$  at 50°. Spar. sol.  $\text{Et}_2\text{O}$ , ligroin. Hyd.  $\rightarrow$   $\text{H}_2\text{S}$  +  $\text{CO}_2$  + methyl 3-aminopropyl sulphone.

Schneider, *Ann.*, 1910, 375, 207.

### Cheirotoxin

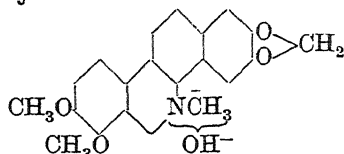
$\text{C}_{35}\text{H}_{52}\text{O}_{15}$  or  $\text{C}_{34}\text{H}_{50}\text{O}_{15}$  MW, 712 or 698

Cardio-active principle of *Cheiranthus cheiri*. Cryst. +  $3\text{H}_2\text{O}$  from  $\text{H}_2\text{O}$ . M.p. 210-11°.  $[\alpha]_D^{25} - 17.2 \pm 2^\circ$  in MeOH. Bitter taste. Hyd.  $\rightarrow$  strophanthidin + hexose + methylpentose.

*Hexa-acetyl deriv.*: needles from MeOH. M.p. 219-21°.  $[\alpha]_D^{25} - 1.3 \pm 2^\circ$  in  $\text{CHCl}_3$ . *Oxime*: m.p. 235°.

Schwartz, Katz, Reichstein, *Pharm. Acta Helv.*, 1946, 21, 25, (*Chem. Abstracts*, 1948, 42, 9084).

## Chelerythrine

 $C_{21}H_{19}O_5N$ 

MW, 377

Occurs in *Chelidonium majus*, Linn., *Bocconia frutescens*, Linn., *Bocconia arborea*, and *Eschscholtzia californica*, Cham. Cryst. + 1EtOH from EtOH. M.p. 207°. Spar. sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, AcOEt. Sols. show blue fluor.

*B.HAuCl<sub>4</sub>*: m.p. 233° decomp.

*ψ-Cyanide*: m.p. 261°.

Späth, Kuffner, *Ber.*, 1931, 64, 1123, 2034.

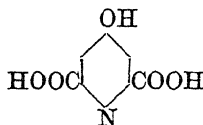
Bauer, Hedinger, *Arch. Pharm.*, 1920, 258, 167.

Manske, *Can. J. Research*, 1943, 21B, 140.

*ψ-Chelerythrene*.

See Sanguinarine.

**Chelidamic Acid** (4-Hydroxypyridine-2:6-dicarboxylic acid, ammonchelidonic acid)

 $C_7H_5O_5N$ 

MW, 183

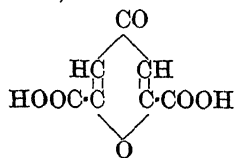
Prisms + 1H<sub>2</sub>O from H<sub>2</sub>O. Decomp. at 248° → 4-hydroxypyridine. Sol. 637 parts cold H<sub>2</sub>O. Spar. sol. EtOH. Prac. insol. Et<sub>2</sub>O.

*Di-Me ester*: C<sub>9</sub>H<sub>9</sub>O<sub>5</sub>N. MW, 211. Needles. M.p. 125°. Spar. sol. Et<sub>2</sub>O.

*Di-Et ester*: C<sub>11</sub>H<sub>13</sub>O<sub>5</sub>N. MW, 239. Needles + 1H<sub>2</sub>O. M.p. 80-1°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.

Riegel, Reinhard, *J. Am. Chem. Soc.*, 1926, 49, 1344.

**Chelidonic Acid** (*γ*-Pyrone-2:6-dicarboxylic acid, jervasic acid)

 $C_7H_4O_6$ 

MW, 184

In *Asparagus officinalis* and *Chelidonium majus*, Linn., (celandine). Needles. M.p. 262°. Mod. sol. hot H<sub>2</sub>O. Heat above m.p. → comanic acid → *γ*-pyrone. HI → pimelic acid. NH<sub>3</sub> → chelidamic acid. Hot milk of lime → 1 mol. acetone + 2 mols. oxalic acid. Forms no oxime.

*Di-Me ester*: C<sub>9</sub>H<sub>8</sub>O<sub>6</sub>. MW, 212. M.p. 122-5°.

*Et ester*: C<sub>9</sub>H<sub>8</sub>O<sub>6</sub>. MW, 212. M.p. 227°. Mod. sol. EtOH.

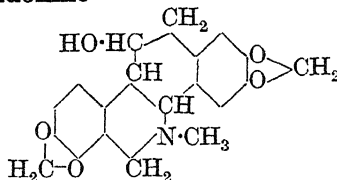
*Di-Et ester*: C<sub>11</sub>H<sub>12</sub>O<sub>6</sub>. MW, 240. Prisms from EtOH. M.p. 63°. Sol. hot EtOH, Et<sub>2</sub>O. Semicarbazone: m.p. 201° decomp.

Verkade, *Rec. trav. chim.*, 1924, 43, 879.

Claisen, *Ber.*, 1891, 24, 111.

Reigel, Zwilgmeyer, *Organic Syntheses*, XVII, 40.

## Chelidonine

 $C_{20}H_{19}O_5N$ 

MW, 353

Alkaloid from roots of *Chelidonium majus*, Linn., (celandine) and other fumariaceae plants. M.p. 135-6°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Insol. H<sub>2</sub>O. Cryst. from HCl.Aq. or EtOH.Aq. with 1H<sub>2</sub>O. [α]<sub>D</sub> + 150-6° for 1% sol. in 96% EtOH, ([α]<sub>D</sub> + 115°). Triboluminescent.

*Acetyl deriv.*: m.p. 165-6°. [α]<sub>D</sub> + 110°. B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>: m.p. 200°. *B.HAuCl<sub>4</sub>*: m.p. 155°.

*Benzoyl deriv.*: m.p. 217°.

Späth, Kuffner, *Ber.*, 1931, 64, 370.

## Chetomin

 $C_{16}H_{17}O_4N_2S_2$ 

MW, 365

Antibiotic from *Chetomium cochliodes*. M.p. 215°. [α]<sub>D</sub><sup>25</sup> + 360°. Inactivated by oxidizing agents, acids and hot alkalis.

Geiger, *Arch. Biochem.*, 1949, 21, 125.

Chimyl Alcohol (*Cetyl α-glyceryl ether*)CH<sub>3</sub>·[CH<sub>2</sub>]<sub>15</sub>·O·CH<sub>2</sub>·CH(OH)·CH<sub>2</sub>OH $C_{19}H_{40}O_3$ 

MW, 316

Occurs in various fish liver oils, and in bull and swine testes ("testriol"). Has the d-configuration. Cryst. M.p. 62.5-3.5°. [α]<sub>D</sub> + 3° in CHCl<sub>3</sub> (c = 1.16).

*Diacetyl*: m.p. 22°.

*Di-3:5-dinitrobenzoyl*: m.p. 58-9° (52°). [α]<sub>D</sub> -29.2° in C<sub>2</sub>H<sub>2</sub>Cl<sub>4</sub> (c = 8.2).

*Diphenylurethane*: m.p. 100°. [α]<sub>D</sub> -6.9° in Py (c = 8.37).

*Antraquinone-2-carboxylate*: m.p. 71-3°.

Toyama, *Chem. Abstracts*, 1924, 18, 2613.

Heilbron, Owens, *J. Chem. Soc.*, 1928, 942; 1930, 3542.

Nakamiya, *Bull. Inst. Phys. Chem. Research, Tokyo*, 1938, 17, 837.

Baer, Fischer, *J. Biol. Chem.*, 1941, 140, 397.

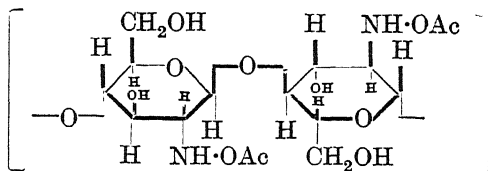
## Chiniofon.

See Loretin.

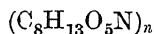
## Chitamic Acid.

See Glucosaminic Acid.

## Chitin



Suggested structural unit



Occurs in shells of crustacea and in fungi. Insol. all ord. org. solvents,  $H_2O$ , dil. acids and alkalis. Insol.  $CuO-NH_3$ ,  $ZnCl_2 \cdot Aq$ ,  $CaCNS$ . Does not exhibit phenomena of mercerisation with alkalis (e.g., X-ray diagram unchanged by 40%  $NaOH$ ). Sol. conc. min. acids with degradation.  $[\alpha]_D^{20} - 14.7^\circ$  (initial)  $\rightarrow + 56^\circ$  (final) in conc.  $HCl$ . Conc.  $HCl$  in 15 days at  $20^\circ \rightarrow 25\%$  *N*-acetylglucosamine. *N*-Acetyl group can only be hydrolysed under conditions that lead to degradation.  $KOH$  fusion  $\rightarrow$  chitosan. Fuming  $HNO_3 \rightarrow$  nitrochitin  $(C_8H_{12}O_7N_2)_n$ . Snail chitinase  $\rightarrow$  *N*-acetylglucosamine. Partially methylated with great difficulty but forms a diacetyl deriv.  $(C_{12}H_{17}O_7N)_n$ .  $Ac_2O + H_2SO_4 \rightarrow$  chitobiose octa-acetate (m.p.  $289^\circ$  decomp.;  $[\alpha]_D^{20} + 50.3^\circ$  in  $AcOH$ ) and chitotriose undeca-acetate (m.p.  $318^\circ$  decomp.;  $[\alpha]_D^{20} + 33^\circ$  in  $AcOH$ ). Viscosity determinations indicate a mol. wt. similar to that of cellulose.

Karrer, White, *Helv. Chim. Acta*, 1930, 13, 1105.

Shorugin, Hait, *Ber.*, 1935, 68, 971.

Bergmann, Zervas, Silberkweit, *Ber.*, 1931, 64, 2436.

Meyer, Pankow, *Helv. Chim. Acta*, 1935, 18, 589.

Meyer, Wehile, *Helv. Chim. Acta*, 1937, 20, 353.

Shorugin, Makarova - Semlyanskaya, Anur'era, *Ber.*, 1935, 68, 969.

Zechmeister, Tóth, *Fortschritte der Chemie organischer Naturstoffe*, Vol. II, 212, (1939).

Jeanloz, Forchielli, *Helv. Chim. Acta*, 1950, 33, 1690.

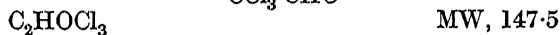
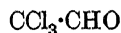
**Chitosamine.**

See Glucosamine.

**Chitosaminic Acid.**

See Glucosaminic Acid.

**Chloral** (*Trichloroacetaldehyde*: see also Chloral Hydrate)



Colourless liq. Freezes at  $-57$  to  $-58^\circ$ . B.p.  $98^\circ$ . Sol.  $H_2O$ ,  $EtOH$ ,  $Et_2O$ .  $D_4^{20} 1.54175$ ,  $D_{25}^{20} 1.5060$ .  $n_D^{20} 1.45572$ . Reduces warm  $NH_3$ .  $AgNO_3$ . Conc.  $HNO_3 \rightarrow$  trichloroacetic acid.  $Zn + HCl \rightarrow$  acetaldehyde.  $Cl$  in sunlight  $\rightarrow HCl + CCl_4 + COCl_2$ .  $NH_3 \rightarrow CCl_3 \cdot CH(OH)NH_2$ .

Forms bisulphite comp. Conc. alkalis  $\rightarrow$  formic acid + chloroform. Forms add. products with water and alcohols; also with certain amines and amides. Forms polymers.

*Mono-Me acetal*: chloral methylalcoholate.  $CCl_3 \cdot CH(OH) \cdot OCH_3$ .  $C_3H_5O_2Cl_3$ . MW, 179.5. Needles. M.p.  $50^\circ$ . B.p.  $98^\circ$  ( $106^\circ$ ).

*Di-Me acetal*:  $CCl_3 \cdot CH(OCH_3)_2$ .  $C_4H_7O_2Cl_3$ . MW, 193.5. B.p.  $183^\circ$ .  $D^{20} 1.40$ .

*Mono-Et acetal*: chloral alcoholate.  $CCl_3 \cdot CH(OH) \cdot OC_2H_5$ .  $C_4H_7O_2Cl_3$ . MW, 193.5. Needles. M.p.  $50^\circ$  ( $56-7^\circ$ ). B.p.  $115-16^\circ$ .

*Di-Et acetal*:  $CCl_3 \cdot CH(OC_2H_5)_2$ .  $C_6H_{11}O_2Cl_3$ . MW, 221.5. B.p.  $204-5^\circ$ . Sol.  $EtOH$ ,  $Et_2O$ . Spar. sol.  $H_2O$ .  $D^{20} 1.2813$ .

*Propyl acetal*:  $C_5H_9O_2Cl_3$ . MW, 207.5. B.p.  $120-2^\circ$ .

*Isopropyl acetal*: needles. M.p.  $47^\circ$ . B.p.  $108^\circ$ .

*n-Butyl acetal*:  $C_6H_{11}O_2Cl_3$ . MW, 221.5. Needles. M.p.  $49^\circ$ .

*tert.-Butyl acetal*: needles. M.p.  $43^\circ$ .

*Di-isobutyl acetal*:  $C_{10}H_{19}O_2Cl_3$ . MW, 277.5. B.p.  $229^\circ/753$  mm.  $D^{22} 1.186$ .

*Isoamyl acetal*:  $C_7H_{13}O_2Cl_3$ . MW, 235.5. Needles. M.p.  $56^\circ$ .

*tert.-Amyl acetal*: b.p.  $98^\circ$ .  $D^{25} 1.2191$ .

*Chloral ammonia*.  $CCl_3 \cdot CH(OH)NH_2$ . Needles, m.p.  $72-4^\circ$ . Insol. cold  $H_2O$ .

*Oxime*: m.p.  $56^\circ$ . B.p.  $85^\circ/20$  mm.

*2:4-Dinitrophenylhydrazone*: yellow. M.p.  $131^\circ$ .

*Cyanhydrin*: see under 2:2:2-Trichlorolactic Acid.

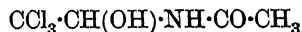
Willcox, Brunel, *J. Am. Chem. Soc.*, 1916, 38, 1837.

Page, *Ann.*, 1884, 225, 209.

Besson, D.R.P. 133,021, (*Chem. Zentr.*, 1902, II, 553).

Ohse, D.R.P. 734,732, (*Chem. Abstracts*, 1944, 38, 3671).

**Chloralacetamide** (2:2:2-Trichloro-1-hydroxyethylacetamide, 2:2:2-trichloro-1-hydroxyacetylpropylamine)



Plates from  $H_2O$ . M.p.  $158^\circ$ . Sol.  $EtOH$ , hot  $H_2O$ . Insol.  $Et_2O$ .

*Me ether*:  $C_5H_8O_2NCl_3$ . MW, 220.5. M.p.  $120^\circ$ .

*O-Acetyl*: prisms. M.p.  $117-18^\circ$ .

*Benzoyl deriv.*: m.p.  $101-2^\circ$ .

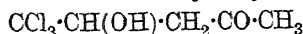
*N-Phenyl: acetyl*, needles. M.p.  $152^\circ$ . *Benzoyl*: needles. M.p.  $164^\circ$ .

Feist, *Ber.*, 1912, 45, 957.

Jacobsen, *Ann.*, 1871, 157, 245.

Meldrum, Deodhar, *J. Indian Chem. Soc.*, 1934, 11, 529.

**Chloralacetone** (*Trichloro-acetoisopropyl alcohol*, 5 : 5 : 5-trichloro-4-hydroxy-2-ketopentane)



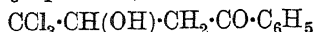
$\text{C}_5\text{H}_7\text{O}_2\text{Cl}_3$  MW, 205.5

Cryst. from ligroin. M.p. 76°. Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O. Sublimes.

*Oxime*: M.p. 104–6°. Sol. H<sub>2</sub>O, EtOH.

Wislicenus, *Ber.*, 1893, 26, 909.

**Chloralacetophenone** (3 : 3 : 3-*Trichloro-2-hydroxypropyl phenyl ketone*, ω-trichloro-γ-hydroxybutyrophenone)



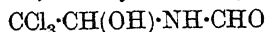
$\text{C}_{10}\text{H}_9\text{O}_2\text{Cl}_3$  MW, 267.5

Cryst. from ligroin. M.p. 76–7°. Sol. most ord. org. solvents. Spar. sol. ligroin, hot H<sub>2</sub>O.

*Oxime*: m.p. 135–7° (131–2°).

Wislicenus, *Ber.*, 1893, 26, 909.

**Chloralamide** (2 : 2 : 2-*Trichloro-1-hydroxyethylformamide*, chloralformamide)



$\text{C}_3\text{H}_4\text{O}_2\text{NCl}_3$  MW, 192.5

M.p. 124–6°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, AcOEt, glycerol. Hypnotic.

*Me ether*:  $\text{C}_4\text{H}_6\text{O}_2\text{NCl}_3$ . MW, 206.5. M.p. 139°. Sol. CHCl<sub>3</sub>, Me<sub>2</sub>CO, AcOEt.

Feist, *Ber.*, 1912, 45, 956.

### Chloral Hydrate



$\text{C}_2\text{H}_3\text{O}_2\text{Cl}_3$  MW, 165.5

Colourless cryst. M.p. 53°. B.p. 96.3°/764 mm. 1 Part H<sub>2</sub>O dissolves 4.7 parts at 17°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. D<sub>4</sub><sup>20</sup> 1.9081, D<sub>20</sub><sup>20</sup> 1.6415. Reduces NH<sub>3</sub>.AgNO<sub>3</sub>. Forms bisulphite comp. Hot alkalis → CHCl<sub>3</sub> and formic acid. Powerful hypnotic.

*Diacetyl deriv.*:  $\text{CCl}_3\text{-CH(O\cdot COCH}_3)_2$ .  $\text{C}_6\text{H}_7\text{O}_4\text{Cl}_3$ . MW, 249.5. B.p. 221°.

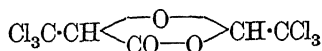
*Ethers*: see under Chloral.

Bartholome, *Chem. Abstracts*, 1930, 24, 918.

Liebig, *Ann.*, 1832, 1, 195.

**Chloralide** (*Trichlorolactic trichloroethylidene ester*, trichlorolactic chloralide)

[*Note*: chloralide is also used as a general term to denote the class of compound formed by condensation of chloral with α-hydroxy acids.]



$\text{C}_5\text{H}_2\text{O}_3\text{Cl}_6$  MW, 323

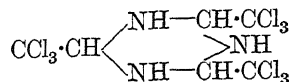
Prisms. M.p. 116°. B.p. 272–3°, 148°/12 mm. Sol. Et<sub>2</sub>O. Spar. sol. cold EtOH. Insol. H<sub>2</sub>O. KOH → CHCl<sub>3</sub> + formic acid.

Wallach, *Ann.*, 1878, 193, 1.

Otto, *Ann.*, 1887, 239, 262.

Bösesken, *Rec. trav. chim.*, 1910, 29, 108.

**Chloralimide** (*Trimeric chloralimide*, 2 : 4 : 6-tris-trichloromethylhexahydro-1 : 3 : 5-triazine, 2 : 4 : 6-tris-trichloromethyltrimethylenetriamine)



$\text{C}_6\text{H}_6\text{N}_3\text{Cl}_9$  MW, 439.5

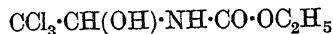
Two forms. (1) Rhombic cryst. or needles. M.p. 150–5°. Sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. EtOH. Insol. H<sub>2</sub>O. Conc. HCl → chloral + NH<sub>4</sub>Cl. (2) Iso-chloralimide. Prisms. M.p. 105–6°. Conc. HCl → chloral + NH<sub>4</sub>Cl.

Béhal, Choay, *Ann. chim.*, 1892, 26, 7.

### Chloralose.

See Glucochloralose.

### Chloralurethane



$\text{C}_5\text{H}_8\text{O}_3\text{NCl}_3$  MW, 236.5

M.p. 103°. Sol. EtOH, Et<sub>2</sub>O. Insol. cold H<sub>2</sub>O. Boiling H<sub>2</sub>O → chloral + urethane.

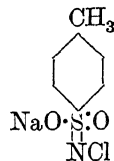
*Me ether*:  $\text{C}_6\text{H}_{10}\text{O}_3\text{NCl}_3$ . MW, 250.5. M.p. 64°. B.p. 137°/22 mm. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O.

*Et ether*:  $\text{C}_7\text{H}_{12}\text{O}_3\text{NCl}_3$ . MW, 264.5. M.p. 37°. B.p. 134°/13 mm. Volatile in steam.

*Acetyl deriv.*: m.p. 47–9°. B.p. 165°/15 mm. Sol. EtOH, Et<sub>2</sub>O.

Diels, Seib, *Ber.*, 1909, 42, 4065.

**Chloramine-T** (*Na derivative of N-chloro-p-toluenesulphonamide*, Chlorazine, Mianine, T-chlorine, Tolamine, Activin, Gansil)



$\text{C}_7\text{H}_7\text{O}_2\text{NClSNa}$  MW, 227.5

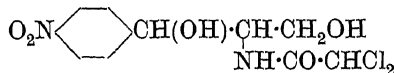
Powder. Cryst. + 1H<sub>2</sub>O. Sol. to 6–7% in cold H<sub>2</sub>O. NaOCl → Dichloramine-T. Anhyd. salt explodes at 175–80°. Powerful antiseptic and disinfectant.

Feldhoff, *Chem. Abstracts*, 1929, 23, 4020.

Briscoe, *Chemical Age*, 1923, 9, 168.

Harold, *Journal of the Royal Sanitary Institute*, 1928, 48, 484.

**Chloramphenicol** (*Chloromycetin*, d(–)-threo-2-dichloroacetamido-1-p-nitrophenyl-1 : 3-propanediol, d(–)-threo-N-(1 : 1'-dihydroxy-1-p-nitrophenylisopropyl)-dichloroacetamide)



$\text{C}_{11}\text{H}_{12}\text{O}_5\text{N}_2\text{Cl}_2$  MW, 323

Antibiotic isolated from cultures of a strain of *Streptomyces*. Pale yellow needles from H<sub>2</sub>O or ethylene dichloride. M.p. 149.7–150.7°.  $[\alpha]_D^{25} -25.5^\circ$  in AcOEt,  $+19^\circ$  in EtOH. Light absorption:  $\lambda_{\max}$ , 278 m $\mu$  in H<sub>2</sub>O or 0.1N HCl. Sol. MeOH, EtOH, butanol, AcOEt, Me<sub>2</sub>CO. Spar. sol. H<sub>2</sub>O, propylene glycol, Et<sub>2</sub>O. Insol. C<sub>6</sub>H<sub>6</sub>, light petroleum.

*Acetyl*: cryst. from EtOH.Aq. M.p. 141–2°.

Bartz, *J. Biol. Chem.*, 1948, 172, 445.

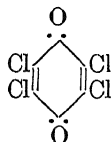
Rebstock, Crooks, Controulis, Bartz, *J. Am. Chem. Soc.*, 1949, 71, 2458.

Crooks, Controulis, Rebstock, *ibid.*, 2463.

Long, Troutman, *ibid.*, 2473.

Ehlich, Bartz, Smith, Joslyn, *Science*, 1947, 106, 417.

**Chloranil** (2 : 3 : 5 : 6-*Tetrachloro-p-benzoquinone, tetrachloroquinone*)



C<sub>6</sub>O<sub>2</sub>Cl<sub>4</sub>

MW, 246

Cryst. in golden-yellow leaflets from AcOH or toluene. Prisms from benzene. Sublimes without melting by careful heating. M.p. 290° (in sealed tube). Mod. sol. Et<sub>2</sub>O. Spar. sol. hot EtOH, CHCl<sub>3</sub>, CS<sub>2</sub>. Insol. H<sub>2</sub>O, cold ligroin. SO<sub>2</sub>, or HI+P → tetrachlorohydroquinone. Stable to oxidising agents. Acts itself as an oxidising agent. Aq. alkalis → alk. salts of chloranilic acid.

Erdelyi, *Chem. Abstracts*, 1929, 23, 4937; *Ber.*, 1930, 63, 1200.

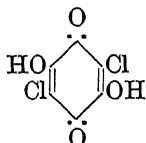
Bouveault, *Ann. chim.*, 1908, 13, 142.

Chulkov, Parini, Staroselets, *Org. Chem. Ind.*, U.S.S.R. 1937, 3, 97, (*Chem. Abstracts*, 1937, 31, 4967).

Chulkov, Chartova, *Russ. P.* 50,440, (*Chem. Abstracts*, 1937, 31, 8550).

Gallotti, *Chem. Abstracts*, 1933, 27, 278.

**Chloranilic Acid** (2 : 5-*Dichloro-3 : 6-dihydroxy-p-benzoquinone*)



C<sub>6</sub>H<sub>2</sub>O<sub>4</sub>Cl<sub>2</sub>

MW, 209

Reddish leaflets +2H<sub>2</sub>O from H<sub>2</sub>O. M.p. 283–4°. Mod. sol. hot H<sub>2</sub>O to violet sol. Reacts strongly acid. Forms stable Na, K, Ba, etc. salts. Red. → 2 : 5-dichloro-1 : 3 : 4 : 6-tetrahydroxybenzene. Reagent for estimation of calcium in plants and soils.

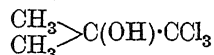
*Di-Me ether*: C<sub>6</sub>H<sub>6</sub>O<sub>4</sub>Cl<sub>2</sub>. MW, 237. Red prisms. M.p. 141–2°.

*Di-Et ether*: C<sub>10</sub>H<sub>10</sub>O<sub>4</sub>Cl<sub>2</sub>. MW, 265. Reddish prisms. M.p. 107°.

*Diacetyl*: yellow needles. M.p. 182.5°.

Graebe, *Ann.*, 1891, 263, 24.

**Chloretone** (1 : 1 : 1-*Trichloro-2-hydroxy-2-methylpropane, 1 : 1 : 1-trichloro-tert-butyl alcohol, acetone-chloroform*)



C<sub>4</sub>H<sub>7</sub>OCl<sub>3</sub>

MW, 177.5

White cryst. +  $\frac{1}{2}$ H<sub>2</sub>O from H<sub>2</sub>O. M.p. 80–1°, anhyd. 97°. B.p. 167°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, Me<sub>2</sub>CO, AcOH. Insol. H<sub>2</sub>O. Volatile in steam. Sublimes readily. Reduces NH<sub>3</sub>.AgNO<sub>3</sub>. Hypnotic and germicide.

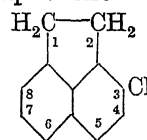
Willgerodt, Genieser, *J. prakt. Chem.*, 1888, 37, 364.

Sah, Lei, Ma, *Chem. Abstracts*, 1932, 26, 5907.

**Chlorguanide.**

See Paludrine.

**3-Chloroacenaphthene**



C<sub>12</sub>H<sub>9</sub>Cl

MW, 188.5

M.p. 76–7°.

Morgan, Harrison, *J. Soc. Chem. Ind.*, 1930, 49, 417T.

**4-Chloroacenaphthene.**

B.p. above 290°.

*Picrate*: orange cryst. from EtOH. M.p. 79–80°.

Morgan, Stanley, *J. Soc. Chem. Ind.*, 1925, 44, 495T.

**5-Chloroacenaphthene.**

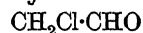
Leaflets. M.p. 70.5°. B.p. 319°/770 mm., 163°/13 mm.  $D_4^{20}$  1.1954.  $n_D^{20}$  1.6169.

*Picrate*: cryst. from EtOH. M.p. 137°.

Dziewoński, Zakrzewska-Barnaowska, *Chem. Abstracts*, 1927, 21, 2682.

Paillard, Favarger, *Helv. Chim. Acta*, 1933, 16, 614.

**Chloroacetaldehyde**



C<sub>2</sub>H<sub>3</sub>OCl

MW, 78.5

B.p. 85°. H<sub>2</sub>O → hydrate. EtOH+HCl → CH<sub>2</sub>Cl·CHCl·O·C<sub>2</sub>H<sub>5</sub>. Reduces NH<sub>3</sub>.AgNO<sub>3</sub>. Conc. HNO<sub>3</sub> → chloroacetic acid. Polymerises on standing or by addition of conc. H<sub>2</sub>SO<sub>4</sub>. Heat alone or with H<sub>2</sub>SO<sub>4</sub> → CH<sub>2</sub>Cl·CH·Cl·CHO.

*Hydrate*:  $2\text{CH}_2\text{Cl}\cdot\text{CHO} + \text{H}_2\text{O}$  [CH<sub>2</sub>Cl·CH(OH)·O·CH(OH)·CH<sub>2</sub>Cl?]. Cryst. from H<sub>2</sub>O. M.p. 43–50°. B.p. 85.5°. Sol. EtOH, Et<sub>2</sub>O.

*Di-Me acetal*: C<sub>4</sub>H<sub>9</sub>O<sub>2</sub>Cl. MW, 124.5. B.p. 140°.  $D^{20}$  1.068.  $n_D^{20}$  1.4183.

*Di-Et acetal*:  $\text{CH}_2\text{Cl}\cdot\text{CH}(\text{OC}_2\text{H}_5)_2$ .  $\text{C}_6\text{H}_{13}\text{O}_2\text{Cl}$ . MW, 152.5. B.p. 157°.  $D^{15}$  1.026. Decomp. by dil.  $\text{H}_2\text{SO}_4$ .

*Dipropyl acetal*:  $\text{C}_8\text{H}_{17}\text{O}_2\text{Cl}$ . MW, 180.5. B.p. 186°/750 mm.  $D^{20}$  0.954.  $n_D^{20}$  1.4244.

*Di-isopropyl acetal*: b.p. 49°/7 mm.  $D^{20}$  0.975.  $n_D^{20}$  1.4192.

*Dibutyl acetal*:  $\text{C}_{10}\text{H}_{21}\text{O}_2\text{Cl}$ . MW, 208.5. B.p. 215°/750 mm.  $D^{20}$  0.959.  $n_D^{20}$  1.4286.

*Di-isobutyl acetal*: b.p. 78°/7 mm.  $D^{20}$  0.949.  $n_D^{20}$  1.4249.

*Diamyl acetal*:  $\text{C}_{15}\text{H}_{25}\text{O}_2\text{Cl}$ . MW, 236.5. B.p. 224°/740 mm.  $D^{20}$  0.94.  $n_D^{20}$  1.4321.

*Di-isomyl acetal*: b.p. 103°/8 mm.  $D^{20}$  0.941.  $n_D^{20}$  1.4318.

*Semicarbazone*: m.p. 148° (134–5°) decomp.

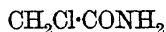
Natterer, *Monatsh.*, 1882, 3, 442.

I.G., B.P. 299,722, (*Chem. Abstracts*, 1929, 23, 3479).

Soc. des Usines Rhône-Poulenc, F.P. 711,095, (*Chem. Zentr.*, 1932, I, 130).

I.G., D.R.P. 496,062; 521,723, (*Chem. Zentr.*, 1930, I, 3722; 1931, I, 3169).

### Chloroacetamide



$\text{C}_2\text{H}_4\text{ONCl}$  MW, 93.5

M.p. 121°. B.p. 224–5°/743 mm., decomp. Sol.  $\text{H}_2\text{O}$ , EtOH. Spar. sol.  $\text{Et}_2\text{O}$ .  $\text{P}_2\text{O}_5 \rightarrow$  chloroacetanitrile.  $\text{NH}_3 \rightarrow$  glycine amide.

*N-Di-Me*:  $\text{C}_4\text{H}_8\text{ONCl}$ . MW, 121.5. B.p. 98–100°/11 mm.

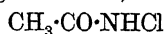
*N-Di-Et*:  $\text{C}_6\text{H}_{12}\text{ONCl}$ . MW, 149.5. B.p. 112–13°/10 mm.

*Formyl*: m.p. 89–90°.

*Acetyl*: plates from  $\text{C}_6\text{H}_6$ . M.p. 105–6°.

Jacobs, Heidelberger, *Organic Syntheses*, Collective Vol. I, 147.

**N-Chloroacetamide** (*Acetochloroamide, acet-chloroamide, chlorylacetylamide*)



$\text{C}_2\text{H}_4\text{ONCl}$  MW, 93.5

Plates from  $\text{C}_6\text{H}_6$ . M.p. 111–12°. Sol.  $\text{Et}_2\text{O}$ .  $\text{HCl} \rightarrow$  acetamide +  $\text{Cl}_2$ .

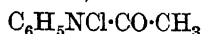
*N-Phenyl*: see *N-Chloroacetanilide*.

Orton, Bradford, *J. Chem. Soc.*, 1927, 993.

Mauguin, *Ann. chim.*, 1911, 22 305.

I.G., D.R.P. 616,381, (*Chem. Zentr.*, 1935, II, 2282).

**N-Chloroacetanilide** (*Acetochloroanilide, acetylphenylchloramine*)



$\text{C}_8\text{H}_8\text{ONCl}$  MW, 169.5

Plates or needles from  $\text{CHCl}_3$ -pet. ether. M.p. 91°. Prac. insol. cold  $\text{H}_2\text{O}$ . Heat alone or warm with abs. EtOH  $\rightarrow$  *o*- and *p*-chloroacetanilides.

Barnes, Porter, *J. Am. Chem. Soc.*, 1930, 52, 1721.

### $\omega$ -Chloroacetanilide.

See under Chloroacetic Acid.

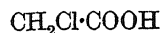
### Chloroacetanilide.

See also under Chloroaniline.

### Chloro-acetanisidide.

See under Chloroanisidine.

### Chloroacetic Acid



$\text{C}_2\text{H}_3\text{O}_2\text{Cl}$  MW, 94.5

Three solid modifications: ( $\alpha$ ) m.p. 61.3°; ( $\beta$ ) m.p. 56.2°; ( $\gamma$ ) m.p. 52.5°. B.p. 189°, 104°/20 mm. Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{CHCl}_3$ ,  $\text{CS}_2$ ,  $\text{C}_6\text{H}_6$ .  $D^{20}$  1.58. Heat of comb.  $\text{C}_p$  171.0 Cal.  $k = 1.55 \times 10^{-3}$  at 25°. Boiling  $\text{H}_2\text{O} \rightarrow$  glycollic acid.  $\text{KSH}\cdot\text{Aq.} \rightarrow$  thioglycollic acid. Aniline  $\rightarrow$  phenylglycine. Anthranilic acid  $\rightarrow$  phenylglycine-*o*-carboxylic acid.  $\text{NH}_3 \rightarrow$  glycine (+ iminodiacetic acid).  $\text{KCN} \rightarrow$  cyanoacetic acid.

*Me ester*:  $\text{C}_3\text{H}_5\text{O}_2\text{Cl}$ . MW, 108.5. B.p. 130°.  $D^{20}$  1.2378.  $n_D^{20}$  1.42207.

*Et ester*: see Ethyl chloroacetate.

*Propyl ester*:  $\text{C}_5\text{H}_9\text{O}_2\text{Cl}$ . MW, 136.5. B.p. 162°.  $D_4^{20}$  1.1050.  $n_D^{20}$  1.42557.

*Isopropyl ester*: b.p. 149°.

*Butyl ester*:  $\text{C}_6\text{H}_{11}\text{O}_2\text{Cl}$ . MW, 150.5. B.p. 175°.

active *Amyl ester*:  $\text{C}_7\text{H}_{13}\text{O}_2\text{Cl}$ . MW, 164.5. B.p. 188–91°/722 mm.  $D_4^{20}$  1.055.  $n_D^{20}$  1.4329.

*Allyl ester*:  $\text{C}_5\text{H}_7\text{O}_2\text{Cl}$ . MW, 134.5. B.p. 164°.

*Phenyl ester*:  $\text{C}_8\text{H}_7\text{O}_2\text{Cl}$ . MW, 170.5. M.p. 45°. B.p. 235°. Sol. EtOH,  $\text{Et}_2\text{O}$ .

*Benzyl ester*:  $\text{C}_9\text{H}_9\text{O}_2\text{Cl}$ . MW, 184.5. B.p. 147–8°/9 mm.  $D_4^{20}$  1.2223.  $n_D^{20}$  1.5246.

*p-Bromophenacyl ester*: m.p. 103–7°.

*Chloride*: see Chloroacetyl chloride.

*Bromide*: see Chloroacetyl bromide.

*Anhydride*:  $\text{C}_4\text{H}_4\text{O}_3\text{Cl}_2$ . MW, 171. M.p. 46°. B.p. 203°/760 mm., 163°/116 mm., 126°/24 mm., 110°/10 mm. Sol.  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ . Spar. sol.  $\text{C}_6\text{H}_6$ .

*Anilide*:  $\omega$ -chloroacetanilide. Needles. M.p. 136–7°. Sublimes. Sol.  $\text{Et}_2\text{O}$ .

*Nitrile*: see Chloroacetanitrile.

*Amide*: see Chloroacetamide.

Simon, Chavanne, *Compt. rend.*, 1923, 176, 309.

Pickering, *J. Chem. Soc.*, 1895, 67, 664.

Lynbarskii, *Chem. Abstracts*, 1935, 29, 2509.

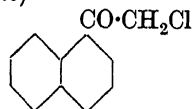
### Chloroacetyl-naphthalide.

See under Chloronaphthylamine.

### Chloroacetoacetic Ester.

See Ethyl chloroacetoacetate.

**$\omega$ -Chloro-1-acetonaphthone** ( *$\alpha$ -Naphthacyl chloride, chloromethyl 1-naphthyl ketone, 1-chloro-acetylnaphthalene*)



$\text{C}_{12}\text{H}_9\text{OCl}$

MW 204.5



M.p. 40-41.5° (34-6°). B.p. 203°/12 mm.  
Picrate : m.p. 94°.

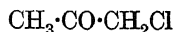
Widman, *Ber.*, 1918, 51, 911.  
Schroeter, Müller, Huang, *Ber.*, 1929, 62, 655.  
Rabczewicz-Zubkowski, *Chem. Abstracts*, 1930, 24, 106.

$\omega$ -Chloro-2-acetonaphthone ( $\beta$ -Naphthacyl chloride, chloromethyl 2-naphthyl ketone, 2-chloroacetylnaphthalene).

Cryst. from EtOH. M.p. 83-4° (67-8°). B.p. 185-7°/10 mm.

Picrate : yellow cryst. M.p. 90-1°.  
Schroeter, Müller, Huang, *Ber.*, 1929, 62, 655.  
Rabczewicz-Zubkowski, *Chem. Abstracts*, 1930, 24, 106.

Chloroacetone (*Acetonyl chloride, chloroprop- anone*)



C<sub>3</sub>H<sub>5</sub>OCl MW, 92.5

Lachrymatory liq. B.p. 119°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. D<sub>16</sub><sup>4</sup> 1.162. Zn+HCl → acetone. NH<sub>3</sub> → aminoacetone. NH<sub>2</sub>OH → oxime and dimethylglyoxime. HCN → chlorohydroxyisobutyronitrile.

Di-Et acetal : C<sub>7</sub>H<sub>15</sub>O<sub>2</sub>Cl. MW, 166.5. B.p. 162-3°, 57°/12 mm. D<sub>0</sub><sup>14</sup> 1.0002.

Oxime : b.p. 171°/730 mm., 85°/21 mm., 71°/9 mm.

Semicarbazone : m.p. 150° (141-2°, 163-5°). Unstable. Decomp. by boiling H<sub>2</sub>O or EtOH.

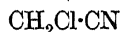
2 : 4-Dinitrophenylhydrazone : m.p. 124-125.5°.

Cyanhydrin : see under 2-Chloro-1-hydroxyisobutyric acid.

Fritsch, *Ann.*, 1894, 279, 310.  
Hoogereen, Jansen, *Rec. trav. chim.*, 1932, 51, 260.

Szper, *Bull. soc. chim.*, 1932, 51, 653.  
Shilov, Kupinskaya, *J. Applied Chem., U.S.S.R.*, 1945, 18, 121.

Chloroacetonitrile (*Chloromethyl cyanide*)



C<sub>2</sub>H<sub>2</sub>NCl MW, 75.5

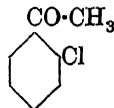
Fuming liq. B.p. 126-7°. D<sub>20</sub> 1.193. Forms add. comp. with AlCl<sub>3</sub>, m.p. 38°. Dry HCl → CH<sub>2</sub>Cl·CCl:NH.

Steinkopf, *Ber.*, 1908, 41, 2541.

$\omega$ -Chloroacetophenone.

See Phenacyl chloride.

*o*-Chloroacetophenone (*Methyl o-chloro- phenyl ketone*)



C<sub>8</sub>H<sub>7</sub>OCl MW, 154.5

B.p. 227-8°/738 mm., 113°/18 mm. D<sub>25</sub><sup>4</sup> 1.1884. n<sub>D</sub><sup>25</sup> 1.685.

Oxime : needles. M.p. 112-13°.

Semicarbazone : m.p. 159-60°.

Auwers, Lechner, Bundesman, *Ber.*, 1925, 58, 49.

Thorp, Brunskill, *J. Am. Chem. Soc.*, 1915, 37, 1260.

Sharp, Sutherland, Wilson, *J. Chem. Soc.*, 1943, 344.

*m*-Chloroacetophenone (*Methyl m-chloro- phenyl ketone*).

B.p. 227-9°. D<sub>4</sub><sup>0</sup> 1.2130. n<sub>D</sub><sup>20</sup> 1.5494.

Oxime : m.p. 88°.

Semicarbazone : m.p. 232°.

*p*-Nitrophenylhydrazone : m.p. 175-6°.

Wahl, Rolland, *Ann. chim.*, 1928, 10, 29.

Leonard, Boyd, *J. Org. Chem.*, 1946, 11, 405.

*p*-Chloroacetophenone (*Methyl p-chloro- phenyl ketone*).

M.p. 20°. B.p. 236°, 99°/7 mm. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. D<sub>20</sub> 1.188. Does not form bisulphite comp. KMnO<sub>4</sub> → *p*-chlorobenzoic acid.

Oxime : m.p. 95°. Sol. EtOH. Conc. H<sub>2</sub>SO<sub>4</sub> → *p*-chloroacetanilide.

Hydrazone : yellowish felted needles from C<sub>6</sub>H<sub>12</sub>. M.p. 55°.

Phenylhydrazone : yellow needles. M.p. 114°.

*p*-Nitrophenylhydrazone : m.p. 239°.

Semicarbazone : m.p. 202-4°.

Azine : platelets from EtOH. M.p. 151°.

Noller, Adams, *J. Am. Chem. Soc.*, 1924, 46, 1889.

Straus, Ackermann, *Ber.*, 1909, 42, 1812.

Szper, *Bull. soc. chim.*, 1932, 51, 653.

Groggins, U.S.P. 2,008,418, (*Chem. Abstracts*, 1935, 29, 5856).

Chloroacet-toluidide.

See under Chlorotoluidine.

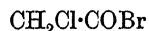
Chloroacet-xylylide.

See under Chloroxylydine.

Chloroacetylanisole.

See under Hydroxyphenacyl chloride.

Chloroacetyl bromide



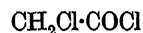
C<sub>2</sub>H<sub>2</sub>OClBr MW, 157.5

B.p. 133-5° (127°). D<sub>0</sub> 1.913.

de Wilde, *Ann.*, 1864, 132, 172.

Aschan, *Ber.*, 1913, 46, 2169.

Chloroacetyl chloride



C<sub>2</sub>H<sub>2</sub>OCl<sub>2</sub> MW, 113

B.p. 108-10°. D<sub>0</sub> 1.495. H<sub>2</sub>O → chloroacetic acid. NH<sub>3</sub> → chloroacetamide. C<sub>6</sub>H<sub>6</sub> + AlCl<sub>3</sub> → phenacyl chloride.

*Anilide*: m.p. 133-4°.

Barnett, *Chem. News*, 1921, 122, 220, (*Chem. Abstracts*, 1921, 15, 2627).

Adams, Ulrich, *J. Am. Chem. Soc.*, 1920, 42, 599.

Soc. des Usines Chim. Rhône-Poulenc, F.P. 687,689, (*Chem. Abstracts*, 1931, 25, 711).

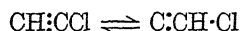
### Chloroacetylphenetole.

See under Hydroxyphenacyl chloride.

### Chloroacetylphenol.

See Hydroxyphenacyl chloride.

### Chloroacetylene (*Acetenyl chloride*)



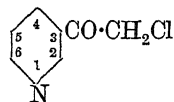
$\text{C}_2\text{HCl}$

MW, 60.5

Very unstable gas with nauseating odour. Liquefies in solid  $\text{CO}_2$  and  $\text{Et}_2\text{O}$ . B.p. -32 to 30°. Mod. sol.  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ . Highly explosive. Spontaneously inflammable in air. Very poisonous. Aq. sol. generates  $\text{O}_3$  and glows in the dark.  $\text{I}_2 \rightarrow \text{Cl}_2\cdot\text{CHCl}$ .  $\text{HOBr} \rightarrow \text{CH}_2\text{Cl}\cdot\text{COOH}$  and  $\text{CClBr}_2\cdot\text{CHO}$ . Light  $\rightarrow$  1:3:5-trichlorobenzene. Ag salt extremely explosive, detonates even under  $\text{H}_2\text{O}$ .

Ingold, *J. Chem. Soc.*, 1924, 125, 1535.

### 3-Chloroacetylpyridine



$\text{C}_7\text{H}_6\text{ONCl}$

MW, 155.5

Prisms. M.p. 51-2°.

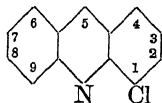
Dornow, *Ber.*, 1940, 73, 185.

### 4-Chloroacetylpyridine.

Cryst. + 1MeOH from MeOH. M.p. 103° decomp.

Dornow, *Ber.*, 1940, 73, 185.

### 1-Chloroacridine



$\text{C}_{13}\text{H}_9\text{NCl}$

MW, 213.5

Cryst. from ligroin in two forms. (1) Needles. M.p. 79°. Changes to (2) on standing. (2) Pale yellow prisms. M.p. 90-1°.

Clemo, Perkin, Robinson, *J. Chem. Soc.*, 1924, 125, 1775.

### 3-Chloroacridine.

Pink cryst. from  $\text{EtOH}$ . Aq. or  $\text{C}_6\text{H}_6$ . M.p. 170°.

$\text{B}_2, \text{HgCl}_2$ : m.p. 245-7°.

Tanasescu, Ramontianu, *Bull. soc. chim.*, 1934, 1, 547.

### 5-Chloroacridine (*ms-Chloroacridine*).

Needles. M.p. 120°. Sublimes. Boiling  $\text{H}_2\text{O} \rightarrow$  acridone.

*Methochloride*: micro-cryst. M.p. 73°.  $\text{B}_2, \text{AuCl}_3$ : orange needles from  $\text{H}_2\text{O}$ . M.p. 227°.  $\text{B}_2, \text{PtCl}_4$ : yellow cryst. from  $\text{H}_2\text{O}$ . M.p. 224-5°.

*Picrate*: yellow plates. M.p. above 330°.

Edinger, Arnold, *Chem. Zentr.*, 1902, I, 124.

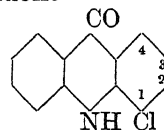
Drozdov, *J. Gen. Chem. U.S.S.R.*, 1934, 4, 117, (*Chem. Abstracts*, 1934, 28, 5456).

Magidson, Grigorovskii, *Ber.*, 1933, 66, 866.

Kliegl, Fehrle, *Ber.*, 1914, 47, 1636.

Albert, Ritchie, *Organic Syntheses*, 1942, XXII, 5.

### 1-Chloroacridone



$\text{C}_{13}\text{H}_9\text{ONCl}$

MW, 229.5

Pale yellow needles from AcOH. M.p. above 360°. Insol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ , ligroin. Sol. conc.  $\text{H}_2\text{SO}_4$  with bluish-green fluor.

Ullmann, Tedesco, *Ann.*, 1907, 355, 337.

### 2-Chloroacridone.

Pale yellow needles from AcOH. M.p. 398° decomp. Insol.  $\text{C}_6\text{H}_6$ , ligroin. Sol. conc.  $\text{H}_2\text{SO}_4$  with bluish-green fluor.

Lehmstedt, Schrader, *Ber.*, 1937, 70, 847.

Goodall, Kermack, *J. Chem. Soc.*, 1936, 1164.

Ullmann, Wagner, *Ann.*, 1907, 355, 365.

### 3-Chloroacridone.

Yellow needles from AcOH. M.p. above 360° decomp. Sol. conc.  $\text{H}_2\text{SO}_4$  with yellow col. and bluish-violet fluor.

*Di-phenyl ketal*: m.p. 204-5° from  $\text{CCl}_4$ .

Ullmann, Bader, *Ann.*, 1907, 355, 339.

### 4-Chloroacridone.

Pale yellow needles from AcOH. M.p. above 360° decomp. Sol. conc.  $\text{H}_2\text{SO}_4$  with blue fluor.

Lehmstedt, Schrader, *Ber.*, 1937, 70, 847.

### 1-Chloroacrylic Acid



$\text{C}_3\text{H}_3\text{O}_2\text{Cl}$

MW, 106.5

M.p. 65° (64-5°). Sublimes at ord. temps. Conc. HCl  $\rightarrow$  1:2-dichloropropionic acid.

*Et ester*:  $\text{C}_5\text{H}_7\text{O}_2\text{Cl}$ . MW, 134.5. B.p. 51-3°/18 mm.  $n_D^{20}$  1.4384.

*d-sec.-Butyl ester*: b.p. 70-1°/23 mm.  $n_D^{20}$  1.4360.  $[\alpha]_D^{25} +26^\circ$ .

*tert.-Butyl ester*:  $\text{C}_7\text{H}_{11}\text{O}_2\text{Cl}$ . MW, 162.5. B.p. 73°/23 mm.  $n_D^{20}$  1.4360.

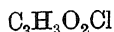
*Cyclohexyl ester*: b.p. 51–3°/2 mm.  $n_D^{20}$  1.4735.

*Phenyl ester*: b.p. 91–3°/8 mm.  $n_D^{20}$  1.5808.

*Chloride*:  $C_3H_5OCl_2$ . MW, 125. B.p. 45–8°/78–80 mm.  $n_D^{20}$  1.4689.

Otto, Beckurts, *Ber.*, 1885, 18, 239.

## 2-Chloroacrylic Acid



MW, 106.5

*Cis*-.

M.p. 63–4°.  $k = 4.77 \times 10^{-4}$ . More sol. than *trans*-form.

*Trans*-.

M.p. 86°. Conc. HCl  $\rightarrow$  2:2-dichloropropionic acid.  $k = 2.22 \times 10^{-4}$ .

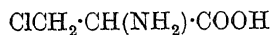
*Et ester*: b.p. 143–5°.

Otto, *Ann.*, 1887, 239, 261.

Backer, Beute, *Rec. trav. chim.*, 1935, 54, 167.

Marvel, Dec, Cooke, *J. Am. Chem. Soc.*, 1940, 62, 3497.

## 2-Chloroalanine (2-Chloro-1-aminopropionic acid)



MW, 123.5

*l*-.

Decomp. above 170° without melting. Sol.  $H_2O$ .  $[\alpha]_D^{20} - 15.46^\circ$  in  $H_2O$ .

*B, HCl*: decomp. above 190° without melting. Sol.  $H_2O$ , MeOH. Mod. sol. EtOH.  $[\alpha]_D^{20} + 0.7^\circ$  in  $H_2O$ .

*Me ester*: *B, HCl*, m.p. 157° decomp.

*dl*-.

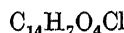
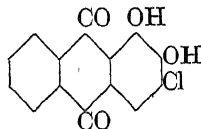
M.p. about 160° decomp. Sol.  $H_2O$ .

*B, HCl*: needles. M.p. about 172° decomp.

*Me ester*: *B, HCl*, m.p. 134° decomp.

Fischer, Raske, *Ber.*, 1907, 40, 3719.

## 3-Chloroalizarin (3-Chloro-1:2-dihydroxyanthraquinone)



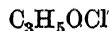
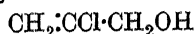
MW, 274.5

Reddish-yellow needles. M.p. 270–1°. Sol. caustic alkalis to violet-blue sols. Spar. sol. hot  $H_2O$ .

Wedekind, D.R.P. 189,937, (*Chem. Zentr.*, 1907, II, 2009).

Heller, *Ber.*, 1913, 46, 2706.

## 2-Chloroallyl Alcohol



MW, 92.5

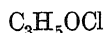
B.p. 136–40°. D 1.164. Sol. conc.  $H_2SO_4$  with evolution of HCl. Dist. aq. sol.  $\rightarrow$  acetylcarbinol.

*Acetyl*: b.p. 145°.

*Et ether*:  $C_5H_9OCl$ . MW, 120.5. B.p. 110°.  $D^{21}_4$  0.995.

van Romburgh, *Rec. trav. chim.*, 1882, 1, 238.

## 3-Chloroallyl Alcohol



MW, 92.5

B.p. 153°. Spar. sol.  $H_2O$ .  $D^{15}_4$  1.162.

*Acetyl*: b.p. 156–9°.

*Et ether*: b.p. 120–5°.  $D^{25}_4$  0.994.

van Romburgh, *Bull. soc. chim.*, 1881, 36, 555.

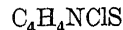
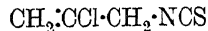
## Chloroallylbenzene.

See Chlorophenylpropylene.

## 3-Chloroallylene.

See Propargyl chloride.

## 2-Chloroallyl isothiocyanate (Chloroallyl mustard oil)



MW, 133.5

B.p. 182°. Sol. EtOH. Spar. sol.  $H_2O$ .  $D^{12}_4$  1.27.

Dixon, *J. Chem. Soc.*, 1901, 79, 554.

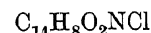
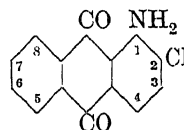
## 2-Chloro-4-aminoacetanilide.

See under 2-Chloro-*p*-phenylenediamine.

## Chloroaminoanisole.

See Chloroanisidine.

## 2-Chloro-1-aminoanthraquinone



MW, 257.5

M.p. 196–7°.

I.C.I., B.P. 391,209; U.S.P. 1,924,664, (*Chem. Zentr.*, 1933, II, 1764).

Scottish Dyes, B.P. 334,166; D.R.P. 560,945, (*Chem. Zentr.*, 1931, I, 3398);

B.P. 347,613, (*Chem. Zentr.*, 1931, II, 3550); B.P. 331,537; U.S.P. 1,858,334,

(*Chem. Zentr.*, 1931, I, 3398); B.P. 268,537; U.S.P. 1,833,809, (*Chem. Zentr.*, 1927, II, 644).

I.G., D.R.P. 590,053, (*Chem. Zentr.*, 1934, I, 2491).

## 4-Chloro-1-aminoanthraquinone.

Red needles. M.p. 180°. Sol.  $PhNO_2$ . Mod. sol. AcOH, amyl alcohol, xylene.

*N-Acetyl*: yellow cryst. from AcOH. M.p. 203–4°.

*N-Di-Me*: 4-chloro-1-dimethylaminoanthraquinone.  $C_{16}H_{12}O_2NCl$ . MW, 285.5. Brownish-

red needles from EtOH. M.p. 172°. Yellow sol. in conc. H<sub>2</sub>SO<sub>4</sub>.

Dettwyler, du Pont, U.S.P. 1,986,798, (*Chem. Abstracts*, 1935, 29, 1102).

I.C.I., B.P. 366,990; F.P. 721,364, (*Chem. Zentr.*, 1932, II, 925).

Badische, D.R.P. 279,866, (*Chem. Zentr.*, 1914, II, 1252).

#### 5-Chloro-1-aminoanthraquinone.

Orange-red powder or dark red needles. Cryst. from PhNO<sub>2</sub>. M.p. 219°. Mod. sol. hot EtOH. Yellow in conc. H<sub>2</sub>SO<sub>4</sub>.

N-Acetyl: yellow leaflets. M.p. 218–20°.

N-Benzoyl: yellow cryst. from PhNO<sub>2</sub>. M.p. 218–19°. Orange-red in conc. H<sub>2</sub>SO<sub>4</sub>.

N-Phenyl: 5-chloro-1-anilinoanthraquinone. C<sub>20</sub>H<sub>12</sub>O<sub>2</sub>NCl. MW, 333.5. Reddish-violet cryst. M.p. 151°. Yellow sol. in conc. H<sub>2</sub>SO<sub>4</sub>.

Gattermann, *Ann.*, 1912, 393, 169.

Maki, Nagai, *J. Soc. Chem. Ind., Japan*, 1930, 33, 464, (*Chem. Abstracts*, 1931, 25, 948).

Scottish Dyes, B.P.s 312,289, 324,311, (*Chem. Zentr.*, 1929, II, 1472; 1930, II, 143).

Cahn, Jones, Simonsen, *J. Chem. Soc.*, 1933, 448.

#### 6-Chloro-1-aminoanthraquinone.

Dark red needles from PhNO<sub>2</sub>. M.p. 210–11°.

N-Acetyl: orange needles. M.p. 211–12°.

Fierz-David, *Helv. Chim. Acta*, 1927, 10, 214.

#### 7-Chloro-1-aminoanthraquinone.

Brownish-red cryst. from anisole. M.p. 212–13°.

N-Acetyl: yellow-orange cryst. from xylene. M.p. 206–7°.

Fierz-David, *Helv. Chim. Acta*, 1927, 10, 214.

#### 8-Chloro-1-aminoanthraquinone.

Reddish-brown cryst. from PhNO<sub>2</sub>. M.p. 225–7°. Mod. sol. hot EtOH. Pale yellow in conc. H<sub>2</sub>SO<sub>4</sub>.

N-Acetyl: pale yellow. M.p. 223–5°.

Turski, D.R.P. 287,756, (*Chem. Zentr.*, 1915, II, 1034).

Cahn, Jones, Simonsen, *J. Chem. Soc.*, 1933, 448.

#### 1-Chloro-2-aminoanthraquinone (α-Chloro-β-aminoanthraquinone).

Reddish-brown needles. M.p. 237°. Sol. AcOH, PhNO<sub>2</sub>.

N-Acetyl: pale yellow leaflets from EtOH or C<sub>6</sub>H<sub>6</sub>. M.p. 241–2°.

Junghans, *Ann.*, 1913, 399, 320.

Diesbach, Gulser, Spoorenberg, *Helv. Chim. Acta*, 1930, 13, 1265.

B.A.S.F., D.R.P. 199,758, (*Chem. Zentr.*, 1908, II, 461).

#### 3-Chloro-2-aminoanthraquinone.

Orange-red needles from AcOH. M.p. 310–11°. Sol. AcOH, PhNO<sub>2</sub>.

N-Acetyl: m.p. 260–1°.

Atack, Soutar, B.P. 172,682, (*J. Soc. Chem. Ind.*, 1922, 41, 170A).

Scottish Dyes, B.P. 334,166; D.R.P. 560,945, (*Chem. Zentr.*, 1931, I, 3398); B.P. 264,916; U.S.P. 1,812,260, (*Chem. Zentr.*, 1929, I, 144).

I.G., D.R.P. 626,788, (*Chem. Abstracts*, 1936, 30, 5593).

I.G., D.R.P. 607,539; B.P. 425,854; F.P. 774,702, (*Chem. Zentr.*, 1935, I, 2896); D.R.P. 590,053, (*Chem. Zentr.*, 1934, I, 2491).

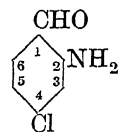
#### 7-Chloro-2-aminoanthraquinone.

Orange cryst. M.p. 302–3°.

N-Phenyl: 7-chloro-2-anilinoanthraquinone. Needles. M.p. 276–7°.

Gubelmann, Weiland, Stallmann, B.P. 327,130. U.S.P.s 1,810,008–1,810,013, (*Chem. Zentr.*, 1931, I, 1522).

#### 4-Chloro-2-aminobenzaldehyde



C<sub>7</sub>H<sub>6</sub>ONCl MW, 155.5

Needles from H<sub>2</sub>O. M.p. 86°.

Phenylhydrazone: plates from EtOH. M.p. 230°.

Sachs, Sichel, *Ber.*, 1904, 37, 1873.

#### 6-Chloro-3-aminobenzaldehyde (2-Chloro-5-aminobenzaldehyde).

Oxime: plates from EtOH. M.p. 159–60°.

Hodgson, Beard, *J. Chem. Soc.*, 1926, 151.

#### 2-Chloro-4-aminobenzaldehyde.

Yellow needles. M.p. 147°. Changes on standing to a red, insol., infusible modification.

N-Acetyl: m.p. 152°.

N-Di-Me: 3-chloro-4-aldehydodimethylaniline. C<sub>9</sub>H<sub>10</sub>ONCl. MW, 183.5. Needles from H<sub>2</sub>O. M.p. 82°. Spar. volatile in steam.

N-Et: C<sub>9</sub>H<sub>10</sub>ONCl. MW, 183.5. Yellow needles. M.p. 101°.

N-Di-Et: C<sub>11</sub>H<sub>14</sub>ONCl. MW, 211.5. M.p. 36°.

Blanksma, *Chem. Zentr.*, 1910, I, 260.

#### Chloro-*o*-aminobenzoic Acid.

See Chloroanthranilic Acid.

#### 2-Chloro-*m*-aminobenzoic Acid



C<sub>7</sub>H<sub>6</sub>O<sub>2</sub>NCl

MW, 171.5

M.p. 160-1°.

N-Acetyl: m.p. 207°.

Bamberger, *Ber.*, 1902, **35**, 3706.**4-Chloro-*m*-aminobenzoic Acid.**Needles. M.p. 216-17°. Sol. hot H<sub>2</sub>O.

N-Acetyl: m.p. 265°.

Bamberger, de Werra, *Ber.*, 1902, **35**, 3719.**5-Chloro-*m*-aminobenzoic Acid.**Needles. M.p. 216°. Sol. EtOH, Et<sub>2</sub>O.  
Spar. sol. H<sub>2</sub>O.

B,HCl: m.p. 118-21°.

N-Acetyl: m.p. 265-7°.

McAlister, Kenner, *J. Chem. Soc.*, 1928, 1915.Hübner, *Ann.*, 1884, **222**, 90.**6-Chloro-*m*-aminobenzoic Acid.**Needles. M.p. 188°. Sol. H<sub>2</sub>O, EtOH.

N-Acetyl: m.p. 215°.

Narishkin, *Chem. Abstracts*, 1930, **24**, 5741.Bamberger, *Ber.*, 1902, **35**, 3719.Minaev, Ripper, *Chem. Zentr.*, 1924, **I**, 905.**2-Chloro-*p*-aminobenzoic Acid.**

M.p. 214-15° decomp.

B,HCl: m.p. 185°.

N-Acetyl: m.p. 206°.

Me ester: m.p. 107-8°.

Et ester: m.p. 110-11°.

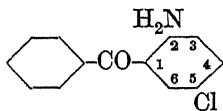
n-Propyl ester: m.p. 76-7°.

Isopropyl ester: m.p. 110-11°.

n-Butyl ester: m.p. 77-8°.

Blanksma, *Chem. Zentr.*, 1910, **I**, 260.Kunckell, Richartz, *Ber.*, 1907, **40**, 3394.

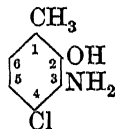
Rubin, Marks, Wishinsky, Lanzilotti,

*J. Am. Chem. Soc.*, 1946, **68**, 623.**5-Chloro-2-aminobenzophenone**C<sub>13</sub>H<sub>10</sub>ONCl

MW, 231.5

Yellow needles. M.p. 100°. Sol. H<sub>2</sub>O, EtOH, CHCl<sub>3</sub>. Very spar. sol. pet. ether.

N-Acetyl: m.p. 117°.

Chattaway, *J. Chem. Soc.*, 1904, **85**, 344.**4-Chloro-3-amino-*o*-cresol**C<sub>7</sub>H<sub>8</sub>ONCl

MW, 157.5

Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 151°. Sol. EtOH.Auwers, *Fortschritte der Chemie, Physik und physikalische Chemie*, 1924, **18**, 70.**5-Chloro-3-amino-*o*-cresol.**

Needles. M.p. 107°.

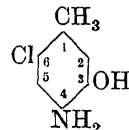
2:3-Diacetyl: needles. M.p. 196°.

Zincke, Preiss, *Ann.*, 1918, **417**, 223.Raiford, Miller, *J. Am. Chem. Soc.*, 1933, **55**, 2128.**6-Chloro-3-amino-*o*-cresol.**Needles. M.p. 102°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>. Mod. sol. H<sub>2</sub>O.Auwers, *Fortschritte der Chemie, Physik und physikalische Chemie*, 1924, **18**, 72.**3-Chloro-5-amino-*o*-cresol.**

Needles. M.p. 138°.

Kehrmann, *Ber.*, 1915, **48**, 2023; 1916, **49**, 1212.**4-Chloro-5-amino-*o*-cresol.**

Cryst. from EtOH. M.p. 217°.

Hodgson, Moore, *J. Chem. Soc.*, 1926, 2038.**6-Chloro-4-amino-*m*-cresol**C<sub>7</sub>H<sub>8</sub>ONCl

MW, 157.5

Leaflets from H<sub>2</sub>O. M.p. 143°. Sol. EtOH, Et<sub>2</sub>O.Walther, Zipper, *J. prakt. Chem.*, 1915, **91**, 414.**2-Chloro-6-amino-*m*-cresol.**

Cryst. M.p. 166-7°.

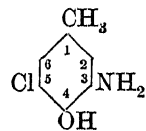
3:6-Diacetyl: m.p. 178°.

Raiford, *Am. Chem. J.*, 1911, **46**, 448.Kehrmann, Tichwinski, *Ann.*, 1898, **303**, 22.**4-Chloro-6-amino-*m*-cresol.**

M.p. 223-5° decomp. (204-5°).

3:6-Diacetyl: needles. M.p. 162°.

3:6-Dibenzoyl: m.p. 220°.

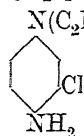
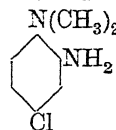
Raiford, *Am. Chem. J.*, 1911, **46**, 437.Kehrmann, Tichwinski, *Ann.*, 1898, **303**, 22.**5-Chloro-3-amino-*p*-cresol**C<sub>7</sub>H<sub>8</sub>ONCl

MW, 157.5

Needles. M.p. 89-90°.

3:4-Diacetyl: needles. M.p. 162-3°.

Zincke, *Ann.*, 1903, **328**, 313.**6-Chloro-3-amino-*p*-cresol.**Me ether: C<sub>8</sub>H<sub>10</sub>ONCl. MW, 171.5. Needles from ligroin. M.p. 106°. N-Acetyl: needles from EtOH.Aq. M.p. 115°.de Vries, *Rec. trav. chim.*, 1909, **28**, 396.

**3-Chloro-*p*-aminodiethylaniline** (3-*Chloro*-unsym.-*diethyl-p*-phenylenediamine)C<sub>10</sub>H<sub>15</sub>N<sub>2</sub>Cl MW, 198.5B.p. 285°. Turns brown on standing. Sol. ord. org. solvents and min. acids. Spar. sol. H<sub>2</sub>O.Bayer, D.R.P. 197,035, (*Chem. Zentr.*, 1908, I, 1507).**4-Chloro-*o*-aminodimethylaniline** (4-*Chloro*-unsym.-*dimethyl-o*-phenylenediamine)C<sub>8</sub>H<sub>11</sub>N<sub>2</sub>Cl MW, 170.5

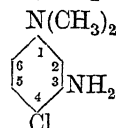
B.p. 267-8°, 158°/22 mm.

N-Acetyl: plates from ligroin. M.p. 90°.

Picrate: m.p. 191°.

Clemo, Smith, *J. Chem. Soc.*, 1928, 2420.**5-Chloro-*o*-aminodimethylaniline** (5-*Chloro*-unsym.-*dimethyl-o*-phenylenediamine).

Picrate: yellow prisms from EtOH. M.p. 151°.

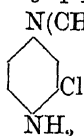
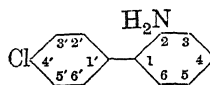
Hodgson, Kershaw, *J. Chem. Soc.*, 1930, 497.**4-Chloro-*m*-aminodimethylaniline** (4-*Chloro*-unsym.-*dimethyl-m*-phenylenediamine)C<sub>8</sub>H<sub>11</sub>N<sub>2</sub>Cl MW, 170.5

Plates from ligroin. M.p. 54°. Darkens in air.

N-Acetyl: prisms. M.p. 97°.

Clemo, Smith, *J. Chem. Soc.*, 1928, 2420.**6-Chloro-*m*-aminodimethylaniline** (6-*Chloro*-unsym.-*dimethyl-m*-phenylenediamine).

Leaflets. M.p. 80°. Sol. EtOH.

A.G.F.A., D.R.P. 303,409, (*Chem. Zentr.*, 1918, I, 495).**3-Chloro-*p*-aminodimethylaniline** (3-*Chloro*-unsym.-*dimethyl-p*-phenylenediamine)C<sub>8</sub>H<sub>11</sub>N<sub>2</sub>Cl MW, 170.5Cryst. M.p. 42°. B.p. 158°/15 mm. Turns grey on standing. Sol. most ord. org. solvents and min. acids. Spar. sol. H<sub>2</sub>O.Bayer, D.R.P. 197,035, (*Chem. Zentr.*, 1908, I, 1507).**4'-Chloro-2-aminodiphenyl**C<sub>12</sub>H<sub>10</sub>NCl MW, 203.5

Cryst. from ligroin. M.p. 52°.

Raiford, McNulty, *J. Am. Chem. Soc.*, 1934, 56, 680.Monsanto, U.S.P. 2,079,450, (*Chem. Abstracts*, 1937, 31, 4346).**4'-Chloro-3-aminodiphenyl.**

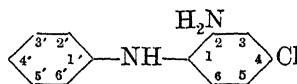
Needles from MeOH. M.p. 82°.

N-Acetyl: m.p. 184°.

Blakey, Scarborough, *J. Chem. Soc.*, 1927, 3003.**3-Chloro-4-aminodiphenyl.**

Needles from EtOH. M.p. 71°.

N-Acetyl: needles from EtOH.Aq. M.p. 147°.

Scarborough, Waters, *J. Chem. Soc.*, 1926, 560.**4-Chloro-2-aminodiphenylamine** (4-*Chloro-1-N-phenyl-o-phenylenediamine*)C<sub>12</sub>H<sub>11</sub>N<sub>2</sub>Cl MW, 218.5Needles from EtOH. M.p. 82°. Sol. AcOH, Et<sub>2</sub>O.Ullmann, *Ann.*, 1904, 332, 94.**4'-Chloro-2-aminodiphenylamine** (4-*Chlorophenyl-o-phenylenediamine*).Needles. M.p. 119°. Sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, hot EtOH.Wilberg, *Ber.*, 1902, 35, 957.**5-Chloro-2-aminodiphenylamine** (5-*Chloro-1-N-phenyl-o-phenylenediamine*).Prisms from ligroin. M.p. 102°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>.

2-N-Acetyl: silky needles. M.p. 150°.

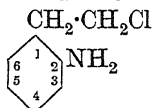
Jacobson, *Ann.*, 1898, 303, 309.**4'-Chloro-4-aminodiphenylamine** (4-*Chlorophenyl-p-phenylenediamine*).

Leaflets from pet. ether. M.p. 70-1°.

Bamberger, Ham, *Ann.*, 1911, 382, 97.Jacobson, *Ann.*, 1909, 367, 321.I.G., D.R.P. 511,526, (*Chem. Zentr.*, 1931, II, 1491).

**4-Chloro-2-aminodiphenyl Ether.**

See under 4-Chloro-2-aminophenol.

 **$\beta$ -Chloro-*o*-aminoethylbenzene** (*o*- $\beta$ -Chloroethylaniline, *o*-aminophenylethyl chloride) $\text{C}_8\text{H}_{10}\text{NCl}$ 

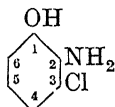
MW, 155.5

*B, HCl*: m.p. 174°.*B*<sub>2</sub>, *H*<sub>2</sub>*PtCl*<sub>6</sub>: m.p. 195°. Insol. cold  $\text{H}_2\text{O}$ .*N-Benzoyl*: cryst. from EtOH. M.p. 120°.Bennett, Hafey, *J. Chem. Soc.*, 1941, 287. **$\beta$ -Chloro-*p*-aminoethylbenzene** (*p*-Amino-phenylethyl chloride, *p*- $\beta$ -chloroethylaniline).

Yellowish-brown oil.

*B, HCl*: needles from EtOH. M.p. 209-10° (205°). Decomp. at 212°.*B*<sub>2</sub>, *H*<sub>2</sub>*PtCl*<sub>6</sub>: orange needles from  $\text{H}_2\text{O}$ . M.p. 192°.*N-Benzoyl*: m.p. 128°.*Picrate*: m.p. 155°.Ferber, *Ber.*, 1929, 62, 187.Braun, *Ber.*, 1912, 45, 1279.**Chloroaminophenetole.**

See Chlorophenetidine.

**3-Chloro-2-aminophenol** (*m*-Chloro-*o*-aminophenol) $\text{C}_6\text{H}_6\text{ONCl}$ 

MW, 143.5

Flat needles. M.p. 122°.

*Me ether*: see 3-Chloro-*o*-anisidine.Hodgson, Kershaw, *J. Chem. Soc.*, 1928, 2703.**4-Chloro-2-aminophenol** (*p*-Chloro-*o*-aminophenol).

Unstable. M.p. 138°.

*Me ether*: see 4-Chloro-*o*-anisidine.*Et ether*: see 4-Chloro-*o*-phenetidine.*Phenyl ether*: 4-chloro-2-aminodiphenyl ether. $\text{C}_{12}\text{H}_{10}\text{ONCl}$ . MW, 219.5. Prisms from EtOH.Aq. M.p. 45°.*o*-Chlorophenyl ether: 4:2'-dichloro-2-aminodiphenyl ether.  $\text{C}_{12}\text{H}_9\text{ONCl}_2$ . MW, 254. B.p. 219°/20 mm.*p*-Chlorophenyl ether: 4:4'-dichloro-2-aminodiphenyl ether. Needles from EtOH.Aq. M.p. 65°.*m*-Tolyl ether:  $\text{C}_{13}\text{H}_{12}\text{ONCl}$ . MW, 233.5. M.p. 43.5°. B.p. 210°/17 mm.*p*-Tolyl ether: needles from EtOH.Aq. M.p. 55.5°. Darkens in air.*N*-Acetyl: 5-chloro-2-hydroxyacetanilide.  $\text{C}_8\text{H}_8\text{O}_2\text{NCl}$ . MW, 185.5. M.p. 185°. Sol.  $\text{H}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ .*O*-Acetyl: needles. M.p. 73-4°. *B, HCl*: m.p. 105-7°.Upson, *Am. Chem. J.*, 1904, 32, 40.Mottier, *Chem. Abstracts*, 1935, 29, 3322.Popov, *Chem. Abstracts*, 1934, 28, 1671.Kiprianov, Mikhaïlenko, *Chem. Abstracts*, 1931, 25, 5033.**5-Chloro-2-aminophenol.**

Prisms from EtOH.Aq. M.p. 154°.

*B, HCl*: plates. M.p. 226-7° decomp.*Me ether*: see 5-Chloro-*o*-anisidine.*Et ether*: see 5-Chloro-*o*-phenetidine.*Butyl ether*: b.p. 160°/12 mm.*Benzyl ether*: m.p. 46-7°.*Dibenzoyl deriv.*: needles from EtOH. M.p. 140°.Auwers, *Fortschritte der Chemie, Physik, und physikalische Chemie*, 1924, 18, 60.Hodgson, Kershaw, *J. Chem. Soc.*, 1928, 2703.General Aniline Works, U.S.P. 1,792,156, (*Chem. Zentr.*, 1931, I, 3059).**2-Chloro-3-aminophenol** (*o*-Chloro-*m*-aminophenol).M.p. 85-7° Sol. EtOH, Et<sub>2</sub>OSchleper, *Ber.*, 1893, 26, 2466.**4-Chloro-3-aminophenol** (*p*-Chloro-*m*-aminophenol).

M.p. 151-2°. Very unstable.

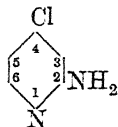
*Et ether*: see 4-Chloro-*m*-phenetidine.*N-Benzoyl*: needles from EtOH. M.p. 191-2°.Meldola, Woolcott, Wray, *J. Chem. Soc.*, 1896, 69, 1323.Musajo, Minchilli, *Gazz. chim. ital*, 1940, 70, 301.**2-Chloro-4-aminophenol** (*o*-Chloro-*p*-aminophenol).Needles. M.p. 153°. Sol. EtOH, Et<sub>2</sub>O.*Me ether*: see 2-Chloro-*p*-anisidine.*Et ether*: see 2-Chloro-*p*-phenetidine.*N*-Acetyl: 3-chloro-4-hydroxyacetanilide.  $\text{C}_8\text{H}_8\text{O}_2\text{NCl}$ . MW, 185.5. Needles. M.p. 144°.*O*-*N*-Diacetyl: needles from  $\text{H}_2\text{O}$ . M.p. 124°.*O*-*p*-Toluenesulphonyl: needles from EtOH.Aq. M.p. 116-17°.Christiansen, *J. Am. Chem. Soc.*, 1923, 45, 2192.**3-Chloro-4-aminophenol** (*m*-Chloro-*p*-aminophenol).

Needles. M.p. 160°. Sol. EtOH. Volatile in steam.

*Me ether*: see 3-Chloro-*p*-anisidine.*Et ether*: see 3-Chloro-*p*-phenetidine.*N*-Acetyl: 2-chloro-4-hydroxyacetanilide.  $\text{C}_8\text{H}_8\text{O}_2\text{NCl}$ . MW, 185.5. Prisms. M.p. 121°.Hodgson, Kershaw, *J. Chem. Soc.*, 1928, 2703.Hurst, Thorpe, *J. Chem. Soc.*, 1915, 107, 934.

**2-Chloro-1-aminopropionic Acid.**

See 2-Chloroalanine.

**4-Chloro-2-aminopyridine** (4-Chloro- $\alpha$ -pyridylamine) $C_5H_5N_2Cl$ 

MW, 128.5

Plates. M.p. 130–1°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Mod. sol. hot H<sub>2</sub>O. Volatile in steam. N-Acetyl: needles from H<sub>2</sub>O. M.p. 115–16°. N-Benzoyl: needles from EtOH. M.p. 120–1°. N-Dibenzoyl: cryst. from EtOH. M.p. 165–6°. Picrate: yellow needles from H<sub>2</sub>O. M.p. 243–4°.

Graf, *Ber.*, 1931, 64, 23.**5-Chloro-2-aminopyridine** (5-Chloro- $\alpha$ -pyridylamine).

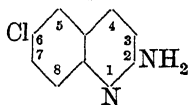
M.p. 135–6°.

Tschitschibabin, Egorov, *Chem. Abstracts*, 1929, 23, 2182.**2-Chloro-3-aminopyridine** (2-Chloro- $\beta$ -pyridylamine).

Cryst. from petrol. M.p. 80°. B.p. 130–4°/13 mm.

N-Acetyl: needles from petrol. M.p. 90–1°.

N-Diacetyl: cryst. from petrol. M.p. 67–8°.

v. Schiekh, Binz, Schulz, *Ber.*, 1936, 69, 2597.v. Schiekh, Binz, D.R.P. 645,548, (*Chem. Abstracts*, 1937, 31, 6478).**4-Chloro-3-aminopyridine** (4-Chloro- $\beta$ -pyridylamine).Cryst. from Et<sub>2</sub>O–pet. ether. M.p. 82°. Sol. H<sub>2</sub>O, ord. org. solvents.Bremer, *Ann.*, 1936, 521, 291.**6-Chloro-3-aminopyridine** (6-Chloro- $\beta$ -pyridylamine).Cryst. from toluene. M.p. 82–83.5°. Sol. EtOH, Et<sub>2</sub>O. Mod. sol. C<sub>6</sub>H<sub>6</sub>, cold H<sub>2</sub>O.Mills, Widdows, *J. Chem. Soc.*, 1908, 93, 1379.Tschitschibabin, Bylinkin, *Chem. Zentr.*, 1923, III, 1020.Binz, Schiekh, *Ber.*, 1935, 68, 320.**6-Chloro-2-aminoquinoline** $C_9H_7N_2Cl$ 

MW, 178.5

Colourless needles. M.p. 152°. Sol. EtOH.

Fischer, *Ber.*, 1902, 35, 3683.**2-Chloro-3-aminoquinoline.**Colourless cryst. M.p. 168°. Sol. EtOH, CHCl<sub>3</sub>. Mod. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Diazotises.Mills, Watson, *J. Chem. Soc.*, 1910, 97, 741.**2-Chloro-4-aminoquinoline.**

Cryst. from toluene. M.p. 188°.

B,HCl: m.p. 250°.

4-N-Phenyl: 2-chloro-4-anilinoquinoline. C<sub>15</sub>H<sub>11</sub>N<sub>2</sub>Cl. MW, 254.5. Needles from EtOH. M.p. 156°. B,HCl: yellow plates. M.p. 247°.Niementowski, *Ber.*, 1907, 40, 4290.Wojahn, *Arch. Pharm.*, 1936, 274, 83, (*Chem. Zentr.*, 1936, I, 2087).**7-Chloro-4-aminoquinoline.**Cryst. from C<sub>6</sub>H<sub>6</sub>–pet. ether. M.p. 149°.Baker, Dodson, Riegel, *J. Am. Chem. Soc.*, 1947, 69, 704.**6-Chloro-5-aminoquinoline.**Pale yellow needles + 1H<sub>2</sub>O. M.p. 115–19°, anhyd. 132–6°.

B,HCl: bluish-red plates. M.p. 215–20°.

B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>: brown needles from EtOH–HCl. M.p. 250° decomp.Claus, Schedler, *J. prakt. Chem.*, 1894, 49, 363.**8-Chloro-5-aminoquinoline.**Needles. M.p. 154–5°. Sol. EtOH, Et<sub>2</sub>O.

B,HCl: red cryst. M.p. 275°.

N-Acetyl: hydrated needles from H<sub>2</sub>O. M.p. anhyd. 172–3°.Claus, Schöller, *J. prakt. Chem.*, 1893, 48, 140.Slater, *J. Chem. Soc.*, 1932, 2106.**5-Chloro-6-aminoquinoline.**Needles from H<sub>2</sub>O. M.p. 128°.B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>: yellow needles + 2H<sub>2</sub>O from EtOH. Decomp. at 250°.Kern, *Dissertation* [Freiburg 1906], p. 7.**8-Chloro-6-aminoquinoline.**

Cryst. from AcOEt–pet. ether. M.p. 156–7°.

Hutchison, Kermack, *J. Chem. Soc.* 1947, 678.**4-Chloro-8-aminoquinoline.**

Cryst. M.p. 100–1°.

Elderfield, Kupchan, Williamson, Birstein, *J. Am. Chem. Soc.*, 1946, 68, 1528.**5-Chloro-8-aminoquinoline.**

Light yellow. M.p. 86.5–7.5°.

N-Acetyl: m.p. 140.5–1.5° (140°).

Price, Guthrie, *J. Am. Chem. Soc.*, 1946, 68, 1592.**6-Chloro-8-aminoquinoline.**

Needles. M.p. 73°. Sublimes.

B,HCl: yellow needles. M.p. 208°.



$B_2H_2PtCl_6$ : brown needles. Decomp. at 212–13°.

*Methiodide*: orange-yellow needles from  $H_2O$  or EtOH. M.p. 178°.

Claus, Schedler, *J. prakt. Chem.*, 1894, 49, 368.

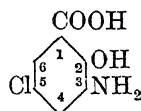
### 7-Chloro-8-aminoquinoline.

Needles. M.p. 72–3.5° (75°). Sol. EtOH, Et<sub>2</sub>O.

*N-Acetyl*: m.p. 184–6°.

Price, Guthrie, *J. Am. Chem. Soc.*, 1946, 68, 1592.

**5-Chloro-3-aminosalicylic Acid** (5-Chloro-2-hydroxy-3-aminobenzoic acid)



$C_7H_6O_3NCl$  MW, 187.5

M.p. 236° decomp.

Badische, D.R.P. 137,118, (*Chem. Zentr.*, 1902, II, 1439).

### 3-Chloro-5-aminosalicylic Acid.

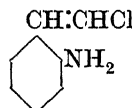
Cryst. from  $H_2O$ . M.p. 259–60° decomp. Insol. EtOH.

*N-Acetyl*: needles from  $H_2O$ . M.p. 258° decomp. Sol. EtOH.

*Diacetyl deriv.*: needles from EtOH.Aq. M.p. 218°.

Meldola, Foster, Brightman, *J. Chem. Soc.*, 1917, 111, 542.

**$\beta$ -Chloro-o-aminostyrene** (*o-Aminostyryl chloride*)



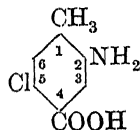
$C_8H_8NCl$  MW, 153.5

Prisms. M.p. 56°. NaOEt at 170°  $\rightarrow$  indole.

*N-Acetyl*: needles. M.p. 158–9°.

Komppa, *Ber.*, 1893, 26, 2970.

### 5-Chloro-2-amino-p-toluic Acid



$C_8H_8O_2NCl$  MW, 185.5

Needles from  $H_2O$ . M.p. 220°. Sol. EtOH.

*B,HCl*: m.p. 245° decomp.

Claus, Davidsen, *Ann.*, 1891, 265, 346.

### 6-Chloro-3-amino-p-toluic Acid.

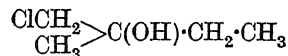
Needles from EtOH. M.p. 220°.

Claus, Böcher, *Ann.*, 1891, 265, 359.

### Chloroaminoxylene.

See Chloroxylylidine.

**1-Chloro-tert.-amyl Alcohol** (1-Chloro-2-methylbutanol-2, methylethylethylene chlorohydrin)

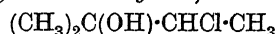


$C_5H_{11}OCl$  MW, 122.5

B.p. 152–3°.  $D_0^0$  1.068.

Fourneau, Tiffeneau, *Compt. rend.*, 1907, 145, 437.

**3-Chloro-tert.-amyl Alcohol** (3-Chloro-2-methylbutanol-2, dimethyl-1-chloroethylcarbinol, trimethylethylene chlorohydrin)



$C_5H_{11}OCl$  MW, 122.5

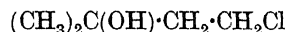
B.p. 141°. Sol. to 6% in cold  $H_2O$ .  $D_0^0$  1.054. Heat at 150°  $\rightarrow$  methyl isopropyl ketone.

*Acetate*: b.p. 99–101°/100 mm.  $D_4$  1.0400.  $n_D$  1.4320.

Fourneau, Tiffeneau, *Compt. rend.*, 1907, 145, 439.

Krassuski, *Chem. Zentr.*, 1901, I, 995.

**4-Chloro-tert.-amyl Alcohol** (4-Chloro-2-methylbutanol-2)



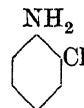
$C_5H_{11}OCl$  MW, 122.5

B.p. 166°, 62–3°/14 mm.

Henry, *Compt. rend.*, 1906, 142, 133.

Spath, Spitzky, *Ber.*, 1925, 58, 2276.

### o-Chloroaniline



$C_6H_6NCl$  MW, 127.5

M.p. – 2°. B.p. 208.8°. Sol. most ord. org. solvents.  $D_4^0$  1.21253.  $n_D^{20}$  1.58951. Volatile in steam.

*N-Me*: see *o*-Chloro-*N*-methylaniline.

*N-Di-Me*: see *o*-Chlorodimethylaniline.

*N-Et*: see *o*-Chloro-*N*-ethylaniline.

*N-Formyl*: leaflets from ligroin. M.p. 77°.

*N-Acetyl*: *o*-chloroacetanilide.  $C_8H_8ONCl$ . MW. 169.5. Needles from AcOH.Aq. M.p. 87–8°.

*N-Chloroacetyl*: m.p. 74°.

*N-Propionyl*: plates from pet. ether. M.p. 91°.

*N-Benozyl*: needles. M.p. 99°.

*N-p-Toluenesulphonyl*: m.p. 193°.

Bashioum, Powers, *Ind. Eng. Chem.*, 1923, 15, 407.

van Duin, *Rec. trav. chim.*, 1932, 51, 878.

Chattaway, Orton, *J. Chem. Soc.*, 1901, 79, 469.

**m-Chloroaniline.**

M.p.  $-10.4^{\circ}$ . B.p.  $230.5^{\circ}$ ,  $118.5^{\circ}/21$  mm. Sol. most ord. org. solvents.  $D_{20}^{25}$  1.2225.  $n_D^{20}$  1.59305.

N-Me: see m-Chloro-N-methylaniline.

N-Di-Me: see m-Chlorodimethylaniline.

N-Et: see m-Chloro-N-ethylaniline.

N-Di-Et: m-chlorodiethylaniline.  $C_{10}H_{14}NCl$ . MW, 183.5. B.p.  $248-9^{\circ}/740$  mm.

N-Phenyl: see 3-Chlorodiphenylamine.

N-Formyl: m.p.  $57-8^{\circ}$ .

N-Acetyl: m-chloroacetanilide.  $C_8H_8ONCl$ . MW, 169.5. Needles. M.p.  $79^{\circ}$  ( $72-3^{\circ}$ ).

N-Chloroacetyl: leaflets from  $C_6H_6$ . M.p.  $101^{\circ}$ .

N-Benzoyl: needles. M.p.  $118^{\circ}$ .

N-Dibenzoyl: m.p.  $132^{\circ}$ .

N-p-Toluenesulphonyl: m.p.  $210^{\circ}$ .

Blanksma, *Rec. trav. chim.*, 1909, **28**, 107.

Beilstein, Kurbatow, *Ann.*, 1876, **182**, 102.

**p-Chloroaniline.**

Prisms. M.p.  $70-1^{\circ}$ . B.p.  $232^{\circ}$ . Sol. most ord. org. solvents.  $D^{19}$  1.427.

N-Me: see p-Chloro-N-methylaniline.

N-Di-Me: see p-Chlorodimethylaniline.

N-Et: see p-Chloro-N-ethylaniline.

N-Phenyl: see 4-Chlorodiphenylamine.

N-Formyl: plates from  $H_2O$ . M.p.  $102^{\circ}$ .

N-Acetyl: p-chloroacetanilide.  $C_8H_8ONCl$ . MW, 169.5. Needles or plates. M.p.  $178.4^{\circ}$  ( $172-3^{\circ}$ ).

N-Chloroacetyl: m.p.  $169^{\circ}$ .

N-Propionyl: plates from  $CHCl_3$ . M.p.  $141^{\circ}$ .

N-Benzoyl: plates or prisms. M.p.  $192-3^{\circ}$ .

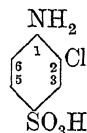
N-p-Toluenesulphonyl: m.p.  $213-31^{\circ}$ .

Bashioum, Powers, *Ind. Eng. Chem.*, 1923, **15**, 407.

Slosson, *Am. Chem. J.*, 1903, **29**, 302.

Popov, *Chem. Abstracts*, 1934, **28**, 1671.

**2-Chloroaniline-4-sulphonic Acid** (2-Chlorosulphanilic acid)



$C_6H_6O_3NCIS$  MW, 207.5

Mod. sol.  $H_2O$ . Na salt: needles +  $4H_2O$ . Br  $\rightarrow$  chlorodibromoaniline.

Nölting, Battagay, *Ber.*, 1906, **39**, 84.

**2-Chloroaniline-5-sulphonic Acid** (6-Chlorometanilic acid).

Needles +  $1H_2O$  from  $H_2O$ . K salt: needles or leaflets. Ba salt: needles +  $4H_2O$ .

Fischer, *Ber.*, 1891, **24**, 3193.

**3-Chloroaniline-2-sulphonic Acid** (3-Chloro-orthanilic acid).

Yellowish leaflets. Mod. sol.  $H_2O$ .

Claus, Bopp, *Ann.*, 1891, **265**, 101.

Post, Meyer, *Ber.*, 1881, **14**, 1607.

**3-Chloroaniline-5-sulphonic Acid** (5-Chlorometanilic acid).

Colourless needles. Sol. hot  $H_2O$ .

Claus, Bopp, *Ann.*, 1891, **265**, 97.

Post, Meyer, *Ber.*, 1881, **14**, 1607.

**3-Chloroaniline-6-sulphonic Acid** (5-Chloro-orthanilic acid).

Colourless leaflets from  $H_2O$ . M.p.  $310-30^{\circ}$ . Sweet taste. Chars without melting. Br.Aq.  $\rightarrow$  3-chloro-2 : 4 : 6-tribromoaniline.

Elgersma, *Rec. trav. chim.*, 1929, **48**, 759.

Claus, Bopp, *Ann.*, 1891, **265**, 105.

Zincke, *Ann.*, 1918, **416**, 95.

**4-Chloroaniline-2-sulphonic Acid** (4-Chloro-orthanilic acid).

Fine needles from  $H_2O$ . Decomp. at  $280^{\circ}$  without melting.

Paal, *Ber.*, 1901, **34**, 2753.

Philip, Colborne, *J. Chem. Soc.*, 1924, **125**, 498.

**4-Chloroaniline-3-sulphonic Acid** (4-Chlorometanilic acid).

Needles from  $H_2O$ . Decomp. about  $280^{\circ}$ . Insol. EtOH, AcOH.

Paal, *Ber.*, 1901, **34**, 2753.

Philip, Colborne, *J. Chem. Soc.*, 1924, **125**, 498.

**Chloroanilinoacetic Acid.**

See Chlorophenyglycine.

**Chloroanilinoanthraquinone.**

See under Chloroaminoanthraquinone.

**2-Chloro-4-anilinoquinoline.**

See under 2-Chloro-4-aminoquinoline.

**Chloroanisaldehyde.**

See under Chloro-p-hydroxybenzaldehyde.

**2-Chloroanisic Acid** (2-Chloro-4-methoxybenzoic acid)



$C_8H_7O_3Cl$  MW, 186.5

Needles. M.p.  $208^{\circ}$ . Sol. EtOH,  $Et_2O$ . Mod. sol.  $C_6H_6$ .

Ullmann, Wagner, *Ann.*, 1907, **355**, 368.

**3-Chloroanisic Acid.**

M.p.  $214-15^{\circ}$ .

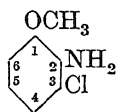
Me ester:  $C_9H_9O_3Cl$ . MW, 200.5. Cryst. from ligroin. M.p.  $94-5^{\circ}$ . Volatile in steam.

Amide:  $C_8H_8O_2NCl$ . MW, 185.5. Needles. M.p.  $193^{\circ}$ .

Gattermann, *Ber.*, 1899, **32**, 1121.

Auwers, *Ber.*, 1897, **30**, 1478.

**3-Chloro-*o*-anisidine** (3-*Chloro-o*-aminoanisole, 3-chloro-2-aminophenyl methyl ether)

C<sub>7</sub>H<sub>8</sub>ONCl

MW, 157.5

B.p. 246° slight decomp.

*B.HCl*: needles from H<sub>2</sub>O. M.p. 211°.*B.HNO<sub>3</sub>*: needles. M.p. 137°.*N-Acetyl*: 3-chloro-*o*-acetanilide. Prisms from 60% EtOH. M.p. 123°.*N-Diacetyl*: m.p. 145.5°.*N-Benzoyl*: needles from EtOH. M.p. 135°.Hodgson, Kershaw, *J. Chem. Soc.*, 1928, 191.Meldola, Eyre, *J. Chem. Soc.*, 1902, **81**, 996.

**4-Chloro-*o*-anisidine** (4-*Chloro-o*-aminoanisole, 4-chloro-2-aminophenyl methyl ether).

Needles. M.p. 84°. Sol. EtOH, Et<sub>2</sub>O. Volatile in steam.*N-Acetyl*: 4-chloro-*o*-acetanilide. Needles from hot H<sub>2</sub>O. M.p. 104°.*N-Benzoyl*: needles from EtOH.Aq. M.p. 77-8°.*Picrate*: m.p. 194° decomp.Raiford, Colbert, *J. Am. Chem. Soc.*, 1926, **48**, 2657.I.G., D.R.P. 605,974; F.P. 774,122, (*Chem. Zentr.*, 1928, I, 2895).

**5-Chloro-*o*-anisidine** (5-*Chloro-o*-aminoanisole, 5-chloro-2-aminophenyl methyl ether).

Needles or prisms. M.p. 52° (45-6°). B.p. 260°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.*B.HCl*: needles. M.p. 238°.*N-Formyl*: leaflets from EtOH. M.p. 177-8°.*N-Acetyl*: 5-chloro-*o*-acetanilide. Leaflets. M.p. 150° (143-4°). B.p. 326°.*Picrate*: m.p. 200° decomp.Hodgson, Handley, *J. Chem. Soc.*, 1926, 543.Orton, King, *J. Chem. Soc.*, 1911, **99**, 1189.Reverdin, Eckhard, *Ber.*, 1899, **32**, 2625.I.G., D.R.P. 511,468, (*Chem. Zentr.*, 1931, I, 361).

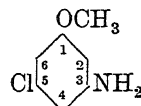
**6-Chloro-*o*-anisidine** (6-*Chloro-o*-aminoanisole, 6-chloro-2-aminophenyl methyl ether).

B.p. 112-16°/10 mm.

*N-Acetyl*: m.p. 84-5°.Lauer et al., *J. Am. Chem. Soc.*, 1946, **68**, 1268.

Diet. of Org. Comp.—I.

**5-Chloro-*m*-anisidine** (5-*Chloro-m*-aminoanisole, 5-chloro-3-aminophenyl methyl ether)

C<sub>7</sub>H<sub>8</sub>ONCl

MW, 157.5

Needles. M.p. 33°.

Hodgson, Wignall, *J. Chem. Soc.*, 1926, 2078.

**6-Chloro-*m*-anisidine** (6-*Chloro-m*-aminoanisole, 6-chloro-3-aminophenyl methyl ether).

Needles. M.p. 77°. Sol. EtOH, Et<sub>2</sub>O. Volatile in steam.*N-Acetyl*: 6-chloro-*m*-acetanilide. Needles from H<sub>2</sub>O. M.p. 122°.Reverdin, Eckhard, *Ber.*, 1899, **32**, 2625.

**2-Chloro-*p*-anisidine** (2-*Chloro-p*-aminoanisole, 2-chloro-4-aminophenyl methyl ether)

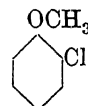
C<sub>7</sub>H<sub>8</sub>ONCl

MW, 157.5

Needles. M.p. 62°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. *B.HCl*: m.p. 278-9°.*N-Acetyl*: 2-chloro-*p*-acetanilide. Needles from H<sub>2</sub>O. M.p. 94°.*Picrate*: m.p. 186° decomp.Reverdin, Eckhard, *Ber.*, 1899, **32**, 2625.

**3-Chloro-*p*-anisidine** (3-*Chloro-p*-aminoanisole, 3-chloro-4-aminophenyl methyl ether).

B.p. 156°/31 mm.

*B.HCl*: needles. M.p. 228°.*N-Acetyl*: 3-chloro-*p*-acetanilide. Prisms from C<sub>6</sub>H<sub>6</sub>. M.p. 114°.Hodgson, Handley, *J. Chem. Soc.*, 1926, 543.Hurst, Thorpe, *J. Chem. Soc.*, 1915, **107**, 939.I.C.I., B.P. 379,741; F.P. 738,157, (*Chem. Zentr.*, 1933, I, 3794); D.R.P. 621,710, (*Chem. Zentr.*, 1936, I, 3021).***o*-Chloroanisole**C<sub>7</sub>H<sub>7</sub>OCl

MW, 142.5

B.p. 195-6°/760 mm., 87-8°/17 mm. D<sub>4</sub><sup>20</sup> 1.248. n<sub>D</sub><sup>20</sup> 1.5480. Sol. EtOH, Et<sub>2</sub>O.Meyer, *Monatsh.*, 1915, **36**, 726.Gattermann, *J. prakt. Chem.*, 1899, **59**, 583.Paty, Quelet, *Bull. soc. chim.*, 1944, **11**, 505.

**m-Chloroanisole.**

B.p. 193-4°. Sol. EtOH, Et<sub>2</sub>O. Volatile in steam.

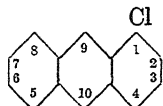
Gattermann, *Ann.*, 1907, **357**, 349.  
Reverdin, Eckhard, *Ber.*, 1899, **32**, 2626.

**p-Chloroanisole.**

B.p. 198°/760 mm., 82-3°/17 mm. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>.

Bryd, *Chem. Abstracts*, 1928, **22**, 2372.  
Beilstein, Kurbatow, *Ann.*, 1875, **176**, 30.

**1-Chloroanthracene**



C<sub>14</sub>H<sub>9</sub>Cl MW, 212.5

Leaflets from AcOH. M.p. 81-2°. Sol. EtOH, Et<sub>2</sub>O. Polymerises in light.

*Picrate*: m.p. 101-2°.  
Fischer, Ziegler, *J. prakt. Chem.*, 1912, **86**, 293.  
Schilling, *Ber.*, 1913, **46**, 1068.

**2-Chloroanthracene.**

Needles or leaflets. M.p. 215°.  
Schilling, *Ber.*, 1913, **46**, 1068.

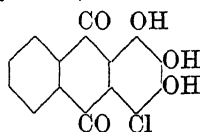
**9-Chloroanthracene (ms-Chloroanthracene, 10-chloroanthracene).**

Golden-yellow needles from EtOH. M.p. 103°.  
Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>, hot PhNO<sub>2</sub>.

Perkin, *Chem. News*, 1876, **34**, 145;  
*J. Chem. Soc.*, 1877, **31**, 209.

Clark, *Chem. News*, 1931, **143**, 265, (*Chem. Abstracts*, 1932, **26**, 1591).

**4-Chloroanthragallol (4-Chloro-1 : 2 : 3-trihydroxyanthraquinone)**

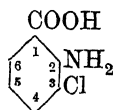


C<sub>14</sub>H<sub>7</sub>O<sub>5</sub>Cl MW, 290.5

Yellow needles. M.p. 223°. Sol. EtOH, xylene, AcOH. Insol. Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Sol. alkalis to green sols. Conc. H<sub>2</sub>SO<sub>4</sub> → red col.

*Triacetyl*: yellow needles. M.p. 187°.  
Bamberger, Bock, *Monatsh.*, 1901, **22**, 717.

**3-Chloroanthranilic Acid (3-Chloro-o-amino-benzoic acid)**



C<sub>7</sub>H<sub>6</sub>O<sub>2</sub>NCl MW, 171.5  
Needles. M.p. 148°.

Hübner, Weiss, *Ber.*, 1873, **6**, 175.  
Eller, Klemm, *Ber.*, 1922, **55**, 219.

**4-Chloroanthranilic Acid.**

Needles from EtOH.Aq. M.p. 240° (235°).  
*Me ester*: C<sub>8</sub>H<sub>8</sub>O<sub>2</sub>NCl. MW, 185.5. Needles.

M.p. 68-9°.  
*Et ester*: C<sub>9</sub>H<sub>10</sub>O<sub>2</sub>NCl. MW, 199.5. Needles.  
M.p. 41°.

*Amide*: C<sub>7</sub>H<sub>7</sub>ON<sub>2</sub>Cl. MW, 170.5. Plates.  
M.p. 181-2°.

*N-Acetyl*: cryst. from H<sub>2</sub>O. M.p. 214°.  
*N-Benzoyl*: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 223°.

Hunn, *J. Am. Chem. Soc.*, 1923, **45**, 1027.  
Heller, Hessel, *J. prakt. Chem.*, 1928, **120**, 67.

Magidson, Travin, *J. Gen. Chem. U.S.S.R.*, 1937, **7**, 842, (*Chem. Abstracts*, 1937, **31**, 5800).

**5-Chloroanthranilic Acid.**

Needles. M.p. 211-12°. Heat at 200° → *p*-chloroaniline.

*Me ester*: yellow leaflets from MeOH.Aq. M.p. 76°. *N-Acetyl*: needles from EtOH. M.p. 127°.

*Amide*: needles from EtOH. M.p. 172°.  
*N-Me*: C<sub>8</sub>H<sub>8</sub>O<sub>2</sub>NCl. MW, 185.5. Yellow needles from EtOH.Aq. M.p. 173°.

*N-Di-Me*: *B,HCl*: m.p. 204°.  
*N-Phenyl*: 4-chlorodiphenylamine-2-carboxylic acid. C<sub>13</sub>H<sub>10</sub>O<sub>2</sub>NCl. MW, 247.5. Yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 207°.

Freundler, *Compt. rend.*, 1906, **143**, 909; 1910, **150**, 1179.

Eller, Klemm, *Ber.*, 1922, **55**, 221.  
Magidson, Travin, *J. Gen. Chem. U.S.S.R.*, 1937, **7**, 842, (*Chem. Abstracts*, 1937, **31**, 5800).

*N-Phenyl*: 4-chlorodiphenylamine-2-carboxylic acid. C<sub>13</sub>H<sub>10</sub>O<sub>2</sub>NCl. MW, 247.5. Yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 207°.

**6-Chloroanthranilic Acid.**

Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 146-7°.  
*Hydrochloride*: needles. M.p. 195° decomp.

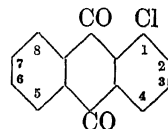
*Me ester*: C<sub>8</sub>H<sub>8</sub>O<sub>2</sub>NCl. MW, 185.5. B.p. 156-9°/10 mm.

*N-Me*: C<sub>8</sub>H<sub>8</sub>O<sub>2</sub>NCl. MW, 185.5. Needles from EtOH. M.p. 178°.

*N-Formyl*: needles from EtOH. M.p. 201-2° decomp.  
*N-Acetyl*: needles from H<sub>2</sub>O. M.p. 215°.

Cohn, *Monatsh.*, 1901, **22**, 473.  
B.A.S.F., D.R.P. 231,962, (*Chem. Zentr.*, 1911, **I**, 937).

**1-Chloroanthraquinone (α-Chloroanthraquinone)**



C<sub>14</sub>H<sub>7</sub>O<sub>2</sub>Cl MW, 242.5

Yellow needles. M.p. 162°. Sol. AcOH, PhNO<sub>2</sub>, amyl alcohol, hot C<sub>6</sub>H<sub>6</sub>. Mod. sol. hot EtOH. Pale yellow sol. in conc. H<sub>2</sub>SO<sub>4</sub>.

Schilling, *Ber.*, 1913, **46**, 1068.  
Ullmann, Ochsner, *Ann.*, 1911, **381**, 2.

**2-Chloroanthraquinone** ( $\beta$ -Chloroanthraquinone).

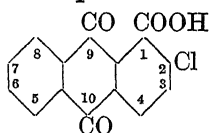
Pale yellow needles from AcOH or EtOH. M.p. 211°. Sol. hot  $C_6H_6$ ,  $PhNO_2$ , conc.  $H_2SO_4$ . Groggins, Newton, *Ind. Eng. Chem.*, 1929, 21, 369.

Höchst, D.R.P. 296,019, (*Chem. Zentr.*, 1917, I, 460).

Karpukhin, *Chem. Abstracts*, 1936, 30, 7112.

du Pont., U.S.P. 1,967,862, (*Chem. Abstracts*, 1934, 28, 5994).

Scottish Dyes, U.S.P. 1,812,274; B.P. 248,411, (*Chem. Abstracts*, 1931, 25, 4894).

**2-Chloroanthraquinone - 1 - carboxylic Acid**

$C_{15}H_7O_4Cl$  MW, 286.5

Cryst. from  $PhNO_2$ . M.p. 176-7°.

Nitrile:  $C_{15}H_6O_2NCl$ . MW, 267.5. M.p. 284-5°.

I.G., B.P. 297,001; F.P. 659,962, (*Chem. Zentr.*, 1929, II, 2262); D.R.P. 570,859, (*Chem. Zentr.*, 1933, II, 454).

**3-Chloroanthraquinone - 1 - carboxylic Acid.**

M.p. 286-7° decomp. (297-9°). Heat at 290°  $\rightarrow$  2-chloroanthraquinone.

Keimatsu, Hiramio, Tanabe, *Chem. Abstracts*, 1929, 23, 4696.

Scholl, Seer, *Ber.*, 1922, 55, 116.

**4-Chloroanthraquinone - 1 - carboxylic Acid.**

Yellow needles from AcOH or AcOEt. M.p. 229°. Spar. sol.  $C_6H_6$ , ligroin. Sol. most other org. solvents.

*Me ester*:  $C_{16}H_9O_4Cl$ . MW, 300.5. Cryst. from  $CHCl_3$ . M.p. 190°.

*Anhydride*:  $C_{30}H_{12}O_7Cl_2$ . MW, 555. M.p. 260-2° decomp.

*Nitrile*: cryst. from AcOH. M.p. 271-2°.

B.A.S.F., D.R.P. 259,365, (*Chem. Zentr.*, 1913, I, 1741).

Heller, Schülke, *Ber.*, 1908, 41, 3636.

Scholl, Wallenstein, *Ber.*, 1936, 69, 503.

Stanley, Adams, *J. Am. Chem. Soc.*, 1931, 53, 2364.

**5-Chloroanthraquinone - 1 - carboxylic Acid.**

Yellow needles from AcOH. M.p. 306° (varies with rate of heating).

*Me ester*: yellow needles from AcOH. M.p. 181°.

Cahn, Jones, Simonsen, *J. Chem. Soc.*, 1933, 444.

**6-Chloroanthraquinone - 1 - carboxylic Acid.**

Golden needles from AcOH. M.p. 306° (295°). Sublimes. Decomp. on prolonged heating at 310°  $\rightarrow$  2-chloroanthraquinone. Sol. conc.  $H_2SO_4$ ,  $PhNO_2$ . Spar. sol.  $C_6H_6$ ,  $CHCl_3$ .

*Me ester*: m.p. 190-1°.

*Chloride*:  $C_{15}H_6O_3Cl_2$ . MW, 305. Yellow prisms from  $C_6H_6$ . M.p. 234-6° decomp.

Cahn, Jones, Simonsen, *J. Chem. Soc.*, 1933, 444.

Scholl, Seer, *Ber.*, 1922, 55, 114.

**7-Chloroanthraquinone - 1 - carboxylic Acid.**

M.p. 262-4°.

*Me ester*: m.p. 193-4°.

Cahn, Jones, Simonsen, *J. Chem. Soc.*, 1933, 444.

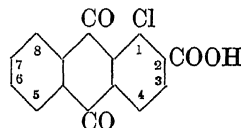
Scholl, Seer, *Ber.*, 1922, 55, 114.

**8-Chloroanthraquinone - 1 - carboxylic Acid.**

Brown powder. M.p. 228-31°.

*Me ester*: yellow needles from MeOH. M.p. 124-5°.

Cahn, Jones, Simonsen, *J. Chem. Soc.*, 1933, 445.

**1-Chloroanthraquinone - 2 - carboxylic Acid** ( $\alpha$ -Chloro- $\beta$ -carboxyanthraquinone)

$C_{15}H_7O_4Cl$  MW, 286.5

Pale yellow needles from EtOH. M.p. 272°. Sol. alkalis. Yellow in conc.  $H_2SO_4$ .

*Me ester*:  $C_{16}H_9O_4Cl$ . MW, 300.5. Yellow plates from  $Me_2CO$ . M.p. 161.5° (155°). Readily sol.  $C_6H_6$ ,  $PhNO_2$ . Sol.  $Me_2CO$ , AcOH. Spar. sol. MeOH,  $Et_2O$ .

*Et ester*:  $C_{17}H_{11}O_4Cl$ . MW, 314.5. Yellow leaflets from EtOH. M.p. 142°.

*Benzyl ester*:  $C_{22}H_{15}O_4Cl$ . MW, 376.5. Yellow needles from EtOH or AcOH. M.p. 135-6°.

*Chloride*:  $C_{15}H_6O_3Cl_2$ . MW, 305. Pale yellow needles from  $SOCl_2$ . M.p. 210°.

*Amide*:  $C_{15}H_8O_3NCl$ . MW, 285.5. Yellow needles. M.p. 317°.

*Nitrile*:  $C_{15}H_6O_2NCl$ . MW, 267.5. Pale yellow cryst. from  $C_6H_6$ -AcOH. M.p. 248-9°.

Ullmann, Binsler, *Ber.*, 1916, 49, 746.

B.A.S.F., D.R.P. 250,742, (*Chem. Zentr.*, 1912, II, 1243).

I.G., D.R.P. 609,401, (*Chem. Zentr.*, 1935, I, 3204).

Rollet, *Monatsh.*, 1925, 46, 131.

Scottish Dyes, B.P. 207,840, (*Chem. Zentr.*, 1926, I, 499).

**3 - Chloroanthraquinone - 2 - carboxylic Acid.**

Yellowish needles from AcOH. M.p. 285°. Mod. sol. hot EtOH, Me<sub>2</sub>CO. Spar. sol. C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>.

*Et ester*: C<sub>17</sub>H<sub>11</sub>O<sub>4</sub>Cl. MW, 314.5. Pale yellow needles from EtOH. M.p. 153-4°. Sol. hot EtOH and most org. solvents. Spar. sol. Et<sub>2</sub>O, ligroin.

*Nitrile*: m.p. 284°.

Ullmann, Dasgupta, *Ber.*, 1914, **47**, 561. I.G., D.R.P. 609,401, (*Chem. Zentr.*, 1935, I, 3204).

Heller, Schülke, *Ber.*, 1908, **41**, 3638.

B.A.S.F., D.R.P. 254,450, (*Chem. Zentr.*, 1913, I, 345).

I.G., B.P. 394,990, (*Chem. Zentr.*, 1933, II, 2753); D.R.P. 583,562; F.P. 745,782, (*Chem. Zentr.*, 1933, II, 2459); F.P. 740,055, (*Chem. Zentr.*, 1933, II, 455); D.R.P. 556,161, (*Chem. Zentr.*, 1932, II, 2114); D.R.P. 560,352, (*Chem. Zentr.*, 1933, II, 286); B.P. 297,001; F.P. 659,962, (*Chem. Zentr.*, 1929, II, 2262); D.R.P. 570,859, (*Chem. Zentr.*, 1933, II, 454).

**4 - Chloroanthraquinone - 2 - carboxylic Acid.**

Decomp. at 256-7° → 1-chloroanthraquinone.

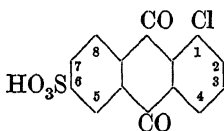
Keimatsu, Hiramo, Tanabe, *Chem. Abstracts*, 1929, **23**, 4696.

**6 - Chloroanthraquinone - 2 - carboxylic Acid.**

*Nitrile*: m.p. 304-6°.

I.G., D.R.P. 570,859, (*Chem. Zentr.*, 1933, II, 454).

**1 - Chloroanthraquinone - 6 - sulphonic Acid**



C<sub>14</sub>H<sub>7</sub>O<sub>5</sub>ClS MW, 322.5

Lemon-yellow prisms. M.p. 236-7° decomp. Sol. H<sub>2</sub>O. Sol. conc. H<sub>2</sub>SO<sub>4</sub> with yellow col. Na salt spar. sol. H<sub>2</sub>O. Ca, Mg, Ni salts prac. insol. H<sub>2</sub>O.

Fierz-David, *Helv. Chim. Acta*, 1927, **10**, 210.

**1 - Chloroanthraquinone - 7 - sulphonic Acid.**

Yellow plates. M.p. 248-9°. Sol. 4 parts H<sub>2</sub>O. Spar. sol. Me<sub>2</sub>CO. K salt sol. 580 parts H<sub>2</sub>O, Ca salt in 6,400.

*Chloride*: C<sub>14</sub>H<sub>6</sub>O<sub>4</sub>Cl<sub>2</sub>S. MW, 341. M.p. 207°.

Fierz-David, *Helv. Chim. Acta*, 1927, **10**, 213.

**1 - Chloroanthraquinone - 8 - sulphonic Acid.**

Pale yellow needles. M.p. 183-4° decomp. Spar. sol. H<sub>2</sub>O. Na salt spar. sol. H<sub>2</sub>O. Ca, Mg, Ba, Ni salts prac. insol. H<sub>2</sub>O.

Fierz-David, *Helv. Chim. Acta*, 1927, **10**, 211.

**2 - Chloroanthraquinone - 6 - sulphonic Acid.**

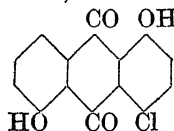
Yellow leaflets from chlorobenzene. M.p. 282°. Spar. sol. H<sub>2</sub>O.

*Chloride*: m.p. 202°.

Fierz-David, *Helv. Chim. Acta*, 1927, **10**, 226.

Goldberg, *J. Chem. Soc.*, 1932, 77.

**4 - Chloroanthrarufin (4 - Chloro - 1 : 5 - di - hydroxyanthraquinone)**

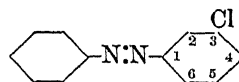


C<sub>14</sub>H<sub>7</sub>O<sub>4</sub>Cl MW, 274.5

Orange-yellow cryst. Sol. EtOH, hot AcOH. Red sol. in conc. H<sub>2</sub>SO<sub>4</sub>.

Wedekind, D.R.P. 167,743, (*Chem. Zentr.*, 1906, I, 1071).

**3-Chloroazobenzene (Benzeneazo-m-chlorobenzene)**



C<sub>12</sub>H<sub>9</sub>N<sub>2</sub>Cl MW, 216.5

Orange-yellow needles. M.p. 67.5°.

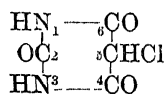
Bamberger, *Ber.*, 1896, **29**, 103.

**4-Chloroazobenzene (Benzeneazo-p-chlorobenzene).**

Orange-yellow leaflets. M.p. 90-1°. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, hot EtOH. Sublimes.

Jacobson, Loeb, *Ber.*, 1903, **36**, 4090.

**5-Chlorobarbituric Acid**



C<sub>4</sub>H<sub>3</sub>O<sub>3</sub>N<sub>2</sub>Cl MW, 162.5

Needles + 2H<sub>2</sub>O from H<sub>2</sub>O. Reddens on heating. M.p. 290-5°.

*NH<sub>4</sub> salt*: darkens at 200°. M.p. 245°.

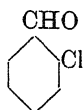
1-N-Me: C<sub>5</sub>H<sub>5</sub>O<sub>3</sub>N<sub>2</sub>Cl. MW, 176.5. M.p. 137°.

1:3-N-Di-Me: C<sub>6</sub>H<sub>7</sub>O<sub>3</sub>N<sub>2</sub>Cl. MW, 190.5. M.p. 129°.

Bock, *Ber.*, 1923, **56**, 1222.

Biltz, *Hamburger. Ber.*, 1916, **49**, 435.

## o-Chlorobenzaldehyde

C<sub>7</sub>H<sub>5</sub>OCl

MW, 140.5

Needles. M.p. 11°. B.p. 213–14°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

α-Oxime: prisms, m.p. 75–6°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. cold H<sub>2</sub>O.

β-Oxime: m.p. 101–3°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

Semicarbazone: two forms. (i) Leaflets. M.p. 229–30°. (ii) Yellow prisms. M.p. 146°.

2:4-Dinitrophenylsemicarbazone: m.p. 248°.

Hydrazone: m.p. 33–4°. B.p. 165–7°/14 mm.

Phenylhydrazone: leaflets from EtOH. M.p. 86°.

o-Chlorophenylhydrazone: yellow. M.p. 121°.

o-Bromophenylhydrazone: m.p. 125°.

o-Nitrophenylhydrazone: orange-yellow. M.p. 178°.

p-Nitrophenylhydrazone: orange plates. M.p. 249°.

2:4-Dinitrophenylhydrazone: orange. M.p. 209°.

Brady, *J. Chem. Soc.*, 1925, 127, 2428.

Erdmann, *Ann.*, 1893, 272, 152.

Mayer, English, *Ann.*, 1918, 417, 78.

Stephens, *J. Chem. Soc.*, 1925, 127, 1877.

Craver, U.S.P. 1,904,414; F.P. 558,230, (*Chem. Zentr.*, 1923, IV, 829).

## m-Chlorobenzaldehyde.

Prisms. M.p. 17–18°. B.p. 213–14°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. D<sup>20</sup> 1.2497.

α-Oxime: prisms. M.p. 70–1°.

β-Oxime: prisms, m.p. 118° (rapid heat.).

Hydrochloride: m.p. 139–40°.

Semicarbazone: m.p. 228°.

Phenylhydrazone: needles from EtOH. M.p. 134–5°.

p-Nitrophenylhydrazone: m.p. 216°.

Curtius, *J. prakt. Chem.*, 1912, 85, 177.

## p-Chlorobenzaldehyde.

Leaflets. M.p. 47°. B.p. 213°/748 mm., 72–5°/3 mm. Sol. EtOH, Et<sub>2</sub>O, CS<sub>2</sub>, AcOH, C<sub>6</sub>H<sub>6</sub>.

Mod. sol. hot H<sub>2</sub>O. Volatile in steam. KMnO<sub>4</sub> → p-chlorobenzoic acid.

Di-Me acetal: b.p. 114–15°/19 mm., 67–70°/0.3 mm.

α-Oxime: m.p. 110°. Sol. Et<sub>2</sub>O.

β-Oxime: prisms. M.p. 146°.

N-p-Tolylloxime: lustrous light yellow cryst. M.p. 160–1°.

Semicarbazone: m.p. 232–3°.

Phenylhydrazone: m.p. 126–7°.

o-Nitrophenylhydrazone: scarlet. M.p. 203–4°.

p-Nitrophenylhydrazone: m.p. 218–20°.

Anil: cryst. from EtOH. M.p. 66°.

Blanksma, *Chem. Zentr.*, 1910, I, 261.

Walther, Raetze, *J. prakt. Chem.*, 1902, 65, 258.

Mayer, English, *Ann.*, 1918, 417, 79.

McFadyen, Stevens, *J. Chem. Soc.*, 1936, 584.

Hinkel, Ayling, Beynon, *J. Chem. Soc.*, 1936, 342.

McEwen, *Organic Syntheses*, 1932, XII, 12. Stevens, *J. Chem. Soc.*, 1925, 127, 1877.

## N-Chlorobenzamide (Benzochloroamide, benzoylchlorylamine)

C<sub>6</sub>H<sub>5</sub>·CO·NHClC<sub>7</sub>H<sub>6</sub>ONCl

MW, 155.5

M.p. 117°. Sol. H<sub>2</sub>O. Insol. EtOH, C<sub>6</sub>H<sub>6</sub>.

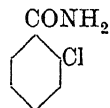
Aq. sol. reacts acid to litmus. Aq. NaOH or KOH → sym.-diphenylurea. Excess NaOH

→ aniline.

Elliott, *J. Chem. Soc.*, 1922, 121, 203.

I.G., D.R.P. 616,381, (*Chem. Zentr.*, 1935, II, 2282).

## o-Chlorobenzamide

C<sub>7</sub>H<sub>6</sub>ONCl

MW, 155.5

M.p. 142° (139°). Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O.

N-Me: plates from EtOH. Aq. M.p. 121–5° (92–4°).

N-Di-Me: m.p. 13.5°. B.p. 157°/14 mm.

N-Diphenyl: o-chlorobenzoyldiphenylamine. M.p. 142–3°.

Kekulé, *Ann.*, 1861, 117, 154.

Remsen, Reid, *Am. Chem. J.*, 1899, 21, 290.

Kao, Ma, *Chem. Abstracts*, 1932, 26, 1592.

## m-Chlorobenzamide.

M.p. 134°. Sol. EtOH, hot H<sub>2</sub>O.

Hg deriv.: m.p. 245°.

N-Me: needles from MeOH. Aq. M.p. 75°.

N-Di-Me: plates from Et<sub>2</sub>O–pet. ether. M.p. 61°.

Hübner, *Ann.*, 1884, 222, 94.

Kao, Ma, *Chem. Abstracts*, 1932, 26, 1592.

## p-Chlorobenzamide.

M.p. 179° (170°). Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O.

Hg deriv.: m.p. 258°.

N-Me: needles from EtOH. Aq. M.p. 161°.

N-Di-Me: needles from Et<sub>2</sub>O–pet. ether. M.p. 59°.

N-Diphenyl: p-chlorobenzoyldiphenylamine. M.p. 138°.

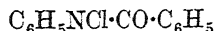
Remsen, Reid, *Am. Chem. J.*, 1899, 21, 290.

Emmerling, *Ber.*, 1875, 8, 882.

Kao, Ma, *J. Chem. Soc.*, 1931, 443.

**Chlorobenzanilide.**

See under Chlorobenzoic Acid.

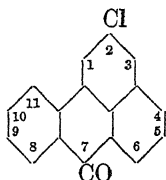
**N-Chlorobenzanilide** $C_{13}H_{10}ONCl$ 

MW, 231.5

Needles from ligroin. M.p. 81.5–82°. Sol. EtOH, Et<sub>2</sub>O. Heat. above 160° or heat. with H<sub>2</sub>O → *p*-chlorobenzanilide. Boiling NaOH → benzanilide.

Chattaway, Orton, *J. Chem. Soc.*, 1899, 75, 1053.

Slosson, *Am. Chem. J.*, 1903, 29, 305.

**2-Chlorobenzanthrone** $C_{17}H_9OCl$ 

MW, 264.5

Yellowish-green plates from C<sub>6</sub>H<sub>6</sub>. M.p. 191–2°. Orange-red sol. in conc. H<sub>2</sub>SO<sub>4</sub> with brown fluor.

Heilbron, Heslop, Irving, *J. Chem. Soc.*, 1936, 783.

**3-Chlorobenzanthrone.**

Yellow needles from AcOH. M.p. 182–3°. Sol. AcOH, C<sub>6</sub>H<sub>6</sub>, PhNO<sub>2</sub>. KOH fusion → isoviolanthrone.

Cahn, Jones, Simonsen, *J. Chem. Soc.*, 1933, 447.

**4-Chlorobenzanthrone.**

Yellow needles from AcOH. M.p. 204–5°. Sublimes 240–60°/1–2 mm. Golden-yellow sol. in conc. H<sub>2</sub>SO<sub>4</sub> without fluor.

Lüttringhaus, Neresheimer, *Ann.*, 1929, 473, 277.

**6-Chlorobenzanthrone.**

Yellow needles. M.p. 121°.

Maki, *Chem. Zentr.*, 1936, II, 468.

**8-Chlorobenzanthrone.**

M.p. 151°. CrO<sub>3</sub> → 8-chloroanthraquinone-1-carboxylic acid.

Maki, Kikuti, *Chem. Abstracts*, 1941, 35, 1783.

**9-Chlorobenzanthrone.**

Golden-yellow needles from PhNO<sub>2</sub>. M.p. 186–7°. Sol. AcOH, C<sub>6</sub>H<sub>6</sub>, PhNO<sub>2</sub>. Spar. sol. EtOH, Et<sub>2</sub>O, ligroin. Yellowish-red col. in conc. H<sub>2</sub>SO<sub>4</sub> with brownish-green fluor.

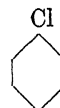
Scholl, Seer, *Ber.*, 1922, 55, 114.

**10-Chlorobenzanthrone.**

Yellow cryst. M.p. 188–9°. Sol. AcOH, C<sub>6</sub>H<sub>6</sub>, PhNO<sub>2</sub>. Yellow col. in conc. H<sub>2</sub>SO<sub>4</sub> with green fluor.

Cahn, Jones, Simonsen, *J. Chem. Soc.*, 1933, 447.

Scholl, Seer, *Ber.*, 1922, 55, 116.

**Chlorobenzene** $C_6H_5Cl$ 

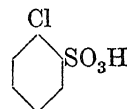
MW, 112.5

F.p. –45.2°. B.p. 132°, 115°/469 mm., 99–100°/290–3 mm., 45°/30 mm. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 1.1066. n<sub>D</sub><sup>20</sup> 1.52479. Heat of comb. (vapour) C<sub>p</sub> 763.9 Cal. Crit. temp. 359.2°. Crit. press. 33,962 mm. Conc. H<sub>2</sub>SO<sub>4</sub> → chlorobenzene-*p*-sulphonic acid.

Mouneyrat, Pouret, *Compt. rend.*, 1898, 127, 1026.

Timmermans, Martin, *Chem. Abstracts*, 1927, 21, 1039.

Heller, Tischner, *Ber.*, 1911, 44, 1251.

***o*-Chlorobenzenesulphonic Acid (1-Chlorobenzene-2-sulphonic acid)** $C_6H_5O_3ClS$ 

MW, 192.5

*Chloride*: *o*-chlorobenzenesulphonyl chloride. C<sub>6</sub>H<sub>4</sub>O<sub>2</sub>Cl<sub>2</sub>S. MW, 211. Cryst. from Et<sub>2</sub>O. M.p. 28.5°.

*Amide*: *o*-chlorobenzenesulphonamide. C<sub>6</sub>H<sub>5</sub>O<sub>2</sub>NClS. MW, 191.5. Leaflets. M.p. 188°.

Bahlmann, *Ann.*, 1877, 186, 325.

***m*-Chlorobenzenesulphonic Acid (1-Chlorobenzene-3-sulphonic acid).**

Plates. Sol. EtOH.

*Amide*: *m*-chlorobenzenesulphonamide.

Cryst. M.p. 148°. Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O.

*Aniline salt*: m.p. 206–7°.

Kieselinsky, *Ann.*, 1875, 180, 108.

Paal, *Ber.*, 1901, 34, 2754.

***p*-Chlorobenzenesulphonic Acid (1-Chlorobenzene-4-sulphonic acid).**

Needles. M.p. 68°. B.p. 148°/high vac.

*Me ester*: C<sub>7</sub>H<sub>7</sub>O<sub>3</sub>ClS. MW, 206.5. M.p. 50.5°. B.p. 166°/15 mm.

*Et ester*: C<sub>8</sub>H<sub>9</sub>O<sub>3</sub>ClS. MW, 220.5. M.p. 26°. B.p. 172°/15 mm.



*Chloride*: p-chlorobenzenesulphonyl chloride.  $C_6H_4O_2Cl_2S$ . MW, 211. Prisms. M.p. 53°. B.p. 141°/15 mm.

*Bromide*: p-chlorobenzenesulphonyl bromide.  $C_6H_4O_2ClBrS$ . MW, 255.5. M.p. 56°.

*Amide*: p-chlorobenzenesulphonamide.  $C_6H_6O_2NCIS$ . MW, 191.5. Leaflets. M.p. 143-4°.

*Anilide*: needles. M.p. 104°.

p-*Chloroanilide*: needles. M.p. 148°.

p-*Bromoanilide*: prisms. M.p. 163°.

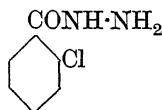
o-*Toluidide*: needles from EtOH. M.p. 111°.

p-*Toluidide*: m.p. 88°.

Rây, Dey, *J. Chem. Soc.*, 1920, 117, 1407.

Baxter, Chattaway, *J. Chem. Soc.*, 1915, 107, 1815.

**o-Chlorobenzhydrazide** (o-Chlorobenzoylhydrazine)



$C_7H_7ON_2Cl$  MW, 170.5

Needles from  $Et_2O$ . M.p. 117-18°. Very sol. EtOH. Sol.  $H_2O$ . Mod. sol.  $Et_2O$ . Employed in characterisation of carbonyl comps.

Sun, Sah, *Science Repts. Natl. Tsinghua Univ.*, 1934, 2, 360, (*Chem. Zentr.*, 1935, I, 57).

**m-Chlorobenzhydrazide** (m-Chlorobenzoylhydrazine).

Needles from  $H_2O$ . M.p. 158°. Sol. EtOH, hot  $H_2O$ . Employed in characterisation of carbonyl comps.

*Hydrochloride*: leaflets from dil. HCl. M.p. 250°.

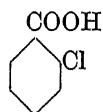
Curtius, Foerster, *J. prakt. Chem.*, 1901, 64, 326.

**p-Chlorobenzhydrazide** (p-Chlorobenzoylhydrazine).

Needles from  $H_2O$ . M.p. 163°. Sol. EtOH, boiling  $H_2O$ . Insol.  $Et_2O$ ,  $C_6H_6$ . Employed in characterisation of carbonyl comps. Yields hydrazones with aldoses but not with ketoses.

Shih, Sah, *Science Repts. Natl. Tsinghua Univ.*, 1934, 2, 354, (*Chem. Zentr.*, 1935, I, 56).

**o-Chlorobenzoic Acid**



$C_7H_5O_2Cl$  MW, 156.5

Prisms. M.p. 142°. Sol. EtOH,  $Et_2O$ , hot  $H_2O$ . D<sup>20</sup> 1.544. Sublimes.  $k = 1.197 \times 10^{-3}$  at 25°. NaHg  $\rightarrow$  benzoic acid.

*Me ester*:  $C_8H_7O_2Cl$ . MW, 170.5. B.p. 234°.

*Et ester*:  $C_9H_9O_2Cl$ . MW, 184.5. B.p. 243°, 122-5°/15 mm.

*Glycol ester*: b.p. 223°/12 mm.

*Phenyl ester*:  $C_{13}H_9O_2Cl$ . MW, 232.5. M.p. 37°. Sol. EtOH,  $Et_2O$ .

p-*Nitrobenzyl ester*: m.p. 106°.

*Phenacyl ester*: m.p. 83°.

p-*Bromophenacyl ester*: m.p. 107°.

p-*Phenylphenacyl ester*: m.p. 123°.

*Chloride*:  $C_7H_4OCl_2$ . MW, 175. M.p. -4°. B.p. 235-8°, 110°/15 mm.

*Anhydride*:  $C_{14}H_8O_3Cl_2$ . MW, 295. Needles from EtOH. M.p. 78-9°.

*Amide*: see o-Chlorobenzamide.

*Nitrile*: see o-Chlorobenzonitrile.

*Anilide*: o-chlorobenzanilide. Needles from pet. ether. M.p. 118°.

p-*Nitroanilide*: yellow needles from EtOH. M.p. 180°.

p-*Toluidide*: cryst. M.p. 131°.

S-p-Bromobenzylthiouronium salt: m.p. 168° (from EtOH).

Clarke, Taylor, *Organic Syntheses*, 1930, X, 20.

Koopal, *Rec. trav. chim.*, 1915, 34, 144.

Sowa, Nieuwland, *J. Am. Chem. Soc.*, 1936, 58, 271.

Sun, Sah, *Chem. Abstracts*, 1935, 29, 466.

Bryd, *Chem. Abstracts*, 1928, 22, 2372.

**m-Chlorobenzoic Acid.**

Prisms. M.p. 158°. Sol. EtOH,  $Et_2O$ , hot  $H_2O$ .  $k = 1.50 \times 10^{-4}$  at 25°. NaHg  $\rightarrow$  benzoic acid. KOH fusion  $\rightarrow$  m-hydroxybenzoic acid.

*Me ester*: m.p. 21°. B.p. 231°, 114°/18 mm.

*Et ester*: b.p. 245°, 119°/13 mm.

*Glycol ester*: m.p. 91°.

*Phenyl ester*: m.p. 53°.

*Phenacyl ester*: m.p. 116°.

p-*Bromophenacyl ester*: m.p. 117°.

p-*Phenylphenacyl ester*: m.p. 154°.

*Chloride*: b.p. 225°.

*Anhydride*: needles from EtOH. M.p. 95°.

*Amide*: see m-Chlorobenzamide.

*Nitrile*: see m-Chlorobenzonitrile.

*Anilide*: m-chlorobenzanilide. Cryst. from EtOH. M.p. 122-5°.

S-p-Bromobenzylthiouronium salt: m.p. 150° (from EtOH).

Glued, Kempf, *J. Chem. Soc.*, 1913, 103, 1530.

Koopal, *Rec. trav. chim.*, 1915, 34, 144.

Bornwater, Hollemann, *Rec. trav. chim.*, 1912, 31, 225.

Bryd, *Chem. Abstracts*, 1928, 22, 2372.

**p-Chlorobenzoic Acid.**

Prisms. M.p. 243° (235°). Sol. EtOH,  $Et_2O$ . Spar. sol.  $H_2O$ . Sublimes.  $k = 1.04 \times 10^{-4}$  at 25°.

*Me ester*: m.p. 44°.

*Et ester*: b.p. 238°.

*Glycol ester*: m.p. 140°.

Phenyl ester : m.p. 100°.

Benzyl ester : m.p. 26-7°. B.p. 155-60°/1 mm.  
n<sub>D</sub><sup>20</sup> 1.5792.

p-Nitrobenzyl ester : cryst. from EtOH. M.p. 129-5°.

Phenacyl ester : m.p. 87-6°.

p-Bromophenacyl ester : m.p. 126°.

p-Phenylphenacyl ester : m.p. 160°.

Chloride : m.p. 16°. B.p. 220-2°, 111°/18 mm.

Anhydride : needles from C<sub>6</sub>H<sub>6</sub>. M.p. 193-4°.

Amide : see p-Chlorobenzamide.

Nitrile : see p-Chlorobenzonitrile.

Anilide : p-chlorobenzanilide. Needles from EtOH. M.p. 194°.

p-Chloroanilide : leaflets from EtOH. M.p. 207-8°.

Montagne, *Rec. trav. chim.*, 1905, **24**, 112.

Bryd, *Chem. Abstracts*, 1928, **22**, 2372.

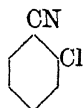
I.G., B.P. 307,223; F.P. 664,611, (*Chem. Zentr.*, 1929, **I**, 3144); F.P. 676,826, (*Chem. Zentr.*, 1930, **I**, 3861).

Berkenheim, Lurle, *J. Gen. Chem. U.S.S.R.*, 1936, **6**, 1043, (*Chem. Abstracts*, 1937, **31**, 1780).

Stubbs, Senseman, *Ind. Eng. Chem.*, 1936, **28**, 559.

Arendonk, Cupery, *J. Am. Chem. Soc.*, 1931, **53**, 3184.

### o-Chlorobenzonitrile



C<sub>7</sub>H<sub>4</sub>NCl

MW, 137.5

Needles. M.p. 42-3°. B.p. 232°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. hot H<sub>2</sub>O. Sublimes. Volatile in steam.

Korczynski, Fandrich, *Compt. rend.*, 1926, **183**, 421.

Montagne, *Rec. trav. chim.*, 1900, **19**, 50.

### m-Chlorobenzonitrile.

Needles. M.p. 40-1°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. Volatile in steam.

Orito, *Science Reports of the Tōhoku Imperial University*, 1929, **18**, 123, (*Chem. Abstracts*, 1930, **24**, 98).

Korczynski, Fandrich, *Compt. rend.*, 1926, **183**, 421.

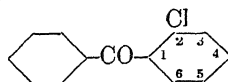
### p-Chlorobenzonitrile.

Needles. M.p. 94-6°. B.p. 223°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O. Volatile in steam.

van Scherpenzeel, *Rec. trav. chim.*, 1897, **16**, 113.

Meyer, Hofmann, *Monatsh.*, 1917, **38**, 350.

### 2-Chlorobenzophenone (Phenyl o-chlorophenyl ketone)



C<sub>13</sub>H<sub>9</sub>OCl

MW, 216.5

M.p. 52-6°. B.p. 330°, 185-8°/13 mm.

Oxime : two forms. (α) M.p. 131°. Beckmann rearrangement → o-chlorobenzanilide. (β) M.p. 96-7°. Beckmann → N-benzoyl-o-chloroaniline.

Auwers, Lechner, Bundesmann, *Ber.*, 1925, **58**, 50.

Montagne, Koopal, *Rec. trav. chim.*, 1910, **29**, 138.

### 3-Chlorobenzophenone.

Needles. M.p. 82-3°. Spar. sol. EtOH.

α-Oxime : m.p. 132-3°. PCl<sub>5</sub> → m-chlorobenzoylaniline.

β-Oxime : m.p. 105-6°. PCl<sub>5</sub> → benzoyl-m-chloroaniline.

Koopal, *Rec. trav. chim.*, 1915, **34**, 153.

### 4-Chlorobenzophenone.

M.p. 77-8°. B.p. 332°/770 mm. Sol. Et<sub>2</sub>O, hot EtOH. NaHg → 4-chlorobenzhydrol.

α-Oxime : m.p. 162-4° (155-6°). Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. O-Acetyl : m.p. 147-8°.

β-Oxime : m.p. 95°. Sol. EtOH. O-Acetyl : m.p. 105-6°.

Hydrazone : (α-). M.p. 154-5°. (β-). M.p. 105-6°.

Phenylhydrazone : m.p. 106°.

2 : 4-Dinitrophenylhydrazone : m.p. 184-5°.

Montagne, *Rec. trav. chim.*, 1907, **26**, 263.

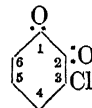
Gomberg, Cone, *Ber.*, 1906, **39**, 3278.

Montagne, Koopal, *Rec. trav. chim.*, 1910, **29**, 138, 143.

### Chlorobenzophenone-carboxylic Acid.

See Chlorobenzoylbenzoic Acid.

### 3-Chloro-o-benzoquinone



C<sub>6</sub>H<sub>3</sub>O<sub>2</sub>Cl

MW, 142.5

Pale yellow prisms from hexane. Decomp. at 68°. Mod. sol. H<sub>2</sub>O, sol. very unstable. Conc. H<sub>2</sub>SO<sub>4</sub> → violet → black col.

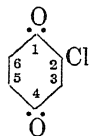
Willstätter, Müller, *Ber.*, 1911, **44**, 2189.

### 4-Chloro-o-benzoquinone.

Pale yellowish-red needles from hexane. M.p. 78°. Very unstable, decomp. rapidly in sol. Conc. H<sub>2</sub>SO<sub>4</sub> → green sol.

Dioxime : brown cryst. powder. M.p. 128°.

Willstätter, Müller, *Ber.*, 1911, **44**, 2189.

Chloro-*p*-benzoquinone (*Chloroquinone*)

$C_6H_3O_2Cl$  MW, 142.5

Yellowish-red rhombic cryst. M.p. 57°. Sol.  $H_2O$ , EtOH,  $Et_2O$ ,  $CHCl_3$ . Sublimes at ord. temp.  $SO_2 \rightarrow$  chlorohydroquinone.  $HCl \rightarrow$  2 : 3- and 2 : 5-dichlorohydroquinone.

1 - *Oxime* : 3-chloro-4-nitrosophenol.  $C_6H_4O_2NCl$ . MW, 157.5. Pale greenish-yellow needles. M.p. 184°. *Benzoyl*: prisms. M.p. 189.5°. *Me ether*: yellow needles. M.p. 113°. *o-Nitrophenylhydrazone*: orange-red micro-cryst. Decomp. at 200°.

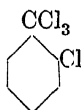
4-*Oxime*: *o*-chloro-*p*-nitrosophenol. Needles. M.p. 148° decomp. Sol. EtOH,  $Et_2O$ , hot  $H_2O$ .  $Sn + HCl \rightarrow$  *o*-chloro-*p*-aminophenol. *O-Acetyl*: two forms. (i) Prisms. M.p. 166-7°. (ii) Labile form. M.p. 136-7° (rapid heat). *Me ether*: ( $\alpha$ -). Yellow needles. M.p. 123° (rapid heat). ( $\beta$ -). M.p. 114-15° (rapid heat).

4-*Semicarbazone*: cryst. M.p. 185° decomp.

van Erp, *Ber.*, 1925, 58, 663.

Levy, Schultz, *Ann.*, 1881, 210, 145.

Hodgson, *J. Chem. Soc.*, 1937, 520.

*o*-Chlorobenzotrichloride

$C_7H_4Cl_4$  MW, 230

Cryst. M.p. 30°. B.p. 260°, 115-18°/5 mm.

Anschütz, Moore, *Ann.*, 1887, 239, 321.

Fox, *Ber.*, 1893, 26, 653.

Höchst, D.R.P. 229,873, (*Chem. Zentr.*, 1911, I, 358).

*m*-Chlorobenzotrichloride.

B.p. 247-50°.

Anschütz, Moore, *Ann.*, 1887, 239, 342.

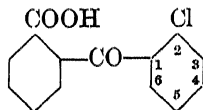
*p*-Chlorobenzotrichloride.

B.p. 245°, 108-12°/high vac.

Kenner, Witham, *J. Chem. Soc.*, 1910, 97, 1963.

Anschütz, Moore, *Ann.*, 1887, 239, 347.

I.G., F.P. 798,727, (*Chem. Zentr.*, 1936, II, 3360).

*o*-2-Chlorobenzoylbenzoic Acid (2'-Chlorobenzophenone-2-carboxylic acid)

$C_{14}H_9O_3Cl$

MW, 260.5

M.p. 122-4°.

I.G., D.R.P. 621,980, (*Chem. Zentr.*, 1936, I, 1507).

*o*-3-Chlorobenzoylbenzoic Acid (3'-Chlorobenzophenone-2-carboxylic acid).

M.p. 149-52°.

I.G., D.R.P. 621,980, (*Chem. Zentr.*, 1936, I, 1507).

*o*-4-Chlorobenzoylbenzoic Acid (4'-Chlorobenzophenone-2-carboxylic acid).

Cryst. M.p. 147-8°. Sol. EtOH,  $Et_2O$ , hot  $C_6H_6$ . Spar. sol. hot  $H_2O$ . Hot conc.  $H_2SO_4 \rightarrow$  2-chloroanthraquinone.

*Me ester*:  $C_{15}H_{11}O_3Cl$ . MW, 274.5. Needles from pet. ether. M.p. 109-10°.

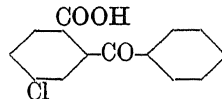
*Et ester*:  $C_{16}H_{13}O_3Cl$ . MW, 288.5. M.p. 88°.

Eckert, Pollak, *Monatsh.*, 1917, 38, 16.

Karpukhin, *Chem. Abstracts*, 1936, 30, 7112.

Groggins, Nagel, *Ind. Eng. Chem.*, 1933, 25, 1083.

Murch, U.S.P. 1,746,736, (*Chem. Zentr.*, 1930, I, 2798).

4-Chloro-2-benzoylbenzoic Acid (5-Chlorobenzophenone-2-carboxylic acid, *o*-benzoyl-*p*-chlorobenzoic acid)

$C_{14}H_9O_3Cl$  MW, 260.5

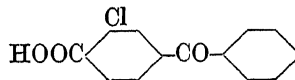
Cryst. from xylene. M.p. 180.5°. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ . Spar. sol.  $CS_2$ , ligroin.

*Me ester*:  $C_{15}H_{11}O_3Cl$ . MW, 274.5. Cryst. from pet. ether. M.p. 102-4°.

*Chloride*:  $C_{14}H_8O_2Cl_2$ . MW, 279. Needles from pet. ether. M.p. 114-17°.

Reé, *Ann.*, 1886, 233, 239.

Egerer, Meyer, *Monatsh.*, 1913, 34, 83.

2-Chloro-4-benzoylbenzoic Acid (3-Chlorobenzophenone-4-carboxylic acid, *p*-benzoyl-*o*-chlorobenzoic acid)

$C_{14}H_9O_3Cl$  MW, 260.5

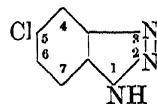
Plates from  $C_6H_6$ . M.p. 187°.

Heller, *Ber.*, 1913, 46, 1500.

## Chlorobenzoyldiphenylamine.

See under Chlorobenzamide.

## 5-Chlorobenztriazole (5-Chloroaziminobenzene)



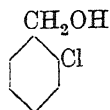
$C_6H_4N_3Cl$

MW, 153.5

Colourless cryst. from xylene. M.p. 156°. Sol. EtOH, Et<sub>2</sub>O. Mod. sol. toluene.

Ullmann, Mauthner, *Ber.*, 1903, **36**, 4028.

## o-Chlorobenzyl Alcohol

C<sub>7</sub>H<sub>7</sub>OCl

MW, 142.5

Needles or leaflets from EtOH.Aq. M.p. 74°. B.p. 230°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O.

*Et ether*: C<sub>9</sub>H<sub>11</sub>OCl. MW, 170.5. B.p. 216°, 103°/8 mm.

*o-Chlorobenzyl ether*: 2:2'-dichlorodibenzyl ether. Prisms from EtOH. M.p. 48-9°.

*p-Nitrobenzyl*: pale yellow plates from EtOH. M.p. 93-4°.

Carothers, Adams, *J. Am. Chem. Soc.*, 1924, **46**, 1681.

Leonard, *J. Chem. Soc.*, 1916, **109**, 571.

## m-Chlorobenzyl Alcohol.

B.p. 234°. Sol. EtOH, Et<sub>2</sub>O.

*Et ether*: b.p. 219°.

Mettler, *Ber.*, 1905, **38**, 1749.

## p-Chlorobenzyl Alcohol.

Cryst. from EtOH. M.p. 75°. B.p. 235°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. hot H<sub>2</sub>O.

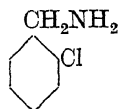
*Et ether*: b.p. 225-7°/741 mm.

*4-Chlorobenzyl ether*: 4:4'-dichlorodibenzyl ether. Needles from EtOH. M.p. 54-5°.

*Acetyl*: b.p. 240°.

Carothers, Adams, *J. Am. Chem. Soc.*, 1924, **46**, 1681.

## o-Chlorobenzylamine

C<sub>7</sub>H<sub>8</sub>NCl

MW, 141.5

B.p. 103-4°/11 mm.

*B,HCl*: leaflets from EtOH. M.p. 215-16°.

*N-Me*: C<sub>8</sub>H<sub>10</sub>NCl. MW, 155.5. B.p. 98-100°/10 mm. *B,HCl*: m.p. 135°. *Picrate*: m.p. 120°.

*N-Di-Me*: C<sub>9</sub>H<sub>12</sub>NCl. MW, 169.5. B.p. 90°/13 mm. *B,HCl*: m.p. 203°. *Picrate*: m.p. 146°.

*N-Phenyl*: b.p. 325-7°. *B,HCl*: m.p. 186-7°.

*N-Acetyl*: leaflets. M.p. 79-80°.

*N-Benzoyl*: needles from EtOH.Aq. M.p. 116-17°.

*Picrate*: yellow needles. M.p. 217° decomp.

v. Braun, Kühn, Weismantel, *Ann.*, 1926, **449**, 274.

Franzen, *Ber.*, 1905, **38**, 1415.

## m-Chlorobenzylamine.

B.p. 110-12°/17 mm.

*B,HCl*: m.p. 225°.

*N-Me*: b.p. 122-4°/11 mm. *B,HCl*: m.p. 170°. *Picrate*: m.p. 128°.

*N-Phenyl*: b.p. 331-3°. *B,HCl*: m.p. 190-1°.

*N-Benzoyl*: cryst. from EtOH. M.p. 214°.

*Picrate*: m.p. 203°.

v. Braun, Kühn, Weismantel, *Ann.*, 1926, **449**, 274.

## p-Chlorobenzylamine.

B.p. 215°/734 mm., 106-7°/15 mm.

*B,HCl*: needles. M.p. 259°.

*B,HAuCl<sub>4</sub>*: yellow plates from H<sub>2</sub>O. M.p. 160°.

*B<sub>2</sub>,H<sub>2</sub>PtCl<sub>6</sub>*: yellow plates from H<sub>2</sub>O. M.p. 244°.

*N-Phenyl*: b.p. 333-4°. *B,HCl*: m.p. 212°.

*N-Benzyl*: *p*-chlorodibenzylamine. C<sub>14</sub>H<sub>14</sub>NCl. MW, 231.5. B.p. 195-6°/13 mm. *B,HCl*: m.p. 268°.

*Picrate*: m.p. 140°. *N-Benzoyl*: m.p. 82°.

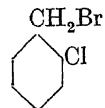
*N-Benzoyl*: needles from EtOH.Aq. M.p. 140°.

*Picrate*: m.p. 210°.

v. Braun, Kühn, Weismantel, *Ann.*, 1926, **449**, 266.

Curtius, *J. prakt. Chem.*, 1914, **89**, 508.

## o-Chlorobenzyl bromide

C<sub>7</sub>H<sub>6</sub>ClBr

MW, 205.5

B.p. 102°/9 mm. (120°/10 mm.).

Shoemith, Slater, *J. Chem. Soc.*, 1926, **218**.

## m-Chlorobenzyl bromide.

B.p. 109°/10 mm. D<sub>20</sub><sup>25</sup> 1.5652.

Shoemith, Slater, *J. Chem. Soc.*, 1926, **218**.

Jenkins, *J. Am. Chem. Soc.*, 1933, **55**, 2896.

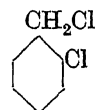
## p-Chlorobenzyl bromide.

Cryst. from EtOH. M.p. 51°. Sol. EtOH, Et<sub>2</sub>O, AcOH, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>. Volatile in steam.

Kharasch, Margolis, White, Mayo, *J. Am. Chem. Soc.*, 1937, **59**, 1405.

Shoemith, Slater, *J. Chem. Soc.*, 1926, **218**.

## o-Chlorobenzyl chloride

C<sub>7</sub>H<sub>6</sub>Cl<sub>2</sub>

MW, 161

B.p. 213–14°.

Olivier, *Rec. trav. chim.*, 1922, **41**, 308.  
 Seyewetz, Trawitz, *Compt. rend.*, 1903,  
**136**, 240.  
 Meyer, English, *Ann.*, 1918, **417**, 78.

***m*-Chlorobenzyl chloride.**

B.p. 215–6°/753 mm. Sol. EtOH.  $D_4^{15}$  1.2695.  
 Kenner, Witham, *J. Chem. Soc.*, 1921,  
**119**, 1460.  
 v. Braun, Kühn, Weismantel, *Ann.*,  
 1926, **449**, 266.  
 Olivier, *Rec. trav. chim.*, 1922, **41**, 308.

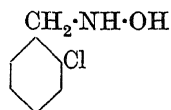
***p*-Chlorobenzyl chloride.**

Needles. M.p. 29°. B.p. 222° (214°) decomp.  
 Sublimes. Sol. Et<sub>2</sub>O, AcOH, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>. Mod.  
 sol. cold EtOH. Boiling H<sub>2</sub>O → *p*-chloro-  
 benzylalcohol. Hot Pb(NO<sub>3</sub>)<sub>2</sub>.Aq. → *p*-chloro-  
 benzaldehyde. CrO<sub>3</sub> → *p*-chlorobenzoic acid.  
 Olivier, *Rec. trav. chim.*, 1922, **41**, 307.  
 Beilstein, Kuhlberg, Neuhofer, *Ann.*, 1868,  
**146**, 320.  
 Mayer, English, *Ann.*, 1918, **417**, 78.

**Chlorobenzyl cyanide.**

See under Chlorophenylacetic Acid.

***o*-Chlorobenzylhydroxylamine**



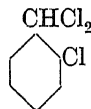
C<sub>7</sub>H<sub>9</sub>ONCl MW, 157.5

Silky leaflets. M.p. 72–4°.  
*B, HCl*: prisms. M.p. 153–8°.  
 Behrend, Nissen, *Ann.*, 1892, **269**, 397.

***p*-Chlorobenzylhydroxylamine.**

Needles. M.p. 87–8°. Sol. hot H<sub>2</sub>O.  
*B, HCl*: prisms. M.p. 165–6°.  
 Neubauer, *Ann.*, 1897, **298**, 196.

***o*-Chlorobenzylidene chloride (*o*-Chloro-  
 benzal chloride)**



C<sub>7</sub>H<sub>5</sub>Cl<sub>3</sub> MW, 195.5

B.p. 228–9°.  $D^{15}$  1.399. CrO<sub>3</sub> → *o*-chloro-  
 benzoic acid.  
 Erdmann, *Ann.*, 1893, **272**, 151.

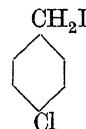
***p*-Chlorobenzylidene chloride (*p*-Chloro-  
 benzal chloride).**

B.p. 234°. CrO<sub>3</sub> → *p*-chlorobenzoic acid.  
 Beilstein, Kuhlberg, *Ann.*, 1868, **146**, 327.  
 Gilliard, Monnet, Cartier, D.R.P. 98,433,  
 (*Chem. Zentr.*, 1898, II, 800).

**Chlorobenzylidenecyanoacetic Acid.**

See Chloro- $\alpha$ -cyanocinnamic Acid.

***p*-Chlorobenzyl iodide**



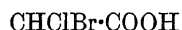
C<sub>7</sub>H<sub>6</sub>ClI MW, 252.5

Needles from EtOH. M.p. 64°.  
 van Raalte, *Rec. trav. chim.*, 1899, **18**, 391.

**Chlorobromoacetanilide.**

See under Chlorobromoaniline.

**Chlorobromoacetic Acid**



C<sub>2</sub>H<sub>2</sub>O<sub>2</sub>ClBr MW, 173.5

M.p. 31.5°. B.p. 215° slight decomp., 103–4°/  
 11 mm.  $k = 5.7 \times 10^{-2}$  at 25°.

*Et ester*: C<sub>4</sub>H<sub>6</sub>O<sub>2</sub>ClBr. MW, 201.5. B.p.  
 174° decomp.  $D_4^{22}$  1.5890.

*Phenyl ester*: m.p. 46.5°. B.p. 266°.  $D_4^{20}$   
 1.5311.

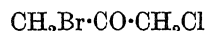
*Amide*: C<sub>2</sub>H<sub>3</sub>ONClBr. MW, 172.5. M.p.  
 126° (117°). Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O.

*Chloride*: C<sub>2</sub>HOCl<sub>2</sub>Br. MW, 192. B.p. 138–  
 9°.

*Bromide*: C<sub>2</sub>HOClBr<sub>2</sub>. MW, 236.5. B.p.  
 158–60°, 47–49°/15 mm.

Backer, Mook, *J. Chem. Soc.*, 1928, 2125.  
 Crompton, Triffitt, *J. Chem. Soc.*, 1921,  
**119**, 1874.

**1-Chloro-3-bromoacetone**



C<sub>3</sub>H<sub>4</sub>OClBr MW, 171.5

Cryst. M.p. 34–5°. B.p. 178–80°. Sol.  
 EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O. Forms bisul-  
 phite comp.

Thecgarten, *Ber.*, 1873, **6**, 1276.

**2-Chloro-*N*-bromoaniline**



C<sub>6</sub>H<sub>5</sub>NCIBr MW, 206.5

*N-Acetyl*: 2-chloro-*N*-bromoacetanilide. Yel-  
 low prisms from CHCl<sub>3</sub>-pet. ether. M.p. 152°  
 decomp. AcOH at 120° → 2-chloro-4-bromo-  
 acetanilide.

*N-Propionyl*: 2-chloro-*N*-bromopropionanil-  
 ide. Yellow prisms from pet. ether. M.p. 106°.  
 Propionic acid at 140° → 2-chloro-4-bromo-  
 propionanilide.

*N-Benzoyl*: 2'-chloro-*N*-bromobenzanilide.  
 Yellow prisms from CHCl<sub>3</sub>-pet. ether. M.p.  
 110°. AcOH at 120° → 2-chloro-4-bromo-  
 benzanilide.

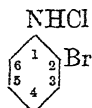
Chattaway, Wadmore, *J. Chem. Soc.*,  
 1902, **81**, 987.

**4-Chloro-*N*-bromoaniline.**

*N*-Acetyl: 4-chloro-*N*-bromoacetanilide. Yellow plates from  $\text{CHCl}_3$ -pet. ether. M.p. 91°.

*N*-Propionyl: 4-chloro-*N*-bromopropionanilide. Yellow prisms. M.p. 71°.  $\text{CHCl}_3$ -AcOH sol.  $\rightarrow$  4-chloro-2-bromopropionanilide.

Chattaway, Orton, *J. Chem. Soc.*, 1901, 79, 820.

***N*-Chloro-2-bromoaniline**

$\text{C}_6\text{H}_5\text{NClBr}$  MW, 206.5

*N*-Acetyl: *N*-chloro-2-bromoacetanilide. Prisms from  $\text{CHCl}_3$ -pet. ether. M.p. 86°. AcOH at 120°  $\rightarrow$  4-chloro-2-bromoacetanilide.

*N*-Propionyl: *N*-chloro-2-bromopropionanilide. Rhombohedra from pet. ether. M.p. 59°. Propionic acid at 150°  $\rightarrow$  4-chloro-2-bromopropionanilide.

*N*-Benzoyl: *N*-chloro-2'-bromobenzanilide. Prisms from  $\text{CHCl}_3$ -pet. ether. M.p. 85°. AcOH at 120°  $\rightarrow$  4'-chloro-2'-bromobenzanilide.

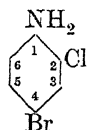
Chattaway, Wadmore, *J. Chem. Soc.*, 1902, 81, 987.

***N*-Chloro-4-bromoaniline.**

*N*-Acetyl: *N*-chloro-4-bromoacetanilide. Rhombohedra from pet. ether. M.p. 108-9°. AcOH  $\rightarrow$  2-chloro-4-bromoacetanilide.

*N*-Propionyl: *N*-chloro-4-bromopropionanilide. Plates from ligroin. M.p. 59°.  $\text{CHCl}_3$ -propionic acid at 100°  $\rightarrow$  2-chloro-4-bromopropionanilide.

Chattaway, Orton, *J. Chem. Soc.*, 1901, 79, 820.

**2-Chloro-4-bromoaniline**

$\text{C}_6\text{H}_5\text{NClBr}$  MW, 206.5

Prisms. M.p. 73° (69°). Volatile in steam. Sublimes. Sol. EtOH. Insol.  $\text{H}_2\text{O}$ .

*N*-Acetyl: 2-chloro-4-bromoacetanilide.  $\text{C}_8\text{H}_7\text{ONClBr}$  MW, 248.5. M.p. 151°.

*N*-Propionyl: 2-chloro-4-bromopropionanilide. Needles from EtOH. M.p. 129°.

*N*-Benzoyl: 2'-chloro-4'-bromobenzanilide. M.p. 145°.

*N*-Chloro: rhombohedra. M.p. 88-9°.

*N*-Bromo: yellow prisms. M.p. 129°.

Chattaway, Cleo, *J. Chem. Soc.*, 1916, 109, 89.

**2-Chloro-5-bromoaniline.**

Silky needles. M.p. 45°. Sol. EtOH, Et<sub>2</sub>O. *B, HCl*: prisms +  $\text{H}_2\text{O}$ . M.p. 190°.

*N*-Acetyl: 2-chloro-5-bromoacetanilide.  $\text{C}_8\text{H}_7\text{ONClBr}$  MW, 248.5. M.p. 141°.

Chattaway, Orton, *J. Chem. Soc.*, 1901, 79, 466.

**3-Chloro-4-bromoaniline.**

Plates from EtOH.Aq. M.p. 67-8°.

*N*-Acetyl: 3-chloro-4-bromoacetanilide.  $\text{C}_8\text{H}_7\text{ONClBr}$  MW, 248.5. M.p. 151°.

*Picrate*: yellow needles. M.p. 141°.

Chattaway, Orton, *J. Chem. Soc.*, 1901, 79, 466.

**3-Chloro-5-bromoaniline.**

Needles or prisms.

Körner, Contardi, *Atti accad. Lincei*, 1913, 22, i, 823; (*Chem. Abstracts*, 1914, 8, 73).

**4-Chloro-2-bromoaniline.**

Needles. M.p. 69°. B.p. 127°/20 mm. Sol. ligroin.

*N*-Chloro: prisms from pet. ether. M.p. 74-5°.

*N*-Bromo: yellow rhombohedra. M.p. 85-6°.

*N*-Acetyl: 4-chloro-2-bromoacetanilide.  $\text{C}_8\text{H}_7\text{ONClBr}$  MW, 248.5. M.p. 137° (134°).

*N*-Propionyl: 4-chloro-2-bromopropionanilide. Prisms from EtOH. M.p. 128.5°.

*N*-Benzoyl: 4'-chloro-2'-bromobenzanilide. M.p. 130-5°.

Chattaway, Cleo, *J. Chem. Soc.*, 1916, 109, 89.

**4-Chloro-3-bromoaniline.**

Plates. M.p. 78°.

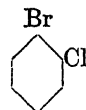
*N*-Acetyl: 4-chloro-3-bromoacetanilide.  $\text{C}_8\text{H}_7\text{ONClBr}$  MW, 248.5. M.p. 135°.

Wheeler, Valentine, *Am. Chem. J.*, 1899, 22, 274.

Chattaway, Orton, *J. Chem. Soc.*, 1901, 79, 466.

**Chlorobromobenzanilide.**

See under Chlorobromoaniline.

***o*-Chlorobromobenzene**

$\text{C}_6\text{H}_4\text{ClBr}$  MW, 191.5

M.p. -12.6°. B.p. 204° (195°).  $D_4^{25}$  1.6511.  $n_D^{25}$  1.5821.

Narbutt, *Ber.*, 1919, 52, 1031.

Bryd, *Chem. Abstracts*, 1928, 22, 2372.

Dobbie, Marsden, *J. Chem. Soc.*, 1898, 73, 254.

***m*-Chlorobromobenzene.**

F.p. -21.2°. B.p. 196°.  $D_4^{25}$  1.6365.  $n_D^{25}$  1.5773.

Körner, *Gazz. chim. ital.*, 1874, 4, 379.

Narbutt, *Ber.*, 1919, 52, 1031.

**p-Chlorobromobenzene.**

Needles from EtOH. M.p. 67° (65°). B.p. 196°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, hot EtOH.

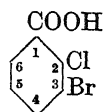
Narbutt, *Ber.*, 1919, 52, 1031.

Cohen, Dakin, *J. Chem. Soc.*, 1899, 75, 895.

Bryd, *Chem. Abstracts*, 1928, 22, 2372.

Schwechten, *Ber.*, 1932, 65, 1605.

Pajeau, *Compt. rend.*, 1936, 202, 1795.

**2-Chloro-3-bromobenzoic Acid**

C<sub>7</sub>H<sub>4</sub>O<sub>2</sub>ClBr

MW, 235.5

Cryst. from EtOH. M.p. 165°.

Chloride: C<sub>7</sub>H<sub>3</sub>OCl<sub>2</sub>Br. MW, 254. M.p. 41–2°.

B.p. 151–2°/25 mm.

Cohen, Raper, *J. Chem. Soc.*, 1904, 85, 1267.

**2-Chloro-4-bromobenzoic Acid.**

Needles from EtOH. M.p. 166–7°. Mod. sol. EtOH.

Chloride: m.p. 35–6°. B.p. 152–3°/22 mm.

Nitrile: C<sub>7</sub>H<sub>3</sub>NCI<sub>2</sub>Br. MW, 216.5. M.p. 51–61°. Sol. C<sub>6</sub>H<sub>6</sub>, ligroin, AcOH. Volatile in steam.

Cohen, Smithells, *J. Chem. Soc.*, 1914, 105, 1911.

Cohen, Raper, *J. Chem. Soc.*, 1904, 85, 1267.

**2-Chloro-5-bromobenzoic Acid.**

Cryst. from AcOH. M.p. 155–6°. Sol. EtOH. Chloride: b.p. 147°/19 mm.

Cohen, Raper, *J. Chem. Soc.*, 1904, 85, 1267.

Cohen, Smithells, *J. Chem. Soc.*, 1914, 105, 1911.

**2-Chloro-6-bromobenzoic Acid.**

Needles from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 143–4°. Sol. EtOH

Chloride: m.p. 30°. B.p. 146°/24 mm.

Cohen, Raper, *J. Chem. Soc.*, 1904, 85, 1268.

**3-Chloro-2-bromobenzoic Acid.**

Cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 143–4°.

Chloride: C<sub>7</sub>H<sub>3</sub>OCl<sub>2</sub>Br. MW, 254. M.p. 40–1°. B.p. 144–6°/22 mm.

Cohen, Raper, *J. Chem. Soc.*, 1904, 85, 1268.

**3-Chloro-4-bromobenzoic Acid.**

Cryst. from EtOH. M.p. 218°.

Chloride: m.p. 58–9°.

Cohen, Smithells, *J. Chem. Soc.*, 1914, 105, 1911.

Cohen, Raper, *J. Chem. Soc.*, 1904, 85, 1268.

**3-Chloro-5-bromobenzoic Acid.**

Cryst. from C<sub>6</sub>H<sub>6</sub>-EtOH. M.p. 189–90°.

Chloride: m.p. 33–4°. B.p. 150°/19 mm.

Cohen, Raper, *J. Chem. Soc.*, 1904, 85, 1267.

**3-Chloro-6-bromobenzoic Acid.**

Cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 153°. Sol. EtOH.

Chloride: m.p. 34–5°. B.p. 146–7°/23 mm.

Cohen, Raper, *J. Chem. Soc.*, 1904, 85, 1267.

**4-Chloro-2-bromobenzoic Acid.**

Needles from EtOH. M.p. 154–5°.

Chloride: C<sub>7</sub>H<sub>3</sub>OCl<sub>2</sub>Br. MW, 254. M.p. 32–3°. B.p. 155–6°/29 mm.

Cohen, Smithells, *J. Chem. Soc.*, 1914, 105, 1912.

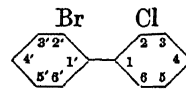
Cohen, Raper, *J. Chem. Soc.*, 1904, 85, 1267.

**4-Chloro-3-bromobenzoic Acid.**

M.p. 214°. Mod. sol. EtOH.

Chloride: m.p. 37–8°.

Cohen, Raper, *J. Chem. Soc.*, 1904, 85, 1267.

**2-Chloro-2'-bromodiphenyl**

C<sub>12</sub>H<sub>8</sub>ClBr

MW, 267.5

Cryst. from EtOH. M.p. 58°.

Mascarelli, Gatti, *Gazz. chim. ital.*, 1931, 61, 794.

**3-Chloro-5-bromodiphenyl.**

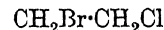
M.p. 29°. B.p. 225°/30 mm. CrO<sub>3</sub> → 3-chloro-5-bromobenzoic acid.

Scarborough, Waters, *J. Chem. Soc.*, 1927, 1136.

**4-Chloro-4'-bromodiphenyl.**

Cryst. from Me<sub>2</sub>CO or EtOH. M.p. 157–8°.

Shaw, Turner, *J. Chem. Soc.*, 1932, 297.

**sym.-Chlorobromoethane (Ethylene chlorobromide)**

C<sub>2</sub>H<sub>4</sub>ClBr

MW, 143.5

F.p. –16.9°. B.p. 106–7°. D<sub>15</sub> 1.689. n<sub>D</sub><sup>20</sup> 1.4908. Alc. KOH → vinyl chloride + HBr. KCN → 2-chloropropionitrile.

James, *J. prakt. Chem.*, 1882, 26, 380.

Timmermans, *Chem. Zentr.*, 1911, II, 1015.

Delépine, Ville, *Bull. soc. chim.*, 1920, 27, 673.

Kharasch, Hannum, *J. Am. Chem. Soc.*, 1934, 28, 712.

**unsym.-Chlorobromoethane** (*Ethylidene chlorobromide*)

$\text{CH}_3\cdot\text{CHClBr}$   
 $\text{C}_2\text{H}_4\text{ClBr}$  MW, 143.5  
 B.p.  $83^\circ$ .  $D^{16}$  1.667.  $n_D^{20}$  1.4660.  $\text{Ag}_2\text{O} \rightarrow$   
 acetaldehyde.

Kharasch, Hannum, *J. Am. Chem. Soc.*, 1934, 28, 712.

**1-Chloro-2-bromoethylene.**

See Acetylene chlorobromide.

**sym.-Chlorobromoisopropyl Alcohol** (3-Chloro-1-bromopropanol-2, chlorobromohydrin)

$\text{CH}_2\text{Br}\cdot\text{CH}(\text{OH})\cdot\text{CH}_2\text{Cl}$   
 $\text{C}_3\text{H}_6\text{OClBr}$  MW, 173.5  
*d.*  
 B.p.  $88^\circ/15$  mm.  $[\alpha]_D^{18} + 0.64^\circ$ .

*dl.*

B.p.  $197^\circ$ ,  $92^\circ/20$  mm.  $D^{12}$  1.74. Conc. KOH.Aq.  $\rightarrow$  epichlorohydrin + HBr. Ox.  $\rightarrow$  chlorobromoacetone.

Phenylurethane: m.p.  $73^\circ$ .

Blanchard, *Bull. soc. chim.*, 1927, 41, 825.

Johnson, Langley, *Am. Chem. J.*, 1910, 44, 358.

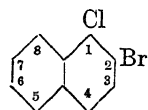
Aberhalden, Eichwald, *Ber.*, 1915, 48, 1862.

**Chlorobromomethane** (*Methylene chlorobromide*)

$\text{CH}_2\text{ClBr}$   
 $\text{CH}_2\text{ClBr}$  MW, 129.5  
 B.p.  $69^\circ$ .  $D^{19}$  1.991.

Henry, *J. prakt. Chem.*, 1885, 32, 431.

**1-Chloro-2-bromonaphthalene**



$\text{C}_{10}\text{H}_6\text{ClBr}$  MW, 241.5  
 M.p.  $57^\circ$ .

Hodgson, Leigh, *J. Chem. Soc.*, 1937, 1352.

**1-Chloro-4-bromonaphthalene.**

Needles. M.p.  $66-7^\circ$ . B.p.  $303^\circ$ . Sol.  $\text{Et}_2\text{O}$ , AcOH.

Guareschi, Biginelli, *Gazz. chim. ital.*, 1886, 16, 152.

Armstrong, Williamson, *Chem. News*, 1886, 54, 256; *Proc. Chem. Soc.*, 1886, 233.

I.G., F.P. 683,792, (*Chem. Zentr.*, 1930, II, 1446).

**1-Chloro-5-bromonaphthalene.**

Needles. M.p.  $116-7^\circ$ .

Missenden, *Chem. News*, 1922, 125, 158.

Guareschi, Biginelli, *Gazz. chim. ital.*, 1886, 16, 152.

**1-Chloro-6-bromonaphthalene.**

M.p.  $60^\circ$ .

Armstrong, Rossiter, *Chem. News*, 1891, 63, 137; *Proc. Chem. Soc.*, 1891, 184.

**1-Chloro-8-bromonaphthalene.**

M.p.  $87-8^\circ$ .

I.G., F.P. 683,792, (*Chem. Zentr.*, 1930, II, 1446).

**2-Chloro-1-bromonaphthalene.**

M.p.  $60^\circ$  ( $46^\circ$ ). B.p.  $110^\circ/21$  mm.

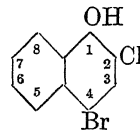
Nakata, *Ber.*, 1931, 64, 2068.

**2(or 3)-Chloro-5-bromonaphthalene.**

Needles from EtOH. M.p.  $68-9^\circ$ . B.p.  $275-80^\circ/745$  mm. Ox.  $\rightarrow$  4-chlorophthalic acid.

Guareschi, *J. Chem. Soc.*, 1889, 56, 614.

**2-Chloro-4-bromo-1-naphthol**



$\text{C}_{10}\text{H}_6\text{OClBr}$  MW, 257.5

Needles. M.p.  $112^\circ$ . Sol. EtOH,  $\text{Et}_2\text{O}$ , ligroin.

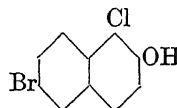
Willstätter, Schuler, *Ber.*, 1928, 61, 367.

**4-Chloro-2-bromo-1-naphthol.**

Needles. M.p.  $96^\circ$ .

Willstätter, Schuler, *Ber.*, 1928, 61, 367.

**1-Chloro-6-bromo-2-naphthol**



$\text{C}_{10}\text{H}_6\text{OClBr}$  MW, 257.5

Needles. M.p.  $105^\circ$ . Cryst. +  $1\text{CH}_3\cdot\text{COOH}$  from AcOH, m.p.  $92^\circ$ .  $\text{KMnO}_4 \rightarrow$  4-bromophthalic acid.

*Me ether*:  $\text{C}_{11}\text{H}_8\text{OClBr}$ . MW, 271.5. M.p.  $92-3^\circ$ .

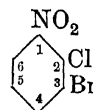
*Et ether*:  $\text{C}_{12}\text{H}_{10}\text{OClBr}$ . MW, 285.5. M.p.  $77.5^\circ$ .

*n-Propyl ether*:  $\text{C}_{13}\text{H}_{12}\text{OClBr}$ . MW, 299.5. M.p.  $60.5^\circ$ .

Armstrong, Rossiter, *Chem. News*, 1889, 59, 225; 1891, 63, 137; *Proc. Chem. Soc.*, 1891, 184.

Fries, Schimmelschmidt, *Ann.*, 1930, 484, 295.

**2-Chloro-3-bromonitrobenzene**



$\text{C}_6\text{H}_3\text{O}_2\text{NClBr}$

MW, 236.5



Green needles from EtOH or Et<sub>2</sub>O. M.p. 65°.

Körner, Contardi, *Atti accad. Lincei*, 1906, 15, i, 528, (*J. Chem. Soc.*, 1906, 90, 641).

**2-Chloro-4-bromonitrobenzene.**

M.p. 44·5°.

Mayes, Turner, *J. Chem. Soc.*, 1928, 693.

**2-Chloro-5-bromonitrobenzene.**

M.p. 72° (69°). Spar. sol. C<sub>6</sub>H<sub>6</sub>. n<sub>D</sub><sup>20</sup> 1·5839.

Holleman, *Rec. trav. chim.*, 1915, 34, 205.

**2-Chloro-6-bromonitrobenzene.**

M.p. 74·4°.

Körner, Contardi, *Atti accad. Lincei*, 1908, 17, i, 477, (*J. Chem. Soc.*, 1908, 94, 523).

**3-Chloro-4-bromonitrobenzene.**

Needles or prisms from CHCl<sub>3</sub>. M.p. 62°.

Körner, Contardi, *Atti accad. Lincei*, 1913, 22, i, 824, (*J. Chem. Soc.*, 1913, 104, 963).

**3-Chloro-5-bromonitrobenzene.**

Leaflets. M.p. 81°.

Körner, Contardi, *Atti accad. Lincei*, 1913, 22, i, 834, (*J. Chem. Soc.*, 1913, 104, 963).

**3-Chloro-6-bromonitrobenzene.**

M.p. 70°. Sol. C<sub>6</sub>H<sub>6</sub>, hot EtOH. n<sub>D</sub><sup>20</sup> 1·5832.

Holleman, *Rec. trav. chim.*, 1915, 34, 208.

**4-Chloro-2-bromonitrobenzene.**

Greenish-yellow needles. M.p. 49·5°. Sol. EtOH.

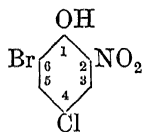
Mayes, Turner, *J. Chem. Soc.*, 1928, 693.

**4-Chloro-3-bromonitrobenzene.**

Pale yellow needles or prisms. M.p. 61°. Sol. EtOH, Et<sub>2</sub>O, AcOH. Volatile in steam

Körner, Contardi, *Atti accad. Lincei*, 1913, 22, i, 825, (*J. Chem. Soc.*, 1913, 104, 963).

**4-Chloro-6-bromo-2-nitrophenol**



C<sub>6</sub>H<sub>3</sub>O<sub>3</sub>NCIBr MW, 252·5

Pale yellow cryst. M.p. 125°.

Ling, *J. Chem. Soc.*, 1889, 55, 588.

Raiford, Miller, *J. Am. Chem. Soc.*, 1933, 55, 2128.

**5-Chloro-6-bromo-2-nitrophenol.**

Yellow prisms from pet. ether. M.p. 98·5°.

Hodgson, Kershaw, *J. Chem. Soc.*, 1930, 1424.

**6-Chloro-4-bromo-2-nitrophenol.**

Yellow monoclinic prisms. M.p. 114°.

Ling, *J. Chem. Soc.*, 1889, 55, 585.

Raiford, Miller, *J. Am. Chem. Soc.*, 1933, 55, 2129.

**6-Chloro-4-bromo-3-nitrophenol.**

M.p. 83°.

*o*-Nitro-*p*-toluenesulphonate: m.p. 107-8°.

Fox, Turner, *J. Chem. Soc.*, 1930, 1858.

**2-Chloro-6-bromo-4-nitrophenol.**

Cryst. from hot H<sub>2</sub>O. M.p. 137° decomp.

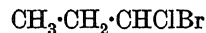
Ling, *J. Chem. Soc.*, 1889, 55, 57.

**3-Chloro-2-bromo-4-nitrophenol.**

Needles from EtOH. M.p. 136°.

Hodgson, Kershaw, *J. Chem. Soc.*, 1930, 1424.

**1-Chloro-1-bromopropane** (*Propylidene chlorobromide*)

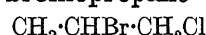


C<sub>3</sub>H<sub>6</sub>ClBr MW, 157·5

B.p. 110-12°. D<sub>4</sub><sup>20</sup> 1·59.

Reboul, *Ann. chim.*, 1878, 14, 484.

**1-Chloro-2-bromopropane**



C<sub>3</sub>H<sub>6</sub>ClBr MW, 157·5

B.p. 118°/756 mm. D<sub>4</sub><sup>20</sup> 1·537. n<sub>D</sub><sup>20</sup> 1·47763.

Dewael, *Chem. Abstracts*, 1930, 24, 3984.

**1-Chloro-3-bromopropane** (*Trimethylene chlorobromide*)



C<sub>3</sub>H<sub>6</sub>ClBr MW, 157·5

B.p. 142-3°. D<sub>8</sub><sup>1</sup> 1·63. KCN → 3-chloro-butyronitrile. Alc. KOH → ethyl allyl ether.

Kamm, Marvel, *J. Am. Chem. Soc.*, 1920, 42, 307.

Dewael, *Chem. Abstracts*, 1930, 24, 3984.

Bruylants, *Chem. Zentr*, 1909, I, 1860.

Cloke, Anderson, Lachmann, Smith, *J. Am. Chem. Soc.*, 1931, 53, 2791.

Stukov, *Chem. Abstracts*, 1933, 27, 5052.

Antsus, *J. Applied Chem. U.S.S.R.*, 1936, 9, 2053, (*Chem. Abstracts*, 1937, 31, 2579).

**2-Chloro-1-bromopropane**



C<sub>3</sub>H<sub>6</sub>ClBr MW, 157·5

B.p. 118°. D<sub>4</sub><sup>20</sup> 1·531. n<sub>D</sub><sup>20</sup> 1·47449.

Dewael, *Chem. Abstracts*, 1930, 24, 3984.

**2-Chloro-2-bromopropane** (*Isopropylidene chlorobromide*)



C<sub>3</sub>H<sub>6</sub>ClBr MW, 157·5

B.p. 93-6°/745 mm. D<sub>4</sub><sup>21</sup> 1·474.

Reboul, *Ann. chim.*, 1878, 14, 482.

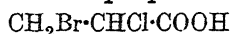
## Chlorobromopropionanilide.

See under Chlorobromoaniline.

## 1-Chloro-1-bromopropionic Acid


 $\text{C}_3\text{H}_4\text{O}_2\text{ClBr}$  MW, 187.5
B.p. 101°/14 mm.  $D_4^{20}$  1.694.Braun, Jostes, Münch, *Ann.*, 1927, 453, 130.

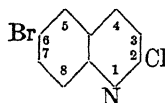
## 1-Chloro-2-bromopropionic Acid


 $\text{C}_3\text{H}_4\text{O}_2\text{ClBr}$  MW, 187.5
M.p. 35°. Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ . Alc. KOH  $\rightarrow$  1-chloroacrylic acid.Me ester:  $\text{C}_4\text{H}_6\text{O}_2\text{ClBr}$ . MW, 201.5. B.p. 185°.  $D^{17}$  1.645.Et ester:  $\text{C}_5\text{H}_8\text{O}_2\text{ClBr}$ . MW, 215.5. B.p. 195°.  $D^{18}$  1.575.Henry, *Chem. Zentr.*, 1906, II, 1551.

## 2-Chloro-1-bromopropionic Acid


 $\text{C}_3\text{H}_4\text{O}_2\text{ClBr}$  MW, 187.5
M.p. 43°. Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ . Alc. KOH  $\rightarrow$  1-bromoacrylic acid.Henry, *Chem. Zentr.*, 1906, II, 1551.

## 2-Chloro-6-bromoquinoline


 $\text{C}_9\text{H}_5\text{NClBr}$  MW, 242.5
Needles from EtOH. M.p. 160°. Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Spar. volatile in steam.Fischer, *Ber.*, 1902, 35, 3682.

## 4-Chloro-3-bromoquinoline.

M.p. 69-70°.

Picrate: m.p. 185-5.5°.

Surrey, Cutler, *J. Am. Chem. Soc.*, 1946, 68, 2570.

## 6-Chloro-3-bromoquinoline.

Needles from EtOH. M.p. 112°.

 $B, \text{HCl}$ : m.p. 168°.

Methiodide: orange prisms. M.p. 286-7° decomp.

Claus, Howitz, *J. prakt. Chem.*, 1894, 50, 239.

## 2-Chloro-3-bromotoluene


 $\text{C}_7\text{H}_6\text{ClBr}$  MW, 205.5

M.p. 18°. B.p. 125-35°/50 mm.

Cohen, Smithells, *J. Chem. Soc.*, 1914, 105, 1908.

## 2-Chloro-4-bromotoluene.

B.p. 100-10°/10 mm.

Cohen, Smithells, *J. Chem. Soc.*, 1914, 105, 1908.

## 2-Chloro-5-bromotoluene.

B.p. 127-9°/45 mm., 90-3°/12 mm.

Varma, Sahay, *J. Indian Chem. Soc.*, 1934, 11, 293.Cohen, Smithells, *J. Chem. Soc.*, 1914, 105, 1908.

## 2-Chloro-6-bromotoluene.

B.p. 118-20°/40 mm.

Cohen, Smithells, *J. Chem. Soc.*, 1914, 105, 1914.

## 3-Chloro-2-bromotoluene.

M.p. 4-5°. B.p. 103-5°/25 mm.

Cohen, Smithells, *J. Chem. Soc.*, 1914, 105, 1908.

## 3-Chloro-4-bromotoluene.

B.p. 125-30°/25 mm., 90-3°/12 mm.

Varma, Sahay, *J. Indian Chem. Soc.*, 1934, 11, 293.Cohen, Smithells, *J. Chem. Soc.*, 1914, 105, 1908.

## 3-Chloro-5-bromotoluene.

Cryst. from EtOH. M.p. 26-7°.

Cohen, Murray, *J. Chem. Soc.*, 1915, 107, 847.

## 3-Chloro-6-bromotoluene.

B.p. 98-100°/25 mm. (120-5°/15 mm.).

Cohen, Smithells, *J. Chem. Soc.*, 1914, 105, 1908.Varma, Sahay, *J. Indian Chem. Soc.*, 1934, 11, 293.

## 4-Chloro-2-bromotoluene.

B.p. 112-14°/12 mm.

Cohen, Smithells, *J. Chem. Soc.*, 1914, 105, 1908, 1912.

## 4-Chloro-3-bromotoluene.

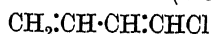
B.p. 120-5°/28 mm.

Cohen, Smithells, *J. Chem. Soc.*, 1914, 105, 1908, 1912.

## 4-Chloro-1:2-butadiene


 $\text{C}_4\text{H}_5\text{Cl}$  MW, 88.5
B.p. 88°.  $D_4^{20}$  0.9891.  $n_D^{20}$  1.4775. Cold conc.  $\text{H}_2\text{SO}_4 \rightarrow$  chloroprene.Carothers, Berchet, Collins, *J. Am. Chem. Soc.*, 1932, 54, 4066.du Pont, U.S.P. 1,950,431, (*Chem. Abstracts*, 1934, 28, 3271).

## 1-Chloro-1:3-butadiene (1-Chloroerythrene)


 $\text{C}_4\text{H}_5\text{Cl}$  MW, 88.5

B.p. 68° (65.5–66.0°, 85°).  $D_4^{20}$  0.9606,  $D_4^{25}$  0.9601.  $n_D^{20}$  1.4712 ( $n_D^{25}$  1.4733). Readily polymerises.

Prins, *Rec. trav. chim.*, 1937, **56**, 119.

Muskat, Northrop, *J. Am. Chem. Soc.*, 1930, **52**, 4054.

Petrov, Sopov, *J. Gen. Chem. U.S.S.R.*, 1945, **15**, 981, (*Chem. Abstracts*, 1946, **40**, 6406).

### 2-Chloro-1 : 3-butadiene.

See Chloroprene.

### Chlorobutane.

See *n*-Butyl chloride and *sec.*-*n*-Butyl chloride.

### Chlorobutanone.

See Methyl chloroethyl Ketone.

### 3-Chloro-*n*-butyl Alcohol (3-Chloro-1-hydroxybutane)



$\text{C}_4\text{H}_9\text{OCl}$  MW, 108.5

B.p. 170–80°.

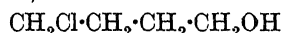
Acetyl : b.p. 71°/13 mm.

Butyryl : b.p. 76°/4 mm.

Benzoyl : b.p. 111–12°/3 mm.  $n_D^{20}$  1.5140.

I.G., B.P. 465,467, (*Chem. Zentr.*, 1937, **II**, 1445).

### 4-Chloro-*n*-butyl Alcohol (4-Chloro-1-hydroxybutane)



$\text{C}_4\text{H}_9\text{OCl}$  MW, 108.5

B.p. 84–5°/16 mm.  $D_4^{20}$  1.0883.  $n_D^{20}$  1.4518.

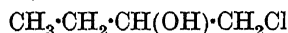
Acetyl : 4-chlorobutyl acetate. B.p. 98°/32 mm., 87°/17 mm.

Phenylurethane : m.p. 54°.

$\alpha$ -Naphthylurethane : m.p. 69–70°.

Starr, Hixon, *Organic Syntheses*, 1937, **XVII**, 84.

### 1-Chloro-*sec.*-butyl Alcohol (1-Chloro-2-hydroxybutane)



$\text{C}_4\text{H}_9\text{OCl}$  MW, 108.5

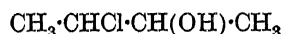
B.p. 141°, 52°/15 mm.  $D_4^{18}$  1.040.  $n_D^{18}$  1.4353. KOH  $\rightarrow$  1 : 2-butylene oxide.

Helferich, Speidel, *Ber.*, 1921, **54**, 2636.

Montmollin, Matile, *Helv. Chim. Acta*, 1924, **7**, 106.

Olson, Whitacre, *J. Am. Chem. Soc.*, 1943, **65**, 1019.

### 3-Chloro-*sec.*-butyl Alcohol (3-Chloro-2-hydroxybutane)



$\text{C}_4\text{H}_9\text{OCl}$  MW, 108.5

B.p. 138–40°. Sol. to 7% in  $\text{H}_2\text{O}$  at 20°.  $D_4^0$  1.087.  $n_D^{20}$  1.44376. NaOH  $\rightarrow$   $\beta$ -butylene oxide.

*Me ether* :  $\text{C}_6\text{H}_{11}\text{OCl}$ . MW, 122.5. B.p. 116°.  $D_4^{15}$  1.023.  $n_D^{14}$  1.4225.

*Et ether* :  $\text{C}_8\text{H}_{13}\text{OCl}$ . MW, 136.5. B.p. 122–4°.  $D_4^{15}$  0.9812.  $n_D^{14}$  1.426.

*Propyl ether* :  $\text{C}_7\text{H}_{15}\text{OCl}$ . MW, 150.5. B.p. 136–8°.  $D_4^{15}$  0.9848.  $n_D^{14}$  1.4285.

*Isopropyl ether* : b.p. 130–1°.  $D_4^{15}$  0.9661.  $n_D^{14}$  1.4298.

*Isoamyl ether* :  $\text{C}_8\text{H}_{17}\text{OCl}$ . MW, 164.5. B.p. 176–8°.  $D_4^{15}$  0.9224.  $n_D^{14}$  1.4245.

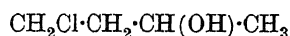
Fourneau, Puyal, *Bull. soc. chim.*, 1922, **31**, 427.

Wilson, Lucas, *J. Am. Chem. Soc.*, 1936, **58**, 2399.

Batalin, Ugryumov, *Chem. Abstracts*, 1935, **29**, 2147.

Lucas, Gould, *J. Am. Chem. Soc.*, 1941, **63**, 2541.

### 4-Chloro-*sec.*-butyl Alcohol (4-Chloro-2-hydroxybutane)



$\text{C}_4\text{H}_9\text{OCl}$  MW, 108.5

B.p. about 70°/13 mm.

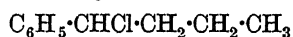
Fourneau, Ramart-Lucas, *Bull. soc. chim.*, 1919, **25**, 367.

Elderfield *et al.*, *J. Am. Chem. Soc.*, 1946, **68**, 1516.

### Chloro-*tert.*-butyl Alcohol.

See Chlorotrimethylcarbinol.

### $\alpha$ -Chloro-*n*-butylbenzene



$\text{C}_{10}\text{H}_{13}\text{Cl}$  MW, 168.5

*dl.*

B.p. 94°/20 mm. decomp.

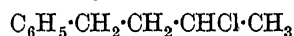
*l.*

B.p. 115°/30 mm.  $D_4^{24}$  1.004.

Engler, Bethge, *Ber.*, 1874, **7**, 1128.

Levene, Marker, *J. Biol. Chem.*, 1932, **97**, 388.

### $\gamma$ -Chloro-*n*-butylbenzene



$\text{C}_{10}\text{H}_{13}\text{Cl}$  MW, 168.5

B.p. 113–6°/16 mm.

Braun, Neumann, *Ber.*, 1917, **50**, 54.

### $\omega$ -Chloro-*n*-butylbenzene



$\text{C}_{10}\text{H}_{13}\text{Cl}$  MW, 168.5

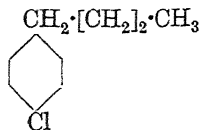
B.p. 122–3°/17 mm., 89–93°/6 mm.  $D_4^{25}$  1.0801.  $n_D^{25}$  1.516.

Rossander, Marvel, *J. Am. Chem. Soc.*, 1928, **50**, 1495.

Braun, *Ber.*, 1910, **43**, 2846.

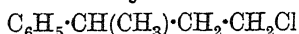
Merck, D.R.P. 238,959, (*Chem. Zentr.*, 1911, **II**, 1284).

*p*-Chloro-*n*-butylbenzene



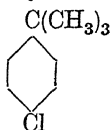
$\text{C}_{10}\text{H}_{13}\text{Cl}$  MW, 168.5  
 B.p. 225–8°.  
 Morgan, Hickinbottom, *J. Chem. Soc.*, 1921, 119, 1886.

$\omega$ -Chloro-*sec.*-butylbenzene



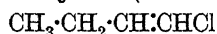
$\text{C}_{10}\text{H}_{13}\text{Cl}$  MW, 168.5  
 B.p. 114–16°/17 mm.  
 Braun, Grabowski, Kirschbaum, *Ber.*, 1913, 46, 1276.

*p*-Chloro-*tert.*-butylbenzene



$\text{C}_{10}\text{H}_{13}\text{Cl}$  WM, 168.5  
 B.p. 211°/759 mm.  $D_4^{25}$  1.0075.  $n_D^{20}$  1.5123.  
 Ox.  $\rightarrow$  *p*-chlorobenzoic acid.  
 Bödtker, *Bull. soc. chim.*, 1906, 35, 826.  
 Tsukervanik, *J. Gen. Chem. U.S.S.R.*, 1945, 15, 699, (*Chem. Abstracts*, 1946, 40, 5707).  
 Rueggeberg, Cushing, Cook, *J. Am. Chem. Soc.*, 1946, 68, 191.

1-Chloro-1-butylene (1-*Chlorobutene-1*)

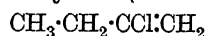


$\text{C}_4\text{H}_7\text{Cl}$  MW, 90.5  
*Cis.*  
 B.p. 63.4–63.6°.  $D_4^0$  0.9329,  $D_4^{15}$  0.9153.  $n_D^{15}$  1.4194.  
*Trans.*  
 B.p. 68.0–68.2°.  $D_4^0$  0.9376,  $D_4^{15}$  0.9205.  $n_D^{14}$  1.4225.

Navez, *Bull. soc. chim. Belg.*, 1930, 39, 435.

Henne, Hinkamp, *J. Am. Chem. Soc.*, 1945, 67, 1197.

2-Chloro-1-butylene (2-*Chlorobutene-1*)

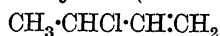


$\text{C}_4\text{H}_7\text{Cl}$  MW, 90.5  
 B.p. 58.4–58.6°.  $D_4^0$  0.9288,  $D_4^{15}$  0.9107.  $n_D^{14}$  1.4166.

Navez, *Bull. soc. chim. Belg.*, 1930, 39, 435.

Vaughan, Rust, U.S.P. 2,396,217, (*Chem. Abstracts*, 1946, 40, 3121).

3-Chloro-1-butylene (3-*Chlorobutene-1*)



$\text{C}_4\text{H}_7\text{Cl}$  MW, 90.5

B.p. 64°/766 mm.  $D_4^{20}$  0.8978.  $n_D^{20}$  1.4149.

Baudrenghien, *Bull. soc. chim. Belg.*, 1922, 31, 165.

Kharasch, Kritchevsky, Mayo, *J. Org. Chem.*, 1937, 2, 489.

4-Chloro-1-butylene (4-*Chlorobutene-1*)



$\text{C}_4\text{H}_7\text{Cl}$  MW, 90.5  
 B.p. 75°/773 mm.  $D_4^{20}$  0.9211.  $n_D^{20}$  1.42330.  
 Juvala, *Ber.*, 1930, 63, 1993.

1-Chloro-2-butylene (1-*Chlorobutene-2*, *crotyl chloride*)



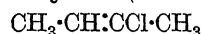
$\text{C}_4\text{H}_7\text{Cl}$  MW, 90.5  
*Cis.*  
 B.p. 84.1°/758 mm.  $D_4^{20}$  0.9426.  $n_D^{20}$  1.4390.  
*Trans.*  
 B.p. 84.8°/752 mm.  $D_4^{20}$  0.9295.  $n_D^{20}$  1.4350,  $n_D^{25}$  1.4327.

Baudrenghien, *Bull. soc. chim. Belg.*, 1922, 31, 165.

Hatch, Nesbitt, *J. Am. Chem. Soc.*, 1950, 72, 727.

Kharasch, Kritchevsky, Mayo, *J. Org. Chem.*, 1937, 2, 489.

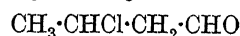
2-Chloro-2-butylene (2-*Chlorobutene-2*)



$\text{C}_4\text{H}_7\text{Cl}$  MW, 90.5  
*Cis.*  
 B.p. 66.7–67°.  $D_4^0$  0.9420,  $D_4^{15}$  0.9246.  $n_D^{13}$  1.4250.  
*Trans.*  
 B.p. 62.4–62.8°.  $D_4^0$  0.9361,  $D_4^{15}$  0.9185.  $n_D^{13}$  1.4217.

Navez, *Bull. soc. chim. Belg.*, 1930, 39, 435.

2-Chlorobutylaldehyde



$\text{C}_4\text{H}_7\text{OCl}$  MW, 106.5  
 B.p. 28–33°/13 mm. Sol. ord. org. solvents. Insol.  $\text{H}_2\text{O}$ . Unstable.

*Di-Et acetal*:  $\text{C}_8\text{H}_{17}\text{O}_2\text{Cl}$ . MW, 180.5. B.p. 70–1°/12 mm. Sol. ord. org. solvents. Insol.  $\text{H}_2\text{O}$ .  $D^{17}$  0.975. Dist. with alkalis  $\rightarrow$  crotonaldehyde diethylacetal.

*Trimeride*:  $(\text{C}_4\text{H}_7\text{OCl})_3$ . MW, 319.5. Needles from EtOH.Aq. M.p. 97°. Sol. hot EtOH. Insol.  $\text{H}_2\text{O}$ .  $\text{H}_2\text{SO}_4 \rightarrow$  crotonaldehyde.  $\text{CrO}_3 \rightarrow$  acetic acid. Conc.  $\text{HNO}_3 \rightarrow$  2-chlorobutyric acid.  $\text{Ag}_2\text{O} \rightarrow$  2-hydroxybutyric acid.

Kekulé, *Ann.*, 1872, 162, 100.

Helferich, Besler, *Ber.*, 1924, 57, 1280.

## 1-Chlorobutyric Acid



$\text{C}_4\text{H}_7\text{O}_2\text{Cl}$  MW, 122.5  
*dl.*

Viscous liq. B.p.  $101^\circ/15$  mm. Sol. hot  $\text{H}_2\text{O}$ .  $k = 1.39 \times 10^{-3}$  at  $25^\circ$ .

*Me ester*:  $\text{C}_5\text{H}_9\text{O}_2\text{Cl}$ . MW, 136.5. B.p.  $146^\circ$ .

*Et ester*:  $\text{C}_6\text{H}_{11}\text{O}_2\text{Cl}$ . MW, 150.5. B.p.  $163-4^\circ$ ,  $63^\circ/70$  mm.  $D^{18}$  1.056.

*Propyl ester*:  $\text{C}_7\text{H}_{13}\text{O}_2\text{Cl}$ . MW, 164.5. B.p.  $183^\circ/754$  mm.  $D^{15}$  1.036.

*Chloride*:  $\text{C}_4\text{H}_6\text{OCl}_2$ . MW, 141. B.p.  $129-32^\circ$ ,  $62-3^\circ/70$  mm.,  $51-2^\circ/41$  mm.  $D^{17}$  1.257.

*Nitrile*:  $\text{C}_4\text{H}_6\text{NCl}$ . MW, 103.5. B.p.  $143^\circ$ .

*l.*

$[\alpha]_D - 8.6^\circ$ .

*Isobutyl ester*:  $\text{C}_8\text{H}_{15}\text{O}_2\text{Cl}$ . MW, 178.5. B.p.  $182^\circ$ .  $D^{15}$  0.984.  $n_D^{20}$  1.4231.  $[\alpha]_D - 10.5^\circ$ .

Paal, Schiedewitz, *Ber.*, 1929, 62, 1937.

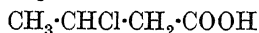
Cloves, *Ann.*, 1901, 319, 357.

Henry, *Chem. Zentr.*, 1898, II, 273.

Blaise, *Bull. soc. chim.*, 1914, 15, 668.

Timmermans, Haegen, *Bull. soc. chim. Belg.*, 1933, 42, 448.

## 2-Chlorobutyric Acid



$\text{C}_4\text{H}_7\text{O}_2\text{Cl}$  MW, 122.5  
*d.*

M.p.  $43-44.5^\circ$ . B.p.  $101^\circ/13$  mm.  $[\alpha]_D^{20} + 49.8^\circ$  in  $\text{H}_2\text{O}$ .  $\text{NaOH.Aq.} \rightarrow$  crotonic acid.

*Me ester*: b.p.  $148-52^\circ$ ,  $48-51^\circ/13$  mm.  $[\alpha]_D^{20} + 23.9^\circ$ .  $D^{29}$  1.077.

*l.*

Needles.  $[\alpha]_D - 33.4^\circ$  in toluene.

*dl.*

Cryst. from  $\text{Et}_2\text{O}$ . M.p.  $16^\circ$ . B.p.  $116^\circ/22$  mm.,  $108^\circ/16$  mm.  $k = 8.9 \times 10^{-5}$  at  $25^\circ$ .

$\text{KOH} \rightarrow$  crotonic acid.

*Me ester*: b.p.  $156^\circ$ .  $D^{14}$  1.0916.

*Et ester*: b.p.  $109^\circ$ ,  $65^\circ/15$  mm.  $D_4^{20}$  1.0517.  $n_D^{20}$  1.42458.

*Propyl ester*: b.p.  $182-3^\circ/754$  mm.  $D^{15}$  0.989. *Chloride*: b.p.  $51-3^\circ/21$  mm.  $D_4^{20}$  1.217.  $n_D^{20}$  1.45085.

*Nitrile*: b.p.  $176^\circ$ .  $D^9$  1.0772.

Fischer, Scheibler, *Ber.*, 1909, 42, 1224;

*Ann.*, 1911, 383, 358.

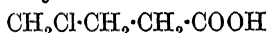
Scheibler, Magasanik, *Ber.*, 1915, 48, 1814.

Cloves, *Ann.*, 1901, 319, 358.

Paal, Schiedewitz, *Ber.*, 1929, 62, 1937.

For configuration see: Levene, Haller, *J. Biol. Chem.*, 1929, 81, 425.

## 3-Chlorobutyric Acid



$\text{C}_4\text{H}_7\text{O}_2\text{Cl}$  MW, 122.5

M.p.  $16^\circ$  ( $12^\circ$ ). B.p.  $196^\circ/22$  mm.  $D^{10}$  1.2498.

*Me ester*: b.p.  $173-4^\circ$ ,  $102-5^\circ/58$  mm.  $D^{14}$  1.1268.

*Et ester*: b.p.  $186^\circ$ ,  $77^\circ/10$  mm., ( $72^\circ/16$  mm.).  $D_4^{20}$  1.0756.  $n_D^{20}$  1.43107.

*Propyl ester*: b.p.  $197-8^\circ$ .  $D^{15}$  1.088.

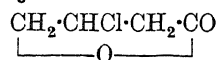
*Chloride*: b.p.  $174^\circ$ ,  $61-2^\circ/12$  mm.  $D^{10}$  1.2679.

*Nitrile*: b.p.  $196-7^\circ$ ,  $78^\circ/12$  mm.  $D^{10}$  1.162. Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ . Insol.  $\text{H}_2\text{O}$ .

Cloves, *Ann.*, 1901, 319, 360.

Wohlgemuth, *Ann. chim.*, 1914, 2, 305.

## 2-Chlorobutyrolactone

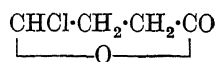


$\text{C}_4\text{H}_5\text{O}_2\text{Cl}$  MW, 120.5

Needles. M.p.  $45^\circ$ . Sol.  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ ,  $\text{C}_6\text{H}_6$ . Deliquescent.

Pace, *Gazz. chim. ital.*, 1929, 59, 585.

## 3-Chlorobutyrolactone



$\text{C}_4\text{H}_5\text{O}_2\text{Cl}$  MW, 120.5

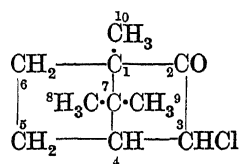
B.p.  $101^\circ/15$  mm.

Carrière, *Ann. chim.*, 1922, 17, 91.

## 2-Chlorocamphane.

See Bornyl chloride and Isobornyl chloride.

## 3-Chloro-d-camphor



$\text{C}_{10}\text{H}_{15}\text{OCl}$  MW, 186.5

*α-Form*:

Leaflets. M.p.  $93-4^\circ$ . B.p.  $244-7^\circ$  part. decomp. Sol.  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ ,  $\text{CS}_2$ ,  $\text{C}_6\text{H}_6$ , hot  $\text{EtOH}$ . Mod. sol. hot  $\text{H}_2\text{O}$ . Volatile in steam.  $[\alpha]_D^{20} + 97^\circ$  in  $\text{EtOH}$ .

*α'-Form*:

Cryst. from  $\text{EtOH}$ . M.p.  $117^\circ$ .  $[\alpha]_D^{20} + 35^\circ$  in  $\text{EtOH}$ . Alkalis  $\rightarrow$   $\alpha$ -isomer.

Lowry, Steele, *J. Chem. Soc.*, 1915, 107, 1384.

Kipping, Pope, *J. Chem. Soc.*, 1893, 63, 593.

## 4-Chlorocamphor.

*l.*

M.p.  $198-9^\circ$ .  $[\alpha]_D^{20} - 30^\circ$  in  $\text{EtOH}$ .

*Semicarbazone*: m.p.  $260-5^\circ$ .

*Hydrazone*: m.p.  $120^\circ$ .  $[\alpha]_D^{19} + 25.7^\circ$  in  $\text{EtOH}$ . *B.HCl*: m.p.  $230-5^\circ$ . *N-Acetyl*: m.p.  $250^\circ$  decomp.

*dl.*

M.p.  $198-9^\circ$ .

*Oxime*: cryst. from  $\text{MeOH.Aq.}$  or  $\text{C}_6\text{H}_6$ . M.p.  $158-60^\circ$ .

*Semicarbazone*: cryst. from AcOH.Aq. M.p. 260–4° decomp.

Houben, Pfankuch, *Ber.*, 1931, 64, 2719; *Ann.*, 1931, 489, 221; *Ann.*, 1933, 501, 245.

### 6-(or 10-)Chloro-*d*-camphor.

Prisms from EtOH. M.p. 132–5°. Sol. CHCl<sub>3</sub>, AcOH, C<sub>6</sub>H<sub>6</sub>, pet. ether. Mod. sol. EtOH.  $[\alpha]_D^{25} + 40.7^\circ$  in EtOH.

*Oxime*: prisms from MeOH. M.p. 142–3°.  $[\alpha]_D^{25} - 58.1^\circ$ .

*Semicarbazone*: plates. M.p. 220–1°.

Henderson, Heilbron, Howie, *J. Chem. Soc.*, 1914, 105, 1371.

### 8-Chlorocamphor.

*d*-

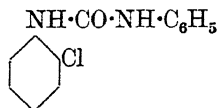
Prisms. M.p. 139°.  $[\alpha]_D^{25} + 99.9^\circ$  in CHCl<sub>3</sub>.

*dl*-

M.p. 138°. Sublimes. Volatile in steam.

Kipping, Pope, *J. Chem. Soc.*, 1895, 67, 377, 379.

### *o*-Chlorocarbanilide (2-Chloro-sym.-di-phenylurea)



C<sub>13</sub>H<sub>11</sub>ON<sub>2</sub>Cl

MW, 246.5

Needles from EtOH. M.p. 181–2°.

Michael, Cobb, *Ann.*, 1908, 363, 93.

### *m*-Chlorocarbanilide.

Needles from EtOH. M.p. 187°.

Goldschmidt, Bardach, *Ber.*, 1892, 25, 1366.

Sah, Wu, *J. Chinese Chem. Soc.*, 1936, 4, 513.

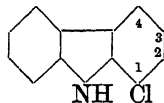
### *p*-Chlorocarbanilide.

Needles from AcOH. M.p. 238–42°.

Walther, *J. prakt. Chem.*, 1906, 73, 108.

Kao, Fang, Sah, *J. Chinese Chem. Soc.*, 1935, 3, 137.

### 1-Chlorocarbazole



C<sub>12</sub>H<sub>8</sub>NCl

MW, 201.5

Plates from EtOH.Aq. M.p. 125° (109–110°).

I.G., D.R.P. 511,021, (*Chem. Zentr.*, 1931, II, 2215).

Barclay, Campbell, *J. Chem. Soc.*, 1945, 530.

### 2-Chlorocarbazole.

Leaflets from AcOH. M.p. 244°.

Ullmann, Kogan, *Ann.*, 1904, 332, 97.

I.G., F.P. 666,450, (*Chem. Zentr.*, 1930, II, 470).

### 3-Chlorocarbazole.

Silvery cryst. from EtOH or AcOH. M.p. 201.5°.

*N*-Acetyl: needles from ligroin. M.p. 124–5°.

Ullmann, Kogan, *Ann.*, 1904, 332, 96.

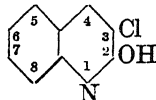
### 4-Chlorocarbazole.

Needles from pet. ether. M.p. 96°.

*N*-Acetyl: plates from EtOH. M.p. 126°.

Moggridge, Plant, *J. Chem. Soc.*, 1937, 1128.

### 3-Chlorocarbstyryl (3-Chloro-2-hydroxyquinoline)



C<sub>9</sub>H<sub>6</sub>ONCl

MW, 179.5

M.p. 241–2°. Sublimes.

Friedländer, Weinberg, *Ber.*, 1882, 15, 2680.

### 4-Chlorocarbstyryl.

Needles. M.p. 246° (254°). Sol. caustic alkalis. Spar. sol. hot H<sub>2</sub>O. Sublimes.

*Et ether*: C<sub>11</sub>H<sub>10</sub>ONCl. MW, 207.5. Needles. M.p. 43°. B.p. 270°.

Camps, *Ber.*, 1901, 34, 2716.

Friedländer, Weinberg, *Ber.*, 1882, 15, 2684.

Buchmann, Hamilton, *J. Am. Chem. Soc.*, 1942, 64, 1357.

Rowlett, Lutz, *J. Am. Chem. Soc.*, 1946, 68, 1288.

### 5-Chlorocarbstyryl.

Leaflets from EtOH. M.p. 287°.

Einhorn, Lauch, *Ann.*, 1888, 243, 358.

### 6-Chlorocarbstyryl.

Needles. M.p. 263° (267.5°). Sol. caustic alkalis. Sublimes.

Eichengrün, Einhorn, *Ann.*, 1891, 262, 165.

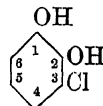
Bachmann, Cooper, *J. Org. Chem.*, 1944, 9, 302.

### 7-Chlorocarbstyryl.

Plates from EtOH. M.p. 296–7°.

Lutz, Ashburn, Rowlett, *J. Am. Chem. Soc.*, 1946, 68, 1322.

### 3-Chlorocatechol (3-Chloro-1:2-dihydroxybenzene)



C<sub>6</sub>H<sub>5</sub>O<sub>2</sub>Cl

MW, 144.5

Cryst. from ligroin. M.p. 46–8°. B.p. 110–11°/11 mm.

*2-Me ether*: see 6-Chloroguaiacol.

*Dibenzoyl*: needles. M.p. 108–9°. Sol. hot EtOH.

Willstätter, Müller, *Ber.*, 1911, 44, 2184.

**4-Chlorocatechol.**

Leaflets. M.p. 90–1°, after resolidification 59–61°. B.p. 136°/8.5 mm. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

1-*Me ether*: see 4-Chloroguaiacol.

2-*Me ether*: see 5-Chloroguaiacol.

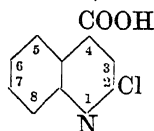
1:2-*Di-Me ether*: see 4-Chloroveratrol.

*Diacetyl*: b.p. 145–7°/7 mm.

*Dibenzoyl*: needles from Et<sub>2</sub>O. M.p. 96–7°.

Frejka, Šefránek, Zika, *Chem. Abstracts*, 1937, 31, 7047.

Willstätter, Müller, *Ber.*, 1911, 44, 2184.

**2-Chlorocinchoninic Acid (2-Chloroquinoline-4-carboxylic Acid)**

C<sub>10</sub>H<sub>6</sub>O<sub>2</sub>NCl MW, 207.5

Needles from EtOH. M.p. 244° (230–50°, 233–5°).

*Me ester*: C<sub>11</sub>H<sub>8</sub>O<sub>2</sub>NCl. MW, 221.5. Needles from Me<sub>2</sub>CO. M.p. 89–90°.

*Et ester*: C<sub>12</sub>H<sub>10</sub>O<sub>2</sub>NCl. MW, 235.5. M.p. 64.5° (63°).

*Chloride*: C<sub>10</sub>H<sub>5</sub>ONCl<sub>2</sub>. MW, 226. M.p. 89–90°.

*Amide*: C<sub>10</sub>H<sub>7</sub>ON<sub>2</sub>Cl. MW, 206.5. Needles from EtOH. Aq. M.p. 234–5°, solidifying and remelting at 276–8°.

*Di-Me-amide*: C<sub>12</sub>H<sub>11</sub>ON<sub>2</sub>Cl. MW, 234.5. M.p. 114°.

*Di-Et-amide*: C<sub>14</sub>H<sub>15</sub>ON<sub>2</sub>Cl. MW, 262.5. M.p. 124°.

*Anilide*: needles from EtOH. M.p. 202°.

Thielpape, *Ber.*, 1938, 71, 388.

Mulert, *Ber.*, 1906, 39, 1903.

Miescher, *Chem. Abstracts*, 1929, 23, 1217.

Campbell, Kerwin, *J. Am. Chem. Soc.*, 1946, 68, 1837.

**3-Chlorocinchoninic Acid (3-Chloroquinoline-4-carboxylic acid).**

Cryst. from EtOH. M.p. 262–3°. Spar. sol. EtOH.

Ellinger, Flamand, *Ber.*, 1906, 39, 4389.

**5-Chlorocinchoninic Acid (5-Chloroquinoline-4-carboxylic acid).**

Cryst. from MeOH. M.p. 254–5°.

*Et ester*: C<sub>12</sub>H<sub>10</sub>O<sub>2</sub>NCl. MW, 235.5. Cryst. from ligroin. M.p. 65.0–65.5°. B.p. 136–9°/0.2 mm.

Senear et al., *J. Am. Chem. Soc.*, 1946, 68, 2695.

**6-Chlorocinchoninic Acid (6-Chloroquinoline-4-carboxylic acid).**

Cryst. from dioxan. M.p. 304° (302°).

*Me ester*: C<sub>11</sub>H<sub>8</sub>O<sub>2</sub>NCl. MW, 221.5. Cryst. from ligroin–C<sub>6</sub>H<sub>6</sub>. M.p. 79.5°.

*Et ester*: C<sub>12</sub>H<sub>10</sub>O<sub>2</sub>NCl. MW, 235.5. Cryst. from ligroin. M.p. 68–9° (63–4°). B.p. 160–5°/2 mm. *Picrate*: needles from EtOH. M.p. 160.1–160.6°.

*Amide*: C<sub>10</sub>H<sub>7</sub>ON<sub>2</sub>Cl. MW, 206.5. M.p. 244°.

Work, *J. Chem. Soc.*, 1942, 426.

Campbell, Kerwin, *J. Am. Chem. Soc.*, 1946, 68, 1837.

**7-Chlorocinchoninic Acid (7-Chloroquinoline-4-carboxylic acid).**

Plates from AcOH. M.p. 290–1° decomp. (281–2°).

*Et ester*: prisms from ligroin. M.p. 35–6° (32–4°). B.p. 145°/0.7 mm. *Picrate*: cryst. from EtOH. M.p. 173–4°.

Campbell et al., *J. Am. Chem. Soc.*, 1946, 68, 1851.

Senear et al., *J. Am. Chem. Soc.*, 1946, 68, 2695.

**8-Chlorocinchoninic Acid (8-Chloroquinoline-4-carboxylic acid).**

*Et ester*: cryst. from EtOH. M.p. 36–7°.

Buchman et al., *J. Am. Chem. Soc.*, 1946, 68, 2692.

**α-Chlorocinnamaldehyde**

C<sub>9</sub>H<sub>7</sub>OCl MW, 166.5

M.p. 34–6° (32°). Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

*Oxime*: m.p. 157–9°. Sol. EtOH. P<sub>2</sub>O<sub>5</sub> → 3-chloroisoquinoline.

*Phenylhydrazone*: yellow plates from EtOH. M.p. 160°.

Naar, *Ber.*, 1891, 24, 246.

**β-Chlorocinnamaldehyde**

C<sub>9</sub>H<sub>7</sub>OCl MW, 166.5

B.p. 125°/10 mm.

*Semicarbazone*: m.p. 216–18°.

Braun, Ostermayer, *Ber.*, 1937, 70, 1004.

**o-Chlorocinnamaldehyde**

C<sub>9</sub>H<sub>7</sub>OCl MW, 166.5

Needles. M.p. 50°. B.p. 140–60°/12 mm.

*Oxime*: needles. Sinters at 92°. M.p. 96°.

Rosenmund, Zetzsche, *Ber.*, 1923, 56, 1485.

Betti, Lucchi, *Atti accad. Lincei*, 1936, 23, 465.

**p-Chlorocinnamaldehyde.**

Prisms or needles. M.p. 62–62.5°. B.p. 155–6°/14 mm.

Straus, *Ann.*, 1912, 393, 311.

$\alpha$ -Chlorocinnamic Acid $C_9H_7O_2Cl$  MW, 182.5*Trans*-.

Needles or prisms. M.p. 137–8°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Mod. sol. boiling H<sub>2</sub>O. Spar. sol. ligroin.  $k = 9.7 \times 10^{-4}$  at 25°. NaHg  $\rightarrow$  hydrocinnamic acid.

*Me ester*: C<sub>10</sub>H<sub>9</sub>O<sub>2</sub>Cl. MW, 196.5. Prisms. M.p. 33°. B.p. 108–9°/0.5 mm.

*Et ester*: C<sub>11</sub>H<sub>11</sub>O<sub>2</sub>Cl. MW, 210.5. B.p. 209°/75 mm., 161–2°/8 mm. D<sub>4</sub><sup>25</sup> 1.1719.  $n_D^{25}$  1.5705.

*Allyl ester*: C<sub>12</sub>H<sub>13</sub>O<sub>2</sub>Cl. MW, 222.5. B.p. 162–3°/11 mm. D<sub>4</sub><sup>25</sup> 1.1702.  $n_D^{25}$  1.5748.

*Chloride*: C<sub>9</sub>H<sub>6</sub>OCl<sub>2</sub>. MW, 201. Needles. M.p. 32–3°. B.p. 156°/22 mm.

*Amide*: C<sub>9</sub>H<sub>8</sub>ONCl. MW, 181.5. Plates. M.p. 121–2°. B.p. 216–17°/12 mm.

*Anilide*: needles from EtOH. M.p. 118°.

*o-Toluidide*: prisms from EtOH. M.p. 78°.

*p-Toluidide*: prisms from EtOH. M.p. 116°.

*$\alpha$ -Naphthylamide*: needles from EtOH. M.p. 134°.

*$\beta$ -Naphthylamide*: plates from EtOH. M.p. 139°.

*Cis*-. Allo- $\alpha$ -chlorocinnamic acid.

Prisms or plates. M.p. 111°. Spar. sol. cold H<sub>2</sub>O.  $k = 1.07 \times 10^{-2}$  at 25°. Heat at 155°  $\rightarrow$  *trans*-form. NaHg  $\rightarrow$  hydrocinnamic acid.

*Me ester*: b.p. 153–4°/28 mm., 98–9°/0.6 mm.

*Et ester*: b.p. 157–8°/10 mm. D<sub>4</sub><sup>25</sup> 1.1569.  $n_D^{25}$  1.5525.

*Allyl ester*: b.p. 171°/28 mm. D<sub>4</sub><sup>25</sup> 1.1457.  $n_D^{25}$  1.5416.

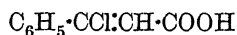
*Amide*: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 134°. B.p. 210°/13 mm.

*Anilide*: needles from EtOH.Aq. M.p. 138–9°.

Stoermer, Kirchner, *Ber.*, 1920, 53, 1289.

Walker, James, *J. Chem. Soc.*, 1919, 115, 1246.

Auwers, Schmellencamp, *Ber.*, 1921, 54, 624.

 $\beta$ -Chlorocinnamic Acid $C_9H_7O_2Cl$  MW, 182.5*Trans*-.

Needles or prisms. M.p. 142°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Spar. sol. H<sub>2</sub>O, ligroin.  $k = 2.8 \times 10^{-4}$  at 25°.

*Me ester*: plates. M.p. 29°. B.p. 113–14°/0.5 mm. D<sub>4</sub><sup>21.4</sup> 1.2248.  $n_D^{21.4}$  1.57810.

*Et ester*: b.p. 293°.

*Amide*: needles. M.p. 118°.

*Et-amide*: m.p. 109°.

*Anilide*: needles. M.p. 128°.

*p-Toluidide*: m.p. 122–5°.

*Cis*-. Allo- $\beta$ -chlorocinnamic acid ( $\beta$ -chloroisocinnamic acid).

Leaflets. M.p. 132°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Spar. sol. H<sub>2</sub>O.  $k = 2.72 \times 10^{-4}$  at 25°. Heat at 170°  $\rightarrow$  *trans*-form. Fuming HCl in sealed tube at 100°  $\rightarrow$  acetophenone.

*Me ester*: m.p. 34°. B.p. 96–7°/0.5 mm. D<sub>4</sub><sup>26.5</sup> 1.1932.  $n_D^{26.5}$  1.55457.

*Et ester*: b.p. 265° part. decomp.

*Amide*: needles. M.p. 76°.

*Anilide*: needles. M.p. 134.5°.

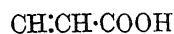
*p-Toluidide*: needles. M.p. 142°.

James, *J. Chem. Soc.*, 1911, 99, 1626.

Stoermer, Kirchner, *Ber.*, 1920, 53, 1289.

Auwers, Schmellencamp, *Ber.*, 1921, 54, 624.

Kharasch, Kane, Brown, *J. Am. Chem. Soc.*, 1942, 64, 333.

*o*-Chlorocinnamic Acid $C_9H_7O_2Cl$  MW, 182.5*Trans*-.

Yellowish cryst. from EtOH. M.p. 212°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. C<sub>6</sub>H<sub>6</sub>. Insol. cold H<sub>2</sub>O.

*Me ester*: C<sub>10</sub>H<sub>9</sub>O<sub>2</sub>Cl. MW, 196.5. Plates. M.p. 10.5°. B.p. 278–9°.

*Et ester*: C<sub>11</sub>H<sub>11</sub>O<sub>2</sub>Cl. MW, 210.5. B.p. 162°/12 mm.

*Chloride*: C<sub>9</sub>H<sub>6</sub>OCl<sub>2</sub>. MW, 201. M.p. 40°. B.p. 155–60°/12 mm.

*Amide*: C<sub>9</sub>H<sub>8</sub>ONCl. MW, 181.5. Needles. M.p. 168°.

*Nitrile*: C<sub>9</sub>H<sub>6</sub>NCl. MW, 163.5. Needles. M.p. 40°.

*Anilide*: m.p. 176°.

*Cis*-. Allo-*o*-chlorocinnamic acid.

Needles. M.p. 127°.

*Amide*: needles. M.p. 112°.

Lasch, *Monatsh.*, 1913, 34, 1653.

Stoermer, *Ber.*, 1911, 44, 658.

Rosenmund, Weiler, *Ber.*, 1923, 56, 1485.

Böck, Lock, Schmidt, *Monatsh.*, 1934, 64, 406.

Pandya, Pandya, *Proc. Indian Acad. Sci.*, 1941, 14A, 112, (*Chem. Abstracts*, 1942, 36, 1599).

*m*-Chlorocinnamic Acid.

Yellowish cryst. from H<sub>2</sub>O. M.p. 176° (165°). Sol. Et<sub>2</sub>O, hot EtOH.

Gabriel, Herzberg, *Ber.*, 1883, 16, 2038.

Reich, Arous, Potok, Tempel, *Helv. Chim. Acta*, 1920, 3, 794.

Böck, Lock, Schmidt, *Monatsh.*, 1934, 64, 406.

Pandya, Pandya, *Proc. Indian Acad. Sci.*, 1941, 14A, 112, (*Chem. Abstracts*, 1942, 36, 1599).



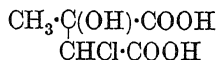
**p-Chlorocinnamic Acid.**

Yellowish cryst. M.p. 240–2° (245°). Sol. EtOH. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

Gabriel, Herzberg, *Ber.*, 1883, 16, 2039.  
Bock, Lock, Schmidt, *Monatsh.*, 1934, 64, 407.

Pandya, Pandya, *Proc. Indian Acad. Sci.*, 1941, 14A, 112, (*Chem. Abstracts*, 1942, 36, 1599)

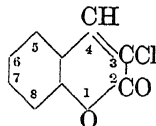
**Chlorocitramalic Acid** (1-Chloro-2-hydroxy-2-methylsuccinic acid, 1-chloro-2-methylmalic acid)



C<sub>5</sub>H<sub>7</sub>O<sub>5</sub>Cl MW, 182.5  
M.p. 139°. Dist. → chlorocitraconic anhydride.

Gottlieb, *Ann.*, 1871, 160, 102.

Melikow, Feldmann, *Ann.*, 1889, 253, 87.

**3-Chlorocoumarin**

C<sub>9</sub>H<sub>5</sub>O<sub>2</sub>Cl MW, 180.5  
Needles from EtOH. M.p. 122–3°. Mod. sol. EtOH. KOH → coumarilic acid.

Perkin, *J. Chem. Soc.*, 1871, 24, 43.

**4-Chlorocoumarin** (*Benzotetronyl chloride*).  
Needles from EtOH. M.p. 91–2°. B.p. 163–5°/12 mm.

Anschutz, *Ann.*, 1909, 367, 200.

**6-Chlorocoumarin.**

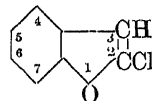
Needles from EtOH. M.p. 161–2°.

Clayton, *J. Chem. Soc.*, 1908, 93, 2022.

**7-Chlorocoumarin.**

Needles from EtOH. M.p. 129°.

Clayton, *J. Chem. Soc.*, 1908, 93, 2022.

**2-Chlorocoumarone**

C<sub>8</sub>H<sub>5</sub>OCl MW, 152.5  
B.p. 203°.

Stoermer, *Ann.*, 1900, 313, 85.

**3-Chlorocoumarone.**

B.p. 199–201°.

Stoermer, *Ann.*, 1900, 313, 85.

**5-Chlorocoumarone.**

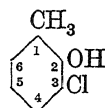
B.p. 215–17°. D<sub>16</sub><sup>16</sup> 1.262. n<sub>D</sub><sup>16</sup> 1.5778. Volatile in steam.

Stoermer, *Ann.*, 1900, 312, 325.

**7-Chlorocoumarone.**

B.p. 210–12°.

Stoermer, *Ann.*, 1900, 312, 325.

**3-Chloro-o-cresol**

C<sub>7</sub>H<sub>7</sub>OCl MW, 142.5

B.p. 185°, 188–9°/740 mm., 45–50°/4 mm.

Saccharin-Fabrik A.G., D.R.P. 256,345, (*Chem. Zentr.*, 1913, I, 866).

Huston, Neeley, *J. Am. Chem. Soc.*, 1935, 57, 2177.

**4-Chloro-o-cresol.**

Needles from pet. ether. M.p. 73–4°.

*Et ether*: C<sub>6</sub>H<sub>11</sub>OCl. MW, 170.5. B.p. 210–20°. D<sub>19</sub><sup>19</sup> 1.127.

*Benzoyl*: leaflets. M.p. 53–4°.

Auwers, *Fortschritte der Chemie, Physik und physikalische Chemie*, 1924, 18, 70.

Zinke, *Preiss, Ann.*, 1918, 417, 207.

**5-Chloro-o-cresol.**

Needles. M.p. 49°. B.p. 222–5°.

*Me ether*: C<sub>8</sub>H<sub>9</sub>OCl. MW, 156.5. B.p. 213–15°.

Datta, Mitter, *J. Am. Chem. Soc.*, 1919, 41, 2033.

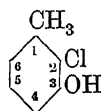
Sah, Anderson, *J. Am. Chem. Soc.*, 1941, 63, 3164.

**6-Chloro-o-cresol.**

Needles. M.p. 86°. B.p. 225°.

*Me ether*: b.p. 213–14°.

Zinke, *Ann.*, 1918, 417, 207.

**2-Chloro-m-cresol**

C<sub>7</sub>H<sub>7</sub>OCl MW, 142.5

Cryst. from pet. ether. M.p. 49–50° (55–6°). B.p. 198–9°, 53–7°/4 mm. Spar. sol. cold H<sub>2</sub>O.

*Me ether*: C<sub>8</sub>H<sub>9</sub>OCl. MW, 156.5. M.p. 24°. B.p. 218–19°.

*Benzoyl*: prisms from EtOH. M.p. 55–6°.

*Benzenesulphonyl*: plates from EtOH. M.p. 58°.

*p-Toluenesulphonyl*: prisms from EtOH. M.p. 96°.

Huston, Neeley, *J. Am. Chem. Soc.*, 1935, 57, 2178.

Huston, Chen, *J. Am. Chem. Soc.*, 1933, 55, 4214.

**4-Chloro-m-cresol.**

Prisms. M.p. 46°. B.p. 196°.

*Me ether*: b.p. 185°.

*Benzoyl*: cryst. from pet. ether, m.p. 40°. Plates + EtOH from EtOH, m.p. 31°.

*Benzenesulphonyl*: prisms from EtOH. M.p. 99°.

*p-Toluenesulphonyl*: plates from EtOH. M.p. 93-4°.

Huston, Neeley, *J. Am. Chem. Soc.*, 1935, 57, 2178.

Huston, Chen, *J. Am. Chem. Soc.*, 1933, 55, 4214.

### 6-Chloro-*m*-cresol.

Cryst. M.p. 55.5° (66°). B.p. 235°. Sol. EtOH, Et<sub>2</sub>O.

*Me ether*: C<sub>8</sub>H<sub>9</sub>OCl. MW, 156.5. B.p. 213-14°.

*Et ether*: C<sub>9</sub>H<sub>11</sub>OCl. MW, 170.5. B.p. 210-20°.

*Acetyl*: b.p. 241-3°. Sol. EtOH, Et<sub>2</sub>O, AcOH.

*Benzoyl*: plates from EtOH. M.p. 86°.

*Benzenesulphonyl*: plates from EtOH. M.p. 66°.

*p-Toluenesulphonyl*: plates from EtOH. M.p. 98°.

*α-Naphthylurethane*: m.p. 153-4°.

Huston, Neeley, *J. Am. Chem. Soc.*, 1935, 57, 2178.

Huston, Chen, *J. Am. Chem. Soc.*, 1933, 55, 4214.

Sulzberger, U.S.P. 1,498,641, (*Chem. Abstracts*, 1924, 18, 3194).

Sah, Anderson, *J. Am. Chem. Soc.*, 1941, 63, 3164.

### 2-Chloro-*p*-cresol



C<sub>7</sub>H<sub>7</sub>OCl MW, 142.5  
Needles. M.p. 55°. B.p. 228°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Mod. sol. H<sub>2</sub>O.

*Me ether*: C<sub>8</sub>H<sub>9</sub>OCl. MW, 156.5. B.p. 212°.

Ullmann, Wagner, *Ann.*, 1907, 355, 367.

### 3-Chloro-*p*-cresol.

B.p. 195-6°. D<sub>4</sub><sup>27</sup> 1.1785. n<sub>D</sub><sup>27</sup> 1.5200. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Mod. sol. hot H<sub>2</sub>O.

*Me ether*: b.p. 215-18°. Ox. → 3-chloroanisic acid.

*Et ether*: C<sub>9</sub>H<sub>11</sub>OCl. MW, 170.5. B.p. 234-8°.

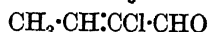
*Benzoyl*: plates from pet. ether. M.p. 71-2°.

Zincke, *Ann.*, 1903, 328, 277.

Cain, Norman, *J. Chem. Soc.*, 1906, 89, 24.

Sah, Anderson, *J. Am. Chem. Soc.*, 1941, 63, 3164.

### 1-Chlorocrotonaldehyde



C<sub>4</sub>H<sub>5</sub>OCl MW, 104.5  
B.p. 146-8°, 53-4°/20 mm. D<sub>4</sub><sup>23</sup> 1.1404, D<sub>4</sub><sup>15</sup> 1.1422. n<sub>D</sub><sup>23</sup> 1.478. Unstable in light. Lachrymatory.

*Di-Me acetal*: b.p. 58°/13 mm. D<sub>4</sub><sup>18</sup> 1.074. n<sub>D</sub><sup>18</sup> 1.4466.

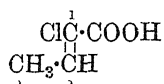
*Di-Et acetal*: b.p. 181-4°.

*Cyanhydrin*: b.p. 137-8°/26 mm. D<sub>4</sub><sup>21</sup> 1.1964. n<sub>D</sub><sup>21</sup> 1.4762.

Moureu, Murat, Tampier, *Bull. soc. chim.*, 1921, 29, 29.

I.G., D.R.P. 559,329 (*Chem. Zentr.*, 1933, I, 2608).

### 1-Chlorocrotonic Acid



C<sub>4</sub>H<sub>5</sub>O<sub>2</sub>Cl MW, 120.5

M.p. 99°. B.p. 212°, 85-95°/10 mm. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O. Sublimes. Part. volatile in steam. k = 7.2 × 10<sup>-4</sup> at 25°. NaHg → crotonic acid. HCl → 1:2-dichlorobutyric acid.

*Me ester*: C<sub>5</sub>H<sub>7</sub>O<sub>2</sub>Cl. MW, 134.5. B.p. 161°.

*Et ester*: C<sub>6</sub>H<sub>9</sub>O<sub>2</sub>Cl. MW, 148.5. B.p. 176°, 61°/10 mm. D<sub>4</sub><sup>20</sup> 1.1133. n<sub>D</sub><sup>20</sup> 1.453.

*Chloride*: C<sub>4</sub>H<sub>4</sub>OCl<sub>2</sub>. MW, 139. B.p. 142°.

*Amide*: C<sub>4</sub>H<sub>6</sub>ONCl. MW, 119.5. M.p. 112°. B.p. 235-40°. Sol. EtOH. Spar. sol. H<sub>2</sub>O.

*Nitrile*: C<sub>4</sub>H<sub>4</sub>NCl. MW, 101.5. B.p. 136°.

Wallach, *Ber.*, 1877, 10, 1530.

Auwers, *Ber.*, 1912, 45, 2806.

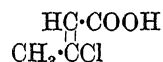
Roberts, *J. Chem. Soc.*, 1938, 779.

Pfeiffer, *Ber.*, 1910, 43, 3041.

Long, U.S.P. 2,376,067, (*Chem. Abstracts*, 1945, 39, 3550).

Staudinger, Tuerck, U.S.P. 2,398,867, (*Chem. Abstracts*, 1946, 40, 4392).

### 2-Chlorocrotonic Acid



C<sub>4</sub>H<sub>5</sub>O<sub>2</sub>Cl MW, 120.5

M.p. 94°. B.p. 206-11° part. decomp. Spar. sol. H<sub>2</sub>O. Spar. volatile in steam. k = 1.44 × 10<sup>-4</sup> at 25°. NaHg → crotonic acid. Long heat. at 130° → 2-chloroisocrotonic acid.

*Me ester*: b.p. 64-7°/14 mm. D<sub>4</sub><sup>22</sup> 1.1555. n<sub>D</sub><sup>20</sup> 1.463.

*Et ester*: b.p. 180°(184°), 66°/10 mm. D<sub>4</sub><sup>20</sup> 1.1062. n<sub>D</sub><sup>20</sup> 1.459.

*Chloride*: m.p. 94°. Heat → 2-chloroisocrotonic acid chloride.

*Amide*: m.p. 100-1°. Sol. EtOH, Et<sub>2</sub>O. Mod. sol. H<sub>2</sub>O.

*Anilide*: needles or prisms from EtOH. M.p. 123-4°.

*α-Naphthylamide*: prisms from EtOH. M.p. 169-70°.

Autenrieth, *Ann.*, 1890, 259, 358.

Auwers, *Ber.*, 1912, 45, 2807.

### 3-Chlorocrotonic Acid



C<sub>4</sub>H<sub>5</sub>O<sub>2</sub>Cl MW, 120.5

M.p. 83°. B.p. 117–18°/13 mm. Sol. Et<sub>2</sub>O, AcOH.

*Me ester*: b.p. 67.5–68.0°/11 mm. D<sub>18</sub><sup>18</sup> 1.169. n<sub>D</sub><sup>18</sup> 1.467.

*Et ester*: b.p. 191–3°/750 mm., 83°/13 mm. D 1.118. n<sub>D</sub><sup>14</sup> 1.463.

*Propyl ester*: b.p. 93–93.5°/10 mm. D<sup>18</sup> 1.090. n<sub>D</sub><sup>18</sup> 1.462.

*Chloride*: b.p. 74.0–4.5°/16 mm. D 1.316. n<sub>D</sub><sup>15</sup> 1.501.

*Amide*: cryst. from H<sub>2</sub>O. M.p. 130–2°.

*Nitrile*: b.p. 73°/15 mm. D° 1.1495.

Glattfield, Rietz, *J. Am. Chem. Soc.*, 1940, 62, 974.

Braun, *J. Am. Chem. Soc.*, 1930, 52, 3167.

Rambaud, *Bull. soc. chim.*, 1934, 1, 1340.

Lespieau, *Bull. soc. chim.*, 1905, 33, 466.

Broche, Rambaud, *Compt. rend.*, 1944, 218, 880.

### 2-Chlorocrotyl Alcohol (2-Chloro-1-hydroxy-2-butylene)



C<sub>4</sub>H<sub>7</sub>OCl MW, 106.5

B.p. 158°/742 mm. Mod. sol. H<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 1.118. n<sub>D</sub><sup>20</sup> 1.46823. HNO<sub>3</sub> → oxalic acid.

Garzarolli, Thurnlackh, *Ann.*, 1882, 213, 375.

Meerwein *et al.*, *J. prakt. Chem.*, 1936, 147, 225.

### 3-Chlorocrotyl Alcohol (3-Chloro-1-hydroxy-2-butylene)



C<sub>4</sub>H<sub>7</sub>OCl MW, 106.5

B.p. 161–2°, 92°/50 mm., 52–3°/19 mm. D<sub>4</sub><sup>23</sup> 1.095. n<sub>D</sub><sup>20</sup> 1.4652 (1.4678).

*Et ether*: C<sub>6</sub>H<sub>11</sub>OCl. MW, 134.5. B.p. 62–4°/40 mm. D<sub>20</sub><sup>20</sup> 0.7929. n<sub>D</sub><sup>20</sup> 1.4332.

*Acetyl*: b.p. 80.5–81.5°/25 mm. D<sub>4</sub><sup>20</sup> 1.1029. n<sub>D</sub><sup>20</sup> 1.4495.

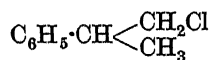
3:5-Dinitrobenzoyl: m.p. 72–3°.

Klebanskiĭ, Chevuichalova, *Chem. Abstracts*, 1936, 30, 1024.

Tishchenko, *Chem. Abstracts*, 1937, 31, 5754.

Petrov, *J. Gen. Chem. U.S.S.R.*, 1940, 10, 1418, (*Chem. Abstracts*, 1941, 35, 3593).

### $\beta$ -Chlorocumene ( $\omega$ -Chlorocumene, $\beta$ -chloro-isopropylbenzene, 2-phenylpropyl chloride)



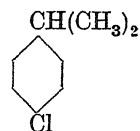
C<sub>9</sub>H<sub>11</sub>Cl MW, 154.5

B.p. 85°/13 mm. D<sup>18</sup> 1.047. n<sub>D</sub><sup>19</sup> 1.5245.

Truffault, *Compt. rend.*, 1936, 202, 1289.

Jülicher, B.P. 448,851, (*Chem. Abstracts*, 1936, 30, 7787).

### p-Chlorocumene



C<sub>9</sub>H<sub>11</sub>Cl MW, 154.5

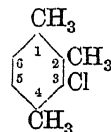
B.p. 190–5°, 81°/15 mm. D<sub>20</sub><sup>20</sup> 1.0257. n<sub>D</sub><sup>20</sup> 1.5120. Ox. → p-chlorobenzoic acid.

Meyer, Bernhauer, *Monatsh.*, 1929, 53–54, 741.

Ellingboe, Fuson, *J. Am. Chem. Soc.*, 1933, 55, 2965.

Varina, Srinivasan, *J. Indian Chem. Soc.*, 1936, 13, 189.

### 3-Chloro- $\psi$ -cumene (3-Chloro-1:2:4-trimethylbenzene)



C<sub>9</sub>H<sub>11</sub>Cl MW, 154.5

B.p. 213°, 127°/61 mm.

Töhl, *Ber.*, 1892, 25, 1529.

Smith, Moyle, *J. Am. Chem. Soc.*, 1936, 58, 8.

### 5-Chloro- $\psi$ -cumene (5-Chloro-1:2:4-trimethylbenzene).

Leaflets. M.p. 70°. B.p. 214–15°, 128–9°/20 mm.

Schultz, *Ber.*, 1909, 42, 3604.

Smith, Moyle, *J. Am. Chem. Soc.*, 1936, 58, 8.

### 6-Chloro- $\psi$ -cumene (6-Chloro-1:2:4-trimethylbenzene).

B.p. 210°, 127–8°/20 mm.

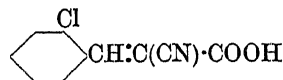
Huender, *Rec. trav. chim.*, 1915, 34, 22.

Smith, Moyle, *J. Am. Chem. Soc.*, 1936, 58, 8.

### $\omega$ -Chloro- $\psi$ -cumene.

See Dimethylbenzyl chloride.

### o-Chloro- $\alpha$ -cyanocinnamic Acid (2-Chloro-benzylidenecyanoacetic acid)



C<sub>10</sub>H<sub>6</sub>O<sub>2</sub>NCl MW, 207.5

M.p. 208°.

*Et ester*: C<sub>12</sub>H<sub>10</sub>O<sub>2</sub>NCl. MW, 235.5. M.p. 53°.

McRae, Hopkins, *Chem. Abstracts*, 1933, 27, 278.

Naps, Johns, *J. Am. Chem. Soc.*, 1940, 62, 2450.

Siddiqui, Salah-Ud-Din, *J. Indian Chem. Soc.*, 1941, 18, 635.

**p-Chloro- $\alpha$ -cyanocinnamic Acid** (4-Chlorobenzylidenecyanoacetic acid).

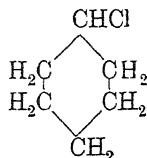
Cryst. M.p. 196°.

*Me ester*:  $C_{11}H_8O_2NCl$ . MW, 221.5. Needles. M.p. 121°.

*Et ester*: m.p. 93°.

Walther, Raetze, *J. prakt. Chem.*, 1902, 65, 285.

**Chlorocyclohexane** (*Cyclohexyl chloride, chlorohexahydrobenzene*)



$C_6H_{11}Cl$

MW, 118.5

B.p. 142°.  $D_4^{20}$  1.0161,  $D_4^{20}$  1.000.  $n_D^{20}$  1.46264. Alc. KOH  $\rightarrow$  cyclohexene.

Krause, Pohland, *Ber.*, 1924, 57, 534.

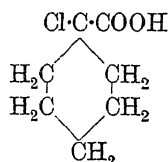
Perlman, Davidson, Bogert, *J. Org. Chem.*, 1936, 1, 298.

Chaleil, *Bull. soc. chim.*, 1934, 1, 742.

Kharasch, Brown, *J. Am. Chem. Soc.*, 1939, 61, 2142.

Zellner, U.S.P. 2,370,342, (*Chem. Abstracts*, 1945, 39, 3535).

### 1-Chlorocyclohexane-1-carboxylic Acid



$C_7H_{11}O_2Cl$

MW, 162.5

B.p. 138–40°/13 mm.

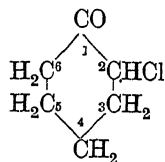
*Chloride*:  $C_7H_{10}OCl_2$ . MW, 181. B.p. 83–5°/13 mm.

*Amide*:  $C_7H_{12}ONCl$ . MW, 161.5. Cryst. from MeOH.Aq. M.p. 110°.

*Et-amide*:  $C_9H_{16}ONCl$ . MW, 189.5. M.p. 53°. B.p. 131–2°/13 mm.

Braun, Jostes, Münch, *Ann.*, 1927, 453, 128.

### 2-Chlorocyclohexanone



$C_6H_9OCl$

MW, 132.5

M.p. 22–3°. B.p. 90–1°/14–15 mm., 79°/7 mm.  $D_{16}^{20}$  1.161.  $n_D^{20}$  1.4825. Grignard reagents  $\rightarrow$

2-alkylcyclohexanones. Alc. KOH  $\rightarrow$  cyclopentane-carboxylic acid.

Kotz, Grethe, *J. prakt. Chem.*, 1909, 80, 487.

Meyer, *Helv. Chim. Acta*, 1933, 16, 1291.

Newman, Farbman, Hipsher, *Organic Syntheses*, 1945, XXV, 22.

### 3-Chlorocyclohexanone.

B.p. 91–2°/14 mm.

Kotz, Grethe, *J. prakt. Chem.*, 1909, 80, 503.

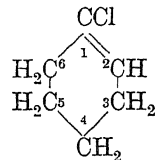
### 4-Chlorocyclohexanone.

B.p. 95°/17 mm.  $n_D^{20}$  1.4867.

*Semicarbazone*: m.p. 191°.

Sabetay, Palfray, *Bull. soc. chim.*, 1928, 43, 906.

### 1-Chlorocyclohexene



$C_6H_9Cl$

MW, 116.5

B.p. 142–3°, 54–6°/20 mm., 35°/13 mm.  $D_4^{19}$  1.0361,  $D_{18}^{18}$  1.0385.

Skita, Rutter, *Ber.*, 1911, 44, 674.

Bloomfield, *J. Chem. Soc.*, 1944, 114.

### 3-Chlorocyclohexene.

Hygroscopic oil with pleasant odour. B.p. 65–6°/40 mm.  $D_{20}^{20}$  1.030.  $n_D^{20}$  1.4860.

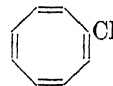
Hofmann, Damm, *Chem. Abstracts*, 1928, 22, 1249.

Ziegler *et al.*, *Ann.*, 1942, 551, 80.

Berlande, *Bull. soc. chim.*, 1942, 9, 644.

Mousseron, Winternitz, Combes, *Compt. rend.*, 1946, 223, 909.

### Chlorocyclo-octatetraene



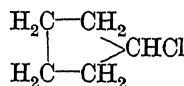
$C_8H_7Cl$

MW, 138.5

Yellow oil. B.p. 51–2°/5.5 mm.  $D_4^{24}$  1.1199.  $n_D^{25}$  1.5542. Heat  $\rightarrow$  *cis*- $\beta$ -chlorostyrene.

Cope, Burg, *J. Am. Chem. Soc.*, 1952, 74, 168.

### Chlorocyclopentane (*Cyclopentyl chloride*)



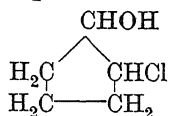
$C_5H_9Cl$

MW, 104.5

B.p. 114.5–115° corr.  $D_4^{20}$  1.0051.  $n_D^{20}$  1.4510.

Zelinsky, *Ber.*, 1908, 41, 2627.  
Turkiewicz, Pilat, *Ber.*, 1938, 71, 285.  
Bailey, McAllister, U.S.P. 2,342,072,  
(*Chem. Abstracts*, 1944, 38, 4621).

## 2-Chlorocyclopentanol



$C_5H_9OCl$

MW, 120.5

*Cis*-

B.p. 44°/15 mm.

*Trans*-

B.p. 81–2°/15 mm., (84°/15 mm.).  $D^{16}$  1.174.  
 $n_D^{16}$  1.4832.

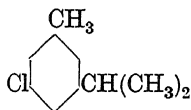
*Phenylurethane*: needles from pet. ether.  
M.p. 107–8°.

Rothstein, Rothstein, *Compt. rend.*, 1939,  
209, 761.

Godchot, Mousseron, Granger, *Compt. rend.*, 1935, 200, 748.

Meiser, *Ber.*, 1899, 32, 2052.

Mousseron *et al.*, *Bull. soc. chim.*, 1946,  
610.

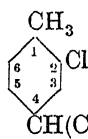
5-Chloro-*m*-cymene

$C_{10}H_{13}Cl$

MW, 168.5

B.p. 222–3°.

Gundlich, Knoevenagel, *Ber.*, 1896, 29,  
170.

2-Chloro-*p*-cymene (2-Chloro-1-methyl-4-isopropylbenzene)

$C_{10}H_{13}Cl$

MW, 168.5

B.p. 214–16°, 118°/35 mm., 104°/20 mm.  
 $D^{18}$  1.01.  $n_D^{20}$  1.50782.

Klages, Kraith, *Ber.*, 1899, 32, 2554.

Varma, Srinivasan, *J. Indian Chem. Soc.*,  
1936, 13, 189.

Inoue, Horiguchi, *Chem. Abstracts*, 1933,  
27, 2677.

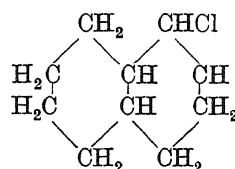
Le Fèvre, *J. Chem. Soc.*, 1933, 982.

3-Chloro-*p*-cymene.

B.p. 213–14°/736 mm., 113°/35 mm.  $D^{15}$   
1.018.  $n_D^{20}$  1.51796.

Jünger, Klages, *Ber.*, 1896, 29, 316.

Frisch, D.R.P. 615,470, (*Chem. Zentr.*,  
1936, I, 883).

1-Chlorodecahydronaphthalene (*Chlorodecalin*, *chloronaphthane*)

$C_{10}H_{17}Cl$

MW, 172.5

B.p. 114–16°/20 mm. Decomp. on heating at  
ord. press.  $KOH \rightarrow$  1-hydroxydecahydro-  
naphthalene (decahydro-1-naphthol).

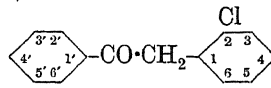
Ferrero, Fehlmann, *Helv. Chim. Acta*,  
1928, 11, 763.

## Chlorodecane.

See Decyl chloride.

 $\alpha$ -Chlorodeoxybenzoin.

See Desyl chloride.

2-Chlorodeoxybenzoin (*Phenyl o-chloro-benzyl ketone*)

$C_{14}H_{11}OCl$

MW, 230.5

M.p. 70.5°.

*Oxime*: prisms. M.p. 85–6°.

Jenkins, Richardson, *J. Am. Chem. Soc.*,  
1933, 55, 1618.

3-Chlorodeoxybenzoin (*Phenyl m-chloro-benzyl ketone*).

M.p. 43°.

*Oxime*: prisms. M.p. 101–2°.

Jenkins, *J. Am. Chem. Soc.*, 1933, 55,  
2896.

4-Chlorodeoxybenzoin (*Phenyl p-chloro-benzyl ketone*).

Plates from EtOH. M.p. 138°. Sol.  $CHCl_3$ ,

$C_6H_6$ , hot EtOH.

*Oxime*: prisms. M.p. 95–6°.

Jenkins, Richardson, *J. Am. Chem. Soc.*,  
1933, 55, 1618.

Petrenko-Kritschenko, *Ber.*, 1892, 25,  
2240.

2'-Chlorodeoxybenzoin (*o-Chlorophenyl benzyl ketone*).

Pale yellow oil. B.p. 176–8°/5 mm.

*Oxime*: prisms. M.p. 132°.

Jenkins, Richardson, *J. Am. Chem. Soc.*,  
1933, 55, 1618.

3'-Chlorodeoxybenzoin (*m-Chlorophenyl benzyl ketone*).

M.p. 62°.

*Oxime*: needles. M.p. 120°.

Jenkins, *J. Am. Chem. Soc.*, 1933, 55,  
2896.

**4'-Chlorodeoxybenzoin** (*p*-Chlorophenyl benzyl ketone).

M.p. 107.5°.

Oxime: needles. M.p. 123°.

Jenkins, Richardson, *J. Am. Chem. Soc.*, 1933, 55, 1618.

**Chlorodiacetamide** (*N*-Acetylchloroacetamide)



$\text{C}_4\text{H}_6\text{O}_2\text{NCl}$  MW, 135.5

M.p. 105-6° (195-6°). Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Me}_2\text{CO}$ . Mod. sol.  $\text{C}_6\text{H}_6$ . Spar. sol.  $\text{Et}_2\text{O}$ , ligroin.

König, *J. prakt. Chem.*, 1904, 69, 15.

Francis, *J. Chem. Soc.*, 1905, 87, 1839.

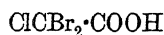
**Chlorodiaminotoluene.**

See Chlorotolylenediamine.

***p*-Chlorodibenzylamine.**

See under *p*-Chlorobenzylamine.

**Chlorodibromoacetic Acid**



$\text{C}_2\text{HO}_2\text{ClBr}_2$  MW, 252.5

M.p. 89°. B.p. 232-4° decomp.

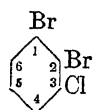
*Et ester*:  $\text{C}_4\text{H}_5\text{O}_2\text{ClBr}_2$ . MW, 280.5. B.p. 203°.

*Fluoride*:  $\text{C}_2\text{OFClBr}_2$ . MW, 254.5. B.p. 114°.

*Amide*:  $\text{C}_2\text{H}_2\text{ONClBr}_2$ . MW, 251.5. M.p. 127°. Sol.  $\text{H}_2\text{O}$ ,  $\text{Et}_2\text{O}$ . Mod. sol. EtOH. Spar. sol.  $\text{C}_6\text{H}_6$ .

Neumeister, *Ber.*, 1882, 15, 603.

**3-Chloro-1 : 2-dibromobenzene**



$\text{C}_6\text{H}_3\text{ClBr}_2$  MW, 270.5

Leaflets. M.p. 73.5°. B.p. 264°, 142°/23 mm. Sol.  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ .

Hurtley, *J. Chem. Soc.*, 1901, 79, 1293.

Körner, Contardi, *J. Chem. Soc.*, 1913, 104, i, 966.

**4-Chloro-1 : 2-dibromobenzene.**

Prisms from EtOH. M.p. 35.5°. B.p. 256°, 121°/19 mm. Sol.  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ .

Hurtley, *J. Chem. Soc.*, 1901, 79, 1293.

**2-Chloro-1 : 3-dibromobenzene.**

Plates. M.p. 71°. B.p. 265°. Sol.  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ .

Körner, Contardi, *J. Chem. Soc.*, 1913, 104, i, 965.

Hurtley, *J. Chem. Soc.*, 1901, 79, 1293.

**4-Chloro-1 : 3-dibromobenzene.**

Prisms. M.p. 27°. B.p. 258°, 139°/40 mm. Sol.  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ .

Hurtley, *J. Chem. Soc.*, 1901, 79, 1293.

**5-Chloro-1 : 3-dibromobenzene.**

Prisms from EtOH. M.p. 99° (96°). B.p. 256°. Sol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ .

Hantzsch, *Ber.*, 1897, 30, 2350.

Hurtley, *J. Chem. Soc.*, 1901, 79, 1293.

**2-Chloro-1 : 4-dibromobenzene.**

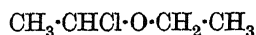
Prisms. M.p. 40-1°. B.p. 259°, 121°/24 mm. Sol.  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ .

Hurtley, *J. Chem. Soc.*, 1901, 79, 1293.

**Chloro-*N*-diethylaniline.**

See under *m*-Chloroaniline.

**1-Chlorodiethyl Ether** ( $\alpha$ -Chloroethyl ether, ethyl 1-chloroethyl ether)



$\text{C}_4\text{H}_9\text{OCl}$  MW, 108.5

B.p. 92-5°.  $D_4^{20}$  0.9655.  $n_D^{20}$  1.4053.  $\text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_5\text{OH}$ ,  $\text{CH}_3\text{CHO}$  and  $\text{HCl}$ . Boiling EtOH  $\rightarrow \text{CH}_3\text{CHO}$  and  $\text{C}_2\text{H}_5\text{Cl}$ .

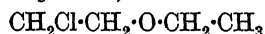
Henze, Murchison, *J. Am. Chem. Soc.*, 1931, 53, 4077.

Waterman, de Kok, Leendertse, Schoenmaker, *Rec. trav. chim.*, 1937, 56, 437.

I.G., D.R.P. 506,033, (*Chem. Zentr.*, 1931, II, 2756).

de Kok, Leendertse, Waterman, *Chem. Weekblad*, 1940, 37, 579, (*Chem. Abstracts*, 1942, 36, 4800).

**2-Chlorodiethyl Ether** ( $\beta$ -Chloroethyl ether, ethyl 2-chloroethyl ether)



$\text{C}_4\text{H}_9\text{OCl}$  MW, 108.5

B.p. 107-8° (108-110°).  $D_4^{20}$  0.98945.  $n_D^{20}$  1.41134.

Swallen, Boord, *J. Am. Chem. Soc.*, 1930, 52, 654.

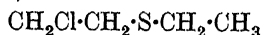
Ernst, D.R.P. 537,696, (*Chem. Zentr.*, 1932, I, 1153).

Dutta, *J. Indian Chem. Soc.*, 1940, 17, 649.

**3-Chloro-*unsym.*-diethyl-*p*-phenylenediamine.**

See 3-Chloro-*p*-aminodiethylaniline.

**2-Chlorodiethyl sulphide** (Ethyl 2-chloroethyl sulphide)

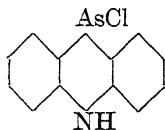


$\text{C}_4\text{H}_9\text{ClS}$  MW, 124.5

Liq. with penetrating odour. B.p. 157°, 63-5°/47 mm.  $D_4^{20}$  1.0663.

Demuth, Meyer, *Ann.*, 1887, 240, 310.

**10 - Chloro-5 : 10 - dihydrophenarsazine**  
(*D.M.*, Adamsite, "phenarsazine chloride," "diphenylamine chloroarsine," 10-chloro-5 : 10-dihydroarsacridine)

C<sub>12</sub>H<sub>9</sub>NClAs

MW, 277.5

Canary yellow cryst. by sublimation or by cryst. from xylene or CCl<sub>4</sub>. Dimorphic. (i) Stable, orthorhombic, m.p. 195°. (ii) Metastable, monoclinic, m.p. 186°; triclinic, m.p. 182°. Spar. sol. C<sub>6</sub>H<sub>6</sub>, xylene. Prac. insol. H<sub>2</sub>O. Heat of volatilisation 54.8 Cal. H<sub>2</sub>SO<sub>4</sub> → cherry-red col. AsCl<sub>3</sub> → green sol. H<sub>2</sub>O gives slowly phenarsazine oxide.

Employed as war gas. Produces intense nose, throat and lung irritation.

Burton, Gibson, *J. Chem. Soc.*, 1926, 450.

Fischer, *Mikrochemie*, 1932, 12, 257.

Lewis, Hamilton, *J. Am. Chem. Soc.*, 1921, 43, 2222.

Wieland, Rheinheimer, *Ann.*, 1921, 423, 12.

**ω-Chloro-dihydroxyacetophenone.**

See Dihydroxyphenacyl chloride.

**Chlorodihydroxyanthraquinone.**

See Chloroalizarin, Chloroanthrarufin, and Chloroquinizarin.

**Chlorodihydroxybenzaldehyde.**

See Chlororesorcylic Aldehyde.

**Chlorodihydroxybenzoic Acid.**

See Chlororesorcylic Acid.

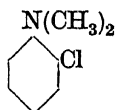
**Chlorodihydroxytoluene.**

See Chlorotoluhydroquinone.

**4 - Chloro - 1 - dimethylaminoanthraquinone.**

See under 4-Chloro-1-aminoanthraquinone.

**o-Chlorodimethylaniline**

C<sub>6</sub>H<sub>10</sub>NCl

MW, 155.5

B.p. 207–8° (205–6°). D<sub>4</sub><sup>20</sup> 1.1067. n<sub>D</sub><sup>20</sup> 1.55278.

*Methiodide* : m.p. 152°.

*Picrate* : m.p. 132°.

sym.-*Trinitrobenzene add. comp.* : m.p. 110–11°.

Ley, Pfeiffer, *Ber.*, 1921, 54, 378.

van Duin, *Rec. trav. chim.*, 1932, 51, 878.

**m-Chlorodimethylaniline.**

B.p. 234° (251–2°).

*Methiodide* : m.p. 187°.

*Picrate* : m.p. 145°.

Jaubert, *Bull. soc. chim.*, 1899, 21, 24.

Goldschmidt, Keller, *Ber.*, 1902, 35, 3542.

**p-Chlorodimethylaniline.**

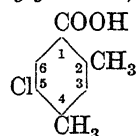
Needles. M.p. 35.5° (32–33.5°). B.p. 231° (233–6°).

sym.-*Trinitrobenzene add. comp.* : brown needles. M.p. 124°.

Heidberg, *Ber.*, 1887, 20, 150.

Ayling, Gorvin, Hinkel, *J. Chem. Soc.*, 1941, 613.

**5-Chloro-2 : 4-dimethylbenzoic Acid** (5-Chloro-unsym.-m-xyllylic acid)

C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Cl

MW, 184.5

Needles from EtOH. M.p. 165°.

Fisher, Grant, *J. Am. Chem. Soc.*, 1935, 57, 718.

Morgan, Hickinbottom, *J. Chem. Soc.*, 1921, 119, 1891.

**6-Chloro-2 : 4-dimethylbenzoic Acid** (6-Chloro-unsym.-m-xyllylic acid).

*Amide* : C<sub>9</sub>H<sub>10</sub>ONCl. MW, 183.5. Needles from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 167°.

*Nitrile* : C<sub>9</sub>H<sub>8</sub>NCl. MW, 165.5. Needles from pet. ether. M.p. 54°.

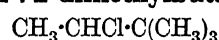
Auwers, *Ber.*, 1911, 44, 809.

**4-Chloro-3 : 5-dimethylbenzoic Acid** (4-Chloromesitylenic acid).

Prisms from EtOH. Decomp. at 220° without melting. Spar. sol. hot H<sub>2</sub>O. Spar. volatile in steam.

Fittig, Hoogewerff, *Ann.*, 1869, 150, 325.

**3-Chloro-2 : 2-dimethylbutane**

C<sub>6</sub>H<sub>13</sub>Cl

MW, 120.5

B.p. 113–14°.

Richard, *Ann. chim. phys.*, 1910, 21, 351.

**4-Chloro-2 : 2-dimethylbutane.**

C<sub>6</sub>H<sub>13</sub>Cl

MW, 120.5

B.p. 115°/760 mm., 41°/50 mm. D<sub>4</sub><sup>20</sup> 0.8670. n<sub>D</sub><sup>20</sup> 1.4160.

Schmerling, Ipatieff, U.S.P. 2,404,927, (*Chem. Abstracts*, 1946, 40, 6494).

Schmerling, U.S.P. 2,399,512, (*Chem. Abstracts*, 1946, 40, 4390).

Schmerling, *J. Am. Chem. Soc.*, 1945, 67, 1152.

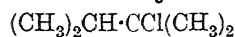
**1-Chloro-2 : 3-dimethylbutane**

C<sub>6</sub>H<sub>13</sub>Cl

MW, 120.5

B.p. 124°. D<sub>4</sub><sup>20</sup> 0.8874.

Aschan, *Ber.*, 1898, 31, 1802.

**2-Chloro-2 : 3-dimethylbutane**

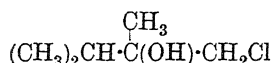
$\text{C}_6\text{H}_{13}\text{Cl}$  MW, 120.5

F.p. — 9 to — 10°. B.p. 110–12°.  $D_4^{20}$  0.897.

Aschan, *Ber.*, 1898, 31, 1802.

Henry, *Chem. Zentr.*, 1906, I, 997.

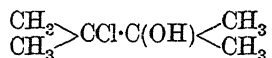
Schmerling, Ipatieff, U.S.P. 2,404,927,  
(*Chem. Abstracts*, 1946, 40, 6494).

**1-Chloro-2 : 3-dimethylbutanol-2 (1-Chloro-2-hydroxy-2 : 3-dimethylbutane)**

$\text{C}_6\text{H}_{13}\text{OCl}$  MW, 136.5

B.p. 162–4°.  $D_4^{20}$  1.049.

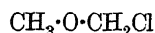
Chalmers, *Chem. Abstracts*, 1929, 23, 2694.

**3-Chloro-2 : 3-dimethylbutanol-2 (3-Chloro-2-hydroxy-2 : 3-dimethylbutane)**

$\text{C}_6\text{H}_{13}\text{OCl}$  MW, 136.5

Needles from  $\text{Et}_2\text{O}$ . M.p. 65° (55°). B.p. 152°. Heat, or with  $\text{H}_2\text{O}$ ,  $\longrightarrow$  pinacolin. Hot conc. KOH  $\longrightarrow$  pinacol.

Henry, *Chem. Zentr.*, 1907, II, 446.

**Chlorodimethyl Ether (Methyl chloromethyl ether)**

$\text{C}_2\text{H}_5\text{OCl}$  MW, 80.5

B.p. 59.5°.  $D_4^{20}$  1.063.  $n_D^{20}$  1.39737.  $\text{H}_2\text{O}$   $\longrightarrow$  formaldehyde.  $\text{NH}_3$   $\longrightarrow$  hexamethylene-tetramine. MeOH  $\longrightarrow$  methylal.

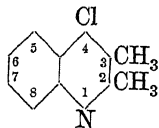
Marvel, Porter, *Organic Syntheses*, Collective Vol. I, 369.

**Chloro - unsym. - dimethylphenylenedi-amine.**

See Chloroaminodimethylaniline.

Chlorodimethylpyridine.

See Chlorolutidine.

**4-Chloro-2 : 3-dimethylquinoline**

$\text{C}_{11}\text{H}_{10}\text{NCl}$  MW, 191.5

Needles from EtOH.Aq. M.p. 78° decomp. Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ , ligroin. Insol.  $\text{H}_2\text{O}$ .

Wohnlich, *Arch. pharm.*, 1913, 251, 541.

**3-Chloro-2 : 4-dimethylquinoline.**

Needles from EtOH. M.p. 75°.

Picrate : needles from EtOH. M.p. 210°.

Plancher, Carrasco, *Atti accad. Lincei*, 1892, 14, i, 164.

**2-Chloro-3 : 4-dimethylquinoline.**

Cryst. from EtOH. M.p. 131°.

Knorr, *Ann.*, 1888, 245, 360.

**4-Chloro-3 : 5-dimethylquinoline.**

Cryst. from EtOH Aq. M.p. 59–60.5°. B.p. 145–52°/5 mm.

Breslow *et al.*, *J. Am. Chem. Soc.*, 1946, 68, 1232.

**4-Chloro-3 : 6-dimethylquinoline.**

Needles from EtOH.Aq. M.p. 58°.

Steck, Hallock, Holland, *J. Am. Chem. Soc.*, 1946, 68, 129.

**4-Chloro-3 : 8-dimethylquinoline.**

Needles from EtOH.Aq. M.p. 63°.

Steck, Hallock, Holland, *J. Am. Chem. Soc.*, 1946, 68, 132.

**2-Chloro-4 : 6-dimethylquinoline.**

M.p. 95–6°.

Kaslow, Sommer, *J. Am. Chem. Soc.*, 1946, 68, 644.

**2-Chloro-4 : 8-dimethylquinoline.**

M.p. 64.5–65.5°.

Kaslow, Sommer, *J. Am. Chem. Soc.*, 1946, 68, 644.

**4-Chloro-6 : 7-dimethylquinoline.**

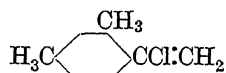
Cryst. from ligroin. M.p. 86–8°.

Price, Roberts, *J. Am. Chem. Soc.*, 1946, 68, 1204.

**2-Chloro-6 : 8-dimethylquinoline.**

Needles from EtOH. M.p. 56°.

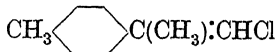
Späth, *Monatsh.*, 1919, 40, 113.

 **$\alpha$ -Chloro-2 : 4-dimethylstyrene**

$\text{C}_{10}\text{H}_{11}\text{Cl}$  MW, 166.5

B.p. 104–5°/19 mm.  $D_4^{15}$  1.044.  $n_D^{15}$  1.5446.

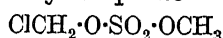
Grignard, Perrichon, *Ann. chim.*, 1926, 5, 5.

 **$\beta$ -Chloro- $\alpha$ p-dimethylstyrene (1-Chloro-2-p-tolyl- $\alpha$ -propylene)**

$\text{C}_{10}\text{H}_{11}\text{Cl}$  MW, 166.5

B.p. 107–8°/10 mm.  $D_4^{20}$  1.058.  $n_D^{20}$  1.55494.  $\text{KMnO}_4$   $\longrightarrow$  p-methylacetophenone.

Auwers, Hessenland, *Ann.*, 1907, 352, 287.

**Chlorodimethyl sulphate**

$\text{C}_2\text{H}_5\text{O}_4\text{ClS}$  MW, 160.5

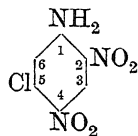
B.p. 95–8°/20 mm.  $D_4^{18}$  1.473.

Volmar, *Bull. soc. chim.*, 1920, 27, 681.

Houben, Arnold, *Ber.*, 1907, 40, 4308.



## 5-Chloro-2 : 4-dinitroaniline

 $C_6H_4O_4N_3Cl$ 

MW, 217.5

Orange-yellow needles from EtOH. M.p.  $178^\circ$  ( $174^\circ$ ).

N-Di-Me : see 5-Chloro-2 : 4-dinitrodimethylaniline.

de Monchy, *Rec. trav. chim.*, 1934, **53**, 141.Fries, Roth, *Ann.*, 1912, **389**, 341.Nietzki, Schedler, *Ber.*, 1897, **30**, 1666.

## 6-Chloro-2 : 4-dinitroaniline.

Yellow needles. M.p.  $157^\circ$ . Sol.  $C_6H_6$ ,  $Me_2CO$ . Spar. sol. EtOH. Insol. ligroin.

N-Di-Me : see 6-Chloro-2 : 4-dinitrodimethylaniline.

Ullmann, Sané, *Ber.*, 1911, **44**, 3734.I.G., D.R.P. 610,613, (*Chem. Zentr.*, 1934, I, 294).

## 3-Chloro-2 : 6-dinitroaniline.

M.p.  $112^\circ$ .de Monchy, *Rec. trav. chim.*, 1934, **53**, 141.

## 4-Chloro-2 : 6-dinitroaniline.

Orange-yellow needles from EtOH. M.p.  $146^\circ$ . Hot conc. KOH  $\rightarrow$  4-chloro-2 : 6-dinitrophenol.N-Acetyl : 4-chloro-2 : 6-dinitroacetanilide. M.p.  $215^\circ$ .

N-Di-Me : see 4-Chloro-2 : 6-dinitrodimethylaniline.

van Horssen, *Rec. trav. chim.*, 1936, **55**, 245.Ullmann, Sané, *Ber.*, 1911, **44**, 3732.Bamberger, Stingelin, *Ber.*, 1897, **30**, 1262.Elderfield, Geusler, Birstein, *J. Org. Chem.*, 1946, **11**, 812.

## 2-Chloro-3 : 5-dinitroaniline.

M.p.  $168^\circ$ .N-Acetyl : 2-chloro-3 : 5-dinitroacetanilide. M.p.  $153^\circ$ .Blanksma, Verberg, *Rec. trav. chim.*, 1934, **53**, 988.

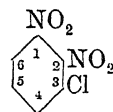
## 4-Chloro-3 : 5-dinitroaniline.

Yellow cryst. M.p.  $187-8^\circ$ .N-Acetyl : 4-chloro-3 : 5-dinitroacetanilide. M.p.  $228^\circ$  decomp.Lindemann, Wessel, *Ber.*, 1925, **58**, 1226.

## Chlorodinitroanisole.

See under Chlorodinitrophenol.

## 3-Chloro-1 : 2-dinitrobenzene (2 : 3-Dinitrochlorobenzene)

 $C_6H_3O_4N_2Cl$ 

MW, 202.5

Prisms from EtOH. M.p.  $78^\circ$ .van de Vliet, *Rec. trav. chim.*, 1924, **43**, 612.Holleman, ter Weel, *Rec. trav. chim.*, 1915, **35**, 46.Welsh, *J. Am. Chem. Soc.*, 1941, **63**, 3276.

## 4-Chloro-1 : 2-dinitrobenzene (3 : 4-Dinitrochlorobenzene).

Exists in three modifications.

 $\alpha$ -Form :Cryst. from EtOH. M.p.  $36^\circ$ . Sol.  $Et_2O$ , hot EtOH. Volatile in steam. NaOH  $\rightarrow$  5-chloro-2-nitrophenol. $\beta$ -Form :Prisms. M.p.  $37^\circ$ . $\gamma$ -Form :M.p.  $40-1^\circ$ .Holleman, ter Weel, *Rec. trav. chim.*, 1915, **35**, 48.Mangini, Deliddo, *Gazz. chim. ital.*, 1933, **63**, 612.Welsh, *J. Am. Chem. Soc.*, 1941, **63**, 3276.

## 2-Chloro-1 : 3-dinitrobenzene (2 : 6-Dinitrochlorobenzene).

Faintly green needles. M.p.  $88^\circ$  ( $86-7^\circ$ ). Dil. alkalis  $\rightarrow$  2 : 6-dinitrophenol.Kubota, *J. Chem. Soc. Japan*, 1932, **53**, 404.Borsche, Rantscheff, *Ann.*, 1911, **379**, 153.Welsh, *J. Am. Chem. Soc.*, 1941, **63**, 3276.Gunstone, Tucker, *J. appl. Chem.*, 1952, **2**, 204.

## 4-Chloro-1 : 3-dinitrobenzene (p-Chloro-m-dinitrobenzene, 2 : 4-dinitrochlorobenzene).

Exists in three forms, one stable and two labile.

Stable form :

Yellow rhombic cryst. from  $Et_2O$ . M.p.  $51^\circ$ . B.p.  $315^\circ$  slight decomp. Sol.  $Et_2O$ ,  $C_6H_6$ ,  $CS_2$ , hot EtOH. Insol.  $H_2O$ .  $D^{25} 1.697$ . $\beta$ -Labile form :Yellow rhombic cryst. from  $Et_2O$ . M.p.  $43^\circ$ . B.p.  $315^\circ$ . More sol. in org. solvents than the stable form.  $D^{16} 1.6867$ . $\gamma$ -Labile form :M.p.  $27^\circ$ . Dil. alkalis  $\rightarrow$  2 : 4-dinitrophenol.  $NH_3 \rightarrow$  2 : 4-dinitroaniline. KOH in MeOH  $\rightarrow$  2 : 4-dinitroanisole. Excess  $SnCl_2 \rightarrow$  4-chloro-m-phenylenediamine.Hoffman, Dame, *J. Am. Chem. Soc.*, 1919, **41**, 1015.Welsh, *J. Am. Chem. Soc.*, 1941, **63**, 3276.

**5-Chloro-1 : 3-dinitrobenzene** (3 : 5-Dinitrochlorobenzene).

Colourless needles. M.p. 55° (59°). Sol. EtOH, Et<sub>2</sub>O. Volatile in steam.

Holleman, ter Weel, *Rec. trav. chim.*, 1915, 35, 48.

Bader, *Ber.*, 1891, 24, 1655.

Welsh, *J. Am. Chem. Soc.*, 1941, 63, 3276.

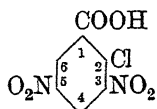
**2-Chloro-1 : 4'-dinitrobenzene** (2 : 5-Dinitrochlorobenzene).

Pale yellow cryst. from ligroin. M.p. 64° (59.5-60.0°).

Holleman, ter Weel, *Rec. trav. chim.*, 1915, 35, 48.

Welsh, *J. Am. Chem. Soc.*, 1941, 63, 3276.

**2-Chloro-3 : 5-dinitrobenzoic Acid**



C<sub>7</sub>H<sub>3</sub>O<sub>6</sub>N<sub>2</sub>Cl MW, 246.5

Needles. M.p. 199°. B.p. 240°. Decomp. at 253°. Spar. sol. cold H<sub>2</sub>O. SnCl<sub>2</sub> + HCl → 2-chloro-3 : 5-diaminobenzoic acid. NaOH or Ba(OH)<sub>2</sub>Aq. → 3 : 5-dinitrosalicic acid. NH<sub>3</sub> → 3 : 5-dinitroanthranilic acid.

*Me ester* : C<sub>8</sub>H<sub>5</sub>O<sub>6</sub>N<sub>2</sub>Cl. MW, 260.5. Needles. M.p. 87°. Sol. MeOH. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Et ester* : C<sub>9</sub>H<sub>7</sub>O<sub>6</sub>N<sub>2</sub>Cl. MW, 274.5. Plates. M.p. 54°. Sol. EtOH, Et<sub>2</sub>O, ligroin.

*Nitrile* : C<sub>7</sub>H<sub>2</sub>O<sub>4</sub>N<sub>3</sub>Cl. MW, 227.5. Yellow cryst. M.p. 139°.

Ullmann, *Ann.*, 1909, 366, 82.

**4-Chloro-3 : 5-dinitrobenzoic Acid.**

M.p. 159°. Sol. Et<sub>2</sub>O, MeOH, Me<sub>2</sub>CO, AcOH. Mod. sol. EtOH, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>, CS<sub>2</sub>. Insol. ligroin.

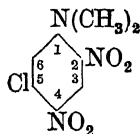
*Me ester* : C<sub>8</sub>H<sub>5</sub>O<sub>6</sub>N<sub>2</sub>Cl. MW, 260.5. Yellow needles. M.p. 105°. Sol. C<sub>6</sub>H<sub>6</sub>, AcOH.

*Et ester* : C<sub>9</sub>H<sub>7</sub>O<sub>6</sub>N<sub>2</sub>Cl. MW, 274.5. M.p. 83°.

Berkenheim, Lur'e, *Chem. Abstracts*, 1937, 31, 1780.

Ullmann, *Ann.*, 1909, 366, 82.

**5-Chloro-2 : 4-dinitrodimethylaniline**



C<sub>8</sub>H<sub>8</sub>O<sub>4</sub>N<sub>3</sub>Cl MW, 245.5

Yellow needles from EtOH. M.p. 129°.

Borsche, *Ber.*, 1917, 50, 1353.

**6-Chloro-2 : 4-dinitrodimethylaniline.**

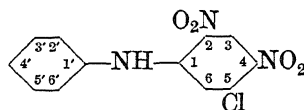
M.p. 90-1°.

van Duin, *Rec. trav. chim.*, 1932, 51, 878.

**4-Chloro-2 : 6-dinitrodimethylaniline.**  
Yellowish-red prisms from EtOH. M.p. 111-12°. Spar. sol. ligroin.

Pinnow, *Ber.*, 1898, 31, 2986.

**5-Chloro-2 : 4-dinitrodiphenylamine**



C<sub>12</sub>H<sub>8</sub>O<sub>4</sub>N<sub>3</sub>Cl MW, 279.5

Orange-red needles. M.p. 120°.

Nietzki, Schneider, *Ber.*, 1897, 30, 1667.

**2'-Chloro-2 : 4-dinitrodiphenylamine.**

Yellow needles from Me<sub>2</sub>CO-EtOH. M.p. 150°.

Reverdin, Crépieux, *Bull. soc. chim.*, 1903, 29, 238.

van der Kam, *Rec. trav. chim.*, 1926, 45, 722.

**3'-Chloro-2 : 4-dinitrodiphenylamine.**

Yellowish-red needles from Me<sub>2</sub>CO.Aq. M.p. 184°.

Reverdin, Crépieux, *Bull. soc. chim.*, 1903, 29, 238.

van der Kam, *Rec. trav. chim.*, 1926, 45, 722.

**4'-Chloro-2 : 4-dinitrodiphenylamine.**

Orange-red needles. M.p. 167°.

Reverdin, Crépieux, *Bull. soc. chim.*, 1903, 29, 238.

van der Kam, *Rec. trav. chim.*, 1926, 45, 722.

**4-Chloro-2 : 6-dinitrodiphenylamine.**

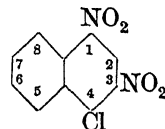
Orange-yellow needles from EtOH. M.p. 130°.

Ullmann, Sané, *Ber.*, 1911, 44, 3733.

**Chlorodinitrodiphenyl Ether.**

See under Chlorodinitrophenol.

**4-Chloro-1 : 3-dinitronaphthalene**



C<sub>10</sub>H<sub>5</sub>O<sub>4</sub>N<sub>2</sub>Cl MW, 252.5

Yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 146.5°. Sol. AcOH, hot Me<sub>2</sub>CO. Spar. sol. EtOH, Et<sub>2</sub>O, warm ligroin. Warm dil. alkalis → 2 : 4-dinitro-1-naphthol.

Talen, *Rec. trav. chim.*, 1928, 47, 346.

**4-Chloro-1 : 5-dinitronaphthalene.**

Yellow plates from C<sub>6</sub>H<sub>6</sub>. M.p. 138°. Sol. EtOH, AcOH, C<sub>6</sub>H<sub>6</sub>. Very spar. sol. ligroin.

Sn + HCl  $\longrightarrow$  1 : 5-diaminonaphthalene.  $\text{PCl}_5$   
 $\longrightarrow$  1 : 4 : 5-trichloronaphthalene.

Ullmann, Consonno, *Ber.*, 1902, **35**, 2810.  
 Atterberg, *Ber.*, 1876, **9**, 927.  
 Faust, Saame, *Ann.*, 1871, **160**, 68.

### 2-Chloro-1 : 8-dinitronaphthalene.

Pale yellow cryst. from AcOH. M.p. 175°. Alc.  
 $\text{NH}_3$  at 130°  $\longrightarrow$  1 : 8-dinitro-2-naphthylamine.

Scheid, *Ber.*, 1901, **34**, 1817.  
 Wahl, Basilius, *Compt. rend.*, 1947, **224**,  
 1569.

### 3-Chloro-1 : 8-dinitronaphthalene.

Pale yellow. M.p. 163°.  
 Hodgson, Ward, *J. Chem. Soc.*, 1945, 794.

### 4-Chloro-1 : 8-dinitronaphthalene.

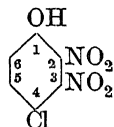
Pale yellow needles from AcOH. M.p. 180°  
 (173°). Spar. sol. boiling EtOH.  $\text{PCl}_5$   $\longrightarrow$   
 1 : 4 : 5-trichloronaphthalene.

Atterberg, *Ber.*, 1876, **9**, 928.  
 Ekstrand, *J. prakt. Chem.*, 1888, **38**, 171.  
 Hodgson, Hathway, *J. Chem. Soc.*, 1945,  
 543.

### Chlorodinitrophenetole.

See under Chlorodinitrophenol.

### 4-Chloro-2 : 3-dinitrophenol



$\text{C}_6\text{H}_3\text{O}_5\text{N}_2\text{Cl}$  MW, 218.5

Prisms. M.p. 127°. Sol. EtOH,  $\text{Et}_2\text{O}$ ,  
 $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ . Spar. volatile in steam.

Meldola, Hay, *J. Chem. Soc.*, 1907, **91**,  
 1483.

### 3-Chloro-2 : 4-dinitrophenol.

Cryst. from  $\text{H}_2\text{O}$ . M.p. 138-40°. Sol.  $\text{Et}_2\text{O}$ .  
 Volatile in steam.

Hodgson, Moore, *J. Chem. Soc.*, 1925,  
 127, 1602.

### 5-Chloro-2 : 4-dinitrophenol.

M.p. 92°. Needles from EtOH or pet. ether.  
 Sol.  $\text{Et}_2\text{O}$ . Spar. sol.  $\text{H}_2\text{O}$ . Volatile in steam.

*Acetyl* : prisms from MeOH. M.p. 69°.  
*Me ether* : 5-chloro-2 : 4-dinitroanisole.  
 $\text{C}_7\text{H}_5\text{O}_5\text{N}_2\text{Cl}$ . MW, 232.5. Plates from EtOH.  
 M.p. 105°.

*Et ether* : 5-chloro-2 : 4-dinitrophenetole.  
 $\text{C}_8\text{H}_7\text{O}_5\text{N}_2\text{Cl}$ . MW, 246.5. M.p. 112°.

*Phenyl ether* : 5-chloro-2 : 4-dinitrodiphenyl  
 ether.  $\text{C}_{12}\text{H}_7\text{O}_5\text{N}_2\text{Cl}$ . MW, 294.5. Needles  
 from EtOH. M.p. 110°.

Borsche, *Ber.*, 1917, **50**, 1350.  
 Hodgson, Moore, *J. Chem. Soc.*, 1925,  
 127, 1601.

Blanksma, *Rec. trav. chim.*, 1904, **23**, 123.

Dict. of Org. Comp.—I.

### 6-Chloro-2 : 4-dinitrophenol.

Plates. M.p. 113° (110°). Very sol.  $\text{C}_6\text{H}_6$ ,  
 warm conc. min. acids. Mod. sol. EtOH,  
 $\text{Et}_2\text{O}$ . Very spar. sol. hot  $\text{H}_2\text{O}$ .

Armstrong, *J. Chem. Soc.*, 1872, **25**, 12.  
 Brazier, McCombie, *J. Chem. Soc.*, 1912,  
 101, 973.

### 4-Chloro-2 : 5-dinitrophenol.

Cryst. from pet. ether. M.p. 118-19°.  
 Hollander, *Chem. Abstracts*, 1919, **13**,  
 3154.

### 3-Chloro-2 : 6-dinitrophenol.

Cryst. from dil. HCl. M.p. 114-15°. Volatile  
 in steam.

Hodgson, Moore, *J. Chem. Soc.*, 1925,  
 127, 1602.

### 4-Chloro-2 : 6-dinitrophenol.

Pale yellow cryst. M.p. 81°. Sol. EtOH,  
 $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ . Sublimes.  $D^{22}$  1.74.

*Acetyl* : m.p. 110-11°.  
*Me ether* : 4-chloro-2 : 6-dinitroanisole. Plates.  
 M.p. 65.4°.

*Et ether* : 4-chloro-2 : 6-dinitrophenetole.  
 Needles from EtOH. M.p. 54-5°.

Petersen, Baehr-Predari, *Ann.*, 1871, **157**,  
 156.

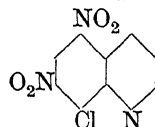
Holleman, *Rec. trav. chim.*, 1915, **34**, 220.

### 2-Chloro-3 : 5-dinitrophenol.

*Me ether* : 2-chloro-3 : 5-dinitroanisole.  
 $\text{C}_7\text{H}_5\text{O}_5\text{N}_2\text{Cl}$ . MW, 232.5. Cryst. from EtOH.  
 M.p. 93-4°.

Borsche, *Ber.*, 1917, **50**, 1347.

### 8-Chloro-5 : 7-dinitroquinoline



$\text{C}_9\text{H}_4\text{O}_4\text{N}_3\text{Cl}$  MW, 239.5

Needles from EtOH. M.p. 154°.

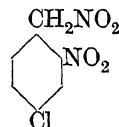
Dikshoorn, *Rec. trav. chim.*, 1929, **48**, 557.

### 5-Chloro-6 : 8-dinitroquinoline.

Yellow needles from EtOH or ligroin. M.p.  
 145.5°.

Bennett, Grove, *J. Chem. Soc.*, 1945, 378.

### 4-Chloro- $\alpha$ : 2-dinitrotoluene (4-Chloro-2-nitrophenyl-nitromethane)



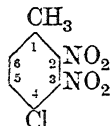
$\text{C}_7\text{H}_5\text{O}_4\text{N}_2\text{Cl}$  MW, 216.5

M.p. 112°.

Gilliard, Monnet, Cartier, D.R.P. 239,953,  
 (*Chem. Zentr.*, 1911, II, 1564).

**6-Chloro- $\alpha$  : 2-dinitrotoluene** (*6-Chloro-2-nitrophenyl-nitromethane*).

M.p. 82°.

Gilliard, Monnet, Cartier, D.R.P. 239,953, (*Chem. Zentr.*, 1911, II, 1564).**4-Chloro-2 : 3-dinitrotoluene** $C_7H_5O_4N_2Cl$ 

MW, 216.5

Yellow prisms from  $C_6H_6$ -pet. ether. M.p. 106-7°. Alc.  $NH_3 \rightarrow$  4-chloro-2-nitro-*m*-toluidine.Kenner, Tod, Witham, *J. Chem. Soc.*, 1925, 127, 2348.**6-Chloro-2 : 3-dinitrotoluene.**Needles or prisms from MeOH or EtOH. M.p. 106-7°. Alc.  $NH_3 \rightarrow$  6-chloro-3-nitro-*o*-toluidine.Morgan, Drew, *J. Chem. Soc.*, 1920, 117, 787.**3-Chloro-2 : 4-dinitrotoluene.**

Pale yellow needles from EtOH. M.p. 92°.

Brady, Bowman, *J. Chem. Soc.*, 1921, 119, 897.**5-Chloro-2 : 4-dinitrotoluene.**Yellow needles from EtOH. M.p. 91°. Volatile in steam.  $Zn + HCl \rightarrow$  5-chloro-*m*-tolylenediamine.Reverdin, Crépieux, *Ber.*, 1900, 33, 2506.Qvist, Moilomen, *Chem. Abstracts*, 1944, 38, 5491.**6-Chloro-2 : 4-dinitrotoluene.**

Prisms. M.p. 49°. Sol. EtOH.

Morgan, Drew, *J. Chem. Soc.*, 1920, 117, 786.**4-Chloro-2 : 5-dinitrotoluene.**

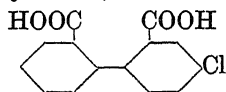
Needles from EtOH or ligroin. M.p. 107°.

Kehrmann, *Ber.*, 1915, 48, 2029.**6-Chloro-2 : 5-dinitrotoluene.**

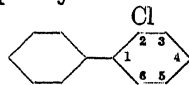
Needles from pet. ether. M.p. 62-3°.

Morgan, Glover, *J. Chem. Soc.*, 1924, 125, 1599.**3-Chloro-2 : 6-dinitrotoluene.**Yellow needles from EtOH. M.p. 77°. Sol.  $C_6H_6$ .Lindemann, Pabst, *Ann.*, 1928, 462, 43.Körner, Contardi, *J. Chem. Soc.*, 1917, 112, i, 85.**4-Chloro-2 : 6-dinitrotoluene.**Yellow needles from  $Et_2O$ . M.p. 76°.Cohen, McCandlish, *J. Chem. Soc.*, 1905, 87, 1265.**2-Chloro-3 : 4-dinitrotoluene.**Needles from AcOH.Aq. M.p. 89°. Sol.  $C_6H_6$ ,  $CHCl_3$ , AcOH. Mod. sol. pet. ether. Alc.  $NH_3 \rightarrow$  2-chloro-4-nitro-*m*-toluidine.Morgan, Glover, *J. Chem. Soc.*, 1921, 119, 1703.**6-Chloro-3 : 4-dinitrotoluene.**Needles from AcOH.Aq. M.p. 88-9°. Alc.  $NH_3 \rightarrow$  6-chloro-4-nitro-*m*-toluidine.Morgan, Drew, *J. Chem. Soc.*, 1920, 117, 786.**2-Chloro-3 : 5-dinitrotoluene.**Yellow needles from  $CCl_4$ . M.p. 64°. Sol. EtOH,  $Et_2O$ .  $SnCl_2 \rightarrow$  2-chloro-3 : 5-tolylenediamine. Alc. KOH  $\rightarrow$  3 : 5-dinitro-*o*-cresol. Alc.  $NH_3 \rightarrow$  3 : 5-dinitro-*o*-toluidine.Morgan, Drew, *J. Chem. Soc.*, 1920, 117, 784.Körner, Contardi, *J. Chem. Soc.*, 1915, 108, i, 790.Yohe, *Chem. Abstracts*, 1941, 35, 2485.**4-Chloro-3 : 5-dinitrotoluene.**Yellow needles or prisms from EtOH. M.p. 114-15°. Alc.  $NH_3 \rightarrow$  3:5-dinitro-*p*-toluidine.Körner, Contardi, *J. Chem. Soc.*, 1915, 108, i, 875.Borsche, Fiedler, *Ber.*, 1913, 46, 2120. **$\alpha$ -Chlorodinitrotoluene.**

See Dinitrobenzyl chloride.

**4-Chlorodiphenic Acid** (*4-Chlorodiphenyl-2 : 2'-dicarboxylic acid*) $C_{14}H_9O_4Cl$ 

MW, 276.5

Needles from EtOH.Aq. M.p. 240° (237°). Sol. MeOH, EtOH,  $Et_2O$ , AcOH,  $CS_2$ . Spar. sol.  $H_2O$ .Schmidt, Sauer, *Ber.*, 1911, 44, 3251.**2-Chlorodiphenyl** $C_{12}H_9Cl$ 

MW, 188.5

M.p. 32° (34°). B.p. 273-4°, 154°/12.5 mm. Sol. ligroin, EtOH,  $CCl_4$ .  $D^{20}_4$  1.1499.Jenkins, McCollough, Booth, *Ind. Eng. Chem.*, 1930, 22, 31.Elks, Haworth, Hey, *J. Chem. Soc.*, 1940, 1284.Zaheer, Faseeh, *J. Indian Chem. Soc.*, 1944, 21, 27.**3-Chlorodiphenyl.**

B.p. 284-5°, 150-60°/6 mm.

Gomberg, Bachmann, *J. Am. Chem. Soc.*, 1924, 46, 2343.Elks, Haworth, Hey, *J. Chem. Soc.*, 1940, 1284.

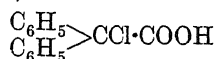
**4-Chlorodiphenyl.**

Cryst. from ligroin or EtOH. M.p. 77°. B.p. 291°, 180–195°/20–30 mm.

Jenkins, McCollough, Booth, *Ind. Eng. Chem.*, 1930, 22, 31.

Elks, Haworth, Hey, *J. Chem. Soc.*, 1940, 1284.

**α-Chlorodiphenylacetic Acid** (*Diphenylchloroacetic acid*)



$\text{C}_{14}\text{H}_{11}\text{O}_2\text{Cl}$  MW, 246.5

Plates from  $\text{C}_6\text{H}_6$ -ligroin. M.p. 118–19° decomp. Sol. most ord. org. solvents.

*Et ester*:  $\text{C}_{16}\text{H}_{15}\text{O}_2\text{Cl}$ . MW, 274.5. Plates. M.p. 43–4°. Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ .

*Chloride*:  $\text{C}_{14}\text{H}_{10}\text{OCl}_2$ . MW, 265. Cryst. from ligroin. M.p. 50°. B.p. 180°/14 mm., 139–143°/0.15 mm. Begins to decomp. above 200°.

*Amide*:  $\text{C}_{14}\text{H}_{12}\text{ONCl}$ . MW, 245.5. M.p. 115°. Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ .

*Anhydride*:  $\text{C}_{28}\text{H}_{20}\text{O}_3\text{Cl}_2$ . MW, 475. M.p. 129°.

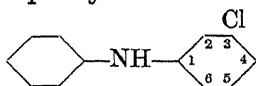
*Anilide*: prisms. M.p. 88°.

Klinger, *Ann.*, 1912, 389, 255.

Bistrzycki, Herbst, *Ber.*, 1903, 36, 145.

Stollé, *Ber.*, 1910, 43, 2471.

Setlur, Nadkarny, *Proc. Indian Acad. Sci.*, 1940, 12A, 266, (*Chem. Abstracts*, 1941, 35, 1398).

**3-Chlorodiphenylamine**

$\text{C}_{12}\text{H}_{10}\text{NCl}$  MW, 203.5

B.p. 335–6°/724 mm. Sol. EtOH,  $\text{C}_6\text{H}_6$ , AcOH,  $\text{Et}_2\text{O}$ .

Ullmann, *Ann.*, 1907, 355, 338.

**4-Chlorodiphenylamine.**

Cryst. from MeOH. M.p. 74°. B.p. 334–5°/726 mm. Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ , ligroin.

*N-Nitroso*: m.p. 88°. Sol. EtOH,  $\text{Et}_2\text{O}$ .

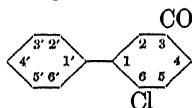
Ullmann, *Ann.*, 1907, 355, 338.

**4-Chlorodiphenylamine-2-carboxylic Acid.**

See under 5-Chloroanthranilic Acid.

**Chlorodiphenylarsine.**

See Diphenylchloroarsine.

**6-Chlorodiphenyl-3-carboxylic Acid**

$\text{C}_{13}\text{H}_9\text{O}_2\text{Cl}$  MW, 232.5

M.p. 208–9°.

*Benzyl ester*: plates from EtOH. M.p. 90°.

Cook, Cook, *J. Am. Chem. Soc.*, 1933, 55, 1212.

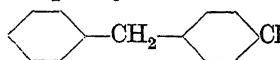
**4'-Chlorodiphenyl-4-carboxylic Acid.**

M.p. 290–3°.

I.G., F.P. 735,846 (*Chem. Abstracts*, 1933, 27, 1001).

**α-Chlorodiphenylmethane.**

See Diphenylmethyl chloride.

**4-Chlorodiphenylmethane**

$\text{C}_{13}\text{H}_{11}\text{Cl}$  MW, 202.5

B.p. 298°/742.5 mm.

Meyer, *J. prakt. Chem.*, 1910, 82, 539.

Montagne, *Rec. trav. chim.*, 1907, 26, 267.

**1-Chlorododecane.**

See Dodecyl chloride.

**Chloroethane.**

See Ethyl chloride.

**1-Chloroethane-1-sulphonic Acid**

$\text{C}_2\text{H}_5\text{O}_3\text{ClS}$  MW, 144.5

Viscous greyish-brown liq.

*K salt*: m.p. 325° decomp.

*Me ester*:  $\text{C}_3\text{H}_7\text{O}_3\text{ClS}$ . MW, 158.5. B.p. 91–3°/13 mm.

*Fluoride*:  $\text{C}_2\text{H}_4\text{O}_2\text{FCIS}$ . MW, 146.5. B.p. 138–9°.  $n_D^{20}$  1.4070.

*Chloride*:  $\text{C}_2\text{H}_4\text{O}_2\text{Cl}_2\text{S}$ . MW, 163. B.p. 72–3°/13 mm., 48–53°/3 mm.

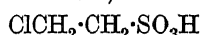
*Amide*:  $\text{C}_2\text{H}_6\text{O}_2\text{NCIS}$ . MW, 143.5. M.p. 66°. Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ .

Müller, Raudenbusch, *Ber.*, 1931, 64, 94.

Müller, Schiller, *J. prakt. Chem.*, 1927, 116, 175.

Davies, Dick, *J. Chem. Soc.*, 1932, 485.

Shriner, Land, *J. Org. Chem.*, 1941, 6, 888.

**2-Chloroethane-1-sulphonic Acid** (*β-Chloroethylsulphonic acid*)

$\text{C}_2\text{H}_5\text{O}_3\text{ClS}$  MW, 144.5

Cryst.  $\text{NH}_3$  at 100° → taurine. Metallic salts are readily sol.  $\text{H}_2\text{O}$ .

*NH<sub>4</sub> salt*: needles or plates. M.p. 192°.

*S-Benzylthiouronium salt*: m.p. 129–30°.

*Chloride*: b.p. 200–3°, 125–7°/30 mm.

Kolbe, *Ann.*, 1862, 122, 38.

I.G., B.P. 360,558; U.S.P. 1,888,794, (*Chem. Zentr.*, 1931, II, 1488).

Dow, U.S.P. 2,067,873, (*Chem. Zentr.*, 1937, I, 3060).

du Pont, B.P. 444,639, (*Chem. Zentr.*, 1936, II, 400).

Josephson, *Biochem. Z.*, 1933, 265, 448.

**Chloroethoxyacetanilide.**

See under Chlorophenetidine.

**1-Chloroethyl Alcohol**

$\text{C}_2\text{H}_5\text{OCl}$  MW, 80.5

Unstable liq. B.p. 25–30°/10 mm. Changes to 1:1'-dichlorodiethyl ether on standing. Decomp. by H<sub>2</sub>O.

*Acetyl*: b.p. 119–21°/740 mm.

*Me ether*: see Methyl 1-chloroethyl Ether.

*Et ether*: see 1-Chlorodiethyl Ether.

*Propyl ether*: C<sub>5</sub>H<sub>11</sub>OCl. MW, 122.5. B.p. 112–15°/731 mm.

*Isobutyl ether*: C<sub>6</sub>H<sub>13</sub>OCl. MW, 136.5. B.p. 132–8°/731 mm.

*Isoamyl ether*: C<sub>7</sub>H<sub>15</sub>OCl. MW, 150.5. B.p. 162–5°/721 mm.

Hanriot, *Ann. chim.*, 1882, 25, 220.

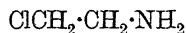
Gebauer-Fuelnegg, Moffett, *J. Am. Chem. Soc.*, 1934, 56, 2009.

Gautier, *Ann. chim. phys.*, 1909, 16, 312.

### 2-Chloroethyl Alcohol.

See Ethylene chlorohydrin.

### 2-Chloroethylamine (2-Chloro-1-amino-ethane)



C<sub>2</sub>H<sub>6</sub>NCl MW, 79.5

Oil.

*B, HCl*: m.p. 144° (147.5–148.0°). Hygroscopic.

*Picrate*: m.p. 100°, anhyd. 142–3°.

*N-2-Chloroethyl*: 2:2'-dichlorodiethylamine. *B, HCl*: m.p. 216°. *Picrate*: m.p. 112–13°.

*N-Di-2-chloroethyl*: 2:2':2''-trichlorotriethylamine. Pale yellow oil. Powerful vesicant. *B, HCl*: m.p. 130–1°. *Picrate*: m.p. 137°.

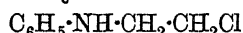
Gabriel, *Ber.*, 1888, 21, 573.

Ward, *J. Am. Chem. Soc.*, 1935, 57, 914.

Raiziss, Clemence, *J. Am. Chem. Soc.*, 1941, 63, 3124.

Jones et al., *J. Org. Chem.*, 1944, 9, 125.

### N- $\beta$ -Chloroethylaniline



C<sub>8</sub>H<sub>10</sub>NCl MW, 155.5

Unstable oil.

*B, HCl*: prisms. M.p. 158°.

*N - Me*: methyl- $\beta$ -chloroethylaniline.

C<sub>9</sub>H<sub>12</sub>NCl. MW, 169.5. B.p. 134°/13 mm. Darkens on standing. *Picrate*: yellow cryst. from EtOH. M.p. 117°. *Methiodide*: leaflets from EtOH. M.p. 125°.

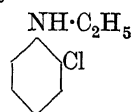
Nemirowsky, *J. prakt. Chem.*, 1885, 31, 175.

Clemo, Perkin, *J. Chem. Soc.*, 1924, 125, 1810.

Braun, Kirschbaum, *Ber.*, 1919, 52, 1716.

Jones et al., *J. Org. Chem.*, 1944, 9, 125.

### o-Chloro-N-ethylaniline



C<sub>8</sub>H<sub>10</sub>NCl

MW, 155.5

B.p. 219°/726 mm. D<sub>4</sub><sup>25</sup> 1.104.

*B, HCl*: m.p. 138–9°.

*Picrate*: m.p. 124°.

Suter, Dains, *J. Am. Chem. Soc.*, 1928, 50, 2737.

Braun, Weissbach, *Ber.*, 1932, 65, 1578.

### m-Chloro-N-ethylaniline.

B.p. 243–4°. D<sub>19</sub> 1.12.

Stoermer, Hoffmann, *Ber.*, 1898, 31, 2531.

### p-Chloro-N-ethylaniline.

B.p. 247–50°.

Crowther, Mann, Purdie, *J. Chem. Soc.*, 1943, 58.

### $\alpha$ -Chloroethylbenzene (1-Phenylethyl chloride)



C<sub>8</sub>H<sub>9</sub>Cl MW, 140.5

*d.*

B.p. 85°/20 mm. D<sub>4</sub><sup>20</sup> 1.0631. [ $\alpha$ ]<sub>D</sub><sup>20</sup> + 50.6°.

*l.*

B.p. 85°/20 mm. D<sub>4</sub><sup>20</sup> 1.0632. [ $\alpha$ ]<sub>D</sub><sup>20</sup> – 30.1°.

*dl.*

B.p. 194–5° decomp., 90–1°/33 mm. (91–2°/15 mm.). D<sub>15</sub><sup>15</sup> 1.0598. n<sub>D</sub><sup>15</sup> 1.5337.

*d, l.*, McKenzie, Clough, *J. Chem. Soc.*, 1913, 103, 694.

*dl.*, Norris, Watt, Thomas, *J. Am. Chem. Soc.*, 1916, 38, 1078.

Grignard, Ono, *Bull. soc. chim.*, 1926, 39, 1589.

Natelson, *Ind. Eng. Chem.*, 1933, 25, 1391.

Zal'kind, Berkovich, Amusin, *Chem. Abstracts*, 1934, 28, 5810.

I.G., D.R.P. 646,479, (*Chem. Zentr.*, 1937, II, 1662).

Kharasch, Brown, *J. Am. Chem. Soc.*, 1939, 61, 2142.

Breitenbach, Maschin, *Z. physik. Chem.*, 1940, 187A, 175.

### $\beta$ -Chloroethylbenzene (2-Phenylethyl chloride)



C<sub>8</sub>H<sub>9</sub>Cl MW, 140.5

B.p. 190–200° part. decomp. (194°), 92°/20 mm., 69°/4 mm. D<sub>4</sub><sup>25</sup> 1.069.

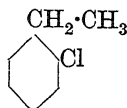
Conant, Kirner, *J. Am. Chem. Soc.*, 1924, 46, 241.

Norris, Taylor, *J. Am. Chem. Soc.*, 1924, 46, 753.

Bemejo, Herrara, *Chem. Abstracts*, 1936, 30, 3418.

Ruggli, Prijs, *Helv. Chim. Acta*, 1945, 28, 674.

## o-Chloroethylbenzene



$C_8H_9Cl$  MW, 140.5

M.p.  $-82.7^\circ$ . B.p.  $179^\circ$ .  $n_D^{20}$  1.5219.

Karabinos, Serijan, Gibbons, *J. Am. Chem. Soc.*, 1946, **68**, 2107.

## p-Chloroethylbenzene.

M.p.  $-62.6^\circ$ . B.p.  $184.5^\circ$  ( $180-2^\circ$ ,  $178-80^\circ$ ).  
 $D_4^{19}$  1.0575 ( $D^{20}$  1.0454).  $n_D^{20}$  1.5179 ( $n_D^{18}$  1.5223).  
 Ox.  $\rightarrow$  p-chlorobenzoic acid.

I.G., B.P. 327,382, (*Chem. Abstracts*, 1930, **24**, 5044).

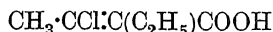
Tohl, Eberhard, *Ber.*, 1893, **26**, 2944.

Schreiner, *J. prakt. Chem.*, 1910, **81**, 557.

Varma, Sahay, Subramonium, *J. Indian Chem. Soc.*, 1937, **14**, 157.

Lock, Stach, *Ber.*, 1944, **77**, 293.

## 2-Chloro-1-ethylcrotonic Acid



$C_8H_9O_2Cl$  MW, 148.5

Two forms.

I. Needles. M.p.  $49.5^\circ$ . B.p.  $215^\circ$ . Sol. EtOH, Et<sub>2</sub>O, spar. sol. H<sub>2</sub>O. KOH  $\rightarrow$  methyl propyl ketone.

Me ester:  $C_7H_{11}O_2Cl$ . MW, 162.5. B.p.  $166-7^\circ$ .  $D^{15}$  1.087.

Et ester:  $C_8H_{13}O_2Cl$ . MW, 176.5. B.p.  $184.5^\circ$ .

Propyl ester:  $C_9H_{15}O_2Cl$ . MW, 190.5. B.p.  $197-8^\circ$ .  $D^{15}$  1.017.

II. M.p.  $74-5^\circ$ .

Koll, *Ann.*, 1888, **249**, 313.

Demarçay, *Ber.*, 1877, **10**, 1177.

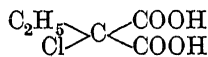
## Chloroethylene.

See Vinyl chloride.

## Chloroethyl Ether.

See Chlorodiethyl Ether.

## Chloroethylmalonic Acid



$C_6H_7O_4Cl$  MW, 166.5

Needles or prisms from  $C_6H_6$ . M.p.  $106-7^\circ$  ( $101-2^\circ$ ).  $D^{17}$  1.110. Heat  $\rightarrow$  1-chlorobutyric acid.

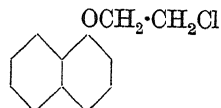
Di-Et ester:  $C_9H_{15}O_4Cl$ . MW, 222.5. B.p.  $228^\circ$ . Boiling HCl  $\rightarrow$  1-hydroxybutyric acid.

Staudinger, Anthes, Schneider, *Ber.*, 1913, **46**, 3549.

Blaise, *Bull. soc. chim.*, 1914, **15**, 661.

## Chloroethylnaphthalene.

See Naphthylethyl chloride.

 $\beta$ -Chloroethyl 1-naphthyl Ether

$C_{12}H_{11}OCl$  MW, 206.5

M.p.  $28^\circ$ . B.p.  $202^\circ/16$  mm.

Clemo, Perkin, *J. Chem. Soc.*, 1922, **121**, 646.

 $\beta$ -Chloroethyl 2-naphthyl Ether.

Plates from pet. ether. M.p.  $83^\circ$ .

Clemo, Perkin, *J. Chem. Soc.*, 1922, **121**, 646.

 $\beta$ -Chloroethyl phenyl Ether (*o*-Chlorophenetole)

$C_8H_9OCl$  MW, 156.5

Cryst. M.p.  $28^\circ$ . B.p.  $220^\circ$ . Very sol. EtOH, Et<sub>2</sub>O,  $C_6H_6$ , ligroin. Insol. H<sub>2</sub>O.

Clemo, Perkin, *J. Chem. Soc.*, 1922, **121**, 644.

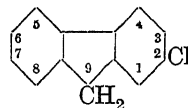
## Chloroethylpropylcarbinol.

See Chlorohexanol-3.

 $\beta$ -Chloroethylsulphonic Acid.

See 2-Chloroethane-1-sulphonic Acid.

## 2-Chlorofluorene



$C_{13}H_9Cl$  MW, 200.5

M.p.  $97^\circ$ .

Buffe, *Helv. Chim. Acta*, 1932, **15**, 1483.

Courtot, *Ann. chim.*, 1930, **14**, 5.

Streitwieser, *J. Am. Chem. Soc.*, 1944, **66**, 2127.

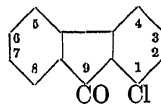
## 9-Chlorofluorene

Needles from EtOH.Aq. M.p.  $92^\circ$ . Sol. hot EtOH.

Kliegl, *Ber.*, 1910, **43**, 2493.

Staudinger, Gaule, *Ber.*, 1916, **49**, 1956.

## 1-Chlorofluorenone



$C_{13}H_7OCl$  MW, 214.5

Yellow needles from EtOH. M.p.  $137.0-7.8^\circ$ .

Huntress, Pfister, Pfister, *J. Am. Chem. Soc.*, 1942, **64**, 2845.

## 2-Chlorofluorenone

Orange-yellow cryst. from EtOH. M.p.  $125-6^\circ$  ( $109-10^\circ$ ).

Chanussot, *Bull. soc. chim.*, 1927, **41**, 1626.

**Chloroform** (*Trichloromethane*)

MW, 119.5

Colourless liq. F.p. -63.5°. B.p. 61-2°. Sol. to 1% in H<sub>2</sub>O at 15°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, Me<sub>2</sub>CO, CS<sub>2</sub>. D<sub>4</sub><sup>15</sup> 1.49845. Non-inflammable. Forms a hydrate with 18H<sub>2</sub>O. Forms constant-boiling mixture with 7% EtOH, b.p. 59°, and with 2.5% H<sub>2</sub>O, b.p. 56°. n<sub>D</sub><sup>15</sup> 1.44858. Mol. b.p. elevation, 38.8. Sp. heat at 20°, 0.234. Dissolves resins, fats, waxes, rubber, iodine, ozone, etc. Decomposes slowly in air and especially in sunlight, giving phosgene, chlorine, hydrogen chloride, water, and carbon dioxide. Addition of a small amount of EtOH retards the decomp. CrO<sub>3</sub> → COCl<sub>2</sub> + Cl. With aniline and KOH → phenylcarbylamine. Powerful anaesthetic.

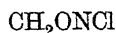
Timmermans, Martin, *J. chim. phys.*, 1926, 23, 763.

Teeple, *J. Am. Chem. Soc.*, 1904, 26, 536.

Frerichs, *Ind. Eng. Chem.*, 1912, 4, 345.

Hantzsch, Hofmann, *Ber.*, 1911, 44, 1777.

Seeger, *Die Chemie*, 1942, 55, 58.

**Chloroformaldoxime** (*Chloroformoxime*)

MW, 79.5

Needles. Stable at low temps. Sublimes and decomposes. Sol. most ord. org. solvents. Decomp. by H<sub>2</sub>O. Conc. HCl → NH<sub>2</sub>OH, HCl. Possesses lachrymatory and vesicant properties.

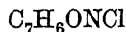
*Me ether*: ClCH:N·OCH<sub>3</sub>. C<sub>2</sub>H<sub>4</sub>ONCl. MW, 93.5. B.p. 68°.

Wieland, Baumann, *Ann.*, 1912, 392, 202.

Mohler, *Chem. Abstracts*, 1941, 35, 5590.

**Chloroformamide.**

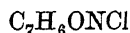
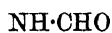
See under Carbamic Acid.

**N-Chloroformanilide**

MW, 155.5

Prisms from CHCl<sub>3</sub>-pet. ether. M.p. 47°. Sol. CHCl<sub>3</sub>, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. pet. ether. Decomp. above 120°.

Chattaway, Orton, *J. Chem. Soc.*, 1899, 75, 1049.

**o-Chloroformanilide**

MW, 155.5

Leaflets from ligroin. M.p. 77°. Sol. H<sub>2</sub>O. ligroin.

Chattaway, Orton, *Ber.*, 1900, 33, 2396.

**m-Chloroformanilide.**

M.p. 57-8°.

Davis, *J. Chem. Soc.*, 1909, 95, 1398.

**p-Chloroformanilide.**

Plates from H<sub>2</sub>O. M.p. 102°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, hot H<sub>2</sub>O. Insol. ligroin.

Chattaway, Orton, Hurlley, *Ber.*, 1899, 32, 3636.

**Chloroformic Acid**

MW, 80.5

Not known in the free state.

*2-Chloroethyl ester*: C<sub>3</sub>H<sub>4</sub>O<sub>2</sub>Cl<sub>2</sub>. MW, 143. B.p. 152.5°/752 mm. D<sub>4</sub><sup>20</sup> 1.3825. n<sub>D</sub><sup>20</sup> 1.4465.

*Propyl ester*: C<sub>4</sub>H<sub>7</sub>O<sub>2</sub>Cl. MW, 122.5. B.p. 115.2°. D<sub>4</sub><sup>20</sup> 1.0901. n<sub>D</sub><sup>20</sup> 1.40350.

*Isopropyl ester*: b.p. 103°/721 mm.

*Butyl ester*: C<sub>5</sub>H<sub>9</sub>O<sub>2</sub>Cl. MW, 136.5. B.p. 138°/735 mm. D<sub>4</sub><sup>25</sup> 1.074. n<sub>D</sub><sup>25</sup> 1.417.

*Isobutyl ester*: b.p. 128.8°. D<sub>15</sub><sup>15</sup> 1.053.

*Isocamyl ester*: C<sub>6</sub>H<sub>11</sub>O<sub>2</sub>Cl. MW, 150.5. B.p. 154.3°. D<sub>15</sub><sup>15</sup> 1.032.

*Allyl ester*: C<sub>4</sub>H<sub>5</sub>O<sub>2</sub>Cl. MW, 120.5. B.p. 180°/717 mm.

*Phenyl ester*: C<sub>7</sub>H<sub>5</sub>O<sub>2</sub>Cl. MW, 156.5. B.p. 187° (decomp. → diphenyl carbonate + COCl<sub>2</sub>), 95°/20 mm. Decomp. by H<sub>2</sub>O. NH<sub>3</sub> → phenyl carbamate.

*o-Chlorophenyl ester*: b.p. 113°/27 mm.

*p-Chlorophenyl ester*: b.p. 114°/20 mm.

*m-Nitrophenyl ester*: b.p. 158°/18 mm.

*p-Tolyl ester*: C<sub>8</sub>H<sub>7</sub>O<sub>2</sub>Cl. MW, 170.5. B.p. 108°/30 mm.

*Benzyl ester*: C<sub>8</sub>H<sub>7</sub>O<sub>2</sub>Cl. MW, 170.5. B.p. 103°/20 mm.

*Phenylethyl ester*: C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Cl. MW, 184.5. B.p. 120°/18 mm. n<sub>D</sub><sup>21</sup> 1.511.

*1-Naphthyl ester*: C<sub>11</sub>H<sub>7</sub>O<sub>2</sub>Cl. MW, 206.5. B.p. 132°/5 mm.

*Amide*: see under Carbamic Acid.

Cappelli, *Gazz. chim. ital.*, 1920, 50, ii, 8.

Oesper, Broker, Cook, *J. Am. Chem. Soc.*, 1925, 47, 2609.

Hammond, U.S.P. 1,618,824, (*Chem. Abstracts*, 1927, 21, 1128).

Nekrasov, Kamisarov, *J. prakt. Chem.*, 1929, 123, 160.

Schring, Sabetay, *Bull. soc. chim.*, 1928, 43, 1241.

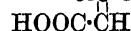
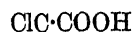
Copisarow, *J. Chem. Soc.*, 1929, 253.

Bergmann, Zervas, *Ber.*, 1932, 65, 1192.

Schotte, Prieue, Roescheissen, *Z. physiol. Chem.*, 1928, 174, 119.

**Chloroformic Ester.**

See Ethyl chloroformate.

**Chlorofumaric Acid**

MW, 150.5

Plates from AcOH. M.p. 191-2°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Spar. sol. C<sub>6</sub>H<sub>6</sub>. Sublimes. Boil



→ chloromaleic anhydride. Na.Hg → succinic acid.  $k$  (first) =  $1.72 \times 10^{-2}$ : (second) =  $1.55 \times 10^{-4}$ .

*Di-Me ester*:  $C_6H_7O_4Cl$ . MW, 178.5. B.p. 224°, 108°/15 mm.  $D_4^{25}$  1.2899.  $n_D^{18}$  1.47198.

*Di-Et ester*:  $C_8H_{11}O_4Cl$ . MW, 206.5. B.p. 250° part. decomp., 202°/210 mm., 127°/10 mm.  $D_{15}^{15}$  1.19372.  $n_D^{21}$  1.4598.

*Di-p-nitrobenzyl ester*:  $C_{18}H_{13}O_8N_2Cl$ . MW, 420.5. M.p. 138.5°.

*Dichloride*:  $C_4HO_2Cl_2$ . MW, 187.5. B.p. 185-7° part. decomp.  $D_{15}^{15}$  1.5731.

*Et ester amide*:  $C_2H_5 \cdot OOC \cdot CH \cdot CCl \cdot CONH_2$ .  $C_6H_8O_3NCl$ . MW, 177.5. Plates from EtOH. M.p. 102°.

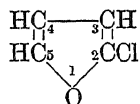
*Dinitrile*: b.p. 172°, 64/10 mm.  $D_4^{20}$  1.2499.  $n_D^{20}$  1.49571.

*Dianilide*: needles from EtOH. M.p. 186°.

Perkin, *J. Chem. Soc.*, 1888, 53, 697.

Auwers, Harres, *Ber.*, 1929, 62, 1685.

## 2-Chlorofuran



$C_4H_3OCl$  MW, 102.5

B.p. 77.2-77.5°/744 mm.  $D_4^{20}$  1.1923.  $n_D^{20}$  1.45687. Volatile in steam.

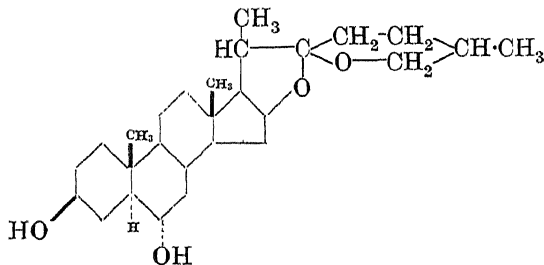
Shepard, Winslow, Johnson, *J. Am. Chem. Soc.*, 1930, 52, 2083.

## 3-Chlorofuran

B.p. 79.0-79.4°/742 mm.  $D_4^{20}$  1.2094.  $n_D^{20}$  1.46005. Volatile in steam.

Shepard, Winslow, Johnson, *J. Am. Chem. Soc.*, 1930, 52, 2083.

## Chlorogenin



$C_{27}H_{44}O_4$  MW, 432

Sapogenin from bulbs of *Chlorogalum pomeridianum*. Needles from MeOH. M.p. 273-6°.  $[\alpha]_{D}^{24}$  - 52° in  $CHCl_3$ .

*Diacetyl*: cryst. from MeOH.Aq. M.p. 154-5°.

*Dibenzoyl*: cryst. from MeOH- $CHCl_3$ . M.p. 200-4°.  $[\alpha]_{D}^{25}$  + 9.5° in  $CHCl_3$ .

*Di-o-bromobenzoyl*: cryst. from EtOH- $CHCl_3$ . M.p. 205-7°.  $[\alpha]_{D}^{25}$  - 9.5°.

Marker, Jones, Turner, *J. Am. Chem. Soc.*, 1940, 62, 2537.

Liang, Noller, *J. Am. Chem. Soc.*, 1935, 57, 525.

Marker, Rohrmann, *J. Am. Chem. Soc.*, 1939, 61, 947, 3479.

Marker, Turner, Ulshafer, *J. Am. Chem. Soc.*, 1940, 62, 3009.

Marker, Turner, *J. Am. Chem. Soc.*, 1940, 62, 3006.

Ladenburg, Noller, *J. Am. Chem. Soc.*, 1941, 63, 1240.

Marker, Turner, Wittbecker, *J. Am. Chem. Soc.*, 1942, 64, 221, 809.

## $\psi$ -Chlorogenin

$C_{27}H_{44}O_4$  MW, 432

Cryst. from MeOH. M.p. 268-70°. Spar. sol. most. org. solvents.

Marker, Rohrmann, Jones, *J. Am. Chem. Soc.*, 1940, 62, 649.

Marker, U.S.P. 2,352,852, (*Chem. Abstracts*, 1945, 39, 1257); U.S.P. 2,418,181, (*Chem. Abstracts*, 1947, 41, 6024).

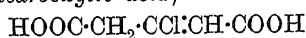
## epi-Chlorogenin

$C_{27}H_{44}O_4$  MW, 432

Sterol. M.p. 270-4°.

Marker, Turner, Wittbecker, *J. Am. Chem. Soc.*, 1942, 64, 222.

**2-Chloroglutaconic Acid** (*2-Chloropropylene-1:3-dicarboxylic acid*)



$C_5H_5O_4Cl$  MW, 164.5

Needles from  $H_2O$ , leaflets from  $C_6H_6$ . M.p. 141-2° (129°). Sol.  $H_2O$ , EtOH,  $Et_2O$ , hot  $C_6H_6$ . Na.Hg → glutaric acid.

*Di-Et ester*:  $C_9H_{13}O_4Cl$ . MW, 220.5. B.p. 136-7°/11 mm.

*Anhydride*:  $C_5H_3O_3Cl$ . MW, 146.5. M.p. 113-14°.

Ingold, Nickolls, *J. Chem. Soc.*, 1922, 121, 1642.

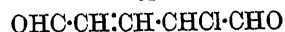
Malachowski, Kalinski, *Chem. Abstracts*, 1927, 21, 3615.

van der Zanden, *Rec. trav. chim.*, 1935, 54, 289.

**Chloroglutaconic Dialdehyde** (*Chloropentenedial*)



or



$C_5H_5O_2Cl$  MW, 132.5

Needles from  $Et_2O$ . M.p. 97° total decomp. Sol. EtOH. Mod. sol.  $H_2O$ ,  $Et_2O$ . Unstable.  $NH_3$  → 2-chloropyridine. Forms Na deriv. sol.  $H_2O$ .

*Dianil*: yellow cryst. powder from Et<sub>2</sub>O. M.p. 128-9°.

*Mono-2 : 4-dinitroanil*: red cryst. from Me<sub>2</sub>CO. M.p. 180° decomp. Sol. hot H<sub>2</sub>O.

Hantzsch, *Ber.*, 1887, 20, 2787.

Dieckmann, *Ber.*, 1902, 35, 3202.

### 1-Chloroglutaric Acid



C<sub>5</sub>H<sub>7</sub>O<sub>4</sub>Cl MW, 166.5  
*dl.*

M.p. 99°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO. Insol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, ligroin. H<sub>2</sub>O at 50° → 1-hydroxyglutaric acid.

*Di-Et ester*: C<sub>9</sub>H<sub>15</sub>O<sub>4</sub>Cl. MW, 222.5. B.p. 245° decomp., 145°/15 mm. D<sub>20</sub><sup>25</sup> 1.14.

*l.*

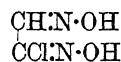
Cryst. from CHCl<sub>3</sub>. M.p. 99°. [α]<sub>D</sub><sup>25</sup> - 12.6° in H<sub>2</sub>O, [α]<sub>D</sub><sup>25</sup> - 27.14° in AcOEt. ([α]<sub>D</sub><sup>25</sup>)<sup>4</sup> - 22.5° in AcOEt).

Fischer, Moreschi, *Ber.*, 1912, 45, 2450.

Jochem, *Z. physiol. Chem.*, 1900, 31, 124.

Karrer, Reschofsky, Kaase, *Helv. Chim. Acta*, 1947, 30, 271.

**Chloroglyoxime** (*Chloro-oximinoacetaldoxime*)



C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>N<sub>2</sub>Cl MW, 122.5

Exists in two stereoisomeric forms.

(a) *Amphi.* Cryst. + 1H<sub>2</sub>O from H<sub>2</sub>O. M.p. 114° (rapid heat.). Sol. EtOH, Et<sub>2</sub>O, dil. alkalis. Spar. sol. cold H<sub>2</sub>O. HCl in Et<sub>2</sub>O → *anti* form.

*Diacetyl*: m.p. 114°.

(b) *Anti.* Cryst. from hot H<sub>2</sub>O. M.p. 161° decomp. Sol. EtOH, Et<sub>2</sub>O. Dil. alkalis → *amphi* form.

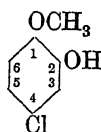
*Diacetyl*: m.p. 90-1°.

Houben, Kauffmann, *Ber.*, 1913, 46, 2824.

Hieber, Leutert, *Ber.*, 1929, 62, 1845.

Ponzio, Baldracco, *Gazz. chim. ital.*, 1930, 60, 415.

**4-Chloroguaiacol** (*4-Chlorocatechol-1-methyl ether, 5-chlorocatechol 2-methyl ether*)



C<sub>7</sub>H<sub>7</sub>O<sub>2</sub>Cl MW, 158.5

Cryst. M.p. 37° (161-163.5°). B.p. 237-9°. Sol. H<sub>2</sub>O, EtOH, C<sub>6</sub>H<sub>6</sub>. Insol. Et<sub>2</sub>O. FeCl<sub>3</sub> → yellow col.

*Acetyl*: plates from ligroin. M.p. 42-4°.

*Benzoyl*: needles from EtOH.Aq. M.p. 56-8°.

*Et ether*: C<sub>9</sub>H<sub>11</sub>O<sub>2</sub>Cl. MW, 186.5. Cryst. from EtOH.Aq. M.p. 49-51°.

Turski, Piotrowski, Winower, *Chem. Abstracts*, 1928, 22, 4505.

Meyer, *Chem. Abstracts*, 1924, 18, 3180.

Jona, Pozzi, *Chem. Zentr.*, 1911, II, 1437.

**5-Chloroguaiacol** (*5-Chlorocatechol 1-methyl ether, 4-chlorocatechol 2-methyl ether*).

Cryst. M.p. 158-61°. B.p. 241-3°. Volatile in steam.

*Benzoyl*: cryst. from EtOH. M.p. 79-80°.

Jona, Pozzi, *Chem. Zentr.*, 1911, II, 1438.

**6-Chloroguaiacol** (*6-Chlorocatechol 1-methyl ether, 3-chlorocatechol 2-methyl ether*).

Plates. M.p. 32-3°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. FeCl<sub>3</sub>.Aq. → green col.

*Acetyl*: b.p. 179-81°/55 mm.

*Benzoyl*: needles from EtOH.Aq. M.p. 37-8°.

*Et ether*: b.p. 162-5°/55 mm.

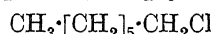
Jona, *Chem. Zentr.*, 1912, II, 1113.

Angeletti, Pirona, *Chem. Abstracts*, 1937, 31, 678.

**1-Chloroheptadecane.**

*See* Heptadecyl chloride.

**1-Chloroheptane** (*n-Heptyl chloride*)



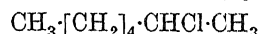
C<sub>7</sub>H<sub>15</sub>Cl MW, 134.5

B.p. 159.5°, 61-4°/27 mm. D<sub>4</sub><sup>20</sup> 0.8725 (0.8766). n<sub>D</sub><sup>20</sup> 1.42844 (1.42571).

Sherrill, *J. Am. Chem. Soc.*, 1930, 52, 1985.

Clark, Streight, *Chem. Abstracts*, 1930, 24, 586.

**2-Chloroheptane** (*sec.-n-Heptyl chloride*)



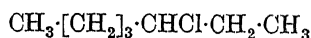
C<sub>7</sub>H<sub>15</sub>Cl MW, 134.5

B.p. 46°/19.5 mm. D<sub>4</sub><sup>20</sup> 0.8672. n<sub>D</sub><sup>20</sup> 1.4221.

Kharasch, Brown, *J. Am. Chem. Soc.*, 1939, 61, 2142.

Sherrill, *J. Am. Chem. Soc.*, 1930, 52, 1985.

**3-Chloroheptane**



C<sub>7</sub>H<sub>15</sub>Cl MW, 134.5

*d.*  
B.p. 87-90°/113 mm. n<sub>D</sub><sup>25</sup> 1.4221. [α]<sub>D</sub><sup>25</sup> + 1.46°.

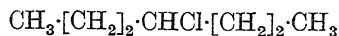
*dl.*

B.p. 48.3°/21 mm. D<sub>4</sub><sup>20</sup> 0.869. n<sub>D</sub><sup>20</sup> 1.4228.

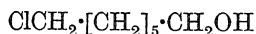
Levene, Rothen, Kuna, *J. Biol. Chem.*, 1937, 119, 189.

Sherrill, *J. Am. Chem. Soc.*, 1930, 52, 1985.

## 4-Chloroheptane



$\text{C}_7\text{H}_{15}\text{Cl}$  MW, 134.5  
 B.p. 48-9°/21 mm.  $D_4^{20}$  0.8710.  $n_D^{20}$  1.4231.  
 Sherrill, *J. Am. Chem. Soc.*, 1930, 52, 1985.

7-Chloroheptanol-1 (*ω*-Chloroheptyl alcohol)

$\text{C}_7\text{H}_{15}\text{OCl}$  MW, 150.5  
 M.p. 10-11°. B.p. 150°/20 mm.  $D_4^{25}$  0.9988.  
 $n_D^{20}$  1.45367.  
*Phenylurethane*: m.p. 76°.

Bennett, Mosses, *J. Chem. Soc.*, 1931, 1699.

1-Chloroheptanol-2 (*Chloromethyl-n-amyl-carbinol*)

$\text{C}_7\text{H}_{15}\text{OCl}$  MW, 150.5  
 B.p. 91-2°/14 mm., 87-8°/10 mm.  $D_4^{20}$  0.9916.  
 $n_D^{20}$  1.4489.

Koelsch, McElvain, *J. Am. Chem. Soc.*, 1930, 52, 1166.

Levene, Walti, *J. Biol. Chem.*, 1932, 98, 735.

Rothstein, *Bull. soc. chim.*, 1935, 2, 1936.

*ω*-Chloroheptyl Alcohol.

See 7-Chloroheptanol-1.

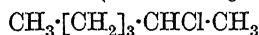
## Chlorohexadecane.

See Cetyl chloride

1-Chlorohexane (*n-Hexyl chloride*)

$\text{C}_6\text{H}_{13}\text{Cl}$  MW, 120.5  
 B.p. 135-6°.  $D^{20}$  0.8759 (0.8784).  $n_D^{20}$  1.42364 (1.41991).

Clark, Streight, *Chem. Abstracts*, 1930, 24, 586.

2-Chlorohexane (*sec.-n-Hexyl chloride*)

$\text{C}_6\text{H}_{13}\text{Cl}$  MW, 120.5  
 B.p. 123°, 61°/100 mm.  $D_4^{14}$  0.876.  $n_D^{20}$  1.4142.  
 Schorlemmer, *Ann.*, 1872, 161, 272  
 Badische, D.R.P. 261,677, (*Chem. Zentr.*, 1913, II, 325).

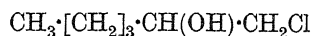
## 3-Chlorohexane



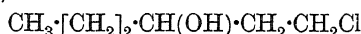
$\text{C}_6\text{H}_{13}\text{Cl}$  MW, 120.5  
 B.p. 123°, 59.5-60°/95 mm.  $D_{20}^{20}$  0.870.  
 $n_D^{20}$  1.4163.

Spiegler, Tinker, *J. Am. Chem. Soc.*, 1939, 61, 940.

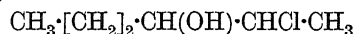
Lagerev, Shadmanov, *Chem. Abstracts*, 1941, 35, 2120.

1-Chlorohexanol-2 (*Chloromethyl-n-butyl-carbinol*)

$\text{C}_6\text{H}_{13}\text{OCl}$  MW, 136.5  
 B.p. 73-5°/12 mm.  $D_4^{20}$  1.0139.  $n_D^{20}$  1.4478.  
 Rothstein, *Bull. soc. chim.*, 1935, 2, 1936.  
 Koelsch, McElvain, *J. Am. Chem. Soc.*, 1930, 52, 1166.

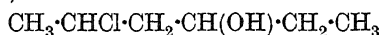
1-Chlorohexanol-3 (*2-Chloroethylpropyl-carbinol*)

$\text{C}_6\text{H}_{13}\text{OCl}$  MW, 136.5  
 B.p. 120°/35 mm., 90-1°/13 mm., 77-8°/6 mm. Sol. hot  $\text{H}_2\text{O}$ .  $D_4^{25}$  1.003.  $n_D^{20}$  1.446.  
 Backer, Bolt, *Rec. trav. chim.*, 1935, 54, 68.  
 Fourneau, Ramart-Lucas, *Bull. soc. chim.*, 1919, 25, 367.

2-Chlorohexanol-3 (*1-Chloroethylpropyl-carbinol*)

$\text{C}_6\text{H}_{13}\text{OCl}$  MW, 136.5  
 Viscous oil. B.p. 170-1°. Insol.  $\text{H}_2\text{O}$ .  $D^{11}$  1.0143.

Henry, *Bull. soc. chim.*, 1884, 41, 362.

5-Chlorohexanol-3 (*Ethyl-2-chloropropyl-carbinol*)

$\text{C}_6\text{H}_{13}\text{OCl}$  MW, 136.5  
 B.p. 78-9°/13 mm. (75°/15 mm.).  $D_4^{17}$  1.0142,  $D_4^{19}$  1.0012.  $n_D^{19}$  1.4433 ( $n_D^{17}$  1.450).  
 Helferich, Besler, *Ber.*, 1924, 57, 1276.  
 Lespieau, *Bull. soc. chim.*, 1940, 7, 254.

o-Chlorohippuric Acid (*o-Chlorobenzoyl-aminoacetic acid, o-chlorobenzoylglycine*)

$\text{C}_9\text{H}_8\text{O}_3\text{NCl}$  MW, 213.5  
 Cryst. M.p. 176°.  
 Novello, Miriam, Sherwin, *J. Biol. Chem.*, 1926, 67, 555.

## m-Chlorohippuric Acid.

Cryst. M.p. 143-4°. Sol. EtOH, Et<sub>2</sub>O.  
*Pb salt*: m.p. 100-20°.

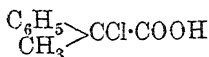
Novello, Miriam, Sherwin, *J. Biol. Chem.*, 1926, 67, 555.

## p-Chlorohippuric Acid.

Cryst. +  $\text{H}_2\text{O}$ . M.p. 143°. Hyd. by HCl.

Novello, Miriam, Sherwin, *J. Biol. Chem.*, 1926, 67, 555.

α-Chlorohydratropic Acid (1-Chloro-1-phenylpropionic acid)



C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Cl MW, 184.5

*d.*

Prisms from pet. ether. M.p. 70–2°. [α]<sub>D</sub><sup>15</sup> + 26.0° in C<sub>6</sub>H<sub>6</sub>.

*Et ester*: C<sub>11</sub>H<sub>13</sub>O<sub>2</sub>Cl. MW, 212.5. B.p. 138.9°/28 mm.

*Chloride*: C<sub>9</sub>H<sub>8</sub>OCl<sub>2</sub>. MW, 203. B.p. 113–15°/15 mm.

*l.*

Cryst. from pet. ether. M.p. 71–2°. [α]<sub>D</sub><sup>15</sup> – 26.3° in C<sub>6</sub>H<sub>6</sub>.

*Et ester*: b.p. 131–2°/18 mm. D<sub>4</sub><sup>17</sup> 1.124.

*Chloride*: b.p. 108–10°/10 mm. [α]<sub>D</sub><sup>12</sup> – 4.5° in Me<sub>2</sub>CO.

*dl.*

Cryst. from pet. ether. M.p. 73–4° (88.5°). Decomp. at 110°. Sol. CS<sub>2</sub>. Spar. sol. H<sub>2</sub>O. Volatile in steam.

*Chloride*: b.p. 108°/15 mm.

*p-Toluidide*: cryst. from pet. ether. M.p. 90–1°.

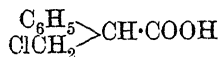
Merling, *Ann.*, 1881, 209, 19.

McKenzie, Clough, *J. Chem. Soc.*, 1910, 97, 1021.

Staudinger, Ruzicka, *Ann.*, 1911, 380, 295.

Ott, Krämer, *Ber.*, 1935, 68, 1655.

α-Chlorohydratropic Acid (2-Chloro-1-phenylpropionic acid)



C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Cl MW, 184.5

*l.*

M.p. 63°. [α]<sub>D</sub><sup>15</sup> – 122.6° in C<sub>6</sub>H<sub>6</sub>.

*dl.*

Prisms from CHCl<sub>3</sub> or plates from CS<sub>2</sub>. M.p. 88–9°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>, hot CHCl<sub>3</sub>, hot H<sub>2</sub>O. Decomp. above 170°. Volatile in steam. Hot NaOH.Aq → atropic acid.

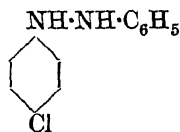
*p-Toluidide*: m.p. 182–182.5° decomp.

Merling, *Ann.*, 1881, 209, 3.

McKenzie, Strathern, *J. Chem. Soc.*, 1925, 127, 82.

McKenzie, Wood, *J. Chem. Soc.*, 1919, 115, 835.

*p*-Chlorohydrazobenzene



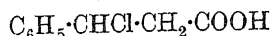
C<sub>12</sub>H<sub>11</sub>N<sub>2</sub>Cl

MW, 218.5

Needles. M.p. 90°. Sol. EtOH, Et<sub>2</sub>O. Oxidises in air to *p*-chloroazobenzene.

Heumann, Mentha, *Ber.*, 1886, 19, 1688.

β-Chlorohydrocinnamic Acid (2-Chloro-2-phenylpropionic acid)



C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Cl MW, 184.5

*d.*

[α]<sub>D</sub><sup>15</sup> + 44.7° in EtOH.

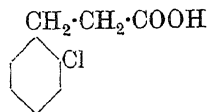
*dl.*

Leaflets. M.p. 126°. Heat or alkalis → cinnamic acid Na<sub>2</sub>CO<sub>3</sub> → styrene.

Glaser, *Ann.*, 1868, 147, 95.

McKenzie, Barrow, *J. Chem. Soc.*, 1911, 99, 925.

o-Chlorohydrocinnamic Acid (2-o-Chlorophenylpropionic acid)



C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Cl MW, 184.5

Needles or leaflets from H<sub>2</sub>O. M.p. 96.5°. Sol. most ord. org. solvents.

*Me ester*: C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>Cl. MW, 198.5. B.p. 255°.

*Chloride*: C<sub>9</sub>H<sub>8</sub>OCl<sub>2</sub>. MW, 203. B.p. 135–58°/20 mm.

*Amide*: C<sub>9</sub>H<sub>10</sub>ONCl. MW, 183.5. Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 119°.

*Nitrile*: C<sub>9</sub>H<sub>8</sub>NCl. MW, 165.5. B.p. 267–8°.

Gabriel, Herzberg, *Ber.*, 1883, 16, 2037.

Mayer, Philipps, Ruppert, Schmidt, *Ber.*, 1928, 61, 1970.

Lasch, *Monatsh.*, 1913, 34, 1657.

Rosenmund, Zetsche, *Ber.*, 1918, 51, 583.

*m*-Chlorohydrocinnamic Acid.

Leaflets from pet. ether. M.p. 77–8°. (Prisms. M.p. 73–4°). Sol. most ord. org. solvents.

*Chloride*: b.p. 161°/39 mm.

*Anilide*: m.p. 86–7°.

Gabriel, Herzberg, *Ber.*, 1883, 16, 2039.

Kenner, Witham, *J. Chem. Soc.*, 1921, 119, 1460.

*p*-Chlorohydrocinnamic Acid.

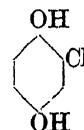
M.p. 124° (122°). Sol. most ord. org. solvents.

Gabriel, Herzberg, *Ber.*, 1883, 16, 2040.

Miersch, *Ber.*, 1892, 25, 2112.

Kindler, Li, *Ber.*, 1941, 74, 315.

Chlorohydroquinone



C<sub>6</sub>H<sub>5</sub>O<sub>2</sub>Cl

MW, 144.5

Leaflets from  $\text{CHCl}_3$ . M.p.  $106^\circ$ . (Needles from toluene. M.p.  $104^\circ$  [ $101-2^\circ$ ].) B.p.  $263^\circ$ . Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ , hot  $\text{CHCl}_3$ . Heat of comb. 647.6 Cal.  $\text{CrO}_3 \rightarrow$  chloro-*p*-benzoquinone.

*Monoacetyl deriv.*: m.p.  $62^\circ$ .

*Diacetyl*: prisms. M.p.  $72^\circ$  ( $99^\circ$ ). Sol. hot EtOH.

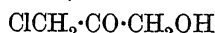
Conant, Fieser, *J. Am. Chem. Soc.*, 1923, 45, 2201.

Beilenson, B.P. 563,541, (*Chem. Abstracts*, 1946, 40, 3135).

### Chlorohydroxyacetanilide.

See under Chloroaminophenol.

**3-Chloro-1-hydroxyacetone** (*Chloroacetylcarbinol, chloroacetol*)



$\text{C}_3\text{H}_5\text{O}_2\text{Cl}$  MW, 108.5

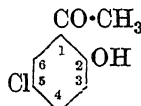
M.p.  $74^\circ$ . Unstable. Stable in dil. sol. Reduces Fehling's. Forms bisulphite comp.

Smirnow, *Chem. Zentr.*, 1904, I, 576.

### $\omega$ -Chlorohydroxyacetophenone.

See Hydroxyphenacyl chloride.

### 5-Chloro-2-hydroxyacetophenone



$\text{C}_8\text{H}_7\text{O}_2\text{Cl}$  MW, 170.5

Plates from EtOH.Aq. M.p.  $57^\circ$  ( $55^\circ$ ). Spar. sol. hot  $\text{H}_2\text{O}$ .  $\text{FeCl}_3 \rightarrow$  cherry-red col.

Nencki, Stoeber, *Ber.*, 1897, 30, 1771.

Claus, *Chem. Zentr.*, 1898, II, 158.

### 3-Chloro-4-hydroxyacetophenone.

Needles from EtOH.Aq. M.p.  $96^\circ$  ( $107^\circ$ ). No col. with  $\text{FeCl}_3$ .

*Benzoyl*: m.p.  $82^\circ$ .

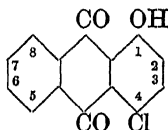
Edkins, Linnell, *Quart. J. Pharm. Pharmacol.*, 1936, 9, 75.

Nencki, Stoeber, *Ber.*, 1897, 30, 1771.

### 4-Chloro- $\omega$ -hydroxyacetophenone.

See 4-Chlorophenacyl Alcohol.

**4-Chloro-1-hydroxyanthraquinone** (4-Chloroerythroxyanthraquinone)



$\text{C}_{14}\text{H}_7\text{O}_3\text{Cl}$  MW, 258.5

Orange-yellow needles. M.p.  $193-4^\circ$  ( $189^\circ$ ). Sol. hot AcOH, hot  $\text{C}_6\text{H}_6$ , hot toluene, hot Py. Spar. sol. EtOH, ligroin.

*Acetyl*: m.p.  $176-7^\circ$ .

*Me ether*: 4-Chloro-1-methoxyanthraquinone.  $\text{C}_{15}\text{H}_9\text{O}_3\text{Cl}$ . MW, 272.5. Yellow needles from Py. M.p.  $168^\circ$ .

Green, *J. Chem. Soc.*, 1926, 1435.

Ullmann, Conzetti, *Ber.*, 1920, 53, 829.

Waldmann, Hartisch, *J. prakt. Chem.*, 1931, 130, 98.

### 5-Chloro-1-hydroxyanthraquinone.

Yellow plates. M.p.  $223-4^\circ$ .

*Acetyl*: pale yellow needles. M.p.  $205^\circ$ .

Green, *J. Chem. Soc.*, 1926, 2203.

### 1-Chloro-2-hydroxyanthraquinone.

Yellow needles. M.p.  $226^\circ$ . Mod. sol. EtOH,  $\text{C}_6\text{H}_6$ ,  $\text{PhNO}_2$ . Red sols. in alkalis. K salt sol. EtOH to violet sol.

*Me ether*: 1-chloro-2-methoxyanthraquinone.  $\text{C}_{15}\text{H}_9\text{O}_3\text{Cl}$ . MW, 272.5. Cryst. from EtOH or  $\text{C}_6\text{H}_6$ . M.p.  $223-4^\circ$ . Sol. conc.  $\text{H}_2\text{SO}_4$  to orange-red sol.

*Acetyl*: yellow needles from EtOH. M.p.  $163.5^\circ$ .

*Benzoyl*: m.p.  $228-30^\circ$ .

Hardacre, Perkin, *J. Chem. Soc.*, 1929, 187.

de Diesbach, Gubser, Spoorenberg, *Helv. Chim. Acta*, 1930, 13, 1269.

### 3-Chloro-2-hydroxyanthraquinone.

Golden-yellow needles from EtOH or AcOH. M.p.  $267^\circ$ . Sol. NaOH.Aq.

*Acetyl*: m.p.  $197-200^\circ$ .

Hayashi, *J. Chem. Soc.*, 1930, 1523.

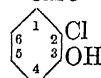
Goldberg, *J. Chem. Soc.*, 1931, 1787.

### Chloro-*o*-hydroxybenzaldehyde.

See Chlorosalicylaldehyde.

### 2-Chloro-*m*-hydroxybenzaldehyde

CHO



$\text{C}_7\text{H}_5\text{O}_2\text{Cl}$  MW, 156.5

Cryst. from AcOH.Aq. M.p.  $139.5^\circ$ .

*Me ether*:  $\text{C}_8\text{H}_7\text{O}_2\text{Cl}$ . MW, 170.5. M.p.  $57^\circ$ .

*Acetyl*: m.p.  $62^\circ$ .

*Benzoyl*: m.p.  $88^\circ$ .

*Oxime*: m.p.  $149^\circ$ .

*Semicarbazone*: m.p.  $236-7^\circ$ .

*p*-Nitrophenylhydrazone: m.p.  $244^\circ$ .

Lock, Hosaeus, *Monatsh.*, 1930, 55, 309.

Hodgson, Beard, *J. Chem. Soc.*, 1926, 149.

Bissell, Kranz, U.S.P. 1,776,803, (*Chem. Abstracts*, 1930, 24, 5769).

### 4-Chloro-*m*-hydroxybenzaldehyde.

Needles. M.p.  $121^\circ$ .

*Me ether*: m.p.  $52^\circ$ .

*Oxime*: m.p. anhyd.  $126^\circ$ .

*Semicarbazone*: m.p.  $238-9^\circ$ .

*p*-Nitrophenylhydrazone: m.p.  $226-7^\circ$ .

Hodgson, Beard, *J. Chem. Soc.*, 1926, 150.

**6-Chloro-*m*-hydroxybenzaldehyde.**

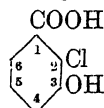
M.p. 111°.

*Me ether*: m.p. 62°.*Oxime*: m.p. anhyd. 146-7°.*Semicarbazone*: m.p. 236°.*p*-Nitrophenylhydrazone: m.p. 250-1°.Bissell, Kranz, U.S.P. 1,776,803, (*Chem. Abstracts*, 1930, 24, 5769).Hodgson, Beard, *J. Chem. Soc.*, 1926, 151.**2-Chloro-*p*-hydroxybenzaldehyde** $C_7H_5O_2Cl$ 

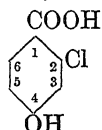
MW, 156.5

Needles from AcOH. M.p. 147-8°. Sol. hot  $H_2O$ , EtOH,  $Et_2O$ . Volatile in steam.*Me ether*: 2-chloroanisaldehyde.  $C_8H_7O_2Cl$ . MW, 170.5. Needles. M.p. 62-3°. Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ . ligroin. Volatile in steam. *Oxime*: m.p. 93°.*Et ether*:  $C_9H_9O_2Cl$ . MW, 184.5. Needles. M.p. 66-7°. *Oxime*: m.p. 89.5°.*Acetyl*: m.p. 51.5°.*Benzoyl*: m.p. 96.5°.*Oxime*: m.p. 194°.*Semicarbazone*: m.p. 214°.*p*-Nitrophenylhydrazone: m.p. 288° decomp.Hodgson, Jenkinson, *J. Chem. Soc.*, 1927, 1742, 3042.Gattermann, *Ann.*, 1907, 357, 334, 349.**3-Chloro-*p*-hydroxybenzaldehyde.**Needles. M.p. 139° (132-4°, 127-8°). B.p. 150°/14 mm. Sol. EtOH,  $Et_2O$ , hot  $H_2O$ . Spar. sol.  $CHCl_3$ .*Me ether*: 3-chloroanisaldehyde. M.p. 53°. *Oxime*: m.p. 115°.*Oxime*: m.p. 144-5°.*Semicarbazone*: m.p. 210° decomp. (212°).Biltz, *Ber.*, 1904, 37, 4032.Gattermann, *Ann.*, 1907, 357, 348.Buchler *et al.*, *J. Org. Chem.*, 1941, 6, 902.**Chloro-*o*-hydroxybenzoic Acid.**

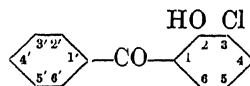
See Chlorosalicylic Acid.

**2-Chloro-*m*-hydroxybenzoic Acid** $C_7H_5O_3Cl$ 

MW, 172.5

Leaflets. M.p. 156-7°. Sol. hot  $H_2O$ .  $k = 1.4 \times 10^{-3}$  at 25°.*Me ester*:  $C_8H_7O_3Cl$ . MW, 186.5. Prisms +  $1H_2O$  from EtOH.Aq. M.p. 71°, anhyd. 62-5°.*Et ester*:  $C_9H_9O_3Cl$ . MW, 200.5. Needles +  $1H_2O$  from EtOH.Aq. M.p. 58°. Hygroscopic. Spar. sol. EtOH,  $Et_2O$ . *Acetyl*: m.p. 48-9°.*Me ether*: 2-chloro-*m*-methoxybenzoic acid.  $C_8H_7O_3Cl$ . MW, 186.5. M.p. 161.5°.*Acetyl*: m.p. 152.5-3.0°.Hodgson, Rosenberg, *J. Chem. Soc.*, 1930, 17.Mazzara, *Gazz. chim. ital.*, 1899, 29, i, 382.Bertozzi, Mazzara, *Gazz. chim. ital.*, 1900, 30, ii, 84.**4-Chloro-*m*-hydroxybenzoic Acid.**Cryst. from  $H_2O$ . M.p. 219-20°.*Me ether*: 4-chloro-*m*-methoxybenzoic acid. Needles. M.p. 215-16°.Beyer, *Rec. trav. chim.*, 1921, 40, 627.**6-Chloro-*m*-hydroxybenzoic Acid.**M.p. 178° (170-1°).  $k = 1.4 \times 10^{-3}$  at 25°.*Me ester*:  $C_8H_7O_3Cl$ . MW, 186.5. M.p. 100°. *Me ether*: 6-chloro-*m*-methoxybenzoic acid. Needles. M.p. 171°.Mazzara, *Gazz. chim. ital.*, 1899, 29, i, 378.Minaev, Ripper, *Chem. Zentr.*, 1924, I, 905.Beyer, *Rec. trav. chim.*, 1921, 40, 627.Minaev, *J. Russ. Phys. Chem. Soc.*, 1926, 58, 113.**2-Chloro-*p*-hydroxybenzoic Acid** $C_7H_5O_3Cl$ 

MW, 172.5

Needles from  $H_2O$ . M.p. 159°.Hodgson, Jenkinson, *J. Chem. Soc.*, 1927, 1742.**3-Chloro-*p*-hydroxybenzoic Acid.**Needles from  $H_2O$ . M.p. 169-70° (164-5°). Sol. EtOH,  $Et_2O$ , hot  $H_2O$ . Sublimes.*Me ester*:  $C_8H_7O_3Cl$ . MW, 186.5. Needles. M.p. 106-7°.*Et ester*:  $C_9H_9O_3Cl$ . MW, 200.5. M.p. 77-8°.*Amide*:  $C_7H_6O_2NCl$ . MW, 171.5. M.p. 180-2°.*Nitrile*:  $C_7H_4ONCl$ . MW, 153.5. M.p. 155°.*Me ether*: see 3-Chloroanisic Acid.Mazzara, Roland, *Gazz. chim. ital.*, 1899, 29, i, 386.Biltz, *Ber.*, 1904, 37, 4035.Leulier, Pinet, *Bull. soc. chim.*, 1927, 41, 1365.**3-Chloro-2-hydroxybenzophenone** $C_{13}H_9O_2Cl$ 

MW, 232.5

M.p. 93°. Sol.  $C_6H_6$ , hot EtOH, hot AcOH. Dil. alkalis  $\rightarrow$  yellow col.*Me ether*:  $C_{14}H_{11}O_2Cl$ . MW, 246.5. B.p. 173-4°/5 mm.Hayashi, *J. prakt. Chem.*, 1929, 123, 296.

**5-Chloro-2-hydroxybenzophenone.**

Yellow leaflets from MeOH. M.p. 95° (96-7°). Sol. C<sub>6</sub>H<sub>6</sub>, hot EtOH, hot AcOH.

*Me ether*: colourless needles from EtOH.Aq. M.p. 103-4° (101°).

Hayashi, *J. prakt. Chem.*, 1929, 123, 297.

Wittig, Bangert, Richter, *Ann.*, 1925, 446, 198.

Chakravarti, Bera, *J. Indian Chem. Soc.*, 1944, 21, 109.

Houtman, U.S.P. 2,419,553, (*Chem. Abstracts*, 1947, 41, 5150).

**4'-Chloro-3-hydroxybenzophenone.**

Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 154-5°.

*Me ether*: m.p. 38°. B.p. 140-5°/0.01 mm. *Oxime*: m.p. 138°.

King, King, Muir, *J. Chem. Soc.*, 1946, 5.

**2'-Chloro-4-hydroxybenzophenone.**

*Me ether*: C<sub>14</sub>H<sub>11</sub>O<sub>2</sub>Cl. MW, 246.5. Needles from ligroin. M.p. 84-5°.

Unger, *Ann.*, 1933, 504, 285.

**3-Chloro-4-hydroxybenzophenone.**

Yellow needles or prisms from H<sub>2</sub>O or Et<sub>2</sub>O. M.p. 176° (180-1°). Sol. EtOH, Et<sub>2</sub>O, alkalis.

*Me ether*: m.p. 98°.

Hayashi, *J. prakt. Chem.*, 1929, 123, 293.

Nencki, Stöber, *Ber.*, 1897, 30, 1771.

Blakey, Jones, Scarborough, *J. Chem. Soc.*, 1927, 2867.

**3'-Chloro-4-hydroxybenzophenone.**

Needles. M.p. 161° (169.5-171.0°). Sol. EtOH, AcOH, alkalis.

*Acetyl*: m.p. 108°.

Zincke, Siebert, *Ber.*, 1906, 39, 1935.

Stephenson, *J. Chem. Soc.*, 1942, 353.

**4'-Chloro-4-hydroxybenzophenone.**

*Me ether*: plates from EtOH. M.p. 127°.

Bergmann, Bindi, *Ber.*, 1931, 64, 1471.

**5-Chloro-2-hydroxybenzyl Alcohol.**

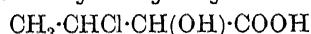
*See* 5-Chlorosaligenin.

**Chlorohydroxybutane.**

*See* Chlorobutyl Alcohol.

**Chloro-1-hydroxy-2-butylene.**

*See* Chlorocrotyl Alcohol.

**2-Chloro-1-hydroxybutyric Acid**

C<sub>4</sub>H<sub>7</sub>O<sub>3</sub>Cl MW, 138.5

Exists in two forms:

(a) Prisms. M.p. 86°. Very sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. *Na salt*: m.p. 172° decomp.

(b) Prisms. M.p. 125°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. This acid is also known as iso-2-chloro-1-hydroxybutyric acid.

(a) Melikoff, *Ann.*, 1886, 234, 205.

Kausler, *Monatsh.*, 1929, 53, 54, 122.

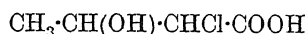
(b) Melikoff, Petrenko-Kritschenko, *Ann.*, 1891, 266, 368.

**3-Chloro-1-hydroxybutyric Acid**

C<sub>4</sub>H<sub>7</sub>O<sub>3</sub>Cl MW, 138.5

Plates from Et<sub>2</sub>O-pet. ether, or CHCl<sub>3</sub>. M.p. 58°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, hot CHCl<sub>3</sub>. Insol. pet. ether. Heat with H<sub>2</sub>O → 1:3-dihydroxybutyric acid.

Raske, *Ber.*, 1912, 45, 728.

**1-Chloro-2-hydroxybutyric Acid**

C<sub>4</sub>H<sub>7</sub>O<sub>3</sub>Cl MW, 138.5

Exists in two forms:

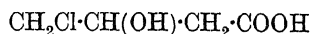
(a) Needles. M.p. 62-3°. Sublimes. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. NaHg → butyric acid.

(b) Prisms. M.p. 80-1°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. *Et ester*: C<sub>6</sub>H<sub>11</sub>O<sub>3</sub>Cl. MW, 166.5. B.p. 100-5°/15 mm.

Melikoff, *Ann.*, 1885, 224, 197.

Melikoff, Petrenko-Kritschenko, *Ann.*, 1891, 266, 359.

Darzens, Lévy, *Compt. rend.*, 1937, 204, 272.

**3-Chloro-2-hydroxybutyric Acid**

C<sub>4</sub>H<sub>7</sub>O<sub>3</sub>Cl MW, 138.5

*Me ester*: C<sub>5</sub>H<sub>9</sub>O<sub>3</sub>Cl. MW, 152.5. B.p. 104-5°/13 mm. D 1.259.  $n_D^{20}$  1.458.

*Et ester*: C<sub>6</sub>H<sub>11</sub>O<sub>3</sub>Cl. MW, 166.5. B.p. 122°/18 mm. CrO<sub>3</sub> → 3-chloroacetoacetic ethylester. *Acetyl*: b.p. 122°/9 mm. *Et ether*: C<sub>8</sub>H<sub>15</sub>O<sub>3</sub>Cl. MW, 194.5. B.p. 108°/20 mm. D 1.078.  $n_D^{17.5}$  1.436.

*Propyl ester*: C<sub>7</sub>H<sub>13</sub>O<sub>3</sub>Cl. MW, 180.5. B.p. 114-15°/8 mm. D 1.150.  $n_D^{20}$  1.453.

*n-Butyl ester*: C<sub>8</sub>H<sub>15</sub>O<sub>3</sub>Cl. MW, 194.5. B.p. 123.0-4.5°/4 mm. D 1.121.  $n_D^{20}$  1.453.

*Nitrile*: C<sub>4</sub>H<sub>6</sub>ONCl. MW, 119.5. B.p. 140°/20 mm. Decomp. on dist. at ord. press. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. *Acetyl*: b.p. 122°/14 mm.

Lespieau, *Bull. soc. chim.*, 1905, 33, 463.

Braun, *J. Am. Chem. Soc.*, 1930, 52, 3170.

Rambaud, *Compt. rend.*, 1935, 200, 2089.

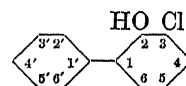
Tomita, Nakashima, *Z. physiol. Chem.*, 1935, 231, 199.

**Chlorohydroxydimethylbenzene.**

*See* Chloroxylenol.

**Chloro-2-hydroxy-2:3-dimethylbutane.**

*See* Chloro-2:3-dimethylbutanol-2.

**3-Chloro-2-hydroxydiphenyl**

C<sub>12</sub>H<sub>9</sub>OCl

MW, 204.5

*Benzoyl*: m.p. 86-7°.

*Salicyloyl*: m.p. 107°.

*Cinnamoyl*: m.p. 74.5-75°.

Dow, B.P. 396,251, (*Chem. Abstracts*, 1934, 28, 578).

Harris, Christiansen, *Chem. Abstracts*, 1935, 29, 6702.

### 5-Chloro-2-hydroxydiphenyl.

M.p. 46°. Germicide.

*Benzoyl*: m.p. 88.5°.

Dow, B.P. 396,251, (*Chem. Abstracts*, 1934, 28, 578).

Crauw, *Rec. trav. chim.*, 1931, 50, 753.

### 6-Chloro-3-hydroxydiphenyl.

M.p. 63°.

Crauw, *Rec. trav. chim.*, 1931, 50, 753.

### 3-Chloro-4-hydroxydiphenyl.

Prisms. M.p. 76-7.5° corr.

*Benzoyl*: m.p. 110-111° (95-7°).

2:4-Dinitrophenyl ether: m.p. 109-11°.

Colbert, Meigs, Mackin, *J. Am. Chem. Soc.*, 1934, 56, 202.

### 4'-Chloro-4-hydroxydiphenyl.

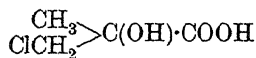
M.p. 146-7°.

Angellati, Gatti, *Gazz. chim. ital.*, 1929, 58, 633.

### β-Chloro-α-hydroxyethylbenzene.

See Styrene chlorohydrin.

### 2-Chloro-1-hydroxyisobutyric Acid



$\text{C}_4\text{H}_7\text{O}_3\text{Cl}$  MW, 138.5

Prisms from  $\text{Et}_2\text{O}$ . M.p. 110°. B.p. 230-5°. Sol.  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ .

*Me ester*:  $\text{C}_5\text{H}_9\text{O}_3\text{Cl}$ . MW, 152.5. B.p. 188-90°.  $D_{20}^{20}$  1.2295.  $n_D^{20}$  1.4440. *Acetyl*: b.p. 212-13°, 91-2°/13 mm.  $n_D^{24}$  1.4380.

*Et ester*:  $\text{C}_6\text{H}_{11}\text{O}_3\text{Cl}$ . MW, 166.5. B.p. 196-7°, 106°/30 mm.

*Propyl ester*:  $\text{C}_7\text{H}_{13}\text{O}_3\text{Cl}$ . MW, 180.5. B.p. 217°, 106-7°/16 mm.

*Benzyl ester*:  $\text{C}_{11}\text{H}_{13}\text{O}_3\text{Cl}$ . MW, 228.5. B.p. 185°/45 mm.

*Nitrile*: chloroacetone-cyanhydrin.  $\text{C}_4\text{H}_6\text{ONCl}$ . MW, 119.5. B.p. 110°/22 mm. Sol.  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ .  $D^{15}$  1.2027.  $n_D^{15}$  1.45362,  $n_D^{20}$  1.4520.

Melikow, *Ann.*, 1885, 234, 210.

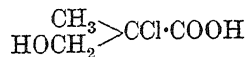
Fourneau, Tiffeneau, *Bull. soc. chim.*, 1914, 15, 23.

Gaind, *J. Indian Chem. Soc.*, 1937, 14, 13.

Bloomfield, Farmer, Hose, *J. Chem. Soc.*, 1933, 803.

Hurd, Rector, *J. Org. Chem.*, 1945, 10, 441.

### 1-Chloro-2-hydroxyisobutyric Acid



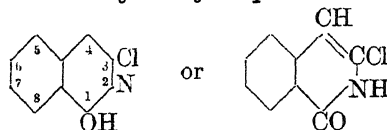
$\text{C}_4\text{H}_7\text{O}_3\text{Cl}$  MW, 138.5

Prisms from  $\text{C}_6\text{H}_6$ -pet. ether. M.p. 77°. Hygroscopic.

*Et ester*:  $\text{C}_6\text{H}_{11}\text{O}_3\text{Cl}$ . MW, 166.5. B.p. 201-2°. *Acetyl*: b.p. 216-17°.  $D_4^2$  1.1686.

Fourneau, Tiffeneau, *Bull. soc. chim.*, 1914, 15, 23.

### 3-Chloro-1-hydroxyisoquinoline



$\text{C}_9\text{H}_6\text{ONCl}$  MW, 179.5

Needles from  $\text{EtOH}$ . Aq. M.p. 219°. Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ ,  $\text{AcOH}$ ,  $\text{CHCl}_3$ . Mod. sol.  $\text{C}_6\text{H}_6$ .

*Me ether*:  $\text{C}_{10}\text{H}_8\text{ONCl}$ . MW, 193.5. Needles. M.p. 74°. Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ ,  $\text{AcOH}$ ,  $\text{CHCl}_3$ .

Spar. sol.  $\text{C}_6\text{H}_6$ . *Et ether*:  $\text{C}_{11}\text{H}_{10}\text{ONCl}$ . MW, 207.5. Needles. M.p. 37.5°.

*N-Me*: m.p. 111-12°.

Gabriel, *Ber.*, 1886, 19, 2360.

### 1-Chloro-3-hydroxyisoquinoline.

Needles from  $\text{EtOH}$ . M.p. 195-7° decomp. Sol.  $\text{NaOH}$ . Aq. Mod. sol. hot  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ ,  $\text{AcOH}$ . Spar. sol.  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ .

*Me ether*: m.p. 67°. Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ ,  $\text{AcOH}$ ,  $\text{C}_6\text{H}_6$ .

Gabriel, *Ber.*, 1886, 19, 2355.

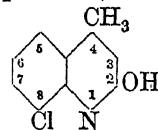
### 1-Chloro-4-hydroxyisoquinoline.

Needles from  $\text{AcOH}$ . M.p. 195-6°.

*Me ether*: m.p. 77°.

Gabriel, Colman, *Ber.*, 1900, 33, 986.

### 8-Chloro-2-hydroxylepidine (8-Chloro-2-hydroxy-4-methylquinoline)



$\text{C}_{10}\text{H}_8\text{ONCl}$  MW, 193.5

Needles from  $\text{EtOH}$ . M.p. 230°.

*Me ether*:  $\text{C}_{11}\text{H}_{10}\text{ONCl}$ . MW, 207.5. Prisms from ligroin. M.p. 122°.

Kermack, Muir, *J. Chem. Soc.*, 1933, 301.

### 2-Chloro-6-hydroxylepidine.

*Me ether*: yellowish needles from ligroin. M.p. 145° corr. Insol.  $\text{H}_2\text{O}$ .

*Et ether*:  $\text{C}_{12}\text{H}_{12}\text{ONCl}$ . MW, 221.5. Needles from  $\text{EtOH}$ . Aq. M.p. 123°. Slowly volatile in steam.

Backeberg, *J. Chem. Soc.*, 1933, 1032.

Rabe, Huntenburg, Schultze, Volger, *Ber.*, 1931, 64, 2492.



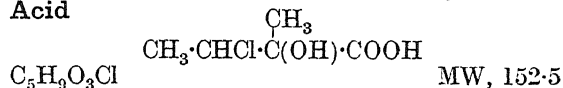
**2-Chloro-7(?)-hydroxylepidine.**

Yellow needles from MeOH or H<sub>2</sub>O. M.p. 214–15° decomp. Sol. dil. alkalis.

*Me ether*: cryst. from pet. ether. M.p. 112.5–13°.

Besthorn, Byranck, *Ber.*, 1898, 31, 800.

Späth, Brunner, *Ber.*, 1924, 57, 1246.

**2-Chloro-1-hydroxy-1-methylbutyric Acid**

Exists in two forms:

(a) Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 89°. Very sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.

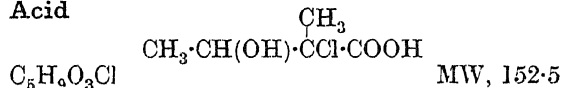
(b) Plates from C<sub>6</sub>H<sub>6</sub>. M.p. 114°.

*Amide*: m.p. 137°.

Melikow, Petrenko-Kritschenko, *Ann.*, 1890, 257, 117, 123.

Bloomfield, Farmer, Hose, *J. Chem. Soc.*, 1933, 804.

Fourneau, Maréchal, *Bull. soc. chim.*, 1945, 12, 990.

**1-Chloro-2-hydroxy-1-methylbutyric Acid**

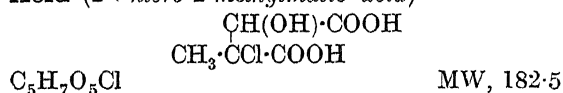
Exists in two forms:

(a) Prisms. M.p. 103°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.  
(b) Prisms. M.p. 111–12°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.

(a) Melikow, Petrenko-Kritschenko, *Ann.*, 1890, 257, 119.

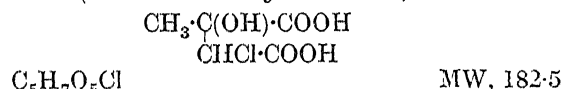
(b) Melikow, *Ann.*, 1886, 234, 224.

Bloomfield, Farmer, Hose, *J. Chem. Soc.*, 1933, 804.

**1-Chloro-2-hydroxy-1-methylsuccinic Acid (2-Chloro-2-methylmalic acid)**

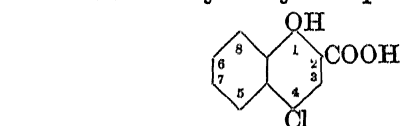
Plates or leaflets. M.p. 160–2° decomp. Sol. H<sub>2</sub>O, Et<sub>2</sub>O. NaHg → 2-methylmalic acid.

Melikow, Feldmann, *Ann.*, 1889, 253, 91.

**1-Chloro-2-hydroxy-2-methylsuccinic Acid (2-Chloro-1-methylmalic acid)**

Prisms from Et<sub>2</sub>O–C<sub>6</sub>H<sub>6</sub>. M.p. 139°.

Gottlieb, *Ann.*, 1871, 160, 102.

**4-Chloro-1-hydroxy-2-naphthoic Acid**

$\text{C}_{11}\text{H}_7\text{O}_3\text{Cl}$  MW, 222.5

Needles from EtOH or AcOH. M.p. 234° (229°). Sol. EtOH, Me<sub>2</sub>CO, AcOH. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. At 170–80° in presence of little aniline or nitrobenzene → 4-chloro-1-naphthol.

*Me ester*: C<sub>12</sub>H<sub>9</sub>O<sub>3</sub>Cl. MW, 236.5. M.p. 120–1°.

*Et ester*: C<sub>13</sub>H<sub>11</sub>O<sub>3</sub>Cl. MW, 250.5. M.p. 92–3°.

*Phenyl ester*: C<sub>17</sub>H<sub>11</sub>O<sub>3</sub>Cl. MW, 298.5. M.p. 103–4°.

*β-Naphthyl ester*: m.p. 186–7°.

*Anilide*: m.p. 180–1°.

*o-Toluidide*: m.p. 148–9°.

*m-Toluidide*: m.p. 188–9°.

*p-Toluidide*: m.p. 143–4°.

*Acetyl*: m.p. 102°.

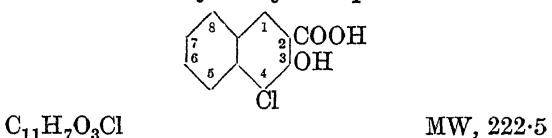
Jadher, Rao, Hirwe, *J. Indian Chem. Soc.*, 1936, 13, 609.

Weil, Heerdt, *Ber.*, 1922, 55, 228.

Reissert, *Ber.*, 1911, 44, 866.

Weil, *Ber.*, 1911, 44, 3061.

Airan, Shah, *Journal of the University of Bombay*, 1942, 10, 131, (*Chem. Abstracts*, 1943, 37, 632).

**4-Chloro-3-hydroxy-2-naphthoic Acid**

Yellow needles. M.p. 231°.

*Me ester*: yellow cryst. M.p. 116°.

*Chloride*: C<sub>11</sub>H<sub>6</sub>O<sub>2</sub>Cl<sub>2</sub>. MW, 241. M.p. 128°.

*Amide*: C<sub>11</sub>H<sub>8</sub>O<sub>2</sub>NCl. MW, 221.5. M.p. 225°.

*Acetyl*: m.p. 186°.

Ioffe, Smolyanitzkaya, *J. Gen. Chem. U.S.S.R.*, 1935, 5, 1205.

Gradenwitz, *Ber.*, 1894, 27, 2622.

Robertson, *J. prakt. Chem.*, 1893, 48, 535.

Airan, Shah, *Journal of the University of Bombay*, 1942, 10, 131, (*Chem. Abstracts*, 1943, 37, 632).

**5-Chloro-3-hydroxy-2-naphthoic Acid.**

M.p. 250°.

I.G., D.R.P. 564,128, (*Chem. Zentr.*, 1933, II, 446).

**6-Chloro-3-hydroxy-2-naphthoic Acid.**

M.p. 277–8°.

I.G., D.R.P. 564,128, (*Chem. Zentr.*, 1933, II, 446).

**7-Chloro-3-hydroxy-2-naphthoic Acid.**

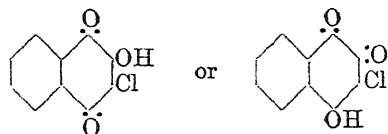
M.p. 260°.

I.G., D.R.P. 564,128, (*Chem. Zentr.*, 1933, II, 446).

**7-Chloro-4-hydroxy-2-naphthoic Acid.**

Pale yellow prisms from AcOH. M.p. 285–7°.

Haworth, Jones, Way, *J. Chem. Soc.*, 1943, 10.

**3-Chloro-2-hydroxy-1 : 4-naphthoquinone (3-Chloro-4-hydroxy-1 : 2-naphthoquinone)**

$C_{10}H_5O_3Cl$  MW, 208.5

Yellow needles from EtOH. M.p. 215°. Sublimes. Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ , hot  $H_2O$ . Acetyl: yellow needles from EtOH. M.p. 98°.

1-Oxime: yellow leaflets from AcOH. Decomp. at 178° (187–8°).

1-Imine: brownish-red needles from EtOH. M.p. 179–80° decomp.

4-Imine: dark-coloured leaflets. M.p. about 260°.

Et ether:  $C_{12}H_5O_3Cl$ . MW, 236.5. Two forms: (a) m.p. 97–8°; (b) m.p. 149–50°.

Zincke, Gerland, *Ber.*, 1887, 20, 3221.

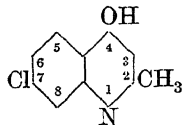
Zincke, Kegel, *Ber.*, 1888, 21, 1045, 3552.

Zincke, Schmunk, *Ann.*, 1890, 257, 142, 153.

Graebe, *Ann.*, 1869, 149, 5, 14.

**2-Chloro-1-hydroxy-2-phenylpropionic Acid.**

See Phenyl-2-chlorolactic Acid.

**7-Chloro-4-hydroxyquinaldine (7-Chloro-4-hydroxy-2-methylquinoline)**

$C_{10}H_8ONCl$  MW, 193.5

Cryst. from EtOH.Aq. M.p. 313.5–315.0°.

Price, Leonard, Reitsema, *J. Am. Chem. Soc.*, 1946, 68, 1256.

**8-Chloro-4-hydroxyquinaldine (8-Chloro-4-hydroxy-2-methylquinoline).**

Cryst. from EtOH.Aq. M.p. 229–30°.

Krahler, Burger, *J. Am. Chem. Soc.*, 1942, 64, 2417.

**4-Chloro-6-hydroxyquinaldine (4-Chloro-6-hydroxy-2-methylquinoline).**

Me ether:  $C_{11}H_{10}ONCl$ . MW, 207.5. Cryst. from EtOH.Aq. M.p. 100°. B.p. 295–302°. Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ . Sol. dil. acids.

Conrad, Limpach, *Ber.*, 1888, 21, 1651.

**4-Chloro-7-hydroxyquinaldine (4-Chloro-7-hydroxy-2-methylquinoline).**

Me ether: m.p. 81–2°. Volatile in steam.

Späth, Brunner, *Ber.*, 1924, 57, 1249.

**5-Chloro-8-hydroxyquinaldine (5-Chloro-8-hydroxy-2-methylquinoline).**

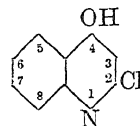
Needles from MeOH. M.p. 68°.

Me ether: cryst. from ligroin. M.p. 93°. B.p. 140°/25 mm. Picrate: yellow cryst. from toluene. M.p. 228°. Methiodide: yellow needles from MeOH. M.p. 222°.

Weizmann, Bograchov, *J. Am. Chem. Soc.*, 1947, 69, 1222.

**Chloro-2-hydroxyquinoline.**

See Chlorocarbostyryl.

**2-Chloro-4-hydroxyquinoline**

$C_9H_6ONCl$  MW, 179.5

Needles from EtOH. M.p. 189–90°.

Buchmann, Hamilton, *J. Am. Chem. Soc.*, 1942, 64, 1357.

**6-Chloro-5-hydroxyquinoline.**

Needles. M.p. 183–4°. Sublimes.

Methiodide: m.p. 199–201°.

Claus, Schedler, *J. prakt. Chem.*, 1894, 49, 365.

**2-Chloro-6-hydroxyquinoline.**

Me ether:  $C_{10}H_8ONCl$ . MW, 193.5. M.p. 107–8° (92°).

Fourneau, Tréfouel, Tréfouel, Benoit, *Chem. Abstracts*, 1932, 26, 1592.

Magidson, Rubtsov, *Chem. Abstracts*, 1938, 32, 564.

**3-Chloro-6-hydroxyquinoline.**

Me ether: needles from EtOH.Aq. M.p. 74°.

Blackie, Perkin, *J. Chem. Soc.*, 1924, 125, 325.

**4-Chloro-6-hydroxyquinoline.**

Cryst. from EtOH.Aq. M.p. 208°.

Me ether: needles. M.p. 79°. Hydrochloride: needles. M.p. 191°.  $B.HAuCl_4$ : m.p. 177°.

Hirsch, *Monatsh.*, 1896, 17, 336.

Magidson, Rubtsov, *Chem. Abstracts*, 1938, 32, 564.

Ramsey, Cretcher, *J. Am. Chem. Soc.*, 1947, 69, 1659.

**5-Chloro-6-hydroxyquinoline.**

Needles from EtOH. M.p. 198°. Sublimes.

Acetyl: m.p. 102°.

Et ether:  $C_{11}H_{10}ONCl$ . MW, 207.5. Yellow needles +  $1H_2O$  from EtOH. M.p. 75°. Methiodide: cryst. +  $1H_2O$  from  $H_2O$ . M.p. 187° decomp.

Zincke, Müller, *Ann.*, 1891, 264, 211

Christensen, *Chem. Zentr.*, 1915, II, 543.

Howitz, Witte, *Ber.*, 1905, 38, 1261.

Ghosh, Lasker, Banerjee, *J. Indian Chem. Soc.*, 1944, 21, 352.

**3-Chloro-7-hydroxyquinoline.**

*Me ether*:  $C_{10}H_8ONCl$ . MW, 193.5. M.p. 91°. Dil.  $H_2SO_4 \rightarrow$  blue fluor. sol.

Kermack, Perkin, Robinson, *J. Chem. Soc.*, 1922, 121, 1882.

**2-Chloro-8-hydroxyquinoline (2-Chloro-quinosol).**

*Me ether*: plates from  $Et_2O$ . M.p. 82°.

Fischer, *Ber.*, 1902, 35, 3680.

**3-Chloro-8-hydroxyquinoline.**

*Me ether*: needles from  $H_2O$ . M.p. 84.5°.

Blackie, Perkin, *J. Chem. Soc.*, 1924, 125, 328

**5-Chloro-8-hydroxyquinoline.**

Needles. M.p. 129–30° (125°, 122–3°).

*B, HCl*: yellow needles. M.p. 256–8° (253°).

Hebebrand, *Ber.*, 1888, 21, 2979.

Ghosh, Lasker, Banerjee, *J. Indian Chem. Soc.*, 1944, 21, 354.

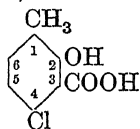
Bose, *J. Indian Chem. Soc.*, 1945, 22, 169.

Sen-Gupta, *ibid.*, 171.

**7-Chloro-8-hydroxyquinoline.**

M.p. 146°. Sublimes.

Claus, Giwartovsky, *J. prakt. Chem.*, 1896, 54, 388.

**4-Chloro-2-hydroxy-*m*-toluic Acid (4-Chloro-*o*-cresotic acid)**

$C_8H_7O_3Cl$  MW, 186.5  
Needles from  $C_6H_6$ . M.p. 155°.  $FeCl_3 \rightarrow$  violet col.

Laska, Haller, U.S.P. 1,846,126, (*Chem. Abstracts*, 1932, 26, 2604).

I.G., D.R.P. 527,395, (*Chem. Abstracts*, 1931, 25, 4558).

**6-Chloro-4-hydroxy-*m*-toluic Acid (6-Chloro-*p*-cresotic acid).**

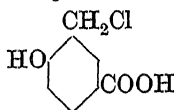
Cryst. from  $EtOH.Aq$ . M.p. 210–12°.  $FeCl_3 \rightarrow$  violet col.

Laska, Haller, U.S.P. 1,846,126, (*Chem. Abstracts*, 1932, 26, 2604).

I.G., D.R.P. 527,395, (*Chem. Abstracts*, 1931, 25, 4558).

 **$\alpha$ -Chloro-4-hydroxy-*m*-toluic Acid.**

See 5-Chloromethyl-salicylic Acid.

 **$\alpha$ -Chloro-6-hydroxy-*m*-toluic Acid (4-Hydroxy-3-chloromethylbenzoic acid)**

$C_8H_7O_3Cl$  MW, 186.5

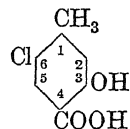
Needles from  $AcOH$ . M.p. 204°.

*Me ester*:  $C_9H_9O_3Cl$ . MW, 200.5. M.p. 139°.

Dict. of Org. Comp.—I.

*Et ester*:  $C_{10}H_{11}O_3Cl$ . MW, 214.5. Needles. M.p. 119.5°.

Bayer, D.R.P. 113,723, (*Chem. Zentr.*, 1900, II, 795).

**6-Chloro-3-hydroxy-*p*-toluic Acid (p-Chloro-*m*-cresotic acid)**

$C_8H_7O_3Cl$  MW, 186.5

Cryst. from  $EtOH$ . M.p. 206–7°.  $FeCl_3 \rightarrow$  bluish-violet col. Powerful antiseptic.

*Me ester*:  $C_9H_9O_3Cl$ . MW, 200.5. Leaflets. M.p. 55°.

*Et ester*:  $C_{10}H_{11}O_3Cl$ . MW, 214.5. Leaflets. M.p. 53°. Volatile in steam.

*Propyl ester*:  $C_{11}H_{13}O_3Cl$ . MW, 228.5. Prisms. M.p. 21°. B.p. 168–70°/18 mm.

*Phenyl ester*:  $C_{14}H_{11}O_3Cl$ . MW, 262.5. Needles from  $MeOH$ . M.p. 88°.

$\alpha$ -*Naphthyl ester*: prisms from  $Me_2CO$ . M.p. 137.5°.

*Chloride*:  $C_8H_6O_2Cl_2$ . MW, 205. Needles from pet. ether. M.p. 48°.

*Amide*:  $C_8H_8O_2NCl$ . MW, 185.5. M.p. 239–40°.

*Anilide*: plates from  $EtOH$ . M.p. 222°.

*Me ether*:  $C_9H_9O_3Cl$ . MW, 200.5. Prisms from  $EtOH$ . M.p. 130°. *Me ester*:  $C_{10}H_{11}O_3Cl$ . MW, 214.5. Yellow needles from  $MeOH$ . M.p. 53–4°. B.p. 160°/14 mm.

*Et ether*:  $C_{10}H_{11}O_3Cl$ . MW, 214.5. Needles from  $H_2O$ . M.p. 143°. *Me ester*:  $C_{11}H_{13}O_3Cl$ . MW, 228.5. Yellow needles from  $MeOH.Aq$ . M.p. 54°.

*Propyl ether*:  $C_{11}H_{13}O_3Cl$ . MW, 228.5. Prisms from  $CCl_4$ . M.p. 112°. *Me ester*:

$C_{12}H_{15}O_3Cl$ . MW, 242.5. B.p. 188°/24 mm.

*Isopropyl ether*: prisms from  $H_2O$ . M.p. 121°. *Me ester*: b.p. 173°/19 mm.

*Butyl ether*:  $C_{12}H_{15}O_3Cl$ . MW, 242.5. Needles from ligroin. M.p. 96.5°. *Me ester*:

$C_{13}H_{17}O_3Cl$ . MW, 256.5. B.p. 194°/20 mm.

*Isocamyl ether*:  $C_{13}H_{17}O_3Cl$ . MW, 256.5. Leaflets from ligroin. M.p. 94°. *Me ester*:

$C_{14}H_{19}O_3Cl$ . MW, 270.5. B.p. 197°/18 mm.

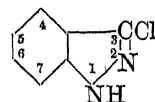
*Acetyl*: needles from  $CHCl_3$ . M.p. 146°.

Gattermann, *Ber.*, 1893, 26, 1851.

Walther, Zipper, *J. prakt. Chem.*, 1915, 91, 380.

 **$\alpha$ -Chloro-4-hydroxy-*m*-toluic Aldehyde.**

See 5-Chloromethyl-salicylaldehyde.

**3-Chloroindazole**

$C_7H_5N_2Cl$

MW, 152.5

Needles from  $H_2O$ . M.p.  $148^\circ$ . Sol. EtOH, hot  $H_2O$ . Sublimes.

1-Acetyl: needles from pet. ether. M.p.  $67^\circ$ .

2-Benzoyl: prisms from pet. ether. M.p.  $47.5^\circ$ .

1-Me:  $C_8H_7N_2Cl$ . MW, 166.5. B.p.  $268.5^\circ/754$  mm.,  $128-9^\circ/10$  mm. Picrate: m.p.  $86^\circ$ .

2-Me: b.p.  $120-1^\circ/10$  mm. Picrate: m.p.  $129-31^\circ$ .

1-Et:  $C_9H_9N_2Cl$ . MW, 180.5. B.p.  $129^\circ/10$  mm. Picrate: m.p.  $66^\circ$ .

Auwers, Lange, *Ber.*, 1922, 55, 1158.

Auwers, Hügel, Ungemach, *Ann.*, 1937, 527, 295.

#### 4-Chloroindazole.

Needles from toluene. M.p.  $156^\circ$ . Sol. hot  $H_2O$ . Spar. sol. cold dil. acids.

1-Acetyl: needles from EtOH. M.p.  $66-7^\circ$ .

2-Acetyl: needles from Et<sub>2</sub>O. M.p.  $93-4^\circ$ .

1-o-Nitrobenzoyl: yellowish cryst. from toluene. M.p.  $174^\circ$ .

2-o-Nitrobenzoyl: m.p.  $192-4^\circ$ .

1-p-Nitrobenzoyl: m.p.  $181-2^\circ$ .

2-p-Nitrobenzoyl: m.p.  $154^\circ$ .

Auwers, Demuth, *Ann.*, 1927, 451, 293.

#### 5-Chloroindazole.

Exists in two forms:

(a) *Stable form.*

Needles. M.p.  $143-4^\circ$ . Sol. EtOH, Et<sub>2</sub>O, AcOH,  $C_6H_6$ .

Acetyl deriv.: needles from MeOH. M.p.  $144-5^\circ$ .

Picrate: cryst. from  $C_6H_6$ . M.p.  $194-5^\circ$ .

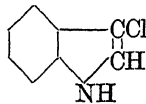
(b) *Labile form.*

Needles. M.p.  $119-20^\circ$ . Sol. Et<sub>2</sub>O, Me<sub>2</sub>CO, EtOH, AcOH,  $C_6H_6$ .

Acetyl deriv.: needles from Et<sub>2</sub>O. M.p.  $119-20^\circ$ .

Auwers, Lange, *Ber.*, 1922, 55, 1159.

#### 3-Chloroindole



$C_8H_7NCl$

MW, 151.5

Silvery scales from pet. ether. M.p.  $94-5^\circ$  decomp. Green sol. in conc.  $H_2SO_4$ . Dil. HCl  $\rightarrow$  oxindole.

N-Benzoyl: prisms from EtOH. M.p.  $97-9^\circ$ .

Mazzaro, Borgo, *Gazz. chim. ital.*, 1905, 35, ii, 563.

Weissgerber, Klemm, *Ber.*, 1913, 46, 655.

#### Chloroiodoacetic Acid

$ClCHI \cdot COOH$

$C_2H_2O_2ClI$

MW, 220.5

*dl.*

Leaflets. M.p.  $90^\circ$ . Easily sol.  $H_2O$ . Mod. sol. pet. ether.

Phenyl ester:  $C_8H_6O_2ClI$ . MW, 296.5. M.p.  $110^\circ$ .

Amide: chloroiodoacetamide.  $C_2H_3ONClI$ . MW, 219.5. Needles from  $H_2O$  or  $C_6H_6$ . M.p.  $140^\circ$ .

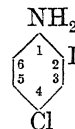
Anilide: chloroiodoacetanilide. Needles from  $H_2O$  or  $C_6H_6$ . M.p.  $142^\circ$ .

$NH_4$  salt: *l*-form. Needles. M.p.  $149-50^\circ$  decomp.  $[\alpha]_D - 25.1^\circ$  in  $H_2O$ . *d*-form:  $[\alpha]_D + 23.5^\circ$  in  $H_2O$ .

McMath, Read, *J. Chem. Soc.*, 1927, 538.

Crompton, Carter, *J. Chem. Soc.*, 1923, 123, 576.

#### 4-Chloro-2-iodoaniline



$C_6H_5NClI$

MW, 253.5

Cryst. from  $H_2O$ . M.p.  $46^\circ$ . Volatile in steam. Spar. sol.  $H_2O$ .

Hydrochloride: m.p.  $202^\circ$  decomp.

N-Acetyl: 4-chloro-2-iodoacetanilide. Cryst. from EtOH. M.p.  $150^\circ$ .

N-Benzoyl: m.p.  $145^\circ$ .

Dains, Vaughan, Janney, *J. Am. Chem. Soc.*, 1918, 40, 930.

Dains, Magers, *J. Am. Chem. Soc.*, 1930, 52, 1573.

#### 5-Chloro-3-iodoaniline.

Plates. M.p.  $69-8^\circ$ . Volatile in steam.

Körner, Contardi, *Atti accad. Lincei*, 1913, 22, (i), 835.

#### 6-Chloro-3-iodoaniline.

M.p.  $61.6^\circ$ .

Kraay, *Rec. trav. chim.*, 1930, 49, 1082.

#### 2-Chloro-4-iodoaniline.

Prisms from EtOH. M.p.  $73^\circ$ .

Hydrochloride: m.p.  $190^\circ$  decomp.

Picrate: needles from  $H_2O$ . M.p.  $132^\circ$ .

N-Acetyl: 2-chloro-4-iodoacetanilide. M.p.  $144^\circ$ .

N-Benzoyl: m.p.  $165^\circ$ .

Caldwell, Werner, *J. Chem. Soc.*, 1907, 91, 246.

Dains, Vaughan, Janney, *J. Am. Chem. Soc.*, 1918, 40, 933.

#### 3-Chloro-4-iodoaniline.

Cryst. from EtOH.Aq. M.p.  $65^\circ$ .

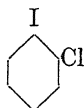
Hydrochloride: m.p.  $180^\circ$  decomp.

N-Acetyl: 3-chloro-4-iodoacetanilide. Needles from EtOH. M.p.  $170^\circ$ .

N-Benzoyl: m.p.  $144^\circ$ .

Dains, Vaughan, Janney, *J. Am. Chem. Soc.*, 1918, 40, 930.

## o-Chloriodobenzene



$C_6H_4ClI$  MW, 238.5

Colourless, viscous liq. B.p.  $235^\circ$ ,  $110^\circ/16$  mm.  
 $D_4^{25}$  1.9515.  $n_D^{25}$  1.6331. Volatile in steam.

Holleman, *Rec. trav. chim.*, 1915, **34**, 223.

## m-Chloriodobenzene.

B.p.  $230^\circ$ .

Klages, Liecke, *J. prakt. Chem.*, 1900, **61**, 307.

## p-Chloriodobenzene.

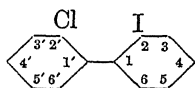
Colourless leaflets from EtOH. M.p.  $57^\circ$ .  
 B.p.  $227^\circ$ .

Datta, Chatterjee, *J. Am. Chem. Soc.*, 1919, **41**, 293.

Gomberg, Cone, *Ber.*, 1906, **39**, 3281.

Birkenbach, Goubeau, *Ber.*, 1932, **65**, 399.

## 2'-Chloro-2-iododiphenyl



$C_{12}H_8ClI$  MW, 314.5

Cryst. from EtOH. M.p.  $63-4^\circ$ .

Mascarelli, Gatti, *Gazz. chim. ital.*, 1931, **61**, 795.

## 4'-Chloro-2-iododiphenyl.

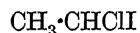
B.p.  $178^\circ/10$  mm.  $n_D^{25}$  1.6622.

Bradsher, Wissow, *J. Am. Chem. Soc.*, 1946, **68**, 404.

## 4'-Chloro-4-iododiphenyl.

Pale yellow flakes from EtOH.Aq. M.p.  $147-8^\circ$ .

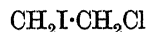
Angeletti, Gatti, *Gazz. chim. ital.*, 1928, **58**, 635.

1-Chloro-1-iodoethane (*Ethylidene chloroiodide*)

$C_2H_4ClI$  MW, 190.5

B.p.  $117-19^\circ$ .  $D^{10}$  2.054.

Simpson, *Bull. soc. chim.*, 1879, **31**, 411.

1-Chloro-2-iodoethane (*Ethylene chloroiodide*)

$C_2H_4ClI$  MW, 190.5

M.p.  $-16^\circ$ . B.p.  $140^\circ$ .  $D_0^{15}$  2.13363. Moist  $Ag_2O$  at  $200^\circ \rightarrow$  ethylene glycol. Alc. KOH  $\rightarrow$  vinyl chloride.

Simpson, *Ann.*, 1863, **127**, 372.

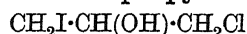
## 1-Chloro-2-iodoethylene.

See Acetylene chloroiodide.

## 5-Chloro-7-iodo-8-hydroxyquinoline.

See Vioform.

## 1-Chloro-3-iodoisopropyl Alcohol



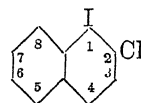
$C_3H_6OClI$  MW, 220.5

B.p.  $226^\circ$ . Insol.  $H_2O$ .  $D^{10}$  2.06. KOH  $\rightarrow$  epichlorohydrin.

Kling, *Compt. rend.*, 1903, **137**, 756.

Blanchard, *Bull. soc. chim.*, 1927, **41**, 824.

## 2-Chloro-1-iodonaphthalene



$C_{10}H_6ClI$  MW, 288.5

Leaflets from MeOH or EtOH. M.p.  $63^\circ$ .

Beattie, Whitmore, *J. Chem. Soc.*, 1934, **51**.

## 4-Chloro-1-iodonaphthalene.

Leaflets or needles from MeOH. M.p.  $54-5^\circ$ .  
 Volatile in steam.

Beattie, Whitmore, *J. Chem. Soc.*, 1934, **51**.

Jacobs *et al.*, *J. Org. Chem.*, 1946, **11**, 223.

## 5-Chloro-1-iodonaphthalene.

Needles. M.p.  $89^\circ$ .

Beattie, Whitmore, *J. Chem. Soc.*, 1934, **51**.

## 7-Chloro-1-iodonaphthalene.

Needles. M.p.  $55-5^\circ$ .

Beattie, Whitmore, *J. Chem. Soc.*, 1934, **52**.

## 8-Chloro-1-iodonaphthalene.

Cryst. from MeOH. M.p.  $80-5^\circ$  ( $80-2^\circ$ ). B.p.  $196-8^\circ/16$  mm.

Beattie, Whitmore, *J. Chem. Soc.*, 1934, **51**.

Willstaedt, Scheiber, *Ber.*, 1934, **67**, 466.

## 1-Chloro-2-iodonaphthalene.

Prisms from EtOH. M.p.  $83-4^\circ$ .

Mascarelli, Martinelli, *Gazz. chim. ital.*, 1915, **45**, ii, 206.

## 4-Chloro-2-iodonaphthalene.

M.p.  $58^\circ$ .

Hodgson, Hathway, *J. Chem. Soc.*, 1944, **538**.

## 5-Chloro-2-iodonaphthalene.

Needles. M.p.  $57^\circ$ .

Beattie, Whitmore, *J. Chem. Soc.*, 1934, **51**.

## 6-Chloro-2-iodonaphthalene.

Plates from MeOH. M.p.  $141^\circ$ .

Beattie, Whitmore, *J. Chem. Soc.*, 1934, **52**.

## 7-Chloro-2-iodonaphthalene.

Pale yellow leaflets. M.p.  $129^\circ$ .

Beattie, Whitmore, *J. Chem. Soc.*, 1934, **52**.

## 8-Chloro-2-iodonaphthalene.

Needles. M.p.  $39^\circ$ .

Beattie, Whitmore, *J. Chem. Soc.*, 1934, **51**.

**2-Chloro-1-iodopropane** (*Propylene chloroiodide*)

$\text{C}_3\text{H}_6\text{ClI}$  MW, 204.5

B.p. 148–9°.  $D^{25}$  1.889. Conc. HI  $\longrightarrow$  isopropyl iodide. Alc. KOH  $\longrightarrow$   $\text{CH}_2\cdot\text{CCl}\cdot\text{CH}_3$ .

Michael, *J. prakt. Chem.*, 1899, 60, 409.

**3-Chloro-1-iodopropane** (*Trimethylene chloroiodide*)

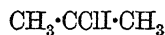
$\text{C}_3\text{H}_6\text{ClI}$  MW, 204.5

B.p. 170–2°, 60.8°/15 mm., 57°/10 mm.  $D^{20}$  1.904.  $n_D^{20}$  1.5472.

Henry, *Bull. soc. chim.*, 1897, 17, 93.

Case, *J. Am. Chem. Soc.*, 1933, 55, 2929.

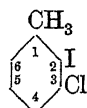
Hass, Huffmann, *J. Am. Chem. Soc.*, 1941, 63, 1233.

**2-Chloro-2-iodopropane** (*Isopropylidene chloroiodide*)

$\text{C}_3\text{H}_6\text{ClI}$  MW, 204.5

B.p. 110–30°/10 mm. Decomp. on dist. in air.  $D^0$  1.824. Moist  $\text{Ag}_2\text{O}$   $\longrightarrow$  acetone.

Oppenheim, *Ann.*, 1830–4, 6, 359, (*Suppl.*).

**3-Chloro-2-iodotoluene**

$\text{C}_7\text{H}_6\text{ClI}$  MW, 252.5

M.p. – 26°. B.p. 130–45°/25.5 mm.  $n^{23}$  1.608.

Long, Dains, *Chem. Abstracts*, 1932, 26, 427.

**4-Chloro-2-iodotoluene.**

M.p. – 25°. B.p. 242–3°, 133.5–137.5°/7.2 mm.  $D^{15}$  1.8358.  $n^{23}$  1.620.

Wroblewski, *Ann.*, 1873, 168, 210.

Long, Dains, *Chem. Abstracts*, 1932, 26, 427.

**5-Chloro-2-iodotoluene.**

M.p. – 21°. B.p. 240°, 110–25°/5.5 mm.  $D^{17}$  1.702.  $n^{23}$  1.616.

Beilstein, Kuhlberg, *Ann.*, 1870, 156, 82.

Long, Dains, *Chem. Abstracts*, 1932, 26, 427.

**6-Chloro-2-iodotoluene.**

B.p. 132–3°/25 mm.  $D_{20}^{20}$  1.844.

Cohen, Miller, *J. Chem. Soc.*, 1904, 85, 1627.

Long, Dains, *Chem. Abstracts*, 1932, 26, 427.

**2-Chloro-3-iodotoluene.**

M.p. – 12°. B.p. 110–25°/11 mm.  $D^{15}$  1.657.  $n^{23}$  1.608.

Long, Dains, *Chem. Abstracts*, 1932, 26, 427.

Caldwell, Werner, *J. Chem. Soc.*, 1907, 91, 249.

**4-Chloro-3-iodotoluene.**

M.p. – 10°. B.p. 249°, 120–5°/14.5 mm.  $D^{15}$  1.7940.  $n^{23}$  1.614.

Ullmann, Glenck, *Ber.*, 1916, 49, 2494.

Long, Dains, *Chem. Abstracts*, 1932, 26, 427.

**5-Chloro-3-iodotoluene.**

M.p. 0° (– 12°). B.p. 138–40°/26 mm., 120–42°/22 mm.  $D^{15}$  1.7682.  $n^{23}$  1.609.

McAlister, Kenner, *J. Chem. Soc.*, 1928, 1915.

Long, Dains, *Chem. Abstracts*, 1932, 26, 427.

**6-Chloro-3-iodotoluene.**

M.p. 20°. B.p. 240°, 108–23°/9.5 mm.  $D^{15}$  1.7857.  $n^{23}$  1.618.

Wroblewski, *Ann.*, 1873, 168, 211.

Long, Dains, *Chem. Abstracts*, 1932, 26, 427.

**2-Chloro-4-iodotoluene.**

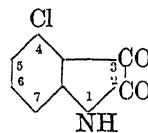
M.p. 8°. B.p. 136.5–147.6°/16 mm.  $n^{23}$  1.624.

Long, Dains, *Chem. Abstracts*, 1932, 26, 427.

**3-Chloro-4-iodotoluene.**

M.p. – 12°. B.p. 120–5°/10 mm.  $D^{15}$  1.8364.  $n^{23}$  1.618.

Long, Dains, *Chem. Abstracts*, 1932, 26, 427.

**4-Chloroisatin**

$\text{C}_8\text{H}_4\text{O}_2\text{NCl}$  MW, 181.5

Yellow cryst. (red needles from AcOH). M.p. 254°, (256.5–258.0°).

Grandmougin, Seyder, *Ber.*, 1914, 47, 2368.

Kalle, D.R.P. 254,468, (*Chem. Zentr.*, 1913, I, 357).

Sandmeyer, *Helv. Chim. Acta*, 1919, 2, 241.

Senear et al., *J. Am. Chem. Soc.*, 1946, 68, 2695.

**5-Chloroisatin.**

Orange-yellow prisms. M.p. 247° decomp. Spar. sol. EtOH, hot  $\text{H}_2\text{O}$ . Dark red sols. in caustic alkalis.

3-Oxime: pale yellow needles. M.p. 252°.

3-Phenylhydrazone: needles. M.p. 250° decomp.

3-Semicarbazone: yellow needles from EtOH. Decomp. at 230°.

3-o-Tolylhydrazone: orange-yellow needles. M.p. 273-4°.

3-p-Tolylhydrazone: orange-yellow needles from EtOH. M.p. 253°.

Heller, *Ber.*, 1910, **43**, 2895.

Hofmann, *Ann.*, 1845, **53**, 12.

Schunck, Marchlewski, *Ber.*, 1895, **28**, 545.

### 6-Chloroisatin.

Orange plates from AcOH. M.p. 258-9°.

Senear *et al.*, *J. Am. Chem. Soc.*, 1946, **68**, 2695.

### 7-Chloroisatin.

Reddish-brown cryst. M.p. 248° (175°).

Sandmeyer, *Helv. Chim. Acta*, 1919, **2**, 241.

Wahl, Féricéan, *Ann. chim.*, 1928, **9**, 284.

### Chloroisobutane.

See Isobutyl chloride and tert.-Butyl chloride.

2-Chloroisobutyl Alcohol (2-Chloro-2-methylpropanol-1)

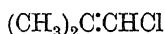


$\text{C}_4\text{H}_9\text{OCl}$  MW, 108.5

B.p. 133° part. decomp.  $\text{H}_2\text{O}$  or dil. aq. carbonate  $\rightarrow$  isobutyraldehyde.

Michael, Leighton, *Ber.*, 1906, **39**, 2789.

### 1-Chloroisobutylene



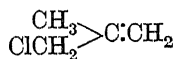
$\text{C}_4\text{H}_7\text{Cl}$  MW, 90.5

B.p. 68-9°/775 mm.  $D_4^0$  0.9416.

Michael, Leighton, *J. prakt. Chem.*, 1901, **64**, 102.

Pogorshelski, *Chem. Zentr.*, 1905, **I**, 667.

3-Chloroisobutylene (Isobutenyl chloride, 2-chloromethylpropylene)



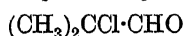
$\text{C}_4\text{H}_7\text{Cl}$  MW, 90.5

B.p. 71-2°.  $D_4^{20}$  0.933 (0.925).  $n_D^{20}$  1.427. Heat with  $\text{H}_2\text{O} \rightarrow$  isobutyraldehyde.

Krassuski, *Chem. Zentr.*, 1901, **I**, 996.

Pogorshelski, *Chem. Zentr.*, 1905, **I**, 667.

### 1-Chloroisobutyraldehyde



$\text{C}_4\text{H}_7\text{OCl}$  MW, 106.5

B.p. 90°.  $D_4^{15}$  1.053.

Oxime: cryst. M.p. 97°.

Brochet, *Ann. chim.*, 1897, **10**, 352.

### 1-Chloroisobutyric Acid



$\text{C}_4\text{H}_7\text{O}_2\text{Cl}$  MW, 122.5

M.p. 31°. B.p. 118°/50 mm., 80-2°/12 mm. Sol.  $\text{H}_2\text{O}$ .

Me ester:  $\text{C}_5\text{H}_9\text{O}_2\text{Cl}$ . MW, 136.5. B.p. 133-5°.

Et ester:  $\text{C}_6\text{H}_{11}\text{O}_2\text{Cl}$ . MW, 150.5. B.p. 148-9°.

Chloride:  $\text{C}_4\text{H}_6\text{OCl}_2$ . MW, 141. B.p. 126-7° (113-14°).

Nitrile:  $\text{C}_4\text{H}_6\text{NCl}$ . MW, 103.5. B.p. 52°/6 mm.  $D_4^{14}$  1.0641.  $n_D^{14}$  1.43482.

Anilide: plates from EtOH. M.p. 69-70°.

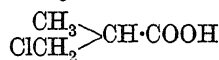
Michael, *Ber.*, 1901, **34**, 4054.

Blaise, Montagne, *Compt. rend.*, 1922, **174**, 1555.

Chrzaszczewska, Sobierański, *Chem. Abstracts*, 1928, **22**, 2146.

du Pont, U.S.P. 2,043,670, (*Chem. Abstracts*, 1937, **31**, 1044).

### 2-Chloroisobutyric Acid



$\text{C}_4\text{H}_7\text{O}_2\text{Cl}$  MW, 122.5

Et ester:  $\text{C}_6\text{H}_{11}\text{O}_2\text{Cl}$ . MW, 150.5. B.p. 56-8°/10 mm.

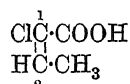
Rydon, *J. Chem. Soc.*, 1936, 1448.

du Pont, U.S.P. 2,043,670, (*Chem. Abstracts*, 1937, **31**, 1044).

### Chloroisocinnamic Acid.

See under  $\beta$ -Chlorocinnamic Acid.

### 1-Chloroisocrotonic Acid



$\text{C}_4\text{H}_5\text{O}_2\text{Cl}$  MW, 120.5

M.p. 66.5°. Mod. sol.  $\text{H}_2\text{O}$ . Mod. volatile in steam.  $k = 1.58 \times 10^{-3}$  at 25°. Heat at 150°  $\rightarrow$  1-chlorocrotonic acid.  $\text{NaHg} \rightarrow$  crotonic acid.

Et ester:  $\text{C}_6\text{H}_9\text{O}_2\text{Cl}$ . MW, 148.5. B.p. 58°/12 mm.  $D_4^{18}$  1.1021.

Auwers, *Ann.*, 1923, **432**, 62.

Pfeiffer, *Ber.*, 1910, **43**, 3045.

### 2-Chloroisocrotonic Acid.

Cryst. from  $\text{H}_2\text{O}$ . M.p. 61°. B.p. 195°. Sublimes at ord. temp. Volatile in steam.  $k = 9.47 \times 10^{-5}$  at 25°.  $\text{KMnO}_4 \rightarrow$  acetic + oxalic acids.  $\text{Cl} \rightarrow$  1:2:2-trichlorobutyric acid.

Me ester:  $\text{C}_5\text{H}_7\text{O}_2\text{Cl}$ . MW, 134.5. B.p. 142°, 42-3°/13 mm.  $D_4^{19}$  1.1361.  $n_D^{19}$  1.457.

Et ester: b.p. 161°, 50°/10 mm.  $D_4^{18}$  1.086.  $n_D^{18}$  1.455.

Propyl ester:  $\text{C}_7\text{H}_{11}\text{O}_2\text{Cl}$ . MW, 162.5. B.p. 175-7°.

Chloride:  $\text{C}_4\text{H}_4\text{OCl}_2$ . MW, 139. B.p. 122-40°.

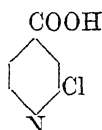
*Amide*:  $C_4H_5ONCl$ . MW, 119.5. M.p. 110°. Mod. sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>.

*Anilide*: m.p. 108°.

Auwers, *Ber.*, 1912, 45, 2807.

Paal, Schiedewitz, Rauscher, *Ber.*, 1931, 64, 1521.

**2-Chloroisonicotinic Acid (2-Chloropyridine-4-carboxylic acid)**



$C_6H_4O_2NCl$  MW, 157.5  
M.p. 234-5°.

*Chloride*:  $C_6H_5ONCl_2$ . MW, 176. B.p. 101°/10 mm.

Büchi, Labhart, Ragaz, *Helv. Chim. Acta*, 1947, 30, 507.

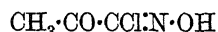
**3-Chloroisonicotinic Acid (3-Chloropyridine-4-carboxylic acid)**

M.p. about 235° (sealed tube). Sol. EtOH, conc. HCl. Spar. sol. hot H<sub>2</sub>O.

*Me ester*:  $C_7H_6O_2NCl$ . MW, 171.5. Needles from MeOH. M.p. 32°.

Meyer, Graf, *Ber.*, 1928, 61, 2213.

**1-Chloro-1-isonitrosoacetone**



$C_3H_4O_2NCl$  MW, 121.5

Cryst. M.p. 110° (107°). B.p. 180-5° decomp. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, alkalis. Decomp. by hot dil. H<sub>2</sub>SO<sub>4</sub>.

*Oxime*: m.p. 182-3° decomp.

*Semicarbazone*: prisms. M.p. 158° decomp.

Henry, *Chem. Zentr.*, 1903, II, 486.

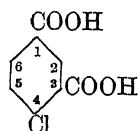
Ponzio, Charrier, *Gazz. chim. ital.*, 1907, 37, ii, 65.

Quilico, Speroni, *Gazz. chim. ital.*, 1946, 76, 200.

**Chloroisopentane.**

See active-Amyl chloride, tert.-Amyl chloride, Isoamyl chloride and sec.-Isoamyl chloride.

**4-Chloroisophthalic Acid**



$C_8H_5O_4Cl$  MW, 200.5

Needles from H<sub>2</sub>O. M.p. 294-5°. Sol. EtOH. Spar. sol. Et<sub>2</sub>O. Insol. C<sub>6</sub>H<sub>6</sub>.

Ullmann, Uzbachian, *Ber.*, 1903, 36, 1799.

**5-Chloroisophthalic Acid.**

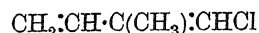
Cryst. from H<sub>2</sub>O. M.p. anhyd. 278°. Sol. EtOH.

*Di-Et ester*:  $C_{12}H_{13}O_4Cl$ . MW, 256.5. Prisms from EtOH. M.p. 45°.

Klages, Knoevenagel, *Ber.*, 1895, 28, 2045.

Beyer, *J. prakt. Chem.*, 1882, 25, 506.

**1-Chloroisoprene (1-Chloro-2-methyl-1-3-butadiene)**

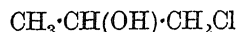


$C_5H_7Cl$  MW, 102.5

Pleasant-smelling liq. B.p. 107° (with slight polymerisation), 50.4°/100 mm.  $D_4^{20}$  0.9710.  $n_D^{20}$  1.4792. Liq. SO<sub>2</sub> → 1-chloro-2-methyl-2-butylene-1:4-sulphone, m.p. 73°. Sulphone heated at 100 mm. regenerates chloroisoprene.

Jones, Williams, *J. Chem. Soc.*, 1934, 833.

**1-Chloroisopropyl Alcohol (1-Propylene chlorohydrin)**



$C_3H_7OCl$  MW, 94.5

B.p. 127°.  $D_{20}^{20}$  1.115.  $n_D^{20}$  1.43924. Heat → acetone + propylene chloride.

*Me ether*:  $C_4H_9OCl$ . MW, 108.5. B.p. 103-4°.  $D_4^{20}$  1.009.  $n_D^{20}$  1.41372.

*Et ether*:  $C_5H_{11}OCl$ . MW, 122.5. B.p. 117-18°.  $D^0$  0.9842.  $n_D^{20}$  1.41902.

*Acetyl*:  $C_5H_9O_2Cl$ . MW, 136.5. B.p. 147-9°/745 mm.  $D^{20}$  1.0788.  $n_D^{20}$  1.4223.

Smith, *Z. physik. Chem.*, 1919, 93, 59.

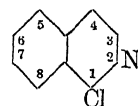
Dobryanskii, Davydova, Papkina, *Chem. Abstracts*, 1937, 31, 4645.

Dewaël, *Bull. soc. chim. Belg.*, 1930, 39, 395.

**Chloroisopropylbenzene.**

See Chlorocumene.

**1-Chloroisoquinoline**



$C_9H_6NCl$  MW, 163.5

Leaflets. M.p. 37-8°. B.p. 274-5°. Volatile in steam.

Gabriel, Colman, *Ber.*, 1900, 33, 985.

Fisher, Hamer, *J. Chem. Soc.*, 1934, 1907.

Elpern, Hamilton, *J. Am. Chem. Soc.*, 1946, 68, 1436.

**3-Chloroisoquinoline.**

Needles. M.p. 47-8°. B.p. 280-1°/752 mm. Volatile in steam.

*Picrate*: m.p. 177°.

Gabriel, *Ber.*, 1886, 19, 1655, 2356.

**8-Chloroisoquinoline.**

Prisms. M.p. 55°. Volatile in steam.

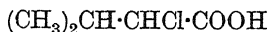
*Picrate*: yellow. M.p. 189.5-191.5°.

Pomeranz, *Monatsh.*, 1897, 18, 4.

Keilin, Cass, *J. Am. Chem. Soc.*, 1942, 64, 2442.



## 1-Chloroisovaleric Acid

 $\text{C}_5\text{H}_9\text{O}_2\text{Cl}$  MW, 136.5

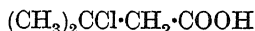
B.p. 210–12°, 126°/32 mm. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. Solidifies in freezing mixture.  
*Et ester*: C<sub>7</sub>H<sub>13</sub>O<sub>2</sub>Cl. MW, 164.5. B.p. 173–9°. D<sub>13</sub> 1.021.

*Chloride*: C<sub>5</sub>H<sub>9</sub>OCl<sub>2</sub>. MW, 155. B.p. 149°.

*Nitrile*: C<sub>5</sub>H<sub>8</sub>NCl. MW, 117.5. B.p. 154–5°. Sol. EtOH. Insol. H<sub>2</sub>O.

Servais, *Rec. trav. chim.*, 1901, 20, 42.

## 2-Chloroisovaleric Acid

 $\text{C}_5\text{H}_9\text{O}_2\text{Cl}$  MW, 136.5

Decomp. on dist.

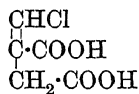
*Me ester*: C<sub>6</sub>H<sub>11</sub>O<sub>2</sub>Cl. MW, 150.5. B.p. 69–72°/17 mm.

*Et ester*: C<sub>7</sub>H<sub>13</sub>O<sub>2</sub>Cl. MW, 164.5. B.p. 184–90°, 103°/30 mm.

Montemartini, *Gazz. chim. ital.*, 1897, 27, ii, 368.

Smith, Spillane, *J. Am. Chem. Soc.*, 1943, 65, 282.

## Chloroitaconic Acid

 $\text{C}_5\text{H}_5\text{O}_4\text{Cl}$  MW, 164.5

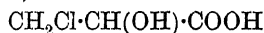
Cryst. from Et<sub>2</sub>O–C<sub>6</sub>H<sub>6</sub>. M.p. 150–1°. Sol. H<sub>2</sub>O, Et<sub>2</sub>O. Insol. C<sub>6</sub>H<sub>6</sub>, ligroin.

*Me ester*: C<sub>6</sub>H<sub>7</sub>O<sub>4</sub>Cl. MW, 178.5. Cryst. from H<sub>2</sub>O. M.p. 74–5°.

*Di-Et ester*: C<sub>9</sub>H<sub>13</sub>O<sub>4</sub>Cl. MW, 220.5. B.p. 125°/20 mm.

Wislicenus, Böklen, Reuthe, *Ann.*, 1908, 363, 361.

## 2-Chlorolactic Acid (2-Chloro-1-hydroxypropionic acid)

 $\text{C}_3\text{H}_5\text{O}_3\text{Cl}$  MW, 124.5

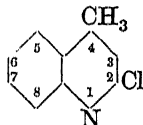
Cryst. from Et<sub>2</sub>O. M.p. 78°. Easily sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Na in EtOH → glycidic acid. Boiling H<sub>2</sub>O → acetaldehyde.

*Me ester*: C<sub>4</sub>H<sub>7</sub>O<sub>3</sub>Cl. MW, 138.5. B.p. 185–7°.

*Et ester*: C<sub>5</sub>H<sub>9</sub>O<sub>3</sub>Cl. MW, 152.5. M.p. 37°. B.p. 205°, 106–8°/25 mm.

Koelsch, *J. Am. Chem. Soc.*, 1930, 52, 1105.

## 2-Chlorolepidine (2-Chloro-4-methylquinoline)

 $\text{C}_{10}\text{H}_8\text{NCl}$  MW, 177.5

Needles from EtOH.Aq. M.p. 59°. B.p. 296°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Insol. H<sub>2</sub>O. Volatile in steam.

Besthorn, Byvanck, *Ber.*, 1898, 31, 799.  
 Mikhailov, *J. Gen. Chem. U.S.S.R.*, 1936, 6, 511.

Ellinger, Riesser, *Ber.*, 1909, 42, 3338.

Krahler, Burger, *J. Am. Chem. Soc.*, 1941, 63, 2367.

Manske, Marion, Leger, *Can. J. Research*, 1942, 20B, 133.

Kovslov, Lauer, *Organic Syntheses*, 1944, XXIV, 28.

## 3-Chlorolepidine.

Needles from EtOH.Aq. M.p. 55°.

*B.HAuCl<sub>4</sub>*: m.p. 164°.

*Picrate*: m.p. 208°.

Magnanini, *Ber.*, 1887, 20, 2612.

Pictet, Misner, *Ber.*, 1912, 45, 1804.

## 5-Chlorolepidine.

Needles from MeOH.Aq. M.p. 106.5°.

Krahler, Burger, *J. Am. Chem. Soc.*, 1941, 63, 2367.

## 6-Chlorolepidine.

Needles. M.p. 65.0–66.5°.

Campbell, Kerwin, *J. Am. Chem. Soc.*, 1946, 68, 1837.

## 7-Chlorolepidine.

Cryst. from ligroin. M.p. 59–61°.

*B.HCl*: m.p. 220–2°.

*Picrate*: m.p. 223°.

Campbell *et al.*, *J. Am. Chem. Soc.*, 1946, 68, 1851.

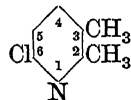
## 8-Chlorolepidine.

Cryst. from EtOH.Aq. M.p. 107°.

Johnson, Hamilton, *J. Am. Chem. Soc.*, 1941, 63, 2864.

Campbell, Schaffner, *J. Am. Chem. Soc.*, 1945, 67, 86.

## 6-Chloro-2 : 3-lutidine (6-Chloro-2 : 3-dimethylpyridine)

 $\text{C}_7\text{H}_8\text{NCl}$  MW, 141.5

M.p. 10–11°. B.p. 100–1°/18 mm.

*Picrate*: m.p. 120.5–121.0°.

Tracy, Elderfield, *J. Org. Chem.*, 1941, 6, 63.

## 6-Chloro-2 : 4-lutidine (6-Chloro-2 : 4-dimethylpyridine).

B.p. 212–14°.

Aston, Collie, *J. Chem. Soc.*, 1897, 71, 309.

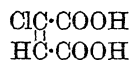
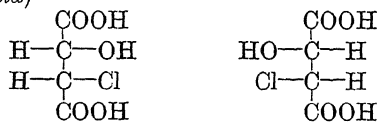
**3-Chloro-2 : 6-lutidine** (3-Chloro-2 : 6-dimethylpyridine,  $\beta$ -chloro- $\alpha'$ -lutidine).Colourless liq. Sol.  $H_2O$ . $B_2H_2PtCl_6$ : m.p. 212°. $B_2HAuCl_4$ : m.p. 131°.

Picrate: m.p. 151°.

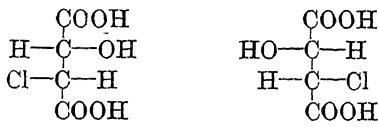
Bocchi, *Gazz. chim. ital.*, 1900, 30, i, 90.**4-Chloro-2 : 6-lutidine.**B.p. 178°.  $D_{17}^{25}$  1.105. Spar. sol.  $H_2O$ . $B_2HCl, SnCl_2$ : m.p. 108-9°. $B_2H_2PtCl_6$ : m.p. 238-9° (decomp. at 225°). $B_2HAuCl_4$ : m.p. 154-5°.

Picrate: m.p. 166-7° (150-6°).

Methiodide: m.p. 233-4°.

Michaelis, Hanisch, *Ber.*, 1902, 35, 3159.Conrad, Epstein, *Ber.*, 1887, 20, 164.**Chloromaleic Acid** $C_4H_3O_4Cl$  MW, 150.5Cryst. from  $Et_2O-CHCl_3$ . Sinters at 96°. M.p. 108° (114°). Sol.  $EtOH$ ,  $Et_2O$ ,  $AcOH$ . Spar. sol.  $C_6H_6$ ,  $CHCl_3$ . Insol. pet. ether. Heat at 180°  $\rightarrow$  anhydride. Hot conc.  $HCl$   $\rightarrow$  chlorofumaric acid.*Di-Me ester*:  $C_6H_7O_4Cl$ . MW, 178.5. B.p. 106.5°/18 mm.  $D_{15}^{25}$  1.2775.*Di-Et ester*:  $C_8H_{11}O_4Cl$ . MW, 206.5. B.p. 235° part. decomp., 190°/210 mm., 122°/15 mm.  $D_{15}^{25}$  1.1821.*Di-benzyl ester*: b.p. 215-20°/4 mm.,  $D_{15}^{27}$  1.225.  $n_D^{27}$  1.4592.Anhydride:  $C_4HO_3Cl$ . MW, 132.5. M.p. 33° (34.5°). B.p. 196°, 78°/8 mm.  $D_{25}^{25}$  1.5421.Auwers, Harres, *Ber.*, 1929, 62, 1686.van der Riet, *Ann.*, 1894, 280, 229.**2-Chloromalonic Acid** (2-Chloro-1-hydroxysuccinic acid)

"Meso."



"Rac."

 $C_4H_5O_5Cl$  MW, 168.5

"Meso."

*dl.*M.p. 145°. Sol.  $H_2O$ ,  $EtOH$ ,  $Et_2O$ . Insol.  $C_6H_6$ ,  $CHCl_3$ , pet. ether. Hygroscopic. Dist.  $\rightarrow$  chloromaleic acid. Decomp. by boiling  $H_2O$ .*Di-Me ester*:  $C_6H_9O_5Cl$ . MW, 196.5. B.p. 140-141.5°/12 mm.*Di-Et ester*:  $C_8H_{13}O_5Cl$ . MW, 224.5. B.p. 151.5°/14 mm.  $D_4^{99}$  1.1560.  $n_D^{64.5}$  1.4321.

(+).

M.p. 166-7°.  $[\alpha]_D^{25}$  +6.80° to +7.07° in  $H_2O$ .

(-).

M.p. 165-6° decomp.  $[\alpha]_D^{25}$  -7.3° in  $H_2O$ , -31.1° in  $AcOEt$ , -11.5° in 96%  $EtOH$ .*Di-Me ester*: b.p. 140°/14.5 mm.  $D_4^{20}$  1.3598.  $n_D^{20}$  1.4594.  $[\alpha]_D^{25}$  -22.05°.*Di-Et ester*: b.p. 147°/11 mm.  $D^{20}$  1.2366.  $n_D^{20}$  1.4524.  $[\alpha]_D^{25}$  -16.8°.

"Rac."

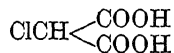
*dl.*M.p. 157°. Sol.  $H_2O$ ,  $EtOH$ ,  $Et_2O$ ,  $AcOEt$ ,  $Me_2CO$ . Spar. sol.  $CHCl_3$ ,  $C_6H_6$ , ligroin.*Et ester*: b.p. 153.5°/14 mm.  $D_4^{99}$  1.1496.  $n_D^{64.5}$  1.4305.

(+).

M.p. 166-7°.  $[\alpha]_D^{25}$  +9.35°  $\pm$  1.5° in  $H_2O$ .

(-).

M.p. 166-7°.

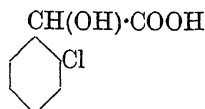
Kuhn, Zell, *Ber.*, 1926, 59, 2514.Kuhn, Wagner-Jauregg, *Ber.*, 1928, 61, 481, 483, 504.**Chloromalondialdehyde** (2-Chloropropandial) $C_3H_3O_2Cl$  MW, 106.5Needles from  $CHCl_3$  or  $C_6H_6-Me_2CO$ . M.p. 145° decomp. Sol.  $H_2O$ ,  $EtOH$ ,  $Et_2O$ ,  $Me_2CO$ . Spar. sol.  $C_6H_6$ ,  $CHCl_3$ ,  $CS_2$ , ligroin. Reduces  $NH_3, AgNO_3$  and Fehling's. Gives Na, K, and Cu comps.Dieckmann, Platz, *Ber.*, 1904, 37, 4643.Prins, D.R.P. 261,689, (*Chem. Zentr.*, 1913, II, 394); *J. prakt. Chem.*, 1914, 89, 421.**Chloromalonic Acid** $C_3H_3O_4Cl$  MW, 138.5Prisms. M.p. 133°. Sol.  $H_2O$ ,  $EtOH$ ,  $Et_2O$ .  $k$  (first) =  $4 \times 10^{-2}$  at 25°; (second) =  $1.94 \times 10^{-4}$  at 25°.  $NH_3$  in  $MeOH$   $\rightarrow$  aminomalonic acid. Heat at 180°  $\rightarrow$  chloroacetic acid*Di-Me ester*:  $C_5H_7O_4Cl$ . MW, 166.5. B.p. 206-8°/772 mm.*Di-Et ester*:  $C_7H_{11}O_4Cl$ . MW, 194.5. B.p. 222°, 138°/50 mm., 119°/16 mm. Sol.  $EtOH$ ,  $Et_2O$ ,  $CHCl_3$ ,  $CS_2$ . Insol.  $H_2O$ .  $D_4^{20}$  1.204.  $n_D^{19}$  1.43527.*Diamide*:  $C_3H_5O_2N_2Cl$ . MW, 136.5. M.p. 170°. Sol.  $Me_2CO$ , hot  $H_2O$ , hot  $EtOH$ .*Mono-Et ester nitrile*:  $C_5H_6O_2NCl$ . MW, 147.5. B.p. 190°.

*Dianilide*: plates from H<sub>2</sub>O. M.p. 118° decomp.

*Di-p-bromoanilide*: prisms from AcOH. M.p. 239°.

Conrad, Reinbach, *Ber.*, 1902, 35, 1814.

**o-Chloromandelic Acid** (o-Chlorophenylglycollic acid)



C<sub>8</sub>H<sub>7</sub>O<sub>3</sub>Cl MW, 186·5  
M.p. 84–5°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O.

*Nitrile*: C<sub>8</sub>H<sub>6</sub>ONCl. MW, 167·5. Needles. M.p. 47°.

Karrer, *Helv. Chim. Acta*, 1921, 4, 144.

**p-Chloromandelic Acid** (p-Chlorophenylglycollic acid).

Needles. M.p. 119–22° (112–13°). Sol. EtOH, Et<sub>2</sub>O. Mod. sol. H<sub>2</sub>O. Spar. sol. C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>.

*Amide*: C<sub>8</sub>H<sub>8</sub>O<sub>2</sub>NCl. MW, 185·5. M.p. 122–3°.  
*Nitrile*: C<sub>8</sub>H<sub>6</sub>ONCl. MW, 167·5. Yellow prisms. M.p. 43°. *Benzoyl*: m.p. 57–8°.

*Me ether*: C<sub>9</sub>H<sub>9</sub>O<sub>3</sub>Cl. MW, 200·5. Prisms from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 85–8°.

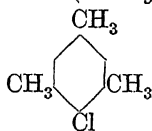
Collet, *Bull. soc. chim.*, 1899, 21, 70.

Buck, *J. Am. Chem. Soc.*, 1933, 55, 2595.

**Chloromenthane.**

See Menthyl chloride.

**Chloromesitylene** (*Mesityl chloride*)



C<sub>9</sub>H<sub>11</sub>Cl MW, 154·5  
B.p. 204–6°, 104°/25 mm. D<sup>20</sup> 1·0337. n<sub>D</sub><sup>20</sup> 1·52119.

Brown, de Bruyne, Gross, *J. Am. Chem. Soc.*, 1934, 56, 1291.

Fittig, Hoogewerff, *Ann.*, 1869, 150, 323.

**ω-Chloromesitylene.**

See 3 : 5-Dimethylbenzyl chloride.

**Chloromesitylenic Acid.**

See Chloro-3 : 5-dimethylbenzoic Acid.

**Chlorometanilic Acid.**

See Chloroaniline-sulphonic Acid.

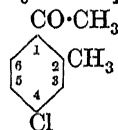
**Chloromethane.**

See Methyl chloride.

**Chloromethoxybenzoic Acid.**

See Chloroanisic Acid, and under Chloro-hydroxybenzoic Acid and Chlorosalicylic Acid.

**4-Chloro-2-methylacetophenone**



C<sub>9</sub>H<sub>9</sub>OCl MW, 168·5

B.p. 239–40°.

*Oxime*: m.p. 116°.

Claus, *J. prakt. Chem.*, 1891, 43, 361.

**4-Chloro-3-methylacetophenone.**

B.p. 254°. n<sub>D</sub><sup>20</sup> 1·5521.

*Oxime*: m.p. 112°.

Allen, Bridges, *J. Am. Chem. Soc.*, 1927, 49, 1846.

Claus, *J. prakt. Chem.*, 1891, 43, 356.

**6-Chloro-3-methylacetophenone.**

B.p. 246°. n<sub>D</sub><sup>20</sup> 1·5419.

*Oxime*: m.p. 94°.

Allen, Bridges, *J. Am. Chem. Soc.*, 1927, 49, 1846.

Claus, *J. prakt. Chem.*, 1892, 46, 26.

**2-Chloro-4-methylacetophenone.**

B.p. 127°/17 mm.

*Semicarbazone*: leaflets from EtOH. M.p. 192–4° decomp.

Borsche, Stackmann, Makaroff-Semljanski, *Ber.*, 1916, 49, 2239.

**3-Chloro-4-methylacetophenone.**

M.p. 45–6°. B.p. 250–4°.

*Oxime*: plates from MeOH.Aq. M.p. 96–7°.

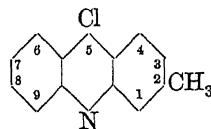
*Semicarbazone*: cryst. from MeOH–AcOEt. M.p. 237–8°.

Wallach, Lautsch, *Ann.*, 1906, 346, 282.

**ω-Chloro-methylacetophenone.**

See Methylphenacyl chloride.

**5-Chloro-2-methylacridine**



C<sub>14</sub>H<sub>10</sub>NCl MW, 227·5  
M.p. 120–1° (125°).

I.G., D.R.P. 571,449, (*Chem. Zentr.*, 1933, I, 3970).

Gleu, Nitzsche, *J. prakt. Chem.*, 1939, 153, 200.

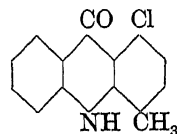
**5-Chloro-3-methylacridine.**

Yellowish needles. M.p. 121–2° (117–18°).

Discherl, Thron, *Ann.*, 1933, 504, 302.

Drozdoz, *Chem. Abstracts*, 1937, 31, 2610.

**4-Chloro-1-methylacridone**



C<sub>14</sub>H<sub>10</sub>ONCl MW, 243·5  
Pale yellow needles. M.p. 298°.

Nisbet, *J. Chem. Soc.*, 1933, 1372.

## 2-Chloro-1-methylacrylic Acid



$\text{C}_4\text{H}_5\text{O}_2\text{Cl}$  MW, 120.5

Needles. M.p. 59°. Volatile in steam.

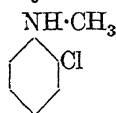
*Me ester*:  $\text{C}_5\text{H}_7\text{O}_2\text{Cl}$ . MW, 134.5. B.p. 141–3°.  $n_D^{20}$  1.4562.

*Et ester*:  $\text{C}_6\text{H}_9\text{O}_2\text{Cl}$ . MW, 148.5. B.p. 155–8°. *Nitrile*:  $\text{C}_4\text{H}_4\text{NCl}$ . MW, 101.5. B.p. 127–9°.  $n_D^{20}$  1.4592.

Auwers, Hessenland, *Ann.*, 1907, 352, 279.  
Hurd, Rector, *J. Org. Chem.*, 1945, 10, 441.

Chloromethyl-*n*-amylcarbinol.

See 1-Chloroheptanol-2.

*o*-Chloro-*N*-methylaniline

$\text{C}_7\text{H}_8\text{NCl}$  MW, 141.5

B.p. 218°, 95–6°/12 mm.  $D^{15}_4$  1.1735.

*Picrate*: m.p. 133°.

Stoermer, Hoffmann, *Ber.*, 1898, 31, 2531.  
Chattaway, Orton, *J. Chem. Soc.*, 1901, 79, 465.

*m*-Chloro-*N*-methylaniline.

B.p. 235°.  $D^{15}_4$  1.174.

*Nitrosamine*: m.p. 34–5°.

*N-Acetyl*: m.p. 92.5°.

Stoermer, Hoffmann, *Ber.*, 1898, 31, 2531.

*p*-Chloro-*N*-methylaniline.

B.p. 240°.  $D^{15}_4$  1.169.

*Nitrosamine*: m.p. 51°.

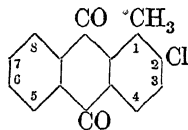
*N-Acetyl*: m.p. 94°.

*Picrate*: m.p. 153°.

Stoermer, Hoffmann, *Ber.*, 1898, 31, 2532.  
Chattaway, Orton, *J. Chem. Soc.*, 1901, 79, 465.

Groggins, Stirton, *Ind. Eng. Chem.*, 1937, 29, 1353.

## 2-Chloro-1-methylanthraquinone



$\text{C}_{15}\text{H}_9\text{O}_2\text{Cl}$  MW, 256.5

M.p. 181°.

Jacobsen, Carothers, *J. Am. Chem. Soc.*, 1933, 55, 1626.

du Pont, U.S.P. 1,967,862, (*Chem. Abstracts*, 1934, 28, 5995).

## 3-Chloro-1-methylanthraquinone.

Yellow needles. M.p. 191°.

Keimatsu, Hirano, Tanabe, *Chem. Abstracts*, 1929, 23, 4696.

## 4-Chloro-1-methylanthraquinone.

Yellow needles from EtOH or AcOH. M.p. 164°. Sol. EtOH,  $\text{Me}_2\text{CO}$ ,  $\text{CHCl}_3$ . Spar. sol.  $\text{Et}_2\text{O}$ , ligroin.

Heller, Schülke, *Ber.*, 1908, 41, 3635.

## 1-Chloro-2-methylanthraquinone.

Pale yellow needles from EtOH or  $\text{C}_6\text{H}_6$ . M.p. 171° (165°). Sol.  $\text{C}_6\text{H}_6$ , toluene,  $\text{PhNO}_2$ , AcOH. Mod. sol. hot EtOH.

Keimatsu, Hirano, *Chem. Abstracts*, 1929, 23, 3466.

Scottish Dyes, B.P. 206,840, U.S.P., 1,504,164, (*Chem. Abstracts*, 1924, 18, 1504).

I.G., B.P. 425,774, (*Chem. Abstracts*, 1935, 29, 5462).

Gen. Aniline Works, U.S.P. 1,997,226, (*Chem. Abstracts*, 1935, 29, 3686).

Hershberg, Fieser, *J. Am. Chem. Soc.*, 1941, 63, 2561.

## 3-Chloro-2-methylanthraquinone.

Pale yellow needles from AcOH. M.p. 219°. Sol.  $\text{CHCl}_3$ ,  $\text{C}_6\text{H}_6$ ,  $\text{PhNO}_2$ . Spar. sol.  $\text{Me}_2\text{CO}$ , AcOH.

Keimatsu, Hirano, *Chem. Abstracts*, 1929, 23, 3466.

Backer, Blass, *Rec. trav. chim.*, 1942, 61, 785, 924.

## 4-Chloro-2-methylanthraquinone.

Yellow cryst. from AcOH. M.p. 187–8°. Sol. EtOH,  $\text{Me}_2\text{CO}$ , AcOH,  $\text{CHCl}_3$ ,  $\text{CS}_2$ ,  $\text{C}_6\text{H}_6$ ,  $\text{CCl}_4$ , ligroin. Insol.  $\text{Et}_2\text{O}$ , pet. ether.

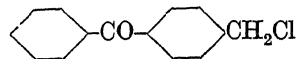
Ruggli, Merz, *Helv. Chim. Acta*, 1929, 12, 91.

Keimatsu, Hirano, Tanabe, *Chem. Abstracts*, 1929, 23, 4697.

## Chloromethylbenzoic Acid.

See Chlorotoluic Acid.

4-Chloromethylbenzophenone (*p*-Benzoylbenzyl chloride)

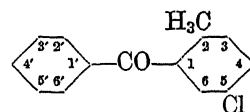


$\text{C}_{14}\text{H}_{11}\text{OCl}$  MW, 230.5

Prisms from EtOH. M.p. 97–8°. Very sol. AcOH,  $\text{C}_6\text{H}_6$ ,  $\text{CHCl}_3$ ,  $\text{CS}_2$ . Spar. sol.  $\text{Et}_2\text{O}$ . Sublimes.

Thörner, *Ann.*, 1877, 189, 89.

## 5-Chloro-2-methylbenzophenone.



$\text{C}_{14}\text{H}_{11}\text{OCl}$  MW, 230.5

M.p. 41°. B.p. 210°/30 mm., 191°/12 mm.

de Diesbach, Dobbemann, *Helv. Chim. Acta*, 1931, 14, 369.

**4'-Chloro-2-methylbenzophenone.**  
B.p. 194°/14 mm.

de Diesbach, Dobbeltmann, *Helv. Chim. Acta*, 1931, 14, 369.

**6-Chloro-3-methylbenzophenone.**  
M.p. 35-6°.

de Diesbach, Dobbeltmann, *Helv. Chim. Acta*, 1931, 14, 369.

**2'-Chloro-4-methylbenzophenone.**  
Prisms. M.p. 99·5°.

Cohen, *Rec. trav. chim.*, 1919, 38, 117.

**3-Chloro-4-methylbenzophenone.**  
Plates from EtOH. M.p. 82-3°. Sol. most org. solvents.

Heller, *Ber.*, 1913, 46, 1500.

**3'-Chloro-4-methylbenzophenone.**  
M.p. 97-8°.

Bachmann, Ferguson, *J. Am. Chem. Soc.*, 1934, 56, 2083.

**4'-Chloro-4-methylbenzophenone.**  
Plates. M.p. 129° (118°).

Cohen, *Rec. trav. chim.*, 1919, 38, 72.  
Newton, Groggins, *Ind. Eng. Chem.*, 1935, 27, 1397.

**1-Chloro-2-methyl-1 : 3-butadiene.**  
See 1-Chloroisoprene.

**Chloro-methylbutanol-2.**

See Chloro-*tert.*-amyl Alcohol.

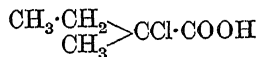
**Chloromethyl-*n*-butylcarbinol.**

See 1-Chlorohexanol-2.

**1-Chloro-2-methyl-2-butylene-1 : 4-sulphone.**

See under 1-Chloroisoprene.

**1-Chloro-1-methylbutyric Acid** (*Chloromethylethylacetic acid*)



$\text{C}_5\text{H}_9\text{O}_2\text{Cl}$  MW, 136·5  
B.p. 200-5° part. decomp., 124°/36 mm. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. D<sup>10</sup> 1·101.

*Et ester*: C<sub>7</sub>H<sub>13</sub>O<sub>2</sub>Cl. MW, 164·5. B.p. 175°/747 mm. Sol. EtOH, Et<sub>2</sub>O. D<sup>14</sup> 1·069.

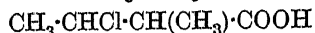
*Chloride*: C<sub>5</sub>H<sub>9</sub>OCl<sub>2</sub>. MW, 155. B.p. 144°/750 mm. D<sup>14</sup> 1·187.

*Nitrile*: C<sub>5</sub>H<sub>8</sub>NCl. MW, 117·5. B.p. 55-60°/32 mm. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. D<sup>20</sup> 0·98058. n<sub>D</sub><sup>20</sup> 1·41732.

Servais, *Rec. trav. chim.*, 1901, 20, 58.

Naster, Gavriloff, *Bull. soc. chim. Belg.*, 1933, 42, 519.

**2-Chloro-1-methylbutyric Acid**



$\text{C}_5\text{H}_9\text{O}_2\text{Cl}$  MW, 136·5

B.p. 198-202° decomp., 123-5°/36 mm., 95-6°/9 mm.

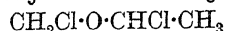
*Me ester*: C<sub>6</sub>H<sub>11</sub>O<sub>2</sub>Cl. MW, 150·5. B.p. 165°/765 mm., 54-5°/12 mm. D<sub>4</sub><sup>20</sup> 1·0734. n<sub>D</sub><sup>20</sup> 1·43006.

*Nitrile*: C<sub>5</sub>H<sub>8</sub>NCl. MW, 117·5. B.p. 62-3°/10 mm. D<sub>4</sub><sup>20</sup> 1·02892. n<sub>D</sub><sup>20</sup> 1·43590.

Morgenstern, *Monatsh.*, 1912, 33, 721.

Naster, Gavriloff, *Bull. soc. chim. Belg.*, 1933, 42, 519.

**Chloromethyl 1-chloroethyl Ether**

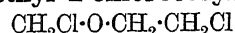


$\text{C}_3\text{H}_6\text{OCl}_2$  MW, 129

Fuming liq. B.p. 112-14°. H<sub>2</sub>O under press. → acetaldehyde.

Litterscheid, *Ann*, 1904, 330, 118.

**Chloromethyl 2-chloroethyl Ether**



$\text{C}_3\text{H}_6\text{OCl}_2$  MW, 129

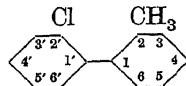
B.p. 153-4° (145-7°). D<sup>20</sup> 1·2817. H<sub>2</sub>O → ethylene chlorohydrin + formaldehyde.

Farren, Fife, *J. Am. Chem. Soc.*, 1925, 47, 2421.

Litterscheid, *Ann.*, 1904, 330, 120.

Salmi, Leimu, Kallio, *Chem. Abstracts*, 1946, 40, 6491.

**2'-Chloro-2-methyldiphenyl**



$\text{C}_{13}\text{H}_{11}\text{Cl}$  MW, 202·5

M.p. 17°. B.p. 276°/755 mm., 174°/50 mm., 103-6°/2-3 mm. n<sub>D</sub><sup>25</sup> 1·588.

Mascarelli, Gatti, *Atti accad. Lincei*, 1932, 15, 89.

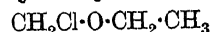
Orchin, Woolfolk, *J. Am. Chem. Soc.*, 1945, 67, 122.

**4'-Chloro-4-methyldiphenyl.**

M.p. 122°.

Gomberg, Pernert, *J. Am. Chem. Soc.*, 1926, 48, 1379.

**Chloromethyl ethyl Ether**



$\text{C}_3\text{H}_7\text{OCl}$  MW, 94·5

B.p. 83°. D<sub>4</sub><sup>15</sup> 1·0188. n<sub>D</sub><sup>20</sup> 1·40398. Distills with part. decomp. Decomp. by H<sub>2</sub>O.

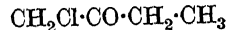
Litterscheid, *Ann.*, 1904, 330, 122.

Favre, *Compt. rend.*, 1894, 119, 284.

Farren, Fife, *J. Am. Chem. Soc.*, 1925, 47, 2421.

Foran, *J. Soc. Chem. Ind.*, 1925, 44, 173r.

**Chloromethyl ethyl Ketone** (1-Chlorobutanone-2)



$\text{C}_4\text{H}_7\text{OCl}$  MW, 106·5

B.p. 137·5°, 67-8°/57 mm., 55-6°/30 mm. Insol. H<sub>2</sub>O. D<sup>13</sup> 1·08. n<sub>D</sub><sup>10</sup> 1·42701, n<sub>D</sub><sup>20</sup> 1·4372.

Conc. HNO<sub>3</sub> → chloroacetic acid. KCN → propionylacetonitrile.

Semicarbazone: m.p. 151°.

Koishorn, *Ber.*, 1904, 37, 2474.

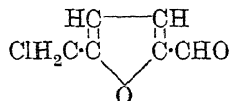
Béhal, Detoeuf, *Compt. rend.*, 1911, 153, 1230.

Rabjohn, Rogier, *J. Org. Chem.*, 1946, 11, 781.

### 2-Chloromethyl-furan.

See Furfuryl chloride.

### ω-Chloromethylfurfural



$C_6H_5O_2Cl$  MW, 144.5

Cryst. from pet. ether. M.p. 37–8°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Spar. sol. pet. ether.

Middendorp, *Rec. trav. chim.*, 1919, 38, 24.

Haworth, Jones, *J. Chem. Soc.*, 1944, 667.

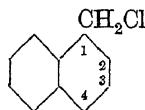
### Chloromethyl hydroxyphenyl Ketone.

See Hydroxyphenacyl chloride.

### Chloromethylmalic Acid.

See Chlorohydroxymethylsuccinic Acid.

### 1-Chloromethylnaphthalene (α-Naphthylmethyl chloride, α-menaphthyl chloride)



$C_{11}H_9Cl$  MW, 176.5

M.p. 31–2°. B.p. 291–2°, 150–2°/13 mm., 134°/3 mm. Readily condenses to Cl-free compound. Zn + HCl in EtOH → 1-methylnaphthalene; hexamethylenetetramine in 95% EtOH → 1-naphthaldehyde.

Coles, Dodds, *J. Am. Chem. Soc.*, 1938, 60, 853.

Rupe, Brentano, *Helv. Chim. Acta*, 1936, 19, 581.

Anderson, Short, *J. Chem. Soc.*, 1933, 485.

Cambron, *Can. J. Research*, 1939, 17B, 10.

Lock, Walter, *Ber.*, 1942, 75, 1158.

Grummitt, Buck, *J. Am. Chem. Soc.*, 1943, 65, 295.

Grummitt, Buck, *Organic Syntheses*, 1944, XXIV, 30.

Funk, U.S.P. 2,387,702, (*Chem. Abstracts*, 1946, 40, 1177).

### 2-Chloromethylnaphthalene (β-Naphthylmethyl chloride, β-menaphthyl chloride).

Plates from EtOH. M.p. 47°. B.p. 168°/20 mm. Pb(NO<sub>3</sub>)<sub>2</sub> → 2-naphthaldehyde. Alk. KMnO<sub>4</sub> → 2-naphthoic acid.

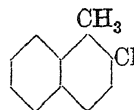
Clar, Lombardi, *Gazz. chim. ital.*, 1932, 62, 539.

Schulze, *Ber.*, 1884, 7, 1529.

Sah, *Rec. trav. chim.*, 1940, 59, 461.

Tarbell, Fukushima, Dam, *J. Am. Chem. Soc.*, 1945, 67, 197.

### 2-Chloro-1-methylnaphthalene



$C_{11}H_9Cl$  MW, 176.5

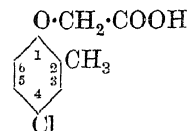
B.p. 155°/23 mm., 144–5°/12 mm.

Scholl, Seer, Zinke, *Monatsh.*, 1920, 41, 589.

### Chloromethyl naphthyl Ketone.

See ω-Chloroacetone naphthone.

### 4-Chloro-2-methylphenoxyacetic Acid (4-Chloro-o-toloxycetic acid, Agroxone)



$C_9H_9O_3Cl$  MW, 200.5

Plates from C<sub>6</sub>H<sub>6</sub> or toluene. M.p. 120°. Monohydrate: m.p. 86°. Very sol. MeOH, EtOH, Et<sub>2</sub>O, AcOEt. Sol. C<sub>6</sub>H<sub>6</sub>, CCl<sub>4</sub>. Spar. sol. pet. ether. Very spar. sol. H<sub>2</sub>O.

Na salt: Methoxone. Powerful selective weed killer. Very sol. H<sub>2</sub>O.

NH<sub>4</sub> salt: m.p. 113°. Very sol. H<sub>2</sub>O.

Me ester: b.p. 138–40°/5 mm. D<sub>4</sub><sup>24</sup> 1.212.

Et ester: b.p. 115–17°/1 mm. n<sub>D</sub><sup>23</sup> 1.5150.

Propyl ester: b.p. 109.5–111.5°/0.5 mm. n<sub>D</sub><sup>23</sup> 1.5100.

Isopropyl ester: b.p. 172–5°/15 mm. n<sub>D</sub><sup>20</sup> 1.5070.

Butyl ester: b.p. 170–2°/7 mm

4-Chloro-o-tolyl ester: m.p. 85°.

Chloride: b.p. 138–9°/6 mm.

Amide: m.p. 149–50°.

Synerholm, Zimmerman, *Chem. Abstracts*, 1946, 40, 1473.

Templeman, Sexton, *Proc. Roy. Soc.*, 1946, 133B, 300.

Foster, I.C.I., B.Ps. 573,479; 573,510, (*Chem. Abstracts*, 1949, 43, 7044, 2234).

### Chloromethylphenylcarbinol.

See Styrene chlorohydrin.

### Chloromethyl phenyl Ketone.

See Phenacyl chloride.

### Chloromethyl phenyl sulphone



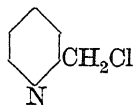
$C_7H_7O_2ClS$  MW, 190.5

Leaflets or prisms from EtOH. M.p. 53°. Sol. hot EtOH. Insol. H<sub>2</sub>O. NaHg → benzenesulphinic acid.

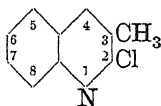
Otto, *J. prakt. Chem.*, 1889, 40, 527.

### Chloro-methylpyridine.

See Chloropicoline.

**2-Chloromethylpyridine** (*ω*-Chloro-*α*-picoline)C<sub>6</sub>H<sub>6</sub>NCl MW, 127.5B.p. 73–6°/10 mm. Very unstable.  
*Picrate*: m.p. 152–3°.Overhoff, Boeke, Gorter, *Rec. trav. chim.*,  
1936, 55, 293.**Chloro-2-methylquinoline.**

See Chloroquinoline.

**2-Chloro-3-methylquinoline**C<sub>10</sub>H<sub>8</sub>NCl MW, 177.5

Cryst. M.p. 89–90°.

Ornstein, *Ber.*, 1907, 40, 1095.**4-Chloro-3-methylquinoline.**

Needles. M.p. 60°.

Steck, Hallock, Holland, *J. Am. Chem. Soc.*, 1946, 68, 129.**7-Chloro-3-methylquinoline.**

M.p. 84.5° B.p. 142–4°/10 mm.

*Picrate*: m.p. 187.5°.*Ethiodide*: m.p. 270°.Utermohlen, *J. Org. Chem.*, 1943, 8, 544.**Chloro-4-methylquinoline.**

See Chlorolepidine.

**8-Chloro-5-methylquinoline.**Needles from H<sub>2</sub>O. M.p. 49°.*Picrate*: m.p. 172°.Gattermann, Kaiser, *Ber.*, 1885, 15, 2603.**2-Chloro-6-methylquinoline.**Needles from EtOH.Aq. M.p. 111–12° (116°).  
Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Spar. sol. H<sub>2</sub>O.  
H<sub>2</sub>O at 180° → 2-hydroxy-6-methylquinoline.Hamer, *J. Chem. Soc.*, 1928, 209.Späth, *Monatsh.*, 1919, 40, 122.Fischer, *Ber.*, 1899, 32, 1305.**3-Chloro-6-methylquinoline.**

M.p. 85.5°.

Robson, *J. Biol. Chem.*, 1924, 62, 495.**8-Chloro-6-methylquinoline.**

M.p. 62.5°.

Mazoński, Mielecki, Sucharda, *Chem. Abstracts*, 1937, 31, 3921.**4-Chloro-7-methylquinoline.**

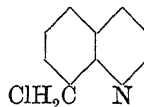
M.p. 28° B.p. 140–2°/9.5 mm.

Breslow *et al.*, *J. Am. Chem. Soc.*, 1946,  
68, 1232.**2-Chloro-8-methylquinoline.**Needles from Et<sub>2</sub>O. M.p. 61° B.p. 286°/734  
mm. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Spar. sol. H<sub>2</sub>O.Späth, *Monatsh.*, 1919, 40, 124.Fischer, *Ber.*, 1902, 35, 3678.**3-Chloro-8-methylquinoline.**

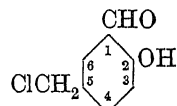
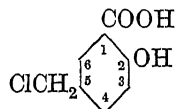
M.p. 55°.

Boyd, Robson, *Biochem. J.*, 1935, 29, 555.**6-Chloro-8-methylquinoline.**

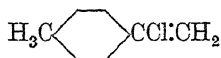
M.p. 65.5°.

Mazoński, Mielecki, Sucharda, *Chem. Abstracts*, 1937, 31, 3921.**7-Chloro-8-methylquinoline.**Needles from EtOH.Aq. M.p. 45–8° B.p.  
278°/759 mm.*B.HNO<sub>3</sub>*: needles from H<sub>2</sub>O. M.p. 149°.*B.(COOH)<sub>2</sub>*: prisms from EtOH. M.p. 146°.*B.HClO<sub>4</sub>*: needles from EtOH. M.p. 171°.*B<sub>2</sub>H<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>*: yellow needles from H<sub>2</sub>O. M.p.  
148°.Bradford, Elliott, Rowe, *J. Chem. Soc.*,  
1947, 437.**8-Chloromethylquinoline**C<sub>10</sub>H<sub>8</sub>NCl MW, 177.5

Needles or plates from pet. ether. M.p. 56°.

Howitz, Nöther, *Ber.*, 1906, 39, 2708.**5-Chloromethyl-salicylaldehyde** (*α*-*Chloro-4-hydroxy-m-toluic aldehyde*)C<sub>8</sub>H<sub>7</sub>O<sub>2</sub>Cl MW, 170.5Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 88°.*Me ester*: C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Cl. MW, 184.5. M.p. 76.5°.Stoermer, Behn, *Ber.*, 1901, 34, 2457.Stoermer, Oetker, *Ber.*, 1904, 37, 192.**5-Chloromethyl-salicylic Acid** (*α*-*Chloro-4-hydroxy-m-toluic acid*)C<sub>8</sub>H<sub>7</sub>O<sub>3</sub>Cl MW, 186.5Cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 163°.*Me ester*: C<sub>9</sub>H<sub>9</sub>O<sub>3</sub>Cl. MW, 200.5. M.p. 68°.*Et ester*: C<sub>10</sub>H<sub>11</sub>O<sub>3</sub>Cl. MW, 214.5. M.p. 96°.Bayer, D.R.P. 113,723, (*Chem. Zentr.*,  
1900, II, 795).Bauer, Bühler, *Chem. Abstracts*, 1924, 18,  
3189.

$\alpha$ -Chloro-*p*-methylstyrene (1-Chloro-1-*p*-tolylethylene)

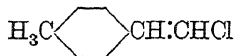


C<sub>9</sub>H<sub>9</sub>Cl MW, 152.5

B.p. 96-97.5°/13 mm.

Auwers, Keil, *Ber.*, 1903, 36, 1876.

$\beta$ -Chloro-*p*-methylstyrene (2-Chloro-1-*p*-tolylethylene, *p*-methylstyryl chloride)



C<sub>9</sub>H<sub>9</sub>Cl MW, 152.5

Needles from MeOH. M.p. 36-7°. B.p. 222-4°, 131-2°/40 mm., 99-102°/14 mm. Sol. EtOH, AcOH. Spar. sol. MeOH, C<sub>6</sub>H<sub>6</sub>. D<sub>4</sub><sup>20</sup> 1.0537. n<sub>D</sub><sup>20</sup> 1.56635.

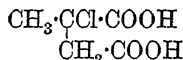
Auwers, *Ber.*, 1912, 45, 2797.

Auwers, Keil, *Ber.*, 1903, 36, 3909.

**Chloro-methylstyrene.**

See also Chlorophenylpropylene.

**1-Chloro-1-methylsuccinic Acid** (*Chloropyrotartaric acid*, *2-chloropropane-1:2-dicarboxylic acid*)



C<sub>5</sub>H<sub>7</sub>O<sub>4</sub>Cl MW, 166.5

Leaflets or plates. M.p. 129-30°. Boiling H<sub>2</sub>O → mesaconic acid.

Fittig, Prehn, *Ann.*, 1877, 188, 51.

Fittig, Landolt, *ibid.*, 83.

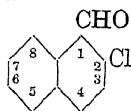
**Chloromethyl tolyl Ketone.**

See Methylphenacyl chloride.

**Chloromycetin.**

See Chloramphenicol.

**2-Chloro-1-naphthaldehyde**



C<sub>11</sub>H<sub>7</sub>OCl MW, 190.5

Needles from EtOH. M.p. 76°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, AcOEt, C<sub>6</sub>H<sub>6</sub>. Spar. sol. EtOH, AcOH, ligroin. Insol. H<sub>2</sub>O.

*Di-Me acetal*: prisms from EtOH. M.p. 86°. *Semicarbazone*: needles from EtOH. M.p. 215°.

*Azine*: yellow needles from ethyl benzoate. M.p. 195°. Insol. common org. solvents.

Sachs, Brigl, *Ber.*, 1911, 44, 2101.

**4-Chloro-1-naphthaldehyde.**

M.p. 81.5-82°.

Jacobs *et al.*, *J. Org. Chem.*, 1946, 11, 229.

**6-Chloro-1-naphthaldehyde.**

M.p. 83-4°.

*Oxime*: cryst. from CCl<sub>4</sub>. M.p. 126-7°.

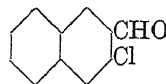
Jacobs *et al.*, *J. Org. Chem.*, 1946, 11, 229.

**7-Chloro-1-naphthaldehyde.**

Yellow cryst. from EtOH.Aq. M.p. 100-2°.

Hurd, Fancher, Bonner, *J. Org. Chem.*, 1947, 12, 369.

**3-Chloro-2-naphthaldehyde**



C<sub>11</sub>H<sub>7</sub>OCl MW, 190.5

Needles from pet. ether. M.p. 121°.

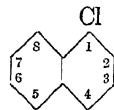
*Oxime*: needles from EtOH. M.p. 152°.

*Semicarbazone*: needles from EtOH. M.p. 268°.

*p-Nitrophenylhydrazone*: scarlet needles from AcOH. M.p. 263°.

Shoesmith, Mackie, *J. Chem. Soc.*, 1930, 1586.

**1-Chloronaphthalene ( $\alpha$ -Chloronaphthalene)**



C<sub>10</sub>H<sub>7</sub>Cl MW, 162.5

B.p. 263° (250-2°, 257°). D<sub>4</sub><sup>20</sup> 1.1938. n<sub>D</sub><sup>20</sup> 1.63321. Conc. H<sub>2</sub>SO<sub>4</sub> at 140-50° → 4-sulphonic acid.

*Picrate*: m.p. 137°.

*Styphnate*: m.p. 126-8°.

*SbCl<sub>3</sub> salt*: C<sub>10</sub>H<sub>7</sub>Cl<sub>2</sub>2SbCl<sub>3</sub> M.p. 46°.

Asaoka, *Chem. Abstracts*, 1929, 23, 3923.

Töhl, Eberhard, *Ber.*, 1893, 26, 2945.

Zil'berman, Rashevskaya, Martyntseva, *Chem. Abstracts*, 1937, 31, 2597.

Vorozhtzov, Karlash, *Chem. Abstracts*, 1935, 29, 2530.

Witt, Ekeley, *Chem. Abstracts*, 1932, 26, 2974.

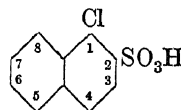
**2-Chloronaphthalene ( $\beta$ -Chloronaphthalene).**

Leaflets. M.p. 61° (56°). B.p. 264-6°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>. D<sub>4</sub><sup>16</sup> 1.2656.

*SbCl<sub>3</sub> salt*: C<sub>10</sub>H<sub>7</sub>Cl<sub>2</sub>SbCl<sub>3</sub>. M.p. 29-5°.

Chattaway, Lewis, *J. Chem. Soc.*, 1894, 65, 877.

**1-Chloronaphthalene-2-sulphonic Acid**



C<sub>10</sub>H<sub>7</sub>O<sub>3</sub>ClS MW, 242.5

Silvery leaflets + 3½H<sub>2</sub>O from H<sub>2</sub>O. M.p. anhyd. 130-3° decomp.

*Et ester*: C<sub>12</sub>H<sub>11</sub>O<sub>3</sub>ClS. MW, 270.5. Needles. M.p. 104°.

*Chloride*: C<sub>10</sub>H<sub>6</sub>O<sub>2</sub>Cl<sub>2</sub>S. MW, 261. Needles. M.p. 84-5°.



*Amide*:  $C_{10}H_8O_2NCIS$ . MW, 241.5. M.p. above  $250^\circ$ .

*Anilide*: cryst. from  $C_6H_6$ . M.p.  $171-2^\circ$ .

Cleve, *Ber.*, 1891, 24, 3474.

**1-Chloronaphthalene-3-sulphonic Acid.**

*Et ester*: needles. M.p.  $76-9^\circ$ .

*Chloride*: m.p.  $106^\circ$ .

*Amide*: m.p.  $168^\circ$ . Spar. sol.  $H_2O$ .

Cleve, *Ber.*, 1888, 21, 3273.

**1-Chloronaphthalene-4-sulphonic Acid.**

M.p.  $130-3^\circ$  decomp. Heat at  $150^\circ \rightarrow$  1-chloronaphthalene-5-sulphonic acid.  $NH_3.Aq.$  at  $200^\circ \rightarrow$  naphthionic acid.

*Me ester*:  $C_{11}H_9O_3ClS$ . MW, 256.5. Prisms. M.p.  $83^\circ$ .

*Et ester*: prisms. M.p.  $104^\circ$ .

*Chloride*: prisms. M.p.  $95^\circ$ .

*Bromide*:  $C_{10}H_8O_2ClBrS$ . MW, 305.5. M.p.  $120^\circ$  ( $115-16^\circ$ ).

*Amide*: needles. M.p.  $187^\circ$ .

*Anilide*: m.p.  $145-6^\circ$ .

p-Nitroanilide: m.p.  $188^\circ$ .

o-Toluidide: m.p.  $151^\circ$ .

$\alpha$ -Naphthylamide: m.p.  $162^\circ$ .

Ferrero, Bolliger, *Helv. Chim. Acta*, 1928, 11, 1145.

Armstrong, Wynne, *Chem. News*, 1890, 61, 285.

Cumming, Muir, *Chem. Abstracts*, 1934, 28, 4409.

Beattie, Whitmore, *J. Am. Chem. Soc.*, 1933, 55, 1547.

**1-Chloronaphthalene-5-sulphonic Acid.**

Cryst. +  $2H_2O$  from  $H_2O$ .

*Me ester*: m.p.  $89^\circ$ .

*Et ester*: prisms. M.p.  $46^\circ$ .

*Chloride*: m.p.  $95^\circ$ .

*Bromide*: m.p.  $110^\circ$ .

*Amide*: m.p.  $226^\circ$ .

*Anilide*: m.p.  $138^\circ$ .

Beattie, Whitmore, *J. Am. Chem. Soc.*, 1933, 55, 1547.

Ferrero, Bolliger, *Helv. Chim. Acta*, 1928, 11, 1145.

Armstrong, Wynne, *Chem. News*, 1890, 61, 285.

**1-Chloronaphthalene-6-sulphonic Acid.**

*Et ester*: prisms. M.p.  $111^\circ$ .

*Chloride*: m.p.  $114-15^\circ$ .

*Amide*: leaflets. M.p.  $216^\circ$ .

Armstrong, Wynne, *Chem. News*, 1889, 59, 189.

Ferrero, Bolliger, *Helv. Chim. Acta*, 1928, 11, 1145.

Beattie, Whitmore, *J. Am. Chem. Soc.*, 1933, 55, 1547.

**1-Chloronaphthalene-7-sulphonic Acid.**

*Et ester*: prisms. M.p.  $92^\circ$ .

*Chloride*: m.p.  $94^\circ$ .

*Amide*: needles. M.p.  $185-6^\circ$ .

Beattie, Whitmore, *J. Am. Chem. Soc.*, 1933, 55, 1547.

Cleve, *Ber.*, 1892, 25, 2480.

Armstrong, Wynne, *Chem. News*, 1889, 59, 189.

**1-Chloronaphthalene-8-sulphonic Acid.**

*Me ester*: needles. M.p.  $70^\circ$ .

*Et ester*: plates. M.p.  $67-8^\circ$ .

*Chloride*: m.p.  $101^\circ$ .

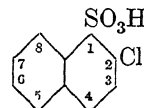
*Amide*: prisms. M.p.  $199^\circ$ .

Cleve, *Ber.*, 1890, 23, 962.

Cumming, Muir, *Chem. Abstracts*, 1936, 30, 4491.

Beattie, Whitmore, *J. Am. Chem. Soc.*, 1933, 55, 1547.

**2-Chloronaphthalene-1-sulphonic Acid**



$C_{10}H_7O_3ClS$  MW, 242.5.

*Chloride*:  $C_{10}H_6O_2Cl_2S$ . MW, 261. Plates. M.p.  $76^\circ$ .

*Amide*:  $C_{10}H_8O_2NCIS$ . MW, 241.5. M.p.  $153^\circ$ .

Armstrong, Wynne, *Chem. News*, 1896, 73, 54.

Beattie, Whitmore, *J. Am. Chem. Soc.*, 1933, 55, 1547.

**2-Chloronaphthalene-5-sulphonic Acid.**

*Et ester*:  $C_{12}H_{11}O_3ClS$ . MW, 270.5. Prisms. M.p.  $114-15^\circ$ .

*Chloride*: m.p.  $70^\circ$ .

*Amide*: m.p.  $214^\circ$ .

Forsling, *Ber.*, 1887, 20, 2105.

Armstrong, Wynne, *Chem. News*, 1889, 59, 188.

**2-Chloronaphthalene-6-sulphonic Acid.**

*Me ester*:  $C_{11}H_9O_3ClS$ . MW, 256.5. Leaflets. M.p.  $89^\circ$ .

*Et ester*: prisms. M.p.  $79^\circ$ .

*Chloride*: prisms. M.p.  $110-5^\circ$ .

*Bromide*:  $C_{10}H_6O_2ClBrS$ . MW, 305.5. Prisms from  $CHCl_3$ . M.p.  $124^\circ$ .

*Amide*: needles. M.p.  $183-4^\circ$ .

Armstrong, Wynne, *Chem. News*, 1887, 55, 91; 1888, 58, 295.

Beattie, Whitmore, *J. Am. Chem. Soc.*, 1933, 55, 1547.

**2-Chloronaphthalene-7-sulphonic Acid.**

Plates +  $4H_2O$  from  $H_2O$ . M.p.  $68^\circ$ , anhyd.  $118^\circ$ .

*Me ester*: m.p.  $89^\circ$ .

*Et ester*: m.p.  $65^\circ$ .

*Chloride*: m.p. 86.5°.

*Amide*: prisms. M.p. 176°.

Armstrong, Wynne, *Chem. News*, 1888, 58, 295; 1889, 59, 189.

Beattie, Whitmore, *J. Am. Chem. Soc.*, 1933, 55, 1547.

### 2-Chloronaphthalene-8-sulphonic Acid.

*Me ester*: prisms. M.p. 115°.

*Chloride*: needles. M.p. 129°.

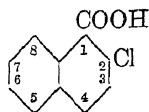
*Bromide*: m.p. 139°.

*Amide*: needles. M.p. 235°.

Armstrong, Wynne, *Chem. News*, 1887, 55, 91; 1888, 58, 295.

Beattie, Whitmore, *J. Am. Chem. Soc.*, 1933, 55, 1547.

### 2-Chloro-1-naphthoic Acid ( $\beta$ -Chloro- $\alpha$ -naphthoic acid)



$C_{11}H_7O_2Cl$  MW, 206.5

M.p. 153°. Sol. EtOH, Et<sub>2</sub>O. Mod. sol. hot H<sub>2</sub>O. NaHg  $\rightarrow$  1-naphthoic acid.

*Me ester*:  $C_{12}H_9O_2Cl$ . MW, 220.5. Prisms. M.p. 50°.

Rabe, *Ber.*, 1889, 22, 394.

### 4-Chloro-1-naphthoic Acid.

Needles. M.p. 210° (223-4°). Sol. EtOH, AcOH. Spar. sol. Et<sub>2</sub>O, CHCl<sub>3</sub>.

*p-Bromophenacyl ester*: m.p. 130-1°.

*Amide*:  $C_{11}H_8ONCl$  MW, 205.5. M.p. 235-6°.

*Nitrile*:  $C_{11}H_6NCl$ . MW, 187.5. M.p. 110°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>.

Friedlander, Weisberg, *Ber.*, 1895, 28, 1843.

Jacobs *et al.*, *J. Org. Chem.*, 1946, 11, 27.

### 5-Chloro-1-naphthoic Acid.

Needles. M.p. 245° (241-2°). Sol. EtOH. Spar. sol. AcOH, C<sub>6</sub>H<sub>6</sub>. Sublimes.

*Me ester*:  $C_{12}H_9O_2Cl$ . MW, 220.5. M.p. 42°. B.p. 130°/2 mm

*Et ester*:  $C_{13}H_{11}O_2Cl$ . MW, 234.5. M.p. 42°.

*Chloride*:  $C_{11}H_6OCl_2$ . MW, 225. M.p. 146-8°. B.p. 160-5°/2 mm.

*Amide*:  $C_{11}H_8ONCl$ . MW, 205.5. M.p. 239°. Spar. sol. EtOH.

*Nitrile*: m.p. 145°.

Whitmore, Fox, *J. Am. Chem. Soc.*, 1929, 51, 3366.

Jacobs *et al.*, *J. Org. Chem.*, 1946, 11, 229.

### 6-Chloro-1-naphthoic Acid.

M.p. 215.8-16.2° (217°).

*Me ester*: cryst. from MeOH. M.p. 66-0-6.5°. B.p. 165-70°/2 mm.

*p-Bromophenacyl ester*: m.p. 142-3°.

*Chloride*: m.p. 69-70°. B.p. 140-50°/1 mm.

*Amide*: m.p. 215-16°.

*Anilide*: m.p. 196-7°.

Price *et al.*, *J. Am. Chem. Soc.*, 1941, 63, 1857.

Price, Huber, *J. Am. Chem. Soc.*, 1942, 64, 2136.

Jacobs *et al.*, *J. Org. Chem.*, 1946, 11, 229.

Hurd, Fancher, Bonner, *J. Org. Chem.*, 1947, 12, 369.

### 7-Chloro-1-naphthoic Acid.

Cryst. from 60% EtOH. M.p. 243° (238-40°). *Me ester*: needles from 60% EtOH. M.p. 54°.

*p-Bromophenacyl ester*: m.p. 145-6°.

*Chloride*: cryst. from pet. ether. M.p. 106°. B.p. 140-50°/1 mm.

*Amide*: needles from 50% EtOH. M.p. 237° (231.5-3.5°).

*Anilide*: needles from EtOH.Aq. M.p. 185°.

Goldstein, Fischer, *Helv. Chim. Acta*, 1938, 21, 1520.

Horn, Warren, *J. Chem. Soc.*, 1946, 144.

Jacobs *et al.*, *J. Org. Chem.*, 1946, 11, 229.

Hurd, Fancher, Bonner, *J. Org. Chem.*, 1947, 12, 369.

### 8-Chloro-1-naphthoic Acid.

Cryst. from EtOH.Aq. M.p. 171-2° (167°). Sublimes.

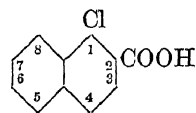
*Et ester*: needles. M.p. 50°.

*Amide*: red needles from EtOH. M.p. 207.5°.

Kalb, *Ber.*, 1914, 47, 1727.

Whitmore, Fox, *J. Am. Chem. Soc.*, 1929, 51, 3366.

### 1-Chloro-2-naphthoic Acid ( $\alpha$ -Chloro- $\beta$ -naphthoic acid)



$C_{11}H_7O_2Cl$  MW, 206.5

Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 196°. NaHg  $\rightarrow$  2-naphthoic acid.

Wolfenstein, *Ber.*, 1888, 21, 1190.

### 3-Chloro-2-naphthoic Acid (3-Chloro- $\beta$ -naphthoic acid).

Cryst. from MeOH.Aq. M.p. 216-17°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>.

*Me ester*:  $C_{12}H_9O_2Cl$ . MW, 220.5. Needles from MeOH. M.p. 58°.

*Et ester*:  $C_{13}H_{11}O_2Cl$ . MW, 234.5. M.p. 50°. B.p. 218-22°/160 mm. Volatile in steam.

*Chloride*:  $C_{11}H_6OCl_2$ . MW, 225. M.p. 56-5°. B.p. 248°/160 mm.

*Amide*:  $C_{11}H_8ONCl$ . MW, 205.5. Needles. M.p. 237°. Spar. sol. EtOH, Me<sub>2</sub>CO.

Hosaeus, *Ber.*, 1893, 26, 668.

Strohbach, *Ber.*, 1901, 34, 4160.

**5-Chloro-2-naphthoic Acid.**

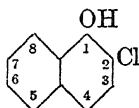
Needles from AcOH or EtOH. M.p. 270°.

*Me ester*: m.p. 81°.*Et ester*: m.p. 45°.*Chloride*: m.p. 89°.*Amide*: m.p. 186-7°.*Nitrile*: C<sub>11</sub>H<sub>6</sub>NCl. MW, 187.5. M.p. 144°.*Anilide*: m.p. 202.5°.Ekstrand, *J. prakt. Chem.*, 1891, **43**, 412.Goldstein, Matthey, *Helv. Chim. Acta*, 1938, **21**, 62.**6-Chloro-2-naphthoic Acid.**

M.p. 285-6°.

*Amide*: m.p. 206.5-7.0°.Jacobs *et al.*, *J. Org. Chem.*, 1946, **11**, 27.**8-Chloro-2-naphthoic Acid.**

Needles. M.p. 260°.

*Et ester*: leaflets. M.p. 29° (not sharp).Ekstrand, *J. prakt. Chem.*, 1891, **43**, 412.**2-Chloro-1-naphthol ( $\beta$ -Chloro- $\alpha$ -naphthol)**C<sub>10</sub>H<sub>7</sub>OCl

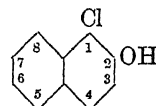
MW, 178.5

Needles from ligroin. M.p. 64-5° (61°). Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.Reissert, *Ber.*, 1911, **44**, 867.Lesser, Gad, *Ber.*, 1923, **56**, 972Franzen, Stäuble, *J. prakt. Chem.*, 1921, **103**, 383.**3-Chloro-1-naphthol.**

Needles. M.p. 143°.

*Me ether*: C<sub>11</sub>H<sub>9</sub>OCl. MW, 192.5. B.p. 162-4°/18 mm*Acetyl*: m.p. 69°.*Benzoyl*: m.p. 118-19°.Hodgson, Elliott, *J. Chem. Soc.*, 1934, 1707.Franzen, Stauble, *J. prakt. Chem.*, 1921, **103**, 383.**4-Chloro-1-naphthol.**Needles from EtOH.Aq. or CHCl<sub>3</sub>. M.p. 120-1° (116-17°). Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Sublimes.*Carbonate*: C<sub>21</sub>H<sub>12</sub>O<sub>3</sub>Cl<sub>2</sub>. MW, 383. Leaflets from C<sub>6</sub>H<sub>6</sub>. M.p. 228°.*Acetyl*: m.p. 44°.*Picrate*: orange needles. M.p. 171°.Reverdin, Kauffmann, *Ber.*, 1895, **28**, 3052.Lesser, Gad, *Ber.*, 1923, **56**, 972.Matter, F.P. 807,536, (*Chem. Abstracts*, 1937, **31**, 5383).Airan, Shah, *Chem. Abstracts*, 1943, **37**, 633.**5-Chloro-1-naphthol.**Needles from H<sub>2</sub>O or leaflets from CS<sub>2</sub>. M.p. 131-2°. Sol. EtOH, Et<sub>2</sub>O, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>. Very spar. sol. H<sub>2</sub>O.*Acetyl*: m.p. 53°.*Picrate*: orange needles. M.p. 160°.Erdmann, Kirchhoff, *Ann.*, 1888, **247**, 372.**6-Chloro-1-naphthol.**Prisms. M.p. 94°. Sol. EtOH, Et<sub>2</sub>O, CS<sub>2</sub>.*Acetyl*: m.p. 47°.*Picrate*: reddish-yellow needles. M.p. 165°.Erdmann, Kirchhoff, *Ann.*, 1888, **247**, 372.**7-Chloro-1-naphthol.**Needles from CS<sub>2</sub>. M.p. 123°. Sol. EtOH, Et<sub>2</sub>O, CS<sub>2</sub>. Spar. sol. H<sub>2</sub>O.*Picrate*: m.p. 139°.Erdmann, Kirchhoff, *Ann.*, 1888, **247**, 374.Winterstein, Maxim, *Helv. Chim. Acta*, 1919, **2**, 202.**8-Chloro-1-naphthol.**

Needles. M.p. 67°.

Vorozhtov, Koslov, *Ber.*, 1936, **69**, 415.**1-Chloro-2-naphthol ( $\alpha$ -Chloro- $\beta$ -naphthol)**C<sub>10</sub>H<sub>7</sub>OCl

MW, 178.5

Plates from H<sub>2</sub>O. Needles from ligroin. M.p. 70°. Sol. EtOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, AcOH. Spar. sol. H<sub>2</sub>O, cold ligroin. Volatile in steam.*Me ether*: C<sub>11</sub>H<sub>9</sub>OCl. MW, 192.5. Pale yellow plates from EtOH. M.p. 67-9°.*Et ether*: C<sub>12</sub>H<sub>11</sub>OCl. MW, 206.5. Leaflets from EtOH. M.p. 58°.*Acetyl*: m.p. 42-3°.Cleve, *Ber.*, 1888, **21**, 895.Zincke, *ibid.*, 3384.Franzen, Stäuble, *J. prakt. Chem.*, 1921, **103**, 379.Ioffe, *Chem. Abstracts*, 1936, **30**, 7111.**3-Chloro-2-naphthol.**Needles from pet. ether. M.p. 90° (64°). Sol. ord. org. solvents, hot H<sub>2</sub>O.*Me ether*: leaflets from MeOH. M.p. 78.5°.Marschalk, *Bull. soc. chim.*, 1928, **43**, 1366.Jambuserwala, Holt, Mason, *J. Chem. Soc.*, 1931, 375.**4-Chloro-2-naphthol.**

M.p. 100°.

*Me ether*: m.p. 44-5°.*Acetyl*: m.p. 56°.Hodgson, Birtwell, *J. Chem. Soc.*, 1943, 468.**5-Chloro-2-naphthol.**Needles. M.p. 128°. Sol. EtOH, AcOH, C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>. Sublimes.Claus, *J. prakt. Chem.*, 1889, **39**, 317.

**6-Chloro-2-naphthol.**

Needles from  $H_2O$  or  $AcOH$ . M.p.  $115^\circ$ . Sol.  $EtOH$ ,  $Et_2O$ ,  $AcOH$ ,  $CHCl_3$ ,  $CS_2$ ,  $C_6H_6$ , hot  $H_2O$ . Sublimes. Ox.  $\rightarrow$  4-chlorophthalic acid.

m-Nitrobenzoyl: m.p.  $146-7^\circ$ .

Ruggli, Knapp, Merz, Zimmermann, *Helv. Chim. Acta*, 1929, 12, 1048.

**7-Chloro-2-naphthol.**

Leaflets from ligroin. M.p.  $126-7^\circ$ . Sol.  $EtOH$ ,  $Et_2O$ ,  $AcOH$ ,  $C_6H_6$ .

Acetyl: m.p.  $104.5^\circ$ .

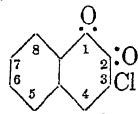
Franzen, Deibel, *J. prakt. Chem.*, 1908, 78, 154.

**8-Chloro-2-naphthol.**

Needles. M.p.  $101^\circ$ . B.p.  $307-8^\circ$ . Sol.  $EtOH$ ,  $Et_2O$ ,  $CHCl_3$ ,  $AcOH$ ,  $C_6H_6$ . Insol. pet. ether.

m-Nitrobenzoyl: m.p.  $176^\circ$ .

Ruggli, Knapp, Merz, Zimmermann, *Helv. Chim. Acta*, 1929, 12, 1050.

**3-Chloro-1:2-naphthoquinone (3-Chloro- $\beta$ -naphthoquinone)**

$C_{10}H_5O_2Cl$  MW, 192.5

Reddish needles from  $CHCl_3$ . M.p.  $172^\circ$ . Sol.  $C_6H_6$ ,  $CHCl_3$ ,  $AcOH$ , hot  $EtOH$ .  $SO_2 \rightarrow$  3-chloro-1:2-dihydroxynaphthalene.

1-Oxime: 3-chloro-1-nitroso-2-naphthol.  $C_{10}H_6O_2NCl$ . MW, 207.5. Reddish-yellow needles. M.p.  $167-8^\circ$  decomp. Sol. hot  $EtOH$ , hot  $AcOH$ , hot  $C_6H_6$ .

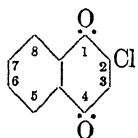
Zincke, *Ber.*, 1886, 19, 2497; 1894, 27, 737.

**4-Chloro-1:2-naphthoquinone.**

Maroon needles from  $EtOH$ . M.p.  $188^\circ$ .

2-Oxime: 4-chloro-2-nitroso-1-naphthol. Pale yellow needles. M.p.  $157^\circ$ .

Hodgson, Elliott, *J. Chem. Soc.*, 1935, 1853.

**2-Chloro-1:4-naphthoquinone (2-Chloro- $\alpha$ -naphthoquinone)**

$C_{10}H_5O_2Cl$  MW, 192.5

Yellow needles from  $H_2O$ ,  $EtOH$  or  $AcOH.Aq$ . M.p.  $117^\circ$  ( $112^\circ$ ). Sol.  $EtOH$ ,  $C_6H_6$ . Mod. sol. hot  $H_2O$ ,  $AcOH$ . Spar. sol.  $Et_2O$ . Volatile in steam.

4-Oxime: 2-chloro-4-nitroso-1-naphthol.  $C_{10}H_6O_2NCl$ . MW, 207.5. Needles. M.p.  $200^\circ$  decomp. Sol.  $EtOH$ ,  $AcOH$ .

Cleve, *Ber.*, 1890, 23, 955.

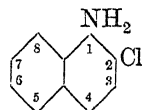
**5-Chloro-1:4-naphthoquinone.**

Yellow needles. M.p.  $163^\circ$ . Sol.  $C_6H_6$ ,  $AcOH$ . Mod. sol.  $EtOH$ . Insol.  $H_2O$ .

Semicarbazone: m.p.  $263^\circ$  decomp.

Fries, Köhler, *Ber.*, 1924, 57, 504.

Fierz-David, Blangey, Krannichfeldt, *Helv. Chim. Acta*, 1947, 30, 816.

**2-Chloro-1-naphthylamine ( $\beta$ -Chloro- $\alpha$ -naphthylamine, 2-chloro-1-aminonaphthalene)**

$C_{10}H_8NCl$  MW, 177.5

Needles. M.p.  $56^\circ$ . Sol.  $EtOH$ . Volatile in steam.

N-Acetyl: 2-chloro-1-acetnaphthalide.  $C_{12}H_{10}ONCl$ . MW, 219.5. Needles from  $EtOH$ . M.p.  $191^\circ$ .

N-Diacetyl: prisms from  $EtOH.Aq$ . M.p.  $88^\circ$ .

Cleve, *Ber.*, 1887, 20, 450.

**3-Chloro-1-naphthylamine.**

M.p.  $62^\circ$ .

B,HCl: m.p.  $219^\circ$ .

N-Acetyl: 3-chloro-1-acetnaphthalide. M.p.  $197^\circ$ .

N-Benzoyl: m.p.  $162^\circ$ .

Hodgson, Elliott, *J. Chem. Soc.*, 1934, 1706.

**4-Chloro-1-naphthylamine.**

Needles. M.p.  $98^\circ$  ( $95-7^\circ$ ). Sol.  $EtOH$ ,  $Et_2O$ .

N-Acetyl: 4-chloro-1-acetnaphthalide. M.p.  $186.5^\circ$  ( $190-1^\circ$ ). Sol.  $EtOH$ ,  $Et_2O$ .

Seidler, *Ber.*, 1878, 11, 1201.

Jacobs et al., *J. Org. Chem.*, 1946, 11, 27, 223.

**5-Chloro-1-naphthylamine.**

Needles. M.p.  $85^\circ$ .

N-Acetyl: 5-chloro-1-acetnaphthalide. Prisms. M.p.  $128^\circ$ .

Friedländer, Karamessinis, Schenck, *Ber.*, 1922, 55, 47.

**6-Chloro-1-naphthylamine.**

M.p.  $63-4^\circ$ .

N-Acetyl: 6-chloro-1-acetnaphthalide. M.p.  $210-11^\circ$ .

Schroeter, *Ber.*, 1930, 63, 1318.

Jacobs et al., *J. Org. Chem.*, 1946, 11, 229.

**7-Chloro-1-naphthylamine.**

Cryst. from pet. ether. M.p.  $46^\circ$ .

B,HCl: leaflets from  $H_2O$ . M.p.  $235-9^\circ$ .

Schroeter, *Ber.*, 1930, 63, 1318.

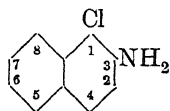
**8-Chloro-1-naphthylamine.**

Needles or leaflets from ligroin. M.p.  $88-9^\circ$  ( $98^\circ$ ).

N-Acetyl: 8-chloro-1-acetnaphthalide. Needles from  $C_6H_6$ -ligroin. M.p.  $137^\circ$ .

Ullmann, Consonno, *Ber.*, 1902, 35, 2809.

**1-Chloro-2-naphthylamine** ( $\alpha$ -Chloro- $\beta$ -naphthylamine, 1-chloro-2-aminonaphthalene)



$C_{10}H_8NCl$  MW, 177.5

Needles. M.p. 59° (60°).

N-Formyl: prisms from  $C_6H_6$ . M.p. 136°.

N-Acetyl: 1-chloro-2-acetnaphthalide.

$C_{12}H_{10}ONCl$ . MW, 219.5. Needles. M.p. 147°.

N-Benzoyl: m.p. 98-9°.

Kuhlmann, F.P. 649,851, (*Chem. Abstracts*, 1929, 23, 2986).

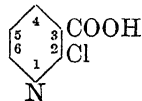
Franzen, Stäuble, *J. prakt. Chem.*, 1921, 103, 380.

**4-Chloro-2-naphthylamine.**

Needles from pet. ether. M.p. 68°.

Hodgson, Elliott, *J. Chem. Soc.*, 1935, 1851.

**2-Chloronicotinic Acid** (2-Chloropyridine-3-carboxylic acid)



$C_6H_4O_2NCl$  MW, 157.5

Needles from  $H_2O$ . M.p. 193°.

Chloride:  $C_6H_3ONCl_2$ . MW, 176. B.p. 98-100°/2 mm.

Anilide: m.p. 125°.

Phenetidide: m.p. 115°.

Seide, *Ber.*, 1924, 57, 1806.

S.C.I. Basle, D.R.P. 582,319, (*Chem. Abstracts*, 1933, 27, 5152).

**5-Chloronicotinic Acid.**

Needles from  $H_2O$ . M.p. 170-1°. Sol. EtOH,  $Me_2CO$ , AcOEt. Spar. sol.  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ .

Me ester:  $C_7H_6O_2NCl$ . MW, 171.5. M.p. 88-9°.

Phenyl ester:  $C_{12}H_8O_2NCl$ . MW, 233.5. M.p. 79°.

Chloride: m.p. 53°. B.p. 120°/12 mm.

Amide:  $C_6H_5ON_2Cl$ . MW, 156.5. M.p. 205-6°.

Meyer, Graf, *Ber.*, 1928, 61, 2210.

Graf, Lederer-Ponzer, Kopetz, Purkert, László, *J. prakt. Chem.*, 1933, 138, 244.

Schultz, *J. Org. Chem.*, 1946, 11, 170.

**6-Chloronicotinic Acid.**

Leaflets from  $H_2O$ . M.p. 199° decomp. Sol. EtOH,  $Et_2O$ , AcOH, conc. HCl. Spar. sol.  $CHCl_3$ ,  $C_6H_6$ . Sublimes.

Me ester: m.p. 86-90°. Sol. EtOH,  $Et_2O$ . Spar. sol.  $H_2O$ . Volatile in steam.

Chloride: m.p. 49-51°. B.p. 85°/3 mm.

Amide: needles from  $H_2O$ . M.p. 210-11° (205°).

Nitrile: m.p. 115°.

Anilide: m.p. 170-2°.

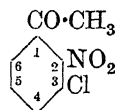
Pechmann, Welsh, *Ber.*, 1884, 17, 2392.

Ráth, Schiffmann, *Ann.*, 1931, 487, 130.

**Chloronitroacetanilide.**

See under Chloronitroaniline.

**3-Chloro-2-nitroacetophenone**



$C_8H_6O_3NCl$  MW, 199.5

Yellow or pale orange plates from EtOH. M.p. 97°.

Waters, *J. Chem. Soc.*, 1945, 629.

Simpson et al., *J. Chem. Soc.*, 1945, 646.

**4-Chloro-2-nitroacetophenone.**

M.p. 44° (55-6°). B.p. 157°/9 mm.

Leonard, Boyd, *J. Org. Chem.*, 1946, 11, 405.

Atkinson, Simpson, *J. Chem. Soc.*, 1947, 232.

**5-Chloro-2-nitroacetophenone.**

Yellow. M.p. 62° (63-5°). B.p. 162-3°/13 mm.

Simpson et al., *J. Chem. Soc.*, 1945, 646.

Leonard, Boyd, *J. Org. Chem.*, 1946, 11, 405.

**4-Chloro-3-nitroacetophenone.**

Yellowish needles from MeOH. M.p. 104° (99-101°).

Semicarbazone: yellow needles from AcOH. M.p. 256-7°.

Mayer, Stark, Schön, *Ber.*, 1932, 65, 1334.

Le Fèvre, Le Fèvre, *J. Chem. Soc.*, 1932, 1991.

Leonard, Boyd, *J. Org. Chem.*, 1946, 11, 405.

Keneford, Simpson, *J. Chem. Soc.*, 1947, 227.

**6-Chloro-3-nitroacetophenone.**

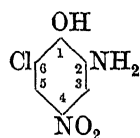
Prisms from EtOH. M.p. 62°. Sol.  $CHCl_3$ ,  $C_6H_6$ , hot EtOH. Spar. sol.  $Et_2O$ . Very spar. sol. ligroin.  $KMnO_4 \rightarrow$  6-chloro-3-nitrobenzoic acid.

Thorp, Brunskill, *J. Am. Chem. Soc.*, 1915, 37, 1261.

**Chloronitroacet-toluidide.**

See under Chloronitrotoluidine.

**6-Chloro-4-nitro-2-aminophenol**



$C_6H_5O_3N_2Cl$

MW, 188.5

Yellow needles + 1H<sub>2</sub>O from H<sub>2</sub>O. Anhyd. at 100° → red. M.p. about 160°. Sol. EtOH, Et<sub>2</sub>O.

Faust, Müller, *Ann.*, 1874, 173, 315.

Vorontsov, *Chem. Abstracts*, 1944, 38, 6278.

#### 4-Chloro-5-nitro-2-aminophenol.

Yellow needles. M.p. 225° decomp. Sol. EtOH. Spar. sol. hot H<sub>2</sub>O. Reddish-brown sols. in alkalis.

*Me ether*: 4-chloro-5-nitro-*o*-anisidine. C<sub>7</sub>H<sub>7</sub>O<sub>3</sub>N<sub>2</sub>Cl. MW, 202.5. Cryst. M.p. 132°. *N-Acetyl*: cryst. M.p. 193°.

Bayer, D.R.P. 186,655, (*Chem. Zentr.*, 1907, II, 1132).

#### 4-Chloro-6-nitro-2-aminophenol.

M.p. 152°.

*N-Acetyl*: yellow cryst. M.p. 150–60°.

Sandoz, D.R.P. 147,060, (*Chem. Zentr.*, 1904, I, 233).

A.G.F.A., D.R.P. 234,742, (*Chem. Zentr.*, 1911, I, 1768).

#### 2-Chloro-3-nitro-4-aminophenol.

Brown plates from C<sub>6</sub>H<sub>6</sub>. M.p. 165.5° decomp.

*Et ether*: 2-chloro-3-nitro-*p*-phenetidine. C<sub>8</sub>H<sub>9</sub>O<sub>3</sub>N<sub>2</sub>Cl. MW, 216.5. Orange cryst. M.p. 74°. *N-Acetyl*: m.p. 184.5°.

van Erp, *J. prakt. Chem.*, 1931, 129, 327.

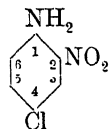
#### 2-Chloro-5-nitro-4-aminophenol.

Red cryst. from dil. AcOH. M.p. 169.5° decomp.

*Et ether*: 2-chloro-5-nitro-*p*-phenetidine. Orange. M.p. 128.5°. *N-Acetyl*: yellow. M.p. 166°.

van Erp, *J. prakt. Chem.*, 1930, 127, 20.

#### 4-Chloro-*o*-nitroaniline



C<sub>6</sub>H<sub>5</sub>O<sub>2</sub>N<sub>2</sub>Cl

MW, 172.5

Orange-yellow or orange-red needles from hot H<sub>2</sub>O. M.p. 116–7°. Sol. EtOH, Et<sub>2</sub>O, AcOH. Spar. sol. ligroin.

*N-Me*: see 4-Chloro-2-nitro-*N*-methylaniline.

*N-Di-Me*: see 4-Chloro-2-nitro-*N*-dimethylaniline.

*N-Et*: see 4-Chloro-2-nitro-*N*-ethylaniline.

*N-Di-Et*: 4-chloro-2-nitro-*N*-diethylaniline. C<sub>10</sub>H<sub>13</sub>O<sub>2</sub>N<sub>2</sub>Cl. MW, 228.5. Red needles. M.p. 32°.

*N-Acetyl*: 4-chloro-*o*-nitroacetanilide. C<sub>8</sub>H<sub>7</sub>O<sub>3</sub>N<sub>2</sub>Cl. MW, 214.5. Yellow needles from EtOH. M.p. 104° (100–1°).

*N-p-Toluenesulphonyl*: yellow needles from EtOH. M.p. 110°.

Kiprianow, Daschewski, *Chem. Zentr.*, 1931, II, 426.

McMaster, Steiner, *Ind. Eng. Chem.*, 1930, 22, 547.

Likhosherstov, Petrov, Voskresenskaya, *Chem. Abstracts*, 1938, 32, 6633.

Crepez, *Chem. Zentr.*, 1936, I, 1411.

#### 5-Chloro-*o*-nitroaniline.

Golden needles from CS<sub>2</sub>. Yellow leaflets from EtOH or C<sub>6</sub>H<sub>6</sub>. M.p. 126.5°. Sol. EtOH, Et<sub>2</sub>O, 50% AcOH. Spar. sol. CS<sub>2</sub>, ligroin. Sublimes.

*N-Me*: see 5-Chloro-2-nitro-*N*-methylaniline.

*N-Di-Me*: see 5-Chloro-2-nitro-*N*-dimethylaniline.

*N-Et*: see 5-Chloro-2-nitro-*N*-ethylaniline.

*N-Acetyl*: 5-chloro-*o*-nitroacetanilide. M.p. 121° (118°). Spar. sol. EtOH.

Fourneau, Tréfouel, Wancolle, *Bull. soc. chim.*, 1930, 47, 747.

Hodgson, Kershaw, *J. Chem. Soc.*, 1929, 2919.

#### 6-Chloro-*o*-nitroaniline.

Yellow needles. M.p. 76°.

*N-Me*: see 6-Chloro-2-nitro-*N*-methylaniline.

*N-Acetyl*: 6-chloro-*o*-nitroacetanilide. Yellow needles. M.p. 193°.

*N-Diacetyl*: m.p. 90°.

Bruyn, *Rec. trav. chim.*, 1916, 36, 137.

van Duin, *Rec. trav. chim.*, 1932, 51, 886.

#### 2-Chloro-*m*-nitroaniline.

M.p. 95–6°.

*N-Di-Me*: see 2-Chloro-3-nitro-*N*-dimethylaniline.

Wallagh, Wibaut, *Rec. trav. chim.*, 1936, 55, 1071.

#### 4-Chloro-*m*-nitroaniline.

Yellow needles from hot H<sub>2</sub>O. M.p. 103°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Mod. sol. hot H<sub>2</sub>O. Spar. sol. ligroin.

*N-Di-Me*: see 4-Chloro-3-nitro-*N*-dimethylaniline.

*N-Acetyl*: 4-chloro-*m*-nitroacetanilide. C<sub>8</sub>H<sub>7</sub>O<sub>3</sub>N<sub>2</sub>Cl. MW, 214.5. M.p. 150° (145°).

*N-p-Toluenesulphonyl*: m.p. 142°.

Fourneau, Tréfouel, Wancolle. *Bull. soc. chim.*, 1930, 47, 743.

Hodgson, *J. Soc. Dyers Colourists*, 1927, 43, 188.

Blanksma, *Rec. trav. chim.*, 1946, 65, 207.

#### 5-Chloro-*m*-nitroaniline.

Orange needles from EtOH. M.p. 133–4°.

Cohen, McCandlish, *J. Chem. Soc.*, 1905, 87, 1264.

**6-Chloro-*m*-nitroaniline.**

Yellow needles from ligroin. M.p. 121° (119°). Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, AcOH. Spar. sol. CS<sub>2</sub>, ligroin. 400 times as sweet as sugar.

N-*Me*: see 6-Chloro-3-nitro-*N*-methylaniline.

N-*Di-Me*: see 6-Chloro-3-nitro-*N*-dimethylaniline.

N-*Acetyl*: 6-chloro-*m*-nitroacetanilide. M.p. 156°. Spar. sol. EtOH.

Chattaway, Orton, Evans, *Ber.*, 1900, 33, 3062.

Blanksma, *Rec. trav. chim.*, 1946, 65, 207.

**2-Chloro-*p*-nitroaniline.**

Yellow needles from H<sub>2</sub>O, ligroin-CS<sub>2</sub>, or 20% AcOH. M.p. 108° (105°). Sol. EtOH, Et<sub>2</sub>O, CS<sub>2</sub>. Spar. sol. 50% AcOH. Insol. ligroin.

N-*Me*: see 2-Chloro-4-nitro-*N*-methylaniline.

N-*Di-Me*: see 2-Chloro-4-nitro-*N*-dimethylaniline.

N-*Acetyl*: 2-chloro-*p*-nitroacetanilide. C<sub>8</sub>H<sub>7</sub>O<sub>3</sub>N<sub>2</sub>Cl. MW, 214.5. Prisms from EtOH. M.p. 139°.

N-*Benzoyl*: 2-chloro-*p*-nitrobenzanilide. Yellow needles from EtOH. M.p. 161°.

N-*p-Toluenesulphonyl*: yellow prisms. M.p. 164°.

Kiprianow, Daschewski, *Chem. Zentr.*, 1931, II, 426.

Grether, Keener, U.S.P. 1,852,811, (*Chem. Abstracts*, 1933, 27, 736).

Holmes, London, *J. Chem. Soc.*, 1940, 1521.

**3-Chloro-*p*-nitroaniline.**

Yellow leaflets from C<sub>6</sub>H<sub>6</sub>. M.p. 156-7°. Sol. EtOH, AcOH. Insol. CS<sub>2</sub>, ligroin.

N-*Di-Me*: see 3-Chloro-4-nitro-*N*-dimethylaniline.

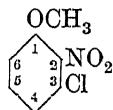
N-*Acetyl*: 3-chloro-*p*-nitroacetanilide. Pale yellow needles. M.p. 145° (142°).

Hodgson, Kershaw, *J. Chem. Soc.*, 1929, 2919.

Fourneau, Tréfoüel, Wancolle, *Bull. soc. chim.*, 1930, 47, 747, 752.

**4-Chloro-5-nitro-*o*-anisidine.**

See under 4-Chloro-5-nitro-2-aminophenol.

**3-Chloro-2-nitroanisole**

C<sub>7</sub>H<sub>6</sub>O<sub>3</sub>NCl MW, 187.5

Needles. M.p. 55°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

Holleman, de Mooy, *Rec. trav. chim.*, 1915, 35, 14.

Hodgson, Moore, *J. Chem. Soc.*, 1925, 127, 1601.

**4-Chloro-2-nitroanisole.**

Yellow needles or prisms from EtOH. M.p. 98°. Sol. warm EtOH. Spar. sol. Et<sub>2</sub>O, ligroin. Volatile in steam.

Reverdin, *Ber.*, 1896, 29, 2599.

Reverdin, Eckhard, *Ber.*, 1899, 32, 2623.

Holleman, de Mooy, *Rec. trav. chim.*, 1915, 35, 14.

**5-Chloro-2-nitroanisole.**

Greenish yellow needles from EtOH. M.p. 71°.

Holleman, de Mooy, *Rec. trav. chim.*, 1915, 35, 15.

Mangini, Deliddo, *Chem. Abstracts*, 1934, 28, 1992.

**6-Chloro-2-nitroanisole.**

M.p. 56°.

Holleman, ter Weel, *Rec. trav. chim.*, 1915, 35, 50.

Holleman, de Mooy, *ibid.*, 14.

London, Shulman, *J. Chem. Soc.*, 1941, 722.

**2-Chloro-3-nitroanisole.**

Pale yellow needles from ligroin. M.p. 94°.

van Erp, *J. prakt. Chem.*, 1930, 127, 24.

Schlieper, *Ber.*, 1893, 26, 2466.

**4-Chloro-3-nitroanisole.**

Cryst. from MeOH. M.p. 45°.

van Erp, *J. prakt. Chem.*, 1930, 127, 24.

Hodgson, Crook, *J. Chem. Soc.*, 1932, 1814.

**5-Chloro-3-nitroanisole.**

Cryst. from EtOH. M.p. 101° (91°).

Blanksma, *Rec. trav. chim.*, 1908, 27, 28.

**6-Chloro-3-nitroanisole.**

Pale yellow needles. M.p. 83°. Volatile in steam.

van Erp, *J. prakt. Chem.*, 1930, 127, 29.

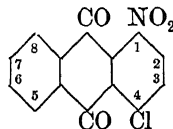
**2-Chloro-4-nitroanisole.**

Needles or prisms. M.p. 98°. Mod. sol. hot EtOH.

Reverdin, Eckhard, *Ber.*, 1899, 32, 2622.

Holleman, de Mooy, *Rec. trav. chim.*, 1915, 35, 14.

Holleman, ter Weel, *ibid.*, 50.

**4-Chloro-1-nitroanthraquinone**

C<sub>14</sub>H<sub>6</sub>O<sub>4</sub>NCl MW, 287.5

Yellow needles. M.p. 260-1°. Sol. PhNO<sub>2</sub>. Spar. sol. EtOH, conc. H<sub>2</sub>SO<sub>4</sub>.

Kopetschni, D.R.P. 363,930, (*Chem. Abstracts*, 1924, 18, 991).

**5-Chloro-1-nitroanthraquinone.**

Needles from AcOH or PhNO<sub>2</sub>. M.p. 314°. Sol. AcOH, PhNO<sub>2</sub>. Insol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, toluene, ligroin. Pale yellow in conc. H<sub>2</sub>SO<sub>4</sub>. Na<sub>2</sub>S.Aq. → 5-chloro-1-aminoanthraquinone.

Ullmann, Kertész, *Ber.*, 1919, 52, 555.  
Maki, Nagai, *Chem. Abstracts*, 1931, 25, 948.  
Weinmayr, U.S.P. 2,417,027, (*Chem. Abstracts*, 1947, 41, 5901).  
Spador, *Chem. Abstracts*, 1941, 35, 2884.

**6-Chloro-1-nitroanthraquinone.**

Yellow leaflets from PhNO<sub>2</sub>. M.p. 274–5°. Fierz-David, *Helv. Chim. Acta*, 1927, 10, 214.

**7-Chloro-1-nitroanthraquinone.**

Pale yellow prisms from anisole or chlorobenzene. M.p. 256–7°.

Fierz-David, *Helv. Chim. Acta*, 1927, 10, 214.

**8-Chloro-1-nitroanthraquinone.**

Pale yellow cryst. M.p. 263°. Na<sub>2</sub>S.Aq. → 8-chloro-1-aminoanthraquinone.

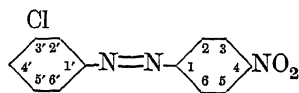
Ullmann, Kertész, *Ber.*, 1919, 52, 555.  
Weinmayr, U.S.P. 2,417,027, (*Chem. Abstracts*, 1947, 41, 5901).

**1-Chloro-2-nitroanthraquinone.**

Yellow needles. M.p. 257–8°. Kopetschni, D.R.P. 363,930, (*Chem. Abstracts*, 1924, 18, 991).

**7-Chloro-2-nitroanthraquinone.**

Yellow cryst. from AcOH. M.p. 251–2°. Gubelmann, Weiland, Stallmann, *J. Am. Chem. Soc.*, 1931, 53, 1036.  
Weinmayr, U.S.P. 2,417,027, (*Chem. Abstracts*, 1947, 41, 5901).

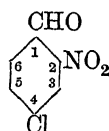
**3'-Chloro-4-nitroazobenzene**

C<sub>12</sub>H<sub>8</sub>O<sub>2</sub>N<sub>3</sub>Cl MW, 261.5  
Red needles from EtOH. M.p. 129°.

Burns, McCombie, Scarborough, *J. Chem. Soc.*, 1928, 2933.

**4'-Chloro-4-nitroazobenzene.**

Red needles from EtOH. M.p. 169°. Burns, McCombie, Scarborough, *J. Chem. Soc.*, 1928, 2933.

**4-Chloro-2-nitrobenzaldehyde**

C<sub>7</sub>H<sub>4</sub>O<sub>3</sub>NCl MW, 185.5

Yellowish needles. M.p. 67–8°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O. Forms bisulphite comp.

*Oxime*: cryst. from EtOH. M.p. 172°. *Semicarbazone*: plates from AcOH. M.p. 269–70°.

Badische, D.R.P. 128,727, (*Chem. Zentr.*, 1902, I, 552).  
van der Lee, *Rec. trav. chim.*, 1926, 45, 681.  
Spalding *et al.*, *J. Am. Chem. Soc.*, 1946, 68, 1596.

**5-Chloro-2-nitrobenzaldehyde.**

M.p. 77–8°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, hot H<sub>2</sub>O. Volatile in steam. *Oxime*: plates from EtOH. M.p. 112°.

Eichengrün, Einhorn, *Ann.*, 1891, 262, 137.

**6-Chloro-2-nitrobenzaldehyde.**

M.p. 70–1°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O.

*Oxime*: m.p. 156–7°. *Phenylhydrazone*: red needles. M.p. 161°. *β-Naphthylhydrazone*: yellow needles. M.p. 178°.

Gindraux, *Helv. Chim. Acta*, 1929, 12, 930.

**4-Chloro-3-nitrobenzaldehyde.**

Needles from EtOH.Aq. M.p. 64–5°. Sol. EtOH, CHCl<sub>3</sub>. Spar. sol. hot H<sub>2</sub>O.

*Oxime*: pale yellow needles from EtOH. M.p. 146°.

*Semicarbazone*: m.p. 244° decomp. *Phenylhydrazone*: m.p. 148°. *p-Nitrophenylhydrazone*: orange needles. M.p. 278–9°.

*p-Thiocyanophenylhydrazone*: m.p. 172°. *Azine*: m.p. 249°.

*Diacetate*: yellow cryst. from EtOH. M.p. 97°.

Hodgson, Beard, *J. Chem. Soc.*, 1927, 24.  
Hodgson, Smith, *J. Soc. Chem. Ind.*, 1930, 49, 408t.

van der Lee, *Rec. trav. chim.*, 1926, 45, 278.

**6-Chloro-3-nitrobenzaldehyde.**

Cryst. from EtOH. M.p. 80°. Sol. EtOH, CHCl<sub>3</sub>. Spar. sol. ligroin, CS<sub>2</sub>, hot H<sub>2</sub>O.

*α-Oxime*: m.p. 147–8°. *β-Oxime*: pale yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 176°.

*Methylhydrazone*: yellow needles. M.p. 121–2°.

*Phenylhydrazone*: m.p. 182°. *2:4-Dinitrophenylhydrazone*: orange. M.p. 280° decomp.

*p-Thiocyanophenylhydrazone*: m.p. 213–14°. *Benzoylhydrazone*: m.p. 135–8°.

Erdmann, *Ann.*, 1892, 272, 153.



**2-Chloro-4-nitrobenzaldehyde.**

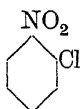
Needles from ligroin or  $H_2O$ . M.p.  $74^\circ$  ( $79^\circ$ ).  
*Semicarbazone*: yellow cryst. from AcOH.  
 M.p.  $234^\circ$  decomp.

*Phenylhydrazone*: red cryst. from EtOH.  
 M.p.  $154^\circ$ .

*2:4-Dinitrophenylhydrazone*: yellow cryst.  
 from  $PhNO_2$ . M.p.  $247^\circ$ .

Tiemann, *Ber.*, 1891, 24, 707.

Chardonnens, Heinrich, *Helv. Chim. Acta*,  
 1940, 23, 292.

**o-Chloronitrobenzene**

$C_6H_4O_2NCl$  MW, 157.5

Needles. M.p.  $33^\circ$ . B.p.  $245^\circ$ ,  $119^\circ/8$  mm.  
 Sol.  $Et_2O$ , EtOH,  $C_6H_6$ .  $NH_3$ . Aq. at  $170^\circ \rightarrow$   
*o*-nitroaniline. KOH in MeOH  $\rightarrow$  *o*-nitro-  
 anisole.

$C_6H_4O_2NCl, AlCl_3$ : m.p.  $89^\circ$ .

$C_6H_4O_2NCl, AlBr_3$ : m.p.  $83.5^\circ$ .

Ullmann, *Ber.*, 1896, 29, 1879.

Griesheim, D.R.P. 97,013, (*Chem. Zentr.*,  
 1898, II, 238).

**m-Chloronitrobenzene.**

Pale yellow prisms. Exists in two forms  
 in the solid state: stable form, m.p.  $46^\circ$ ,  
 and labile form, m.p.  $24^\circ$ . B.p.  $235-6^\circ$ . Sol.  
 $Et_2O$ , AcOH,  $CHCl_3$ ,  $CS_2$ , hot EtOH. Sn +  
 HCl  $\rightarrow$  *m*-chloroaniline.

$C_6H_4O_2NCl, AlCl_3$ : m.p.  $104^\circ$ .

$C_6H_4O_2NCl, AlBr_3$ : m.p.  $103.5^\circ$ .

Hartman, Brethen, *Organic Syntheses*,  
 Collective Vol. I, 156.

Hodgson, Birtwell, Walker, *J. Chem. Soc.*,  
 1944, 18.

**p-Chloronitrobenzene.**

M.p.  $83^\circ$ . B.p.  $242^\circ$ ,  $113^\circ/8$  mm. Sol.  $Et_2O$ ,  
 $CS_2$ , hot EtOH. Sn + HCl  $\rightarrow$  *p*-chloroaniline.  
 $NH_3$ . Aq. at  $130^\circ \rightarrow$  *p*-nitroaniline.

$C_6H_4O_2NCl, AlCl_3$ : m.p.  $126^\circ$ .

$C_6H_4O_2NCl, AlBr_3$ : m.p.  $115^\circ$ .

Griesheim, D.R.P. 97,013, (*Chem. Zentr.*,  
 1898, II, 238).

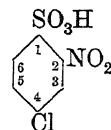
Marckwald, D.R.P. 137,847, (*Chem.*  
*Zentr.*, 1903, I, 208).

Hodgson, Birtwell, Walker, *J. Chem. Soc.*,  
 1942, 720.

Hodgson *et al.*, *J. Chem. Soc.*, 1944, 18, 22.

Hodgson, Sibbald, *J. Chem. Soc.*, 1945,  
 545, 819.

Newman, Fones, *J. Am. Chem. Soc.*, 1947,  
 69, 1221.

**4-Chloro-2-nitrobenzenesulphonic Acid**  
(*m*-Chloronitrobenzene-6-sulphonic acid, *m*-nitro-  
chlorobenzene-*p*-sulphonic acid)

$C_6H_4O_5NCIS$  MW, 237.5

Cryst. M.p. anhyd.  $114-5^\circ$ .

*Phenyl ester*:  $C_{12}H_8O_5NCIS$ . MW, 313.5.  
 M.p.  $82^\circ$ .

*Chloride*:  $C_6H_3O_4NCl_2S$ . MW, 256. Cryst.  
 M.p.  $75^\circ$ .

*Amide*:  $C_6H_5O_4N_2ClS$ . MW, 236.5. M.p.  
 $164^\circ$ .

*Anilide*: m.p.  $138^\circ$ .

*Phenylhydrazide*: m.p.  $151^\circ$ .

Riesz, *Monatsh.*, 1928, 50, 266.

Elgersma, *Rec. trav. chim.*, 1929, 48, 758.

**5-Chloro-2-nitrobenzenesulphonic Acid.**

Cryst. M.p.  $93^\circ$  (not completely anhydrous).  
*Amide*: needles from  $H_2O$ . M.p.  $158-9^\circ$ .

Elgersma, *Rec. trav. chim.*, 1929, 48, 760.

**6-Chloro-2-nitrobenzenesulphonic Acid.**

*K salt*: yellow prisms +  $\frac{1}{2}H_2O$ .

*Ba salt*: yellow needles +  $\frac{1}{2}H_2O$ . Insol. EtOH.

*Chloride*: prisms from  $Et_2O$ . M.p.  $180^\circ$ .

*Amide*: needles from  $H_2O$ . Decomp. without  
 melting.

Claus, Bopp, *Ann.*, 1891, 265, 100.

**4-Chloro-3-nitrobenzenesulphonic Acid.**

(*o*-Chloronitrobenzene-5-sulphonic acid, *o*-nitro-  
 chlorobenzene-*p*-sulphonic acid).

Needles +  $H_2O$ .  $Na_2SO_3 \rightarrow$  nitrobenzene-  
 2:5-disulphonic acid. NaOH  $\rightarrow$  2-nitro-  
 phenol-4-sulphonic acid.

*K salt*: m.p.  $325-6^\circ$  decomp.

*Ba salt*: yellow leaflets +  $H_2O$ . Prac. insol.  
 EtOH.

*Phenyl ester*:  $C_{12}H_8O_5NCIS$ . MW, 313.5.  
 M.p.  $92-3^\circ$ .

*Chloride*:  $C_6H_3O_4NCl_2S$ . MW, 256. M.p.  $40-1^\circ$   
 ( $61-2^\circ$ ).

*Amide*:  $C_6H_5O_4N_2ClS$ . MW, 236.5. Yellow  
 prisms from EtOH. M.p.  $175-6^\circ$ .

Fischer, *Ber.*, 1891, 24, 3187.

Hillyer, U.S.P. 1,701,367, (*Chem. Ab-*  
*stracts*, 1929, 23, 1419).

**5-Chloro-3-nitrobenzenesulphonic Acid.**

*K salt*: cryst. Sol. EtOH.

*Ba salt*: yellowish-brown cryst. +  $2H_2O$ .  
 Sol. EtOH.

*Amide*: leaflets from EtOH or  $H_2O$ . M.p.  
 $164-5^\circ$ .

Claus, Bopp, *Ann.*, 1891, 265, 96.

**6-Chloro-3-nitrobenzenesulphonic Acid.**  
Triclinic plates + 1 or 2 H<sub>2</sub>O. M.p. 168–9°  
decomp. Sol. H<sub>2</sub>O. Spar. sol. EtOH. NH<sub>3</sub>  
→ 4-nitroaniline-2-sulphonic acid.

*Na salt*: needles or leaflets + H<sub>2</sub>O. Mod.  
sol. H<sub>2</sub>O.

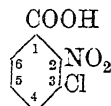
*Chloride*: cryst. from Et<sub>2</sub>O. M.p. 89–90°.

*Amide*: cryst. from H<sub>2</sub>O. M.p. 185–6°.

Elgersma, *Rec. trav. chim.*, 1929, 48, 760.

Gilman, Stueckwisch, *J. Am. Chem. Soc.*,  
1943, 65, 1461.

### 3-Chloro-2-nitrobenzoic Acid



C<sub>7</sub>H<sub>4</sub>O<sub>4</sub>NCl MW, 201.5

Cryst. from H<sub>2</sub>O. M.p. 235°. Sol. Et<sub>2</sub>O.  
Spar. sol. H<sub>2</sub>O. Insol. C<sub>6</sub>H<sub>6</sub>. D<sup>18</sup> 1.566.  $k = 4.4 \times 10^{-3}$  at 25°.

*Anilide*: m.p. 186°.

Brand, Zöller, *Ber.*, 1907, 40, 3333.

Holleman, de Bruyn, *Rec. trav. chim.*,  
1901, 20, 206.

Waters, *J. Chem. Soc.*, 1945, 629.

### 4-Chloro-2-nitrobenzoic Acid.

Cryst. from H<sub>2</sub>O or C<sub>6</sub>H<sub>6</sub>. M.p. 142°.  
 $k = 1.0 \times 10^{-2}$  at 25°.

*Me ester*: C<sub>8</sub>H<sub>5</sub>O<sub>4</sub>NCl. MW, 215.5. M.p. 41–3°.

*Chloride*: C<sub>7</sub>H<sub>3</sub>O<sub>3</sub>NCl<sub>2</sub>. MW, 220. M.p. 31–4°.

*Amide*: C<sub>7</sub>H<sub>5</sub>O<sub>3</sub>N<sub>2</sub>Cl. MW, 200.5. Needles  
from EtOH. M.p. 172°.

*Nitrile*: C<sub>7</sub>H<sub>3</sub>O<sub>2</sub>N<sub>2</sub>Cl. MW, 182.5. Needles.  
M.p. 98°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, hot H<sub>2</sub>O.

Heller, *Ber.*, 1916, 49, 545.

Leonard, Boyd, *J. Org. Chem.*, 1946, 11,  
405.

Atkinson, Simpson, *J. Chem. Soc.*, 1947,  
232.

### 5-Chloro-2-nitrobenzoic Acid.

Cryst. from H<sub>2</sub>O or Et<sub>2</sub>O. M.p. 139°. Sol.  
EtOH, hot H<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. D<sup>18</sup> 1.593.  $k = 1.52 \times 10^{-2}$   
at 25°.

*Me ester*: plates from MeOH. M.p. 48.5°.

*Chloride*: b.p. 167°/17 mm.

*Amide*: needles from Et<sub>2</sub>O. M.p. 154°.

*Me-amide*: C<sub>8</sub>H<sub>7</sub>O<sub>3</sub>N<sub>2</sub>Cl. MW, 214.5.  
Needles from EtOH.Aq. M.p. 134°.

*Di-Me-amide*: C<sub>9</sub>H<sub>9</sub>O<sub>3</sub>N<sub>2</sub>Cl. MW, 228.5.  
M.p. 104.5°.

*Anilide*: needles from Et<sub>2</sub>O. M.p. 164°.

Holleman, de Bruyn, *Rec. trav. chim.*,  
1901, 20, 206.

### 6-Chloro-2-nitrobenzoic Acid.

Needles. M.p. 161° (163°). Sol. H<sub>2</sub>O.

*Me ester*: needles. M.p. 80–2° (94–5°).

*Et ester*: m.p. 49–50°.

*Chloride*: cryst. from pet. ether. M.p. 32–4°.  
B.p. 160°/12–13 mm.

*Amide*: m.p. 186–7°.

*Anilide*: m.p. 176–7°.

Cohen, McCandlish, *J. Chem. Soc.*, 1905,  
87, 1271.

### 2-Chloro-3-nitrobenzoic Acid.

Needles. M.p. 185°. Sol. EtOH, hot H<sub>2</sub>O.  
D<sup>18</sup> 1.662.  $k = 8.7 \times 10^{-3}$  at 25°. (NH<sub>4</sub>)<sub>2</sub>S

→ 2-chloro-3-aminobenzoic acid. Alc. NH<sub>3</sub>  
→ 3-nitroanthranilic acid.

*Me ester*: C<sub>8</sub>H<sub>6</sub>O<sub>4</sub>NCl. MW, 215.5. Needles  
from pet. ether. M.p. 70°.

*Et ester*: C<sub>9</sub>H<sub>8</sub>O<sub>4</sub>NCl. MW, 229.5. B.p. 314°  
part. decomp.

*Nitrile*: pale yellow needles. M.p. 97–101°.

Kenner, Stubbings, *J. Chem. Soc.*, 1921,  
119, 598.

Gunstone, Tucker, *J. appl. Chem.*, 1952,  
2, 207.

### 4-Chloro-3-nitrobenzoic Acid.

M.p. 181–2°. Mod. sol. hot H<sub>2</sub>O. D<sup>18</sup> 1.645  
 $k = 4.6 \times 10^{-4}$  at 25°. Sn + HCl → 4-chloro-  
3-aminobenzoic acid.

*Me ester*: needles from MeOH. M.p. 83°.

*Et ester*: yellow needles. M.p. 59°. Sol.  
EtOH, AcOH, C<sub>6</sub>H<sub>6</sub>.

*Chloride*: C<sub>7</sub>H<sub>3</sub>O<sub>3</sub>NCl<sub>2</sub>. MW, 220. M.p. 51°.  
B.p. 170°/22 mm.

*Amide*: C<sub>7</sub>H<sub>5</sub>O<sub>3</sub>N<sub>2</sub>Cl. MW, 200.5. Cryst.  
from EtOH. M.p. 156°.

*Nitrile*: C<sub>7</sub>H<sub>3</sub>O<sub>2</sub>N<sub>2</sub>Cl. MW, 182.5. Needles.  
M.p. 100–1°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, hot H<sub>2</sub>O.

*Me-amide*: C<sub>8</sub>H<sub>7</sub>O<sub>3</sub>N<sub>2</sub>Cl. MW, 214.5.  
Plates from EtOH. M.p. 135.5°.

*Di-Me-amide*: C<sub>9</sub>H<sub>9</sub>O<sub>3</sub>N<sub>2</sub>Cl. MW, 228.5.  
M.p. 113.5°.

*Anilide*: m.p. 131°.

Claus, Kurz, *J. prakt. Chem.*, 1888, 37,  
196.

Montagne, *Rec. trav. chim.*, 1900, 19, 55.  
Berkenheim, Lur'e, *Chem. Abstracts*, 1937,  
31, 1780.

### 5-Chloro-3-nitrobenzoic Acid.

Needles. M.p. 147°. Sol. EtOH, Et<sub>2</sub>O,  
AcOH. Spar. sol. H<sub>2</sub>O.  $k = 7.48 \times 10^{-4}$  at  
25°.

*Me ester*: needles from EtOH.Aq. M.p. 80°.

*Et ester*: cryst. from EtOH. M.p. 54°.

Blanksma, *Chem. Zentr.*, 1914, I, 538.

### 6-Chloro-3-nitrobenzoic Acid.

Needles from H<sub>2</sub>O. M.p. 165° (168°). Sol.  
EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. cold H<sub>2</sub>O. D<sup>18</sup>  
1.608,  $k = 6.5 \times 10^{-3}$  at 25°. Sn + HCl →  
6-chloro-3-aminobenzoic acid. Boiling conc.  
KOH.Aq. → 5-nitrosalicylic acid.

*Me ester*: cryst. from MeOH. M.p. 73°.

*Et ester*: m.p. 28–9°.

*Chloride*: cryst. from ligroin. M.p. 60°. B.p.  
157–8°/11 mm.

*Amide*: needles from H<sub>2</sub>O. M.p. 178°.

*Me-amide*: needles from EtOH.Aq. M.p. 174°.

*Di-Me-amide*: cryst. from Et<sub>2</sub>O. M.p. 124.5°.

*Nitrile*: needles. M.p. 105-6°. Sol. hot EtOH. Insol. H<sub>2</sub>O.

Lehmstedt, *Ber.*, 1931, 64, 2384.

Rupe, *Ber.*, 1897, 30, 1099.

Blanksma, *Rec. trav. chim.*, 1946, 65, 207.

### 2-Chloro-4-nitrobenzoic Acid.

Needles from H<sub>2</sub>O M.p. 140-2° (138-9°).  
 $k = 1.03 \times 10^{-2}$  at 25°.

*Me ester*: C<sub>8</sub>H<sub>6</sub>O<sub>4</sub>NCl. MW, 215.5. M.p. 73-5°.

*Chloride*: C<sub>7</sub>H<sub>5</sub>O<sub>3</sub>NCl<sub>2</sub>. MW, 220. M.p. 115°.

*Amide*: C<sub>7</sub>H<sub>5</sub>O<sub>3</sub>N<sub>2</sub>Cl. MW, 200.5. Cryst. from EtOH. M.p. 172°.

*Anilide*: m.p. 168°.

Cohen, Armes, *J. Chem. Soc.*, 1906, 89, 457.

Cohen, McCandlish, *J. Chem. Soc.*, 1905, 87, 1271.

Aoyami, Eguchi, *Chem. Abstracts*, 1937, 31, 97.

Albert, Linnell, *J. Soc. Chem. Ind.*, 1936, 55, 54r.

Fel'dman *et al.*, *J. Gen. Chem. U.S.S.R.*, 1945, 15, 962, (*Chem. Abstracts*, 1946, 40, 6443).

### 3-Chloro-4-nitrobenzoic Acid.

Needles. M.p. 180-2°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, hot H<sub>2</sub>O.

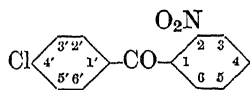
*Chloride*: m.p. 54-6°.

*Nitrile*: C<sub>7</sub>H<sub>5</sub>O<sub>3</sub>N<sub>2</sub>Cl. MW, 182.5. Needles. M.p. 87°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>.

Claus, Kurz, *J. prakt. Chem.*, 1888, 37, 196.

Cohen, Armes, *J. Chem. Soc.*, 1906, 89, 460.

### 4'-Chloro-2-nitrobenzophenone



C<sub>13</sub>H<sub>8</sub>O<sub>3</sub>NCl MW, 261.5  
Cryst. from EtOH. M.p. 151.5°. B.p. 236° corr./11 mm.

Montagne, *Ber.*, 1916, 49, 2268.

### 4-Chloro-3-nitrobenzophenone.

Needles from EtOH. M.p. 105°. B.p. 235°/13 mm. Very sol. C<sub>6</sub>H<sub>6</sub>. Sol. EtOH, AcOH, pet. ether. Insol. H<sub>2</sub>O.

Montagne, *Ber.*, 1916, 49, 2275.

Marou, Fox, *Ber.*, 1914, 47, 2777.

### 4'-Chloro-3-nitrobenzophenone.

Cryst. from EtOH. M.p. 95.5°. B.p. 247°/13 mm. (corr.).

Montagne, *Ber.*, 1916, 49, 2269.

### 6-Chloro-3-nitrobenzophenone.

Needles from EtOH. M.p. 86° corr. Spar. sol. pet. ether. Insol. H<sub>2</sub>O.

*Oxime*: pale yellow. M.p. 180°.

*Phenylhydrazone*: two forms. (1) Red. M.p. 171°. (2) Yellow. M.p. 134°.

Ernst, *Ber.*, 1906, 39, 299.

Ullmann, Mallett, *Ber.*, 1898, 31, 1695.

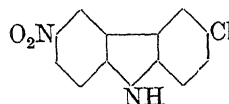
### 4'-Chloro-4-nitrobenzophenone.

Needles from AcOEt. M.p. 98°. Cryst. + C<sub>6</sub>H<sub>6</sub> from C<sub>6</sub>H<sub>6</sub>. M.p. 100.75°. B.p. 246°/12 mm. Effloresces in air.

Böeseken, *Rec. trav. chim.*, 1904, 23, 107.

Montagne, *Ber.*, 1916, 49, 2251.

### 3-Chloro-6-nitrocarbazole



C<sub>12</sub>H<sub>7</sub>O<sub>2</sub>N<sub>2</sub>Cl MW, 246.5

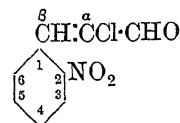
Silky yellow needles. M.p. 285-6°. Sol. EtOH. N-Acetyl: needles. M.p. 205-6°.

N-Benzoyl: yellow needles from AcOH. M.p. 257-8°.

A.G.F.A., D.R.P. 295,817, (*Chem. Zentr.*, 1917, I, 295).

Lamberti-Zanardi, *Gazz. chim. ital.*, 1896, 26, 289.

### $\alpha$ -Chloro-2-nitrocinnamaldehyde



C<sub>9</sub>H<sub>6</sub>O<sub>3</sub>NCl MW, 211.5

Yellow needles from EtOH. M.p. 112-13°.

*Oxime*: yellow needles. M.p. 191°.

*Hydrazone*: yellow leaflets. M.p. 140-1°.

Naar, *Ber.*, 1891, 24, 248.

### $\alpha$ -Chloro-3-nitrocinnamaldehyde.

Pale yellow leaflets from EtOH. M.p. 112°. Sol. EtOH, Et<sub>2</sub>O, AcOH.

*Oxime*: needles. M.p. 185-6°.

*Hydrazone*: pale yellow scales. M.p. 154-6°.

Naar, *Ber.*, 1891, 24, 248.

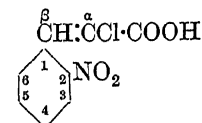
### $\alpha$ -Chloro-4-nitrocinnamaldehyde.

Needles. M.p. 145°. Spar. sol. EtOH, AcOH. *Oxime*: needles. M.p. 213-15°.

*Hydrazone*: red leaflets. M.p. 179°.

Naar, *Ber.*, 1891, 24, 248.

### $\alpha$ -Chloro-2-nitrocinnamic Acid



C<sub>9</sub>H<sub>6</sub>O<sub>4</sub>NCl MW, 227.5

Needles from H<sub>2</sub>O. M.p. 201-2°.

Naar, *Ber.*, 1891, 24, 250.

$\alpha$ -Chloro-3-nitrocinnamic Acid.

Needles from H<sub>2</sub>O. M.p. 205-7°.

Naar, *Ber.*, 1891, 24, 252.

$\alpha$ -Chloro-4-nitrocinnamic Acid.

*Trans* :

Yellow needles from EtOH. M.p. 220-1°. Sol. Et<sub>2</sub>O, Me<sub>2</sub>CO.

*Me ester* : C<sub>10</sub>H<sub>8</sub>O<sub>4</sub>NCl. MW, 241.5. Yellow needles from MeOH. M.p. 139-40°.

*Et ester* : C<sub>11</sub>H<sub>10</sub>O<sub>4</sub>NCl. MW, 255.5. Needles from EtOH. M.p. 113°. Spar. sol. ligroin.

*Cis* : (*allo*-) :

Needles from C<sub>6</sub>H<sub>6</sub>. M.p. 153-4°. Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O, hot C<sub>6</sub>H<sub>6</sub>. Warm with Py + pyridine hydrochloride  $\rightarrow$  *trans*-form.

*Me ester* : yellow needles from MeOH. M.p. 81-2°.

*Et ester* : m.p. 67-8°.

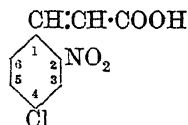
Pfeiffer, *Ber.*, 1914, 47, 1759.

$\beta$ -Chloro-3-nitrocinnamic Acid.

*Me ester* : C<sub>10</sub>H<sub>8</sub>O<sub>4</sub>NCl. MW, 241.5. Cryst. from pet. ether. M.p. 113-14°.

Reich, *Chem. Zentr.*, 1918, II, 22.

4-Chloro-2-nitrocinnamic Acid



C<sub>9</sub>H<sub>6</sub>O<sub>4</sub>NCl MW, 227.5

Needles from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 214-6° decomp. Sol. EtOH, Me<sub>2</sub>CO. Mod. sol. C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>, Et<sub>2</sub>O.

van der Lee, *Rec. trav. chim.*, 1926, 45, 684.

5-Chloro-2-nitrocinnamic Acid.

Cryst. from EtOH.Aq. M.p. 174-5°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Spar. sol. C<sub>6</sub>H<sub>6</sub>. Insol. ligroin. Sol. conc. H<sub>2</sub>SO<sub>4</sub> to green sol.

*Et ester* : C<sub>11</sub>H<sub>10</sub>O<sub>4</sub>NCl. MW, 255.5. Needles. M.p. 62°.

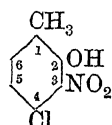
Eichengrün, Einhorn, *Ann.*, 1891, 262, 153.

4-Chloro-3-nitrocinnamic Acid.

Yellow needles. M.p. 184-5°. Sol. EtOH, Me<sub>2</sub>CO. Mod. sol. C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Insol. H<sub>2</sub>O, pet. ether.

van der Lee, *Rec. trav. chim.*, 1926, 45, 686.

4-Chloro-3-nitro-*o*-cresol



C<sub>7</sub>H<sub>6</sub>O<sub>3</sub>NCl

MW, 187.5

Golden-yellow prisms from pet. ether. M.p. 54-5°.

Auwers, Schornstein, *Fortschritte der Chemie, Physik, und physikalischen Chemie*, 1924, 18, 71.

5-Chloro-3-nitro-*o*-cresol.

Yellow needles. M.p. 107°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>. *Acetyl* : colourless needles. M.p. 88°. Mod. sol. EtOH.

Zincke, *Ann.*, 1918, 417, 222.

6-Chloro-3-nitro-*o*-cresol.

Yellow cryst. M.p. 64-5°. Volatile in steam. Sol. AcOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Mod. sol. EtOH.

Noelting, *Ber.*, 1904, 37, 1020.

3-Chloro-4-nitro-*o*-cresol.

Pale yellow needles or leaflets. M.p. 74°. Sol. AcOH, EtOH. Mod. sol. ligroin.

*Acetyl* : colourless cryst. M.p. 59°.

Zincke, Schürmann, *Ann.*, 1918, 417, 246.

3-Chloro-5-nitro-*o*-cresol.

Yellowish needles. M.p. 123°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin, H<sub>2</sub>O. Volatile in steam.

Kehrmann, *Ber.*, 1915, 48, 2024.

Raschig, D.R.P. 160,304, (*Chem. Zentr.*, 1905, I, 1448).

4-Chloro-5-nitro-*o*-cresol.

Needles from H<sub>2</sub>O or C<sub>6</sub>H<sub>6</sub>. M.p. 144-5°. Sol. EtOH.

Auwers, Schornstein, *Fortschritte der Chemie, Physik, und physikalischen Chemie*, 1924, 18, 71.

6-Chloro-5-nitro-*o*-cresol.

Cryst. from H<sub>2</sub>O. M.p. 135°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Mod. sol. hot H<sub>2</sub>O. Non-volatile in steam.

Noelting, *Ber.*, 1904, 37, 1020.

3-Chloro-6-nitro-*o*-cresol.

Needles. M.p. 79°. Mod. sol. H<sub>2</sub>O.

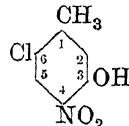
*Acetyl* : leaflets. M.p. 84°.

Zincke, Schürmann, *Ann.*, 1918, 417, 241.

$\alpha$ -Chloro-6-nitro-*o*-cresol.

See 6-Nitro-*o*-hydroxybenzyl chloride.

6-Chloro-4-nitro-*m*-cresol



C<sub>7</sub>H<sub>6</sub>O<sub>3</sub>NCl

MW, 187.5

Yellow leaflets from EtOH. M.p. 133-4° (89°). Sol. hot EtOH, ligroin. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O.

Walther, Zipper, *J. prakt. Chem.*, 1915, 91, 411.

Gibbs, Robertson, *J. Chem. Soc.*, 1914, 105, 1890.

Kenner, Tod, Witham, *J. Chem. Soc.*, 1925, 127, 2349.

**2-Chloro-6-nitro-*m*-cresol.**

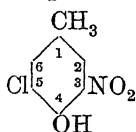
Cryst. from  $C_6H_6$ . M.p. 133°. Sol. EtOH,  $C_6H_6$ ,  $CHCl_3$ . Spar. sol.  $H_2O$ .

Raiford, *J. Am. Chem. Soc.*, 1914, 36, 673.

**4-Chloro-6-nitro-*m*-cresol.**

Cryst. from  $C_6H_6$ . M.p. 143-4°. Sol. EtOH,  $CHCl_3$ .

Raiford, *J. Am. Chem. Soc.*, 1914, 36, 673.

**5-Chloro-3-nitro-*p*-cresol**

$C_7H_6O_3NCl$  MW, 187.5

Yellow needles. M.p. 65°. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ . Sol. alkalis to red sols.

*Me ether*:  $C_8H_8O_3NCl$ . MW, 201.5. Pale yellow needles from EtOH.Aq. M.p. 41°.

*Acetyl*: pale yellow needles from ligroin. M.p. 95°.

Zincke, *Ann.*, 1903, 328, 311.

**6-Chloro-3-nitro-*p*-cresol.**

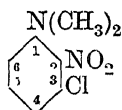
Lemon-yellow needles. M.p. 71°. Sol.  $Et_2O$ , EtOH,  $Me_2CO$ ,  $C_6H_6$ . Mod. sol.  $CHCl_3$ , AcOH, pet. ether. Volatile in steam. Sublimes.

*Benzoyl*: colourless needles. M.p. 129°.

Davies, *J. Chem. Soc.*, 1921, 119, 866.

**4-Chloro-2-nitro-*N*-diethylaniline.**

See under 4-Chloro-*o*-nitroaniline.

**3-Chloro-2-nitro-*N*-dimethylaniline**

$C_8H_9O_2N_2Cl$  MW, 200.5

Yellow prisms from ligroin. M.p. 36°.

Hodgson, Nicholson, *J. Chem. Soc.*, 1941, 766.

**4-Chloro-2-nitro-*N*-dimethylaniline.**

Orange-yellow needles or red cryst. from EtOH. M.p. 57°. Sol.  $Et_2O$ ,  $C_6H_6$ , ligroin.

Pinnow, *Ber.*, 1898, 31, 2984.

**5-Chloro-2-nitro-*N*-dimethylaniline.**

Yellow prisms from pet. ether. M.p. 49°. Volatile in steam.

*Picrate*: m.p. 70°.

Hodgson, Kershaw, *J. Chem. Soc.*, 1930, 500.

Hodgson, Nicholson, *J. Chem. Soc.*, 1941, 766.

**2-Chloro-3-nitro-*N*-dimethylaniline.**

Yellow needles from EtOH.Aq. M.p. 41°.

Ayling, Gorvin, Hinkel, *J. Chem. Soc.*, 1946, 530.

**4-Chloro-3-nitro-*N*-dimethylaniline.**

Yellow needles from MeOH. M.p. 83° (79°). Sol. most ord. org. solvents. Spar. sol. EtOH.Aq.

*Methodide*: prisms. M.p. 176°.

Pinnow, *Ber.*, 1898, 31, 2986.

Haworth, Lamberton, Woodcock, *J. Chem. Soc.*, 1947, 182.

**6-Chloro-3-nitro-*N*-dimethylaniline.**

M.p. 64-5°.

van Duin, *Rec. trav. chim.*, 1932, 51, 878.

**2-Chloro-4-nitro-*N*-dimethylaniline.**

Yellow plates from EtOH. M.p. 78°.

van Duin, *Rec. trav. chim.*, 1932, 51, 878.

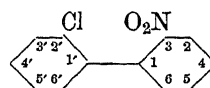
Ayling, Gorvin, Hinkel, *J. Chem. Soc.*, 1942, 755.

Drake *et al.*, *J. Am. Chem. Soc.*, 1946, 68, 1602.

**3-Chloro-4-nitro-*N*-dimethylaniline.**

Yellow needles from EtOH. M.p. 125-6°.

Hodgson, Nicholson, *J. Chem. Soc.*, 1941, 766.

**2'-Chloro-2-nitrodiphenyl**

$C_{12}H_8O_2NCl$  MW, 233.5

Cryst. from ligroin. M.p. 71°.

Mascarelli, Gatti, *Gazz. chim. ital.*, 1931, 61, 788.

**3'-Chloro-3-nitrodiphenyl.**

M.p. 101°.

Mascarelli, Gatti, *Gazz. chim. ital.*, 1929, 59, 869; 1931, 61, 324.

**4'-Chloro-3-nitrodiphenyl.**

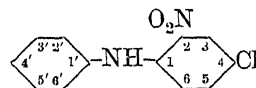
Needles from MeOH. M.p. 89°.

Blakey, Scarborough, *J. Chem. Soc.*, 1927, 3003.

**4'-Chloro-4-nitrodiphenyl.**

Yellow needles. M.p. 157-8°.

Le Fèvre, Turner, *J. Chem. Soc.*, 1928, 253.

**4-Chloro-2-nitrodiphenylamine**

$C_{12}H_9O_2N_2Cl$  MW, 248.5

Orange-red or reddish-brown cryst from EtOH. M.p. 61°. Sol.  $C_6H_6$ , hot AcOH. Spar. sol.

EtOH. Insol.  $H_2O$ .  $SnCl_2 + HCl \rightarrow$  4-chloro-2-aminodiphenylamine.

*N-Me*:  $C_{13}H_{11}O_2N_2Cl$ . MW, 262.5. Red prisms. M.p. 70-1°.

*N-Et*:  $C_{14}H_{13}O_2N_2Cl$ . MW, 276.5. Red cryst. from EtOH. M.p. 81-2°.

Ullmann, Kogan, *Ann.*, 1904, 332, 93.

Storrie, Tucker, *J. Chem. Soc.*, 1931, 2260.

**5-Chloro-2-nitrodiphenylamine.**

Red needles from EtOH. M.p. 108-5°. Sol. AcOH, CS<sub>2</sub>, hot EtOH, hot Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

Ullmann, Kogan, *Ann.*, 1904, 332, 97

**2'-Chloro-2-nitrodiphenylamine.**

Red prisms from EtOH. M.p. 114°.

Campbell, MacLean, *J. Chem. Soc.*, 1942, 504.

**4'-Chloro-2-nitrodiphenylamine.**

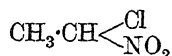
Orange-red needles from EtOH. M.p. 146°. Sol. C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Spar. sol. EtOH.

Wilberg, *Ber.*, 1902, 35, 957 (*Footnote*).

**3'-Chloro-4-nitrodiphenylamine.**

Yellow leaflets from EtOH. M.p. 129°. Sol. C<sub>6</sub>H<sub>6</sub>, hot EtOH.

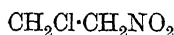
Ullmann, D.R.P., 193,448, (*Chem. Zentr.*, 1908, I, 1003).

**1-Chloro-1-nitroethane**

C<sub>2</sub>H<sub>4</sub>O<sub>2</sub>NCl MW, 109.5

B.p. 124-5°. Sol. aq. alkalis. Insol. H<sub>2</sub>O. D<sup>7</sup> 1.247. Combines with aldehydes.

Henry, *Chem. Zentr.*, 1898, I, 192.

**2-Chloro-1-nitroethane**

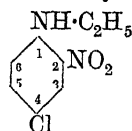
C<sub>2</sub>H<sub>4</sub>O<sub>2</sub>NCl MW, 109.5

B.p. 173-4°, 105°/72 mm. Insol. H<sub>2</sub>O. D<sup>7</sup> 1.405. HCl → chloroacetic acid + hydroxylamine.

Henry, *Chem. Zentr.*, 1898, I, 193.

McBee, Riley, U.S.P. 2,337,912, (*Chem. Abstracts*, 1944, 38, 3295).

Dreyfus, U.S.P. 2,345,701, (*Chem. Abstracts*, 1944, 38, 4620).

**4-Chloro-2-nitro-N-ethylaniline**

C<sub>8</sub>H<sub>9</sub>O<sub>2</sub>N<sub>2</sub>Cl MW, 200.5

M.p. 93°.

Blanksma, *Rec. trav. chim.*, 1902, 21, 274.

**5-Chloro-2-nitro-N-ethylaniline.**

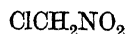
Golden yellow needles from EtOH. M.p. 83-4° (76°).

Laubenheimer, *Ber.*, 1878, 11, 1156.

Stoermer, Hoffmann, *Ber.*, 1898, 31, 2533.

**Chloronitrolepidine.**

See Chloronitro-4-methylquinoline.

**Chloronitromethane**

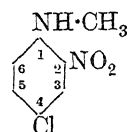
CH<sub>2</sub>O<sub>2</sub>NCl MW, 95.5

B.p. 122-3°. Sol. alkalis. Mod. sol. H<sub>2</sub>O. D<sup>15</sup> 1.466.

Tscherniak, *Ber.*, 1875, 8, 609.

Steinkopf, Kühnel, *Ber.*, 1942, 75, 1323.

Berlin, Pozharskaya, *Chem. Abstracts*, 1946, 40, 7228.

**4-Chloro-2-nitro-N-methylaniline**

C<sub>7</sub>H<sub>7</sub>O<sub>2</sub>N<sub>2</sub>Cl MW, 186.5

Orange-red or reddish-brown cryst. from EtOH. M.p. 110°.

Stoermer, Hoffmann, *Ber.*, 1898, 31, 2534.

**5-Chloro-2-nitro-N-methylaniline.**

Yellow or orange needles from EtOH. M.p. 106-7°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. Volatile in steam.

Kehrmann, Müller, *Ber.*, 1901, 34, 1095.

**6-Chloro-2-nitro-N-methylaniline.**

M.p. 49-50°.

van Duin, *Rec. trav. chim.*, 1932, 51, 883.

**6-Chloro-3-nitro-N-methylaniline.**

M.p. 99°.

Phillips, *J. Chem. Soc.*, 1931, 1151.

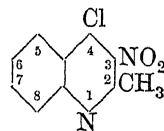
**2-Chloro-4-nitro-N-methylaniline.**

Yellow needles. M.p. 116-17°.

N-Nitroso: yellowish needles. M.p. 95°.

Stoermer, Hoffmann, *Ber.*, 1898, 31, 2532.

van Duin, *Rec. trav. chim.*, 1932, 51, 882.

**4-Chloro-3-nitro-2-methylquinoline (4-Chloro-3-nitroquinaldine)**

C<sub>10</sub>H<sub>7</sub>O<sub>2</sub>N<sub>2</sub>Cl MW, 222.5

Cryst. from Et<sub>2</sub>O. M.p. 93-4°. Sol. hot EtOH, C<sub>6</sub>H<sub>6</sub>. Vapour irritates the eyes.

Conrad, Limpach, *Ber.*, 1888, 21, 1981.

**2-Chloro-6-nitro-4-methylquinoline (2-Chloro-6-nitrolepidine).**

Pale brown needles from C<sub>6</sub>H<sub>6</sub>. M.p. 207° (212-13°). Mod. sol. C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Spar. sol. Et<sub>2</sub>O, EtOH. Insol. H<sub>2</sub>O.

Balaban, *J. Chem. Soc.*, 1930, 23.

Johnson, Hamilton, *J. Am. Chem. Soc.*, 1941, 63, 2867.

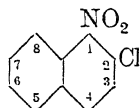
**2-Chloro-8-nitro-6-methylquinoline.**

Needles from EtOH. M.p. 150-1°.

Ing, *J. Chem. Soc.*, 1931, 2202.

$\omega$ -Chloro-5-nitro-8-methylquinoline (8-Chloromethyl-5-nitroquinoline).

Yellow needles from EtOH. M.p. 91°.

Howitz, Nother, *Ber.*, 1906, 39, 2706.2-Chloro-1-nitronaphthalene ( $\beta$ -Chloro- $\alpha$ -nitronaphthalene) $C_{10}H_6O_2NCl$ 

MW, 207.5

Yellow needles from EtOH. M.p. 99°. Sol. EtOH, Et<sub>2</sub>O, AcOH, C<sub>6</sub>H<sub>6</sub>.Hodgson, Kilner, *J. Chem. Soc.*, 1926, 9.Contardi, Mor, *Chem. Abstracts*, 1925, 19, 827.

## 3-Chloro-1-nitronaphthalene.

Greenish-brown needles from PhNO<sub>2</sub>. M.p. 105°.Hodgson, Elliott, *J. Chem. Soc.*, 1934, 1706.

## 4-Chloro-1-nitronaphthalene.

Brownish-yellow needles from EtOH. M.p. 85°. NH<sub>3</sub>.Aq. under press. → 4-nitro-1-naphthylamine. Dil. alkalis under press. → 4-nitro-1-naphthol.*Isomeride*: greenish-yellow cryst. from EtOH. M.p. 60-1°.Ferrero, Caffisch, *Helv. Chim. Acta*, 1928, 11, 803.Asaoka, *Chem. Abstracts*, 1929, 23, 3923.Franzen, Helwert, *Ber.*, 1920, 53, 320.

## 5-Chloro-1-nitronaphthalene.

Needles from EtOH.Aq. or AcOH. M.p. 111°.

Friedländer, Karamessinis, Schenk, *Ber.*, 1922, 55, 47.Ferrero, Caffisch, *Helv. Chim. Acta*, 1928, 11, 803.Asaoka, *Chem. Abstracts*, 1929, 23, 3923.

## 6-Chloro-1-nitronaphthalene.

Needles from Me<sub>2</sub>CO.Aq. M.p. 100.5°.Hodgson, Turner, *J. Chem. Soc.*, 1942, 723.

## 7-Chloro-1-nitronaphthalene.

Yellow needles from EtOH. M.p. 116°.

Armstrong, Wynne, *Chem. News*, 1889, 59, 225.

## 8-Chloro-1-nitronaphthalene.

Needles from C<sub>6</sub>H<sub>6</sub> or AcOH. M.p. 94°. SnCl<sub>2</sub> → 8-chloro-1-naphthylamine.Friedländer, Karamessinis, Schenk, *Ber.*, 1922, 55, 47.Ferrero, Caffisch, *Helv. Chim. Acta*, 1928, 11, 806.Asaoka, *Chem. Abstracts*, 1929, 23, 3923.Vorozhtzov, Koslov, *Ber.*, 1936, 69, 412.1-Chloro-2-nitronaphthalene ( $\alpha$ -Chloro- $\beta$ -nitronaphthalene).

Pale yellow needles. M.p. 76°.

Hodgson, Kilner, *J. Chem. Soc.*, 1926, 8.

## 3-Chloro-2-nitronaphthalene.

Brown cryst. M.p. 94.5°. Spar. volatile in steam.

Hodgson, Elliott, *J. Chem. Soc.*, 1936, 1153.

## 4-Chloro-2-nitronaphthalene.

Needles from formic acid. M.p. 127°.

Hodgson, Elliott, *J. Chem. Soc.*, 1935, 1851.Hodgson, Birtwell, Marsden, *J. Chem. Soc.*, 1944, 112.

## 5-Chloro-2-nitronaphthalene.

Cream needles from EtOH.Aq. M.p. 118-20°.

Hodgson, Turner, *J. Chem. Soc.*, 1943, 391.

## 6-Chloro-2-nitronaphthalene.

Yellow needles. M.p. 170°. B.p. 180-90°/15 mm.

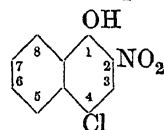
Hodgson, Ward, *J. Chem. Soc.*, 1947, 327.

## 7-Chloro-2-nitronaphthalene.

Yellow needles. M.p. 136°.

Hodgson, Ward, *J. Chem. Soc.*, 1947, 327.

## 4-Chloro-2-nitro-1-naphthol

 $C_{10}H_6O_3NCl$ 

MW, 223.5

Yellow needles from 70% EtOH. M.p. 155°.

Hodgson, Smith, *J. Chem. Soc.*, 1935, 673.

## 2-Chloro-4-nitro-1-naphthol.

Pale yellow micro-plates from 90% formic acid. M.p. 231°.

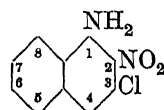
Hodgson, Elliott, *J. Chem. Soc.*, 1934, 1705.

## 2-Chloro-6-nitro-1-naphthol.

Yellow needles from AcOH. M.p. 179-80°.

Hodgson, Turner, *J. Chem. Soc.*, 1944, 8.

## 3-Chloro-2-nitro-1-naphthylamine

 $C_{10}H_7O_2N_2Cl$ 

MW, 222.5

Yellow needles. M.p. 149°.

Hodgson, Elliott, *J. Chem. Soc.*, 1936, 115.

**4-Chloro-2-nitro-1-naphthylamine.**

Orange needles from AcOH. M.p. 202° (205°).

Hodgson, Crook, *J. Chem. Soc.*, 1936, 1502.

Hodgson, Birtwell, *J. Chem. Soc.*, 1943, 321.

**4-Chloro-3-nitro-1-naphthylamine.**

Yellow needles from EtOH.Aq. M.p. 128° (156°).

N-Formyl: needles from EtOH. M.p. 230°.

N-Acetyl: needles from AcOH. M.p. 235° (223°).

Giacomo, Panizzon-Faure, *Gazz. chim. ital.*, 1924, 54, 826.

Hodgson, Hathway, *J. Chem. Soc.*, 1945, 123.

**2-Chloro-4-nitro-1-naphthylamine.**

Yellow needles from EtOH or PhNO<sub>2</sub>. M.p. 249°.

Hodgson, Elliott, *J. Chem. Soc.*, 1934, 1705.

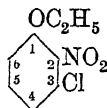
**8-Chloro-4-nitro-1-naphthylamine.**

Brownish-red plates from EtOH. M.p. 203°. Sol. C<sub>6</sub>H<sub>6</sub>.

Fries, Köhler, *Ber.*, 1924, 57, 504.

**Chloronitrophenetidine.**

See under Chloronitro-4-aminophenol.

**3-Chloro-2-nitrophenetole (3-Chloro-2-nitrophenyl ethyl ether)**

C<sub>8</sub>H<sub>8</sub>O<sub>3</sub>NCl

MW, 201.5

Leaflets from EtOH. M.p. 52°.

Hodgson, Clay, *J. Chem. Soc.*, 1930, 966.

**4-Chloro-2-nitrophenetole.**

Yellow needles or leaflets from EtOH. M.p. 61°. Sol. EtOH, Et<sub>2</sub>O.

Raiford, Colbert, *J. Am. Chem. Soc.*, 1926, 48, 2657.

**5-Chloro-2-nitrophenetole.**

Needles from EtOH. M.p. 63°. Sol. EtOH, Et<sub>2</sub>O.

Beilstein, Kurbatow, *Ann.*, 1876, 182, 110.

**2-Chloro-3-nitrophenetole.**

Cryst. from MeOH. M.p. 51°.

van Erp, *J. prakt. Chem.*, 1930, 127, 24.

**4-Chloro-3-nitrophenetole.**

Needles from EtOH. M.p. 47.5°. Sol. hot EtOH, hot C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O.

van Erp, *J. prakt. Chem.*, 1930, 127, 24.

**5-Chloro-3-nitrophenetole.**

Cryst. from EtOH. M.p. 47°. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Mod. sol. EtOH.

van Erp, *J. prakt. Chem.*, 1931, 129, 335.

**6-Chloro-3-nitrophenetole.**

Yellow needles from ligroin or colourless leaflets from EtOH. M.p. 64.5°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. ligroin. Insol. H<sub>2</sub>O. Volatile in steam.

Hodgson, Clay, *J. Chem. Soc.*, 1930, 966.

van Erp, *J. prakt. Chem.*, 1930, 127, 36.

**2-Chloro-4-nitrophenetole.**

Dark brown or yellow needles from EtOH. M.p. 82° (78°, 142°). Sol. hot EtOH, Me<sub>2</sub>CO. Insol. H<sub>2</sub>O.

Hallock, *Ber.*, 1881, 14, 37.

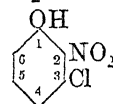
Reverdin, Düring, *Ber.*, 1899, 32, 156.

McMaster, Magill, *J. Am. Chem. Soc.*, 1928, 50, 3041.

**3-Chloro-4-nitrophenetole.**

Prisms from EtOH. M.p. 39-40°.

Hodgson, Clay, *J. Chem. Soc.*, 1930, 966.

**3-Chloro-2-nitrophenol**

C<sub>6</sub>H<sub>4</sub>O<sub>3</sub>NCl

MW, 173.5

M.p. 37.5°.

Me ether: see 3-Chloro-2-nitroanisole.

Et ether: see 3-Chloro-2-nitrophenetole.

Benzoyl: m.p. 123°.

Hodgson, Moore, *J. Chem. Soc.*, 1925, 127, 1600.

**4-Chloro-2-nitrophenol.**

Yellow monoclinic prisms. M.p. 87°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>. Mod. sol. hot EtOH. Insol. H<sub>2</sub>O. Volatile in steam. The NH<sub>4</sub> salt is also volatile in steam.

Me ether: see 4-Chloro-2-nitroanisole.

Et ether: see 4-Chloro-2-nitrophenetole.

Acetyl: m.p. 47-8°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

Schwartz, *Rec. trav. chim.*, 1915, 35, 135.

Kiprianov, Mikhailenko, *Chem. Abstracts*, 1931, 25, 5033.

Likhosherstov, Petrov, Voskresenskaya, *Chem. Abstracts*, 1938, 32, 6633.

Mottier, *Chem. Abstracts*, 1935, 29, 3322.

**5-Chloro-2-nitrophenol.**

Yellow needles. M.p. 41°. Sol. EtOH, Et<sub>2</sub>O, AcOH. Spar. sol. H<sub>2</sub>O. Sublimes. Volatile in steam.

Me ether: see 5-Chloro-2-nitroanisole.

Et ether: see 5-Chloro-2-nitrophenetole.

Hodgson, Moore, *J. Chem. Soc.*, 1925, 127, 1600.

**6-Chloro-2-nitrophenol.**

Yellow needles from H<sub>2</sub>O. M.p. 70°. Sol. EtOH, CHCl<sub>3</sub>. Spar. sol. H<sub>2</sub>O. Volatile in steam.

Me ether: see 6-Chloro-2-nitroanisole.

Faust, Müller, *Ann.*, 1874, 173, 306.

Barton, Linnell, Senior, *Quart. J. Pharm. Pharmacol.*, 1945, 18, 41.



**2-Chloro-3-nitrophenol.**

Prisms from  $H_2O$ . M.p. 120.5°. Sol. most ord. org. solvents, hot  $H_2O$ , hot  $C_6H_6$ . Sublimes in vacuo. Volatile in steam.

*Me ether*: see 2-Chloro-3-nitroanisole.

*Et ether*: see 2-Chloro-3-nitrophenetole.

*Acetyl*: m.p. 51.5°.

*Benzoyl*: m.p. 94°.

van Erp, *J. prakt. Chem.*, 1930, 127, 22, 25; 1931, 129, 327, 335.

**4-Chloro-3-nitrophenol.**

Needles from hot  $H_2O$ . M.p. 126.5°.

*Me ether*: see 4-Chloro-3-nitroanisole.

*Et ether*: see 4-Chloro-3-nitrophenetole.

*Acetyl*: needles. M.p. 83.5°.

*Benzoyl*: m.p. 96-7°.

van Erp, *J. prakt. Chem.*, 1930, 127, 31-2.

**5-Chloro-3-nitrophenol.**

M.p. 147°. Sublimes.

*Me ether*: see 5-Chloro-3-nitroanisole.

*Et ether*: see 5-Chloro-3-nitrophenetole.

*Acetyl*: m.p. 84°.

*Benzoyl*: m.p. 78°.

Hodgson, Wignall, *J. Chem. Soc.*, 1926, 2077.

**6-Chloro-3-nitrophenol.**

Prisms from hot  $H_2O$ . M.p. 119.5°.

*Me ether*: see 6-Chloro-3-nitroanisole.

*Et ether*: see 6-Chloro-3-nitrophenetole.

*Acetyl*: m.p. 82°.

*Benzoyl*: m.p. 127-8°.

van Erp, *J. prakt. Chem.*, 1930, 127, 28, 30, 35, 37.

**2-Chloro-4-nitrophenol.**

Needles from hot  $H_2O$ . M.p. 111°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Mod. volatile in steam.  $k = 1.8 \times 10^{-4}$  at 25°.

*Me ether*: see 2-Chloro-4-nitroanisole.

*Et ether*: see 2-Chloro-4-nitrophenetole.

*Acetyl*: needles. M.p. 63°.

Kollrepp, *Ann.*, 1886, 234, 3.

Ghosch, Banerjee, Lasher, *J. Indian Chem. Soc.*, 1944, 21, 354.

Barton, Linnell, Senior, *Quart. J. Pharm. Pharmacol.*, 1945, 18, 41.

**3-Chloro-4-nitrophenol.**

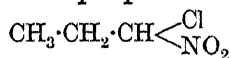
Needles from  $C_6H_6$ . M.p. 121-2°. Non-volatile in steam.

*Et ether*: see 3-Chloro-4-nitrophenetole.

Hodgson, Moore, *J. Chem. Soc.*, 1925, 127, 1600.

**Chloronitrophenyl-nitromethane.**

See Chloro- $\alpha$ : 2-dinitrotoluene.

**1-Chloro-1-nitropropane**

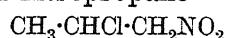
$C_3H_6O_2NCl$

MW, 123.5

B.p. 141-3°. D<sup>15</sup> 1.205.

Henry, *Chem. Zentr.*, 1898, I, 193.

Pauwels, *ibid.*, 194.

**2-Chloro-1-nitropropane**

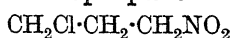
$C_3H_6O_2NCl$

MW, 123.5

B.p. 172°, 75°/15 mm. D<sup>15</sup> 1.2361.

Henry, *Chem. Zentr.*, 1898, I, 193.

Fourneau, *Bull. soc. chim.*, 1940, 7, 603.

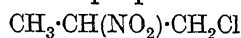
**3-Chloro-1-nitropropane**

$C_3H_6O_2NCl$

MW, 123.5

B.p. 197° slight decomp., 116°/40 mm. D<sup>20</sup> 1.267.

Henry, *Bull. soc. chim.*, 1896, 15, 1225; 1897, 17, 93.

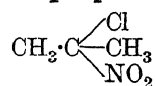
**1-Chloro-2-nitropropane**

$C_3H_6O_2NCl$

MW, 123.5

B.p. 172-3°, 94°/46 mm. D<sup>18</sup> 1.2.

Henry, *Chem. Zentr.*, 1897, I, 741; 1898, I, 193.

**2-Chloro-2-nitropropane**

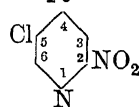
$C_3H_6O_2NCl$

MW, 123.5

B.p. 134° slight decomp. (careful heating). Explodes if rapidly heated. Sol. EtOH, Et<sub>2</sub>O. Spar. sol.  $H_2O$ . Insol. alkalis. D<sup>16</sup> 1.179. Volatile in steam.

Henry, *Chem. Zentr.*, 1898, I, 193.

Tindall, U.S.P. 2,365,981, (*Chem. Abstracts*, 1946, 40, 3126).

**5-Chloro-2-nitropyridine**

$C_5H_3O_2N_2Cl$

MW, 158.5

M.p. 120.5-1.0°.

Bystritskaya, Kirsanov, *J. Gen. Chem. U.S.S.R.*, 1940, 10, 1101, (*Chem. Abstracts*, 1941, 35, 4023).

**2-Chloro-3-nitropyridine.**

Needles from  $H_2O$ . M.p. 101-2°. Weakly basic.

Tschitschibabin, Bylinkin, *J. Russ. Phys.-Chem. Soc.*, 1920, 50, 471, (*Chem. Zentr.*, 1923, III, 1020).

**4-Chloro-3-nitropyridine.**

M.p. 45°. B.p. 95°/5 mm.

*B, HCl*: prisms from AcOH. M.p. 156°.

Koenigs, Fulde, *Ber.*, 1927, 60, 2107.

Reitman, *Chem. Zentr.*, 1934, I, 3597.

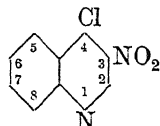
**6-Chloro-3-nitropyridine.**

Needles from  $H_2O$ . M.p. 108–10°. Weakly basic.

- Phillips, *J. Chem. Soc.* 1941, 12.  
 Rath, *Ann.* 1931, 486, 77.  
 Caldwell, Kornfeld, *J. Am. Chem. Soc.*, 1942, 64, 1695.  
 Ishikawa, *Chem. Abstracts*, 1947, 41, 3463.

**Chloronitroquinaldine.**

See Chloronitro-2-methylquinoline.

**4-Chloro-3-nitroquinoline**

$C_9H_5O_2N_2Cl$  MW, 208.5  
 M.p. 121–2°.

Bachmann *et al.*, *J. Am. Chem. Soc.*, 1947, 69, 365.

**2-Chloro-5-nitroquinoline.**

Needles from  $Et_2O$ -EtOH. M.p. 130° (127°, 133–4°). Sol.  $Et_2O$ .  $NH_3 \rightarrow$  5-nitro-2-aminoquinoline. Volatile in steam.

- Fischer, Guthmann, *J. prakt. Chem.*, 1916, 93, 382.  
 Deinet, Lutz, *J. Am. Chem. Soc.*, 1946, 68, 1325.  
 Wetzel *et al.*, *J. Am. Pharm. Assocn.*, 1946, 35, 331.  
 Gouley *et al.*, *J. Am. Chem. Soc.*, 1947, 69, 303.

**3-Chloro-5-nitroquinoline.**

Needles. M.p. 127°.  
 $B, HCl$ : m.p. 95°.  
*Methiodide*: yellow needles. M.p. 120–30° decomp.

- Edinger, Lubberger, *J. prakt. Chem.*, 1896, 54, 351.  
 Wetzel *et al.*, *J. Am. Pharm. Assocn.*, 1946, 35, 331.  
 Gouley, Moersch, Mosher, *J. Am. Chem. Soc.*, 1947, 69, 303.

**4-Chloro-5-nitroquinoline.**

M.p. 149–50°.

- Wetzel *et al.*, *J. Am. Pharm. Assocn.*, 1946, 35, 331.  
 Gouley, Moersch, Mosher, *J. Am. Chem. Soc.*, 1947, 69, 303.

**6-Chloro-5-nitroquinoline.**

Cryst. from EtOH. M.p. 129°. Sublimes.  
 $B, HCl$ : prisms. M.p. 215°.  
 $B, HNO_3$ : leaflets. M.p. 194° decomp.  
*Methiodide*: red cryst. M.p. 243°.

Fourneau, Tréfouel, Wancolle, *Bull. soc. chim.*, 1930, 47, 741.

**8-Chloro-5-nitroquinoline.**

Yellow needles from EtOH. M.p. 145°.  
 $B, H_2PtCl_6$ : yellow needles. M.p. 260° decomp.

Fourneau, Tréfouel, Wancolle, *Bull. soc. chim.*, 1930, 47, 741.

**2-Chloro-6-nitroquinoline.**

M.p. 235° (230°). Sol.  $Me_2CO$ , Py, hot EtOH. Spar. sol. cold EtOH,  $Et_2O$ , pet. ether. Hot conc. HCl  $\rightarrow$  6-nitrocarbostyryl.

- Fischer, Guthmann, *J. prakt. Chem.*, 1916, 93, 381.  
 Bachmann, Cooper, *J. Org. Chem.*, 1944, 9, 302.

**4-Chloro-6-nitroquinoline.**

Cryst. from EtOH. M.p. 142.5°.

- Bachmann, Cooper, *J. Org. Chem.*, 1944, 9, 302.  
 Baker *et al.*, *J. Am. Chem. Soc.*, 1946, 68, 1267.

**5-Chloro-6-nitroquinoline.**

Cryst. from EtOH or dil.  $H_2SO_4$ . M.p. 153°.

- Fourneau, Tréfouel, Wancolle, *Bull. soc. chim.*, 1930, 47, 751.  
 Lutz *et al.*, *J. Am. Chem. Soc.*, 1946, 68, 1324.

**7-Chloro-6-nitroquinoline.**

Cryst. from dil.  $H_2SO_4$ . M.p. 155–6° (153–5°). Mod. sol.  $CCl_4$ .

- Fourneau, Tréfouel, Wancolle, *Bull. soc. chim.*, 1930, 47, 751.  
 Lutz *et al.*, *J. Am. Chem. Soc.*, 1946, 68, 1324.

**6-Chloro-7-nitroquinoline.**

Prisms from  $CCl_4$ . M.p. 160°.

Fourneau, Tréfouel, Wancolle, *Bull. soc. chim.*, 1930, 47, 744.

**2-Chloro-8-nitroquinoline.**

M.p. 152° (149°, 145°). Sol.  $CHCl_3$ ,  $C_6H_6$ . Boiling HCl  $\rightarrow$  8-nitrocarbostyryl.  $NH_3 \rightarrow$  8-nitro-2-aminoquinoline.

- Fischer, Guthmann, *J. prakt. Chem.*, 1916, 93, 382.  
 Deinet, Lutz, *J. Am. Chem. Soc.*, 1946, 68, 1325.

**3-Chloro-8-nitroquinoline.**

Cryst. from EtOH. M.p. 139–40°.

Baker *et al.*, *J. Am. Chem. Soc.*, 1946, 68, 1532.

**4-Chloro-8-nitroquinoline.**

Cryst. from EtOH. M.p. 126–7° (129–30°).

- Riegel *et al.*, *J. Am. Chem. Soc.*, 1946, 68, 1264.  
 Baker *et al.*, *J. Am. Chem. Soc.*, 1946, 68, 1532.  
 Gouley, Moersch, Mosher, *J. Am. Chem. Soc.*, 1947, 69, 303.

**5-Chloro-8-nitroquinoline.**

Yellow needles from EtOH. M.p. 138° (135°).  
 $B_2H_2PtCl_6$ : decomp. at 290°.

Fourneau, Tréfoüel, Wancolle, *Bull. soc. chim.*, 1930, 47, 744.

Bennett, Grove, *J. Chem. Soc.*, 1945, 378.  
 Lutz et al., *J. Am. Chem. Soc.*, 1946, 68, 1324.

**6-Chloro-8-nitroquinoline.**

Needles. M.p. 158°. Sol. EtOH. Mod sol. hot  $H_2O$ . Sublimes.

$B_2H_2PtCl_6$ : decomp. at 250°.

Claus, Schedler, *J. prakt. Chem.*, 1894, 49, 355.

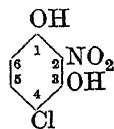
Richter, Smith, *J. Am. Chem. Soc.*, 1944, 66, 396.

**7-Chloro-8-nitroquinoline.**

Needles from dil.  $H_2SO_4$ . M.p. 185°. Sol. EtOH. Sublimes.

$B_2H_2PtCl_6$ : m.p. 221° decomp.

Fourneau, Tréfoüel, Wancolle, *Bull. soc. chim.*, 1930, 47, 750.

**4-Chloro-2-nitroresorcinol**

$C_6H_4O_4NCl$

MW, 189.5

Red plates from EtOH. M.p. 128°.

1-*Me ether*:  $C_7H_6O_4NCl$ . MW, 203.5.

Reddish gold plates. M.p. 89°.

Di-*Me ether*:  $C_8H_8O_4NCl$ . MW, 217.5. Plates from EtOH. M.p. 66-7°.

Meldola, Eyre, *J. Chem. Soc.*, 1902, 81, 1000.

**6-Chloro-4-nitroresorcinol.**

M.p. 117°.

*Diacetyl*: m.p. 113°.

Di-*Me ether*: pale yellow needles from EtOH. M.p. 125.5°. Very sol.  $CHCl_3$ . Sol.  $C_6H_6$ . Spar. sol.  $Et_2O$ . Insol.  $H_2O$ .

Di-*Et ether*:  $C_{10}H_{12}O_4NCl$ . MW, 245.5. Pale red needles from EtOH. M.p. 120.5°.

Badische, D.R.P. 135,331, (*Chem. Zentr.*, 1902, II, 1351).

Potyunin, *J. Gen. Chem. U.S.S.R.*, 1944, 14, 203, (*Chem. Abstracts*, 1945, 39, 2285).

**5-Chloro-3-nitrosalicylic Acid (5-Chloro-3-nitro-o-hydroxybenzoic acid)**

$C_7H_4O_5NCl$

MW, 217.5

Dict. of Org. Comp.—I.

Needles. M.p. 163°. Sol.  $H_2O$ .

*Et ester*:  $C_9H_8O_5NCl$ . MW, 245.5. Colourless needles from EtOH. M.p. 91°.

*Amide*:  $C_7H_5O_4N_2Cl$ . MW, 216.5. M.p. 199°. Sol. EtOH. Spar. sol.  $H_2O$ .

Anschtz, *Ann.*, 1906, 346, 339.

**3-Chloro-5-nitrosalicylic Acid.**

Needles from hot  $H_2O$ . M.p. 202-3°. (Needles from MeOH. Sinters above 250°.)  $FeCl_3$  in EtOH sol. → reddish-violet col. NaOH → orange sol.

*Me ether*:  $C_8H_6O_5NCl$ . MW, 231.5. M.p. 155.5°. Sol.  $H_2O$ .

Meldola, Foster, Brightman, *J. Chem. Soc.*, 1917, 111, 541.

Davies, Rubenstein, *J. Chem. Soc.*, 1923, 123, 2852.

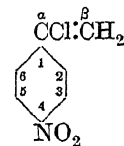
Chattaway, Goepf, *J. Chem. Soc.*, 1933, 700.

**Chloronitrosophenol.**

See under Chloronitrosophenol.

**Chloronitrosophenol.**

See under Chlorobenzoquinone.

 **$\alpha$ -Chloro-4-nitrostyrene**

$C_8H_6O_2NCl$

MW, 183.5

Pale yellow needles from ligroin. M.p. 63-4°. Spar. sol.  $H_2O$ .

Drewsen, *Ann.*, 1882, 212, 162.

 **$\beta$ -Chloro-2-nitrostyrene.**

Pale yellow needles. M.p. 58°. Sol.  $Et_2O$ . Spar. sol. EtOH.

Dann, Howard, Davies, *J. Chem. Soc.*, 1928, 608.

Lipp, *Ber.*, 1884, 17, 1070.

 **$\beta$ -Chloro-3-nitrostyrene.**

Yellow prisms from EtOH. M.p. 83°.

Dann, Howard, Davies, *J. Chem. Soc.*, 1928, 608.

 **$\beta$ -Chloro-4-nitrostyrene.**

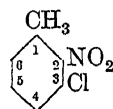
Pale yellow needles from EtOH. M.p. 128°.

Dann, Howard, Davies, *J. Chem. Soc.*, 1928, 608.

**4-Chloro- $\beta$ -nitrostyrene.**

Needles. M.p. 111-12°.

Remfry, *J. Chem. Soc.*, 1911, 99, 286.

**3-Chloro-2-nitrotoluene**

$C_7H_6O_2NCl$

MW, 171.5

35

Yellow cryst. M.p. 23°. Volatile in steam.

Elson, Gibson, Johnson, *J. Chem. Soc.*, 1929, 2740.

Wibaut, *Rec. trav. chim.*, 1913, 32, 297.

I.G., D.R.P. 638,486, (*Chem. Abstracts*, 1937, 31, 1046).

#### 4-Chloro-2-nitrotoluene.

Needles. M.p. 38°. B.p. 240°/720 mm., 115-6°/11 mm. Sol. Et<sub>2</sub>O, hot EtOH. Volatile in steam. Sn + HCl → 4-chloro-*o*-toluidine. KMnO<sub>4</sub> → 4-chloro-2-nitrobenzoic acid.

Gindraux, *Helv. Chim. Acta*, 1929, 12, 927.

#### 5-Chloro-2-nitrotoluene.

M.p. 24-9°.  $n_D^{25}$  1.5496.

Wibaut, *Rec. trav. chim.*, 1913, 32, 288.

#### 6-Chloro-2-nitrotoluene.

Needles. M.p. 37°. B.p. 238°. Volatile in steam. Sn + HCl → 6-chloro-*o*-toluidine. KMnO<sub>4</sub> → 6-chloro-2-nitrobenzoic acid.

Gindraux, *Helv. Chim. Acta*, 1929, 12, 927.

#### 2-Chloro-3-nitrotoluene.

M.p. 21-2°. B.p. 263°. Volatile in steam. Sn + HCl → 2-chloro-*m*-toluidine.

Wibaut, *Rec. trav. chim.*, 1913, 32, 254.

#### 4-Chloro-3-nitrotoluene.

F.p. 6°. M.p. 7°. B.p. 260°/745 mm., 118°/11 mm. Sn + HCl → 4-chloro-*m*-toluidine.

Gindraux, *Helv. Chim. Acta*, 1929, 12, 932.

Shaw, Turner, *J. Chem. Soc.*, 1932, 1886.

#### 5-Chloro-3-nitrotoluene.

Yellow needles. F.p. 58°. M.p. 61° (55°). Cryst. from EtOH. Volatile in steam. Sn + HCl → 5-chloro-*m*-toluidine.

Wibaut, *Rec. trav. chim.*, 1913, 32, 297.

#### 6-Chloro-3-nitrotoluene.

Yellow cryst. M.p. 44°. B.p. 248°/711 mm. Sol. Et<sub>2</sub>O. Sn + HCl → 6-chloro-*m*-toluidine.

Wibaut, *Rec. trav. chim.*, 1913, 32, 251.

#### 2-Chloro-4-nitrotoluene.

Needles. F.p. 62°. M.p. 65° (68°). Sol. EtOH, Et<sub>2</sub>O, AcOH. Spar. sol. hot H<sub>2</sub>O. Volatile in steam. KMnO<sub>4</sub> → 2-chloro-4-nitrobenzoic acid. Sn + HCl → 2-chloro-*p*-toluidine.

Bradbury, Linnell, *Quart. J. Pharm. Pharmacol.*, 1938, 11, 248.

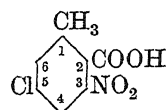
Wibaut, *Rec. trav. chim.*, 1913, 32, 247.

#### 3-Chloro-4-nitrotoluene.

Pale yellow needles. M.p. 24°. B.p. 146°/19 mm. Volatile in steam.

Elson, Gibson, Johnson, *J. Chem. Soc.*, 1929, 2739.

#### 5-Chloro-3-nitro-*o*-toluic Acid



C<sub>8</sub>H<sub>6</sub>O<sub>4</sub>NCl MW, 215.5

Needles. M.p. 189°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. pet. ether, hot H<sub>2</sub>O.

Nitrile: C<sub>8</sub>H<sub>5</sub>O<sub>2</sub>N<sub>2</sub>Cl. MW, 196.5. Yellow cryst. from EtOH. M.p. 140°.

Claus, Stapelberg, *Ann.*, 1893, 274, 297.

#### 5-Chloro-4-nitro-*o*-toluic Acid.

Cryst. from EtOH. M.p. 193°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. hot H<sub>2</sub>O.

Nitrile: cryst. from EtOH. M.p. 86°.

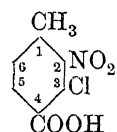
Claus, Stapelberg, *Ann.*, 1893, 274, 297.

#### 5-Chloro-6-nitro-*o*-toluic Acid.

Cryst. from EtOH. M.p. 186°. Sol. EtOH, Et<sub>2</sub>O.

Claus, Stapelberg, *Ann.*, 1893, 274, 297.

#### 3-Chloro-2-nitro-*p*-toluic Acid



C<sub>8</sub>H<sub>6</sub>O<sub>4</sub>NCl MW, 215.5

Needles from EtOH.Aq. M.p. 192°. Sol. EtOH. Insol. C<sub>6</sub>H<sub>6</sub>.

Claus, Davidsen, *Ann.*, 1891, 265, 347.

#### 5-Chloro-2-nitro-*p*-toluic Acid.

Needles from EtOH. M.p. 180-1°. Spar. sol. H<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

Et ester: C<sub>10</sub>H<sub>10</sub>O<sub>4</sub>NCl. MW, 243.5. Cryst. from EtOH. M.p. 60°.

Nitrile: C<sub>8</sub>H<sub>5</sub>O<sub>2</sub>N<sub>2</sub>Cl. MW, 196.5. Needles. M.p. 93°.

Claus, Davidsen, *Ann.*, 1891, 265, 347.

#### 6-Chloro-2-nitro-*p*-toluic Acid.

Needles. M.p. 159°. Sol. hot H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Sublimes.

Claus, Beysen, *Ann.*, 1891, 266, 238.

#### 2-Chloro-3-nitro-*p*-toluic Acid.

Plates from H<sub>2</sub>O. M.p. 211°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO. Spar. sol. C<sub>6</sub>H<sub>6</sub>, pet. ether.

Claus, Böcher, *Ann.*, 1891, 265, 362.

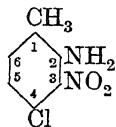
#### 6-Chloro-3-nitro-*p*-toluic Acid.

Needles from EtOH. M.p. 184-5°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO. Spar. sol. C<sub>6</sub>H<sub>6</sub>, pet. ether.

Nitrile: C<sub>8</sub>H<sub>5</sub>O<sub>2</sub>N<sub>2</sub>Cl. MW, 196.5. M.p. 157°. Sol. EtOH. Sublimes.

Claus, Beysen, *Ann.*, 1891, 266, 234.

Wahl, *Ann. chim.*, 1936, 5, 5.

4-Chloro-3-nitro-*o*-toluidine $C_7H_7O_2N_2Cl$ 

MW, 186.5

Light brown needles from  $C_6H_6$ -pet. ether, M.p. 60–62.5°.

*N*-Acetyl: 4-chloro-3-nitro-*o*-acet-toluidide. M.p. 194–5°.

Kenner, Tod, Witham, *J. Chem. Soc.*, 1925, 127, 2347.

5-Chloro-3-nitro-*o*-toluidine.

Yellow leaflets from EtOH. M.p. 129–30° (118–19°). Sol. Et<sub>2</sub>O.

*N*-Acetyl: 5-chloro-3-nitro-*o*-acet-toluidide. M.p. 197–8°.

Claus, Stapelberg, *Ann.*, 1893, 274, 295.

Cohen, Dakin, *J. Chem. Soc.*, 1902, 81, 1329.

6-Chloro-3-nitro-*o*-toluidine.

Amber coloured prisms from EtOH. M.p. 151.5°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O.

Morgan, Drew, *J. Chem. Soc.*, 1920, 117, 787.

5-Chloro-4-nitro-*o*-toluidine.

Yellow cryst. from EtOH. M.p. 128° (124°). Sol. EtOH, Et<sub>2</sub>O. Spar. sol. ligroin.

*N*-Acetyl: 5-chloro-4-nitro-*o*-acet-toluidide. M.p. 141° (262°).

Kleiderer, Adams, *J. Am. Chem. Soc.*, 1933, 55, 4221.

3-Chloro-5-nitro-*o*-toluidine.

M.p. 168°.

Wynne, Greeves, *Chem. News*, 1895, 72, 58.

4-Chloro-5-nitro-*o*-toluidine.

Cryst. from  $C_6H_6$ . M.p. 163–4°.

*N*-Acetyl: 4-chloro-5-nitro-*o*-acet-toluidide. M.p. 181–2°.

Kenner, Tod, Witham, *J. Chem. Soc.*, 1925, 127, 2346.

4-Chloro-6-nitro-*o*-toluidine.

Yellow needles from EtOH. M.p. 95–6°.

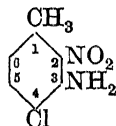
Cohen, McCandlish, *J. Chem. Soc.*, 1905, 87, 1266.

5-Chloro-6-nitro-*o*-toluidine.

Yellow needles from ligroin. M.p. 96°.

*N*-Acetyl: 5-chloro-6-nitro-*o*-acet-toluidide. M.p. 158–60° (150–2°).

Brand, Zöller, *Ber.*, 1907, 40, 3332.

4-Chloro-2-nitro-*m*-toluidine $C_7H_7O_2N_2Cl$ 

MW, 186.5

Yellow needles from EtOH.Aq. M.p. 52–3°.  
*N*-Acetyl: 4-chloro-2-nitro-*m*-acet-toluidide. M.p. 210–2°.

Kenner, Tod, Witham, *J. Chem. Soc.*, 1925, 127, 2347.

2-Chloro-4-nitro-*m*-toluidine.

Golden-yellow needles from EtOH.Aq. M.p. 105°. Sol. EtOH, Me<sub>2</sub>CO, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. pet. ether.

Morgan, Glover, *J. Chem. Soc.*, 1921, 119, 1704.

6-Chloro-4-nitro-*m*-toluidine.

Orange-red prisms or needles from EtOH. M.p. 158–9° (144°). Sol. ord. org. solvents. Insol. H<sub>2</sub>O.

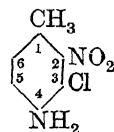
*N*-Acetyl: 6-chloro-4-nitro-*m*-acet-toluidide. M.p. 113°.

Morgan, Drew, *J. Chem. Soc.*, 1920, 117, 789.

4-Chloro-6-nitro-*m*-toluidine.

Yellow needles from EtOH.Aq. M.p. 120–1°.  
*N*-Acetyl: 4-chloro-6-nitro-*m*-acet-toluidide. M.p. 134–5°.

Kenner, Tod, Witham, *J. Chem. Soc.*, 1925, 127, 2347.

3-Chloro-2-nitro-*p*-toluidine $C_7H_7O_2N_2Cl$ 

MW, 186.5

Pale yellow needles from pet. ether. M.p. 63°.

*N*-Acetyl: 3-chloro-2-nitro-*p*-acet-toluidide. M.p. 123–4°.

Brand, Zöller, *Ber.*, 1907, 40, 3333.

5-Chloro-2-nitro-*p*-toluidine.

Orange-red leaflets from EtOH. M.p. 131°.

Orange-red leaflets from EtOH. M.p. 131°.  
Volatile in steam.  
*N*-Acetyl: 5-chloro-2-nitro-*p*-acet-toluidide. M.p. 143°.

Brand, Zöller, *Ber.*, 1907, 40, 3333.

5-Chloro-3-nitro-*p*-toluidine.

Orange-yellow leaflets from EtOH. M.p. 70–5°.

Volatile in steam.  
*N*-Acetyl: 5-chloro-3-nitro-*p*-acet-toluidide. M.p. 196°.

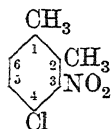
Claus, Davidsen, *Ann.*, 1891, 265, 344.

6-Chloro-3-nitro-*p*-toluidine.

Golden-yellow leaflets from EtOH. M.p. 165°.

Volatile in steam.  
*N*-Acetyl: 6-chloro-3-nitro-*p*-acet-toluidide. M.p. 113°.

Claus, Böcher, *Ann.*, 1891, 265, 354.

4-Chloro-3-nitro-*o*-xylene

$C_8H_8O_2NCl$  MW, 185.5

Pale yellow plates from EtOH.Aq. M.p. 75°.

Hinkel, Ayling, Walters, *J. Chem. Soc.*, 1934, 286.

3-Chloro-4-nitro-*o*-xylene.

Yellow needles from EtOH. M.p. 46°.

Hinkel, Ayling, Walters, *J. Chem. Soc.*, 1934, 287.

5-Chloro-4-nitro-*o*-xylene.

Pale yellow needles from EtOH. M.p. 63°.

Hinkel, Ayling, Walters, *J. Chem. Soc.*, 1934, 287.

3-Chloro-5-nitro-*o*-xylene.

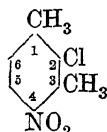
Pale yellow needles. M.p. 101°.

Hinkel, *J. Chem. Soc.*, 1924, 125, 1852.

3-Chloro-6-nitro-*o*-xylene.

Pale yellow needles from EtOH. M.p. 62°.  
Spar. sol. pet. ether.

Hinkel, Collins, Ayling, *J. Chem. Soc.*, 1923, 123, 2972.

2-Chloro-4-nitro-*m*-xylene

$C_8H_8O_2NCl$  MW, 185.5

M.p. 46-7°.

I.G., D.R.P. 510,438, (*Chem. Abstracts*, 1931, 25, 973).

5-Chloro-(4 or 2)-nitro-*m*-xylene.

Cryst. M.p. 48-9°. Volatile in steam.

Klages, Knoevenagel, *Ber.*, 1895, 28, 2045.

6-Chloro-4-nitro-*m*-xylene.

Needles. M.p. 42°. Sol. EtOH.

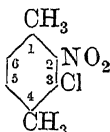
Bamberger, Reber, *Ber.*, 1913, 46, 799.

I.G., D.R.P. 510,438, (*Chem. Abstracts*, 1931, 25, 973).

4-Chloro-5-nitro-*m*-xylene.

Needles from ligroin. M.p. 52°. B.p. 278°, 161°/20 mm. Volatile in steam.

Klages, *Ber.*, 1896, 29, 311.

3-Chloro-2-nitro-*p*-xylene

$C_8H_8O_2NCl$

MW, 185.5

M.p. 56°. B.p. 135°/15 mm.

Wahl, *Compt. rend.*, 1933, 197, 1330.

5-Chloro-2-nitro-*p*-xylene.

Yellow needles. M.p. 78° (97°). B.p. 135-6°/13 mm.

Varma, Raman, *J. Indian Chem. Soc.*, 1935, 12, 540.

Wahl, *Compt. rend.*, 1933, 196, 1900.

6-Chloro-2-nitro-*p*-xylene.

Yellow needles. M.p. 36°. B.p. 133-4°/15 mm.

Wahl, *Compt. rend.*, 1934, 198, 100.

 $\omega$ -Chloro-nitroxylene.

See Nitro-xylyl chloride.

## Chloro-octadecane.

See Octadecyl chloride.

## Chloro-octane.

See Octyl chloride.

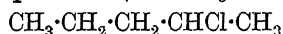
## Chloro-orthanilic Acid.

See Chloroaniline-sulphonic Acid.

## 1-Chloropentane.

See *n*-Amyl chloride.

## 2-Chloropentane (sec.-Amyl chloride)



$C_5H_{11}Cl$  MW, 106.5

B.p. 95-7°.  $D_4^{20}$  0.870.  $n_D^{20}$  1.4060

*d*.

$D_4^{20}$  0.8691.  $[\alpha]_D^{20} +42.46^\circ$ .

Norris, Taylor, *J. Am. Chem. Soc.*, 1924, 46, 753.

Hass, Weber, *Ber.*, 1934, 67, 974; *Chem. Abstracts*, 1935, 29, 5774.

Brauns, *Rec. trav. chim.*, 1946, 65, 799.

## 3-Chloropentane



$C_5H_{11}Cl$  MW, 106.5

B.p. 104-5°, 96°/753 mm.  $D_4^{15}$  0.8967,  $D_4^{20}$  0.8723.  $n_D^{15}$  1.4163,  $n_D^{20}$  1.40820.

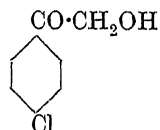
Grignard, *Bull. soc. chim.*, 1926, 39, 1592.

Wagner, Saytzeff, *Ann.*, 1875, 179, 321.

Hass, Weber, *Ber.*, 1934, 67, 974; *Chem. Abstracts*, 1935, 29, 5774.

## Chlorophenacetin.

See under Chloro-*p*-phenetidinc.

4-Chlorophenacyl Alcohol (4-Chloro- $\omega$ -hydroxyacetophenone)

$C_8H_7O_2Cl$  MW, 170.5

Needles from ligroin. M.p. 122-4°. Begins to sublime at 110°.

*Formyl*: m.p. 128°.

*Acetyl*: plates from ligroin. M.p. 67.2°.

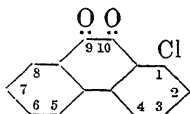
B.p. 174-5°/20 mm.

*Propionyl*: m.p. 98.2°.

*Butyryl* : m.p. 55°.  
*Valeryl* : m.p. 97-8°.  
*Palmityl* : m.p. 82°.  
*Stearyl* : m.p. 86°.

Straus, *Ann.*, 1912, 393, 330.

### 1-Chlorophenanthraquinone



$C_{14}H_7O_2Cl$

MW, 242.5

Orange needles. M.p. 217-18°.

Fieser, Young, *J. Am. Chem. Soc.*, 1931, 53, 4125.

### 2-Chlorophenanthraquinone.

Reddish needles from AcOH. M.p. 252-3°. Sol.  $C_6H_6$ . Spar. sol. EtOH,  $Et_2O$ , AcOH.  $CrO_3 \rightarrow$  4-chlorodiphenic acid.

*Monoxime* : greenish-yellow needles. M.p. 180-5°.

*Semicarbazone* : yellow needles. M.p. 220°.

Schmidt, Sauer, *Ber.*, 1911, 44, 3249.

Yakubovich, Vorob'ova, *J. prakt. Chem.*, 1935, 143, 281.

### 3-Chlorophenanthraquinone.

Orange-yellow needles from AcOH. M.p. 265°. *Monoxime* : yellow needles. M.p. 204° decomp.

Sandqvist, Hagelin, *Ber.*, 1918, 51, 1523.

Nylén, *Ber.*, 1920, 53, 163.

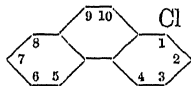
Fieser, Young, *J. Am. Chem. Soc.*, 1931, 53, 4125.

### 4-Chlorophenanthraquinone.

Orange cryst. M.p. 162-3°.

Yakubovich, Vorob'ova, *J. prakt. Chem.*, 1935, 143, 281.

### 1-Chlorophenanthrene



$C_{14}H_9Cl$

MW, 212.5

Plates from EtOH. M.p. 120-120.5°.

Bachmann, Boatner, *J. Am. Chem. Soc.*, 1936, 58, 2194.

### 2-Chlorophenanthrene.

Plates from EtOH. M.p. 85.5-86°.

Bachmann, Boatner, *J. Am. Chem. Soc.*, 1936, 58, 2194.

### 3-Chlorophenanthrene.

Needles from EtOH. M.p. 80.5-81.5°.

Sandqvist, *Ann.*, 1909, 369, 116.

Bachmann, Boatner, *J. Am. Chem. Soc.*, 1936, 58, 2194.

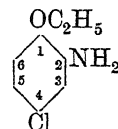
### 9-Chlorophenanthrene.

Needles from AcOH. M.p. 53-53.5°. B.p. 370°/737 mm. Sol.  $Et_2O$ ,  $C_6H_6$ ,  $CCl_4$ ,  $CS_2$ . Ox.  $\rightarrow$  phenanthraquinone.

*Picrate* : yellow needles. M.p. 115°.

Sandqvist, Hagelin, *Ber.*, 1918, 51, 1520.

**4-Chloro-*o*-phenetidine** (4-Chloro-*o*-aminophenetole, 4-chloro-2-aminophenyl ethyl ether)



$C_8H_{10}ONCl$

MW, 171.5

Needles from EtOH.Aq. M.p. 42°. Spar. sol.  $H_2O$ . Sol. EtOH. Volatile in steam.

*N-Acetyl* : 5-chloro-2-ethoxyacetanilide.  $C_{10}H_{12}O_2NCl$ . MW, 213.5. M.p. 110°.

*Picrate* : m.p. 132-5°.

Reverdin, Düring, *Ber.*, 1899, 32, 154.

### 5-Chloro-*o*-phenetidine.

Needles. M.p. 32° (21-2°).

*N-Acetyl* : 4-chloro-2-ethoxyacetanilide. Plates from EtOH. M.p. 106° (98°).

*B,HCl* : decomp. at 250-60°.

Orton, King, *J. Chem. Soc.*, 1911, 99, 1190.  
Mangini, Deliddo, *Gazz. chim. ital.*, 1933, 63, 612.

General Aniline Works, U.S.P. 1,792,156, (*Chem. Zentr.*, 1931, I, 3059).

**4-Chloro-*m*-phenetidine** (4-Chloro-*m*-aminophenetole, 4-chloro-3-aminophenyl ethyl ether).

Oil. Volatile in steam. Sol. EtOH,  $Et_2O$ .

*N-Acetyl* : 6-chloro-3-ethoxyacetanilide. Leaflets from EtOH. M.p. 106°.

*Picrate* : yellow needles. M.p. 111°.

Reverdin, Düring, *Ber.*, 1899, 32, 157.

**2-Chloro-*p*-phenetidine** (2-Chloro-*p*-aminophenetole, 2-chloro-4-aminophenyl ethyl ether).

Needles from EtOH. M.p. 66°. Sol. EtOH,  $Et_2O$ . Volatile in steam.

*N-Acetyl* : 3-chloro-4-ethoxyacetanilide, 3-chlorophenacetin.  $C_{10}H_{12}O_2NCl$ . MW, 213.5. Needles from EtOH. M.p. 132°.

*Picrate* : m.p. 167-70°.

Hurst, Thorpe, *J. Chem. Soc.*, 1915, 107, 938.

Reverdin, Düring, *Ber.*, 1899, 32, 157.

### 3-Chloro-*p*-phenetidine.

Needles. M.p. 24°. B.p. 161.5°/33 mm.

*Hydrochloride* : needles. M.p. 225° decomp.

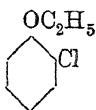
*N-Acetyl* : 2-chloro-4-ethoxyacetanilide, 2-chlorophenacetin. Prisms from  $C_6H_6$ . M.p. 99°.

I.G., D.R.P. 621,710, (*Chem. Zentr.*, 1936, I, 3021).

I.C.I., B.P. 379,741, F.P. 738,157, (*Chem. Abstracts*, 1933, 27, 1640).

Hurst, Thorpe, *J. Chem. Soc.*, 1915, 107, 938.

**o-Chlorophenetole** (*o*-Chlorophenyl ethyl ether)



$C_8H_9OCl$  MW, 156.5

B.p. 208°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.  
Beilstein, Kurbatow, *Ann.*, 1875, 176, 39.

**m-Chlorophenetole.**

B.p. 204-5°/717 mm. Sol. EtOH, Et<sub>2</sub>O, AcOH, C<sub>6</sub>H<sub>6</sub>.  $D_4^{20}$  1.1712.

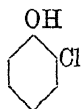
Wohleben, *Ber.*, 1909, 42, 4372.

**p-Chlorophenetole.**

M.p. 21°. B.p. 212°. Sol. EtOH, Et<sub>2</sub>O.

Autenrieth, Mühlinghaus, *Ber.*, 1906, 39, 4102.

**o-Chlorophenol**



$C_6H_5OCl$  MW, 128.5

Colourless cryst. M.p. 8-8°. B.p. 175-6°. Sol. EtOH, Et<sub>2</sub>O. Slightly sol. cold H<sub>2</sub>O.  $k = 7.7 \times 10^{-11}$ . Conc. caustic alkalis (melt or under pressure) → catechol. PCl<sub>5</sub> → *o*-dichlorobenzene. Dil. HNO<sub>3</sub> → 4- and 6-nitro derivs. Conc. HNO<sub>3</sub> → 4:6-dinitro deriv. Forms add. comp. with AlCl<sub>3</sub>, m.p. 207-10°.

*Me ether*: see *o*-Chloroanisole.

*Et ether*: see *o*-Chlorophenetole.

*Acetyl*: *o*-chlorophenyl acetate. B.p. 103°/15 mm.  $D_4^{20}$  1.2166.

*Benzoyl*: *o*-chlorophenyl benzoate. B.p. 155-7°/3 mm.

*m*-Nitrobenzoyl: m.p. 98°.

*p*-Iodophenylurethane: m.p. 156-7°.

*Picrate*: yellow needles. M.p. 81°.

Takagi, Kutani, *Chem. Abstracts*, 1926, 20, 2669.

Holleman, Rinkes, *Rec. trav. chim.*, 1911, 30, 79.

Likhosherstov, *Chem. Abstracts*, 1930, 24, 836.

Huston, Neeley, *J. Am. Chem. Soc.*, 1935, 57, 2176.

**m-Chlorophenol.**

Needles. M.p. 33°. B.p. 214°. Sol. EtOH. KOH melt → resorcinol.

*Me ether*: see *m*-Chloroanisole.

*Et ether*: see *m*-Chlorophenetole.

*Acetyl*: *m*-chlorophenyl acetate. B.p. 116°/21 mm., 84-6°/2 mm.

*Benzoyl*: *m*-chlorophenyl benzoate. M.p. 71°.

*p*-Iodophenylurethane: m.p. 138-9°.

Holleman, Rinkes, *Rec. trav. chim.*, 1911, 30, 81.

Haller, Schaffer, *J. Am. Chem. Soc.*, 1933, 55, 4954.

**p-Chlorophenol.**

Needles. M.p. 43°. B.p. 217°. Sol. EtOH, Et<sub>2</sub>O, alkalis. Prac. insol. H<sub>2</sub>O. Sol. conc. aq. alkali carbonates and re-ppd. by CO<sub>2</sub>.  $k = 4.1 \times 10^{-10}$ . KOH melt → hydroquinone (and resorcinol). K<sub>2</sub>CO<sub>3</sub> → hydroquinone. Dil. HNO<sub>3</sub> → 2-nitro deriv. Conc. HNO<sub>3</sub> → 2:6-dinitro deriv. NH<sub>3</sub> under press. → *p*-aminophenol. Forms add. comp. with AlCl<sub>3</sub>, m. p. 185-7°.

*Me ether*: see *p*-Chloroanisole.

*Et ether*: see *p*-Chlorophenetole.

*Acetyl*: *p*-chlorophenyl acetate. M.p. 7-8°. B.p. 226-8°. Sol. EtOH, AcOH, Et<sub>2</sub>O.

*Benzoyl*: *p*-chlorophenyl benzoate. Silky leaflets. M.p. 88°.

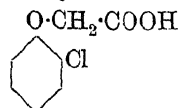
*p*-Iodophenylurethane: m.p. 214-15°.

Holleman, Rinkes, *Rec. trav. chim.*, 1911, 30, 82.

Likhosherstov, *Chem. Abstracts*, 1930, 24, 836.

Kipriyanov, Dasherskii, *Chem. Abstracts*, 1933, 27, 3824.

**o-Chlorophenoxyacetic Acid**



$C_8H_7O_3Cl$  MW, 186.5

Needles from H<sub>2</sub>O. M.p. 145-6°.

*Me ester*: C<sub>9</sub>H<sub>9</sub>O<sub>3</sub>Cl. MW, 200.5. B.p. 186-8°.

*Et ester*: C<sub>10</sub>H<sub>11</sub>O<sub>3</sub>Cl. MW, 214.5. Needles. M.p. 32°.

*Chloride*: C<sub>8</sub>H<sub>6</sub>O<sub>2</sub>Cl<sub>2</sub>. MW, 205. M.p. 18-4°. B.p. 136°/12 mm. Sol. CS<sub>2</sub>, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Amide*: C<sub>8</sub>H<sub>8</sub>O<sub>2</sub>NCl. MW, 185.5. Needles. M.p. 149-5°.

*Anilide*: m.p. 121°.

Minton, Stephen, *J. Chem. Soc.*, 1922, 121, 1600.

Koelsch, *J. Am. Chem. Soc.*, 1931, 53, 304.

**m-Chlorophenoxyacetic Acid.**

M.p. 108-10°.

Koelsch, *J. Am. Chem. Soc.*, 1931, 53, 304.

**p-Chlorophenoxyacetic Acid.**

Needles or prisms from H<sub>2</sub>O. M.p. 155-6° (157-8°).

*Me ester*: b.p. 177-80°.

*Et ester*: C<sub>10</sub>H<sub>11</sub>O<sub>3</sub>Cl. MW, 214.5. Needles. M.p. 49°. B.p. 180°/22 mm.

*2-Chloro-Et ester*: m.p. 41.5-2.5°. B.p. 156-7°/2.5 mm.

*2-Bromo-Et ester*: m.p. 29.6-40.4°. B.p. 182-4°/4.5 mm.

*2-Hydroxy-Et ester*: m.p. 29-30°. B.p. 163-6°/1.5 mm.

*Allyl ester*: b.p. 122-4°/2 mm.

*Crotyl ester*: b.p. 141-2°/12 mm.



*Chloride*: m.p. 18.8°. B.p. 142°/17 mm. Sol. CS<sub>2</sub>, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Amide*: C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>NCl. MW, 185.5. Needles. M.p. 133° (140°).

*Anilide*: m.p. 125°.

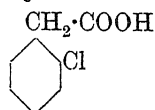
Minton, Stephen, *J. Chem. Soc.*, 1922, 121, 1600.

Koelsch, *J. Am. Chem. Soc.*, 1931, 53, 304.

### 1-Chloro-1-phenylacetic Acid.

See Phenylchloroacetic Acid.

### *o*-Chlorophenylacetic Acid



C<sub>8</sub>H<sub>7</sub>O<sub>2</sub>Cl MW, 170.5

Needles from H<sub>2</sub>O. M.p. 95°.  $k = 1.35 \times 10^{-4}$ .

*Me ester*: C<sub>9</sub>H<sub>9</sub>O<sub>2</sub>Cl. MW, 184.5. B.p. 125–8°/23 mm.

*Et ester*: C<sub>10</sub>H<sub>11</sub>O<sub>2</sub>Cl. MW, 198.5. B.p. 134°/23 mm.

*Amide*: C<sub>9</sub>H<sub>9</sub>ONCl. MW, 169.5. Leaflets from H<sub>2</sub>O. M.p. 175°. Sol. EtOH, hot C<sub>6</sub>H<sub>6</sub>. Spar. sol. Et<sub>2</sub>O. Insol. ligroin.

*Nitrile*: *o*-chlorobenzyl cyanide. C<sub>8</sub>H<sub>6</sub>NCl. MW, 151.5. Needles. M.p. 24°. B.p. 251° (242°).

*Anilide*: needles from EtOH.Aq. M.p. 138.5°.

*o*-Toluidide: m.p. 174°.

*p*-Toluidide: m.p. 170°.

Mehner, *J. prakt. Chem.*, 1900, 62, 554.

### *m*-Chlorophenylacetic Acid.

Plates from EtOH. M.p. 74°.

*Nitrile*: *m*-chlorobenzyl cyanide. M.p. 11.5°. B.p. 261°.

Buck, Ide, *J. Am. Chem. Soc.*, 1932, 54, 3308.

Kenner, Morton, *J. Chem. Soc.*, 1934, 679.

### *p*-Chlorophenylacetic Acid.

Needles. M.p. 105–6° (104°). Sol. EtOH, Et<sub>2</sub>O, H<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Et ester*: needles. M.p. 32°. B.p. 260°.

*Chloride*: C<sub>8</sub>H<sub>6</sub>OCl<sub>2</sub>. MW, 189. B.p. 120°/14 mm.

*Amide*: plates from EtOH. M.p. 175°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O.

*Nitrile*: *p*-chlorobenzyl cyanide. Prisms. M.p. 30°. B.p. 265–7°. Sol. EtOH, Et<sub>2</sub>O.

*Anilide*: leaflets from EtOH. M.p. 164–5°.

*o*-Toluidide: cryst. from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 179°.

*p*-Toluidide: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 190°.

*Hydrazide*: needles from EtOH. M.p. 170°.

Straus, *Ann.*, 1912, 393, 317.

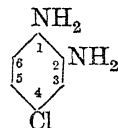
Petrenko-Kritschenko, *Ber.*, 1892, 25, 2240.

Friedmann, Maase, *Biochem. Z.*, 1910, 27, 107.

### Chlorophenyl benzyl Ketone.

See Chlorodeoxybenzoin.

### 4-Chloro-*o*-phenylenediamine



C<sub>6</sub>H<sub>7</sub>N<sub>2</sub>Cl MW, 142.5

Leaflets from H<sub>2</sub>O. M.p. 76°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. cold H<sub>2</sub>O. Mod. volatile in steam.

1 : 2-*N*-Diacetyl: leaflets. M.p. 208°.

1 : 2-*N*-Dibenzoyl: silky needles from EtOH. M.p. 230°.

1-*N*-*Di*-*Me*: see 4-Chloro-*o*-aminodimethylaniline.

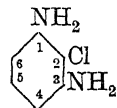
1 : 2-*N*-*Di*-*Me*: m.p. 61°.

Ullmann, Mauthner, *Ber.*, 1903, 36, 4027.

Popov, *Chem. Abstracts*, 1934, 28, 1671.

Mangini, Deliddo, *Gazz. chim. ital.*, 1933, 63, 612.

### 2-Chloro-*m*-phenylenediamine



C<sub>6</sub>H<sub>7</sub>N<sub>2</sub>Cl MW, 142.5

Cryst. M.p. 85–6°. Sol. Et<sub>2</sub>O.

1 : 3-*N*-Dibenzoyl: yellowish needles from hot EtOH. M.p. 196–7°.

Borsche, Rantscheff, *Ann.*, 1911, 379, 161.

### 4-Chloro-*m*-phenylenediamine.

Needles. M.p. 91°. Sol. EtOH. Spar. sol. H<sub>2</sub>O.

1 : 3-*N*-Diacetyl: cryst. from H<sub>2</sub>O. M.p. 242–3°.

1 : 3-*N*-Dibenzoyl: needles from C<sub>6</sub>H<sub>6</sub>. M.p. 178°.

1 : 3-*N*-*Di*-*p*-toluenesulphonyl: prisms. M.p. 215°.

1-*N*-*Di*-*Me*: see 4-Chloro-*m*-aminodimethylaniline.

3 : 3-*N*-*Di*-*Me*: plates. M.p. 80°.

1-*N*-*Et*: C<sub>8</sub>H<sub>11</sub>N<sub>2</sub>Cl. MW, 170.5. M.p. 53°.

Morgan, *J. Chem. Soc.*, 1900, 77, 1206.

### 5-Chloro-*m*-phenylenediamine.

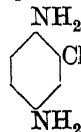
Prisms from EtOH. M.p. 105–6°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, Me<sub>2</sub>CO, hot H<sub>2</sub>O. Spar. sol. CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>. Insol. ligroin.

1 : 3-*N*-Diacetyl: cryst. M.p. above 300°.

1 : 3-*N*-Dibenzoyl: cryst. M.p. 254–5°.

Cohn, *Monatsh.*, 1901, 22, 118.

### 2-Chloro-*p*-phenylenediamine



C<sub>6</sub>H<sub>7</sub>N<sub>2</sub>Cl

MW, 142.5

Needles. M.p. 64°. Sol. H<sub>2</sub>O.

1-N-Acetyl: 2-chloro-4-aminoacetanilide.  
Pale red cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 134-5°.

1:4-N-Diacetyl: m.p. 196°.

1:4-N-Dibenzoyl: m.p. 228°.

1:4-N-Di-p-toluenesulphonyl: m.p. 167°.

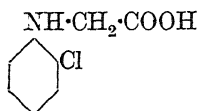
4-N-Di-Me: see 3-Chloro-p-aminodimethyl-aniline.

4-N-Di-Et: see 3-Chloro-p-aminodiethyl-aniline.

Kehrmann, *Ann.*, 1898, 303, 11.

Niyogy, *Chem. Zentr.*, 1927, II, 411.

**o-Chlorophenylglycine** (2-Chloroanilino-acetic acid)



C<sub>8</sub>H<sub>8</sub>O<sub>2</sub>NCl MW, 185.5

Leaflets from H<sub>2</sub>O. M.p. 166-7° (171°).  
Loses CO<sub>2</sub> at 210°.

Et ester: C<sub>10</sub>H<sub>12</sub>O<sub>2</sub>NCl. MW, 113.5. B.p. 288-91°. N-Acetyl: b.p. 205°/20 mm.

Amide: C<sub>8</sub>H<sub>7</sub>N<sub>2</sub>Cl. MW, 184.5. Needles from H<sub>2</sub>O. M.p. 142°.

N-Acetyl: cryst. from EtOH-CHCl<sub>3</sub>. Chars at 210°.

Schwalbe, Schultz, Jochheim, *Ber.*, 1908, 41, 3793.

Knoevenagel, *Ber.*, 1904, 37, 4082.

**m-Chlorophenylglycine.**

Needles from org. solvents. M.p. 93°.

Schwalbe, Schultz, Jochheim, *Ber.*, 1908, 41, 3793.

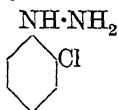
**p-Chlorophenylglycine.**

Cryst. M.p. 141°.

Amide: m.p. 125-6°.

Schwalbe, Schultz, Jochheim, *Ber.*, 1908, 41, 3793.

**o-Chlorophenylhydrazine**



C<sub>6</sub>H<sub>7</sub>N<sub>2</sub>Cl MW, 142.5

Needles from Et<sub>2</sub>O. M.p. 48°. Decomp. on dist.

B, HCl: needles. M.p. 194° decomp.

Graziani, *Chem. Zentr.*, 1913, II, 496.

**m-Chlorophenylhydrazine.**

B.p. 165°/23 mm. Decomp. at 200-20°.

B, HCl: needles. M.p. 236°.

B, HNO<sub>3</sub>: decomp. at 175°.

Graziani, *Chem. Zentr.*, 1913, II, 496.

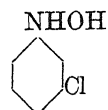
**p-Chlorophenylhydrazine.**

Needles from Et<sub>2</sub>O. M.p. 90°.

B, HCl: needles. M.p. 225-30° decomp.

Graziani, *Chem. Zentr.*, 1913, II, 496.

**m-Chlorophenylhydroxylamine**



C<sub>6</sub>H<sub>8</sub>ONCl MW, 143.5

Plates from C<sub>6</sub>H<sub>6</sub>. M.p. 49°. EtOH sol. in air → 3:3'-dichloroazoxybenzene.

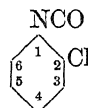
Haworth, Lapworth, *J. Chem. Soc.*, 1921, 119, 773.

**p-Chlorophenylhydroxylamine.**

Glistening plates from H<sub>2</sub>O. M.p. 86°. Sol. C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>, hot H<sub>2</sub>O. Mod. sol. EtOH.

Bamberger, Baudisch, *Ber.*, 1909, 42, 3581.

**2-Chlorophenyl isocyanate** (2-Chlorophenylcarbomimide)



C<sub>7</sub>H<sub>4</sub>ONCl MW, 153.5

Liq. with irritating odour. B.p. 114-15°/43 mm.

Vittenet, *Bull. soc. chim.*, 1899, 21, 955.

**3-Chlorophenyl isocyanate.**

Liq. with irritating odour. B.p. 113-14°/43 mm.

Vittenet, *Bull. soc. chim.*, 1899, 21, 955.

**4-Chlorophenyl isocyanate.**

Cryst. mass. M.p. 30-1°. B.p. 115-17°/45 mm.

Vittenet, *Bull. soc. chim.*, 1899, 21, 955.

**N<sup>2</sup>-p-Chlorophenyl-N<sup>5</sup>-isopropylidoguanide.**

See Paludrine.

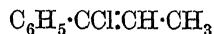
**Chlorophenyl Mercaptan.**

See Chlorothiophenol.

**Chloro-1-phenylpropionic Acid.**

See Chlorohydratropic Acid.

**1-Chloro-1-phenylpropylene** (α-Chloro-β-methylstyrene, α-chloropropenylbenzene)



C<sub>9</sub>H<sub>9</sub>Cl MW, 152.5

B.p. 90.5°/0.9 mm. D<sub>4</sub><sup>20</sup> 1.085. n<sub>D</sub><sup>15</sup> 1.56352.

Auwers, *Ber.*, 1912, 45, 2801.

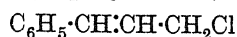
**2-Chloro-1-phenylpropylene** (β-Chloro-β-methylstyrene, β-chloropropenylbenzene)



C<sub>9</sub>H<sub>9</sub>Cl MW, 152.5

Sweet smelling mobile liq. B.p. 118-23°/28 mm.

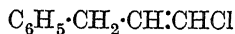
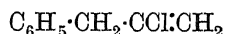
Farmer, Ghose, *J. Chem. Soc.*, 1933, 962.

**3-Chloro-1-phenylpropylene** (*Cinnamyl chloride,  $\gamma$ -chloropropenylbenzene*) $\text{C}_9\text{H}_9\text{Cl}$  MW, 152.5

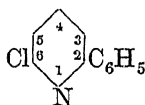
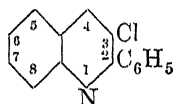
Needles. M.p. 8–9°. B.p. 140°/37 mm. part. decomp., 125–6°/22 mm., 115°/13 mm., 86–7°/2 mm.

Norris, Watt, Thomas, *J. Am. Chem. Soc.*, 1916, **38**, 1078.Rupe, Bürgin, *Ber.*, 1910, **43**, 173.Klages, Klenk, *Ber.*, 1906, **39**, 2552.**1-Chloro-2-phenylpropylene** ( $\beta$ -Chloro- $\alpha$ -methylstyrene) $\text{C}_9\text{H}_9\text{Cl}$  MW, 152.5

B.p. 213–15°, 102–6°/14 mm.

Tiffeneau, *Ann. chim.*, 1907, **10**, 166.**1-Chloro-3-phenylpropylene** ( $\gamma$ -Chloro-allylbenzene) $\text{C}_9\text{H}_9\text{Cl}$  MW, 152.5Liq. with penetrating odour. B.p. 212–14°, 97°/18 mm.  $D_4^{14}$  1.073.  $n_D^{15}$  1.545.Braun, Kuhn, *Ber.*, 1925, **58**, 2168.Bert, *Compt. rend.*, 1925, **180**, 1504.**2-Chloro-3-phenylpropylene** ( $\beta$ -Chloroallylbenzene) $\text{C}_9\text{H}_9\text{Cl}$  MW, 152.5

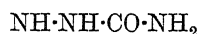
B.p. 105–7°/26 mm.

Zaki, Iskander, *J. Chem. Soc.*, 1943, 68.**6-Chloro-2-phenylpyridine** $\text{C}_{11}\text{H}_8\text{NCl}$  MW, 189.5Needles from pet. ether. M.p. 34°. Sol. EtOH. Prac. insol.  $\text{H}_2\text{O}$ .Leben, *Ber.*, 1896, **29**, 1679.**3-Chloro-2-phenylquinoline** $\text{C}_{15}\text{H}_{10}\text{NCl}$  MW, 239.5Prisms from  $\text{Et}_2\text{O}$ . M.p. 92° (92.5–93°).John, Ottawa, *J. prakt. Chem.*, 1931, **131**, 354.**4-Chloro-2-phenylquinoline.**Cryst. from ligroin. M.p. 63–4°. Volatile in steam. Very spar. sol.  $\text{H}_2\text{O}$ .*Methiodide*: orange-yellow cryst. M.p. 163–4°.Knorr, Fertig, *Ber.*, 1897, **30**, 938.John, Wünsche, *J. prakt. Chem.*, 1928, **118**, 303; 1930, **126**, 220.**2-Chloro-3-phenylquinoline.**

M.p. 54–5°.

S.C.I., D.R.P. 547,082, (*Chem. Abstracts*, 1932, **26**, 3624).**4-Chloro-3-phenylquinoline.**

Needles from MeOH. M.p. 74–5°.

Elderfield, Wright, *J. Am. Chem. Soc.*, 1946, **68**, 1276.**1-[2-Chlorophenyl]-semicarbazide** $\text{C}_7\text{H}_8\text{ON}_3\text{Cl}$  MW, 185.5Plates from  $\text{H}_2\text{O}$ . M.p. 164°.Hewitt, *J. Chem. Soc.*, 1891, 59, 210.**1-[3-Chlorophenyl]-semicarbazide.**

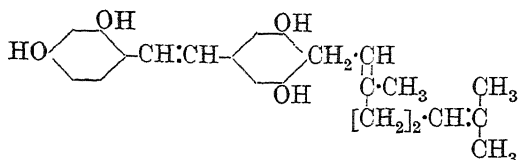
Prisms or plates from EtOH.Aq. M.p. 155°.

Hewitt, *J. Chem. Soc.*, 1893, **63**, 870.**1-[4-Chlorophenyl]-semicarbazide.**

Plates from EtOH. M.p. 233–4°.

Hewitt, *J. Chem. Soc.*, 1893, **63**, 870.Hantzsch, Schultze, *Ber.*, 1895, **28**, 2081.***o*-Chlorophenylurea** $\text{C}_7\text{H}_7\text{ON}_2\text{Cl}$  MW, 170.5Prisms from  $\text{H}_2\text{O}$ . M.p. 152°. Sol. EtOH,  $\text{Me}_2\text{CO}$ . Spar. sol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ .  $\text{Ac}_2\text{O} \rightarrow$  2-chloroacetanilide.*N-Phenyl*: see *o*-Chlorocarbanilide.Doht, *Monatsh.*, 1900, **27**, 213.***m*-Chlorophenylurea.**Needles from  $\text{H}_2\text{O}$ . M.p. 142°. Sol. EtOH,  $\text{Me}_2\text{CO}$ . Spar. sol.  $\text{Et}_2\text{O}$ .*N-Phenyl*: see *m*-Chlorocarbanilide.Doht, *Monatsh.*, 1900, **27**, 213.***p*-Chlorophenylurea.**Needles or prisms from  $\text{H}_2\text{O}$ . M.p. 204–7° (212° decomp.), varies with rate of heating and  $\rightarrow$  di-*[p*-chlorophenyl]-urea. Sol. EtOH,  $\text{Me}_2\text{CO}$ . Spar. sol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ .*N-Phenyl*: see *p*-Chlorocarbanilide.Young, Dunstan, *J. Chem. Soc.*, 1908, **93**, 1058.Doht, *Monatsh.*, 1900, **27**, 213.

## Chlorophorin



$C_{24}H_{28}O_4$  MW, 380

Constituent of iroko (*Chlorophora excelsa*).  
Amorph. M.p. 157-9°.

*Tetra-Me ether*: prisms from EtOH. M.p. 73-4°.

*Tetra-Et ether*: pale yellow prisms from EtOH.  
M.p. 78-9°.

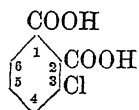
*Tetra-acetyl*: needles from EtOH. M.p. 133-4°.

*Tetrabenzoyl*: needles from EtOH. M.p. 164.5-165.5°.

King, Grunton, *J. Chem. Soc.*, 1949,  
3349; 1950, 3547.

Nunn, Rapson, *J. Chem. Soc.*, 1949, 3151.

## 3-Chlorophthalic Acid



$C_8H_5O_4Cl$  MW, 200.5

Needles from  $H_2O$ . M.p. 186°. Sol. EtOH,  
 $Et_2O$ . Heat above m.p.  $\rightarrow$  anhydride.

*Anhydride*:  $C_8H_3O_3Cl$ . MW, 182.5. M.p.  
124-5°. Sublimes.

*Imide*: 3-chlorophthalimide.  $C_8H_4O_2NCl$ .  
MW, 181.5. M.p. 118-20° (sealed tube). Sub-  
limes when heated.

Bogert, Boroschek, *J. Am. Chem. Soc.*,  
1901, 23, 751.

Smith, *J. Chem. Soc.*, 1933, 1643.

## 4-Chlorophthalic Acid.

Needles. M.p. 157°. Sol.  $H_2O$ , EtOH. Heat  
above m.p.  $\rightarrow$  anhydride. KOH fusion  $\rightarrow$   
4-hydroxyphthalic acid.

*Di-Me ester*:  $C_{10}H_9O_4Cl$ . MW, 228.5.  
Needles. M.p. 37°.

*Di-Et ester*:  $C_{12}H_{13}O_4Cl$ . MW, 256.5. B.p.  
300-5°.

*Dichloride*:  $C_8H_3O_2Cl_2$ . MW, 237.5. B.p.  
275-6°. Easily hyd. by  $H_2O$ .

*Anhydride*: prisms. M.p. 98.5°. B.p. 294-  
5°/720 mm. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ .

*Imide*: 4-chlorophthalimide. M.p. 210-11°. Sol.  
 $Me_2CO$ ,  $CHCl_3$ ,  $C_6H_6$ . Spar. sol. hot EtOH,  $Et_2O$ .  
*Anil*: m.p. 174°.

Moore, Marrack, Proud, *J. Chem. Soc.*,  
1921, 119, 1788.

Auwers, Harres, *Chem. Abstracts*, 1930,  
24, 2108.

Scottish Dyes, B.P. 348,632, (*Chem.*  
*Abstracts*, 1932, 26, 5105).

## Chlorophthalic Anhydride.

See under Chlorophthalic Acid.

## Chlorophthalimide.

See under Chlorophthalic Acid.

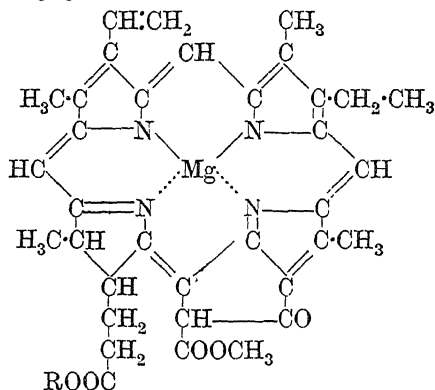
## Chlorophyll

a.  $C_{55}H_{72}O_5N_4Mg(+\frac{1}{2}H_2O)$  MW, 892

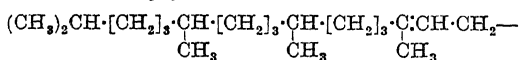
b.  $C_{55}H_{70}O_6N_4Mg$  MW, 906

Green pigment of the leaves of plants.

*Chlorophyll a*.



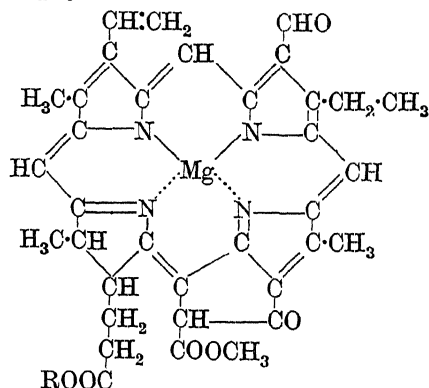
Note.—R = Phytol =



(see Phytol).

Blue-black powder. Sol. EtOH  $\rightarrow$  bluish-  
green sol. with deep red fluor. Sol.  $Et_2O$  with  
blue col. which on dilution develops greenish  
tint. Sol. pet. ether. Acids remove Mg, re-  
placing it by  $H_2$   $\rightarrow$  *phaeophytin a*:  $C_{55}H_{74}O_5N_4$ .  
Hyd. of *phaeophytin a*  $\rightarrow$  phytol + a mono-  
carboxylic acid, *phaeophorbide a*, which is also  
produced by hyd. of chlorophyll by the enzyme  
*chlorophyllase*. *Phaeophorbide a*, on hyd.  $\rightarrow$  a  
dicarboxylic acid, *phaeophorbins a*, +  $CH_3OH$ .  
*Phaeophorbins a* + NaOH  $\rightarrow$  Na salt of a tri-  
carboxylic acid, *chlorophyllins a*, which gives  
porphyrins on treatment with acid. Absorption  
maxima in  $Et_2O$ , 6556, 6085, 5746, 5318, 5108,  
4942, 4641, 4307A°.

*Chlorophyll b*.



Dark green powder. Sol. MeOH. Green sols. in EtOH and Et<sub>2</sub>O with brownish-red fluor. Undergoes similar reactions to *chlorophyll a*, giving rise to corresponding products. Absorption maxima in Et<sub>2</sub>O, 6376, 5891, 5667, 5594, 5526, 5404, 4999, 4499A°.

Willstätter, *Ber.*, 1914, 47, 2831.

Fischer, Siebel, *Ann.*, 1932, 499, 84.

Fischer, Wenderoth, *Ann.*, 1939, 537, 170.

Conant, Dietz, Bailey, Kamerling, *J. Am. Chem. Soc.*, 1931, 53, 2382.

Fischer, Süss, Klebs, *Ann.*, 1931, 490, 38.

Conant, Dietz, Werner, *J. Am. Chem. Soc.*, 1931, 53, 4436.

Fischer, *Chem. Reviews*, 1937, 20, 41.

Linstead, *Annual Reports on the Progress of Chemistry (Chemical Society)*, 1937, 34, 375.

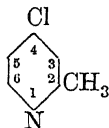
Winterstein, Stein, *Z. physiol. Chem.*, 1933, 220, 263.

Stoll, Wiedemann, *Helv. Chim. Acta*, 1933, 16, 739; *Fortschritte der Chemie Organischer Naturstoffe* (Springer), 1938, 1, 159.

Treibs, *Angew. Chem.*, 1934, 47, 294 (*Bibl.*).

Mayer, Cook, *Chemistry of Natural Coloring Matters*, (New York), 1943.

#### 4-Chloro- $\alpha$ -picoline (4-Chloro-2-methylpyridine)



C<sub>6</sub>H<sub>6</sub>NCl MW, 127.5

B.p. 163° corr. Volatile in steam. KMnO<sub>4</sub> → 4-chloropicolinic acid.

Sedgwick, Collie, *J. Chem. Soc.*, 1895, 67, 405.

#### 5-Chloro- $\alpha$ -picoline.

M.p. 21° (19°). B.p. 163°. D<sub>20</sub><sup>4</sup> 1.146. Volatile in steam. Ox. → 5-chloropicolinic acid.

Graf, *J. prakt. Chem.*, 1932, 133, 19.

Ost, *J. prakt. Chem.*, 1883, 27, 278.

#### 6-Chloro- $\alpha$ -picoline.

Liq. with sweet odour. B.p. 183-4°. Spar. sol. H<sub>2</sub>O.

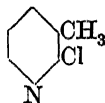
*Chloroplatinate*: red prisms. Decomp. above 290°.

Seide, *Chem. Zentr.*, 1923, III, 1022.

#### $\omega$ -Chloro- $\alpha$ -picoline.

See 2-Chloromethylpyridine.

#### 2-Chloro- $\beta$ -picoline (2-Chloro-3-methylpyridine)



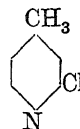
C<sub>6</sub>H<sub>6</sub>NCl MW, 127.5

B.p. 192-3°. Faintly basic properties. Sol. min. acids, pptd. by H<sub>2</sub>O. KMnO<sub>4</sub> → 2-chloronicotinic acid.

*Chloroplatinate*: orange prisms + H<sub>2</sub>O. M.p. 208°.

Seide, *Ber.*, 1924, 57, 1805.

#### 2-Chloro- $\gamma$ -picoline (2-Chloro-4-methylpyridine)



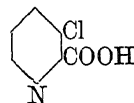
C<sub>6</sub>H<sub>6</sub>NCl MW, 127.5

B.p. 194-5°. D<sub>20</sub><sup>4</sup> 1.1459. n<sub>D</sub><sup>20</sup> 1.5293.

Seide, *Ber.*, 1924, 57, 793.

Aston, Collie, *J. Chem. Soc.*, 1897, 71, 655.

#### 3-Chloropicolinic Acid (3-Chloropyridine-2-carboxylic acid)



C<sub>6</sub>H<sub>4</sub>O<sub>2</sub>NCl MW, 157.5

M.p. 121° decomp.

*Amide*: C<sub>6</sub>H<sub>5</sub>ON<sub>2</sub>Cl. MW, 156.5. Cryst. from H<sub>2</sub>O. M.p. 140°.

Graf, *J. prakt. Chem.*, 1932, 133, 50.

#### 4-Chloropicolinic Acid.

Needles. M.p. 182° decomp. Sol. hot EtOH, hot Et<sub>2</sub>O.

*Me ester*: C<sub>7</sub>H<sub>6</sub>O<sub>2</sub>NCl. MW, 171.5. M.p. 57-8°.

*Phenyl ester*: C<sub>12</sub>H<sub>8</sub>O<sub>2</sub>NCl. MW, 233.5. Cryst. from pet. ether. M.p. 68°.

*Chloride*: C<sub>6</sub>H<sub>3</sub>ONCl<sub>2</sub>. MW, 176. M.p. 46°. Sol. C<sub>6</sub>H<sub>6</sub>.

*Amide*: needles. M.p. 158° (152-4°).

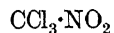
Meyer, Graf, *Ber.*, 1928, 61, 2210.

#### 6-Chloropicolinic Acid.

Plates. Darkens at 180°, melts at 190°. Sol. EtOH, CHCl<sub>3</sub>, AcOEt, hot EtOH. Spar. sol. Et<sub>2</sub>O. Insol. ligroin.

Fischer, Hess, Stahlschmidt, *Ber.*, 1912, 45, 2461.

#### Chloropicrin (Trichloronitromethane, nitrochloroform)

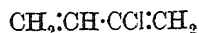


CO<sub>2</sub>NCl<sub>3</sub> MW, 164.5

Colourless liq. F.p. -69°. B.p. 112°, 15°/30 mm. Sol. EtOH. Insol. H<sub>2</sub>O. D<sub>4</sub><sup>15</sup> 1.69225. n<sub>D</sub><sup>20</sup> 1.46075. Stable to H<sub>2</sub>O, dil. acids and alkalis. Lachrymator and lung irritant.

Frahm, *Rec. trav. chim.*, 1931, 50, 1125, (*Bibl.*).

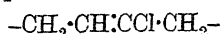
**Chloroprene** (*Chloroerythrene*, 2-chloro-1:3-butadiene)



$\text{C}_4\text{H}_5\text{Cl}$  MW, 88.5

B.p. 59.4°, 47°/500 mm., 33°/300 mm., 6.4°/100 mm. Misc with most ord. org. solvents. Spar. sol.  $\text{H}_2\text{O}$ .  $D_4^{20}$  0.9583.  $n_D^{20}$  1.4583. Adds  $\text{Br}_2$  in  $\text{CHCl}_3$  sol. Decolourises  $\text{KMnO}_4$  sol. Polymerises completely in 10 days  $\rightarrow$   $\mu$ -polychloroprene. In presence of polymerisation inhibitor  $\rightarrow$  1:6-dichloro-1:5-cyclooctadiene.

$\mu$ -Polychloroprene:



Skeleton structure

$(\text{C}_4\text{H}_5\text{Cl})_n$

Rubber-like substance (Neoprene). Insol. but swells in  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ ,  $\text{CCl}_4$ ,  $\text{CS}_2$ ,  $\text{PhNO}_2$ , Py, aniline,  $\text{AcOEt}$ . Shows unsaturation to Br. Ox.  $\rightarrow$  succinic acid. Highly resistant to ozone.

Carothers, Williams, Collins, Kirby, *J. Am. Chem. Soc.*, 1931, 53, 4203.

Carothers, Berchet, Collins, *J. Am. Chem. Soc.*, 1932, 54, 4066.

du Pont, B.P. 387,325, (*Chem. Zentr.*, 1932, II, 2107): B.P. Application 27740/39.

I.G., B.Ps. 458,100; 492,689, (*Chem. Zentr.*, 1937, I, 2022; 1938, II, 950); U.S.P. 2,180,115, (*Chem. Abstracts*, 1940, 34, 1690).

Muskat, U.S.P. 2,038,593, (*Chem. Zentr.*, 1936, II, 3358).

### Chloropropane.

See Propyl chloride and Isopropyl chloride.

### Chloropropenylbenzene.

See Chlorophenylpropylene.

### 1-Chloropropionaldehyde



$\text{C}_3\text{H}_5\text{OCl}$  MW, 92.5

B.p. 86°.  $D_4^{15}$  1.182.

*Dipropyl acetal*:  $\text{C}_9\text{H}_{19}\text{O}_2\text{Cl}$ . MW, 194.5. B.p. 203° (195-7°). Sol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ ,  $\text{CHCl}_3$ ,  $\text{AcOH}$ . Insol.  $\text{H}_2\text{O}$ .  $D_4^{15}$  0.990.

*Hydrate*:  $\text{C}_3\text{H}_7\text{O}_2\text{Cl}$ . MW, 110.5. B.p. 81°.

Oddo, Cusmano, *Gazz. chim. ital.*, 1911, 41, ii, 231, 242, 245, 263.

Voet, *Bull. soc. chim.*, 1927, 41, 1308.

### 2-Chloropropionaldehyde



$\text{C}_3\text{H}_5\text{OCl}$  MW, 92.5

B.p. 125-30°, 40-50°/10 mm. Sol.  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ . Insol.  $\text{H}_2\text{O}$ .  $D_4^{15}$  1.268.  $n_D^{15}$  1.475. Reduces Fehling's.  $\text{HNO}_3 \rightarrow$  2-chloropropionic acid. Readily polymerises to a comp., m.p. 34-5°.

*Di-Me acetal*:  $\text{C}_5\text{H}_{11}\text{O}_2\text{Cl}$ . MW, 138.5. B.p. 86°/100 mm., 51°/19 mm.  $D_4^{15}$  1.064.  $n_D^{20}$  1.41631.

*Di-Et acetal*:  $\text{C}_7\text{H}_{15}\text{O}_2\text{Cl}$ . MW, 166.5. B.p. 84°/25 mm., 74°/20 mm.  $D_4^{19}$  0.9951.  $n_D^{19}$  1.4206.

Evans, Hass, *J. Am. Chem. Soc.*, 1926, 48, 2705.

Hartung, Adkins, *J. Am. Chem. Soc.*, 1927, 49, 2521.

Spoehr, Young, *Chem. Abstracts*, 1928, 22, 2368.

Crawford, Kenyon, *J. Chem. Soc.*, 1927, 399.

Kirmann, Goudard, Chahidzadeh, *Bull. soc. chim.*, 1935, 2, 2143.

Witzemann, Evans, Hass, Schroeder, *Organic Syntheses*, 1931, XI, 26.

### 1-Chloropropionic Acid



$\text{C}_3\text{H}_5\text{O}_2\text{Cl}$  MW, 108.5

*dl.*

B.p. 186°, 84°/12 mm. Misc. with  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$  all proportions.  $D_4^0$  1.28.  $k = 1.465 \times 10^{-3}$  at 25°. Red.  $\rightarrow$  propionic acid. Alkali hyd.  $\rightarrow$  lactic acid.

*Me ester*:  $\text{C}_4\text{H}_7\text{O}_2\text{Cl}$ . MW, 122.5. B.p. 132-3°.

*Et ester*:  $\text{C}_5\text{H}_9\text{O}_2\text{Cl}$ . MW, 136.5. B.p. 147-8°, 52-4°/18 mm.  $D_4^{20}$  1.0869.  $n_D^{20}$  1.41850.

*Chloride*:  $\text{C}_3\text{H}_4\text{OCl}_2$ . MW, 127. B.p. 110°/744 mm.  $D_7^{15}$  1.2394.

*Amide*:  $\text{C}_6\text{H}_9\text{ONCl}$ . MW, 107.5. M.p. 80°. Sol.  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ .

*Nitrile*:  $\text{C}_3\text{H}_4\text{NCl}$ . MW, 89.5. B.p. 123-4°, 73°/144 mm.  $D_4^{10}$  1.0792.

*d.*

*Me ester*: b.p. 133-4°, 50°/35 mm.  $D^{20}$  1.1815.  $[\alpha]_D^{25} + 2.15^\circ$ .

*Et ester*: b.p. 146-8°, 60°/37 mm.  $D^{20}$  1.089.  $[\alpha]_D + 19.88^\circ$ .

*Propyl ester*:  $\text{C}_6\text{H}_{11}\text{O}_2\text{Cl}$ . MW, 150.5. B.p. 57°/12 mm.  $D_4^1$  1.065.  $[\alpha]_D + 11.0^\circ$ .

*Chloride*: b.p. 110-3°.  $[\alpha]_D^{15} + 0.2^\circ$ .

*l.*

Liq.  $[\alpha]_D^{15} - 2.36^\circ$ .

*Me ester*: b.p. 79-80°/120 mm.  $D_4^1$  1.158.  $[\alpha]_D - 26.83^\circ$ .

*Et ester*: b.p. 143-5°, 53°/30 mm.  $[\alpha]_D^{16} - 2.92^\circ$  to  $-4.76^\circ$  ( $-16.8^\circ$ ).  $n_D^{15}$  1.4169.

Michael, *Ber.*, 1901, 34, 4049.

Frankland, Garner, *J. Chem. Soc.*, 1914, 105, 1110.

Levene, Haller, *J. Biol. Chem.*, 1929, 81, 707.

See also Paal, Lobeck, *Ber.*, 1931, 64, 2142.

### 2-Chloropropionic Acid



$\text{C}_3\text{H}_5\text{O}_2\text{Cl}$  MW, 108.5

Leaflets from  $\text{H}_2\text{O}$ , m.p. 41° (61°). Cryst. from hot ligroin, m.p. 39°. B.p. 204°. Sol.

H<sub>2</sub>O, EtOH. Hygroscopic.  $k = 8.6 \times 10^{-5}$  at 25°. Part decomp. on dist.  $\rightarrow$  acrylic acid + HCl. Aq. alkalis  $\rightarrow$  acrylic acid.

*Me ester*: C<sub>4</sub>H<sub>7</sub>O<sub>2</sub>Cl. MW, 122.5. B.p. 155–7°. D<sub>4</sub><sup>20</sup> 1.198.

*Et ester*: C<sub>5</sub>H<sub>9</sub>O<sub>2</sub>Cl. MW, 136.5. B.p. 162°. D<sub>4</sub><sup>20</sup> 1.1086.  $n_D^{20}$  1.42537.

*Propyl ester*: C<sub>6</sub>H<sub>11</sub>O<sub>2</sub>Cl. MW, 150.5. B.p. 180°. D<sub>4</sub><sup>20</sup> 1.092.

*l-Menthyl ester*: b.p. 105–7°/4 mm. D<sub>4</sub><sup>20</sup> 1.011.  $n_D^{20}$  1.4642.  $[\alpha]_D^{25}$  25.8°.

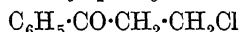
*Chloride*: C<sub>3</sub>H<sub>4</sub>OCl<sub>2</sub>. MW, 127. B.p. 143–5°, 82°/102 mm. D<sub>15</sub><sup>18</sup> 1.3307.

*Nitrile*: C<sub>3</sub>H<sub>4</sub>NCl. MW, 89.5. B.p. 175–6°. D<sub>15</sub><sup>18</sup> 1.1443.

Powell, *Organic Syntheses*, Collective Vol. I, 160; Moureu, Chaux, *ibid.*, 162.

See also Paal, Lobeck, *Ber.*, 1931, **64**, 2142.

$\gamma$ -Chloropropiophenone (*o*-Chloropropiophenone, 2-chloroethyl phenyl ketone)



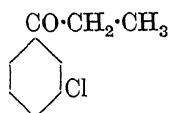
C<sub>9</sub>H<sub>9</sub>OCl MW, 168.5

Leaflets from Et<sub>2</sub>O. M.p. 49–50°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

Kohler, *Am. Chem. J.*, 1909, **42**, 389.

Kenner, Statham, *J. Chem. Soc.*, 1935, 301.

*o*-Chloropropiophenone (*Ethyl o*-chlorophenyl ketone)



C<sub>9</sub>H<sub>9</sub>OCl MW, 168.5

B.p. 105–6°/12 mm.

*Semicarbazone*: m.p. 172–3°.

Zenitz, Hartung, *J. Org. Chem.*, 1946, **11**, 444

*m*-Chloropropiophenone (*Ethyl m*-chlorophenyl ketone).

M.p. 79° (45–6°).

*Semicarbazone*: 79–80°.

Edkins, Linnell, *Chem. Abstracts*, 1936, **30**, 6724.

Zenitz, Hartung, *J. Org. Chem.*, 1946, **11**, 444.

*p*-Chloropropiophenone (*Ethyl p*-chlorophenyl ketone).

M.p. 36°. B.p. 134–7°/31 mm., 114–18°/2 mm. Sol. EtOH, CS<sub>2</sub>. Insol. H<sub>2</sub>O. Ox.  $\rightarrow$  *p*-chlorobenzoic acid.

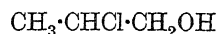
*Oxime*: m.p. 62–3°.

*Semicarbazone*: m.p. 175–6°.

Collet, *Compt. rend.*, 1898, **126**, 1577.

Zenitz, Hartung, *J. Org. Chem.*, 1946, **11**, 444.

2-Chloropropyl Alcohol (*2*-Propylene chlorohydrin)



C<sub>3</sub>H<sub>7</sub>OCl MW, 94.5

*dl.*

B.p. 133–4°. D<sub>20</sub> 1.103.  $n_D^{20}$  1.43623. Conc. caustic alkalis  $\rightarrow$  propylene oxide.

*d.*

B.p. 40–1°/15 mm.  $[\alpha]_D^{15}$  + 9.26°.

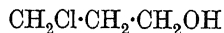
*l.*

$[\alpha]_D^{15}$  – 2.92°.

Smith, *Chem. Abstracts*, 1921, **15**, 2627.

Abderhalden, Eichwald, *Ber.*, 1918, **51**, 1317.

3-Chloropropyl Alcohol (*Trimethylene chlorohydrin*)



C<sub>3</sub>H<sub>7</sub>OCl MW, 94.5

B.p. 161–2°, 53°/6 mm. Very sol. H<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 1.1309.  $n_D^{20}$  1.44693.

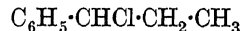
*Benzoyl*: b.p. 154–6°/22 mm. D<sub>4</sub><sup>22</sup> 1.1672.  $n_D^{22}$  1.5136.

*p-Nitrobenzoyl*: b.p. 168.5–9.5°/2 mm. D<sub>25</sub><sup>25</sup> 1.3222.  $n_D^{25}$  1.54736.

*p-Toluenesulphonyl*: b.p. 188–92°/5 mm. D<sub>25</sub><sup>25</sup> 1.2396.  $n_D^{25}$  1.5225.

Marvel, Calvery, *Organic Syntheses*, Collective Vol. I, 519.

$\alpha$ -Chloropropylbenzene (*1*-Chloro-1-phenylpropane)



C<sub>9</sub>H<sub>11</sub>Cl MW, 154.5

*dl.*

B.p. 87–8°/15 mm., 200–5° decomp.  $\rightarrow$  propenylbenzene + HCl.

*d.*

B.p. 86–7°/15 mm. D<sub>4</sub><sup>17</sup> 1.0429.  $[\alpha]_D^{17}$  + 3.79°.

*l.*

B.p. 95°/25 mm. D<sub>4</sub><sup>17</sup> 1.0430.  $[\alpha]_D^{17}$  – 3.87°,  $[\alpha]_D^{25}$  – 28.9°.

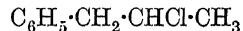
Straus, Berkow, *Ann.*, 1913, **401**, 152.

Meisenheimer, Casper, Piper, Scholtz, *Ann.*, 1925, **442**, 193.

Pickard, Kenyon, *J. Chem. Soc.*, 1911, **99**, 71.

Levene, Rothen, Kuna, *J. Biol. Chem.*, 1937, **120**, 777.

$\beta$ -Chloropropylbenzene (*2*-Chloro-1-phenylpropane)



C<sub>9</sub>H<sub>11</sub>Cl MW, 154.5

*dl.*

B.p. 204–7° part. decomp.  $\rightarrow$  propenylbenzene + HCl.

*d.*

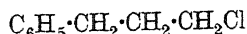
B.p. 94°/17 mm.  $n_D^{21}$  1.5198.  $[\alpha]_{4359}^{21}$  + 21.2°.

*l.*  
B.p. 94°/17 mm.  $D_4^{19}$  1.038.  $n_D^{25}$  1.5198.  
[ $\alpha$ ]<sub>5780</sub> - 5.65°.

Norris, Taylor, *J. Am. Chem. Soc.*, 1924, 46, 753.

Kenyon *et al.*, *J. Chem. Soc.*, 1935, 1072.

$\gamma$ -Chloropropylbenzene (3-Chloro-1-phenylpropane,  $\omega$ -chloropropylbenzene)



$C_9H_{11}Cl$  MW, 154.5

B.p. 219-20°, 110°/21 mm.  $D_4^{25}$  1.056. Much more stable than the  $\beta$ - and  $\alpha$ -comps.

Braun, Aust, *Ber.*, 1916, 49, 507.

Suter, Evans, *J. Am. Chem. Soc.*, 1938, 60, 537.

***o*-Chloropropylbenzene**



$C_9H_{11}Cl$  MW, 154.5

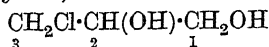
B.p. 79°/10 mm.  $D_4^{17}$  1.0367.  $n_D^{15}$  1.52129.

Nenitzescu, Isăcescu, *Ber.*, 1933, 66, 1102.

**Chloropropylene.**

See Propenyl chloride, Isopropenyl chloride and Allyl chloride.

**3-Chloropropylene Glycol** (*Glycerol  $\alpha$ -monochlorohydrin*)



$C_3H_7O_2Cl$  MW, 110.5

Liq. with sweet taste. B.p. 139°/18 mm., 83°/1 mm. Sol.  $H_2O$ , EtOH,  $Et_2O$ .  $D^0$  1.338,  $D^{20}$  1.3209.  $n_D^{20}$  1.4809.  $Na + H_2O \rightarrow$  propylene glycol.  $Na$  in  $Et_2O \rightarrow$  glycide.

*Di-Me Ether*:  $C_5H_{11}O_2Cl$ . MW, 138.5. B.p. 156°.  $D_4^{25}$  1.08.  $n_D^{25}$  1.43.

*1-Et ether*:  $C_5H_{11}O_2Cl$ . MW, 138.5. B.p. 188°.

*1-Acetyl*: b.p. 240°.

*2-Acetyl*: b.p. 218°.

*Diacetyl*: b.p. 145-50°/40 mm., 90-1°/1.8 mm.  $n_D^{20}$  1.4407.

*Di-p-nitrobenzoyl*: m.p. 108°.

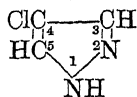
Conant, Quayle, *Organic Syntheses*, Collective Vol. I, 288.

Fairbourne, Gibson, Stephens, *J. Chem. Soc.*, 1931, 445.

**Chloropropylene oxide.**

See Epichlorohydrin.

**4-Chloropyrazole** (4-Chloro-1 : 2-diazole)



$C_3H_3N_2Cl$

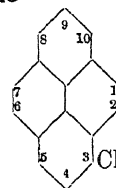
MW, 102.5

M.p. 77°. B.p. 220°.

Knorr, *Ber.*, 1895, 28, 715 (*Footnote*).

Mazzara, Borgo, *Gazz. chim. ital.*, 1906, 36, iii, 351.

**3-Chloropyrene**



$C_{16}H_9Cl$

MW, 236.5

Prisms from AcOH. M.p. 119°. Very sol.  $Et_2O$ ,  $C_6H_6$ ,  $CHCl_3$ ,  $CS_2$ . Sol. EtOH, AcOH. Conc.  $H_2SO_4 \rightarrow$  bluish-violet col.

*Picrate*: needles. M.p. 177-8°.

Vollmann, Becker, Corell, Streeck, *Ann.*, 1937, 531, 80.

Goldschmiedt, Wegscheider, *Monatsh.*, 1883, 4, 238.

Pongratz, Eichler, *Ber.*, 1936, 69, 1294.

**2-Chloropyridine** ( $\alpha$ -Chloropyridine)



$C_5H_4NCl$

MW, 113.5

B.p. 170° (166°/714 mm.). Sol.  $Et_2O$ .  $D^{15}$  1.205. Volatile in steam.

Wibaut, Nicolai, *Rec. trav. chim.*, 1939, 58, 709.

Deutsche Gold-Schneideanstalt, D.R.P. 489,183, (*Chem. Abstracts*, 1930, 24, 2146).

Fischer, *Ber.*, 1899, 32, 1298.

Rath, *Ann*, 1931, 486, 76.

**3-Chloropyridine** ( $\beta$ -Chloropyridine).

B.p. 148°/744 mm. Mod. sol.  $H_2O$ . Reacts strongly alkaline.

$B, HCl$ : m.p. 60°.

$B_2, H_2PtCl_6, 2H_2O$ : m.p. 168°.

$B, HgCl_2$ : needles. M.p. 180°.

$B, H_2AuCl_4$ : decomp. at 200°.

*Picrate*: m.p. 135°.

Ciamician, Dennstedt, *Ber.*, 1881, 14, 1153.

Hantzsch, *Ber.*, 1889, 22, 2835.

Binz, Rath, *Ann.*, 1931, 486, 95.

**4-Chloropyridine** ( $\gamma$ -Chloropyridine).

B.p. 147-8°, 85-7°/100 mm. Sol.  $H_2O$ .

$B, HCl$ : m.p. 223° (sealed tube).

$B_2, H_2PtCl_6, H_2O$ : m.p. 202°.

Wibaut, Brockman, *Rec. trav. chim.*, 1939, 58, 885.

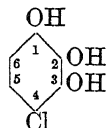
Fischer, Demeler, *Ber.*, 1899, 32, 1308.

Koenigs, Miels, Gurlt, *Ber.*, 1924, 57, 1182.



**Chloropyridine-carboxylic Acid.**

See Chloropicolinic Acid, Chloronicotinic Acid and Chloro-isonicotinic Acid.

**4-Chloropyrogallol**

$C_6H_5O_3Cl$  MW, 160.5  
Cryst. M.p. 143–5°.

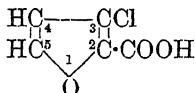
Graebe, Sutter, *Ann.*, 1905, **340**, 228.

**5-Chloropyrogallol.**

*Tri-Me ether*:  $C_9H_{11}O_3Cl$ . MW, 202.5. Cryst. from EtOH.Aq. M.p. 72°.

Graebe, Sutter, *Ann.*, 1905, **340**, 228.

**3-Chloropyromucic Acid** (*3-Chlorofuroic acid*, *3-chlorofuran-2-carboxylic acid*: see note under 4-Chloropyromucic acid, below)



$C_5H_3O_3Cl$  MW, 146.5

Plates or prisms. M.p. 148.5–149.5°. Spar. sol. cold  $H_2O$ . Ox.  $\rightarrow$  chlorofumaric acid.

*Et ester*:  $C_7H_7O_3Cl$ . MW, 174.5. Prisms. M.p. 30°. B.p. 217°.

Shepard, Winslow, Johnson, *J. Am. Chem. Soc.*, 1930, **52**, 2086.

**4-Chloropyromucic Acid** (*4-Chloro-2-furoic acid*, *4-chlorofuran-2-carboxylic acid*. Note: this compound is generally described as *3-chloropyromucic acid*).

Plates or prisms from  $H_2O$ . M.p. 145–6°.

*Et ester*:  $C_7H_7O_3Cl$ . MW, 174.5. Prisms. M.p. 29–30°. B.p. 217°/764 mm.

Hill, Jackson, *Am. Chem. J.*, 1890, **12**, 32.

Shepard, Winslow, Johnson, *J. Am. Chem. Soc.*, 1930, **52**, 2086.

Wal, *Chem. Abstracts*, 1937, **31**, 2207.

**5-Chloropyromucic Acid** (*5-Chlorofuroic acid*, *5-chlorofuran-2-carboxylic acid*).

Leaflets. M.p. 179–80°. Spar. sol. cold  $H_2O$ . Ox.  $\rightarrow$  fumaric acid.

*Et ester*: m.p. 2°. B.p. 216–18°, 134–6°/34 mm.

*Amide*:  $C_5H_4O_2NCl$ . MW, 145.5. Needles. M.p. 154–5°. Sol. hot  $H_2O$ .

Hill, Jackson, *Am. Chem. J.*, 1890, **12**, 32.

Shepard, Winslow, Johnson, *J. Am. Chem. Soc.*, 1930, **52**, 2086.

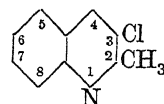
Hewlett, *Chem. Abstracts*, 1933, **27**, 980.

**6-Chloro- $\alpha$ -pyrone.**

See under Glutaconic Acid.

**Chloropyrotartaric Acid.**

See 1-Chloro-1-methylsuccinic Acid.

**3-Chloroquinaldine** (*3-Chloro-2-methylquinoline*)

$C_{10}H_8NCl$  MW, 177.5

Needles. M.p. 71–2°. Sol. EtOH,  $Et_2O$ .

*Picrate*: m.p. 223° decomp.

Koenigs, Stockhausen, *Ber.*, 1902, **35**, 2560.

**4-Chloroquinaldine.**

M.p. 42–3°. B.p. 265–70°. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ ,  $CS_2$ . Spar. sol.  $H_2O$ .

*Picrate*: m.p. 178°.

*Methiodide*: yellow cryst. Decomp. at 212°.

*N-Oxide*: m.p. 135°. *B,HCl*: m.p. 173–4°.

*Picrate*: m.p. 145.5°.

Fischer, Diepolder, Wölfel, *J. prakt. Chem.*, 1925, **109**, 60.

Heller, Dietrich, Reichardt, *J. prakt. Chem.*, 1928, **118**, 138.

**5-Chloroquinaldine.**

Needles from EtOH.Aq. or  $C_6H_6$ . M.p. 39–40°. Sol. EtOH, AcOH,  $CHCl_3$ , ligroin.

*Picrate*: m.p. 158–9°.

Heller, Dietrich, Reichardt, *J. prakt. Chem.*, 1928, **118**, 143.

**6-Chloroquinaldine.**

Flakes. M.p. 91°.

Bartow, McCollum, *J. Am. Chem. Soc.*, 1904, **26**, 703.

See also Bayer, D.R.P. 204,255, (*Chem. Zentr.*, 1908, II, 1906).

**7-Chloroquinaldine.**

Cryst. M.p. 74.5–76° (78°). B.p. 87°/0.5 mm.

Bartow, McCollum, *J. Am. Chem. Soc.*, 1904, **26**, 703.

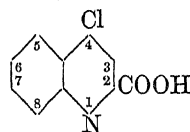
Campbell, Helbing, Kerwin, *J. Am. Chem. Soc.*, 1946, **68**, 1840.

**8-Chloroquinaldine.**

Cryst. M.p. 68–70°.

Bartow, McCollum, *J. Am. Chem. Soc.*, 1904, **26**, 703.

I.G., F.P. 646,711, (*Chem. Abstracts*, 1929, **23**, 2185); D.R.P. 567,273 (*Chem. Abstracts*, 1933, **27**, 1362).

**4-Chloroquinaldinic Acid** (*4-Chloroquinoline-2-carboxylic acid*)

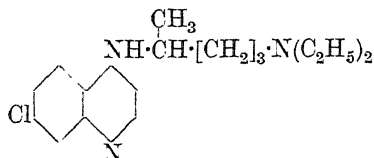
$C_{10}H_6O_2NCl$  MW, 207.5

Cryst. from MeOH. M.p. 170–1°.

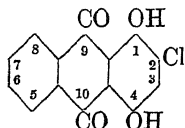
Späth, *Monatsh.*, 1921, **42**, 94.

**7-Chloroquinaldinic Acid.**

M.p. 213° decomp.

*Et ester*: m.p. 72-4°. B.p. 155-7°/1 mm.Campbell, Helbring, Kerwin, *J. Am. Chem. Soc.*, 1946, **68**, 1840.**Chloroquine** (*Aralen, resochin, 7-chloro-4-(4'-diethylamino-1'-methylbutylamino)-quinoline*) $C_{18}H_{26}N_3Cl$ 

MW, 319.5

Cryst. from  $C_6H_6$ -ligroin. M.p. 88°. B.p. 212-14°/0.2 mm. Antimalarial drug.*Picrate*: m.p. 207°.Andersag, Breitner, Jung, D.R.P. 683,692, (*Chem. Abstracts*, 1942, **36**, 4973).Andersag, *Ber.*, 1948, **81**, 499.Surrey, Hammer, *J. Am. Chem. Soc.*, 1946, **68**, 113.**2-Chloroquinizarin** (*2-Chloro-1:4-dihydroxy-anthraquinone*) $C_{14}H_7O_4Cl$ 

MW, 274.5

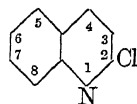
Ruby plates from toluene. M.p. 239-40°.

*Diacetyl*: m.p. 209-10°.Dimroth, Schultze, *Ann.*, 1916, **411**, 348.Raudnitz, *Ber.*, 1929, **62**, 2763.Newport, D.R.P. 491,878, (*Chem. Abstracts*, 1930, **24**, 2474).**5-Chloroquinizarin.**

Brownish-red needles from AcOH. M.p. 243°.

*Diacetyl*: m.p. 205°.M.L.B., D.R.P. 172,105, (*Chem. Zentr.*, 1906, II, 478).Waldmann, *J. prakt. Chem.*, 1931, **130**, 92.**6-Chloroquinizarin.**

Plates from toluene. M.p. 188°.

*Di-Me ether*:  $C_{16}H_{11}O_4Cl$ . MW, 302.5. M.p. 168.5°.*Diacetyl*: m.p. 213°.Waldmann, *J. prakt. Chem.*, 1930, **126**, 254.**2-Chloroquinoline** (*α-Chloroquinoline*) $C_9H_6NCl$ 

MW, 163.5

Needles from EtOH.Aq. M.p. 37-8°. B.p. 266-7° (276°). Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, ligroin. Insol. H<sub>2</sub>O. Volatile in steam. H<sub>2</sub>O at 120° → carbostyrl.*Picrate*: m.p. 122°.Fischer, *Ber.*, 1898, **31**, 612.Rath, *Ann.*, 1931, **486**, 76.Bobrański, *Ber.*, 1938, **71**, 578.**3-Chloroquinoline** (*β-Chloroquinoline*).

B.p. 255°/743 mm. Hygroscopic. Volatile in steam.

*B.HCl*: m.p. 210° decomp.*B.H<sub>2</sub>SO<sub>4</sub>*: m.p. 148-50°.*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>, 2H<sub>2</sub>O*: m.p. above 300°.*B.HAuCl<sub>4</sub>*: m.p. 183-4°.*Dichromate*: m.p. 125-6°.*Picrate*: m.p. 182°.*Methiodide*: sublimes at 276°.Edinger, Lubberger, *J. prakt. Chem.*, 1896, **54**, 348.Meisenheimer, *Ber.*, 1926, **59**, 1853.**4-Chloroquinoline** (*γ-Chloroquinoline*).M.p. 31°. B.p. 261°/744 mm., 130°/15 mm. Sol. EtOH, Et<sub>2</sub>O, dil. HCl.*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>, 2H<sub>2</sub>O*: yellow needles. M.p. 278-9° decomp.*B.HAuCl<sub>4</sub>*: m.p. 242-4°.*Picrate*: m.p. 212-3° decomp.Bobrański, *Ber.*, 1938, **71**, 578.Meisenheimer, *Ber.*, 1926, **59**, 1853.**5-Chloroquinoline.**

M.p. 45°. B.p. 256°. Volatile in steam.

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: yellow needles. M.p. 255°.*B<sub>2</sub>AgNO<sub>3</sub>*: m.p. 120°.*Picrate*: m.p. 220-3°.*Nitrate*: m.p. 159-61°.*Perchlorate*: m.p. 198°.*Dichromate*: m.p. 121°.*Oxalate*: needles from EtOH. M.p. 145°.*Methiodide*: m.p. 231-2° decomp. (172°).La Coste, *Ber.*, 1885, **18**, 2941; 1884, **17**, 926.Freydl, *Monatsh.*, 1886, **8**, 582.**6-Chloroquinoline.**

Needles. M.p. 41°. B.p. 261-2°/740 mm.

*Nitrate*: needles. M.p. 176°. Spar. sol. H<sub>2</sub>O.*Chromate*: yellow needles. M.p. 168°.*Methiodide*: m.p. 248° decomp.*Ethiodide*: yellow plates. M.p. 168-9°.La Coste, *Ber.*, 1882, **15**, 559.Mazonki, Sucharda, *Chem. Abstracts*, 1937, **31**, 2217.I.G., F.P. 727,528, (*Chem. Abstracts*, 1932, **26**, 5104).**7-Chloroquinoline.**

Needles or prisms. M.p. 31-2°. B.p. 267-8°.

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: decomp. at 253°.

$B_2(AgNO_3)_2$ : m.p. 154°.

*Picrate*: m.p. 225°.

*Oxalate*: m.p. 155°.

*Nitrate*: m.p. 199°.

*Perchlorate*: m.p. 126°.

*Dichromate*: m.p. 172–8°.

*Methochloride*: yellowish needles from  $H_2O$ .  
M.p. 213° decomp.

*Methiodide*: yellow needles from  $H_2O$ . M.p.  
250° decomp.

Freydl, *Monatsh.*, 1886, 8, 582.

Hauser, *J. Am. Chem. Soc.*, 1946, 68,  
1544.

Bradford, Elliott, Rowe, *J. Chem. Soc.*,  
1947, 437.

### 8-Chloroquinoline.

B.p. 288°. Sol.  $H_2O$ , most ord. org. solvents.

$B_2HCl$ : m.p. 169–71.5° (97°).

$B_2H_2PtCl_6$ : m.p. 235° decomp.

*Dichromate*: m.p. 160–1°.

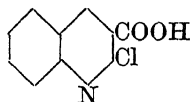
*Methiodide*: m.p. 165°.

Claus, Schöller, *J. prakt. Chem.*, 1893, 48,  
141.

### 4-Chloroquinoline-2-carboxylic Acid.

See 4-Chloroquinaldinic Acid.

### 2-Chloroquinoline-3-carboxylic Acid



$C_{10}H_6O_2NCl$

MW, 207.5

Needles. M.p. about 240° (200°). P + HI  
→ quinoline-3-carboxylic acid.

*Amide*:  $C_{10}H_7ON_2Cl$ . MW, 206.5. Cryst.  
from  $H_2O$ . M.p. 200–1°.

Mills, Watson, *J. Chem. Soc.*, 1910, 97,  
142.

Friedländer, Göhring, *Ber.*, 1884, 17, 460.

### Chloroquinoline-4-carboxylic Acid.

See Chlorocinchoninic Acid.

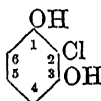
### Chloroquinone.

See Chloro-*p*-benzoquinone.

### Chloroquinolone.

See Chloro-8-hydroxyquinoline.

### 2-Chlororesorcinol



$C_6H_5O_2Cl$

MW, 144.5

Cryst. M.p. 97–8°. Sublimes.

Milligan, Hope, *J. Am. Chem. Soc.*, 1941,  
63, 544.

Dict. of Org. Comp.—I.

### 4-Chlororesorcinol.

Cryst. M.p. 89° (105°). B.p. 259°, 147°/18  
mm. Sol.  $H_2O$ , EtOH, Et<sub>2</sub>O,  $C_6H_6$ ,  $CS_2$ . Sub-  
limes. Reduces  $NH_3 \cdot AgNO_3$ .  $FeCl_3$  → bluish-  
violet col.

*3-Me ether*:  $C_7H_7O_2Cl$ . MW, 158.5. Cryst.  
mass. M.p. 79–80°. B.p. 141–52°/13 mm.

*Di-Me ether*:  $C_8H_9O_2Cl$ . MW, 172.5. B.p.  
135–7°/17 mm.

*Butyl ether*: b.p. 128–30°/1 mm.

*Hexyl ether*: b.p. 152–62°/2 mm.

*Diacetyl*: m.p. 46–7°.

*Dibenzoyl*: m.p. 66°.

Moore, Day, Suter, *J. Am. Chem. Soc.*,  
1934, 56, 2456.

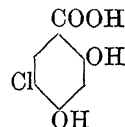
Clark, *J. Am. Chem. Soc.*, 1933, 55, 319.

Auwers, Pohl, *Ann.*, 1914, 405, 278.

Reinhard, *J. prakt. Chem.*, 1878, 17, 322.

Petyunin, *Chem. Abstracts*, 1945, 39, 2285.

### 5-Chloro-β-resorcylic Acid (5-Chloro-2:4-dihydroxybenzoic acid)



$C_7H_5O_4Cl$

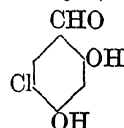
MW, 188.5

Cryst. from  $H_2O$ . M.p. 224–5°.

*4-Acetyl*: needles. M.p. 169° (176–7°).

Sandin, McKee, *J. Am. Chem. Soc.*, 1935,  
57, 1077.

### 5-Chloro-β-resorcylic Aldehyde (5-Chloro-2:4-dihydroxybenzaldehyde)



$C_7H_5O_3Cl$

MW, 172.5

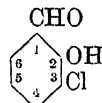
Needles from  $H_2O$ . M.p. 157°. Sublimes.

*Oxime*: needles from  $H_2O$ . M.p. 184°.

Gattermann, *Ann.*, 1907, 357, 338.

Chakravarti, Ghosh, *Chem. Abstracts*,  
1936, 30, 3802.

### 3-Chlorosalicylaldehyde (3-Chloro-*o*-hydroxybenzaldehyde)



$C_7H_5O_2Cl$

MW, 156.5

M.p. 54.5–5.5°.  $FeCl_3$  → violet-red col.

*Oxime*: m.p. 167–8°.  $FeCl_3$  → violet-  
brown col.

*Semicarbazone*: m.p. 240–3°.  $FeCl_3$  →  
olive-green col.

Hanus, *J. prakt. Chem.*, 1941, 158, 254.

**4-Chlorosalicylaldehyde** (4-Chloro-o-hydroxybenzaldehyde).

Needles from EtOH or AcOH. Aq. M.p. 52·5°. Sol. ord. org. solvents. Volatile in steam.

*Oxime*: m.p. 153°.

*Semicarbazone*: m.p. 212°.

*p-Nitrophenylhydrazone*: m.p. 257°.

*Benzoyl*: m.p. 98·5°.

*Me ether*: C<sub>8</sub>H<sub>7</sub>O<sub>2</sub>Cl. MW, 170·5. M.p. 74°.

Hodgson, Jenkinson, *J. Chem. Soc.*, 1927, 1740.

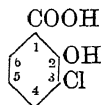
**5-Chlorosalicylaldehyde.**

Plates from EtOH. M.p. 99·5°. Sol. EtOH, Et<sub>2</sub>O, alkalis. Insol. H<sub>2</sub>O. Heat of comb. C<sub>p</sub> 746·4 Cal. Forms bisulphite comp. NaHg → 5-chlorosaligenin. Alk. H<sub>2</sub>O<sub>2</sub> → 4-chlorocatechol.

*Oxime*: needles. M.p. 128°.

*Semicarbazone*: needles. M.p. 286-7°.

Weil, Traun, Marcel, *Ber.*, 1922, 55, 2665.

**3-Chlorosalicylic Acid** (3-Chloro-o-hydroxybenzoic acid)

C<sub>7</sub>H<sub>5</sub>O<sub>3</sub>Cl

MW, 172·5

Needles from H<sub>2</sub>O. M.p. 178° (182°). Sol. EtOH, CHCl<sub>3</sub>, AcOH. Spar. sol. cold H<sub>2</sub>O. Volatile in steam. Sublimes with part. decomp. FeCl<sub>3</sub> on aq. sol. → violet col.

*Me ester*: C<sub>8</sub>H<sub>7</sub>O<sub>3</sub>Cl. MW, 186·5. Needles. M.p. 38°. B.p. 260° part. decomp.

*Et ester*: C<sub>9</sub>H<sub>9</sub>O<sub>3</sub>Cl. MW, 200·5. M.p. 21°. B.p. 269-70°, 147°/12 mm.

*Chloride*: C<sub>7</sub>H<sub>4</sub>O<sub>2</sub>Cl<sub>2</sub>. MW, 191. M.p. 62-3°.

Reissert, Crämer, *Ber.*, 1928, 61, 2565.

Clark, *Chem. News*, 1931, 143, 265.

**4-Chlorosalicylic Acid.**

Needles. M.p. 207°. Sol. EtOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O. Volatile in steam. Sublimes with part. decomp. FeCl<sub>3</sub> → violet col.

Vanholt, Cohn, *Chem. Zentr.*, 1901, II, 925.

**5-Chlorosalicylic Acid.**

Needles from hot H<sub>2</sub>O. M.p. 172° (167·5°). Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, AcOH. Mod. sol. hot H<sub>2</sub>O. FeCl<sub>3</sub> → reddish-violet col.

*Me ester*: C<sub>8</sub>H<sub>7</sub>O<sub>3</sub>Cl. MW, 186·5. Needles. M.p. 50°. B.p. 249° decomp.

*Et ester*: C<sub>9</sub>H<sub>9</sub>O<sub>3</sub>Cl. MW, 200·5. Needles. M.p. 25°.

*Phenyl ester*: "Chlorsalol." C<sub>13</sub>H<sub>9</sub>O<sub>3</sub>Cl. MW, 248·5. Needles. M.p. 81-3°. Sol. EtOH, Et<sub>2</sub>O, AcOH. Insol. H<sub>2</sub>O.

*Amide*: C<sub>7</sub>H<sub>6</sub>O<sub>2</sub>NCl. MW, 171·5. Needles. M.p. 226-7°. Sol. EtOH.

*Nitrile*: C<sub>7</sub>H<sub>4</sub>ONCl. MW, 153·5. M.p. 165-7°.

*Acetyl*: 5-chloro-o-acetoxybenzoic acid. M.p. 149°. *Chloride*: m.p. 45°. *Nitrile*: m.p. 79-80°.

*Me ether*: 5-chloro-o-methoxybenzoic acid. C<sub>8</sub>H<sub>7</sub>O<sub>3</sub>Cl. MW, 186·5. M.p. 81-2°. *k* = 1·97 × 10<sup>-3</sup> at 25°.

*Et ether*: 5-chloro-o-ethoxybenzoic acid. C<sub>9</sub>H<sub>9</sub>O<sub>3</sub>Cl. MW, 200·5. M.p. 118°. *k* = 1·33 × 10<sup>-4</sup> at 25°. *Et ester*: C<sub>11</sub>H<sub>13</sub>O<sub>3</sub>Cl. MW, 228·5. B.p. 226°/55 mm.

*Phenyl ether*: 4-chlorodiphenyl ether 2-carboxylic acid. C<sub>13</sub>H<sub>9</sub>O<sub>3</sub>Cl. MW, 248·5. M.p. 115°.

Weil, Traun, Marcel, *Ber.*, 1922, 55, 2664.

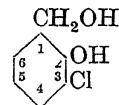
Leulier, Pinet, *Bull. soc. chim.*, 1927, 41, 1363.

**6-Chlorosalicylic Acid.**

Needles. M.p. 166°. Sol. H<sub>2</sub>O, most ord. org. solvents. Turns red in air. FeCl<sub>3</sub> → violet col.

*Me ether*: 6-chloro-o-methoxybenzoic acid. M.p. 141°.

Cohn, *Chem. Zentr.*, 1901, II, 925.

**3-Chlorosaligenin** (3-Chloro-2-hydroxybenzyl alcohol)

C<sub>7</sub>H<sub>7</sub>O<sub>2</sub>Cl

MW, 158·5

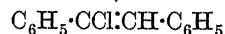
Cryst. M.p. 116°. FeCl<sub>3</sub> → bluish-violet col.

Reissert, Cramer, *Ber.*, 1928, 61, 2565.

**5-Chlorosaligenin.**

Plates from H<sub>2</sub>O. M.p. 93°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Heat of comb. C<sub>p</sub> 801 Cal. Sol. conc. H<sub>2</sub>SO<sub>4</sub> to deep green sol. Ox. → 5-chlorosalicylaldehyde and 5-chlorosalicylic acid. FeCl<sub>3</sub> → blue col.

Mettler, *Ber.*, 1906, 39, 2939.

**α-Chlorostilbene** (1-Chloro-1:2-diphenylethylene, β-chlorostilbene)

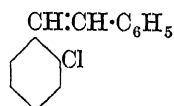
C<sub>14</sub>H<sub>11</sub>Cl

MW, 214·5

Cryst. M.p. 53-4°. B.p. 320-4° slight decomp. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, AcOH, C<sub>6</sub>H<sub>6</sub>, hot EtOH. Insol. H<sub>2</sub>O. NaHg → stilbene.

Pfeiffer, *Ber.*, 1912, 45, 1817.

Sudborough, *J. Chem. Soc.*, 1897, 71, 220.

**o-Chlorostilbene** (o-Chlorodiphenylethylene)

C<sub>14</sub>H<sub>11</sub>Cl

MW, 214·5

Needles from EtOH. M.p. 40°. B.p. 195°/22 mm., 145°/0.03 mm.

Dibromide: rods from pet. ether. M.p. 181-2°.

Klages, Tetzner, *Ber.*, 1902, 35, 3970.

Bergmann, Weizman, Schapiro, *J. Org. Chem.*, 1944, 9, 408.

**m-Chlorostilbene.**

M.p. 73-4°. B.p. 175-80°/0.2 mm.

Dibromide: leaflets from pet. ether. M.p. 166°.

Bergmann, Weizman, Schapiro, *J. Org. Chem.*, 1944, 9, 408.

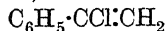
**p-Chlorostilbene.**

Leaflets from pet. ether. M.p. 129°.

Dibromide: prismatic plates. M.p. 189-90°.

Bergmann, Weizman, Schapiro, *J. Org. Chem.*, 1944, 9, 408.

**α-Chlorostyrene** (1-Chloro-1-phenylethylene, α-chlorovinylbenzene)



$C_8H_7Cl$  MW, 138.5

M.p. -23°. B.p. 199°, 87°/22 mm., 64°/9 mm.  $D_4^{18}$  1.1016.  $n_D^{17}$  1.5623. Hot conc. HCl → acetophenone.

Dufraisse, Viel, *Bull. soc. chim.*, 1928, 37, 874.

Auwers, *Ber.*, 1912, 45, 2799.

**β-Chlorostyrene** (2-Chloro-1-phenylethylene, ω-chlorostyrene, styryl chloride, β-chlorovinylbenzene)



$C_8H_7Cl$  MW, 138.5

B.p. 199°, 112°/40 mm., 90°/18 mm., 79.5°/11 mm.  $D_4^{18}$  1.1095.  $n_D^{18}$  1.5774. Ox. → benzoic acid.

Auwers, *Ber.*, 1912, 45, 2796.

Biltz, *Ann.*, 1897, 296, 266.

Forrer, *Ber.*, 1884, 17, 983.

**o-Chlorostyrene** (o-Chlorophenylethylene)



$C_8H_7Cl$  MW, 138.5

B.p. 60-1°/4 mm., 48°/2 mm.  $D_4^{20}$  1.100.  $n_D^{20}$  1.5648.

Ushakov, Matuzov, *Chem. Abstracts*, 1945, 39, 916.

Brooks, *J. Am. Chem. Soc.*, 1944, 66, 1295.

**m-Chlorostyrene** (m-Chlorophenylethylene).

B.p. 62-3°/6 mm., 51°/3 mm.  $D_4^{20}$  1.090.  $n_D^{20}$  1.5619.

Ushakov, Matuzov, *Chem. Abstracts*, 1945, 39, 916.

Brooks, *J. Am. Chem. Soc.*, 1944, 66, 1295.

**p-Chlorostyrene** (p-Chlorophenylethylene).  
B.p. 74°/12 mm., 53-4°/3 mm., 33-5°/0.4 mm.  
Polymerises rapidly.  $D_4^{20}$  1.1554.  $n_D^{20}$  1.5742.

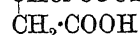
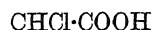
Staudinger, Suter, *Ber.*, 1920, 53, 1099.

Braun, Nelles, *Ber.*, 1933, 66, 1464.

Usakov, Matuzov, *Chem. Abstracts*, 1945, 39, 916.

Brooks, *J. Am. Chem. Soc.*, 1944, 66, 1295.

**Chlorosuccinic Acid**



$C_4H_5O_4Cl$

MW, 152.5

d.

M.p. 176° (rapid heat.) decomp. Sol.  $H_2O$ , EtOH,  $Et_2O$ ,  $Me_2CO$ .  $[\alpha]_D^{20} + 20.1^\circ$  in  $H_2O$ .  $k = 2.94 \times 10^{-3}$  at 25°.

Di-Me ester:  $C_6H_9O_4Cl$ . MW, 180.5. B.p. 111°/11 mm.  $D_4^{20}$  1.2513.  $[\alpha]_D^{20} + 41.96^\circ$ .

Di-Et ester:  $C_8H_{13}O_4Cl$ . MW, 208.5. B.p. 124°/18 mm.  $D_4^{20}$  1.152.  $n_D^{20}$  1.4372.  $[\alpha]_D^{20} + 32.7^\circ$ .

Dichloride:  $C_4H_5O_2Cl_2$ . MW, 189.5. B.p. 92°/11 mm.  $[\alpha]_D + 29.53^\circ$ .

l.

M.p. 176°.  $[\alpha]_D^{20} - 19.67^\circ$  in  $H_2O$ .  $k = 2.94 \times 10^{-3}$  at 25°.

Di-Me ester: b.p. 111°/11 mm.  $D_4^{20}$  1.2501.  $[\alpha]_D - 42.32^\circ$ .

dl.

M.p. 153-4°. Sol.  $H_2O$ , hot AcOH.  $k$  (first) =  $2.84 \times 10^{-3}$  at 25°; (second) =  $3.6 \times 10^{-5}$  at 25°.

Di-Me ester: b.p. 106°/14 mm.  $D_4^{20}$  1.2506.

Di-Et ester: b.p. 122°/15 mm.  $D_4^{20}$  1.1456.

Anil: chlorosuccinil. Needles. M.p. 118-19°.

McKenzie, Barrow, *J. Chem. Soc.*, 1911, 99, 1919.

Oddo, Casalino, *Gazz. chim. ital.*, 1917, 47, ii, 213.

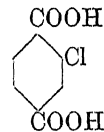
Clough, *J. Chem. Soc.*, 1926, 1674.

Levene, Haller, *J. Biol. Chem.*, 1929, 83, 185.

**Chlorosulphanilic Acid.**

See Chloroaniline-sulphonic Acid.

**Chloroterephthalic Acid** (2-Chlorobenzene-1:4-dicarboxylic acid)



$C_8H_5O_4Cl$

MW, 200.5

Cryst. from hot  $H_2O$ . M.p. above 300°. Sol. EtOH,  $Et_2O$ .

Di-Me ester:  $C_{10}H_9O_4Cl$ . MW, 228.5. M.p. 60°. Sol. EtOH,  $Et_2O$ .

**2-Chloro-1 : 2 : 3 : 4-tetrahydro-1-naphthol**

564

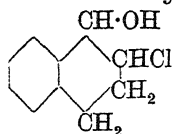
**6-Chlorothymol**

*Diamide*:  $C_8H_7O_2N_2Cl$ . MW, 198.5. M.p. above  $300^\circ$ .

I.G., F.P. 663,791, (*Chem. Abstracts*, 1930, 24, 628).

Ahrens, *Ber.*, 1886, 19, 1637.

**2-Chloro-1 : 2 : 3 : 4-tetrahydro-1-naphthol (2-Chloro-ac.-tetrahydro- $\alpha$ -naphthol)**

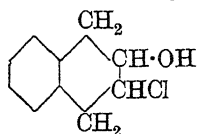


$C_{10}H_{11}OCl$  MW, 182.5

Needles. M.p.  $92^\circ$ .

Straus, Rohrbacher, *Ber.*, 1921, 54, 52.

**3-Chloro-1 : 2 : 3 : 4-tetrahydro-2-naphthol (3-Chloro-ac.-tetrahydro- $\beta$ -naphthol)**



$C_{10}H_{11}OCl$  MW, 182.5

Needles from EtOH. M.p.  $117.5^\circ$ . Sol.  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ , hot EtOH. Prac. insol. cold  $H_2O$ , pet. ether. Sublimes readily. Volatile in steam.

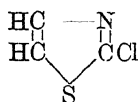
*Acetyl*: m.p.  $47^\circ$ .

*Benzoyl*: needles from EtOH. M.p.  $64.5^\circ$ .

Bamberger, Lodter, *Ann.*, 1895, 288, 81.

Waser, *Ber.*, 1916, 49, 1207.

**2-Chlorothiazole**

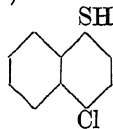


$C_3H_2NClS$  MW, 119.5

B.p.  $144.5^\circ$ . Sol. EtOH,  $Et_2O$ . Spar. sol.  $H_2O$ . Volatile in steam.

Schatzmann, *Ann.*, 1891, 261, 10.

**4-Chloro-1-thionaphthol (4-Chloro- $\alpha$ -naphthyl mercaptan)**

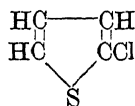


$C_{10}H_7ClS$  MW, 194.5

Greenish-yellow cryst. from EtOH. M.p.  $43.4^\circ$ .

Taboury, *Ann. chim.*, 1908, 15, 20.

**2-Chlorothiophene**



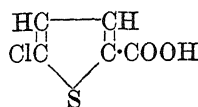
$C_4H_3ClS$  MW, 118.5

B.p.  $130^\circ$ . Volatile in steam.

*HgCl\_2 add. comp.*: leaflets. M.p.  $218.9^\circ$ .

Töhl, Eberhard, *Ber.*, 1893, 26, 2947.

**5-Chloro- $\alpha$ -thiophenic Acid (5-Chlorothiophene-2-carboxylic acid)**



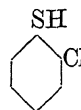
$C_5H_3O_2ClS$  MW, 162.5

Needles from  $H_2O$ . M.p.  $146.7^\circ$ . Sublimes.

Steinkopf, Jacob, Penz, *Ann.*, 1934, 512, 161.

Gattermann, Römer, *Ber.*, 1886, 19, 694.

**o-Chlorothiophenol (2-Chlorophenyl mercaptan)**



$C_6H_5ClS$  MW, 144.5

B.p.  $205.6^\circ$ .  $D^{19}$  1.275.

*Acetyl*: b.p.  $254.8^\circ$ . Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ .

*Benzoyl*: b.p.  $335.40^\circ$ .

Friedländer, Mauthner, *Chem. Zentr.*, 1904, II, 1176.

Daccomo, *J. Chem. Soc.*, 1891, 62, 308.

**m-Chlorothiophenol.**

B.p.  $205.7^\circ$ . Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ ,  $CS_2$ . Insol. cold  $H_2O$ .  $D^{18}$  1.2637.

*Acetyl*: b.p.  $255.60^\circ$ . Sol. EtOH,  $Et_2O$ .  $D^{20}$  1.2537.

Daccomo, *J. Chem. Soc.*, 1891, 62, 308.

**p-Chlorothiophenol.**

Prisms or plates from EtOH. M.p.  $54^\circ$ . B.p.  $205.7^\circ$ . Sol.  $Et_2O$ ,  $C_6H_6$ , hot EtOH. Sublimes. Volatile in steam.

*Acetyl*: m.p.  $39.40^\circ$ . B.p.  $255^\circ$ .  $n_D^{23}$  1.5830. Volatile in steam.

*Benzoyl*: m.p.  $75.5^\circ$ .

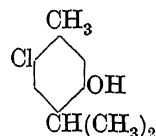
Taboury, *Ann. chim.*, 1908, 15, 18.

Daccomo, *J. Chem. Soc.*, 1891, 62, 308.

Otto, *Ann.*, 1867, 143, 109.

Backer, Dykstra, *Rec. trav. Chim.*, 1933, 52, 701.

**6-Chlorothymol (6-Chloro-3-hydroxy-p-cymene)**



$C_{10}H_{13}OCl$  MW, 184.5

Plates from ligroin. M.p.  $60.4^\circ$  ( $62.4^\circ$ ).

*Me ether*:  $C_{11}H_{15}OCl$ . MW, 198.5. B.p.  $251^\circ$ .

*Benzyl ether*: m.p.  $55^\circ$ .

*p-Methylbenzyl ether*: m.p.  $51^\circ$ .

*p-Chlorobenzyl ether*: m.p.  $59^\circ$ .

*p*-Bromobenzyl ether : m.p. 69°.

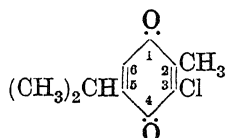
*o*-Nitrobenzyl ether : m.p. 117°.

Raschig, Swiss P. 127,035, (*Chem. Abstracts*, 1929, 23, 1142).

Robertson, Briscoe, *J. Chem. Soc.*, 1902, 101, 1968.

Niederl, Natelson, *J. Am. Chem. Soc.*, 1932, 54, 1069.

**3-Chlorothymoquinone** (3-Chloro-2-methyl-5-isopropyl-1 : 4-benzoquinone)



$C_{10}H_{11}O_2Cl$

MW, 198.5

Yellow prisms from EtOH or pet. ether. M.p. 39—40°. Sol. Et<sub>2</sub>O, AcOH, C<sub>6</sub>H<sub>6</sub>. Volatile in steam.

1-Oxime : 2-chloro-6-nitrosothymol. Yellow prisms or leaflets from EtOH. M.p. 152° decomp. N-Acetyl : yellow prisms from pet. ether. M.p. 76—7°.

Kehrmann, Kruger, *Ann.*, 1900, 310, 99.

**6-Chlorothymoquinone.**

Yellow leaflets from ligroin. M.p. 41—2°. Prac. insol. H<sub>2</sub>O.

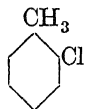
4-Oxime : 3-chloro-5-nitrosocarvaerol. Yellow prisms from EtOH. Decomp. at 158°. N-Acetyl : yellow needles or prisms from pet. ether. M.p. 81—2°.

Mono-semicarbazone : m.p. 232°.

Kehrmann, Kruger, *Ann.*, 1900, 310, 90.

Olivieri-Tortorici, *Gazz. chim. ital.*, 1897, 27, 582.

***o*-Chlorotoluene**



$C_7H_7Cl$

MW, 126.5

M.p. — 34° (— 36°). B.p. 159°. Volatile in steam.  $D_4^{20}$  1.0817.  $n_D^{20}$  1.5238.  $KMnO_4 \rightarrow$  *o*-chlorobenzoic acid. Dry Cl (+PCl<sub>5</sub>)  $\rightarrow$  *o*-chlorobenzylidene chloride.

Marvel, McElvain, *Organic Syntheses*, Collective Vol. I, 163.

Bryd, *Chem. Abstracts*, 1928, 22, 2372.

McMaster, Carol, *Ind. Eng. Chem.*, 1931, 23, 218.

Caille, Lemire, Normandin, *Chem. Abstracts*, 1933, 27, 961.

***m*-Chlorotoluene.**

M.p. — 48°. B.p. 162°.  $D_4^{20}$  1.0722.  $n_D^{19}$  1.5214.  $CrO_3 \rightarrow$  *m*-chlorobenzoic acid.

Autenrieth, Geyer, *Ber.*, 1908, 41, 156.

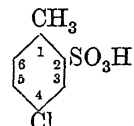
***p*-Chlorotoluene.**

M.p. 7.5°. B.p. 162°, 44°/10 mm.  $D_4^{20}$  1.0697.  $n_D^{19}$  1.5199.  $CrO_3$  or  $KMnO_4 \rightarrow$  *p*-chlorobenzoic acid.

Marvel, McElvain, *Organic Syntheses*, Collective Vol. I, 163.

Autenrieth, Geyer, *Ber.*, 1908, 41, 156.

**4-Chlorotoluene-2-sulphonic Acid**



$C_7H_7O_3ClS$

MW, 206.5

Chloride :  $C_7H_6O_2Cl_2S$ . MW, 225. Plates. M.p. 24°. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

Amide :  $C_7H_8O_2NCIS$ . MW, 205.5. Needles from EtOH. Aq. M.p. 145°.

Wynne, Bruce, *J. Chem. Soc.*, 1898, 73, 731.

**5-Chlorotoluene-2-sulphonic Acid.**

Chloride : m.p. 54°.

Amide : m.p. 185°.

I.G., B.P. 281,290, (*Chem. Zentr.*, 1929, II, 352).

Silvester, Wynne, *J. Chem. Soc.*, 1936, 691.

**6-Chlorotoluene-2-sulphonic Acid.**

Laminæ. M.p. 60—70° (about 72° anhyd.). Sol. H<sub>2</sub>O. Deliquescent.

Chloride : prisms from pet. ether. M.p. 72°. Sol. C<sub>6</sub>H<sub>6</sub>. Spar. sol. pet. ether.

Amide : scales from hot H<sub>2</sub>O. M.p. 180°.

Davies, *J. Chem. Soc.*, 1921, 119, 878.

**4-Chlorotoluene-3-sulphonic Acid**

Needles.

Aniline salt : m.p. 229—30.5°.

Chloride :  $C_7H_6O_2Cl_2S$ . MW, 225. Plates. M.p. 56°. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

Amide :  $C_7H_8O_2NCIS$ . MW, 205.5. Plates from EtOH. M.p. 156°.

Wynne, Bruce, *J. Chem. Soc.*, 1898, 73, 731, 772.

**6-Chlorotoluene-3-sulphonic Acid.**

Prisms +  $\frac{1}{2}$ H<sub>2</sub>O.

Chloride : m.p. 65°. Sol. C<sub>6</sub>H<sub>6</sub>, pet. ether.

Bromide :  $C_7H_6O_2ClBrS$ . MW, 269.5. M.p. 67.5°. Sol. C<sub>6</sub>H<sub>6</sub>.

Amide : m.p. 128°. Sol. EtOH.

Wynne, *J. Chem. Soc.*, 1892, 61, 1040, 1072.

**2-Chlorotoluene-4-sulphonic Acid.**

Chloride : prisms. M.p. 38°. B.p. 178°/36 mm., 166°/24 mm.

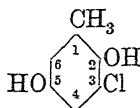
Amide : cryst. from hot H<sub>2</sub>O. M.p. 137°.

Davies, *J. Chem. Soc.*, 1921, 119, 860.

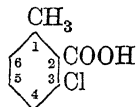
**3-Chlorotoluene-4-sulphonic Acid.**

Chloride : m.p. 46°.

Amide : m.p. 186°.

Silvester, Wynne, *J. Chem. Soc.*, 1936, 691.**3-Chlorotoluhydroquinone (3-Chloro-2 : 5-dihydroxytoluene)** $C_7H_7O_2Cl$ 

MW, 158.5

Needles from  $Et_2O$ . M.p. 115°. Volatile in steam.Claus, Schweitzer, *Ber.*, 1886, 19, 929.**4-Chlorotoluhydroquinone.**Needles or leaflets. M.p. 175–6°. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ , hot  $H_2O$ .Vorländer, Schrödter, *Ber.*, 1901, 34, 1653.**6-Chlorotoluhydroquinone.**Leaflets. M.p. 173°. Sol. EtOH. Spar. sol.  $CHCl_3$ ,  $C_6H_6$ , ligroin.Raiford, *Am. Chem. J.*, 1911, 46, 450.**3-Chloro-*o*-toluic Acid (6-Chloro-2-methylbenzoic acid)** $C_8H_7O_2Cl$ 

MW, 170.5

Needles from  $H_2O$ . M.p. 102°.Amide :  $C_8H_8ONCl$ . MW, 169.5. Scales. M.p. 167°.Nitrile :  $C_8H_6NCl$ . MW, 151.5. Prisms from pet. ether. M.p. 82–3°.Kenner, Witham, *J. Chem. Soc.*, 1921, 119, 1458.**4-Chloro-*o*-toluic Acid.**

M.p. 169°.

Nitrile : needles from pet. ether. M.p. 45–6°.

Auwers, Harres, *Z. physik. Chem.*, 1929, 143A, 16.**5-Chloro-*o*-toluic Acid.**Needles. M.p. 172°. Sol. hot  $H_2O$ . Volatile in steam.  $KMnO_4 \rightarrow$  4-chlorophthalic acid.*Et ester* :  $C_{10}H_{11}O_2Cl$ . MW, 198.5. B.p. 258°. Sol. EtOH,  $Et_2O$ .  $D_4^{20}$  1.163.

Amide : m.p. 183°.

Nitrile : m.p. 67°. Volatile in steam.

Auwers, Harres, *Z. physik. Chem.*, 1929, 143A, 16.**6-Chloro-*o*-toluic Acid.**Needles. M.p. 159° (154°). Sol. EtOH.  $KMnO_4 \rightarrow$  3-chlorophthalic acid.

Nitrile : m.p. 19°. B.p. 107°/28 mm.

Noelting, *Ber.*, 1904, 37, 1025. **$\omega$ -Chloro-*o*-toluic Acid (o-Chloromethylbenzoic acid, o-carboxybenzyl chloride).**

Chloride : b.p. 265°, 135°/12 mm.

Amide : needles. Sinters at 100°, m.p. about 190° decomp.

Nitrile : see *o*-Cyanobenzyl chloride.Gabriel, *Ber.*, 1887, 20, 2234.Cf. Olivier, *Rec. trav. chim.*, 1923, 42, 518.**4-Chloro-*m*-toluic Acid (6-Chloro-3-methylbenzoic acid).**

Needles. M.p. 167°.

Claus, *J. prakt. Chem.*, 1892, 46, 27.**5-Chloro-*m*-toluic Acid.**

Needles from EtOH.Aq. M.p. 178°.

Klages, Knoevenagel, *Ber.*, 1895, 28, 2045.**6-Chloro-*m*-toluic Acid.**Needles from hot  $H_2O$ . M.p. 209–10°. Spar. sol. hot  $H_2O$ .*Et ester* :  $C_{10}H_{11}O_2Cl$ . MW, 198.5. B.p. 260–5°.Mailhe, *Bull. soc. chim.*, 1921, 29, 290. **$\omega$ -Chloro-*m*-toluic Acid (m-Chloromethylbenzoic acid, m-carboxybenzyl chloride).**Cryst. from hot  $H_2O$ . M.p. 138°. Sol. EtOH,  $Et_2O$ .*Et ester* : b.p. 168–9°/25 mm.

Chloride : b.p. 149–50°/20 mm.

Amide : m.p. 124°. Sol. EtOH,  $Et_2O$ , hot  $H_2O$ .Nitrile : see *m*-Cyanobenzyl chloride.Olivier, *Rec. trav. chim.*, 1923, 42, 518.**2-Chloro-*p*-toluic Acid (3-Chloro-4-methylbenzoic acid).**Leaflets. M.p. 200–2°. Sol. EtOH. Spar. sol.  $H_2O$ .Nitrile :  $C_8H_8NCl$ . MW, 151.5. M.p. 48–9°.Hintikka, *Chem. Abstracts*, 1925, 19, 42.Varma, Raman, *Chem. Abstracts*, 1936, 30, 438.**3-Chloro-*p*-toluic Acid.**Needles. M.p. 155–6°. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ , hot  $C_6H_6$ .Amide :  $C_8H_8ONCl$ . MW, 169.5. M.p. 182°.

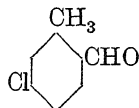
Nitrile : m.p. 61–2°. Sublimes. Volatile in steam

Crosa, *Gazz. chim. ital.*, 1886, 16, 290. **$\omega$ -Chloro-*p*-toluic Acid (p-Chloromethylbenzoic acid, p-carboxybenzyl chloride).**Needles. M.p. 203°. Sol.  $Et_2O$ , hot EtOH, hot  $H_2O$ .

Chloride : b.p. 150–5°/22 mm.

Amide : m.p. 173°. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ , hot  $H_2O$ .Nitrile : see *p*-Cyanobenzyl chloride.Olivier, *Rec. trav. chim.*, 1923, 42, 516.

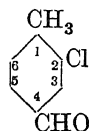


5-Chloro-*o*-toluic Aldehyde $C_8H_7OCl$ 

MW, 154.5

B.p. 228°.  $D_{17}^{20}$  1.277.

Semicarbazone: needles. M.p. 224°.

Auwers, Keil, *Ber.*, 1905, 38, 1695.2-Chloro-*p*-toluic Aldehyde $C_8H_7OCl$ 

MW, 154.5

Cryst. M.p. 232°.

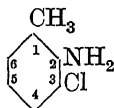
I.G., B.P. 250,955, (*Chem. Zentr.*, 1927, II, 1086).3-Chloro-*p*-toluic Aldehyde.

M.p. 30°.

Oxime: m.p. 95°.

Semicarbazone: m.p. 270° decomp.

Phenylhydrazone: m.p. 118°.

*p*-Nitrophenylhydrazone: m.p. 230° corr.Wahl, *Ann. chim.*, 1936, 5, 39.3-Chloro-*o*-toluidine (3-Chloro-2-aminotoluene) $C_7H_8NCl$ 

MW, 141.5

B.p. 215°.

N-Acetyl: 3-chloro-*o*-acet-toluidide. $C_9H_{10}ONCl$ . MW, 183.5. Needles. M.p. 120°.Badische, D.R.P. 218,370, (*Chem. Zentr.*, 1910, I, 704).4-Chloro-*o*-toluidine.

M.p. 21-2°. B.p. 237°/722 mm.

*B, HCl*: m.p. 265-7°.N-Acetyl: 4-chloro-*o*-acet-toluidide. Leaflets. M.p. 139-40° (131°). Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O.Goldschmidt, Höinig, *Ber.*, 1886, 19, 2440.5-Chloro-*o*-toluidine.

Leaflets from EtOH. M.p. 29-30°. B.p. 236-8°/730 mm.

N-Acetyl: 5-chloro-*o*-acet-toluidide. Pearly leaflets. M.p. 140°.Beilstein, Kuhlberg, *Ann.*, 1870, 156, 81.Cie. Nationale des Matières Colorantes, F.P. 649,851, (*Chem. Abstracts*, 1929, 23, 2985).6-Chloro-*o*-toluidine.

B.p. 245°. Volatile in steam.

*B, HCl*: m.p. 250-2° decomp.*B, H<sub>2</sub>SO<sub>4</sub>*: m.p. 252-6° decomp.N-Acetyl: 6-chloro-*o*-acet-toluidide. M.p. 157-9° (136°).

N-Benzoyl: m.p. 173°.

Reverdin, Crépieux, *Ber.*, 1900, 33, 2499.Noelting, *Ber.*, 1904, 37, 1019.2-Chloro-*m*-toluidine (2-Chloro-3-aminotoluene).

B.p. 228-9°.

N-Acetyl: 2-chloro-*m*-acet-toluidide. M.p. 133-4°.

N-Benzoyl: needles. M.p. 125°.

Cohen, Dakin, *J. Chem. Soc.*, 1901, 79, 1128.4-Chloro-*m*-toluidine.

M.p. 29-30°. B.p. 230°.

N-Acetyl: 4-chloro-*m*-acet-toluidide. Silky needles. M.p. 93-4°.Goldschmidt, Höinig, *Ber.*, 1886, 19, 2442.5-Chloro-*m*-toluidine.

B.p. 242°/730 mm.

*B, HNO<sub>3</sub>*: m.p. 198° decomp.N-Acetyl: 5-chloro-*m*-acet-toluidide. Needles. M.p. 151°.Höinig, *Ber.*, 1887, 20, 2419.6-Chloro-*m*-toluidine.

Needles from pet. ether. M.p. 83-4°. B.p. 241°. Sol. most ord. org. solvents.

*B, HNO<sub>3</sub>*: m.p. 165° decomp.N-Acetyl: 6-chloro-*m*-acet-toluidide. Leaflets. M.p. 91-7°.

N-Benzoyl: needles. M.p. 119.5°.

Reverdin, Crépieux, *Ber.*, 1900, 33, 2503.2-Chloro-*p*-toluidine (2-Chloro-4-aminotoluene).

M.p. 26°. B.p. 237-238.5°.

N-Acetyl: 2-chloro-*p*-acet-toluidide. M.p. 105°.

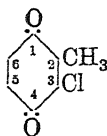
N-Benzoyl: needles. M.p. 122°.

Witt, *Ber.*, 1892, 25, 86.3-Chloro-*p*-toluidine.M.p. 7°. B.p. 219°/732 mm.  $D_{20}^{20}$  1.151.*B, HNO<sub>3</sub>*: m.p. 189° decomp.N-Acetyl: 3-chloro-*p*-acet-toluidide. Plates. M.p. 118°.

N-Benzoyl: m.p. 137-9°.

Chattaway, Orton, *J. Chem. Soc.*, 1901, 79, 465.Cie. Nationale des Matières Colorantes, F.P. 649,851, (*Chem. Abstracts*, 1929, 23, 2985).

**3-Chlorotoluquinone** (*3-Chloro-2-methyl-p-benzoquinone*)



$C_7H_5O_2Cl$

MW, 156.5

Cryst. from ligroin. M.p.  $55^\circ$ . Sol. EtOH,  $CHCl_3$ . Spar. sol.  $H_2O$ .

Raiford, *Am. Chem. J.*, 1911, **46**, 449.

**5-Chlorotoluquinone.**

Yellow needles from  $H_2O$ . M.p.  $105^\circ$ . Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ . Mod. sol. hot  $H_2O$ . Volatile in steam.

4-*Oxime*: yellow needles. M.p.  $190^\circ$ .

Vorländer, Schrödter, *Ber.*, 1901, **34**, 1653.

Hodgson, Moore, *J. Chem. Soc.*, 1926, 2036, 2039.

**6-Chlorotoluquinone.**

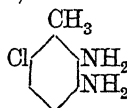
Yellow needles. M.p.  $90^\circ$ . Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ . Mod. sol. hot  $H_2O$ . Volatile in steam.

4-*Oxime*: m.p.  $158-9^\circ$  decomp.

Claus, Schweitzer, *Ber.*, 1886, **19**, 929.

Kehrmann, *Ber.*, 1915, **48**, 2022; 1916, 49, 1211.

**6-Chloro-2 : 3-tolylenediamine** (*6-Chloro-2 : 3-diaminotoluene*)



$C_7H_9N_2Cl$

MW, 156.5

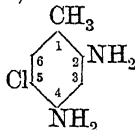
Needles from  $C_6H_6$ -ligroin. M.p.  $46-7^\circ$ .

*B,HCl*: leaflets. Decomp. at  $263^\circ$ .

2 : 3-*N-Diacetyl*: m.p.  $201-3^\circ$ .

Morgan, Drew, *J. Chem. Soc.*, 1920, **117**, 788.

**5-Chloro-2 : 4-tolylenediamine** (*5-Chloro-2 : 4-diaminotoluene*)



$C_7H_9N_2Cl$

MW, 156.5

Leaflets from  $C_6H_6$ . M.p.  $123^\circ$ . Sol.  $H_2O$ .

2 : 4-*N-Diformyl*: m.p.  $166^\circ$ .

2 : 4-*N-Diacetyl*: m.p. above  $260^\circ$ .

2 : 4-*N-Dibenzoyl*: leaflets. M.p.  $205^\circ$ .

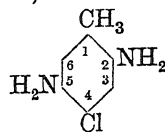
Reverdin, Crépieux, *Ber.*, 1900, **33**, 2507.

**6-Chloro-2 : 4-tolylenediamine.**

Needles from EtOH.Aq. or  $C_6H_6$ . M.p.  $69.5^\circ$ .

Morgan, Drew, *J. Chem. Soc.*, 1920, **117**, 786.

**4-Chloro-2 : 5-tolylenediamine** (*4-Chloro-2 : 5-diaminotoluene*)



$C_7H_9N_2Cl$

MW, 156.5

Cryst. M.p.  $146^\circ$ . Turns violet in air.

2 : 5-*N-Diacetyl*: m.p. above  $300^\circ$ .

Vorländer, Schrödter, *Ber.*, 1901, **34**, 1652.

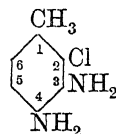
Kenner, Tod, Witham, *J. Chem. Soc.*, 1925, **127**, 2347.

**6-Chloro-2 : 5-tolylenediamine.**

Needles from pet. ether. M.p.  $89-90^\circ$ . Sol. EtOH.

Morgan, Glover, *J. Chem. Soc.*, 1924, **125**, 1600.

**2-Chloro-3 : 4-tolylenediamine** (*2-Chloro-3 : 4-diaminotoluene*)



$C_7H_9N_2Cl$

MW, 156.5

Pale brownish needles from pet. ether. M.p.  $55-6^\circ$ . Sol. most ord. org. solvents.

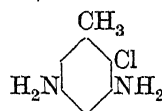
Morgan, Glover, *J. Chem. Soc.*, 1921, **119**, 1706.

**6-Chloro-3 : 4-tolylenediamine.**

Brownish-yellow leaflets. M.p.  $143^\circ$ .

Morgan, Drew, *J. Chem. Soc.*, 1920, **117**, 790.

**2-Chloro-3 : 5-tolylenediamine** (*2-Chloro-3 : 5-diaminotoluene*)



$C_7H_9N_2Cl$

MW, 156.5

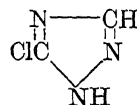
Needles from  $H_2O$ . M.p.  $74^\circ$ .

Morgan, *J. Chem. Soc.*, 1902, **81**, 97.

**Chlorotolyethylene.**

See Chloromethylstyrene.

**5-Chloro-1 : 2 : 4-triazole**



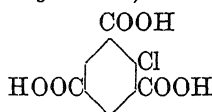
$C_2H_2N_3Cl$

MW, 103.5

Needles from  $C_6H_6$ . M.p.  $167.5^\circ$ . Sol. EtOH,  $Me_2CO$ , hot  $H_2O$ . Prac. insol.  $CHCl_3$ . Volatile in steam. Sublimes.

Thiele, Manchot, *Ann.*, 1898, **303**, 50, 55.

**Chlorotrimetic Acid** (2-Chlorobenzene-1 : 3 : 5-tricarboxylic acid)



$C_9H_5O_6Cl$  MW, 244.5

Cryst. +  $1H_2O$  from  $H_2O$ . M.p.  $278^\circ$ . Sol. EtOH,  $Et_2O$ , hot  $H_2O$ . Insol.  $CHCl_3$ . Sublimes.  $FeCl_3 \rightarrow$  brown col.  $NaHg \rightarrow$  trimesic acid.

Ost, *J. prakt. Chem.*, 1877, 15, 308.

**Chlorotrimethylcarbinol** (Chloro-tert.-butyl alcohol)



$C_4H_9OCl$  MW, 108.5

Viscous liq. M.p.  $-20^\circ$ . B.p.  $128^\circ$ . Mod. sol.  $H_2O$ .  $D_0^{20}$  1.088.  $KCN \rightarrow$  2-hydroxyisovaleronitrile.

Michael, Leighton, *Ber.*, 1906, 39, 2789.

**2-Chlorotrimethylene Glycol** (Glycerol  $\beta$ -monochlorohydrin)



$C_3H_7O_2Cl$  MW, 110.5

B.p.  $146^\circ/18$  mm.  $D_0^{20}$  1.328.  $NaHg \rightarrow$  trimethylene glycol.

*Me ether*:  $C_4H_9O_2Cl$ . MW, 124.5. B.p.  $173^\circ/737$  mm. Sol.  $H_2O$ .

*Et ether*:  $C_5H_{11}O_2Cl$ . MW, 138.5. B.p.  $184-5^\circ$ . Sol.  $H_2O$ .  $D_0^{20}$  1.117.

*Di-Et ether*:  $C_7H_{15}O_2Cl$ . MW, 166.5. B.p.  $184^\circ$ .  $D_0^{20}$  1.1005.

*Monoacetyl*: b.p.  $230^\circ$ .

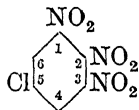
Henry, *Chem. Zentr.*, 1897, I, 741.

Novelli, *Chem. Abstracts*, 1930, 24, 5021.

**Chlorotrimethylene oxide.**

See  $\beta$ -Epichlorohydrin.

**5-Chloro-1 : 2 : 3-trinitrobenzene**



$C_6H_2O_6N_3Cl$  MW 247.5

Yellow cryst. M.p.  $168^\circ$ .

*Naphthalene add. comp.*:  $C_6H_2O_6N_3Cl, C_{10}H_8$ . M.p.  $110^\circ$ .

van de Vliet, *Rec. trav. chim.*, 1924, 43, 606 (*Bibl.*).

Holleman, *Chem. Abstracts*, 1922, 16, 4193.

**6-Chloro-1 : 2 : 3-trinitrobenzene.**

Needles from EtOH. M.p.  $69^\circ$ .

*Naphthalene add. comp.*: m.p.  $112-13^\circ$ .

van de Vliet, *Rec. trav. chim.*, 1924, 43, 606 (*Bibl.*).

Holleman, *Chem. Abstracts*, 1922, 16, 4193.

**5-Chloro-1 : 2 : 4-trinitrobenzene.**

Yellow leaflets from EtOH. M.p.  $116^\circ$ . Sol.

$C_6H_6$ , AcOH, hot EtOH. Insol.  $H_2O$ .

*Naphthalene add. comp.*: m.p.  $108^\circ$ .

van de Vliet, *Rec. trav. chim.*, 1924, 43, 606 (*Bibl.*).

Holleman, *Chem. Abstracts*, 1922, 16, 4193.

**6-Chloro-1 : 2 : 4-trinitrobenzene.**

Cryst. from EtOH. M.p.  $106^\circ$ .

*Naphthalene add. comp.*: m.p.  $95-6^\circ$ .

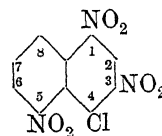
van de Vliet, *Rec. trav. chim.*, 1924, 43, 606 (*Bibl.*).

Holleman, *Chem. Abstracts*, 1922, 16, 4193.

**2-Chloro-1 : 3 : 5-trinitrobenzene.**

See Picryl chloride.

**4-Chloro-1 : 3 : 5-trinitronaphthalene**



$C_{10}H_4O_6N_3Cl$  MW, 297.5

Cryst. from AcOH. M.p.  $118-26^\circ$ . KOH.Aq.  $\rightarrow$  2 : 4 : 8-trinitro-1-naphthol.

Rindl, *J. Chem. Soc.*, 1913, 103, 1913.

**4-Chloro-1 : 3 : 8-trinitronaphthalene.**

Yellowish needles from AcOH. M.p.  $143-4^\circ$ . Sol.  $C_6H_6$ . Spar. sol. EtOH. Insol. pet. ether.

Cu in  $PhNO_2 \rightarrow$  1 : 3 : 8-trinitronaphthalene. KOH.Aq.  $\rightarrow$  2 : 4 : 5-trinitro-1-naphthol.

Rindl, *J. Chem. Soc.*, 1913, 103, 1913.

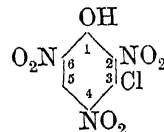
**2-Chloro-1 : 6 : 8-trinitronaphthalene.**

Cryst. from AcOH. M.p.  $194^\circ$ . Sol.  $Me_2CO$ ,  $C_6H_6$ ,  $CHCl_3$ . Spar. sol.  $Et_2O$ , pet. ether.

van der Kam, *Rec. trav. chim.*, 1926, 45, 564.

Scheid, *Ber.*, 1901, 34, 1818.

**3-Chloro-2 : 4 : 6-trinitrophenol** (Chloro-picric acid)



$C_6H_2O_7N_3Cl$  MW, 263.5

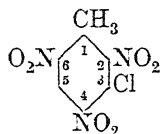
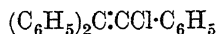
Yellow cryst. from AcOH. M.p.  $119^\circ$  ( $114^\circ$ ).  $NaOH \rightarrow$  trinitroresorcinol.

*Me ether*: 3-chloro-2 : 4 : 6-trinitroanisole.  $C_7H_4O_7N_3Cl$ . MW, 277.5. Cryst. from EtOH. M.p.  $88^\circ$ .

*Et ether*: 3-chloro-2 : 4 : 6-trinitrophenetole.  $C_8H_6O_7N_3Cl$ . MW, 291.5. Cryst. M.p.  $51^\circ$ .

Hodgson, Moore, *J. Chem. Soc.*, 1925, 127, 1603.

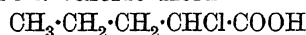
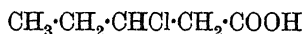
Tijmstra, *Rec. trav. chim.*, 1902, 21, 293.

**3-Chloro-2 : 5 : 6-trinitrophenol.**M.p. 113°. Mod. sol. H<sub>2</sub>O.Hodgson, Moore, *J. Chem. Soc.*, 1925, 127, 1603.**3-Chloro-2 : 4 : 6-trinitrotoluene**C<sub>7</sub>H<sub>4</sub>O<sub>6</sub>N<sub>3</sub>Cl MW, 261.5Needles from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 149°. Sol. Me<sub>2</sub>CO, AcOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. EtOH, Et<sub>2</sub>O, ligroin.Ullmann, Nádai, *Ber.*, 1908, 41, 1878.**Chlorotriphenylethylene (Triphenylchloroethylene)**C<sub>20</sub>H<sub>15</sub>Cl MW, 290.5Needles from EtOH or pet. ether. M.p. 117°. Sol. CHCl<sub>3</sub>. Spar. sol. Et<sub>2</sub>O. Oestrogenic.Robson, Schönberg, Fahim, *Nature*, 1938, 142, 292.Bergmann, Bondi, *Ber.*, 1931, 64, 1467.Danilow, *J. Russ. Phys.-Chem. Soc.*, 1920, 51, 125, (*Chem. Zentr.*, 1923, III, 761).**α-Chlorotriphenylmethane.**

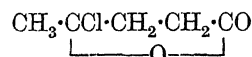
See Triphenylmethyl chloride.

**Chlorotritolylmethane.**

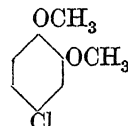
See Tritolylmethyl chloride.

**1-Chloro-n-valeric Acid**C<sub>5</sub>H<sub>9</sub>O<sub>2</sub>Cl MW, 136.5B.p. 222°, 133-5°/30 mm. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.*Me ester*: C<sub>6</sub>H<sub>11</sub>O<sub>2</sub>Cl. MW, 150.5. B.p. 160°.*Et ester*: C<sub>7</sub>H<sub>13</sub>O<sub>2</sub>Cl. MW, 164.5. B.p. 185-6°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.*Chloride*: C<sub>5</sub>H<sub>8</sub>OCl<sub>2</sub>. MW, 155. B.p. 155-7°.*Nitrile*: C<sub>5</sub>H<sub>8</sub>NCl. MW, 117.5. B.p. 160°. Insol. H<sub>2</sub>O.Henry, *Chem. Zentr.*, 1899, I, 194.**2-Chloro-n-valeric Acid**C<sub>5</sub>H<sub>9</sub>O<sub>2</sub>Cl MW, 136.5*d.**Et ester*: b.p. 66-7°/10 mm. [α]<sub>D</sub><sup>20</sup> + 6.65°.*l.**Nitrile*: b.p. 68-70°/10 mm. [α]<sub>D</sub><sup>20</sup> - 10.5° in ether.Levene, Mori, *J. Biol. Chem.*, 1928, 78, 7.**3-Chloro-n-valeric Acid**C<sub>5</sub>H<sub>9</sub>O<sub>2</sub>Cl MW, 136.5*l.*B.p. 108-11°/10 mm. [α]<sub>D</sub><sup>20</sup> - 5.17° in 25% EtOH.*Et ester*: b.p. 71-3°/9 mm. [α]<sub>D</sub><sup>20</sup> - 19.7° in Et<sub>2</sub>O.*dl.*

B.p. 115-6°/10 mm.

*Amide*: C<sub>5</sub>H<sub>10</sub>ONCl. MW, 135.5. Plates. M.p. 79-80°.Levene, Mori, *J. Biol. Chem.*, 1928, 78, 16.Wohlgemuth, *Ann. chim.*, 1914, 2, 299.**4-Chloro-n-valeric Acid**C<sub>5</sub>H<sub>9</sub>O<sub>2</sub>Cl MW, 136.5Cryst. M.p. 18°. B.p. 141-9°/12 mm. part. decomp., 128-131°/11 mm. *k* = 2.044 × 10<sup>-5</sup> at 25°.*Me ester*: b.p. 89-92°/18 mm., 77°/10 mm. *n*<sub>D</sub><sup>25</sup> 1.4360.*Et ester*: b.p. 206°, 120-5°/40 mm., 83°/8 mm.Conant, Kirner, *J. Am. Chem. Soc.*, 1924, 46, 244.Cloves, *Ann.*, 1901, 319, 364.Joyo, *Chem. Abstracts*, 1946, 40, 3768.**3-Chloro-3-valerolactone**C<sub>5</sub>H<sub>7</sub>O<sub>2</sub>Cl MW, 134.5

B.p. 80-2°/10 mm. part. decomp. HCl → levulinic acid.

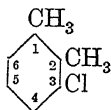
Wolff, *Ann.*, 1885, 229, 271.**4-Chloroveratrol (4-Chlorocatechol dimethyl ether)**C<sub>8</sub>H<sub>9</sub>O<sub>2</sub>Cl MW, 172.5

B.p. 242.4°/763 mm.

Peratoner, Ortoleva, *Gazz. chim. ital.*, 1898, 28 (I), 229.**2-Chlorovinylldichloroarsine (Lewisite)**C<sub>2</sub>H<sub>2</sub>Cl<sub>3</sub>As MW, 207.5F.p. - 13°. M.p. 0.1°. B.p. 190° decomp., 93°/26 mm., 76-7°/12.5 mm. Sol. most ord. org. solvents. Insol. H<sub>2</sub>O, dil. min. acids. D<sub>20</sub> 1.888. H<sub>2</sub>O → oxide, ClCH:CH·AsO, m.p. 143°. Dil. NaOH → acetylene. Ox. → chlorovinylarsinic acid, m.p. 130°. Br in CCl<sub>4</sub> → bromo deriv., m.p. 122°. Powerful vesicant.Gibson, Johnson, *J. Chem. Soc.*, 1931, 754.Lewis, Perkins, *Ind. Eng. Chem.*, 1923, 15, 290.Lewis, Steigler, *J. Am. Chem. Soc.*, 1925, 47, 2546.Wieland, *Ann.*, 1923, 431, 38.

$\omega$ -Chloroxylylene.

See Xylyl chloride.

**3-Chloro-*o*-xylene** (3-Chloro-1 : 2-dimethylbenzene) $C_8H_9Cl$ 

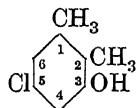
MW, 140.5

B.p. 189°. Dil.  $HNO_3 \longrightarrow$  6-chloro-*o*-toluic acid.Krüger, *Ber.*, 1885, 18, 1755.Claus, Bayer, *Ann.*, 1893, 274, 305.**4-Chloro-*o*-xylene.**B.p. 191-2°.  $D_4^{20}$  1.0692.Krüger, *Ber.*, 1885, 18, 1755.Claus, Bayer, *Ann.*, 1893, 274, 305.**2-Chloro-*m*-xylene** (2-Chloro-1 : 3-dimethylbenzene).

B.p. 185-7°.

I.G., D.R.P. 491,220, (*Chem. Abstracts*, 1930, 24, 2307).**4-Chloro-*m*-xylene.**B.p. 187-8°.  $CrO_3 \longrightarrow$  6-chloro-*m*-toluic acid.Klages, *Ber.*, 1896, 29, 310.**5-Chloro-*m*-xylene.**

B.p. 191°.

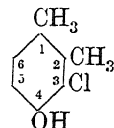
Klages, *Ber.*, 1896, 29, 310.**2-Chloro-*p*-xylene** (2-Chloro-1 : 4-dimethylbenzene).M.p. 2°. B.p. 184-5°.  $D_4^{20}$  1.0589.Willgerodt, Wolfien, *J. prakt. Chem.*, 1889, 39, 402.Wahl, *Ann. chim.*, 1936, 5, 13.**5-Chloro-*o*-3-xyleneol** (5-Chloro-3-hydroxy-1 : 2-dimethylbenzene, 5-chloro-3-hydroxy-*o*-xylene) $C_8H_9OCl$ 

MW, 156.5

Needles. M.p. 81-2°. Sol. most ord. org. solvents.

*Benzoyl* : prisms from EtOH. M.p. 88°.Hinkel, Collins, Ayling, *J. Chem. Soc.*, 1923, 123, 2970.**6-Chloro-*o*-3-xyleneol.**

Silky needles. M.p. 84.5°. Sol. most ord. org. solvents.

*Benzoyl* : plates or needles. M.p. 102°.Hinkel, Collins, Ayling, *J. Chem. Soc.*, 1923, 123, 2970.**3-Chloro-*o*-4-xyleneol** (3-Chloro-4-hydroxy-1 : 2-dimethylbenzene, 3-chloro-4-hydroxy-*o*-xylene) $C_8H_9OCl$ 

MW, 156.5

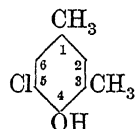
Cryst. from pet. ether. M.p. 27°.

*Benzoyl* : prisms from EtOH.Aq. M.p. 87°.Hinkel, Ayling, Bevan, *J. Chem. Soc.*, 1928, 2531.**5-Chloro-*o*-4-xyleneol.**

Needles. M.p. 72°. Sol. most ord. org. solvents.

*Benzoyl* : cryst. from EtOH. M.p. 43°.Hinkel, Collins, Ayling, *J. Chem. Soc.*, 1923, 123, 2973.**6-Chloro-*o*-4-xyleneol.**

Needles. M.p. 98°. Volatile in steam.

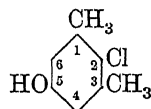
*Benzoyl* : needles from EtOH. M.p. 42°.Hinkel, *J. Chem. Soc.*, 1924, 125, 1853.**5-Chloro-*m*-4-xyleneol** (5-Chloro-4-hydroxy-1 : 3-dimethylbenzene, 5-chloro-4-hydroxy-*m*-xylene) $C_8H_9OCl$ 

MW, 156.5

B.p. 221-3°, 100-1°/17 mm., 86-7°/9 mm.

*Phenylurethane* : m.p. 129-30°.*p*-Nitrobenzoyl : needles. M.p. 94-5°.Bamberger, Reber, *Ber.*, 1913, 46, 793.**6-Chloro-*m*-4-xyleneol.**

Silky needles. M.p. 90-1°.

*Benzoyl* : prisms. M.p. 85°.Bamberger, Reber, *Ber.*, 1913, 46, 795.**2-Chloro-*m*-5-xyleneol** (2-Chloro-5-hydroxy-1 : 3-dimethylbenzene, 2-chloro-5-hydroxy-*m*-xylene) $C_8H_9OCl$ 

MW, 156.5

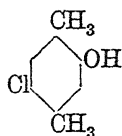
M.p. 115-16°.

*Acetyl* : m.p. 48.7°. B.p. 102°/2.5 mm.Lesser, Gad, *Ber.*, 1923, 56, 974.**6-Chloro-*m*-5-xyleneol.**

Needles. M.p. 49-50°.

Lesser, Gad, *Ber.*, 1923, 56, 974.

5-Chloro-*p*-xylenol (5-Chloro-2-hydroxy-1:4-dimethylbenzene, 5-chloro-2-hydroxy-*p*-xylene)

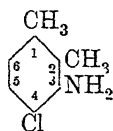


$C_8H_9OCl$  MW, 156.5

Silver-grey needles. M.p. 74–5°.

Lesser, *Gad, Ber.*, 1923, 56, 977.

4-Chloro-*o*-3-xylylidine (4-Chloro-3-amino-*o*-xylene)



$C_8H_{10}NCl$  MW, 155.5

Colourless oil, darkening in air. Volatile in steam.

N-Acetyl: 4-chloro-*o*-3-acet-xylylidine.  $C_{10}H_{12}ONCl$ . MW, 197.5. Needles from  $H_2O$ . M.p. 169°.

Hinkel, Ayling, Walters, *J. Chem. Soc.*, 1934, 284.

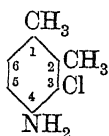
6-Chloro-*o*-3-xylylidine.

Cryst. M.p. 30–1°. Sol. most ord. org. solvents.

N-Acetyl: 6-chloro-*o*-3-acet-xylylidine. Needles from EtOH.Aq. M.p. 150°.

Hinkel, Collins, Ayling, *J. Chem. Soc.*, 1923, 123, 2972.

3-Chloro-*o*-4-xylylidine (3-Chloro-4-amino-*o*-xylene)



$C_8H_{10}NCl$  MW, 155.5

Needles from pet. ether. M.p. 26°.

N-Acetyl: 3-chloro-*o*-4-acet-xylylidine. Needles from EtOH.Aq. M.p. 114°.

Hinkel, Ayling, Collins, *J. Chem. Soc.*, 1934, 286.

5-Chloro-*o*-4-xylylidine.

Silvery leaflets. M.p. 88°. Cryst. from hot  $H_2O$ . Sol. EtOH,  $Et_2O$ .

N-Acetyl: 5-chloro-*o*-4-acet-xylylidine. Prisms. M.p. 154°.

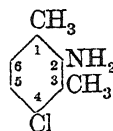
Claus, *J. prakt. Chem.*, 1892, 46, 34.

6-Chloro-*o*-4-xylylidine.

Needles from EtOH.Aq. M.p. 72°. Volatile in steam.

Hinkel, *J. Chem. Soc.*, 1924, 125, 1853.

4-Chloro-*m*-2-xylylidine (4-Chloro-2-amino-*m*-xylene)



$C_8H_{10}NCl$  MW, 155.5

B.p. 136–8°/17 mm.

N-Acetyl: 4-chloro-*m*-2-acet-xylylidine.  $C_{10}H_{12}ONCl$ . MW, 197.5. Needles from EtOH.Aq. M.p. 146–7°.

Dadswell, Kenner, *J. Chem. Soc.*, 1927, 1106.

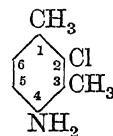
5-Chloro-*m*-2-xylylidine.

Needles. M.p. 4–5°.

N-Acetyl: 5-chloro-*m*-2-acet-xylylidine. Plates from EtOH.Aq. M.p. 195°.

Dadswell, Kenner, *J. Chem. Soc.*, 1927, 1106.

2-Chloro-*m*-4-xylylidine (2-Chloro-4-amino-*m*-xylene)



$C_8H_{10}NCl$  MW, 155.5

M.p. 58–9°.

I.G., F.P. 663,683, (*Chem. Abstracts*, 1930, 24, 729).

5-Chloro-*m*-4-xylylidine.

Needles. M.p. 40–1°.

N-Acetyl: 5-chloro-*m*-4-acet-xylylidine. Needles. M.p. 205–6°.

Bamberger, *Ann.*, 1925, 443, 206.

6-Chloro-*m*-4-xylylidine.

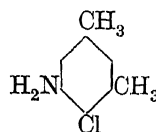
Leaflets from ligroin. M.p. 99°.

N-Acetyl: 6-chloro-*m*-4-acet-xylylidine. Silky needles. M.p. 158.5°.

Bamberger, Reber, *Ber.*, 1913, 46, 800.

I.G., D.R.P. 499,591, (*Chem. Abstracts*, 1930, 24, 4521).

4-Chloro-*m*-5-xylylidine (4-Chloro-5-amino-*m*-xylene)

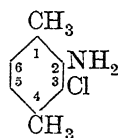


$C_8H_{10}NCl$  MW, 155.5

B.p. 251°.

N-Benzoyl: m.p. 128°. Volatile in steam.

Klages, *Ber.*, 1896, 29, 311.

**3-Chloro-*p*-xylylidine** (3-Chloro-2-amino-*p*-xylene)

$C_8H_{10}NCl$  MW, 155.5  
Needles from pet. ether. M.p. 41°. B.p. 126–7°/15 mm.

*N*-Acetyl: 3-chloro-*p*-2-acet-xylylidine.  
 $C_{10}H_{12}ONCl$  MW, 197.5. M.p. 179°.

*N*-Benzoyl: m.p. 144°.

*Picrate*: m.p. 120°.

Wahl, *Ann. chim.*, 1936, 5, 29.

**5-Chloro-*p*-xylylidine.**

Plates from hot  $H_2O$ . M.p. 92–3°. B.p. 136°/15 mm. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*N*-Acetyl: 5-chloro-*p*-2-acet-xylylidine.  
Plates from EtOH.Aq. M.p. 176° (181°).

*N*-Benzoyl: m.p. 163°.

*Picrate*: m.p. 195°.

Wheeler, Morse, *J. Am. Chem. Soc.*, 1924, 46, 2573.

Wahl, *Compt. rend.*, 1934, 198, 102.

**6-Chloro-*p*-xylylidine.**

M.p. 40°. B.p. 132–3°/15 mm.  
*N*-Acetyl: 6-chloro-*p*-2-acet-xylylidine. M.p. 171°.

*N*-Benzoyl: m.p. 177°.

*Picrate*: m.p. 171° decomp.

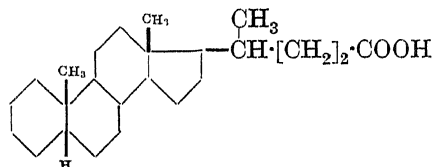
Wahl, *Ann. chim.*, 1936, 5, 31.

**Chloroxylylic Acid.**

See Chloro-dimethylbenzoic Acid.

**Chlorsalol.**

See under 5-Chlorosalicylic Acid.

**Cholanic Acid**

$C_{24}H_{40}O_2$  MW, 360  
Cryst. from AcOH. M.p. 164°.  $[\alpha]_D^{25} + 21.74^\circ$  in  $CHCl_3$ .

*Et ester*:  $C_{26}H_{44}O_2$ . MW, 388. Needles from 80% EtOH. M.p. 93–4°.  $[\alpha]_D^{25} + 20.97^\circ$  in  $CHCl_3$ .

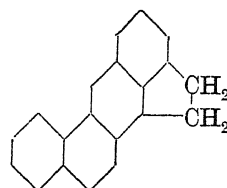
*Propyl ester*: m.p. 56–7°.

*Butyl ester*: m.p. 53°.

*Amide*:  $C_{24}H_{41}ON$ . MW, 359. M.p. 75°.

Wieland, Vocke, *Z. physiol. Chem.*, 1930, 191, 69.

See also references under Cholic Acid.

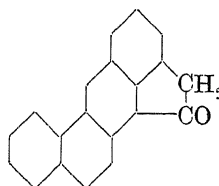
**Cholanthrene**

$C_{20}H_{14}$  MW, 254

Pale yellow leaflets from C<sub>6</sub>H<sub>6</sub>-EtOH. M.p. 170–1°. Sublimes. Carcinogenic.

*Picrate*: purple-black needles from C<sub>6</sub>H<sub>6</sub>. M.p. 167–8°.

Cook, Haslewood, Robinson, *J. Chem. Soc.*, 1935, 667.

**1-Cholanthrenone**

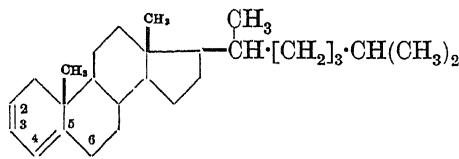
$C_{20}H_{12}O$  MW, 268

Yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 230°. Sublimes at 240°/0.05 mm.  $Zn + HCl \rightarrow$  cholanthrene.

Bachmann, *J. Org. Chem.*, 1938, 3, 434.

**Choleic Acid.**

See Deoxycholic Acid.

 **$\Delta^{2:4}$ -Cholestadiene**

$C_{27}H_{44}$  MW, 368

Cryst. from Et<sub>2</sub>O. M.p. 68.5°.  $[\alpha]_D^{25} + 168.5^\circ$  in Et<sub>2</sub>O. Absorption maxima at 2670 and 2750A<sup>6</sup>.

Bergmann, Skau, *J. Am. Chem. Soc.*, 1938, 60, 986.

Bergmann, Hirschmann, *J. Org. Chem.*, 1939, 4, 40.

Eck, Peursem, *Chem. Abstracts*, 1940, 34, 112.

Stavely, Bergmann, *J. Org. Chem.*, 1937, 1, 575.

 **$\Delta^{2:6}$ -Cholestadiene.**

M.p. 70–2°.  $[\alpha]_D^{25} - 3.7^\circ \pm 1^\circ$  in  $CHCl_3$ .

Wintersteiner, Moore, *J. Am. Chem. Soc.*, 1950, 72, 1923.

$\Delta^3$ -5-Cholestadiene (*Cholesterilene*).

Needles from EtOH. M.p. 80°.  $[\alpha]_D^{25} - 103^\circ$  in  $\text{CCl}_4$  ( $-123.2^\circ$ ). Absorption maximum at 2300–2400Å.

Bergmann, Hirschmann, *J. Org. Chem.*, 1940, 4, 40.

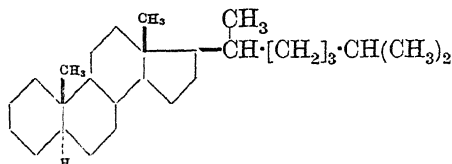
Eck, Peurseem, Hollingsworth, *J. Am. Chem. Soc.*, 1939, 61, 173.

 $\Delta^4$ -6-Cholestadiene.

Cryst. from  $\text{Me}_2\text{CO}-\text{MeOH}$ . M.p. 84–5°.  $[\alpha]_D^{25} + 45.8^\circ$  in  $\text{CCl}_4$ .

Eck, Peurseem, Hollingsworth, *J. Am. Chem. Soc.*, 1939, 61, 173.

## Cholestane



$\text{C}_{27}\text{H}_{48}$  MW, 372

Plates. M.p. 80–80.5°.  $[\alpha]_D^{18} + 30.2^\circ$  in  $\text{CHCl}_3$ . Sol.  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ . Spar. sol. alcohols.  $\text{CrO}_3 \rightarrow$  allocholanolic acid.

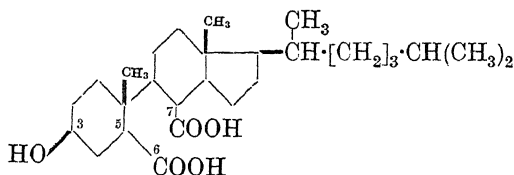
Diels, Linn, *Ber.*, 1908, 41, 548.

Windaus, *Ber.*, 1917, 50, 136.

 $\psi$ -Cholestan.

See Coprostan.

**Cholestane-3 $\beta$ -ol-6//7-dicarboxylic Acid**  
(3 $\beta$ -Hydroxy-6 : 7-secocholestane-6 : 7-dioic acid)



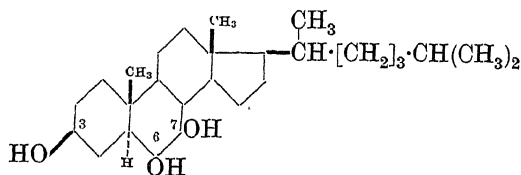
$\text{C}_{27}\text{H}_{46}\text{O}_5$  MW, 450

Rods from  $\text{Me}_2\text{CO}-\text{pentane}$ . M.p. 225° decomp.  $[\alpha]_D^{24} + 45.7^\circ \pm 2^\circ$  in EtOH.

6  $\rightarrow$  3-Lactone:  $\text{C}_{27}\text{H}_{44}\text{O}_4$ . MW, 432. Needles from  $\text{Me}_2\text{CO}-\text{pentane}$ . M.p. 204–7°.

Acetyl: rods from  $\text{Me}_2\text{CO}-\text{Aq}$ . M.p. 212–13°.  $[\alpha]_D^{24} + 23^\circ \pm 2^\circ$  in  $\text{CHCl}_3$ .

Wintersteiner, Moore, *J. Am. Chem. Soc.*, 1950, 72, 1923.

Cholestane-3 $\beta$  : 6 : 7-triol

$\text{C}_{27}\text{H}_{48}\text{O}_3$

MW, 420

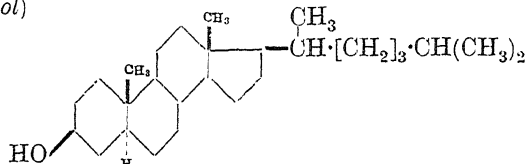
Needles from AcOEt. M.p. 211.5–212.5°.  $[\alpha]_D^{25} + 41^\circ$  in EtOH.

Triacetyl: m.p. 84–7°.  $[\alpha]_D^{25} + 24^\circ$  in  $\text{CHCl}_3$ .

Tri-p-nitrobenzoyl: needles from EtOH. M.p. 226–7°.  $[\alpha]_D^{25} + 180^\circ$  in  $\text{CHCl}_3$ .

Wintersteiner, Moore, *J. Am. Chem. Soc.*, 1950, 72, 1923.

**Cholestanol** (*Dihydrocholesterol*,  $\beta$ -cholestanol)



$\text{C}_{27}\text{H}_{48}\text{O}$  MW, 388

Leaflets from EtOH. M.p. 140.5°.  $[\alpha]_D^{22} + 27.4^\circ$  in  $\text{CHCl}_3$ .

Acetyl: prisms from AcOEt–MeOH. M.p. 110–1° corr.  $[\alpha]_D^{20} + 11.5^\circ$  in  $\text{CHCl}_3$ .

Chloroacetyl: plates from  $\text{CHCl}_3-\text{AcOEt}$ . M.p. 178–9°.

Benzoyl: plates from AcOEt. M.p. 136–7°.  $[\alpha]_D^{25} + 21.4^\circ$  in  $\text{CHCl}_3$ .

p-Nitrobenzoyl: m.p. 157–8°.

p-Aminobenzoyl: m.p. 191–2°.

p-Toluenesulphonyl: m.p. 134–5°.

Stearyl: cryst. mass from EtOH– $\text{CHCl}_3$ . M.p. 100°.

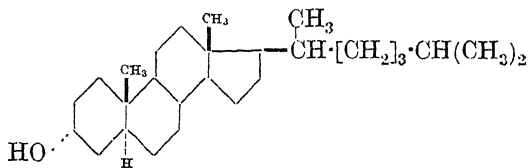
Phenylmethane: plates from EtOH–Aq. M.p. 151°.  $[\alpha]_D^{20} + 11.8^\circ$  in  $\text{CHCl}_3$ .

Me ether: plates from MeOH. M.p. 83°.  $[\alpha]_D^{20} + 19.8^\circ$ .

Heath-Brown, Heilbron, Jones, *J. Chem. Soc.*, 1940, 1483.

Bruce, Ralls, *Organic Syntheses*, 1937, XVII, 45.

## epi-Cholestanol



$\text{C}_{27}\text{H}_{48}\text{O}$  MW, 388

Cryst. from EtOH. M.p. 185–6°.  $[\alpha]_D + 22.8^\circ$  in  $\text{CHCl}_3$ ,  $[\alpha]_{5461} + 33.9^\circ$  in  $\text{CHCl}_3$ .

Acetyl: cryst. from MeOH. M.p. 96°.

Benzoyl: m.p. 102–3°.  $[\alpha]_{5461} + 27.2^\circ$ .

Isovaleryl: m.p. 79–80°.  $[\alpha]_{5461} + 29.5^\circ$ .

Ruzicka, Brüngger, Eichenberger, Meyer, *Helv. Chim. Acta*, 1934, 17, 1411.

Windaus, Uibrig, *Ber.*, 1914, 47, 2387.

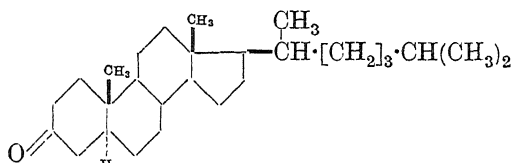
Vavon, Jakubowicz, *Bull. soc. chim.*, 1933, 53, 584.

Marker, Whitmore, Kamm, *J. Am. Chem. Soc.*, 1935, 57, 2359.

Barnett, Heilbron, Jones, Verrill, *J. Chem. Soc.*, 1940, 1390.



## Cholestanone



$C_{27}H_{46}O$  MW, 386

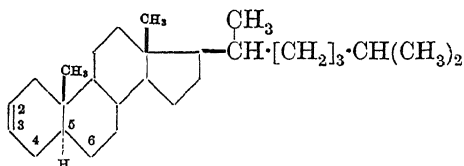
Leaflets from EtOH. M.p. 128–9°.  $[\alpha]_D^{20} + 43.7^\circ$  in  $CHCl_3$ .

Willstätter, Mayer, *Ber.*, 1908, **41**, 2199.

Vavon, Jakubowicz, *Bull. soc. chim.*, 1933, **53**, 581.

*i*-Cholestanone.

See under *i*-Cholesterol.

 $\Delta^2$ -Cholestene (*Neocholestene*)

$C_{27}H_{46}$  MW, 370

Needles from  $Et_2O$ - $Me_2CO$ . M.p. 75–6°.  $[\alpha]_D^{24} + 64^\circ$ .

*Dibromide*:  $\alpha$ -. m.p. 143–4°.  $[\alpha]_D^{15} - 53^\circ$ .

$\beta$ -. M.p. 122–4°.  $[\alpha]_D^{15} + 81^\circ$ .

Hattori, Kawasaki, *J. pharm. Soc. Japan*, 1937, **57**, 115.

 $\Delta^4$ -Cholestene ( *$\psi$ -Cholestene, coprostene*).

Prisms from  $Me_2CO$ . M.p. 78–9°. Sol.  $Et_2O$ ,  $CHCl_3$ . Mod. sol.  $Me_2CO$ . Spar. sol. EtOH.  $[\alpha]_D^{15} + 64.9^\circ$  in  $CHCl_3$ .

*Dibromide*: m.p. 116–7°.

Stavely, Bergmann, *J. Org. Chem.*, 1937, **1**, 575.

Mauthner, *Monatsh.*, 1909, **30**, 639.

Heilbron, Sexton, *J. Chem. Soc.*, 1928, 347.

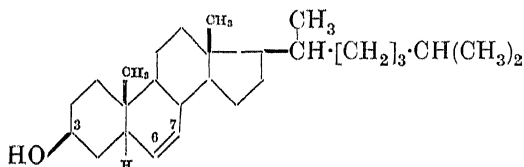
 $\Delta^5$ -Cholestene.

Needles. M.p. 89–90° (91°). Sol.  $Et_2O$ ,  $CHCl_3$ . Spar. sol. EtOH.  $[\alpha]_D^{15} - 56.3^\circ$  in  $CHCl_3$ . Forms two isomeric dibromides,  $C_{27}H_{46}Br_2$ , m.p.s., 106° and 141–2°.

Mauthner, Suida, *Monatsh.*, 1894, **15**, 86.

Mauthner, *Monatsh.*, 1909, **30**, 635.

von Firth, Felsenreich, *Biochem. Z.*, 1915, **69**, 416.

 $\Delta^6$ -Cholestene-3 $\beta$ -ol

$C_{27}H_{46}O$

MW, 386

Plates from MeOH. M.p. 114–19°. After drying at 100°/2 mm., m.p. 129–31°.  $[\alpha]_D^{15} - 81^\circ \pm 1^\circ$  in  $CHCl_3$ .

*Acetyl*: m.p. 104–6°  $[\alpha]_D^{14} - 88^\circ \pm 1^\circ$  in  $CHCl_3$ .

*Benzoyl*: cryst. from MeOH. M.p. 128–9°.  $[\alpha]_D^{15} - 74^\circ \pm 2^\circ$  in  $CHCl_3$ .

Wintersteiner, Moore, *J. Am. Chem. Soc.*, 1950, **72**, 1923.

 $\Delta^7$ -Cholestene-3 $\beta$ -ol ( *$\gamma$ -Cholestenol*)

Needles from MeOH. M.p. 122–3° (118–22°).  $[\alpha]_D^{15} + 1.6^\circ$  in  $CHCl_3$  ( $[\alpha]_D 0^\circ$ ).

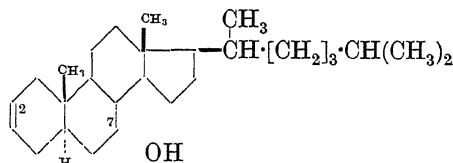
*Acetyl*: needles from MeOH. M.p. 118–19°.  $[\alpha]_D 0^\circ$  (–73.1°).

*Benzoyl*: needles from  $Me_2CO$ . M.p. 157–8°.  $[\alpha]_D^{15} + 7.14^\circ$ .

Schenk, Bucholz, *Ber.*, 1936, **69**, 2696

Wintersteiner, Moore, *J. Am. Chem. Soc.*, 1943, **65**, 1507.

Buser, *Helv. Chim. Acta*, 1947, **30**, 1379

 $\Delta^2$ -Cholestene-7 $\alpha$ -ol

$C_{27}H_{46}O$  MW, 386

M.p. 80–85°.  $[\alpha]_D^{24} + 41.7^\circ \pm 2^\circ$  in  $CHCl_3$ .

*Benzoyl*: m.p. 136–8°.  $[\alpha]_D^{15} - 27.7^\circ \pm 1^\circ$  in  $CHCl_3$ .

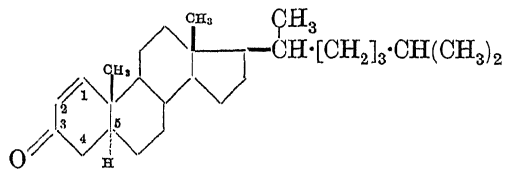
Wintersteiner, Moore, *J. Am. Chem. Soc.*, 1950, **72**, 1923.

 $\Delta^4$ -Cholestenol.

See Allocholesterol.

 $\Delta^4$ -*epi*Cholestenol.

See *epi*Allocholesterol.

 $\Delta^1$ -Cholestenone

$C_{27}H_{44}O$  MW, 384

Needles from  $Me_2CO$ . Aq. or EtOH. M.p. 95°.  $[\alpha]_D^{15} + 64.5^\circ$  in EtOH. Red.  $\rightarrow$  cholestanone. Absorption maximum about 2300A°.

Butenandt, Mamoli, Dannenberg, Masch, Paland, *Ber.*, 1939, **72**, 1621.

 $\Delta^4$ -Cholestenone.

Plates. M.p. 80°. Sol.  $Et_2O$ ,  $C_6H_6$ , pet. ether,  $CS_2$ . Spar. sol. cold AcOEt, alcohols.  $[\alpha]_D + 87^\circ$  in EtOH. Absorption maximum at 2430A°.

*Oxime*: m.p. 150°.

*Semicarbazone*: m.p. 234°.

*Enol acetyl*: needles from MeOH. M.p. 81°.  
[ $\alpha$ ]<sub>D</sub><sup>25</sup> = 100·4°.

*Enol benzoyl*: cryst. from Me<sub>2</sub>CO. M.p. 117·5°.

*Enol Et ether*: m.p. 84–5°. [ $\alpha$ ]<sub>D</sub> = 102·3° in CHCl<sub>3</sub>.

Diels, *Abderhalden, Ber.*, 1904, 37, 3092.

Sexton, *J. Chem. Soc.*, 1928, 2825.

Oppenauer, *Rec. trav. chim.*, 1937, 56, 141.

Westphal, *Ber.*, 1937, 70, 2128.

Schoenheimer, *J. Biol. Chem.*, 1935, 110, 461.

### $\Delta^5$ -Cholestenone.

Leaflets from EtOH. M.p. 127°. [ $\alpha$ ]<sub>D</sub><sup>20</sup> = 4·3° in CHCl<sub>3</sub>.

*Oxime*: needles from EtOH. M.p. 188° decomp.

*Dibromide*: plates from Me<sub>2</sub>CO. M.p. 80°.

$\alpha$ -*Oxide*: m.p. 202°.

$\beta$ -*Oxide*: m.p. 122°.

Butenandt, Schmidt-Thomé, *Ber.*, 1936, 69, 886.

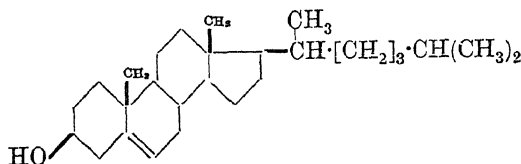
Ruzicka, Bosshard, *Helv. Chim. Acta*, 1937, 20, 244.

Schering-Kahlbaum, B.P. 486,992, (*Chem. Abstracts*, 1938, 32, 8707).

### Cholesterilene.

See  $\Delta^3$ :<sup>5</sup>-Cholestadiene.

### Cholesterol



C<sub>27</sub>H<sub>46</sub>O

MW, 386

Characteristic sterol of the higher animals. Constituent, either free or as esters, of fish liver oils, egg yolk, gallstones, bile, brain, etc. Pearly leaflets + 1H<sub>2</sub>O from EtOH.Aq. M.p. anhyd. 148·5°. Distills at 360° with part decomp. [ $\alpha$ ]<sub>D</sub> = 31·12° in Et<sub>2</sub>O. Sol. C<sub>6</sub>H<sub>6</sub>, Et<sub>2</sub>O, CHCl<sub>3</sub>, CS<sub>2</sub>, Py. Mod. sol. hot AcOH, EtOH. Insol. H<sub>2</sub>O.

*Formyl*: m.p. 96°. [ $\alpha$ ]<sub>D</sub> = 52·5°.

*Acetyl*: needles from Me<sub>2</sub>CO. M.p. 114–5°. [ $\alpha$ ]<sub>D</sub><sup>20</sup> = 47·4° in CHCl<sub>3</sub>.

*Propionyl*: plates from EtOH–Et<sub>2</sub>O. M.p. 114°. [ $\alpha$ ]<sub>D</sub> = 40·9°.

*n-Butyryl*: m.p. 110° (102°).

*n-Caproyl*: m.p. 98–9°.

*Oxalyl (diester)*: m.p. 226–7°.

*Succinyl (monoester)*: m.p. 175–5·5°.

*Succinyl (diester)*: m.p. 220° (240°).

*Adipyl (diester)*: m.p. 195° (222°).

*Palmityl*: m.p. 80°. [ $\alpha$ ]<sub>D</sub> = 25·4° in CHCl<sub>3</sub>.

*Stearyl*: m.p. 81° (82–3°). [ $\alpha$ ]<sub>D</sub> = 21·2°.

*Oleyl*: m.p. 40–1°. [ $\alpha$ ]<sub>D</sub> = 23·4°.

*Benzoyl*: m.p. 150–1°.

*p-Nitrobenzoyl*: m.p. 190–3°. [ $\alpha$ ]<sub>D</sub><sup>21</sup> = 6·3° in CHCl<sub>3</sub>.

*Dibromide*: needles from Et<sub>2</sub>O–AcOH. M.p. 124–5°.

*Me ether*: m.p. 84·5°. [ $\alpha$ ]<sub>D</sub><sup>20</sup> = 45·8° in CHCl<sub>3</sub>.

*Et ether*: leaflets from EtOH. M.p. 88·5°. [ $\alpha$ ]<sub>D</sub><sup>21</sup> = 39° in CHCl<sub>3</sub>.

*Propyl ether*: m.p. 100°. [ $\alpha$ ]<sub>D</sub><sup>23</sup> = 34·8° in CHCl<sub>3</sub>.

*Benzyl ether*: needles from Me<sub>2</sub>CO. M.p. 118·5°. [ $\alpha$ ]<sub>D</sub><sup>20</sup> = 25·8° in CHCl<sub>3</sub>.

*Oxide*:  $\alpha$ -. Needles from MeOH. M.p. 142°.

*Benzoyl*: prisms from AcOEt. M.p. 168–9°. [ $\alpha$ ]<sub>D</sub><sup>26</sup> = 31·3°.  $\beta$ -. Needles from MeOH. M.p. 108°.

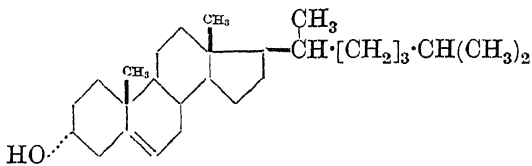
*Acetyl*: cryst. from MeOH. M.p. 111–2°.

*Benzoyl*: needles from AcOEt–MeOH. M.p. 151–2°. [ $\alpha$ ]<sub>D</sub><sup>20</sup> = 3·8°.

Lettré, Inhoffen, *Über Sterine, Gallensäuren und verwandte Naturstoffe*. Enke, Stuttgart, 1936.

Fieser, *The Chemistry of Natural Products related to Phenanthrene*. Rheinhold Publishing Corp., New York, 3rd. Ed., 1949.

### *epi*-Cholesterol



C<sub>27</sub>H<sub>46</sub>O

MW, 386

Cryst. from EtOH. M.p. 141·5°. [ $\alpha$ ]<sub>D</sub><sup>20</sup> = 35° in EtOH, [ $\alpha$ ]<sub>D</sub> = 43·0° (–44·5°) in CHCl<sub>3</sub>. Br → tetrabromocholestane.

*Acetyl*: cryst. from MeOH. M.p. 85°. [ $\alpha$ ]<sub>D</sub> = 12·8° in CHCl<sub>3</sub>.

*Benzoyl*: m.p. 99·5°. [ $\alpha$ ]<sub>D</sub><sup>20</sup> = 29° in CHCl<sub>3</sub>.

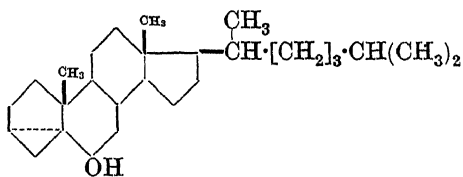
Marker, Kamm, Oakwood, Laucius, *J. Am. Chem. Soc.*, 1936, 58, 1949.

Ruzicka, Goldberg, *Helv. Chim. Acta*, 1936, 19, 1409.

Marker, U.S.P. 2,177,355, (*Chem. Abstracts*, 1940, 34, 1038).

Barnett, Heilbron, Jones, Verrill, *J. Chem. Soc.*, 1940, 1390.

### *i*-Cholesterol (3:5-cyclocholestane-6-ol)



C<sub>27</sub>H<sub>46</sub>O

MW, 386

Needles. M.p. 74–5°.  $[\alpha]_D^{20} + 23.9^\circ$  in  $\text{CHCl}_3$ .  $\text{CrO}_3 \rightarrow$  *i*-cholestanone (heterocholestenone), m.p. 96°.

*Acetyl*: cryst. from EtOH. M.p. 73°.  $[\alpha]_D^{20} + 47.8^\circ$  in  $\text{CHCl}_3$ .

*Me ether*: cryst. from  $\text{Me}_2\text{CO}$ . M.p. 79°.  $[\alpha]_D^{20} + 55^\circ$  in  $\text{CHCl}_3$ .

*Et ether*: plates from  $\text{Me}_2\text{CO}$ . M.p. 47°.  $[\alpha]_D^{20} + 49.8^\circ$  in  $\text{CHCl}_3$ .

Wallis, Fernholz, Gephart, *J. Am. Chem. Soc.*, 1937, 59, 137.

Heilbron, Hodges, Spring, *J. Chem. Soc.*, 1938, 759.

Beynon, Heilbron, Spring, *J. Chem. Soc.*, 1936, 907.

Ford, Chakravorty, Wallis, *J. Am. Chem. Soc.*, 1938, 60, 413.

Ladenburg, Chakravorty, Wallis, *J. Am. Chem. Soc.*, 1939, 61, 3483.

Winstein, Adams, *J. Am. Chem. Soc.*, 1948, 70, 838.

### Cholesteryl bromide

$\text{C}_{27}\text{H}_{45}\text{Br}$  MW, 449

Leaflets from EtOH. M.p. 98°.  $[\alpha]_D^{25} - 19.14^\circ$  in  $\text{C}_6\text{H}_6$ .

Kolm, *Monatsh.*, 1912, 33, 447.

### Cholesteryl chloride

$\text{C}_{27}\text{H}_{45}\text{Cl}$  MW, 404.5

Cryst. from  $\text{Et}_2\text{O}$  or  $\text{Me}_2\text{CO}$ . M.p. 96°.  $[\alpha]_D - 26.4^\circ$  in  $\text{C}_6\text{H}_6$ .

*Dibromide*: m.p. 130–1°.  $[\alpha]_D - 55^\circ$ .

Diels, Abderhalden, *Ber.*, 1904, 37, 3102.

Shoppee, *J. Chem. Soc.*, 1946, 1147.

### Cholesteryl iodide

$\text{C}_{27}\text{H}_{45}\text{I}$  MW, 496

Needles from AcOEt. M.p. 106.5–7° (104–6°).  $[\alpha]_D^{20} - 11.94^\circ$  in  $\text{CHCl}_3$ .

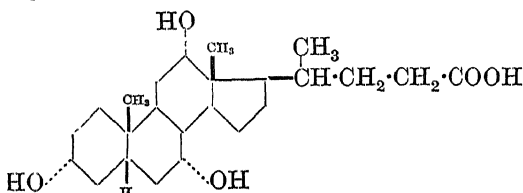
Helferich, Gunther, *Ber.*, 1939, 72, 340; D.R.P. 696,319, (*Chem. Abstracts*, 1941, 35, 6269).

Beynon, Heilbron, Spring, *J. Chem. Soc.*, 1936, 910.

### Cholestrophane.

See Dimethylparabanic Acid.

**Cholic Acid** (*Cholalic acid*, 3:7:12-*tri*hydroxycholanoid acid)



$\text{C}_{24}\text{H}_{40}\text{O}_5$  MW, 408

In combination with taurine and glycine in bile and animal excretions. Cryst. +  $1\text{H}_2\text{O}$

Dict. of Org. Comp.—I.

from  $\text{H}_2\text{O}$  or  $\text{Et}_2\text{O}$ . Aq. Cryst. +  $1\text{C}_2\text{H}_5\text{OH}$  from EtOH. M.p. anhyd. 197°.  $[\alpha]_D^{20} + 37^\circ$  in EtOH. Sol. AcOH,  $\text{Me}_2\text{CO}$ , alkalis. Mod. sol. warm EtOH,  $\text{Et}_2\text{O}$ . Spar. sol.  $\text{H}_2\text{O}$ . Sol. conc.  $\text{H}_2\text{SO}_4$  to yellow sol. with green fluor.

*Me ester*:  $\text{C}_{25}\text{H}_{42}\text{O}_5$ . MW, 422. Exists in two forms. (i) M.p. 155°.  $[\alpha]_D^{20} + 30.09^\circ$  in  $\text{CHCl}_3$ . (ii) M.p. 162°.  $[\alpha]_D^{20} + 25^\circ$ .

*Et ester*:  $\text{C}_{26}\text{H}_{44}\text{O}_5$ . MW, 436. Needles from pet. ether- $\text{CHCl}_3$ . M.p. 162–3°.

3-*Acetyl*: *Me ester*: m.p. 149.5–150°.  $[\alpha]_D^{15} + 47.6^\circ$  in  $\text{CHCl}_3$ .

3:7-*Diacyl*: m.p. 261–3° (257°).  $[\alpha]_D^{17} + 49.8^\circ$  in EtOH. *Me ester*: m.p. 182–3°.  $[\alpha]_D^{14} + 31.0^\circ$  in  $\text{CHCl}_3$ .

7:12-*Diacyl*: m.p. 204–5°.  $[\alpha]_D^{28} + 71^\circ$  in MeOH. *Me ester*: m.p. 57–9°.  $[\alpha]_D^{14} + 63.7^\circ$  in  $\text{CHCl}_3$ .

3:7:12-*Triacyl*: *Me ester*: m.p. 89–91°.  $[\alpha]_D^{27} 77^\circ$  in MeOH.

Wieland, Weil, *Z. physiol. Chem.*, 1912, 80, 287.

Uraki, *Z. physiol. Chem.*, 1932, 207, 16.

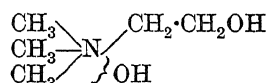
Cortese, *J. Am. Chem. Soc.*, 1937, 59, 2532.

Wieland, Kapitel, *Z. physiol. Chem.*, 1932, 212, 263.

Shimizu, *Chemie und Physiologie der Gallensäuren*. Muramoto, Okayama, 1935.

Lettré, Inhoffen, *Über Sterine, Gallensäuren und verwandte Naturstoffe*. Enke. Stuttgart. 1936.

**Choline** (*Trimethyl-2-hydroxyethylammonium hydroxide, bilineurine, sincalin*)



$\text{C}_5\text{H}_{15}\text{O}_2\text{N}$  MW, 121

Occurs free and combined in many animal and vegetable products, e.g., bile, brain, yolk of egg, hops, belladonna, strophanthus and the seeds, leaves and stems of many other plants. The basic constituent of lecithin.

Colourless syrup which crystallises with difficulty. Reacts strongly alk. Very sol.  $\text{H}_2\text{O}$  and abs. EtOH. Insol.  $\text{Et}_2\text{O}$ . Absorbs  $\text{CO}_2$  from the air. Ox.  $\rightarrow$  betaine. Forms cryst. additive comps. with  $\text{HAuCl}_4$  and  $\text{H}_2\text{PtCl}_6$ , for which various m.ps. are recorded in the literature. Also combines with  $\text{ZnCl}_2$ ,  $\text{CdCl}_2$ , iodine, etc.

*B, HClO<sub>4</sub>*: cryst. from EtOH. M.p. 273°.

*Acetyl*: see Acetylcholine.

Renshaw, *J. Am. Chem. Soc.*, 1910, 32, 128.

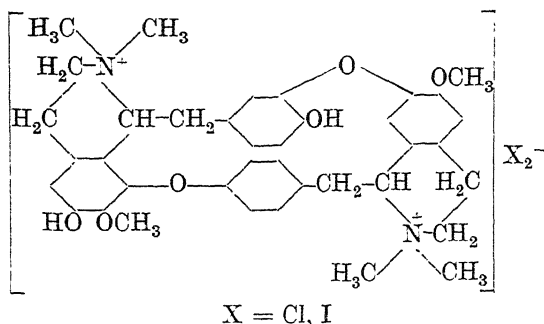
Hofmann, Höbold, *Ber.*, 1911, 44, 1766.

Gaddum, *Ann. Rev. Biochem.*, 1935, 4, 311 (Review).

### Cholyglycine.

See Glycocholic Acid.

## Chondocurarine chloride (iodide)



d.

## Chloride :

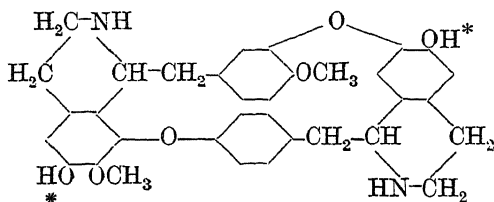
$C_{38}H_{44}O_6N_2Cl_2$ . MW, 695. Amorph.  $[\alpha]_D^{25} + 188^\circ$  in  $H_2O$ ,  $+ 195^\circ$  in MeOH. Occurs naturally with *d*-tubocurarine chloride.

## Iodide :

$C_{38}H_{44}O_6N_2I_2$ . MW, 878. Prisms + 1  $CHCl_3$  from MeOH- $CHCl_3$ . M.p. (unsolvated) 277-80° decomp.  $[\alpha]_D^{25} + 150^\circ$  in  $H_2O$ . *Diacetyl*: decomp. at 230-5°.  $[\alpha]_D^{25} + 128^\circ$  in MeOH.

Dutcher, *J. Am. Chem. Soc.*, 1952, 74, 2221.

## l-Chondrofoline



\* One of these H atoms is replaced by a  $CH_3$  group.

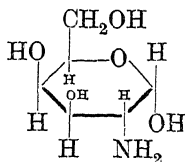
$C_{35}H_{36}O_6N_2$  MW, 580

Alkaloid from the leaves of *Chondrodendron platyphyllum*. Triangular plates +  $H_2O$  from MeOH. M.p. about 135°.  $FeCl_3$  in MeOH  $\rightarrow$  faint pinkish-purple col. No Millon reaction.  $[\alpha]_{461}^{20}$  (anhyd.) - 280.6° in 0.1N HCl.

$B, 2HNO_3, H_2O$ : needles from  $H_2O$ . M.p. 225°.

King, *J. Chem. Soc.*, 1940, 737.

## Chondrosamine (d-Galactosamine)



$C_6H_{13}O_5N$  MW, 179

M.p. 185°.  $[\alpha]_D^{20} + 59.3^\circ$ . Gives same osazone as galactose.

$B, HCl$ : m.p. 202°.  $[\alpha]_D^{20} + 105^\circ \rightarrow + 96^\circ$  in  $H_2O$  after 24 hours.

*Penta-acetyl*: exists in two forms.  $\alpha$ : m.p. 178° (197°).  $[\alpha]_D^{20} + 90^\circ$ ,  $[\alpha]_D^{20} + 102^\circ$  in  $CHCl_3$ .  $\beta$ : m.p. 235° (237°).  $[\alpha]_D^{20} + 8.75^\circ$ ,  $[\alpha]_D^{20} + 7^\circ$  in  $CHCl_3$ .

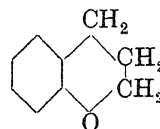
*N-Acetyl*: +  $H_2O$ . M.p. 120-22°.  $[\alpha]_D^{21} + 115^\circ \rightarrow + 80^\circ$  in  $H_2O$  after 50 hours.

Levene, *J. Biol. Chem.*, 1917, 31, 609.

Jolles, Morgan, *Biochem. J.*, 1940, 34, 1183.

Stacey, *J. Chem. Soc.*, 1944, 272.

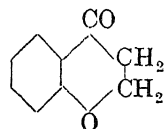
## Chroman (Dihydrobenzopyran)



$C_9H_{10}O$  MW, 134

B.p. 214°/742 mm., 98-9°/18 mm.  $D_{20}^{20}$  1.0610.  $[n]_D^{20}$  1.544.

Rindfusz, *J. Am. Chem. Soc.*, 1919, 41, 668.

Chromanone (Dihydrobenz- $\gamma$ -pyrone)

$C_9H_8O_2$  MW, 148

Cryst. from pet. ether. M.p. 39-40° (111°). B.p. 128°/13 mm.

*Oxime*: needles from  $H_2O$ . M.p. 144-5°.

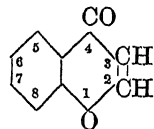
*Semicarbazone*: needles from EtOH. M.p. 227°.

Powell, *J. Am. Chem. Soc.*, 1923, 45, 2711.

Mayer, Zütphen, *Ber.*, 1924, 57, 200.

Arndt, Kallner, *ibid.*, 202.

Krollpfeiffer, Schultz, *ibid.*, 206.

Chromone (Benz- $\gamma$ -pyrone, benzopyrone)

$C_9H_6O_2$  MW, 146

Needles. M.p. 59°. Sol. EtOH, Et<sub>2</sub>O,  $CHCl_3$ ,  $C_6H_6$ . Cryst. from boiling  $H_2O$  or pet. ether. Sublimes. Volatile in steam. Distills undecomp.  $KMnO_4$  or hot dil. NaOH  $\rightarrow$  salicylic acid.

*Hydrochloride*: m.p. 101-2°. Stable in dry air.

*Hydrobromide*: red cryst. M.p. 175°.

Gomberg, Cone, *Ann.*, 1910, 376, 228.

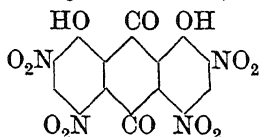
## Chromotrope Acid.

See 1 : 8 - Dihydroxynaphthalene-3 : 6 - disulphonic Acid.

## Chrysammic Acid.

See Chrysammic Acid.

**Chrysamminic Acid** (2:4:5:7-Tetranitro-chryszazin, 2:4:5:7-tetranitro-1:8-dihydroxy-anthraquinone, chrysammic acid)



$C_{14}H_4O_{12}N_4$  MW, 420

Yellow plates or leaflets. Decomp. on heating. Explodes if rapidly heated in air. Sol EtOH, Et<sub>2</sub>O, min. acids. Spar. sol. hot H<sub>2</sub>O. Forms series of metallic salts which decompose with explosion when heated.

Léger, *Ann. chim.*, 1916, 6, 370.

### Chrysanisic Acid.

See 3:5-Dinitro-4-aminobenzoic Acid.

### Chrysanthem in (Asterin)

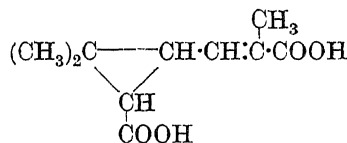
$C_{21}H_{21}O_{11}Cl$  (chloride) MW, 484.5

Pigment of *Chrysanthemum indicum*, Linn., and *Aster chinensis*, Linn. Glucoside of cyanidin. Bronze-red prisms + 1½ H<sub>2</sub>O. Sol. dil. HCl, alc. HCl. Hyd. → cyanidin + glucose.

Willstätter, Burdick, *Ann.*, 1916, 412, 149.

Robinson, Willstätter, *Ber.*, 1928, 61, 2503.

**Chrysanthemum-dicarboxylic Acid** (Dimethyl-carboxypropenylcyclopropane-carboxylic acid)



$C_{10}H_{14}O_4$  MW, 198

Degradation product of the pyrethrins. Cryst. from CHCl<sub>3</sub>-ligroin or H<sub>2</sub>O. M.p. 164°.  $[\alpha]_D^{25} +27.8^\circ$  in MeOH.

*Mono-Me ester*: occurs as one of the pyrethrins esterified with pyrethrolone. B.p. 129-30°/0.33 mm.  $[\alpha]_D^{25} +103.9^\circ$  in CCl<sub>4</sub>. *Chloride*: b.p. 114°/0.5 mm.

*Di-Me ester*: b.p. 149°/16 mm., 87-8°/0.25 mm.

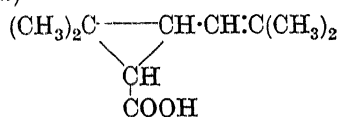
*Di-p-phenylphenacyl ester*: cryst. from toluene or Me<sub>2</sub>CO. M.p. 154°.

*Dichloride*: cryst. from ligroin. M.p. 48-50°. B.p. 151°/12 mm.

*Dianilide*: m.p. 204-5°.

Staudinger, Ruzicka, *Helv. Chim. Acta*, 1924, 7, 201.

**Chrysanthemum-monocarboxylic Acid** (2:2-Dimethyl-3-isobutenylcyclopropane-1-carboxylic acid)



$C_{10}H_{16}O_2$

MW, 168

### d-Trans-

Ester with pyrethrolone occurs as one of the pyrethrins. M.p. 17-21° (18-20°). B.p. 245°, slight decomp., 135°/12 mm., 90°/0.1 mm.  $[\alpha]_D^{25} +14.16^\circ$  in EtOH ( $[\alpha]_D^{25} +20.1^\circ$ ). O<sub>3</sub> → Me<sub>2</sub>CO + *l-trans*-caronic acid.

*Me ester*: b.p. 99°/14 mm., 86-7°/10 mm.  $[\alpha]_D^{25} +20.74^\circ$ .

*p-Phenylphenacyl ester*: cryst. from MeOH or ligroin. M.p. 66-7° (65°).  $[\alpha]_D^{25} +32.33^\circ$  in EtOH.

*Allylrethronyl ester*: see Allethrin.

*Cineronyl ester*: see Cinerin I.

*Quinine salt*: m.p. 97-110°.  $[\alpha]_D^{25} -109.3^\circ$  in EtOH.

*Chloride*: b.p. 85°/12 mm., 58°/0.033 mm.

*Amide*: needles from ligroin. M.p. 122°; resolidifies and then has m.p. 131-2°.  $[\alpha]_D^{25} +10.65^\circ$  in EtOH.

*Anilide*: needles from ligroin. M.p. 101°.  $[\alpha]_D^{25} -2.6^\circ$  in EtOH.

*Anhydride*: b.p. 125°/12 mm.

### l-Trans-

M.p. 17-21°.  $[\alpha]_D^{25} -14.0^\circ$  in EtOH.

*p-Phenylphenacyl ester*: m.p. 66-7°.  $[\alpha]_D^{25} -32.11^\circ$  in EtOH.

*Amide*: needles from ligroin. M.p. 122°; resolidifies, m.p. 131-2°.  $[\alpha]_D^{25} -11.1^\circ$  in EtOH.

*Anilide*: m.p. 101°.  $[\alpha]_D^{25} +2.6^\circ$  in EtOH.

*Quinine salt*: cryst. from EtOH.Aq. M.p. 159.0-61.5°.  $[\alpha]_D^{25} -115.3^\circ$  in EtOH.

### dl-Trans-

Prisms from AcOEt. M.p. 54°.

*Me ester*: b.p. 108°/20 mm., 95°/13 mm.  $D_D^{25} 0.9274$ .  $n_D^{25} 1.4614$ .

*Et ester*: b.p. 117-21°/20 mm.

*p-Phenylphenacyl ester*: plates from EtOH. M.p. 115°.

*Amide*: needles from ligroin. M.p. 126°.

*Anilide*: needles from ligroin. M.p. 111°.

### dl-Cis-

Prisms from AcOEt. M.p. 115-16°.

*p-Nitrobenzyl ester*: plates. M.p. 44-5°.

*p-Phenylphenacyl ester*: prisms from EtOH. M.p. 91°.

*Amide*: needles from ligroin. M.p. 125°.

*Anilide*: needles from ligroin. M.p. 93°.

Staudinger, Ruzicka, *Helv. Chim. Acta*, 1924, 7, 201.

Staudinger, Muntwyler, Ruzicka, Seibt, *Helv. Chim. Acta*, 1924, 7, 390.

Takei, Wakazono, *Chem. Abstracts*, 1941, 35, 3385.

Campbell, Harper, *J. Chem. Soc.*, 1945, 283.

### Chrysanthin

$C_{17}H_{22}O_5$  MW, 306

Present in extract of pyrethrum flowers. Cryst. from Me<sub>2</sub>CO or CHCl<sub>3</sub>-EtOH. M.p. 201°.  $[\alpha]_D^{25} -30.5^\circ$  in CHCl<sub>3</sub>.

Rose, Haller, *J. Org. Chem.*, 1937, 2, 484.

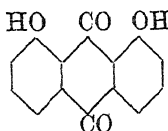
Chou, Chu, *Chem. Abstracts*, 1934, 28, 5168.

**Chrysanthranol.**

See Anthralin.

**Chrysotropic Acid.**

See Scopoletin.

**Chryszazin (1 : 8-Dihydroxyanthraquinone)** $C_{14}H_8O_4$ 

MW, 240

Red or reddish-yellow needles or leaflets. M.p. 193°. Sol. caustic alkalis. Mod. sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, AcOH, PhNO<sub>2</sub>. Red sol. in conc. H<sub>2</sub>SO<sub>4</sub>. Insol. cold NH<sub>3</sub>.Aq. or aq. carbonates.

*Mono-Me ether*: C<sub>15</sub>H<sub>10</sub>O<sub>4</sub>. MW, 254. Orange-red needles from EtOH. M.p. 197-8°.

*Di-Me ether*: C<sub>16</sub>H<sub>12</sub>O<sub>4</sub>. MW, 268. Yellow cryst. M.p. 219°.

*Diphenyl ether*: 1 : 8-diphenoxyanthraquinone. C<sub>26</sub>H<sub>16</sub>O<sub>4</sub>. MW, 392. Yellow cryst. M.p. 190°.

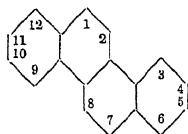
*Diacetyl*: yellow needles. M.p. 231-2°.

Naylor, Gardner, *J. Am. Chem. Soc.*, 1931, 53, 4112.

Aoyama, Morita, *J. Pharm. Soc. Japan*, 1932, 52, 17.

**Chryszazol.**

See 1 : 8-Dihydroxyanthracene.

**Chrysene (1 : 2-Benzphenanthrene)** $C_{18}H_{12}$ 

MW, 228

Colourless rhombic plates from C<sub>6</sub>H<sub>6</sub> or AcOH, with reddish-violet fluor. M.p. 254° (250°). B.p. 448°. Sol. hot C<sub>6</sub>H<sub>6</sub>, hot toluene. Spar. sol. EtOH, Et<sub>2</sub>O, AcOH, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>. CrO<sub>3</sub> in AcOH → chrysoquinone.

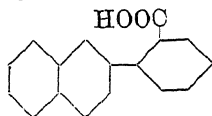
Weitzenböck, Lieb, *Monatsh.*, 1912, 33, 549.

I.G., B.P. 435,254, (*Chem. Abstracts*, 1936, 30, 1388); U.S.P. 2,056,915, (*Chem. Abstracts*, 1936, 30, 8249).

S.C.I., Swiss P. 182,873, (*Chem. Abstracts*, 1936, 30, 8249).

**Chrysenequinone.**

See Chrysoquinone.

**α-Chrysenic Acid (o-2-Naphthylbenzoic acid, 2-o-carboxyphenylnaphthalene)** $C_{17}H_{12}O_2$ 

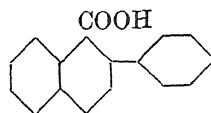
MW, 248

Leaflets. M.p. 190°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, AcOH, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>. Conc. H<sub>2</sub>SO<sub>4</sub> → 1 : 2-benzfluorenone.

*Me ester*: C<sub>18</sub>H<sub>14</sub>O<sub>2</sub>. MW, 262. M.p. 63°.

*Amide*: C<sub>17</sub>H<sub>13</sub>ON. MW, 247. M.p. 169-170°. Sol. EtOH. Spar. sol. hot H<sub>2</sub>O. Insol. Et<sub>2</sub>O.

Graebe, *Ann.*, 1904, 335, 129.

**β-Chrysenic Acid (2-Phenyl-1-naphthoic acid, 2-phenylnaphthalene-1-carboxylic acid)** $C_{17}H_{12}O_2$ 

MW, 248

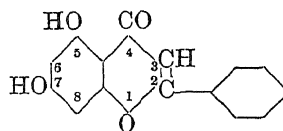
Cryst. from AcOH.Aq. M.p. 114°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, AcOH. Conc. H<sub>2</sub>SO<sub>4</sub> → 1 : 2-benzfluorenone.

*Me ester*: C<sub>18</sub>H<sub>14</sub>O<sub>2</sub> MW, 262. M.p. 75°.

Graebe, *Ann.*, 1904, 335, 129.

**Chrysidine.**

See Benzacridine.

**Chrysin (5 : 7-Dihydroxyflavone)** $C_{15}H_{10}O_4$ 

MW, 254

Pale yellow plates. M.p. 275°. Sol. hot EtOH, hot AcOH, hot aniline. Mod. sol. Et<sub>2</sub>O. Spar. sol. CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>, ligroin. Sol. alkalis to deep yellow sols. Insol. H<sub>2</sub>O. Sublimes.

*7-Me ether*: tectochrysin. C<sub>16</sub>H<sub>12</sub>O<sub>4</sub>. MW, 268. Yellow prisms from EtOH. M.p. 163°.

*5-Acetyl*: needles from EtOH. M.p. 149°.

*Mono-Et ether*: C<sub>17</sub>H<sub>14</sub>O<sub>4</sub>. MW, 282. Needles. M.p. 146°.

*Mono-isoamyl ether*: C<sub>20</sub>H<sub>20</sub>O<sub>4</sub>. MW, 324. Needles. M.p. 125°.

*7-Acetyl*: m.p. 160-5°.

*Diacetyl*: needles from EtOH. M.p. 192°.

Robinson, Venkataraman, *J. Chem. Soc.*, 1926, 2347.

Piccard, *Ber.*, 1877, 10, 176.

Seka, Prosche, *Monatsh.*, 1936, 69, 284.

Warriar *et al.*, *Current Science*, 1937, 5, 475.

**Chrysoaphin fb** $C_{30}H_{26}O_9$ 

MW, 630

Pigment derived from *Aphis fabae*. Fluor. orange cryst from CHCl<sub>3</sub>-CCl<sub>4</sub>. Decomp. above 250°. Sol. CHCl<sub>3</sub>, Me<sub>2</sub>CO, AcOEt, dioxan, Py. Mod. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, EtOH, CCl<sub>4</sub>. Spar. sol. light petroleum. Insol. H<sub>2</sub>O. Neutral or acid sols are yellow with bluish-green fluor. Alkalis

—→ crimson sol. with orange fluor. H·COOH  
 —→ erythroaphin fb. Ac<sub>2</sub>O —→ diacetyl-  
 erythroaphin fb. Light absorption at 268, 326,  
 380, 402, 430, 486 mμ.

Human, Johnson, MacDonald, Todd, *J.*  
*Chem. Soc.*, 1950, 477.

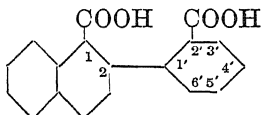
### Chrysoaphin sl

C<sub>30</sub>H<sub>26</sub>O<sub>9</sub> MW, 530

Pigment derived from *Tuberolachnus salignus*.  
 Fluor. orange needles from Et<sub>2</sub>O. M.p. 238–9°.  
 Very sol. Py. Sol. CHCl<sub>3</sub>, Me<sub>2</sub>CO, AcOEt, C<sub>6</sub>H<sub>6</sub>.  
 Spar. sol. CCl<sub>4</sub>, Et<sub>2</sub>O, EtOH. Insol. light  
 petroleum. Sols in org. solvents are yellow with  
 green fluor. Alk. sols crimson —→ green col.  
 H·COOH —→ erythroaphin sl.

Duewell, Johnson, MacDonald, Todd, *J.*  
*Chem. Soc.*, 1950, 485.

### Chrysodiphenic Acid (2-Phenylanthracene- 1 : 2'-dicarboxylic acid)



C<sub>18</sub>H<sub>12</sub>O<sub>4</sub> MW, 292

M.p. 199°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Conc.  
 H<sub>2</sub>SO<sub>4</sub> —→ 1 : 2-benzfluorenone-carboxylic acid.

1-*Me ester*: C<sub>19</sub>H<sub>14</sub>O<sub>4</sub>. MW, 306. Cryst.  
 from MeOH. M.p. 171.5°. Sol. alkalis.

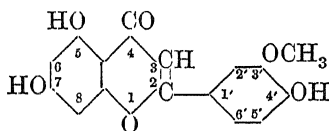
2'-*Me ester*: prisms. M.p. 124°. Sol. alkalis.  
*Di-Me ester*: C<sub>20</sub>H<sub>16</sub>O<sub>4</sub>. MW, 320. Plates.  
 M.p. 90°.

1-*Amide*: C<sub>18</sub>H<sub>13</sub>O<sub>3</sub>N. MW, 291. M.p. 275°.  
 2'-*Amide*: m.p. 220°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.  
 Spar. sol. hot H<sub>2</sub>O.

*Anhydride*: needles from AcOH + little Ac<sub>2</sub>O.  
 M.p. 146°.

Graebe, Gnehm, *Ann.*, 1904, 335, 114.

### Chrysoeriol (5 : 7 : 4'-Trihydroxy-3'-methoxy- flavone)



C<sub>16</sub>H<sub>12</sub>O<sub>6</sub> MW, 300

Flavone from *Fridodictyon glutinosum*, Benth.  
 Golden-yellow plates from EtOH. M.p. above  
 337° (325°). Sol. Py. Spar. sol. EtOH, AcOEt.

*Triacetyl*: m.p. 200° (215°).

Tutin, Clewer, *J. Chem. Soc.*, 1909, 95, 81.

Osterle, *Arch. Pharm.*, 1918, 256, 119.

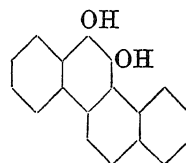
### Chrysofluorene.

See 1 : 2-Benzfluorene.

### Chrysofluorenone.

See 1 : 2-Benzfluorenone.

### Chrysohydroquinone (1 : 2-Dihydroxy- chrysene)



C<sub>18</sub>H<sub>12</sub>O<sub>2</sub> MW, 260

Colourless needles. M.p. 152–4°. Sol. conc.  
 H<sub>2</sub>SO<sub>4</sub> to green sol., changing to blue on warming.  
 Heat at 200° —→ chrysoquinone.

*Diacetyl*: m.p. 225–8°.

Knesch, D.R.P. 151,981, (*Chem. Zentr.*,  
 1904, II, 167).

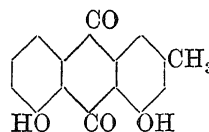
### Chrysoidine.

See 2 : 4-Diaminoazobenzene.

### Chrysoketone.

See 1 : 2-Benzfluorenone.

### Chrysophanic Acid (3-Methylchrysozin, 4 : 5-dihydroxy-2-methylanthraquinone, rheic acid)



C<sub>15</sub>H<sub>10</sub>O<sub>4</sub> MW, 254

Constituent of various species of rhubarb  
 (*Rheum*), of cassia, goa, etc. Golden-yellow  
 cryst. M.p. 196°. Sol. Me<sub>2</sub>CO, AcOH, CHCl<sub>3</sub>,  
 hot EtOH, hot C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O, ligroin,  
 Et<sub>2</sub>O. Sublimes. Conc. H<sub>2</sub>SO<sub>4</sub> —→ red col.  
 Sol. caustic alkalis, hot alk. carbonates. Zn  
 dust dist. —→ 2-methylanthracene.

*Di-Me ether*: C<sub>17</sub>H<sub>14</sub>O<sub>4</sub>. MW, 282. Orange  
 needles. M.p. 195°. Sol. EtOH, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>,  
 AcOH.

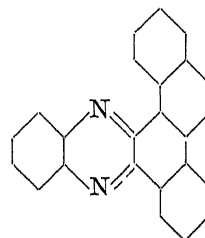
*Diacetyl*: yellow needles. M.p. 204–5°. Sol.  
 AcOH.

*Dibenzoyl*: prisms. M.p. 200°.

Naylor, Gardner, *J. Am. Chem. Soc.*,  
 1931, 53, 4114.

Gardner, *J. Am. Pharm. Assoc.*, 1934,  
 23, 1178.

### Chrysofenazine



C<sub>24</sub>H<sub>14</sub>N<sub>2</sub>

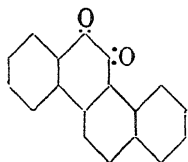
MW, 330

Yellow needles from Py-EtOH. M.p. 215-16°. (Cryst. from PhNO<sub>2</sub>, m.p. 207-8°; cryst. from AcOH, m.p. 199°).

Newman, *J. Am. Chem. Soc.*, 1938, **60**, 2947.

Singh, Dutt, *Chem. Abstracts*, 1939, **33**, 1943.

### Chrysoquinone (*Chrysenequinone*)



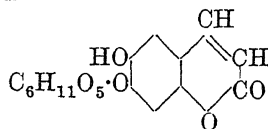
C<sub>18</sub>H<sub>10</sub>O<sub>2</sub> MW, 258

Reddish needles. M.p. 239.5°. Mod. sol. hot EtOH, hot C<sub>6</sub>H<sub>6</sub>. Spar. sol. cold AcOH, toluene. Very spar. sol. Et<sub>2</sub>O. Sublimes. Conc. H<sub>2</sub>SO<sub>4</sub> → blue sol. KOH fusion → α- and β-chrysenic acids. KMnO<sub>4</sub> → diphthalic acid → phthalic acid. Hot SO<sub>2</sub>Aq., or Zn dust + KOH → chrysohydroquinone. Dist. with PbO → 1:2-benzfluorenone.

*Monoxime*: orange cryst. M.p. 161°. Mod. sol. EtOH, AcOH, C<sub>6</sub>H<sub>6</sub>. Sol. conc. H<sub>2</sub>SO<sub>4</sub> to deep reddish-violet sol.

Graebe, Hönlingsberger, *Ann.*, 1900, **311**, 262.

### Cichoriin



C<sub>15</sub>H<sub>16</sub>O<sub>9</sub> MW, 340

Glucoside from *Cichotium intybus*, Linn., isomeric with aesculin. Needles + 2H<sub>2</sub>O from H<sub>2</sub>O. Anhyd. at 120-30°. M.p. 215-20°. Sol. EtOH. Insol. Et<sub>2</sub>O. Dil. H<sub>2</sub>SO<sub>4</sub> → aesculetin + glucose. Reduces NH<sub>3</sub>.AgNO<sub>3</sub>.

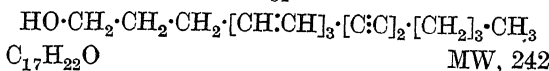
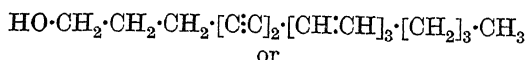
*Me ether*: m.p. 218°. Hygroscopic.

*Penta-acetyl*: m.p. 217-8°.

Merz, *Arch. Pharm.*, 1932, **270**, 476.

Head, Robertson, *J. Chem. Soc.*, 1939, 1266.

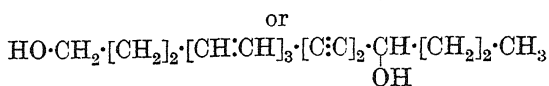
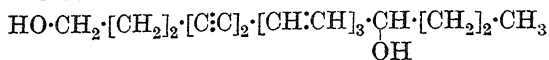
### Cicutol



Occurs in *Cicuta virosa*. Cryst. M.p. 66°. [α]<sub>D</sub> 0° in EtOH.

Anet, Lythgoe, Silk, Trippett, *Chemistry and Industry*, 1952, 757.

### Cicutoxin



C<sub>17</sub>H<sub>22</sub>O<sub>2</sub> MW, 258

Convulsant poison occurring in *Cicuta virosa*. Cryst. M.p. 54°. [α]<sub>D</sub> -4.5° in EtOH. UV absorption maxima at 242, 252, 287 (inflexion), 303 (inflexion), 318.5 and 333.5 mμ.

Anet, Lythgoe, Silk, Trippett, *Chemistry and Industry*, 1952, 757.

### Cignolin

See Anthralin.

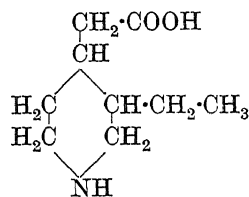
### Cinchol.

See β-Sitosterol.

### Cincholeuponic Acid.

See Cincholoiponic Acid.

### Cincholoipon (3-Ethyl-4-piperidylacetic acid)



C<sub>9</sub>H<sub>17</sub>O<sub>2</sub>N MW, 171

*l.*  
*B,HCl*: m.p. 202-3° (198-200°). [α]<sub>D</sub><sup>19</sup> -4.6° in H<sub>2</sub>O.

*Me ester*: b.p. 122-4°/12 mm.

*Et ester*: b.p. 137-8°/11 mm., 81.5-84.0°/0.04 mm. D<sub>4</sub><sup>20</sup> 0.9918. n<sub>D</sub> 1.4675. [α]<sub>D</sub><sup>17</sup> +16.75. *B,HCl*: cryst. from Me<sub>2</sub>CO. M.p. 159-60°. [α]<sub>D</sub><sup>23</sup> -9.3° in EtOH, [α]<sub>D</sub><sup>22</sup> -7° in H<sub>2</sub>O.

*Hydrazide*: needles from EtOH. M.p. 115°.

*dl.*

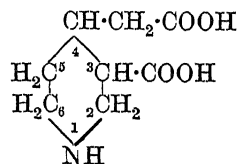
*Et ester*: b.p. 133-5°/11 mm. D<sub>4</sub><sup>20</sup> 0.9910 n<sub>D</sub><sup>20</sup> 1.4672. *B,HCl*: cryst. from AcOEt-CHCl<sub>3</sub>. M.p. 130-1°.

Schöpf *et al.*, *Ann.*, 1928, **465**, 97.

Prelog, Zalan, *Helv. Chim. Acta*, 1944, **27**, 535.

Stork, McElvain, *J. Am. Chem. Soc.*, 1946, **68**, 1053.

### Cincholoiponic Acid (3-Carboxypiperidyl-4-acetic acid, cincholeuponic acid)

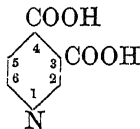


C<sub>8</sub>H<sub>13</sub>O<sub>4</sub>N MW, 187



*α*-Form :*dl.*M.p. anhyd. 211°. Very sol. H<sub>2</sub>O. Insol. EtOH, Et<sub>2</sub>O.*B, HCl*: m.p. 212-3°.*Anhydride*: *N*-acetyl, m.p. 121°.*N*-Acetyl: m.p. 175°.*N*-Nitroso: prisms from H<sub>2</sub>O. M.p. 152-3°.*d.*M.p. 253°.  $[\alpha]_D^{20} +34.90^\circ$  in H<sub>2</sub>O.*l.*M.p. 253°.  $[\alpha]_D^{20} -35.0^\circ$  in H<sub>2</sub>O.*β*-Form :*dl.*

M.p. 248-9°.

*B, HCl*: m.p. 223-4°.*Anhydride*: *N*-acetyl, m.p. 135-6°.*N*-Acetyl: m.p. 184-5°.*N*-Nitroso: cryst. from H<sub>2</sub>O. M.p. 157-8°.*d.*Prisms + H<sub>2</sub>O. M.p. 126-7°, anhyd. 225-6°. Very sol. H<sub>2</sub>O. Insol. EtOH, Et<sub>2</sub>O.  $[\alpha]_D^{20} +30.1^\circ$  in H<sub>2</sub>O.*B, HCl*: m.p. 192-4°.  $[\alpha]_D^{20} +38.04^\circ$  in H<sub>2</sub>O.*N*-Acetyl: m.p. 167-8°.  $[\alpha]_D^{20} +19.9^\circ$  in H<sub>2</sub>O.*N*-Nitroso: plates or prisms from H<sub>2</sub>O. M.p. 161-4°.*l.**B, HCl*: m.p. 192-4°.  $[\alpha]_D^{20} -36.51^\circ$  in H<sub>2</sub>O.*N*-Acetyl: m.p. 167-8°.  $[\alpha]_D^{20} +19.86^\circ$  in H<sub>2</sub>O.Wohl, Losanitsch, *Ber.*, 1907, 40, 4698.Wohl, Maag, *Ber.*, 1909, 42, 627.**Cinchomeric Acid** (*Pyridine*-3:4-*dicarboxylic acid*)C<sub>7</sub>H<sub>5</sub>O<sub>4</sub>N

MW, 167

Prisms from H<sub>2</sub>O. M.p. 260° decomp. Spar. sol. EtOH, hot H<sub>2</sub>O. Prac. insol. Et<sub>2</sub>O. Insol. CHCl<sub>3</sub>. Heat with lime → pyridine. CH<sub>3</sub>I → apophyllenic acid.*3-Me ester*: C<sub>8</sub>H<sub>7</sub>O<sub>4</sub>N. MW, 181. M.p. 182°.*4-Me ester*: m.p. 154-72° (depending on rate of heating).*Di-Me ester*: C<sub>9</sub>H<sub>9</sub>O<sub>4</sub>N. MW, 195. M.p. 141°.*4-Et ester*: C<sub>9</sub>H<sub>9</sub>O<sub>4</sub>N. MW, 195. Plates from C<sub>6</sub>H<sub>6</sub>. M.p. 131-3°. Mod. sol. H<sub>2</sub>O, EtOH, C<sub>6</sub>H<sub>6</sub>.*Di-Et ester*: C<sub>11</sub>H<sub>13</sub>O<sub>4</sub>N. MW, 223. B.p. 172°/21 mm. Sol. EtOH, Et<sub>2</sub>O, ligroin.*3-Amide*: C<sub>7</sub>H<sub>6</sub>O<sub>3</sub>N<sub>2</sub>. MW, 166. Cryst. from H<sub>2</sub>O. M.p. about 200° decomp.*4-Amide*: plates + H<sub>2</sub>O. M.p. 170° decomp.*Diamide*: C<sub>7</sub>H<sub>7</sub>O<sub>2</sub>N<sub>3</sub>. MW, 165. M.p. 163-5° decomp. Sol. H<sub>2</sub>O. Insol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.*Anhydride*: C<sub>7</sub>H<sub>3</sub>O<sub>3</sub>N. MW, 149. M.p. 77-8°. Unstable.*Imide*: C<sub>7</sub>H<sub>4</sub>O<sub>2</sub>N<sub>2</sub>. MW, 148. M.p. 229-30°. Sublimes.*Dianilide*: needles. M.p. 199-206°.Weidel, Schmidt, *Ber.*, 1879, 12, 1146.Niementowski, Frühling, Joszt, *Chem.**Abstracts*, 1928, 22, 2167.Kirpal, *Monatsh.*, 1902, 23, 248.**Cinchonicine.**

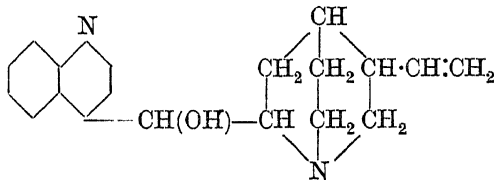
See Cinchotoxine.

**Cinchonidine**C<sub>19</sub>H<sub>22</sub>ON<sub>2</sub>

MW, 294

Alkaloid of cinchona bark (chief alkaloid of *Cinchona succirubra*, Pav.). Prisms. M.p. 210-5°. Sol. CHCl<sub>3</sub>, EtOH. Mod. sol. Et<sub>2</sub>O. Prac. insol. H<sub>2</sub>O.  $[\alpha]_D^{25} -107.48^\circ$  in EtOH. Stereoisomer of cinchonine.*B, HCl, 2H<sub>2</sub>O*: softens at 160-70°. M.p. 242° decomp.  $[\alpha]_D^{20} -117.6^\circ$  in H<sub>2</sub>O.*Acetyl deriv.*: m.p. 47-9°.*Benzoyl deriv.*: m.p. 183°.*Benzenesulphonyl deriv.*: m.p. 166°.*Picrate*: m.p. 208-9°.Hesse, *Ann.*, 1880, 205, 196.Heidelberger, Jacobs, *J. Am. Chem. Soc.*, 1919, 41, 819.Rabe, *Ber.*, 1922, 55, 522.**Cinchonigine.**

See under Isocinchonine.

**Cinchonine**C<sub>19</sub>H<sub>22</sub>ON<sub>2</sub>

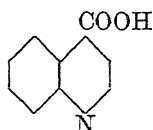
MW, 294

One of the cinchona alkaloids. Needles. M.p. 255° (264°). Sublimes at 220°. Sol. amyl alcohol. Mod. sol. EtOH, CHCl<sub>3</sub>. Spar. sol. Et<sub>2</sub>O. Prac. insol. H<sub>2</sub>O.  $[\alpha]_D +229^\circ$  in EtOH.*O*-Acetyl: amorph. M.p. 51-3°.  $[\alpha]_D^{25} +114.1^\circ$  in EtOH.*O*-Benzoyl: prisms from Et<sub>2</sub>O. M.p. 105-6°.  $[\alpha]_D^{25} -22.3^\circ$  in EtOH.*O*-Benzenesulphonyl: cryst. from Et<sub>2</sub>O.  $[\alpha]_D^{20} +62.2^\circ$  in CHCl<sub>3</sub>.*O*-*p*-Toluenesulphonyl: m.p. 173°.  $[\alpha]_D^{20} +51^\circ$ .*B, HCl*: m.p. 166°.  $[\alpha]_D^{20} +45.5^\circ$ .*Picrate*: m.p. 193-4°.*Styphnate*: m.p. 106°.Martinotti, *Industria chimica*, 1931, 6, 395.Rabe, Buchholz, *Ber.*, 1908, 41, 62.Rabe, *Ber.*, 1922, 55, 522.

ψ-Cinchonine.

See Cinchotine.

Cinchonic Acid (Quinoline-4-carboxylic acid)



$C_{10}H_7O_2N$  MW, 173

Needles + 1 or 2H<sub>2</sub>O. M.p. 253-4°. Spar. sol. H<sub>2</sub>O, EtOH. Insol. Et<sub>2</sub>O.  $KMnO_4 \rightarrow$  pyridine-2 : 3 : 4-tricarboxylic acid.  $HNO_3 \rightarrow$  quinolinic and cinchomeronic acids.

Me ester :  $C_{11}H_9O_2N$ . MW, 187. M.p. 24°.

Et ester :  $C_{12}H_{11}O_2N$ . MW, 201. M.p. 13°. B.p. 173°/15 mm. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

Chloride :  $C_{10}H_6ONCl$ . MW, 191.5. Yellow needles. M.p. 68°. B.p. 210° part. decomp., 148°/12 mm. B.HCl : m.p. 170°.

Amide :  $C_{10}H_8ON_2$ . MW, 172. Needles. M.p. 181°. Sol. hot H<sub>2</sub>O, hot EtOH.

Anhydride :  $C_{20}H_{12}O_3N_2$ . MW, 328. M.p. 245° decomp. B.p. 245-50°/1 mm.

Nitrile : 4-cyanoquinoline.  $C_{10}H_6N_2$ . MW, 154. M.p. 102°. Volatile in steam. B.HAuCl<sub>4</sub> : m.p. 232°. Methiodide : red needles. M.p. 216° decomp.

Methiodide : orange-red cryst. M.p. 222°.

Thielepape, *Ber.*, 1938, 71, 387.

Meyer, *Rec. trav. chim.*, 1925, 44, 323.

Koenigs, *Ber.*, 1879, 12, 97.

Kaufmann, *Ber.*, 1918, 51, 116.

S.C.I., B.P. 451,746, (*Chem. Abstracts*, 1937, 31, 429); Swiss P. 186,664,

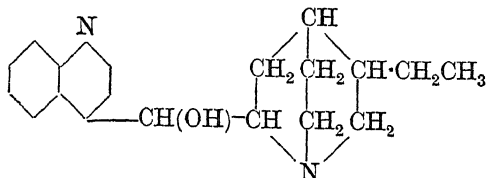
(*Chem. Abstracts*, 1937, 31, 5110).

Späth, Spitzer, *Ber.*, 1926, 59, 1484.

Cinchophene.

See 2-Phenylquinoline-4-carboxylic Acid.

Cinchotine (ψ-Cinchonine, hydrocinchonine)



$C_{18}H_{24}ON_2$  MW, 296

Occurs naturally in association with cinchonine. Prisms. M.p. 263-9°.  $[\alpha]_D^{25} + 204.5$  in EtOH.

B.HCl : m.p. anhyd. 220-1°.

B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub> : needles. M.p. anhyd. 195°.

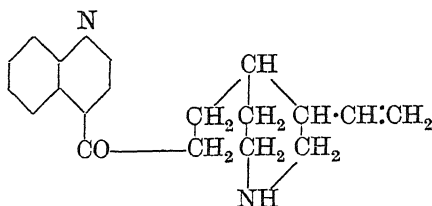
Hesse, *Ann.*, 1898, 300, 44.

Pum, *Monatsh.*, 1895, 16, 68.

Heidelberger, Jacobs, *J. Am. Chem. Soc.*, 1919, 41, 817.

Kaufmann, Huber, *Ber.*, 1913, 46, 2923.

Cinchotoxine (Cinchonicine)



$C_{19}H_{22}ON_2$  MW, 294

Needles. M.p. 58-60°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O.  $[\alpha]_D^{15} + 47.2$  in EtOH or CHCl<sub>3</sub>.

B,HI : prisms from H<sub>2</sub>O or EtOH. M.p. 176-7°.

N-Benzyl :  $C_{26}H_{28}ON_2$ . MW, 384. M.p. 115-16°.  $[\alpha]_D^{18} + 72$ . Picrate : m.p. 125°. Picrolonate : m.p. 157°.

Phenylhydrazone : yellow cryst. from EtOH-pet. ether. M.p. 148°.

Methiodide : m.p. 159°.

Miller, Rohde, *Ber.*, 1900, 33, 3214.

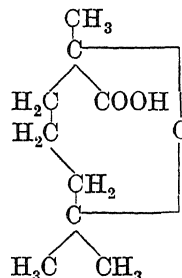
Comanducci, *Chem. Zentr.*, 1910, I, 1886-7.

Rabe, *Ber.*, 1922, 55, 522.

Cinene.

See Limonene.

Cinenic Acid



$C_9H_{16}O_2$  MW, 172

α-

Cryst. + H<sub>2</sub>O from EtOH.Aq. M.p. 76°, anhyd 83-4°. B.p. 245-7°, 127.5-9.5°/14 mm. Volatile in steam. Sol. most org. solvents. Mod. sol. boiling H<sub>2</sub>O.

Me ester :  $C_{10}H_{18}O_3$ . MW, 186. B.p. 86-9°/14 mm.

Et ester :  $C_{11}H_{20}O_3$ . MW, 200. B.p. 89-90°/10 mm.

Amide :  $C_9H_{17}O_2N$ . MW, 171. Needles. M.p. 86-7°.

Nitrile :  $C_9H_{15}ON$ . MW, 153. B.p. 74.5°/9 mm.

Benzylamine salt : m.p. 147°.

β-

B.p. 127-8°/12 mm.  $D_4^{20}$  1.0385.  $n_D^{20}$  1.4508.

Me ester : b.p. 89°/11 mm.

Et ester : b.p. 92-3°/12 mm.

Either acid with HBr → 5-bromo-1-hydroxy-1:5-dimethylheptico acid.

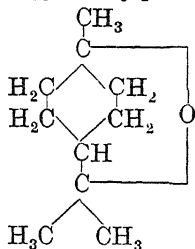
Rupe *et al.*, *Ber.*, 1905, **38**, 1502; 1908,

**41**, 3952; *J. prakt. Chem.*, 1917, **96**, 59.

Rupe, Hirschmann, *Helv. Chim. Acta*, 1933, **16**, 505.

Cologne, Lagier, *Bull. soc. chim.*, 1949, 24.

**Cineole** (*Eucalyptol*, *cajeputol*, *cineol-1.8*)



$C_{10}H_{18}O$

MW, 154

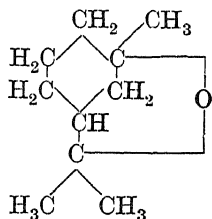
Constituent of oils of eucalyptus, cajeput, wormseed and lavender. M.p. +1.5°. B.p. 176-7°.  $D^{20}$  0.9267.  $n_D^{25}$  1.4584. Heat of comb. 1460.1 Cal. Forms add comp. with  $H_3PO_4$  (m.p. 80°), with resorcinol and other phenols.

*Hydromide*: m.p. 56°.

Wallach *et al.*, *Ann.*, 1888, **246**, 268; 1890, **258**, 319; 1892, **271**, 20.

Rheinische Kampfer Fabrik. Ges., B.P. 345,517, (*Chem. Abstracts*, 1932, **26**, 1947).

**m-Cineole**



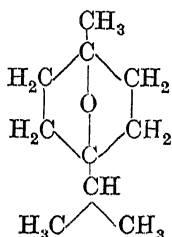
$C_{10}H_{18}O$

MW, 154

B.p. 177-8°/765 mm., 85-95°/20 mm.

Perkin, Tattersall, *J. Chem. Soc.*, 1907, **91**, 495, 502.

**Cineole-1:4**



$C_{10}H_{18}O$

MW, 154

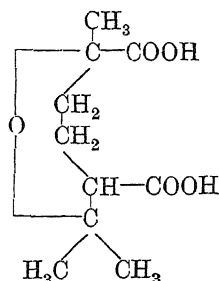
B.p. 173-4°.  $D^{20}$  0.8997.  $n_D^{25}$  1.4479.

Austerweil, *Bull. soc. chim.*, 1929, **45**, 862.

Wallach, *Ann.*, 1912, **392**, 62.

Hercules Powder Co., U.S.P. 1,994,131, (*Chem. Abstracts*, 1935, **29**, 2978).

**Cineolic Acid**



$C_{10}H_{16}O_5$

MW, 216

*d.*

Cryst. +  $H_2O$  from  $H_2O$ . M.p. 79°, anhyd. 138-9°. Sol. EtOH, AcOEt,  $CHCl_3$ . Less sol.  $Et_2O$ . Spar. sol.  $C_6H_6$ , ligroin.  $[\alpha]_D^{20} + 18.6^\circ$  in  $H_2O$ .

*l.*

Rhomboheda +  $H_2O$ . M.p. 79°, anhyd. 138-9°.  $[\alpha]_D^{20} - 19.1^\circ$  in  $H_2O$ .

*dl.*

Cryst. M.p. 196-7° decomp. Sol. hot  $H_2O$ . Spar. sol.  $CHCl_3$ .  $KMnO_4$  or  $HNO_3$  → oxalic acid.

*Di-Me ester*:  $C_{12}H_{20}O_5$ . MW, 244. M.p. 31°.

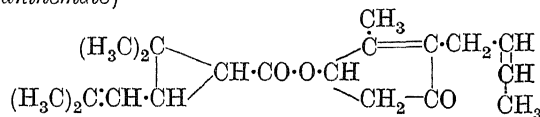
*Di-Et ester*:  $C_{14}H_{24}O_5$ . MW, 272. B.p. 155°/12 mm.

*Anhydride*:  $C_{10}H_{14}O_4$ . MW, 198. Needles. M.p. 77-8°. B.p. 157°/12 mm. Sol.  $CHCl_3$ ,  $C_6H_6$ .

Wallach, Gildermeister, *Ann.*, 1888, **246**, 268.

Rupe, *Ber.*, 1900, **33**, 1129, 3541; 1901, **34**, 2196, 2204.

**Cinerin I** ( $\pm$ -*cis-Cineronyl* +  $\pm$ -*trans-chrysanthemate*)



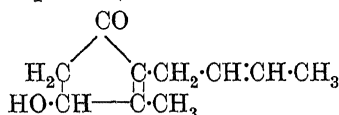
$C_{20}H_{28}O_3$

MW, 316

Insecticide present in flower heads of *Chrysanthemum cinerariifolium* (pyrethrum). B.p. 132°/5 × 10<sup>-3</sup> mm.  $n_D^{20}$  1.5043. Hyd. → chrysanthemum-monocarboxylic acid + cinerolone.

Crombie, Harper, *J. Chem. Soc.*, 1950, 1152.

**Cinerolone** (*5-Hydroxy-3-keto-1-methyl-2-β-butenylcyclopentene*)



$C_{10}H_{14}O_2$

MW, 166

*Cis.* "Natural" cinerolone.

*d*-.  
Oil. B.p. 180-4°/1 mm.  $n_D^{25}$  1.5214.  $[\alpha]_D^{25}$   
+ 9.9° in EtOH.

*dl*-.  
Oil. B.p. 102-5°/0.05 mm.  $n_D^{20}$  1.5120.  
*Acetyl*: cryst. M.p. 147-8° (rapid heat).  
*Semicarbazone*: cryst. M.p. 197-9° decomp.

*Trans*-.  
*dl*-.  
Oil. B.p. 116-18°/0.6 mm.  $n_D^{25}$  1.5124.  
*Semicarbazone*: cryst. M.p. 208-9°.

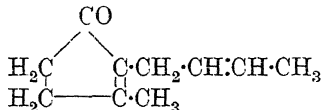
Crombie, Harper, *J. Chem. Soc.*, 1950,  
1152.

Schechter, Green, LaForge, *J. Am. Chem.  
Soc.*, 1949, 71, 3165.

LaForge, Barthel, *J. Org. Chem.*, 1945,  
10, 106, 114.

West, *J. Chem. Soc.*, 1946, 463.

**Cinerone** (3-Keto-1-methyl-2-β-butenylcyclo-  
pentene)



$\text{C}_{10}\text{H}_{14}\text{O}$  MW, 150

*Cis*-. "Natural" cinerone.

B.p. 120°/15 mm.  $n_D^{20}$  1.5002.

*Semicarbazone*: leaflets from EtOH. M.p.  
213-14° decomp.

*p*-Nitrophenylhydrazone: m.p. 148-50°.

2:4-Dinitrophenylhydrazone. dark red  
needles. M.p. 137-8°.

*Trans*-.  
B.p. 130°/27 mm., 107-113°/9 mm.  $n_D^{20}$   
1.5002,  $n_D^{25}$  1.4980.

*Semicarbazone*: m.p. 210-15°.

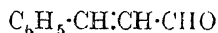
*p*-Nitrophenylhydrazone: m.p. 158-9°.

Crombie, Harper, *J. Chem. Soc.*, 1950,  
1152.

LaForge, Green, Gersdorff, *J. Am. Chem  
Soc.*, 1948, 70, 3707.

**Cinnamal**-.  
*See* Cinnamylidene-.

**Cinnamaldehyde** (*Cinnamic aldehyde*, 2-  
*phenylacrolein*, *styrone*)



$\text{C}_9\text{H}_8\text{O}$  MW, 132

Constituent of cinnamon and cassia oils.  
F.p. -7.5°. B.p. 252° part. decomp., 210°/250  
mm., 130°/20 mm. Sol. 70% EtOH, Et<sub>2</sub>O.  
Slightly sol. H<sub>2</sub>O. Insol. pet. ether.  $D_4^{20}$  1.0497.  
 $n_D^{20}$  1.61949. Heat of comb.  $C_p$  1112.9 Cal.,  
 $C_v$  1112.0 Cal. Volatile in steam. Oxidises in  
air to cinnamic acid. Forms bisulphite comp.  
syn.-*Oxime*: needles. M.p. 138.5°. *Acetyl  
deriv.*: m.p. 69-70°.

anti-*Oxime*: m.p. 64-5°. *Acetyl deriv.*: m.p.  
35.5°.

*Semicarbazone*: m.p. 208° (217°).

2-Methylsemicarbazone: m.p. 155°.

4-Methylsemicarbazone: m.p. 194°.

2:4-Dimethylsemicarbazone: m.p. 114°.

4:4-Dimethylsemicarbazone: m.p. 207°.

*Phenylhydrazone*: m.p. 168°.

2:4-Dinitrophenylhydrazone: m.p. 200.5-  
201.5° (251°).

*Di-Me acetal*: b.p. 125-7°/11 mm.  $D^{17}$  1.021.

*Di-Et acetal*: b.p. 264-8°, 140-2°/12 mm.  
 $D^{15}$  0.981.

*Cyanhydrin*: *see under* Styrylglycollic Acid.

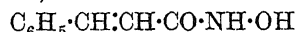
Bert, Annequin, *Compt. rend.*, 1931, 192,  
1315.

Braun, Rudolph, Kröper, Pinkernelle,  
*Ber.*, 1934, 67, 269.

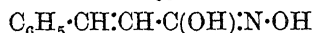
**Cinnamene**.

*See* Styrene.

**Cinnamhydroxamic Acid** (*N*-Cinnamoyl-  
*hydroxylamine*)



or



$\text{C}_9\text{H}_9\text{O}_2\text{N}$  MW, 163

Plates from CHCl<sub>3</sub>. M.p. 111°. Sol. EtOH,  
Et<sub>2</sub>O, hot H<sub>2</sub>O. Insol. C<sub>6</sub>H<sub>6</sub>. FeCl<sub>3</sub> → violet  
col.

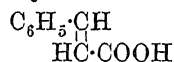
*Acetyl deriv.*: m.p. 112°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>,  
AcOH. Hot H<sub>2</sub>O → cinnamic acid.

*Benzoyl deriv.*: needles from EtOH. M.p.  
144°. Insol. H<sub>2</sub>O, Et<sub>2</sub>O.

Thiele, Pickard, *Ann.*, 1899, 309, 194.

**Cinnamic Acid** (2-Phenylacrylic acid)

*Trans*-. ordinary cinnamic acid



$\text{C}_9\text{H}_8\text{O}_2$  MW, 148

Occurs as free acid and as esters in storax,  
Peruvian balsam and other resins. Monoclinic,  
colourless cryst. M.p. 133°. B.p. 300°. Sol.  
3500 parts H<sub>2</sub>O at 17°, 4.2 parts abs. EtOH  
at 20°, 17 parts CHCl<sub>3</sub> at 15°. Sol. Et<sub>2</sub>O.  $D_4$   
1.2475. Heat of comb.  $C_p$  1040.1 Cal.,  $C_v$   
1044.1 Cal.  $k = 3.5 \times 10^{-5}$  at 25°. Volatile  
in steam. Protracted heating → styrone +  
CO<sub>2</sub>. Hot alk. KMnO<sub>4</sub> or CrO<sub>3</sub> → benzalde-  
hyde. NaHg → hydrocinnamic acid. The  
NH<sub>4</sub>, Na, and K salts are sol. H<sub>2</sub>O. Ca and  
Ba salts spar. sol. H<sub>2</sub>O.

*Propyl ester*: C<sub>12</sub>H<sub>14</sub>O<sub>2</sub>. MW, 190. B.p.  
285°.  $D_0^{20}$  1.0435.

*Isobutyl ester*: C<sub>13</sub>H<sub>16</sub>O<sub>2</sub>. MW, 204. B.p.  
165°/17 mm.

*d*-*Amyl ester*: C<sub>14</sub>H<sub>18</sub>O<sub>2</sub>. MW, 218. B.p.  
192°/29 mm.  $D_4^{20}$  0.999.

*Phenyl ester*: C<sub>15</sub>H<sub>12</sub>O<sub>2</sub>. MW, 224. M.p.  
72-3°. B.p. 205-7°/15 mm. Dist. → stil-  
bene.

*Anhydride*:  $C_{18}H_{14}O_3$ . MW, 278. Needles. M.p. 136°. Sol.  $C_6H_6$ . Mod. sol. hot EtOH.

*Chloride*: cinnamoyl chloride.  $C_9H_7OCl$ . MW, 166.5. M.p. 36°. B.p. 170°/58 mm., 131°/11 mm. Sol. pet. ether,  $CCl_4$ .

*Amide*:  $C_9H_9ON$ . MW, 147. Needles. M.p. 147° (144°, 141°). Sol. EtOH,  $Et_2O$ ,  $CS_2$ , HCl.Aq. Spar. sol. hot  $H_2O$ .

*Nitrile*: styryl cyanide.  $C_9H_7N$ . MW, 129. M.p. 20-1° (11°). B.p. 255-6°, 159°/280 mm., 134°/12 mm. Sol. EtOH.  $D_4^{20}$  1.037.

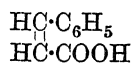
*Hydrazide*: cinnamoylhydrazine.  $C_9H_{10}ON_2$ . MW, 162. Needles. M.p. 101°. Sol. hot  $H_2O$ .

*Dibromide*: see  $\alpha$ : $\beta$ -Dibromohydrocinnamic Acid.

*Dichloride*: see  $\alpha$ : $\beta$ -Dichlorohydrocinnamic Acid.

*Anilide*: m.p. 109° (153°).

*Cis* -:



Occurs in three crystalline forms.

(1) The most stable has m.p. 68° and is commonly called *allocinnamic acid*. It distills in high vacuum at 95°.  $k = 14.2 \times 10^{-5}$  at 25°.

*Ca salt*,  $2H_2O$ : m.p. 90°.

The other two forms are both called *isocinnamic acid*.

(2) Long prisms from ligroin. M.p. 58°. B.p. 265°  $\rightarrow$  *trans*-form. Sol. EtOH,  $CHCl_3$ , ligroin. NaHg  $\rightarrow$  hydrocinnamic acid.  $k = 14.1 \times 10^{-5}$  at 25°.

(3) M.p. 42°. Sol. AcOH. Heat  $\rightarrow$  (1).  $KMnO_4 \rightarrow$  benzaldehyde.  $k = 13.8 \times 10^{-5}$  at 25°.

Berthoud, Urech, *Helv. Chim. Acta*, 1930, 13, 437.

Stobbe, Reuss, *Ber.*, 1911, 44, 2735, 2739. de Jong, *Ber.*, 1922, 55, 463.

Rodionov, *J. Am. Chem. Soc.*, 1929, 51, 847.

Kao, Ma, *J. Chem. Soc.*, 1931, 443.

Robinson, James, *J. Chem. Soc.*, 1933, 1453.

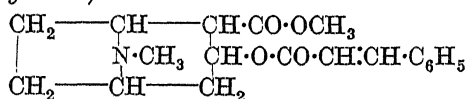
Rutkovskii, Brodskii, *Russ. P.* 23,396. (*Chem. Abstracts*, 1932, 26, 1623).

Bacharach, U.S.P. 1,853,030, (*Chem. Abstracts*, 1932, 26, 3264).

### Cinnamol.

See Styrene.

*Cinnamoylcocaine* (*Cinnamoyl ecgonine methyl ester*)



$C_{19}H_{23}O_4N$  MW, 329

Chief alkaloid of Java coca leaves. Needles from  $C_6H_6$ . M.p. 121°. Sol. ord. org. solvents. Insol.  $H_2O$ .  $[\alpha]_D^{20}$  -4.7° in  $CHCl_3$ .

*B,HCl,2H\_2O*: needles. M.p. anhyd. 176°.

*B,H AuCl\_4*: m.p. 156°.

*B\_2,H\_2PtCl\_6*: m.p. 217°.

*d* -.

Prisms. M.p. 68°.  $[\alpha]_D^{20}$  +2° in EtOH.

*B,HCl*: needles. M.p. 186°.

*B,H AuCl\_4*: m.p. 164°.

*B\_2,H\_2PtCl\_6*: m.p. 208°.

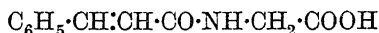
Liebermann, *Ber.*, 1888, 21, 3372.

Deckers, Einhorn, *Ber.*, 1891, 24, 7.

### 4-Cinnamoyldiphenyl Ether.

See under 4'-Hydroxychalkone.

*Cinnamoylglycine* (*Cinnamoylaminoacetic acid*)



$C_{11}H_{11}O_3N$  MW, 205

Needles. M.p. 197° (193-4°). Sol. AcOEt. Mod. sol. hot EtOH. Spar. sol.  $H_2O$ . Prac. insol.  $Et_2O$ ,  $CHCl_3$ , pet. ether.

*Et ester*:  $C_{13}H_{15}O_3N$ . MW, 233. M.p. 108°. Sol. EtOH,  $Et_2O$ ,  $C_6H_6$ .

*Nitrile*:  $C_{11}H_{10}ON_2$ . MW, 186. M.p. 154°. Sol. EtOH.

Dakin, *J. Biol. Chem.*, 1909, 5, 303.

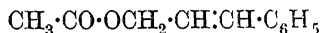
### Cinnamoylhydrazine.

See under Cinnamic Acid.

### Cinnamoylhydroxylamine.

See Cinnamhydroxamic Acid.

### Cinnamyl acetate



$C_{11}H_{12}O_2$  MW, 176

Constituent of cassia oil. B.p. 141°/18 mm, 135-40°/11 mm.  $D_4^{20}$  1.0567.  $n_D^{20}$  1.54415.

Bert, Dorier, *Compt. rend.*, 1930, 191, 332.

Duyk, *J. Chem. Soc.*, 1897, 62, 358.

### Cinnamylacetic Acid.

See 3-Benzylidenebutyric Acid.

*Cinnamyl Alcohol* (*3-Phenylallyl alcohol, styryl alcohol*)



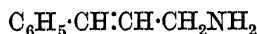
$C_9H_{10}O$  MW, 134

Constituent of storax and Peruvian balsam mainly as ester of cinnamic acid. Needles. M.p. 33°. B.p. 257.5°, 143-5°/14 mm. Sol. EtOH,  $Et_2O$ . Mod. sol.  $H_2O$ .  $D_4^{20}$  1.0440.  $n_D^{20}$  1.58190.  $CrO_3 \rightarrow$  cinnamic acid.

Bert, Dorier, *Compt. rend.*, 1930, 191, 332.

Young, Hartung, Crossley, *J. Am. Chem. Soc.*, 1936, 58, 100.

*Cinnamylamine* (*Styrylamine,  $\gamma$ -aminoprop-*enyl*benzene, 1-phenylallylamine*)



$C_9H_{11}N$  MW, 133

B.p. 235-7°/775 mm. Spar. volatile in steam. *B, HCl*: m.p. 236° (212°). Mod. sol. H<sub>2</sub>O. *B<sub>2</sub>, 2HCl, HgCl<sub>2</sub>*: cryst. from H<sub>2</sub>O. M.p. 189°. *B, H<sub>2</sub>AuCl<sub>4</sub>*: brick-red plates. M.p. 138-9° decomp.

*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 217-18° (205-7°).

*Picrate*: m.p. 173° (179-80°).

*N-Me*: b.p. 148-50°/30 mm. *B, HCl*: plates from Me<sub>2</sub>CO. M.p. 151-5°. *B, H<sub>2</sub>AuCl<sub>4</sub>*: yellow plates. M.p. 103°. *B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: reddish-yellow needles. M.p. 212° decomp. *B, HCl, HgCl<sub>2</sub>*: needles from H<sub>2</sub>O. M.p. 166°. *Picrate*: yellow plates from H<sub>2</sub>O. M.p. 147°. *Benzoyl*: m.p. 187-5°.

*N-Me-N-Ph*: b.p. 153°/0.33 mm. *n<sub>D</sub><sup>25</sup>* 1.6231. *Picrate*: m.p. 127-8° decomp.

*N-Me-N-Benzyl*: b.p. 175-80°/10 mm. *B, HCl*: m.p. 141-2°.

*N-Di-Et*: b.p. 146-7°/25 mm. *B, HCl*: m.p. 141°. *Picrate*: m.p. 130°.

Posner, *Ber.*, 1893, 26, 1858.

Schmidt, *Arch. Pharm.*, 1905, 243, 78.

Emde, *Arch. Pharm.*, 1911, 249, 98; 1906, 244, 272.

Franke, *Arch. Pharm.*, 1909, 247, 335.

Emde, Franke, *ibid.*, 340.

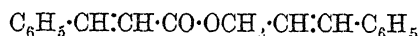
### Cinnamyl bromide.

See 3-Bromo-1-phenylpropylene.

### Cinnamyl chloride.

See 3-Chloro-1-phenylpropylene.

### Cinnamyl cinnamate (*Styracin*)



C<sub>18</sub>H<sub>16</sub>O<sub>2</sub> MW, 264

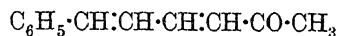
Occurs in storax and Peruvian balsam. Needles. M.p. 44°. Sol. EtOH, Et<sub>2</sub>O. *D<sub>4</sub>* 1.1565.

Tschirch, Werdmüller, *Chem. Zentr.*, 1910, II, 1295.

### Cinnamylideneacetic Acid.

See 2-Styrylacrylic Acid.

### Cinnamylideneacetone (*Cinnamalacetone*)



C<sub>12</sub>H<sub>12</sub>O MW, 172

Leaflets from Et<sub>2</sub>O. M.p. 68°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Prac. insol. H<sub>2</sub>O. Boiling NaOCl. Aq → cinnamylideneacetic acid + chloroform.

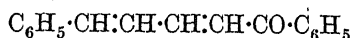
*Oxime*: needles. M.p. 153°. *Acetyl deriv*: m.p. 83°.

*Semicarbazone*: m.p. 186° (193-5°).

*Phenylhydrazone*: m.p. 180°.

Diehl, Einhorn, *Ber.*, 1885, 18, 2320.

### Cinnamylideneacetophenone (*Cinnamalacetophenone*)



C<sub>17</sub>H<sub>14</sub>O MW, 234

*Two forms.* (1) Yellow needles from EtOH. M.p. 102°. Sol. conc. H<sub>2</sub>SO<sub>4</sub> to bright red sol. (2) Yellow cryst. M.p. 235°. Spar. sol. EtOH, Et<sub>2</sub>O.

*Oxime*: α-form, m.p. 135°. β-Form, m.p. 140°.

*Phenylhydrazone*: brownish-yellow needles. M.p. 156-8°.

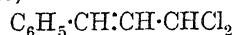
*Di-picrate*: yellow needles. M.p. 115-17°.

*Dimeride*: C<sub>34</sub>H<sub>28</sub>O<sub>2</sub>. MW, 468. M.p. 192°.

Scholtz, *Ber.*, 1895, 28, 1726.

Stobbe, Rücker, *Ber.*, 1911, 44, 869.

Cinnamylidene chloride (*Cinnamal chloride*, 3:3-dichloro-1-phenylpropylene, γγ-dichloropropenylbenzene)

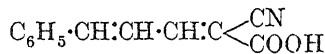


C<sub>9</sub>H<sub>8</sub>Cl<sub>2</sub> MW, 187

Plates from pet. ether. M.p. 59°. B.p. 143°/30 mm., 121-2°/14 mm. Unstable. H<sub>2</sub>O → cinnamaldehyde.

Straus, Berkow, *Ann.*, 1913, 401, 132.

Cinnamylidenecyanoacetic Acid (*Cinnamalmononic mononitrile*, 2-styryl-1-cyanoacrylic acid)



C<sub>12</sub>H<sub>9</sub>O<sub>2</sub>N MW, 199

Yellow cryst. from EtOH. M.p. 212° Sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Dist. → 2-styrylacrylic nitrile.

*Me ester*: C<sub>13</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 213. Needles. M.p. 145°.

*Et ester*: C<sub>14</sub>H<sub>13</sub>O<sub>2</sub>N. MW, 227. M.p. 118° (114°). Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

*Nitrile*: di-nitrile of cinnamylidenemalonic acid. See under Cinnamylidenemalonic Acid.

Fiquet, *Ann. chim.*, 1893, 29, 493.

Cinnamylidenemalonic Acid (*Cinnamalmononic acid*, 4-phenyl-1:3-butadiene-1:1-dicarboxylic acid)



C<sub>12</sub>H<sub>10</sub>O<sub>4</sub> MW, 218

Yellow needles from EtOH. M.p. 208° decomp. → 2-styrylacrylic acid. Heat of comb. C<sub>p</sub> 1321.0 Cal., C<sub>v</sub> 1320.7 Cal.

*Di-Me ester*: C<sub>14</sub>H<sub>14</sub>O<sub>4</sub>. MW, 246. Yellow cryst. M.p. 67°. Sol. ord. org. solvents.

*Di-Et ester*: C<sub>16</sub>H<sub>18</sub>O<sub>4</sub>. MW, 274. M.p. 36°.

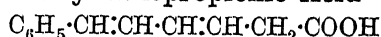
*Mono-nitrile*: see Cinnamylidenecyanoacetic Acid.

*Di-nitrile*: C<sub>12</sub>H<sub>8</sub>N<sub>2</sub>. MW, 180. Yellow needles from EtOH. M.p. 128°.

Dutt, *J. Indian Chem. Soc.*, 1925, 1, 297.

Liebermann, *Ber.*, 1895, 28, 1438.

### 2-Cinnamylidenepropionic Acid

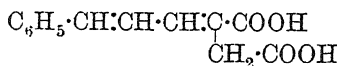


C<sub>12</sub>H<sub>12</sub>O<sub>2</sub> MW, 188

Leaflets from Et<sub>2</sub>O. M.p. 113-14°.

Fittig, Batt, *Ann.*, 1904, 331, 162.

## Cinnamylidenesuccinic Acid

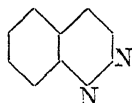


$\text{C}_{13}\text{H}_{12}\text{O}_4$  MW, 232

Needles from  $\text{Me}_2\text{CO}$ . M.p. 215–18° decomp. Mod. sol.  $\text{Et}_2\text{O}$ ,  $\text{Me}_2\text{CO}$ . Spar. sol.  $\text{AcOH}$ . Insol.  $\text{H}_2\text{O}$ ,  $\text{CHCl}_3$ .

Fichter, Hirsch, *Ber.*, 1901, 34, 2189.

## Cinnoline (5 : 6-Benzpyridazine)



$\text{C}_8\text{H}_6\text{N}_2$  MW, 130

Cryst. from ligroin. M.p. 39°. Cryst. from  $\text{Et}_2\text{O}$  with 1 mol.  $\text{Et}_2\text{O}$ , m.p. 24–5°. Distills with part. decomp. Sol.  $\text{H}_2\text{O}$ ,  $\text{EtOH}$ ,  $\text{Et}_2\text{O}$ .

*B.HCl*: yellow cryst. M.p. 190° decomp. Prac. insol.  $\text{H}_2\text{O}$ .

$\text{B}_2\text{H}_2\text{PtCl}_6$ : m.p. 280° decomp.

$\text{B.HAuCl}_4$ : m.p. 146°.

*Methiodide*: m.p. 168°.

*Picrate*: m.p. 196–196.5°.

Busch, Rast, *Ber.*, 1897, 30, 524.

Jacobs *et al.*, *J. Am. Chem. Soc.*, 1946, 68, 1310.

## Cinobufagin

$\text{C}_{26}\text{H}_{34}\text{O}_6$  (see Note) MW, 442

Constituent of *Ch'an Su* (or *Sensu*), the dried venom of Chinese toads. M.p. 222–3°. Absorption maximum 2900–3000 Å. Pharmacological action similar to digitalis glycosides.

*Mono-acetyl*: needles from  $\text{MeOH}$ . M.p. 202°.

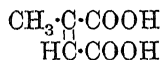
Jensen, *Science*, 1932, 75, 53.

Jensen, Evans, *J. Biol. Chem.*, 1934, 104, 307.

Crowfoot, Jensen, *J. Am. Chem. Soc.*, 1936, 58, 2018.

Tschesche, *Offe, Ber.*, 1936, 69, 2361.

*Note.* Kotake, Kuwada, *Chem. Abstracts*, 1937, 31, 6251, give formula  $\text{C}_{23}\text{H}_{32}\text{O}_6$ , and m.p. 212–3°.

Citraconic Acid (*Methylmaleic acid*)

$\text{C}_5\text{H}_6\text{O}_4$  MW, 130

Needles from  $\text{Et}_2\text{O}$ –ligroin. M.p. 91° decomp. Sol.  $\text{H}_2\text{O}$ ,  $\text{Et}_2\text{O}$ . Insol.  $\text{C}_6\text{H}_6$ ,  $\text{CS}_2$ , ligroin. Volatile in steam with formation of anhydride.  $k$  (first) =  $3.8 \times 10^{-3}$  at 25°, (second)  $0.24 \times 10^{-6}$  at 100°. Heat of comb.  $\text{C}_v$  483.5 (480.0) Cal.,  $\text{C}_p$  479.7 Cal. Dist. → anhydride. Heat at 180° →  $\text{HNO}_3$  or  $\text{NaOH}$  → mesaconic acid  $\text{NaHg}$  → methylsuccinic acid.

*Di-Me ester*:  $\text{C}_7\text{H}_{10}\text{O}_4$ . MW, 158. B.p. 210–11°, 92.8°/10 mm. Mod. sol.  $\text{H}_2\text{O}$ .  $D_{15}^{20}$  1.1208.  $n_D^{20}$  1.447332.

*Di-Et ester*:  $\text{C}_9\text{H}_{14}\text{O}_4$ . MW, 186. B.p. 231°, 116–17°/15 mm.  $D_{15}^{20}$  1.047.  $n_D^{20}$  1.446776.

*Dichloride*:  $\text{C}_5\text{H}_4\text{O}_2\text{Cl}_2$ . MW, 167. B.p. 95°/18 mm.  $D^{16.4}$  1.408.

*Diamide*:  $\text{C}_5\text{H}_8\text{O}_2\text{N}_2$ . MW, 128. Decomp. at 185–7° → imide. Sol.  $\text{H}_2\text{O}$ . Spar. sol.  $\text{EtOH}$ .

*Dinitrile*:  $\text{C}_5\text{H}_4\text{N}_2$ . MW, 92. M.p. 106.3–106.5°.  $D_4^{10.7}$  1.1555.  $n_D^{10.7}$  1.48420.

*Anhydride*:  $\text{C}_5\text{H}_4\text{O}_3$ . MW, 112. M.p. 7°. B.p. 213°.

*Anilide*: m.p. 175°.

*Dianilide*: m.p. 175.5°.

*Dihydrazide*: m.p. 177°.

Fittig, *Ann.*, 1877, 188, 72.

Hope, *J. Chem. Soc.*, 1912, 101, 900.

Boehringer, B.P. 452,460, (*Chem. Abstracts*, 1937, 31, 1045).

van de Straete, *Chem. Abstracts*, 1935, 29, 3985.

Shriner, Ford, Roll, *Organic Syntheses*, 1931, XI, 74.

Citral (*Geranial, neral*)

$\text{C}_{10}\text{H}_{16}\text{O}$  MW, 152

An important constituent of many essential oils, such as lemon, lemon grass, orange, mandarin, sassafras, bay, etc. As obtained from these it is a mixture of two stereoisomers, sometimes distinguished as geranial and neral.

Oil with characteristic citron odour. B.p. 226–8° (228–9°), 117–19°/20 mm., 100–3°/7 mm.  $D^{20}$  0.8868.  $n_D^{20}$  1.48752.  $\text{NaHg}$  in dil.  $\text{AcOH}$  → geraniol and nerol. Conc.  $\text{HCl}$  or  $\text{AcOH}$  → cymene. Forms a bisulphite comp. Polymerised by dil. alc.  $\text{KOH}$  to a comp., m.p. 82°.

*Oxime*: b.p. 143–5°/12 mm.  $D^{20}$  0.9386.  $n_D^{20}$  1.51433.

Geranial, citral a. B.p. 229°, 119°/20 mm.  $D^{20}$  0.8898.  $n_D^{20}$  1.4895. Alkalis → neral.

*Oxime*: b.p. 143–5°/12 mm.

*Semicarbazone*: m.p. 164°.

2 : 4-Dinitrophenylhydrazone: m.p. 108–10°

Neral, citral b. B.p. 103°/12 mm.  $D^{19}$  0.888.  $n_D^{19}$  1.4900. Acids → geranial.

*Oxime*: b.p. 137°/11 mm.

*Semicarbazone*: m.p. 171°.

2 : 4-Dinitrophenylhydrazone: m.p. 96°.

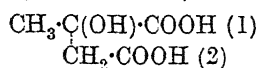
Tiemann, *Ber.*, 1899, 32, 117; 1900, 33, 880.

Verley, *Bull. soc. chim.*, 1919, 25, 68; 1928, 43, 854.

Maier, Karpov, *Russ. P.* 35,833, (*Chem. Abstracts*, 1935, 29, 8008).

Russel, Kenyon, *Organic Syntheses*, 1943, XXIII, 78.

**Citramalic Acid** (1-Methylmalic acid, 1-hydroxy-1-methylsuccinic acid)



$\text{C}_5\text{H}_8\text{O}_5$  MW, 148  
*dl.*

M.p. 119°. Sol. EtOH, Me<sub>2</sub>CO, AcOEt. Insol. C<sub>6</sub>H<sub>6</sub>, pet. ether. Sublimes. Dist. → citraconic anhydride.

*Di-Me ester*: C<sub>7</sub>H<sub>12</sub>O<sub>5</sub>. MW, 176. B.p. 112°/15 mm.

*Di-Et ester*: b.p. 119°/15 mm. D<sub>15</sub><sup>20</sup> 1.089. n<sub>D</sub><sup>15</sup> 1.4318.

*Et-n-butyl ester*: b.p. 140°/15 mm. D<sub>15</sub><sup>20</sup> 1.047. n<sub>D</sub><sup>15</sup> 1.4348.

*2-Monoamide*: C<sub>5</sub>H<sub>9</sub>O<sub>4</sub>N. MW, 147. M.p. 140–1°. Sol. H<sub>2</sub>O. Spar. sol. EtOH.

*1-Nitrile-2-ethyl ester*: C<sub>7</sub>H<sub>11</sub>O<sub>3</sub>N. MW, 157. M.p. 8°. B.p. 128°/16 mm. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O, CS<sub>2</sub>.

*Me ether*: C<sub>6</sub>H<sub>10</sub>O<sub>5</sub>. MW, 162. M.p. 90–2°.

*Et ether*: C<sub>7</sub>H<sub>12</sub>O<sub>5</sub>. MW, 176. M.p. 81–3°.

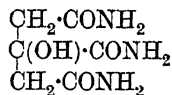
*d.*

M.p. 109° (95°). [α]<sub>D</sub><sup>20</sup> + 34.7° in H<sub>2</sub>O.

*d.*, Marckwald, Axelrod, *Ber.*, 1899, 32, 713.

*dl.*, Michael, Tissot, *J. prakt. Chem.*, 1892, 46, 287.

### Citramide



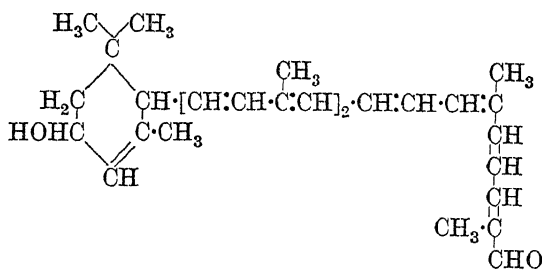
$\text{C}_6\text{H}_{11}\text{O}_4\text{N}_3$  MW, 189

M.p. 210–15° with blackening. Sol. hot H<sub>2</sub>O. Insol. EtOH, Et<sub>2</sub>O. Heated with HCl → citrazinic acid.

NN'N''-Tribenzyl: m.p. 169–70°.

Curtius, *J. prakt. Chem.*, 1917, 95, 249.

### α-Citraurin



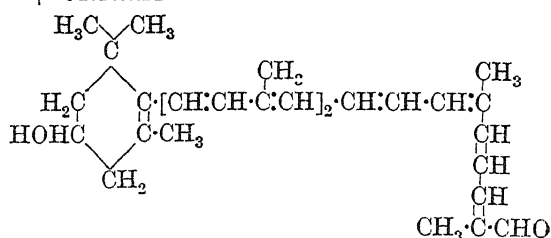
$\text{C}_{30}\text{H}_{40}\text{O}_2$  MW, 432

Leaflets from MeOH. M.p. 153°. [α]<sub>D</sub><sup>18</sup> + 372° in C<sub>6</sub>H<sub>6</sub>. Absorption maxima at 514, 480, 440 mμ in CS<sub>2</sub>, 477, 448 mμ in pet. ether.

*Oxime*: cryst. from MeOH. M.p. 148°. Absorption maxima at 499, 468 mμ in CS<sub>2</sub>, 470, 440 mμ in EtOH.

Karrer, Koenig, Solmssen, *Helv. Chim. Acta*, 1938, 21, 445.

### β-Citraurin



$\text{C}_{30}\text{H}_{40}\text{O}_2$  MW, 432

Constituent of orange peel. Cryst. from EtOH. M.p. 146–7°. Absorption maxima at 523, 489 mμ in CS<sub>2</sub>, 484 (488), 456 (459) mμ in pet. ether, 497, 467 mμ in C<sub>6</sub>H<sub>6</sub>, 487, 458 mμ in hexane.

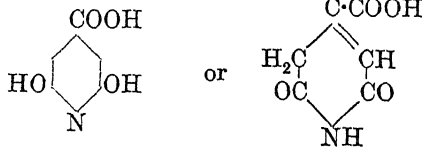
*Oxime*: m.p. 192–4° (188°). Absorption maxima at 504, 472 mμ in CS<sub>2</sub>, 472 (474), 442 (444) mμ in pet. ether, 476, 444 mμ in EtOH, 487, 456 mμ in C<sub>6</sub>H<sub>6</sub>.

Zechmeister, Tuzson, *Ber.*, 1936, 69, 1878; 1937, 70, 1966.

Zechmeister, Cholnoky, *Ann.*, 1937, 530, 291.

Karrer, Rügger, Solmssen, *Helv. Chim. Acta*, 1938, 21, 448.

**Citrazinic Acid** (2:6-Dihydroxyisonicotinic acid)



$\text{C}_8\text{H}_5\text{O}_4\text{N}$  MW, 155

Chars above 300° without melting. Sol. hot H<sub>2</sub>O. Alk. sols. turn blue on standing.

*Me ester*: C<sub>7</sub>H<sub>7</sub>O<sub>4</sub>N. MW, 169. Leaflets. Decomp. above 220°. Sublimes with part. decomp. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O, EtOH.

*Diacetyl deriv.*: m.p. 183–5° decomp.

Sell, Dootson, *J. Chem. Soc.*, 1897, 71, 1068.

### Citrene.

See *d*-Limonene.

### Citreoesein

$\text{C}_{15}\text{H}_{10}\text{O}_6$  MW, 286

Pigment from *Penicillium citreo-roseum*, Dierck. Yellowish-orange needles from EtOH. M.p. 273–5° with darkening. Sol. isobutyl alcohol. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Alkalis → red sols. H<sub>2</sub>SO<sub>4</sub> → red-orange sol. Zn dist. → 2-methylantracene.

*Tetra-Me ether*: dimorphous. Needles or rectangular prisms from EtOH. M.p. 187–8°.

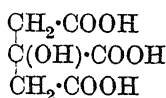
*Tetra-acetyl*: yellow needles from EtOH. M.p. 187–8°.

*Tetra-benzoyl*: yellow needles from C<sub>6</sub>H<sub>6</sub>. M.p. 206–8. Remelts at 223°.

Posternak, Jacob, *Helv. Chim. Acta*, 1940, 23, 237.



**Citric Acid** (*2-Hydroxytricarballic acid, 2-hydroxypropane-1:2:3-tricarboxylic acid*)

C<sub>6</sub>H<sub>8</sub>O<sub>7</sub>

MW, 192

Occurs in the free state in lemons, currants, beetroot, etc., and in the seeds and juices of many flowers and plants.

Cryst. + 1H<sub>2</sub>O from H<sub>2</sub>O. The H<sub>2</sub>O of cryst. is lost at 70–75° or by standing over conc. H<sub>2</sub>SO<sub>4</sub> in a desiccator. By careful heating to 130° a sharp m.p. at 153° can be obtained. This is the m.p. of the anhyd. acid. Very sol. H<sub>2</sub>O, EtOH. Mod. sol. Et<sub>2</sub>O. *k* (first) = 8.2 × 10<sup>-4</sup> at 25°; (second) 3.2 × 10<sup>-6</sup> at 100°; (third) 0.7 × 10<sup>-6</sup> at 100°. Heat of comb. (anhyd.) C<sub>p</sub> 475.7 Cal., C<sub>p</sub> 474.6 Cal. Heated to 175° → aconitic acid. At higher temps. → itaconic anhydride (→ citraconic anhydride) and acetone-dicarboxylic acid. HNO<sub>3</sub> or KOH fusion → acetic + oxalic acids. KMnO<sub>4</sub> or conc. H<sub>2</sub>SO<sub>4</sub> → acetone-dicarboxylic acid.

*Acetyl*: 2-acetoxytricarballic acid. M.p. 138–40°. Sol. H<sub>2</sub>O.

*Me ester*: see Trimethyl citrate.

*Et ester*: see Triethyl citrate.

*Triamide*: see Citramide.

*Triphenyl ester*: C<sub>21</sub>H<sub>20</sub>O<sub>7</sub>. MW, 420. Needles. M.p. 124°. Sol. hot EtOH. Insol. H<sub>2</sub>O.

*Trianilide*: needles from EtOH.Aq. M.p. 192°.

*Tri-m-nitroanilide*: yellow cryst. M.p. 122°.

*Tri-p-toluidide*: needles from EtOH. M.p. 189°.

*Tri-α-naphthylamide*: prisms from AcOH.Aq. M.p. 129°.

*Tri-β-naphthylamide*: prisms. M.p. 215°.

Pechmann, Dünschmann, *Ann.*, 1891, 261, 162.

Bülow, Engler, *Ber.*, 1918, 51, 1247.

Challenger, *Industrial Chemist*, 1929, 5, 181, (*Bibl.*).

Leone, U.S.P. 2,066,892, (*Chem. Abstracts*, 1937, 81, 1045).

Klapproth, D.R.P. 619,977, (*Chem. Abstracts*, 1936, 30, 1511).

Cahn, U.S.P. 2,047,669, (*Chem. Abstracts*, 1936, 30, 6128).

Galcano, *Chem. Abstracts*, 1935, 29, 5417.

### Citriofoliol

C<sub>23</sub>H<sub>34</sub>O<sub>14</sub>

MW, 594

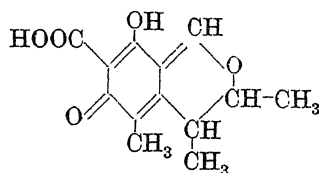
Glycoside of fruit of *Citrus trifoliata*. M.p. 198°. [α]<sub>D</sub><sup>20</sup> = 90° in EtOH. Hyd. → glucose + rhamnose.

Sannié, Sosa, *Chem. Abstracts*, 1949, 43, 4669.

### Citrin.

See Vitamin P.

### Citrinin

C<sub>13</sub>H<sub>14</sub>O<sub>5</sub>

MW, 250

Antibiotic from *Penicillium citrinum*, *Aspergillus terreus* and the *candidus* groups. Cryst. from MeOH. M.p. 178–9° decomp. [α]<sub>D</sub><sup>25</sup> –42.8°.

*Me ester*: prisms from C<sub>6</sub>H<sub>6</sub> or Me<sub>2</sub>CO. M.p. 138° decomp. [α]<sub>D</sub><sup>20</sup> +96.9° in CHCl<sub>3</sub>.

*Phenylhydrazide*: m.p. 207° decomp.

Raistrick *et al.*, *Trans. Roy. Soc.*, 1931, 220B, 269, 297.

Hirschy, Ruoff, *J. Am. Chem. Soc.*, 1942, 64, 1490.

Oxford, *Ann. Rev. Biochem.*, 1945, 14, 757.

Sprenger, Ruoff, *J. Org. Chem.*, 1946, 11, 189.

Gore *et al.*, *Nature*, 1946, 157, 333; *J. Am. Chem. Soc.*, 1948, 70, 2287.

Wyllie, *Chem. Abstracts*, 1946, 40, 2190.

Robertson *et al.*, *J. Chem. Soc.*, 1949, 859, 867, 1563; 1950, 2971.

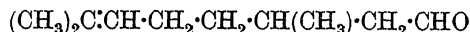
Fry, Wallis, Dougherty, *J. Org. Chem.*, 1949, 14, 397.

Cartwright, Robertson, Whalley, *Nature*, 1949, 163, 94

### Citrolimonin.

See Limonin.

### Citronellal (*Rhodinal*)

C<sub>10</sub>H<sub>18</sub>O

MW, 154

*d.*

Chief constituent of citronella oil. Also contained in lemon, rose and other ethereal oils. B.p. 204–5° (208°), 90°/14 mm. D<sub>17</sub><sup>20</sup> 0.855. n<sub>D</sub><sup>20</sup> 1.4456. [α]<sub>D</sub><sup>20</sup> +10.6°, [α]<sub>D</sub><sup>15</sup> +13.09°. NaHg in dil. AcOH → citronellol. Ac<sub>2</sub>O, dil. H<sub>2</sub>SO<sub>4</sub>, or on long standing → isopulegol. Ox. → isopulegone. Forms a bisulphite comp.

*Di-Et acetal*: b.p. 118–21°/10 mm. D<sub>17</sub><sup>20</sup> 0.8644.

*Oxime*: b.p. 136°/14 mm. D<sub>20</sub><sup>20</sup> 0.9055. n<sub>D</sub><sup>20</sup> 1.4763.

*Semicarbazone*: m.p. 84° (82.5°).

2:4-Dinitrophenylhydrazone: golden yellow cryst. M.p. 78° (76.5°).

*l.*

B.p. 205–6°, 103.8°/27 mm. D<sub>16</sub><sup>16</sup> 0.8567. n<sub>D</sub><sup>20</sup> 1.4570. [α]<sub>D</sub><sup>20</sup> –2.5°.

*Semicarbazone*: m.p. 91–2°.

Valli-Douau, *Revue de parfumerie*, 1925, 5, 10 (*Review*).

Verley, *Bull. soc. chim.*, 1928, 43, 846.

Waterman, Elsbach, *Bull. soc. chim.*, 1929, 45, 137.

Doeuvre, *ibid.*, 1098.

Armstrong, Hilditch, *Proc. Roy. Soc.*, 1925, 108 A, 121.

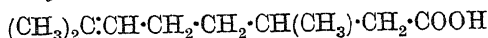
Prins, *Chem. Zentr.*, 1917, II, 678.

Harries, *Ann.*, 1915, 410, 10.

Bag, Egupov, Volokitin, *Org. Chem. Ind. U.S.S.R.*, 1936, 2, 144.

Kolobolotskaya, Yaroslavtseva, *J. Applied Chem. U.S.S.R.*, 1937, 10, 125.

**Citronellic Acid** (2:6-Dimethyl-1-octene-8-carboxylic acid, rhodinic acid, rhodinolic acid)



$\text{C}_{10}\text{H}_{18}\text{O}_2$  MW, 170

*d.*

B.p. 257°, 143°/10 mm.  $D_{20}^{20}$  0.9308.  $[\alpha]_D^{20} + 21^\circ$ . Ox.  $\rightarrow$  2-methyladipic acid and acetone.

*Et ester*:  $\text{C}_{12}\text{H}_{22}\text{O}_2$ . MW, 198. B.p. 113–5°/12 mm.  $[\alpha]_D^{16} + 0.3^\circ$ .

*Amide*:  $\text{C}_{10}\text{H}_{19}\text{ON}$ . MW, 169. M.p. 84–5°. B.p. 166°/12 mm. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O.

*Nitrile*:  $\text{C}_{10}\text{H}_{17}\text{N}$ . MW, 151. B.p. 230°, 105°/14 mm.  $D_{20}^{20}$  0.8645.

*l.*

“Callitrol.” Found in wood of *Callitris glauca*. B.p. 117.9°/0.6 mm.  $D_{25}^{25}$  0.9274.  $n_D^{24}$  1.4563.  $[\alpha]_D^{24} - 6.60^\circ$ .

*Me ester*:  $\text{C}_{11}\text{H}_{20}\text{O}_2$ . MW, 184. B.p. 86°/1.1 mm.

*Amide*: leaflets from pet. ether. M.p. 84–5°.

*Anilide*: needles from pet. ether. M.p. 76°.

*p-Toluidide*: prisms from MeOH. M.p. 93–4°.

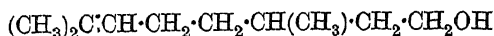
Semmler, *Ber.*, 1891, 24, 201.

Harries, Himmelmann, *Ber.*, 1908, 41, 2191.

Falk, D.R.P. 473,727, (*Chem. Abstracts*, 1929, 23, 3300).

Trikojous, White, *J. Proc. Roy. Soc. N.S. Wales*, 1932, 66, 284.

**Citronellol** (*Rhodinol*)



$\text{C}_{10}\text{H}_{20}\text{O}$  MW, 156

*d.*

Constituent of oil of geranium and certain rose and citronella oils.

B.p. 222°, 118°/17 mm., 106–8°/12 mm.  $D_{20}^{20}$  0.8590,  $D_{17}^{17}$  0.8565.  $n_D^{20}$  1.45659.  $[\alpha]_D^{17} + 4^\circ$ . Ox.  $\rightarrow$  citronellol. Red. (PtO<sub>2</sub>)  $\rightarrow$  dihydrocitronellol.

*Acetyl*: b.p. 119–121°/15 mm.  $D_{17}^{17}$  0.8928.  $n_D^{17}$  1.4456.  $[\alpha]_D^{17} + 2.37^\circ$ .

*Allophanate*: m.p. 105–6°.

*l.*

Constituent of rose and geranium oils. B.p. 108–9°/10 mm. corr.  $D_4^{18}$  0.859.  $n_D^{18}$  1.4576.  $[\alpha]_{4860}^{18} - 4.4^\circ$ ,  $[\alpha]_{6460}^{18} - 2.4^\circ$ .

*Allophanate*: cryst. from pet. ether. M.p. 106–7° corr.

*dl.*

B.p. 99°/10 mm.  $D_4^{19}$  0.8488.

Grignard, Doeuvre, *Compt. rend.*, 1928, 187, 270.

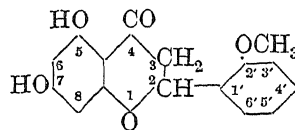
Barbier, Locquin, *Compt. rend.*, 1913, 157, 1114.

Doeuvre, *Bull. soc. chim.*, 1930, 47, 323; 1940, 7, 139.

Young, Hartung, Crossley, *J. Am. Chem. Soc.*, 1936, 58, 100.

Kunz, U.S.P. 1,802,472, (*Chem. Abstracts*, 1931, 25, 3670).

**Citronetin** (5:7-Dihydroxy-2'-methoxyflavanone)



$\text{C}_{16}\text{H}_{14}\text{O}_5$  MW, 286

Occurs as the glycoside citronin in the rind of *Citrus limon*. Plates from AcOH.Aq. M.p. 224–5° (210°).

*Mono-Me ether*:  $\text{C}_{17}\text{H}_{16}\text{O}_5$ . MW, 300. M.p. 92°.

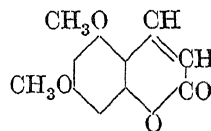
*Di-Me ether*:  $\text{C}_{18}\text{H}_{18}\text{O}_5$ . MW, 314. M.p. 125°.

*Diacetyl*: m.p. 118–19°.

*Oxime*: m.p. 234–5°.

Shinoda, Sato, *Chem. Zentr.*, 1931, II, 2326.

**Citropten** (*Limettin*, 5:7-dimethoxycoumarin)

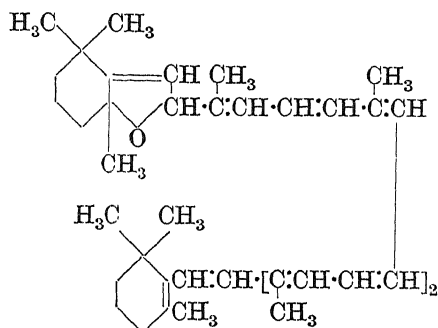


$\text{C}_{11}\text{H}_{10}\text{O}_4$  MW, 206

Constituent of the essential oil of the lime. Prisms or needles from EtOH. M.p. 147.5° (145°). Sol. EtOH, AcOH, C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O, pet. ether. Sols. fluoresce violet.

Tilden, Burrows, *J. Chem. Soc.*, 1902, 81, 508.

Heyes, Robertson, *J. Chem. Soc.*, 1936, 1831.

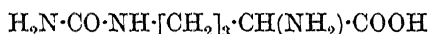
Citroxanthin (*Mutochrome*) $C_{40}H_{56}O$ 

MW, 552

A carotenoid occurring in orange peel. M.p. 167°. Absorption maxima at 488 and 456 m $\mu$ . Conc.  $H_2SO_4 \rightarrow$  deep blue col.

Karrer, Jucker, *Helv. Chim. Acta*, 1944, 27, 1695; 1945, 28, 427; 1947, 30, 536.

## Citrulline (4-Ureido-ornithine, 1-amino-4-ureidovaleric acid)

 $C_6H_{13}O_3N_3$ 

MW, 175

Occurs in *Citrullus vulgaris*, Schrad., etc. Prisms from MeOH.Aq. M.p. 222°. Sol.  $H_2O$ . Insol. MeOH, EtOH.  $[\alpha]_D^{20} + 3.7^\circ$  in  $H_2O$ . Pptd from conc. sol. by phosphotungstic acid. Conc. alkali  $\rightarrow$  ornithine,  $CO_2$  and  $NH_3$ .

*Hydrochloride*: decomp. at 185°.  $[\alpha]_D^{22} + 17.9^\circ$  in  $H_2O$ .

*Cu salt*: blue prisms. M.p. 257–8°.

*Monopicrate*: decomp. at 206°.

*Monoflavianate*: decomp. at 218°.

$\alpha$ -N-Benzoyl: *Me ester*: decomp. at 120°. *Amide*: decomp. at 140°.

Wada, *Biochem. Z.*, 1933, 257, 1; 1930, 224, 420.

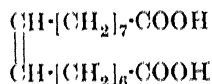
Duschinsky, *Compt. rend.*, 1938, 207, 735. Gornall, Hunter, *Biochem. J.*, 1939, 33, 170.

Fox, *J. Biol. Chem.*, 1938, 123, 687.

I.G., B.P. 421,407, (*Chem. Abstracts*, 1935, 29, 3468).

Fox, Dunn, Stoddard, *J. Org. Chem.*, 1941, 6, 410.

## Civetic Acid (7-Pentadecylene-1:15-dicarboxylic acid)

 $C_{17}H_{30}O_4$ 

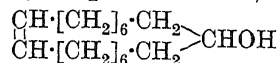
MW, 298

M.p. 86–7°.

*Di-Me ester*: b.p. 172–4°/0.3 mm.

Ruzicka, *Helv. Chim. Acta*, 1932, 15, 1459.

Dict. of Org. Comp.—I.

Civetol (*Cycloheptadecene-10-ol*) $C_{17}H_{32}O$ 

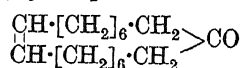
MW, 252

Cryst. from light petroleum. M.p. 65°.

*Hydrogen phthalate*: needles from light petroleum. M.p. 117.5–119°.

Blomquist, Holley, *J. Am. Chem. Soc.*, 1948, 70, 39.

Ruzicka, Shinz, Seidel, *Helv. Chim. Acta*, 1927, 10, 695.

Civetone (*Cycloheptadecene-10-one*) $C_{17}H_{30}O$ 

MW, 250

Constituent of civet. M.p. 32.5° (31°). B.p. 342°/742 mm., 158–60°/2 mm.

*Oxime*: m.p. 92°.

*Semicarbazone*: m.p. 187°.

*p-Nitrophenylhydrazone*: m.p. 125°.

$\alpha$ -Form:

M.p. 37.5–8.5°.  $D_4^{20}$  0.9135.

*Semicarbazone*: m.p. 190–1°.

Ruzicka, *Helv. Chim. Acta*, 1926, 9, 230.

Ruzicka, Shinz, Seidel, *Helv. Chim. Acta*, 1927, 10, 695.

Société anonyme M. Naef & Cie., Swiss P. 136,543, (*Chem. Abstracts*, 1930, 24, 4307).

Hunsdiecker, *Ber.*, 1943, 76, 142.

## Clavacin.

See Patulin.

## Clavatine

 $C_{16}H_{25}O_2N$ 

MW, 263

Alkaloid present in *Lycopodium clavatum*, Linn. Plates from pet. ether. M.p. 212–13°.

*Methiodide*: m.p. 317–18°.

Achmatowicz, Uziębło, *Chem. Abstracts*, 1938, 32, 9092.

## Clavatul.

See 2:4-Dihydroxy-3:5-dimethylacetophenone.

## Clavatoxine

 $C_{17}H_{27}O_2N$ 

MW, 277

Alkaloid constituent of *Lycopodium clavatum*, Linn. Needles from pet. ether. M.p. 185–6°.

Achmatowicz, Uziębło, *Chem. Abstracts*, 1938, 32, 9092.

## Clerodin

 $C_{13}H_{18}O_3$ 

MW, 222

Constituent of leaves of *Clerodendron infortunatum*. Needles. M.p. 161–2°. Sol. common org. solvents.  $[\alpha]_D^{20} - 37.6^\circ$  in EtOH. No hæmolytic action in saline solution. Possesses anthelmintic properties.

*Acetyl*: m.p. 110°.

*Benzoyl*: b.p. 140°/1 mm.

*Phenylurethane*: m.p. 240° decomp.

Banerjee, *Chem. Abstracts*, 1937, 31, 209;

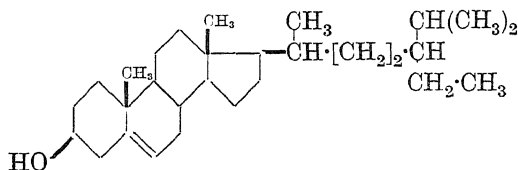
*Brit. Chem. Abstracts*, 1938, II, 288;

1939, II, 439.

### Cleve's Acids.

See 1-Naphthylamine-6-sulphonic Acid and 1-Naphthylamine-7-sulphonic Acid.

### Clionasterol



$C_{29}H_{50}O$

MW, 414

Constituent of *Xiphogorgia spongia*, *Sphicosporgia vesparia* and *Cliona celata*. Cryst. from  $Et_2O$  or  $EtOH$ . M.p. 139.5–140.5°.  $[\alpha]_D^{25} -37^\circ$  in  $CHCl_3$ . Ox.  $\rightarrow$  clionastenone.  $H_2O_2 \rightarrow$  clionastantriol.

*Acetyl*: m.p. 140–1°.  $[\alpha]_D^{25} -48.3^\circ$  in  $CHCl_3$ . Hydrogenation  $\rightarrow$  poriferastanyl acetate.

*Propionyl*: m.p. 114–5.5° (117–18°).  $[\alpha]_D^{25} -45.6^\circ$  in  $CHCl_3$ .

*Benzoyl*: m.p. 134.5–135°.  $[\alpha]_D^{25} -16.8^\circ$  in  $CHCl_3$ .

3:5-Dinitrobenzoyl: m.p. 214–16° (201–3°).  $[\alpha]_D^{25} -15.3^\circ$  in  $CHCl_3$ .

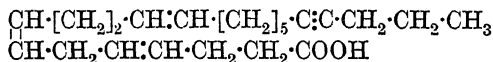
o-Iodobenzoyl: m.p. 103.5–104.5°.  $[\alpha]_D^{25} -19.76^\circ$  in  $CHCl_3$ .

*Phenylurethane*: m.p. 180.5–182°.  $[\alpha]_D^{25} -29.36^\circ$  in  $CHCl_3$ .

Bergmann, Maclean, Lester, *J. Org. Chem.*, 1943, 8, 271.

Valentine, Bergmann, *J. Org. Chem.*, 1941, 6, 452.

### Clupanodonic Acid



Suggested structure

$C_{22}H_{34}O_2$

MW, 330

Constituent of many fish oils. Pale yellow oil with fishy odour. B.p. 174–5°/0.018–0.02 mm.  $D^{20} 0.9290$ .  $n_D^{20} 1.4868$ .

*Me ester*:  $C_{23}H_{36}O_2$ . MW, 344. B.p. 222°/5 mm. (215°/15 mm.).  $D^{25} 0.9247$ .  $n_D^{25} 1.4960$ .

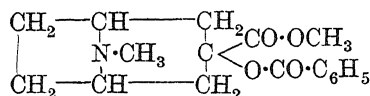
Inoue, Kato, *Proc. Imper. Acad., Tokyo*, 1934, 10, 463; 1932, 8, 371.

Tsujimoto, *Bull. Chem. Soc. Japan*, 1928, 3, 299.

### Cocaethylene.

See under Ecgonine.

### $\alpha$ -Cocaine



$C_{17}H_{21}O_4N$

MW, 303

Prisms from ligroin. M.p. 87–8°. Sol.  $EtOH$ ,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ . Insol.  $H_2O$ . Possesses no local anaesthetic action.

*B, HCl*: m.p. 180° decomp.

*B, HI*: m.p. 192° decomp.

*B, H AuCl<sub>4</sub>*: m.p. 222° decomp.

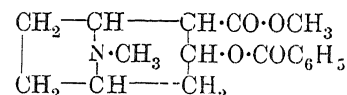
*B<sub>2</sub>, H<sub>2</sub> PtCl<sub>6</sub>*: m.p. 220° decomp.

*Methiodide*: m.p. 202°.

*Picrate*: m.p. 195°.

Willstätter, *Ber.*, 1896, 29, 2224.

### $\beta$ -Cocaine (Benzoyl ecgonine methyl ester)



$C_{17}H_{21}O_4N$

MW, 303

*l.*

Most important of the coca alkaloids. Colourless prisms. M.p. 98°. Cryst. from  $EtOH$ . Very sol.  $CHCl_3$ . Sol.  $EtOH$ ,  $Et_2O$ ,  $CS_2$ ,  $C_6H_6$ , olive oil. Spar. sol. cold  $H_2O$ . Sublimes with decomp. above m.p.  $[\alpha]_D^{20} -15.83^\circ$  in  $CHCl_3$ . Aq. sol. alk. to litmus. Anaesthetic, anodyne and sedative.

*B, HCl*: prisms. M.p. 197°. Sol.  $H_2O$ ,  $EtOH$ . Insol. olive oil.  $[\alpha]_D -71.95^\circ$  in  $H_2O$ . Anaesthetic, sedative and mydriatic.

*Methochloride*: m.p. 152.5°. Sol.  $H_2O$ .

*Methiodide*: leaflets. M.p. 169°.

*B, HCl, HgCl<sub>2</sub>*: m.p. 123°.

*B, H<sub>2</sub>CrO<sub>4</sub>, 1H<sub>2</sub>O*: m.p. 127°.

*Styphnate*: m.p. 187°.

*dl.*

M.p. 79–80°.

*B, HCl*: m.p. 187°.

Chemnitius, *J. prakt. Chem.*, 1927, 116, 285.

Merck, B.P. 214.917, (*Chem. Abstracts*, 1924, 18, 2945).

Willstätter, Wolfes, Mäder, *Ann.*, 1923, 434, 111.

Perrot, *Bull. sci. pharmacol.*, 1935, 42, 266 (*Review*).

Elgazin, *Chem. Abstracts*, 1932, 26, 3331.

### $\psi$ -Cocaine (Isococaine)

$C_{17}H_{21}O_4N$

MW, 303

*d.*

Stereoisomeric with  $\beta$ -cocaine. M.p. 46°.  $[\alpha]_D^{20} +42.2^\circ$  in  $CHCl_3$ .

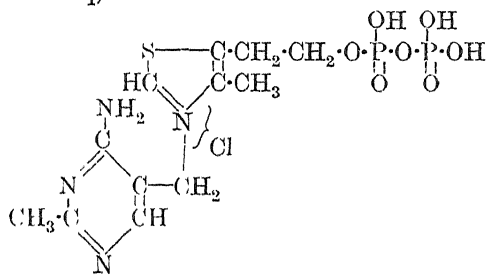
*B, HCl*: m.p. 208°.  $[\alpha]_D^{20} +49.8^\circ$  in  $H_2O$ .

*B, H AuCl<sub>4</sub>*: m.p. 148°.

*Methiodide*: m.p. 172°.

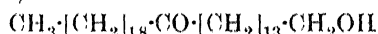
*dl.*

M.p. 81.5°.

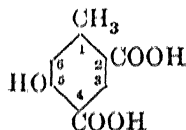
*B.HCl*: m.p. 205-6°.*B.HAuCl<sub>4</sub>*: m.p. anhyd. 164-5°.*Methiodide*: m.p. 213°.Willstätter, Bode, *Ann.*, 1903, 326, 42.Willstätter, Bommer, *Ann.*, 1921, 422, 34.Willstätter, Wolfes, Mäder, *Ann.*, 1923, 434, 138.**Cocarboxylase** (*Pyrophosphoric ester of vitamin B<sub>1</sub>*) $C_{12}H_{19}O_7N_4ClSP_2$ 

MW, 460.5

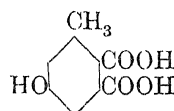
Coenzyme of the yeast enzyme, carboxylase. Cryst. from EtOH containing HCl. M.p. 240°. Catalyses the decarboxylation of pyruvic acid.

Tauber, *J. Am. Chem. Soc.*, 1938, 60, 730.Tauber, Weijlard, *J. Am. Chem. Soc.*, 1938, 60, 2263.Weijlard, *J. Am. Chem. Soc.*, 1941, 63, 1160.  
Lohmann, Schuster, *Biochem. Z.*, 1937, 294, 188.Williams, *Ergebnisse der Vitamin- und Hormone-Forschung*, Leipzig, 1938, I, 259.**Coccenyl Alcohol** (*15-Keto-n-tetratriacontanol*) $C_{34}H_{68}O_2$ 

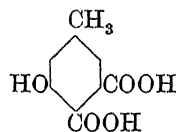
MW, 508

Constituent of wax from cochineal. Cryst. from most org. solvents. Leaflets. M.p. 100.5-100.7° (102°). Sol. hot Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>. Spar. sol. hot Et<sub>2</sub>O. Red. → *n*-tetratriacontanol. CrO<sub>3</sub> → *n*-tetratriacontanoic acid.*Acetyl*: plates from Me<sub>2</sub>CO-Et<sub>2</sub>O. M.p. 80.9-81.3°.*Oxime*: needles from EtOH. M.p. 74.5-75°.Becker, *Biochem. Z.*, 1931, 239, 235.Chiknall, Latner, Williams, Ayre, *Biochem. J.*, 1934, 28, 313.**α-Coccinic Acid** (*6-Hydroxy-4-methylisophthalic acid*) $C_9H_8O_5$ 

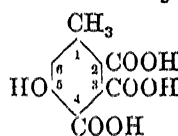
MW, 196

Needles from EtOH.Aq. M.p. 320-2° decomp. B.p. 288-9°/465 mm., 242-3°/110 mm. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO. Spar. sol. hot H<sub>2</sub>O. Insol. C<sub>6</sub>H<sub>6</sub>, ligroin, CHCl<sub>3</sub>. FeCl<sub>3</sub> → reddish violet col. Dist. with CaO → *m*-cresol.*Di-Me ester*: C<sub>11</sub>H<sub>12</sub>O<sub>5</sub>. MW, 224. M.p. 108°.*2-Et ester*: C<sub>11</sub>H<sub>12</sub>O<sub>5</sub>. MW, 224. Leaflets. M.p. 185-6°. Mod. sol. hot H<sub>2</sub>O.*Di-Et ester*: C<sub>13</sub>H<sub>16</sub>O<sub>5</sub>. MW, 252. M.p. 51°.*Me ether*: C<sub>10</sub>H<sub>10</sub>O<sub>5</sub>. MW, 210. M.p. 250-2°.Meldrum, Alimchandani, *J. Indian Chem. Soc.*, 1929, 6, 253.Shah, Alimchandani, *J. Indian Chem. Soc.*, 1931, 8, 261.**β-Coccinic Acid** (*5-Hydroxy-3-methylphthalic acid*) $C_9H_8O_5$ 

MW, 196

M.p. 155-7°. Sol. H<sub>2</sub>O*Anhydride*: C<sub>9</sub>H<sub>6</sub>O<sub>4</sub>. MW, 178. M.p. 166-8°.*Me ether*: C<sub>10</sub>H<sub>10</sub>O<sub>5</sub>. MW, 210. M.p. 184° decomp. *Anhydride*: m.p. 139°.Meldrum, *J. Chem. Soc.*, 1911, 99, 1718.Meldrum, Vaidyanathan, *Chem. Abstracts*, 1935, 29, 5430.**γ-Coccinic Acid** (*6-Hydroxy-4-methylphthalic acid*) $C_9H_8O_5$ 

MW, 196

Leaflets. M.p. 226-8°. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, CHCl<sub>3</sub>, hot H<sub>2</sub>O. Insol. C<sub>6</sub>H<sub>6</sub>.*Me ether*: C<sub>10</sub>H<sub>10</sub>O<sub>5</sub>. MW, 210. M.p. 202° decomp. *Anhydride*: m.p. 167°.*Et ether*: C<sub>11</sub>H<sub>12</sub>O<sub>5</sub>. MW, 224. M.p. 224° decomp.*Anhydride*: C<sub>9</sub>H<sub>6</sub>O<sub>4</sub>. MW, 178. Yellowish needles. M.p. 209°. *Acetyl*: yellowish prisms. M.p. 196°.Schleussner, Voswinckel, *Ann.*, 1921, 422, 124.Meldrum, *J. Chem. Soc.*, 1911, 99, 1718.Meldrum, Vaidyanathan, *Chem. Abstracts*, 1935, 29, 5430.**Cochenillic Acid** (*5-Hydroxytoluene-2:3:4-tricarboxylic acid, 6-hydroxy-4-methylhemimellitic acid, m-cresol-4:5:6-tricarboxylic acid*) $C_{10}H_8O_7$ 

MW, 240

Needles from MeOH-CHCl<sub>3</sub>. Sol. EtOH, AcOH, Me<sub>2</sub>CO, hot H<sub>2</sub>O. Spar. sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>, CHCl<sub>3</sub>. FeCl<sub>3</sub> → red col. Sublimes at 145–70° with decomp to anhydride.

*Tri-Me ester*: C<sub>13</sub>H<sub>14</sub>O<sub>7</sub>. MW, 282. M.p. 136–8°.

*Me ether*: C<sub>11</sub>H<sub>10</sub>O<sub>7</sub>. MW, 254. Cryst. from dil. HCl. M.p. 200° decomp. (rapid heat.). Sol. hot AcOH. Mod. sol. H<sub>2</sub>O. Spar. sol. C<sub>6</sub>H<sub>6</sub>.

*Me ester*: C<sub>12</sub>H<sub>12</sub>O<sub>7</sub>. MW, 268. Plates from H<sub>2</sub>O. M.p. 178–80°. Strong heat → anhydride. Very sol. EtOH, hot H<sub>2</sub>O. Sol. Et<sub>2</sub>O, AcOEt. Insol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. *Di-Me ester*: C<sub>13</sub>H<sub>14</sub>O<sub>7</sub>. MW, 282. Needles from MeOH.Aq. M.p. (air dried) 58–62°; (vac. dried) 85–7°. *Tri-Me ester*: C<sub>14</sub>H<sub>16</sub>O<sub>7</sub>. MW, 296. Needles or leaflets from MeOH.Aq. M.p. 111–13°.

*Anhydride*: m.p. 229°. Very sol. C<sub>6</sub>H<sub>6</sub>. Sol. EtOH. *O-Acetyl*: leaflets from AcOH. M.p. 152–3° decomp. Sol. EtOH, Et<sub>2</sub>O, AcOH. *O-Benzoyl*: cryst. from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 187–9°.

Liebermann, Voswinckel, *Ber.*, 1897, 30, 1731.

Schleussner, Voswinckel, *Ann.*, 1921, 442, 111.

Dimroth, *Ber.*, 1910, 43, 1396.

Meldrum, Vaidyanathan, *Chem. Abstracts*, 1935, 29, 5430.

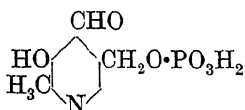
### Cocositol.

See Scyllitol.

### Coculene.

See Sinomenine.

### Codecarboxylase (*Pyridoxal phosphite*)



C<sub>8</sub>H<sub>10</sub>O<sub>6</sub>NP

MW, 247

White powder. Shows high catalytic activity in transaminase, tyrosine decarboxylase, aspartic acid β-decarboxylase and tyrosinase systems.

*Ca salt*: bright yellow powder. UV. absorption max in H<sub>2</sub>O at pH 11 at 228, 307.5, 390 mμ.

*Oxime*: cryst. M.p. 218° decomp.

Wilson, Harris, *J. Biol. Chem.*, 1951, 73, 4693.

Heyl, Luz, Harris, Folkers, *J. Am. Chem. Soc.*, 1951, 73, 3430.

Heyl, Harris, *ibid.*, 3434.

Gunsalus, Umbreit, Bellamy, Foust, *J. Biol. Chem.*, 1945, 161, 743.

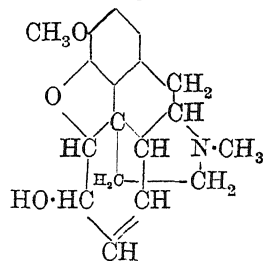
Paterson, Sober, Meister, *J. Am. Chem. Soc.*, 1952, 74, 570.

Viscontini, Ebnother, Karrer, *Helv. Chim. Acta*, 1951, 34, 1834.

### Codehydrogenase.

See Coenzyme.

### Codeine (*Methylmorphine*)



C<sub>18</sub>H<sub>21</sub>O<sub>3</sub>N

MW, 299

Alkaloid of opium. Rhombic octahedra + 1H<sub>2</sub>O. M.p. anhyd. 155°. Sol. hot H<sub>2</sub>O, EtOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Mod. sol. Et<sub>2</sub>O, toluene. Spar. sol. cold H<sub>2</sub>O. [α]<sub>D</sub><sup>20</sup> –137.75° in EtOH. Aq. sol. reacts strongly alk.

*B, HCl, 2H<sub>2</sub>O*: [α]<sub>D</sub><sup>20</sup> –108.2° in H<sub>2</sub>O.

*B<sub>2</sub>, H<sub>2</sub>SO<sub>4</sub>, 5H<sub>2</sub>O*: [α]<sub>D</sub><sup>15</sup> –101.2° in H<sub>2</sub>O.

*Acetyl*: m.p. 133.5°.

*Picrate*: m.p. 196–7° (202–8°).

*Styphnate*: m.p. 115° (195–7°).

Rodionow, *Bull. soc. chim.*, 1929, 45, 119.

Schöpf, *Ann.*, 1927, 452, 211.

Freund, Melber, Schlesinger, *J. prakt. Chem.*, 1921, 101, 1.

Speyer, Krauss, *Ann.*, 1923, 432, 233.

Gulland, Robinson, *Chem. Abstracts*, 1926, 20, 765.

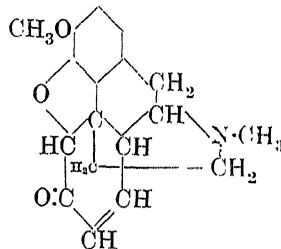
Hoffmann-La Roche, B.P. 457,433, (*Chem. Abstracts*, 1937, 31, 2360).

Shaposhnikov, Russ. P. 50,438, (*Chem. Abstracts*, 1937, 31, 8833).

### β-Codeine.

See Neopine.

### Codeinone



C<sub>18</sub>H<sub>19</sub>O<sub>3</sub>N

MW, 297

Prisms from AcOEt. M.p. 181.5–182.5°. [α]<sub>D</sub><sup>20</sup> –205° in EtOH, –218° in CHCl<sub>3</sub>. Sublimes at 140°/0.3 mm.

*B, HCl*: cryst. from H<sub>2</sub>O. M.p. 180–1°.

*B<sub>2</sub>, H<sub>2</sub>SO<sub>4</sub>*: cryst. + 1H<sub>2</sub>O from H<sub>2</sub>O. M.p. 176–7°.

*Picrate*: m.p. 208.5°.

*Methiodide*: cryst. from H<sub>2</sub>O. M.p. 175°.

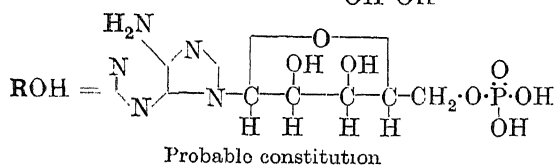
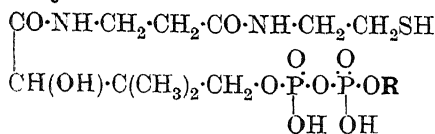
*Oxime*: needles from EtOH. M.p. 209–10°.

*B, HCl*: prisms from EtOH. M.p. 258°.

*2:4-Dinitrophenylhydrazone*: orange tablets. M.p. 261°.

Findlay, Small, *J. Am. Chem. Soc.*, 1950, 72, 3247.

## Coenzyme A



Coenzyme of acetylation. Amorphous powder. Hyd.  $\rightarrow$   $\beta$ -alanine. Inactivated by phosphatase.

Lipmann *et al.*, *J. Biol. Chem.*, 1947, 167, 869.

Novelli, Kaplan, Lipmann, *J. Biol. Chem.*, 1949, 177, 97.

Snell *et al.*, *Arch. Biochem.*, 1950, 27, 473.

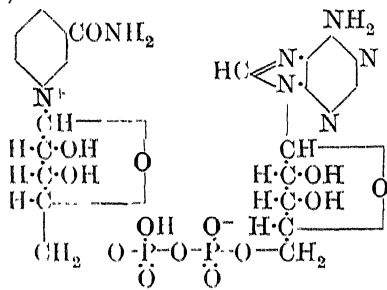
McRorie *et al.*, *ibid.*, 471.

Snell *et al.*, *J. Am. Chem. Soc.*, 1950, 72, 5349.

Novelli, Gregory, Flynn, Schmetz, *Federation Proceedings*, 1951, 10, 229.

Baddiley, Thain, *Chemistry and Industry*, 1951, 337.

**Coenzyme I** (*Cozymase, codehydrase I, codehydrogenase I, diphosphopyridine nucleotide, D.P.N.*)



Suggested formula



Component of yeast fermentation enzymes. Acts as hydrogen acceptor in lactic acid, triose-phosphoric acid and other systems, being converted into dihydrocoenzyme I, flavoproteins converting this back to coenzyme I. Sol.  $\text{H}_2\text{O}$ . Thermostable. Dialysable. Alk. hyd.  $\rightarrow$  adenosinediphosphoric acid. Incubation with adenosinetriphosphoric acid and phosphate in presence of apozymase at  $p_{\text{H}}$  7-8  $\rightarrow$  coenzyme II (q.v.).

von Euler, Schlenk, *Z. physiol. Chem.*, 1937, 246, 64.

Olmeyer, *Biochem. Z.*, 1938, 297, 66.

Warburg, Christian, *Biochem. Z.*, 1936, 287, 291.

Todd, *J. Chem. Soc.*, 1941, 431.

**Coenzyme II** (*Codehydrase II, codehydrogenase II, triphosphopyridine nucleotide, T.P.N.*)



Component of vitamin  $\text{B}_2$  complex, present in red blood corpuscles. Probably of similar constitution to coenzyme I except that it contains three phosphoric acid residues. Acts as hydrogen acceptor in hexosemonophosphoric acid system being converted into dihydrocoenzyme II, flavoproteins converting this back to coenzyme II. Sol.  $\text{H}_2\text{O}$ . Insol. EtOH,  $\text{Et}_2\text{O}$ . Aq. sol. acid to Congo Red.

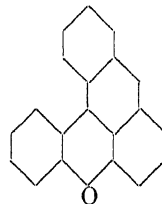
Warburg, Christian, Griese, *Biochem. Z.*, 1935, 282, 157.

Schlenk, Gleim, *Chem. Zentr.*, 1938, I, 912.

Warburg, Christian, *Biochem. Z.*, 1936, 287, 291.

Todd, *J. Chem. Soc.*, 1941, 431.

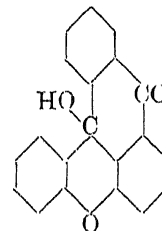
## Coeroxene



Yellow leaflets from AcOH. M.p. 153°. Very sol.  $\text{C}_6\text{H}_6$ ,  $\text{CHCl}_3$ , ligroin. Sol. AcOH. Spar. sol. boiling McOH, EtOH. Insol.  $\text{H}_2\text{O}$ . Sols. exhibit greenish-yellow fluor.  $\text{H}_2\text{SO}_4 \rightarrow$  red sol. with yellow fluor.

Decker, Ferrario, *Ann.*, 1906, 348, 229.

**Coeroxonol** (*Cöroxonol, 9-hydroxy-10-ketocöroxan*)



Strongly refracting, glistening violet cryst. from  $\text{Et}_2\text{O}$ ,  $\text{Me}_2\text{CO}$ , AcOH,  $\text{C}_6\text{H}_6$  or  $\text{CHCl}_3$ . M.p. 179-80° decomp. (rapid heat.). Spar. sol. pet. ether. Insol.  $\text{H}_2\text{O}$ . Darkens in air and light.

*Chloride*:  $\text{C}_{20}\text{H}_{11}\text{O}_2\text{Cl}$ . Red needles from AcOH-HCl. M.p. 185°.

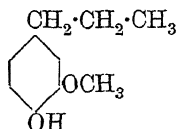
*Me ether*: needles. M.p. 133°.

*Et ether*: violet cryst. from EtOH. M.p. 145-6°.

Propyl ether : cryst. M.p. 151°.  
Isobutyl ether : cryst. M.p. 132°.

Decker, *Ann.*, 1906, **348**, 216.  
Decker, Fellenberg, Ferrario, *Ann.*,  
1907, **356**, 318.  
Bayer, D.R.P. 186,882, (*Chem. Zentr.*,  
1907, II, 1031).

**Cœrulignol** (3 : 4-Dihydroxy-1-propylbenzene  
3-methyl ether, 4-hydroxy-3-methoxy-1-propyl-  
benzene, dihydroeugenol, 5-propylguaiacol)



$C_{10}H_{14}O_2$  MW, 166

B.p. 240–2° (246°). Very sol. EtOH, Et<sub>2</sub>O,  
AcOH. Spar. sol. H<sub>2</sub>O. D<sup>0</sup> 1.06. H<sub>2</sub>SO<sub>4</sub> →  
red col. FeCl<sub>3</sub>.Aq. → carmine red col. Alc.  
sol. with alc. FeCl<sub>3</sub> → green col. KOH  
fusion → protocatechuic acid.

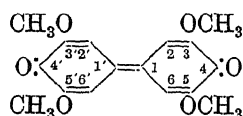
Acetyl : b.p. 365°.  
Me ether : 4-propylveratrol. C<sub>11</sub>H<sub>16</sub>O<sub>2</sub>. MW,  
180. B.p. 247°. D<sup>20</sup> 1.0105.

Picrate : reddish needles. M.p. 61°.

Ipatiew, *Ber.*, 1913, **46**, 3591.

Frank, Gnädiger, *Chem. Zentr.*, 1911, I,  
401.

**Cœrulignone** (*Cedrilet*, 3 : 5 : 3' : 5'-tetra-  
methoxydiphenoquinone-4 : 4')



$C_{16}H_{16}O_6$  MW, 304

Bluish-grey needles. Sol. conc. H<sub>2</sub>SO<sub>4</sub> to  
cornflower-blue sol. Sol. phenol. Insol. ord.  
org. solvents. Hyd. by H<sub>2</sub>O. Red. → hydro-  
cœrulignone.

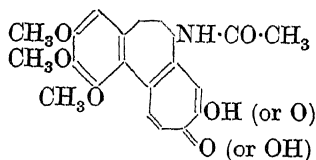
Schlenk, *Ann.*, 1909, **368**, 276.

Hofmann, *Ber.*, 1878, **11**, 335.

**Colamine.**

See 2-Aminoethyl Alcohol.

**Colchicine** (*Acetotrimethylcolchicine acid*)



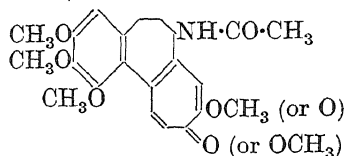
$C_{21}H_{23}O_6N$  MW, 385

M.p. anhyd. 139–40°. Sol. EtOH, CHCl<sub>3</sub>.  
Sol. alkalis with deep yellow col. Sol. mineral  
acids with intense yellow col. Spar. sol. H<sub>2</sub>O.

Insol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Lævorotatory. Conc.  
HCl → trimethylcolchicine acid.

Windaus, *Ann.*, 1924, **439**, 59.

**Colchicine** (*Colchicine methyl ether*)



$C_{22}H_{25}O_6N$  MW, 399

Alkaloid of *Colchicum autumnale*, Linn. Pale  
yellow needles from AcOEt. M.p. 155–7°.  
Separates from C<sub>6</sub>H<sub>6</sub> as yellow cryst. + 1 C<sub>6</sub>H<sub>6</sub>,  
m.p. 140°. Sol. H<sub>2</sub>O, EtOH, CHCl<sub>3</sub>. Very spar.  
sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. [α]<sub>D</sub> – 121° in CHCl<sub>3</sub>. [α]<sub>D</sub>  
– 429° in H<sub>2</sub>O. Yellow in conc. H<sub>2</sub>SO<sub>4</sub>. FeCl<sub>3</sub>  
→ green col. Inhibits tumour growth but  
very toxic.

B.HAuCl<sub>4</sub> : m.p. 209°.

Methylamide : m.p. 173–4°.

Ethylamide : m.p. 160–2°.

Isopropylamide : m.p. 164° decomp

Allylamide : m.p. 152°.

Dimethylamide : m.p. 204–6°.

Cohen, Cook, Roe, *J. Chem. Soc.*, 1940, 194.

Chemnitius, *J. prakt. Chem.*, 1926, **118**, 29.

Windaus, *Ann.*, 1924, **439**, 59

Santavy, *Compt. rend. soc. biol.*, 1946,  
**140**, 932.

Tarbell, Frank, Fanta, *J. Am. Chem. Soc.*,  
1946, **68**, 502–6.

Dewar, *Nature*, 1945, **155**, 141.

Loudon, *Annual Reports of the Chemical  
Society* (London), 1948, XLV, 190,  
(*Bibl.*).

Cook, Loudon, *Quarterly Reviews*, 1951, 5,  
104.

**Collidine.**

See Trimethylpyridine and Methylethyl-  
pyridine.

**α-Colubrin**

$C_{22}H_{24}O_3N_2$  MW, 364

Strychnos alkaloid. Cryst. + 4H<sub>2</sub>O from  
EtOH.Aq. M.p. 184°. Sol. EtOH, CHCl<sub>3</sub>,  
C<sub>6</sub>H<sub>6</sub>. [α]<sub>D</sub><sup>20</sup> – 76.5° in 80% EtOH. Froede's  
reagent → violet col.

Hydrochloride : plates from H<sub>2</sub>O. [α]<sub>D</sub><sup>18</sup> – 3.1°  
in 80% EtOH.

Warnat, *Helv. Chim. Acta*, 1931, **14**, 997.

**β-Colubrin**

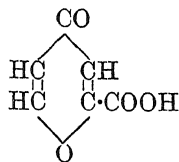
$C_{22}H_{24}O_3N_2$  MW, 364

Cryst. from EtOH.Aq. M.p. 222°. Sol.  
EtOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. [α]<sub>D</sub><sup>19</sup> – 107.7° in 80%  
EtOH. Froede's reagent → violet col.

Hydrochloride : cryst. from H<sub>2</sub>O. [α]<sub>D</sub><sup>18</sup> – 32.7°  
in H<sub>2</sub>O.

Warnat, *Helv. Chim. Acta*, 1931, **14**, 997.



Comanic Acid ( $\gamma$ -Pyrone-2-carboxylic acid)

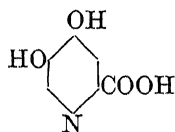
$C_6H_4O_4$  MW, 140

Prisms. M.p.  $250^\circ$  decomp. to  $\gamma$ -pyrone. Spar. sol.  $H_2O$ .

*Et ester*:  $C_8H_8O_4$ . MW, 168. Prisms. M.p.  $103^\circ$ . Sublimes.

Peratoner, Palazzo, *Chem. Zentr.*, 1905, II, 678.

## Comenamic Acid (4 : 5-Dihydroxypicolinic acid)



$C_6H_5O_4N$  MW, 155

Plates +  $2H_2O$ . M.p.  $262^\circ$  decomp. Sol. alkalis, min. acids. Spar. sol. EtOH, cold  $H_2O$ . Decomp. at  $270^\circ$  to 3 : 4-dihydroxypyridine.  $k = 2.4 \times 10^{-4}$  at  $25^\circ$ .

*Et ester*:  $C_8H_9O_4N$ . MW, 183. Needles. M.p.  $205^\circ$ . Sol. hot  $H_2O$ . *Acetyl deriv.*, m.p.  $152^\circ$ . *Diacetyl*: m.p.  $38^\circ$ . *Dibenzoyl*: m.p.  $101-2^\circ$ .

*5-Me ether*:  $C_7H_7O_4N$  MW, 169. Needles from hot  $H_2O$ . M.p.  $269^\circ$  decomp. *B, HNO<sub>3</sub>*: cryst. from dil.  $HNO_3$ . M.p.  $236-7^\circ$  decomp. *Picrate*: cryst. from hot  $H_2O$ . M.p.  $225^\circ$  decomp. *Me ester*:  $C_8H_9O_4N$ . MW, 183. Cryst. M.p. about  $118^\circ$ . Very sol.  $H_2O$ , EtOH. Spar. sol. Et<sub>2</sub>O.

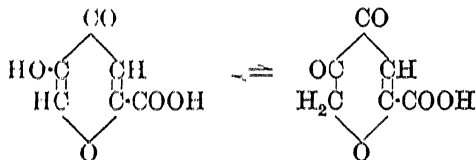
*5-Et ether*:  $C_8H_9O_4N$ . MW, 183. Needles +  $H_2O$  from  $H_2O$ . M.p. anhyd.  $235^\circ$  decomp.  $FeCl_3 \rightarrow$  orange-yellow col.

Reibstein, *J. prakt. Chem.*, 1881, 24, 284.

Yabuta, *J. Chem. Soc.*, 1924, 125, 583.

Verkade, *Rec. trav. chim.*, 1924, 43, 886.

Armit, Nolan, *J. Chem. Soc.*, 1931, 3028.

Comenic Acid (5-Hydroxy- $\gamma$ -pyrone-2-carboxylic acid)

$C_6H_4O_5$  MW, 156

Yellow cryst. Decomp. above  $260^\circ$ . Mod. sol. hot  $H_2O$ . Insol. EtOH.  $FeCl_3 \rightarrow$  reddish-violet col.

*Et ester*:  $C_8H_8O_5$ . MW, 184. Needles. M.p.  $135^\circ$  ( $126^\circ$ ). Sol. EtOH, hot  $H_2O$ . Sublimes. *Acetyl deriv.*, m.p.  $104^\circ$ .

*Me ether*:  $C_7H_6O_5$ . MW, 170. M.p.  $280-2^\circ$ . *Et ether*:  $C_8H_8O_5$ . MW, 184. M.p.  $239-40^\circ$ .

Reibstein, *J. prakt. Chem.*, 1881, 24, 284.

Yabuta, *J. Chem. Soc.*, 1924, 125, 583.

Verkade, *Rec. trav. chim.*, 1924, 43, 886.

Takahashi, Asai, *Chem. Abstracts*, 1934, 28, 6519.

## Compound A (Kendall).

See 11-Dehydrocorticosterone.

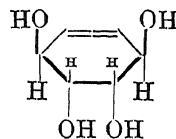
## Compound B (Kendall).

See Corticosterone

## Compound E (Kendall).

See Cortisone.

## Conduritol



$C_6H_{10}O_4$  MW, 146

Constituent of Condurango bark. Prisms from EtOH. M.p.  $142-3^\circ$ . Sweet taste. Heat. with HCl  $\rightarrow$  catechol.

*Di-Me ether*: m.p.  $100-1^\circ$ . *Diacetyl deriv.*: m.p.  $79^\circ$ .

*Tetra-acetyl*: b.p.  $165^\circ/0.6$  mm.

*Phenylurethane*: powder. M.p.  $120^\circ$ .

Dangschat, Fischer, *Naturwiss.*, 1939, 27, 756.

Kubler, *Arch. Pharm.*, 1908, 246, 620.

## Conessidine

$C_{21}H_{32}N_2$  MW, 312

Found in *Holarrhena antidysenterica*. Cryst. from  $Me_2CO$  M.p.  $123^\circ$ .  $[\alpha]_D^{25} -52.2^\circ$  in  $CHCl_3$ .

*Dihydrate*: m.p.  $291-2^\circ$ .

*B, 2HCl*: discolours at  $200^\circ$ , melts at  $259^\circ$  decomp.

*Diperchlorate*: m.p.  $243^\circ$  decomp.

Bertho, *Ber.*, 1933, 66, 786; *Ann.*, 1944, 555, 214.

## Conessimine

$C_{23}H_{38}N_2$  MW, 342

Alkaloid from *Holarrhena antidysenterica*, Wall. Needles from pct. ether or AcOEt. M.p.  $100^\circ$ . B.p.  $230^\circ/1.8$  mm.  $[\alpha]_D^{25} -22.25^\circ$  in  $CHCl_3$ .

*B, 2HCl*: m.p.  $342-4^\circ$ .  $[\alpha]_D^{25} -15.1^\circ$  in  $H_2O$ .

*B, 2III*: m.p.  $318-9^\circ$  decomp.

*B, 2HAuCl<sub>4</sub>*: m.p.  $165^\circ$  decomp.

*B, H<sub>2</sub>PtCl<sub>6</sub>*: m.p.  $301^\circ$  decomp.

*Carbonate*: m.p.  $105^\circ$  (softens at  $70^\circ$ ).

*Picrate*: yellow prisms. M.p.  $172-4^\circ$ .

Siddiqui, Pillay, *J. Indian Chem. Soc.*, 1932, 9, 553.

Siddiqui, *J. Indian Chem. Soc.*, 1934, 11, 283.

**Conessine**

$C_{24}H_{40}N_2$  MW, 356

Alkaloid present in various species of *Holarhena*. Leaflets from  $Me_2CO$ . M.p. 123–4°. Spar. sol.  $H_2O$ .  $[\alpha]_D^{20} - 1.9^{\circ}$  in  $CHCl_3$ , + 25.3° in EtOH. Tertiary base.

*B, 2HCl, H\_2O*: m.p. 340°.  $[\alpha]_D^{20} + 9.3^{\circ}$  in  $H_2O$ .

*B, 2HBr*:  $[\alpha]_D + 7.4^{\circ}$  in  $H_2O$ .

*Acid oxalate, B, 2C\_2H\_2O\_4*: prisms from  $H_2O$ . M.p. 280° decomp.

*Dimethiodide, B, (CH\_3I)\_2, 3H\_2O*: m.p. 285°.

*Dimethosulphate*: prisms from MeOH– $Me_2CO$ . M.p. 240–2°.

*Picrate*: m.p. 222–4°.

Siddiqui, Pillay, *J. Indian Chem. Soc.*, 1932, 9, 553.

Siddiqui, *J. Indian Chem. Soc.*, 1934, 11, 283.

Späth, Hromatka, *Ber.*, 1930, 63, 127.

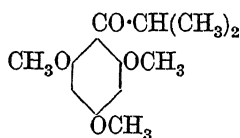
Kanga, Ayyar, Simonsen, *J. Chem. Soc.*, 1926, 2123.

Pyman, *J. Chem. Soc.*, 1919, 115, 163.

Hermans, *Pharmaceutisch Weekblad*, 1927, 64, 821 (Review).

Haworth, McKenna, *Chemistry and Industry*, 1951, 312.

Haworth et al., *Chemistry and Industry*, 1952, 215.

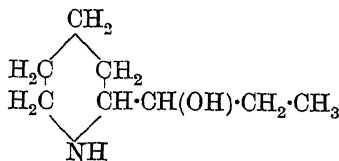
**Conglomerone** (2:4:6-Trimethoxyisobutyrophenone)

$C_{13}H_{18}O_4$  MW, 238

Constituent of *Eucalyptus conglomerata* oil. M.p. 62–62.5°.  $CrO_3 \rightarrow$  2:6-dimethoxy-p-benzoquinone.

2:4-Dinitrophenylhydrazones: m.p. 164°.

Lahey, Jones, *Brit. Chem. Abstracts*, 1940, II, 176.

**Conhydrine** (2- $\alpha$ -Hydroxypropylpiperidine,  $\alpha$ -hydroxyconiine)

$C_8H_{17}ON$  MW, 143

Alkaloid from hemlock. Cryst. from  $Et_2O$ . M.p. 121°. B.p. 226°. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ . Mod. sol.  $H_2O$ .  $[\alpha]_D + 10^{\circ}$ . Ox.  $\rightarrow$  piperidine-2-carboxylic acid. Conc. HCl  $\rightarrow$   $\alpha$ -,  $\beta$ -, and  $\gamma$ -coniceines.

*B, HAuCl\_4*: m.p. 133°.

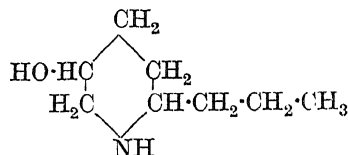
*N-Acetyl*: b.p. 133–5°/3 mm. *Oxime*: m.p. 132–6°. *Hydrazone*: m.p. 124–5°.

Chemnitz, *J. prakt. Chem.*, 1928, 118, 25.

Hess, Eichel, *Ber.*, 1917, 50, 1386.

Späth, Adler, *Monatsh.*, 1933, 63, 127.

Galinovsky, Mulley, *Monatsh.*, 1948, 79, 426.

 **$\psi$ -Conhydrine** (5-Hydroxy-2-propylpiperidine, 5-hydroxyconiine)

$C_8H_{17}ON$  MW, 143

Occurs in hemlock. Slender needles. M.p. 105–6°. B.p. 236.5°.  $[\alpha]_D^{15} + 11^{\circ}$  in EtOH.

*B, HCl*: m.p. 212–3°.

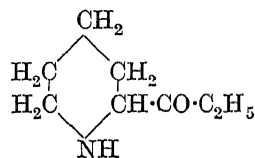
*B, HAuCl\_4*: m.p. 133–4°.

*B\_2, H\_2PtCl\_6*: needles. M.p. 185–6°.

*N-Benzoyl*: m.p. 132–3°.  $[\alpha]_D^{17} + 23.4^{\circ}$ .

Löffler, *Ber.*, 1909, 42, 116.

Späth, Kuffner, Ensfellner, *Ber.*, 1933, 66, 591.

**Conhydrinone** (Ethyl  $\alpha$ -piperidyl ketone, 2-propionylpiperidine)

$C_8H_{15}ON$  MW, 141

*d.*

B.p. 94°/18 mm., 85–7°/10 mm.  $[\alpha]_D^{21} - 11.42^{\circ}$  in  $H_2O$ . Misc. with  $H_2O$  in all proportions.  $D_4^{20} 0.9380$ .  $n_D^{20} 1.46215$ .

*B, HBr*: cryst. from  $Me_2CO$ . M.p. 146°.

*Hydrazone*: b.p. 123–5°/18 mm. *Picrate*: cryst. from MeOH. M.p. 164°.

*Picrate*: cryst. from EtOH. M.p. 107–8°.

*N-Me*:  $C_9H_{17}ON$ . MW, 155. B.p. 85–7°/12 mm.  $D_4^{20} 0.9343$ .  $n_D^{20} 1.46105$ . *B, HBr*: m.p. 152–3°. *Oxime*: b.p. 135°/10 mm. *Picrate of oxime*: cryst. from EtOH. M.p. 152°. *Hydrazone*: b.p. 126–8°/12 mm. *Methiodide*: m.p. 113°. *Picrate*: m.p. 86–7°.

*dl.*

B.p. 93–4°/10 mm.

*N-Me*: b.p. 95°/15 mm. Sol.  $H_2O$ . *B, HCl*: needles from  $Me_2CO$ . M.p. 124°. *B, HBr*: needles from  $Me_2CO-Et_2O$ . M.p. 137–8°. *Oxime*: b.p. 158°/22 mm. *Picrate of oxime*: cryst. from EtOH. M.p. 138–45°. *Methiodide*: prisms from

EtOH. M.p. 117-9°. *Picrate*: cubes from EtOH. M.p. 107°.

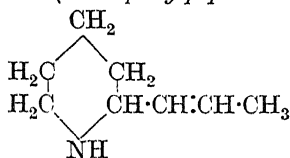
Hess, Grau, *Ann.*, 1925, 441, 112.  
Hess, Eichel, *Ber.*, 1917, 50, 1403.  
Hess, *Ber.*, 1919, 52, 981.

$\alpha$ -Coniceine.

B.p. 158°.  $[\alpha]_D + 18.4^\circ$ .

Löffler, *Ber.*, 1904, 37, 1896.

$\beta$ -Coniceine (2-Propenylpiperidine)



C<sub>8</sub>H<sub>15</sub>N

MW, 125

*d*-.

Needles. M.p. 39°. B.p. 168-9°. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O.  $[\alpha]_D^{25} + 49.9^\circ$ .

*B, HCl*: m.p. 181-2°.

*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 175-7°.

*B, HAuCl<sub>4</sub>*: m.p. 123°.

*d-Tartrate*: cryst. + 2H<sub>2</sub>O from H<sub>2</sub>O. M.p. 62-3°.

*l*-.

M.p. 39.5-40.5°. B.p. 168-9°.  $[\alpha]_D^{25} - 50.47^\circ$ .

*B, HCl*: needles from EtOH-Et<sub>2</sub>O. M.p. 182-3°.

*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 176°.

*B, HAuCl<sub>4</sub>*: m.p. 122-5°.

*l-Tartrate*: cryst. + 2H<sub>2</sub>O from H<sub>2</sub>O. M.p. 63°.

*dl*-.

M.p. 8°. B.p. 168.5-70°/753 mm.  $D_4^{15} 0.8716$ .

*B, HCl*: m.p. 206-7°.

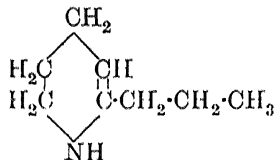
*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 184°.

*B, HAuCl<sub>4</sub>*: m.p. 107-8°.

*Picrate*: m.p. 113-114.5°.

Löffler, Friederich, *Ber.*, 1909, 42, 107.

$\gamma$ -Coniceine (2-Propyl-1:4:5:6-tetrahydropyridine)



C<sub>8</sub>H<sub>15</sub>N

MW, 125

Alkaloid from hemlock. B.p. 171-2°, 64-5°/24 mm. Spar. sol. H<sub>2</sub>O.  $D_4^{15} 0.8753$ .  $n_D^{18.4} 1.4697$ . Red. -  $\rightarrow$  *dl*-coniine.

*B, HCl*: m.p. 143°.

*B, HBr*: m.p. 139°.

*B, HI*: m.p. 102°.

*B, HAuCl<sub>4</sub>*: m.p. 69-70°.

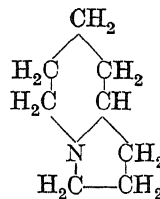
*N-Acetyl*: b.p. 252-5°.

*Picrate*: m.p. 62°.

Gabriel, *Ber.*, 1909, 42, 4059.

Löffler, Tschunke, *Ber.*, 1909, 42, 945.

$\delta$ -Coniceine (2-Piperolidine)



C<sub>8</sub>H<sub>15</sub>N

MW, 125

B.p. 161°.  $D_4^{15} 0.904$ .

*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 213° decomp.

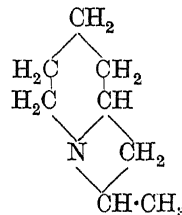
*B, HAuCl<sub>4</sub>*: m.p. 192°.

*Picrate*: m.p. 226°.

Löffler, Kaim, *Ber.*, 1909, 42, 94.

Lellmann, *Ann.*, 1890, 259, 194.

$\epsilon$ -Coniceine (2-Methylconidine)



C<sub>8</sub>H<sub>15</sub>N

MW, 125

*d*-.

B.p. 151-4°.  $D_4^{15} 0.8856$ .  $[\alpha]_D^{25} + 67.4^\circ$ .

*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 184-5°.

*B, HAuCl<sub>4</sub>*: m.p. 167-8°.

*l*-.

B.p. 143-5°.  $D_4^{15} 0.8624$ .  $[\alpha]_D^{25} - 87.34^\circ$ .

*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 184-5°.

*B, HAuCl<sub>4</sub>*: m.p. 198-9°.

*dl*-.

B.p. 150-1°.  $D^{15} 0.8836$ .

*B, HAuCl<sub>4</sub>*: m.p. 178°.

*Picrate*: m.p. 223-4°.

Löffler, *Ber.*, 1909, 42, 948.

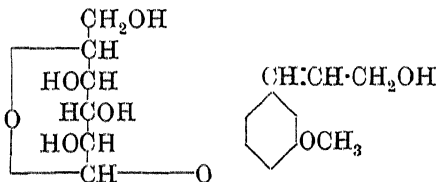
Conidendrin.

See Tsugaresinol.

*p*-Coniferaldehyde.

See Ferula-aldehyde.

Coniferin



C<sub>16</sub>H<sub>22</sub>O<sub>8</sub>

MW, 342

Chief glucoside of the conifers. Needles + 2H<sub>2</sub>O. M.p. 185°. Sol. hot H<sub>2</sub>O. Spar. sol. EtOH. Insol. Et<sub>2</sub>O.  $[\alpha]_D^{20} - 66.9^\circ$  in H<sub>2</sub>O. Conc. H<sub>2</sub>SO<sub>4</sub>  $\rightarrow$  red. col. Phenol + conc. HCl  $\rightarrow$  deep blue col. CrO<sub>3</sub>  $\rightarrow$  glucovanillin.

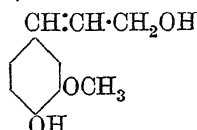
KMnO<sub>4</sub> → glucovanillic acid. Emulsin → coniferyl alcohol + glucose.

*Tetracetyl deriv.*: m.p. 132°.

*Tribenzoyl deriv.*: m.p. 80°.

Pauly, Feuerstein, *Ber.*, 1927, 60, 1031.

**Coniferyl Alcohol** (p-Hydroxy-m-methoxy-cinnamyl alcohol, 1-ω-hydroxypropenyl-3-methoxy-4-hydroxybenzene)



C<sub>10</sub>H<sub>12</sub>O<sub>3</sub>

MW, 180

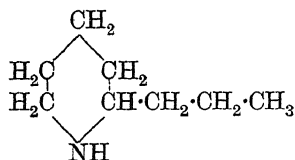
Prisms. M.p. 73-4°. Sol. Et<sub>2</sub>O, alkalis. Mod. sol. EtOH. Spar. sol. hot H<sub>2</sub>O. CrO<sub>3</sub> → vanillin + acetaldehyde. KOH fusion → protocatechuic acid. Resinified by min. acids.

Tiemann, Haarmann, *Ber.*, 1874, 7, 611.

**Coniferyl Aldehyde.**

See Ferula-aldehyde.

**Coniine** (2-Propylpiperidine)



C<sub>8</sub>H<sub>17</sub>N

MW, 127

*d.*

Alkaloid of hemlock (*Conium maculatum*, Linn.). Colourless liq. M.p. -2°. B.p. 166-7°. Misc. with EtOH in all proportions. Sol Et<sub>2</sub>O. Spar. sol. CS<sub>2</sub>, CHCl<sub>3</sub>, cold H<sub>2</sub>O. Less sol. hot H<sub>2</sub>O. Volatile in steam. Dissolves 25% of H<sub>2</sub>O. [α]<sub>D</sub> +13.79° (+15.7°). Heat of comb. C<sub>v</sub> 1273.5 Cal. Resinifies on long standing in air. Dist. with Zn dust → conyryne.

*B.HCl*: m.p. 220°.

*B.HBr*: m.p. 207°.

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: m.p. anhyd. 175°.

*B.HAuCl<sub>4</sub>*: yellow needles. M.p. 77°.

*Picrate*: m.p. 75°.

*l.*

B.p. 166.5°. [α]<sub>D</sub> -15.6°. D<sub>4</sub><sup>20</sup> 0.845.

*B.HCl*: m.p. 220-1° (214-5°).

*B.HBr*: m.p. 205°.

*B.HI*: m.p. 145-6°.

*B.HNO<sub>3</sub>*: m.p. 82-3°.

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 160°.

*B.HAuCl<sub>4</sub>*: m.p. 59°.

*dl.*

B.p. 166°. D<sub>20</sub> 0.8447.

*B.HCl*: m.p. 216-7°.

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 160°.

Chemnitius, *J. prakt. Chem.*, 1928, 118, 25.

Kollor, *Monatsh.*, 1926, 47, 393.

**Conquinine.**

See Quinidine.

**Consolidine**

C<sub>33</sub>H<sub>49</sub>O<sub>9</sub>N

MW, 603

Alkaloid of *Delphinium consolida*, Linn. M.p. 153-7°. [α] +64° in MeOH. Hyd. → benzoic acid.

*B.HClO<sub>4</sub>*: m.p. 252°. [α]<sub>D</sub><sup>25</sup> +33° in 90% MeOH.

Marion, Edwards, *J. Am. Chem. Soc.*, 1947, 69, 2010.

**Convallamaretin**

C<sub>26</sub>H<sub>40</sub>O<sub>5</sub>

MW, 432

The aglycone of convallamarin. M.p. 248.5-50.5° decomp. [α]<sub>D</sub><sup>25</sup> -86.0° in CHCl<sub>3</sub>.

Voss, Vogt, *Ber.*, 1936, 69, 2333.

**Convallamarin**

C<sub>44</sub>H<sub>70</sub>O<sub>19</sub>

MW, 902

Occurs in *Convallaria majalis* and *Adonis vernalis*. Hygroscopic amorphous powder. Very sol. H<sub>2</sub>O, MeOH, AcOH. Sol. EtOH. Spar. sol. AcOEt, CHCl<sub>3</sub>, Me<sub>2</sub>CO, Et<sub>2</sub>O. Insol. C<sub>6</sub>H<sub>6</sub>, pet. ether. [α]<sub>D</sub> -66.5°. Hyd. → *l*-rhamnose + *d*-glucose + convallamaretin. Reduces Fehling's. Acids → red col.

Voss, Vogt, *Ber.*, 1936, 69, 2333.

Votoček, Vondráček, *Chem. Zentr.*, 1903, I, 1035.

**Convallatoxin**

C<sub>28</sub>H<sub>42</sub>O<sub>10</sub>

MW, 538

*l*-Rhamnoside of strophanthidin (q.v.). Occurs in *Convallaria majalis*, Linn. Cryst. from AcOEt, m.p. 238-9°. Needles -| H<sub>2</sub>O from EtOH.Aq. M.p. 225° (212°).

*Acetyl deriv.*: needles from Me<sub>2</sub>CO-Et<sub>2</sub>O. M.p. 237-41°. [α]<sub>D</sub><sup>25</sup> -8.2 ± 2° in CHCl<sub>3</sub>.

*Oxime*: softens at 140°, melts at 170-90°.

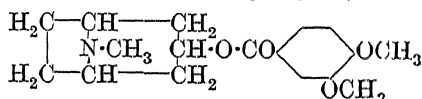
Karrer, *Helv. Chim. Acta*, 1929, 12, 506.

Tschesche, Haupt, *Ber.*, 1936, 69, 459.

Reichstein, Katz, *Chem. Abstracts*, 1944, 38, 2046.

Katz, *Pharm. Acta Helv.*, 1947, 22, 244.

**Convolvamine** (*Veratroyltropine*)



C<sub>17</sub>H<sub>23</sub>O<sub>4</sub>N

MW, 305

Alkaloid from *Convolvulus pseudocantabricus*, Schrenk. Prisms from pet. ether. M.p. 114-5°. Sol. EtOH, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Spar. sol. Et<sub>2</sub>O, hot H<sub>2</sub>O. Alc. KOH → veratric acid -| tropine.

*B.HCl*: cryst. powder from EtOH. M.p. 237-9°.

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: orange needles. M.p. 216-7°.

*B,HAuCl<sub>4</sub>*: reddish-yellow needles. M.p. 201-2°.

*Picrate*: yellow leaflets from H<sub>2</sub>O or EtOH. M.p. 263-4° decomp.

*Methiodide*: needles from H<sub>2</sub>O. M.p. 257-9°.

Orechov, Konavolova, *Ber.*, 1935, 68, 814; 1934, 67, 1153; *Arch. Pharm.*, 1933, 271, 145.

Orekhov, *Arch. Pharm.*, 1934, 272, 673.

**Convolvicine**

C<sub>10</sub>H<sub>16</sub>N<sub>2</sub> MW, 164

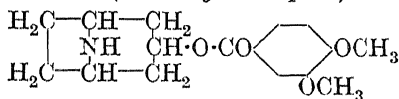
Liquid base from *Convolvulus pseudocantabricus*, Schrenk.

*Picrate*: needles from H<sub>2</sub>O. M.p. 200-2°.

Orechov, Konavolova, *Ber.*, 1935, 68, 814; 1934, 67, 1153; *Arch. Pharm.*, 1933, 271, 145.

Orekhov, *Arch. Pharm.*, 1934, 272, 673.

**Convolveine (Veratrolynortropine)**



C<sub>16</sub>H<sub>21</sub>O<sub>4</sub>N MW, 291

Alkaloid from *Convolvulus pseudocantabricus*, Schrenk. M.p. 114-5°. Sol. EtOH, Me<sub>2</sub>CO, (CHCl<sub>3</sub>). Spar. sol. Et<sub>2</sub>O, pet. ether, hot H<sub>2</sub>O.

*B,HCl*: m.p. 260-1°.

*B,HNO<sub>3</sub>*: m.p. 212-3°.

*Oxalate*: m.p. 265-6° decomp.

*B<sub>2</sub>,H<sub>2</sub>PtCl<sub>6</sub>*: yellowish-red. M.p. 240-1° decomp.

*B,HAuCl<sub>4</sub>*: yellow. M.p. 217° decomp.

*Picrate*: yellow. M.p. 261-3°.

*Methiodide*: m.p. 230-1°.

Orechov, Konavolova, *Ber.*, 1935, 68, 814; 1934, 67, 1153; *Arch. Pharm.*, 1933, 271, 145.

Orekhov, *Arch. Pharm.*, 1934, 272, 673.

**Convolvulin (Rhodeoretin)**

C<sub>54</sub>H<sub>96</sub>O<sub>27</sub> MW, 1176

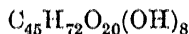
Glycoside of jalap. Colourless, amorphous powder. M.p. 158°. Sol. EtOH, AcOH. Spar. sol. H<sub>2</sub>O. Conc. H<sub>2</sub>SO<sub>4</sub> → red. col. Hyd. to glucose, rhodeose and convolvulinic acid. Decomp. by alkalis.

*Acetyl deriv.*: m.p. 112°.

*Tribenzoyl deriv.*: m.p. 125-31°.

Hoechnel, *Chem. Zentr.*, 1897, I, 418.

**Convolvulinic Acid**



C<sub>45</sub>H<sub>80</sub>O<sub>28</sub> MW, 1068

Glucoside formed by partial hydrolysis of convolvulin. M.p. 150-5°. [α]<sub>D</sub> -34° 68'. Hyd. → convolvulinic acid + glucose (5 mols.).

*Tetrazobenzoyl deriv.*: m.p. 115-8°.

Davies, Adams, *J. Am. Chem. Soc.*, 1928, 50, 1749.

**Convolvulinic Acid (? Hydroxypentadecanoic acid)**

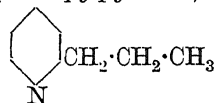
C<sub>15</sub>H<sub>30</sub>O<sub>3</sub> MW, 253

Powder. M.p. 51-2°. Sol. EtOH.

*Me ester*: C<sub>16</sub>H<sub>32</sub>O<sub>3</sub>. MW, 272. M.p. 31-2°.

Davies, Adams, *J. Am. Chem. Soc.*, 1928, 50, 1749.

**Conyryne (2-Propylpyridine)**



C<sub>8</sub>H<sub>11</sub>N MW, 121

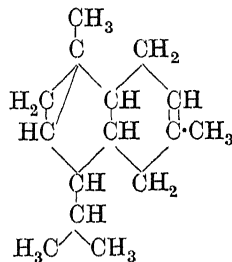
B.p. 165-8°. KMnO<sub>4</sub> → picolinic acid. HI at 300° → coniine.

*B<sub>2</sub>,H<sub>2</sub>PtCl<sub>6</sub>*: orange cryst. M.p. 172°.

Tafel, *Ber.*, 1892, 25, 1622.

Späth, Galinovsky, *Ber.*, 1936, 69, 766.

**Copaene**



C<sub>15</sub>H<sub>24</sub> MW, 204

Constituent of oil of African Copaiba balsam, also from oil of *Sindora wallichii*, Benth. B.p. 246-51°, 119-20°/10 mm. D<sub>4</sub><sup>20</sup> 0.9077. n<sub>D</sub><sup>20</sup> 1.4894. [α]<sub>D</sub> -13.3°. HCl → levorotatory cadinene dihydrochloride. S → cadalene.

Henderson, McNab, Robertson, *J. Chem. Soc.*, 1926, 3077.

Semmler, Stenzel, *Ber.*, 1914, 47, 2556.

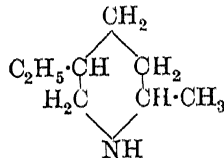
Downes, Gill, Lions, *Australian Journal of Science*, 1948, 10, 147.

Briggs, Gill, Lions, Taylor, *J. Chem. Soc.*, 1949, 1098.

**Copareolatin.**

See 1 : 5 : 6 : 7-Tetrahydroxy-2-methylantranthraquinone.

**Copellidine (2-Methyl-5-ethylpiperidine, copellidine-A)**



C<sub>8</sub>H<sub>17</sub>N MW, 127

*d.* (β-).

B.p. 162-3°. D<sub>4</sub><sup>15</sup> 0.8375. [α]<sub>D</sub> +36.93°.

*B,HCl*: m.p. 215°.

*B,HBr*: m.p. 216°.

*B,HAuCl<sub>4</sub>*: m.p. 89°.

*l.* ( $\gamma$ -).

B.p. 162-3°.  $D^{10}$  0.8347.  $[\alpha]_D -16.26^\circ$ .

*dl.* ( $\alpha$ -).

B.p. 162-3°.  $D^{18}$  0.8362. Spar. sol.  $H_2O$ .

*B, HCl*: m.p. 173°. Very sol.  $H_2O$ .

*B, HBr*: m.p. 169°.

*B, H<sub>2</sub>PtCl<sub>6</sub>*: yellow needles. M.p. 145-7°.

*B, HAuCl<sub>4</sub>*: m.p. 105°.

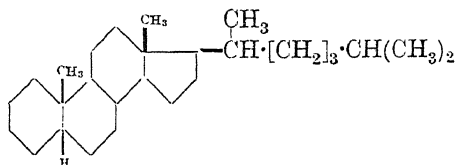
Braun, Lemke, Nelken, *Ber.*, 1923, 56, 1564.

Ladenburg, Durkopf, *Ann.*, 1888, 247, 90.

### Copellidine-B.

See Isocopellidine.

### Coprostanone ( $\psi$ -Cholestane)



$C_{27}H_{48}$  MW, 372

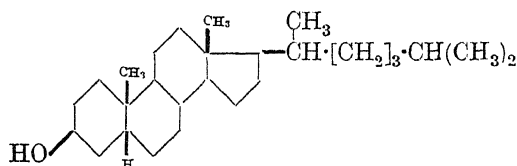
Needles from EtOH. M.p. 71-2°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>. Spar. sol. alcohols.  $[\alpha]_D^{11} + 25.07^\circ$  in CHCl<sub>3</sub>. CrO<sub>3</sub>  $\rightarrow$  cholic acid.

Mauthner, *Monatsh.*, 1909, 30, 639.

Windaus, Ubrig, *Ber.*, 1915, 48, 857.

Ruzicka, Furter, Thomann, *Helv. Chim. Acta*, 1933, 16, 334.

### Coprostanol (Coprosterol)



$C_{27}H_{48}O$  MW, 388

Occurs in faeces. Needles from MeOH. M.p. 101°.  $[\alpha]_D^{18} + 28^\circ$  in CHCl<sub>3</sub>.

*Acetyl*: cryst. from AcOH. M.p. 89-90°.

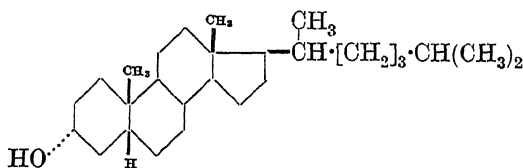
*Propionyl*: m.p. 99-100°.

*Benzoyl*: m.p. 124-5°.  $[\alpha]_D^{18} + 31^\circ$ .

Ruzicka, Furter, Goldberg, *Helv. Chim. Acta*, 1938, 21, 498.

Ruzicka, Brungger, Eichenberger, Meyer, *Helv. Chim. Acta*, 1934, 17, 1415.

### epi-Coprostanol



$C_{27}H_{48}O$  MW, 388

Cryst. from EtOH, m.p. 111°. Cryst. from Me<sub>2</sub>CO, m.p. 117-8°.  $[\alpha]_D + 31^\circ$ .

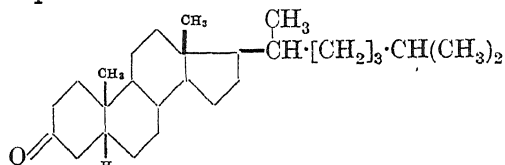
*Acetyl*: cryst. from EtOH. M.p. 87-8°.  $[\alpha]_D + 43.8^\circ$ .

*Benzoyl*: m.p. 85-6°.

Ruzicka, Furter, Goldberg, *Helv. Chim. Acta*, 1938, 21, 498.

Ruzicka, Brungger, Eichenberger, Meyer, *Helv. Chim. Acta*, 1934, 17, 1415.

### Coprostanone



$C_{27}H_{46}O$  MW, 386

Plates from Me<sub>2</sub>CO-EtOH. M.p. 63°.  $[\alpha]_D + 36.3^\circ$  in C<sub>6</sub>H<sub>6</sub>.

*Oxime*: m.p. 71°.

*Semicarbazone*: from C<sub>6</sub>H<sub>6</sub>. M.p. 192°.

*Phenylhydrazone*: plates from C<sub>6</sub>H<sub>6</sub>-EtOH. M.p. 192°.

Dorée, Gardner, *J. Chem. Soc.*, 1908, 93, 1628.

Windaus, *Ber.*, 1916, 49, 1732.

Grasshof, *Z. physiol. Chem.*, 1934, 223, 249.

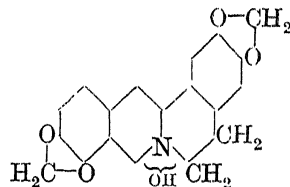
### Coprostene.

See  $\Delta^4$ -Cholestene.

### Coprosterol

See Coprostanol.

**Coptisine** (2:3:9:10-Bismethylenedioxyprotoberberine)



$C_{19}H_{15}O_5N$  MW, 337

Alkaloid of *Coptis japonica*, Mak. Yellow needles from EtOH. M.p. 216-8°. KMnO<sub>4</sub>  $\rightarrow$  hydrastic acid.

Kitasato, *Brit. Chem. Abstracts*, 1926, 1160.

Späth, Posega, *Ber.*, 1929, 62, 1029.

Huang-Minlon, *Ber.*, 1936, 69, 1744.

### Coramine.

See under Nicotinamide.

### Corchorin.

See Strophanthidin.

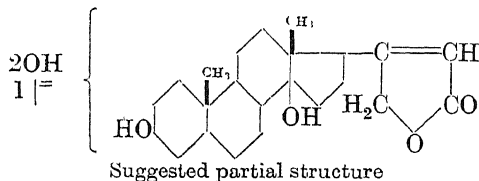
### Corchoritin

$C_{12}H_{18}O_3$  MW, 210

Bitter principle of jute (*Corchorus capsularis*, Linn.). Prisms from EtOH. M.p. 218-20°.  $[\alpha]_D^{27} - 35.1^\circ$  in 96% EtOH.

Sen, *J. Indian Chem. Soc.*, 1931, 8, 651, (*Chem. Zentr.*, 1932, I, 533).

## Corchortoxin



$C_{23}H_{32}O_6$  MW, 404

Cardiac aglycone occurring in jute seeds (*Corchorus capsularis*). M.p. 247°.  $[\alpha]_D^{18} + 67.9^\circ$  in EtOH.

Acetyl deriv.: m.p. 210°.

Tetrahydro deriv.: m.p. 82°.

Karrer, Banerjea, *Helv. Chim. Acta*, 1949, 32, 2385.

## Coriandrol.

See Linalool.

## Coriarin

$C_{12}H_{14}O_5$  (?) MW, 238

Occurs in seeds of *Coriaria japonica*, A. Gray. Cryst. from EtOH. M.p. 212–13°. Sublimes.

Acetyl: cryst. from EtOH.Aq. M.p. 240°.

Benzoyl: needles. M.p. 170–5°.

Kariyone, Sato, *J. Pharm. Soc. Japan*, 1930, 50, 106.

Kinoshita, *J. Chem. Soc. Japan*, 1931, 52, 171.

Slater, *J. Chem. Soc.*, 1943, 50.

## Corinnic Acid

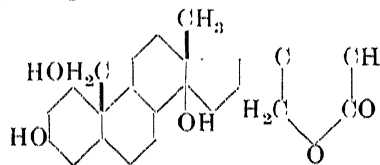
$C_{35}H_{68}O_2$  (?) MW, 520

Isolated from diphtheria cells. M.p. 70°.

Et ester: m.p. 62°.

Gubarev, Vakulenko, *Chem. Abstracts*, 1946, 40, 1557.

## Coroglaucigenin



$C_{23}H_{34}O_5$  MW, 390

Constituent of *Coronilla glauca*. M.p. 249°.

$[\alpha]_D^{20} - 23^\circ$  in MeOH.

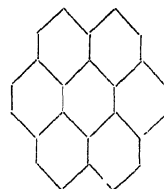
Diacetyl: m.p. 222°.  $[\alpha]_D - 9^\circ$  in  $CHCl_3$ .

3-d-Allomethyloside: frugoside. Constituent of *Gomphocarpus fruticosus*, (Linn.), R.Br. Cryst. + 2H<sub>2</sub>O from MeOH.Aq. M.p. 169–70°, then again at 237–42°.  $[\alpha]_D^{25} - 17.4^\circ$  in 80% MeOH. Tetra-benzoyl deriv.: needles from Me<sub>2</sub>CO-MeOH. M.p. 160–2°.  $[\alpha]_D^{24} + 15.5^\circ$  in  $CHCl_3$ .

Stoll, Pereira, Renz, *Helv. Chim. Acta*, 1949, 32, 293.

Hunger, Reichstein, *Helv. Chim. Acta*, 1952, 35, 429, 1073.

## Coronene (Hexabenzobenzene)



$C_{24}H_{12}$  MW, 300

Stout yellow needles from  $C_6H_6$ . M.p. 438–40° corr. B.p. 525°/760 mm. Sol. 1290 parts cold, 315 parts boiling  $C_6H_6$ . Insol. cold conc.  $H_2SO_4$ . Bluish-violet fluor. in ord. org. solvents.

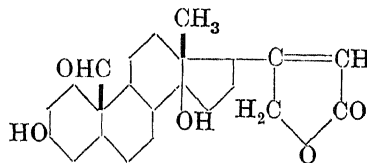
Picrate: deep red cryst. from  $C_6H_6$ . Decomp. above 250°.

1:3:5-Trinitrobenzene add. comp.: orange needles from  $C_6H_6$ . Decomp. above 280°.

Scholl, Meyer, *Ber.*, 1932, 65, 902.

Newman, *J. Am. Chem. Soc.*, 1940, 62, 1683.

## Corotoxigenin



$C_{23}H_{32}O_5$  MW, 388

Occurs in *Coronilla glauca*. M.p. 221°.  $[\alpha]_D + 43^\circ$  in MeOH.

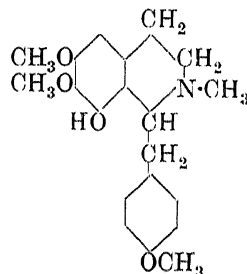
Diacetyl: m.p. 256°.  $[\alpha]_D + 31^\circ$  in MeOH.

3-d-Allomethyloside: gofruside. Constituent of *Gomphocarpus fruticosus*, (Linn.), R.Br. M.p. 250°.  $[\alpha]_D - 5^\circ$  in MeOH.

Stoll, Pereira, Renz, *Helv. Chim. Acta*, 1949, 32, 293.

Hunger, Reichstein, *Helv. Chim. Acta*, 1952, 35, 1073.

## Corpaverine (Alkaloid F24)

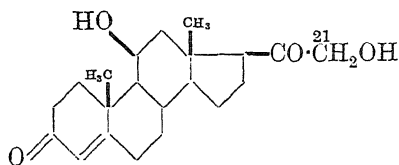


$C_{20}H_{25}O_4N$  MW, 343

Alkaloid of *Corydalis aurea*, Willd. Cryst.  $[\alpha]_D^{20} - 154.2^\circ$  in  $CHCl_3$ . Ox. → anisic acid.

Manske, *Can. J. Research*, 1938, 16B, 81; *J. Am. Chem. Soc.*, 1952, 74, 2864.

**Corticosterone** (*Kendall's Compound B*, *Reichstein's Substance H*)



$C_{21}H_{30}O_4$  MW, 346

Hormone isolated from the adrenal cortex. Prolongs the life of adrenalectomised animals. Lustrous plates from  $Me_2CO$ . Needles + EtOH from EtOH. M.p.  $177-9^\circ$  ( $180-2^\circ$  corr.). Sublimes at about  $190^\circ/0.01$  mm.  $[\alpha]_D^{25} + 223^\circ \pm 3^\circ$  in EtOH,  $[\alpha]_{5461}^{25} + 258^\circ$  in EtOH. Reduces  $NH_3 \cdot AgNO_3$ . UV absorption maximum at  $2400\text{\AA}$ . Conc.  $H_2SO_4 \rightarrow$  green fluor.  $HIO_4 \rightarrow$  acid ( $C_{20}H_{28}O_4$ ) +  $H \cdot COOH$ . For dogs and rats 0.2-1.5 mg. required as daily dose. Hydrogenation of the double bond results in diminished activity. Esters, e.g., acetate and butyrate, are as active as the parent.

21-Acetyl:  $Ac_2O \rightarrow$  comp., m.p.  $145^\circ$  which solidifies  $\rightarrow$  needles, m.p.  $153^\circ$ . Cryst. from  $Me_2CO-Et_2O$ .

21-Propionyl: m.p.  $177-9^\circ$ .

21-Butyryl: needles from  $Et_2O-Me_2CO$ . M.p.  $170-1^\circ$  corr.

21-Acid succinyl: needles from  $Et_2O$  or  $Me_2CO-Et_2O$ . M.p.  $194-5^\circ$ .

21-Palmityl: needles. M.p.  $87-93^\circ$ .

21-Oleyl: m.p.  $79-81^\circ$ .

21-Benzoyl: cryst. from  $Me_2CO-Et_2O$ . M.p.  $201-2^\circ$  corr.

Reichstein, *Helv. Chim. Acta*, 1937, **20**, 983, 964; 1936, **19**, 1107.

de Fremery, Laquer, Reichstein, Spanhoff, Uyldert, *Nature*, 1937, **139**, 26.

Kendall, Mason, Myers, *J. Biol. Chem.*, 1936, **114**, 613.

Kendall, Mason, Hoehn, McKenzie, *J. Biol. Chem.*, 1937, **120**, 719.

Wintersteiner, Pfiffner, *J. Biol. Chem.*, 1935, **111**, 599.

Reichstein, *Ergebnisse der Vitamin- und Hormon-forschung* (Akademische Verlag, Leipzig), 1938, **1**, 334.

Steiger, Reichstein, *Helv. Chim. Acta*, 1938, **21**, 161.

Shoppee, *Helv. Chim. Acta*, 1940, **23**, 740.

Reichstein, Fuchs, *ibid.*, 684.

von Euw, Lardon, Reichstein, *Helv. Chem. Acta*, 1944, **27**, 281.

Lardon, Reichstein, *ibid.*, 713.

Kendall, *Proceedings of the New York Academy of Sciences*, 1949, **71**, 4160.

Reichstein, *Chimia*, 1950, **4**, 1, 47.

### Corticotrophin.

See A.C.T.H.

**Corticocin** (*Dodecahexaene-1:8-dicarboxylic acid*)



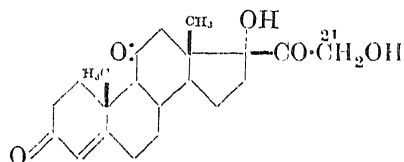
$C_{14}H_{14}O_4$  MW, 246

Pigment of mycelium of *Coriicum croceum*. Orange-yellow needles from Py. Sublimes at  $270^\circ$ . M.p.  $317^\circ$  decomp. Shows ultraviolet absorption maxima at 374, 393, 416  $\mu$ .

*Di-Me ester*:  $C_{16}H_{18}O_4$ . MW, 274. Orange-red cryst. from  $CHCl_3$  or yellow cryst. from AcOH. M.p.  $230-2^\circ$ . Hydrogenation  $\rightarrow$  dimethyl dodecanedicarboxylate.

Erdtmann, *Acta Chem. Scand.*, 1948, **2**, 209, *Nature*, 1947, **160**, 331.

**Cortisone** (*17-Hydroxy-11-dehydrocorticosterone*, *Kendall's Compound E*, *Reichstein's Substance Fa*)



$C_{21}H_{28}O_5$  MW, 360

Adrenal cortical hormone. Prisms from EtOH. M.p.  $217^\circ$ .  $[\alpha]_D^{25} + 209^\circ$  in EtOH. Diabetogenic. Used in rheumatoid arthritis and rheumatic fever therapy.

21-Acetyl: needles from  $Me_2CO$ . M.p.  $239-41^\circ$ .

*p*-Nitrobenzoyl deriv.: m.p.  $220-1^\circ$ .

*Di-semicarbazone*: part. decomp. at  $250^\circ$ . Does not melt at  $300^\circ$ .

Mason, Myers, Kendall, *J. Biol. Chem.*, 1936, **116**, 267.

Kendall et al., *J. Biol. Chem.*, 1937, **119**, 56.

Wintersteiner et al., *J. Biol. Chem.*, 1935, **111**, 585; 1936, **116**, 291.

Reichstein, *Helv. Chim. Acta*, 1936, **19**, 1125; 1937, **20**, 978.

Sarett, *J. Biol. Chem.*, 1946, **162**, 601; *J. Am. Chem. Soc.*, 1948, **70**, 1454.

*Chemical and Engineering News*, 1949, **27**, 1818.

Chemerda, Chamberlain, Wilson, Tischler, *J. Am. Chem. Soc.*, 1951, **73**, 4052.

Heymann, Fieser, *ibid.*, 4054.

Rosenkranz, Pataki, Djerassi, *ibid.*, 4055.

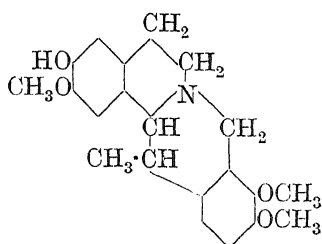
Woodward, Sondheimer, Taub, *ibid.*, 4057.

Djerassi, Rosenkranz, Ringold, *ibid.*, 5514.

Sarett et al., *J. Am. Chem. Soc.*, 1952, **74**, 4974.



**Corybulbine** (3-Hydroxy-2:11:12-trimethoxy-16-methylberbine, *corydalis-G*)



$C_{21}H_{25}O_4N$  MW, 355

Alkaloid from root nodules of *Corydalis tuberosa*, D.C.

*d*-.

Needles from EtOH. M.p. 237-8° (235° rapid heat., 244° evacuated tube). Sol.  $Me_2CO$ ,  $CHCl_3$ , hot  $C_6H_6$ , alkalis. Spar. sol.  $Et_2O$ , AcOEt. Insol.  $H_2O$ .  $[\alpha]_D^{20} + 303.3^\circ$  in  $CHCl_3$ . Unstable in light.

*B, HCl*: yellowish prisms from  $H_2O$ . M.p. 245-50° decomp.

*Et ether*: m.p. 129-30°.  $[\alpha]_D^{20} + 299^\circ$  in EtOH. *B, HCl*: m.p. 245-50°. *Methiodide*: two forms. M.p. 223-4° and 240-1°.

*dl*-.

Cryst. from  $CHCl_3$ -EtOH. M.p. 220-2°. More sol. EtOH than *d*-. form.

*B, HNO\_3*: needles. M.p. 207-8°.

*Platinichloride*: yellowish-brown amorphous powder. M.p. 223°.

Späth, Holter, *Ber.*, 1926, **59**, 2800.

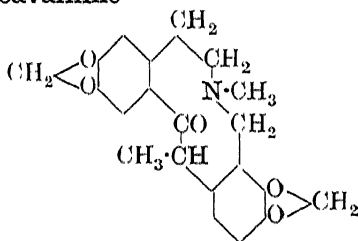
Späth, Dobrowsky, *Ber.*, 1925, **58**, 1274.

Späth, Mosettig, Trothandl, *Ber.*, 1923, **56**, 876.

Dobbie, Lauder, *J. Chem. Soc.*, 1895, **67**, 25.

Huang-Minlon, *Ber.*, 1936, **69**, 1742

### Corycavamine



$C_{21}H_{21}O_5N$  MW, 367

Constituent of root nodules of *Corydalis tuberosa*, D.C. Desmotropic with corycavine. Prisms from  $Et_2O$ . M.p. 148-9°.  $[\alpha]_D^{20} + 166.6^\circ$  in  $CHCl_3$ .

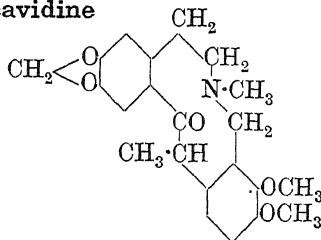
Späth, Holter, *Ber.*, 1927, **60**, 1892.

Bruchhausen, *Arch. Pharm.*, 1925, **263**, 584.

Gadamer, Bruchhausen, *Arch. Pharm.*, 1922, **260**, 101, 113.

Gadamer, *Arch. Pharm.*, 1902, **240**, 21, 83.

### Corycavidine



$C_{22}H_{25}O_5N$  MW, 383

Constituent of root nodules of *Corydalis tuberosa*, D.C.

*d*-.

Cryst. from MeOH. M.p. 212-3°  $\rightarrow$  *dl*-. form. Insol. EtOH,  $Et_2O$ .  $[\alpha]_D^{20} + 210-18^\circ$  in  $CHCl_3$ . Unstable in light.

*B, HAuCl\_4*: red powder. Sinters at 85°, decomp at 170°.

*Methiodide*: cryst. + 3 $H_2O$  from 50% EtOH. M.p. 207-10° decomp. Optically inactive.

*dl*-.

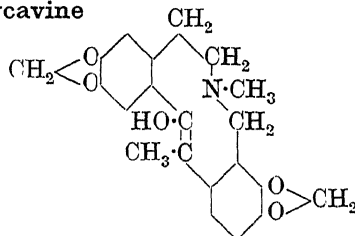
Prisms from  $Et_2O$ . M.p. 193-5°.

Bruchhausen, *Arch. Pharm.*, 1925, **263**, 583, 600.

Gadamer, Lederlotz, *Arch. Pharm.*, 1918, **256**, 162.

Gadamer, *Arch. Pharm.*, 1911, **249**, 30.

### Corycavine



$C_{21}H_{21}O_5N$  MW, 367

Alkaloid present in *Corydalis tuberosa*, D.C. Plates from EtOH. M.p. 218-9°. Insol.  $H_2O$ , cold EtOH, alkalis. Optically inactive.

*B, HCl, H\_2O*: needles. M.p. 219°.

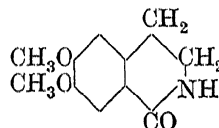
*B, HI, H\_2O*: yellowish needles. M.p. 236°.

*B\_2, H\_2, PiCl\_6*: yellow cryst. M.p. 214° decomp.

*B, HAuCl\_4*: m.p. 178-9° decomp.

Späth, Holter, *Ber.*, 1927, **60**, 1891.

**Corydaldine** (6 : 7 - Dimethoxy - 1 - keto - 1 : 2 : 3 : 4 - tetrahydroisoquinoline)

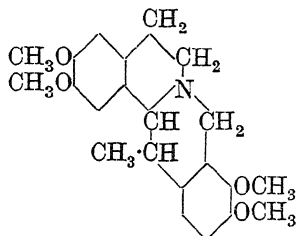


$C_{11}H_{13}O_3N$  MW, 207

Cryst. from  $H_2O$  or EtOH. M.p. 175°. Sol.  $H_2O$ ,  $Et_2O$ ,  $C_6H_6$ ,  $CHCl_3$ . Insol. pet. ether.

*N-Me*: m.p. 124-5°.

Dobbie, Lauder, *J. Chem. Soc.*, 1899, **75**, 673; 1895, **67**, 17, 20.

Corydaline (*Corydalis-A*) $C_{22}H_{27}O_4N$ 

MW, 369

*d.*

Alkaloid from *Corydalis tuberosa*, D.C. Prisms from EtOH. M.p. 135°. Sol.  $CHCl_3$ , hot EtOH. Insol.  $H_2O$ .  $[\alpha]_D^{25} +295^\circ$  in EtOH.

*B, HCl*: cryst. +  $2H_2O$  from  $H_2O$ . M.p. 214°.

*B, HNO\_3*: m.p. 197°.

*B, HAuCl\_4*: m.p. 207°.

*B\_2, H\_2PtCl\_6*: m.p. 227°.

*Methiodide*: (a) cryst. M.p. 228° (244–5°).  
(b) Amorphous. M.p. 64–8°.

*dl.*

M.p. 135°.

*Meso.*

M.p. 158–9°.

*B, HCl*: m.p. 238–40°, anhyd. 247–8°.

*B, HNO\_3*: m.p. 207–8° decomp.

*B, HAuCl\_4*: m.p. 191–2° decomp.

Späth, Mosettig, *Ann.*, 1923, 433, 138.

Gadamer, Bruchhausen, *J. Chem. Soc.*, 1922, 122, i, 675.

Bruchhausen, *Chem. Abstracts*, 1924, 18, 2900.

Chou, *Chem. Abstracts*, 1928, 22, 2359.

Späth, Kruta, *Ber.*, 1929, 62, 1024.

Bruchhausen, Stippler, *Chem. Abstracts*, 1927, 21, 1963.

Huang-Minlon, *Ber.*, 1936, 69, 1744.

**Corydalis-A.**

See Corydalinc.

**Corydalis-B.**

See Tetrahydropalmatine.

**Corydalis-C.**

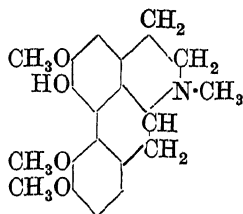
See Protopine.

**Corydalis-D and Corydalis-E.**

See Tetrahydrocoptisine.

**Corydalis-G.**

See Corybulbine.

**Corydine (*Corytuberine methyl ether*)** $C_{20}H_{23}O_4N$ 

MW, 341

*l.*

Alkaloid from *Corydalis tuberosa*, D.C. Cryst. +  $\frac{1}{2}H_2O$  from  $Et_2O$ . M.p. 129–30°, anhyd. 149°. Sol. EtOH,  $CHCl_3$ , AcOEt.  $H_2SO_4 \rightarrow$  red col.  $[\alpha]_D^{26} -206^\circ$  in EtOH.

*d.*

Cryst. +  $\frac{1}{2}EtOH$  from EtOH. M.p. (solvent free) 149°.

*dl.*

M.p. 165–7°. Less sol. than active forms.

Späth, Haworth, *Ber.*, 1928, 61, 1692.

Späth, Berger, *Ber.*, 1931, 64, 2038.

Go, *Chem. Abstracts*, 1930, 24, 620.

Gulland, Haworth, *J. Chem. Soc.*, 1928, 1834.

**Corynantheidine** $C_{22}H_{28}O_3N_2$ 

MW, 368

Alkaloid from bark of *Pseudocinchona africana*, A. Chev. Cryst. from  $Me_2CO$ . M.p. 117°.  $[\alpha]_D^{15} -165^\circ$  in MeOH.

*B, HCl, 2H\_2O*: m.p. 213°.  $[\alpha]_D^{15} -128^\circ$  in MeOH.

*Picrate*: m.p. 252°.

*Styphnate*: m.p. 246°.

Janot, Goutarel, *Compt. rend.*, 1944, 218, 852.

**Corynantheine** $C_{22}H_{28}O_3N_2$ 

MW, 368

Alkaloid from bark of *Pseudocinchona africana*, A. Chev.  $[\alpha]_D^{20} +28.8^\circ$  in MeOH.

*B, HCl*: m.p. 205°.  $[\alpha]_D^{20} +43.8^\circ$  in MeOH.

Karrer, Salomon, *Helv. Chim. Acta*, 1926, 9, 1059.

Janot, Goutarel, *Bull. soc. chim.*, 1941, 8, 625.

Janot *et al.*, *Helv. Chim. Acta*, 1951, 34, 1207.

Karrer *et al.*, *ibid.*, 1933; 1952, 35, 851.

**Corynanthic Acid** $C_{20}H_{24}O_3N_2$ 

MW, 340

Obtained by acid hyd. of corynanthine. Cryst. from MeOH. M.p. 284°.  $[\alpha]_D^{20} -67.8^\circ$  in NaOH.  $[\alpha]_D^{20} -43^\circ$  in HCl.Aq.

Fourneau, Benoit, *Bull. soc. chim.*, 1945, 12, 934.

**Corynanthidic Acid** $C_{20}H_{24}O_3N_2$ 

MW, 340

Obtained by hyd. of corynanthidine. M.p. 322–3°.  $[\alpha]_D^{20} +43.3^\circ$  in Py.

Janot, Goutarel, *Compt. rend.*, 1945, 220, 617.

**Corynanthidine** $C_{21}H_{26}O_3N_2$ 

MW, 354

Alkaloid from bark of *Pseudocinchona africana*, A. Chev. Cryst. from MeOH. M.p. 243-4°.  $[\alpha]_D^{25} -11.5^\circ$  in MeOH.

*B, HCl*: m.p. 288°.  $[\alpha]_D^{25} +57.4^\circ$  in  $H_2O$ .

*Acetyl*: m.p. 231-2°.

*Picrate*: m.p. 231-2°.

Janot, Goutarel, *Compt. rend.*, 1945, 220, 617.

### Corynanthine

$C_{21}H_{26}O_3N_2$  MW, 354

Alkaloid from bark of *Pseudocinchona africana*, A. Chev. M.p. 242°.  $[\alpha]_D +125^\circ$  in EtOH.

*B, HCl*: m.p. 285-90°.  $[\alpha]_D -63^\circ$  in  $H_2O$ .

*Monoacetyl*: m.p. 147°.  $[\alpha]_D -60.4^\circ$  in Py.

*Diacetyl*: m.p. 194-5°.  $[\alpha]_D -105^\circ$  in Py.

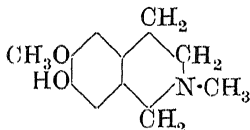
Fourncau, Fiore, *Bull. soc. chim.*, 1911, 9, 1037.

Janot, Goutarel, *Bull. soc. chim.*, 1943, 10, 383.

### Corynine.

See Yohimbine.

**Corypalline** (7-Hydroxy-6-methoxy-2-methyl-tetrahydroisoquinoline)



$C_{11}H_{15}O_2N$  MW, 193

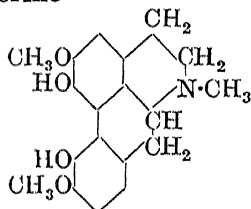
Alkaloid from *Corydalis pallida*. Prisms from MeOH-Et<sub>2</sub>O. M.p. 168°.

*Me ether*: m.p. 65°.

*Picrate*: m.p. 178°.

Manske, *Can. J. Research*, 1937, 15B, 159.

### Corytuberine



$C_{19}H_{21}O_4N$  MW, 327

Found in *Dicentra formosa*, Walp. Needles from EtOH. M.p. 240° (245°). Sol. hot  $H_2O$ . Insol. Et<sub>2</sub>O,  $C_6H_6$ ,  $CHCl_3$ .  $[\alpha]_D^{20} +282.65^\circ$  in EtOH. EtOH sol. shows violet fluor.

*Diacetyl*: m.p. 72°. *B, HAuCl<sub>4</sub>*, m.p. 195-6°.

*Me ether*: see Corydine.

*Di-Me ether*: b.p. 200-40°/0.06 mm. *Methiodide*, m.p. 248°.

Shinoda, *Chem. Abstracts*, 1927, 21, 2272.

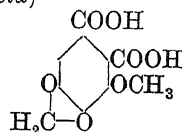
Späth, Berger, *Ber.*, 1931, 64, 2038.

Gulland, Haworth, *J. Chem. Soc.*, 1928, 1834.

Manske, *Can. J. Research*, 1934, 10, 521.

Dict. of Org. Comp.—I.

**Cotarnic Acid** (3-Methoxy-4:5-methylene-dioxyphthalic acid)



$C_{10}H_8O_7$  MW, 240

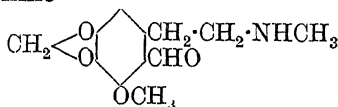
Plates. M.p. 178° → anhydride. Spar. sol.  $H_2O$ .

*Anhydride*:  $C_{10}H_6O_6$ . MW, 222. M.p. 161-2°.

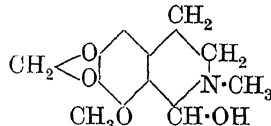
Roser, *Ann.*, 1888, 249, 165.

Späth, Schmid, Sternberg, *Ber.*, 1934, 67, 2095.

### Cotarnine



or



$C_{12}H_{15}O_4N$  MW, 237

Needles. M.p. 132-3° decomp. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. cold  $H_2O$ .  $HNO_3$  → apophyllenic acid.  $Zn + HCl$  → hydrocotarnine. Reacts tautomerically. Salts probably have the isoquinoline structure.

*B, HCl*: Stypticin. Yellow cryst. M.p. 197°.

*Oxime*: m.p. 165-8° decomp.

*Benzoyl deriv.*: needles. M.p. 122-3°.

*Phthalate*: Styptol. Orange cryst. M.p. 103°. Sol.  $H_2O$ .

*B, HAuCl<sub>4</sub>*: m.p. 137°.

*Picrate*: m.p. 143°.

Decker, Becker, *Ann.*, 1913, 395, 328.

Tanaka, Midzuno, Okami, *Chem. Abstracts*, 1930, 24, 4899.

Dey, Kantan, *J. Indian Chem. Soc.*, 1935, 12, 421.

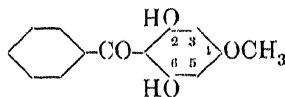
### Cotarnone.

See under Norcotarnone.

### Cotogenin.

See under Maclurin.

**Cotoin** (2:6-Dihydroxy-4-methoxybenzophenone, phlorbenzophenone 4-methyl ether)



$C_{14}H_{12}O_4$  MW, 244

Occurs in Coto rind. Yellowish cryst. from hot  $H_2O$ . M.p. 130-1°. Sol. EtOH, Et<sub>2</sub>O,  $CHCl_3$ ,  $Me_2CO$ ,  $CS_2$ , hot  $C_6H_6$ , aq. alkalis. Spar. sol.  $H_2O$ . Reduces Fehling's and  $NH_3 \cdot AgNO_3$  slowly in the cold.

*Me ether*: hydrocotoin, benzocotoin.  $C_{15}H_{14}O_4$ . MW, 258. M.p. 98° (93–5°).

*Di-Me ether*: methylhydrocotoin.  $C_{16}H_{16}O_4$ . MW, 272. M.p. 115°.

*2:6-Diacetyl*: cryst. M.p. 94°.

*p-Toluenesulphonyl*: m.p. 138°.

*Di-p-toluenesulphonyl*: m.p. 144°.

Karrer, Lichtenstein, *Helv. Chim. Acta*, 1928, 11, 789.

$\alpha$ -Couepic Acid ( $\alpha$ -Couepinic acid,  $\alpha$ -licanic acid)

$CH_3 \cdot [CH_2]_3 \cdot [CH:CH]_3 \cdot [CH_2]_4 \cdot CO \cdot [CH_2]_2 \cdot COOH$   
 $C_{18}H_{28}O_3$  MW, 292

Found in oiticica fat and in kernel fat of *Licania rigida*. M.p. 74–5°. Irradiation in presence of I or S  $\rightarrow$   $\beta$ -couepic acid.

*Semicarbazone*: prisms from EtOH. M.p. 110–11°, readily decomp. by boiling EtOH  $\rightarrow$  comp., m.p. 127°.

Brown, Farmer, *J. Chem. Soc.*, 1935, 1632; *Biochem. J.*, 1935, 29, 631.

Kappelmeier, *Fettchem. Umschau*, 1935, 42, 145.

$\beta$ -Couepic Acid ( $\beta$ -Couepinic acid, *isolicanic acid*,  $\beta$ -licanic acid).

Stereo-isomeride of  $\alpha$ -couepic acid. Present in polymerised oiticica fat. Cryst. from  $Me_2CO$ . M.p. 95·5°. Sol. org. solvents except pet. ether. More stable than the  $\alpha$ -acid.

*K salt*: cryst. Very stable.

*Me ester*: leaflets from pet. ether. M.p. 41°. Polymerises on standing.

*Oxime*: m.p. 60°.

*Semicarbazone*: m.p. 137–8°.

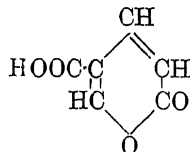
Brown, Farmer, *J. Chem. Soc.*, 1935, 1632; *Biochem. J.*, 1935, 29, 631.

Kappelmeier, *Fettchem. Umschau*, 1935, 42, 145.

**Couepinic Acid.**

See Couepic Acid.

**Coumalic Acid** (*Coumalinic acid, formylglutaconic anhydride,  $\alpha$ -pyrone-5-carboxylic acid*)



$C_6H_4O_4$  MW, 140

Prisms. M.p. 205–10° part. decomp. B.p. 218°/120 mm. Mod. sol. EtOH, AcOH. Spar. sol.  $Et_2O$ ,  $Me_2CO$ , cold  $H_2O$ . Insol.  $CHCl_3$ ,  $C_6H_6$ , ligroin. Decomp. by boiling  $H_2O$ . Sublimes with part. decomp. Reduces warm Fehling's and warm  $NH_3 \cdot AgNO_3$ .  $NH_3 \rightarrow$  2-hydroxynicotinic acid.

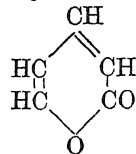
*Me ester*:  $C_7H_6O_4$ . MW, 154. Leaflets. M.p. 74°. B.p. 250–60°, 179°/60 mm.

*Et ester*:  $C_8H_8O_4$ . MW, 168. M.p. 36°. B.p. 262–5°.

Pechmann, *Ann.*, 1891, 264, 272.

Wiley, Smith, *Organic Syntheses*, 1951, XXXI, 23.

**Coumalin** ( $\alpha$ -Pyrone, *cumalin*)



$C_5H_4O_2$  MW, 96

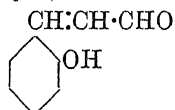
M.p. 5°. B.p. 206–9° slight decomp., 120°/30 mm. Misc. with  $H_2O$ .  $D_4^{20}$  1·200. Alkalis  $\rightarrow$   $OHC \cdot CH_2 \cdot CH:CH \cdot COOH$ .

Pechmann, *Ann.*, 1891, 264, 305.

**Coumalinic Acid.**

See Coumalic Acid.

**o-Coumaraldehyde** (*Coumaraldehyde, o-hydroxycinnamaldehyde*)



$C_9H_8O_2$  MW, 148

Needles. M.p. 133°. Sol. EtOH,  $Et_2O$ . Spar. sol.  $H_2O$ .

*Me ether*:  $C_{10}H_{10}O_2$ . MW, 162. M.p. 46°. B.p. 295° part. decomp., 160°/12 mm. Sol. EtOH,  $Et_2O$ . *Oxime*: m.p. 126°.

Pauly, Wäscher, *Ber.*, 1923, 56, 606.

**p-Coumaraldehyde** (*p-Hydroxycinnamaldehyde*).

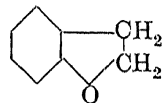
Cryst. from AcOEt. M.p. 134°. Sol.  $Et_2O$ , AcOEt. Spar. sol.  $H_2O$ ,  $C_6H_6$ , ligroin.

*Me ether*: m.p. 58°. B.p. 171°/15 mm.  $D^{20}$  1·137.

*Semicarbazone*: m.p. 224°.

Pauly, Wäscher, *Ber.*, 1923, 56, 606.

**Coumaran** (*Dihydrobenzofuran, dihydrocoumarone*)



$C_8H_8O$  MW, 120

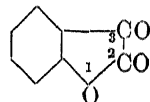
B.p. 188–9°, 84°/17 mm.

*Picrate*: m.p. 76°.

Alexander, *Ber.*, 1892, 25, 2409.

Bennett, Hafez, *J. Chem. Soc.*, 1941, 287.

**Coumarandione** (2:3-Diketocoumaran, *oxisatin*)



$C_8H_4O_3$  MW, 148

Yellow plates. M.p. 134°. B.p. 142°/17 mm. Decomp. on dist. at ord. press. to polysalicylide + CO<sub>2</sub>.

2-Oxime: isonitrosocoumaranone. Needles. M.p. 172° decomp.

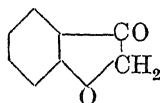
3-Phenylhydrazone: m.p. 185°.

Fries, Pfaffendorf, *Ber.*, 1912, 45, 154.

Stoermer, *ibid.*, 162.

See also Stobbe, Knabel, *Ber.*, 1921, 54, 1213.

### Coumaranone (3-Ketocoumaran)



C<sub>8</sub>H<sub>6</sub>O<sub>2</sub> MW, 134

Needles from EtOH. M.p. 101–2° (102–3°). Sol. NaOH.Aq. Spar. sol. H<sub>2</sub>O. Spar. volatile in steam. Turns brown on standing in air. Reduces Fehling's.

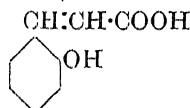
Oxime: m.p. 159°.

Semicarbazone: m.p. 231°.

Mameli, *Gazz. chim. ital.*, 1926, 56, 759.

Friedländer, *Ber.*, 1899, 32, 1868.

*o*-Coumaric Acid (*o*-Cumaric acid, *o*-hydroxycinnamic acid)



C<sub>9</sub>H<sub>8</sub>O<sub>3</sub> MW, 164

*Trans*-.

Needles from H<sub>2</sub>O. M.p. 207–8° decomp. Sol. EtOH. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O. Insol. CS<sub>2</sub>, CHCl<sub>3</sub>. Non-volatile in steam.  $k = 2.14 \times 10^5$  at 25°. Decomp. on dist. KOH fusion → acetic and salicylic acids.

Acetyl: needles. M.p. 146°. Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O. Heat → coumarin.

*Cis*-: coumarinic acid. See Coumarin.

Fittig, Ebert, *Ann.*, 1883, 216, 141; 1884, 226, 351.

Tiemann, Herzfeld, *Ber.*, 1877, 10, 284.

*m*-Coumaric Acid (*m*-Cumaric acid, *m*-hydroxycinnamic acid).

Prisms from H<sub>2</sub>O. M.p. 191°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, hot H<sub>2</sub>O.

*Me ester*: C<sub>10</sub>H<sub>10</sub>O<sub>3</sub>. MW, 178. Leaflets. M.p. 85°.

*Nitrile*: C<sub>9</sub>H<sub>7</sub>ON. MW, 145. M.p. 148°.

*Acetyl*: m.p. 151°.

Ricche, *Ber.*, 1889, 22, 2356.

Borsche, Streitberger, *Ber.*, 1904, 37, 4127.

*p*-Coumaric Acid (*p*-Cumaric acid, *p*-hydroxycinnamic acid).

Cryst. + 1H<sub>2</sub>O from cold H<sub>2</sub>O, anhyd. from hot H<sub>2</sub>O. M.p. 210–3° (206°). Sol. Et<sub>2</sub>O, hot EtOH. Spar. sol. C<sub>6</sub>H<sub>6</sub>. Insol. ligroin.  $k = 2.16 \times 10^5$  at 25°.

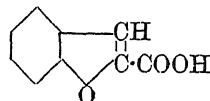
*Me ester*: m.p. 137° (126°).

*Acetyl*: m.p. 200–5°.

Ogawa, *Bull. Chem. Soc. Japan*, 1927, 2, 25.

Zincke, Leisse, *Ann.*, 1902, 322, 224.

Coumarilic Acid (*Coumarone-2-carboxylic acid*)



C<sub>9</sub>H<sub>6</sub>O<sub>3</sub> MW, 162

Needles from H<sub>2</sub>O. M.p. 192–3°. B.p. 310–315° slight decomp. Sol. EtOH. Mod. sol. hot H<sub>2</sub>O. Spar. sol. CS<sub>2</sub>, CHCl<sub>3</sub>. Spar. volatile in steam.

*Et ester*: C<sub>11</sub>H<sub>10</sub>O<sub>3</sub>. MW, 190. M.p. 27°. B.p. 274°/720 mm.

*Phenyl ester*: C<sub>15</sub>H<sub>10</sub>O<sub>3</sub>. MW, 238. M.p. 101°.

*Chloride*: C<sub>9</sub>H<sub>5</sub>O<sub>2</sub>Cl. MW, 180.5. M.p. 52°.

B.p. 264–5°.

*Amide*: C<sub>9</sub>H<sub>7</sub>O<sub>2</sub>N. MW, 161. Leaflets. M.p. 159°.

*Nitrile*: C<sub>9</sub>H<sub>5</sub>ON. MW, 143. Needles. M.p. 36°.

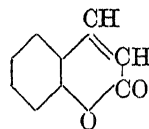
*Anilide*: m.p. 159°.

Fittig, Ebert, *Ann.*, 1883, 216, 163.

Stoermer, Calov, *Ber.*, 1901, 34, 772.

Perkin, *J. Chem. Soc.*, 1871, 24, 45.

Coumarin (*cis-o-Coumarinic lactone, coumarinic anhydride*)



C<sub>9</sub>H<sub>6</sub>O<sub>2</sub> MW, 146

Occurs in woodruff, melilot, tonka beans, and lavender oil. Rhombic cryst. M.p. 70°. B.p. 291°. Sol. EtOH, hot H<sub>2</sub>O, caustic alkalis. Hyd. by hot conc. caustic alkalis to salts of *cis-o*-coumaric acid.

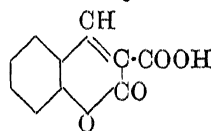
May, *Perfumery & Essential Oil Record*, 1925, 16, 45, (*Chem. Abstracts*, 1925, 19, 1471).

Dow, U.S.P. 1,290,494, (*Chem. Abstracts*, 1933, 27, 4819).

Givaudan, B.P. 438,361, (*Chem. Abstracts*, 1936, 30, 2581).

Hunger, *Seifensieder Zeitung*, 1937, 64, 269.

Coumarin-3-carboxylic Acid



C<sub>10</sub>H<sub>6</sub>O<sub>4</sub> MW, 190

Needles from H<sub>2</sub>O. M.p. 187° decomp. At 290° → coumarin + CO<sub>2</sub>. Insol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, ligroin.

*Me ester*:  $C_{11}H_8O_4$ . MW, 204. M.p. 116–7°.

*Et ester*:  $C_{12}H_{10}O_4$ . MW, 218. M.p. 94°.

*Amide*:  $C_{10}H_7O_3N$ . MW, 189. M.p. 236°.

*Nitrile*: 3-cyanocoumarin.  $C_{10}H_5O_2N$ . MW, 171. M.p. 182°.

*Anilide*: m.p. 250°.

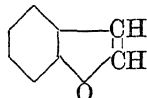
Cajar, *Ber.*, 1898, 31, 2809.

Khan, Kurien, Pandya, *Chem. Abstracts*, 1935, 29, 3325.

### Coumarinic Acid.

See Coumarin.

### Coumarone (*Benzfuran, coumarone*)



$C_8H_6O$  MW, 118

B.p. 174° (169°). Sol.  $Et_2O$ . Volatile in steam.  $D_{15}^{25}$  1.0776.  $H_2SO_4$  produces a resin (paracoumarone). Stable to alkalis,  $NH_3$ , KCN and HCl. Decomp. by  $KMnO_4$  and other oxidising agents. Stable at high temps. Cl in  $Et_2O \rightarrow$  dichloro deriv.

*Picrate*: m.p. 102–3°.

*Tetrameride*: m.p. 230–40°. Sol.  $C_6H_6$ ,  $CHCl_3$ ,  $CHBr_3$ . Spar. sol. EtOH,  $Et_2O$ .

*Octameride*: m.p. 120–30°.

Kostanecki, Tambor, *Ber.*, 1896, 29, 238.

Stoermer, *Ann.*, 1900, 312, 261.

Stern, *Z. angew. Chem.*, 1919, 32, i, 246.

### Coumarone-2-carboxylic Acid.

See Coumarilic Acid.

### Coumingidine

$C_{28}H_{45}O_6N$  MW, 491

Alkaloid from bark of *Erythrophleum couminga*. M.p. 160–1°.

*Acetyl*: m.p. 155°.

*Nitroso deriv.*: m.p. 174°.

*Phenylthioureido deriv.*: m.p. 146°.

Schlittler, *Helv. Chim. Acta*, 1941, 24, 319E.

### Coumingine

$C_{29}H_{47}O_6N$  MW, 505

Alkaloid from bark of *Erythrophleum couminga*. Cryst. from  $Et_2O$ . M.p. 142°.  $[\alpha]_D^{20}$   $-70^\circ$  in EtOH.

*B,HCl*: m.p. 195°.

*Acetyl*: m.p. 154–5°.

*Oxime*: m.p. 165°.

Ruzicka, Dalma, Scott, *Helv. Chim. Acta*, 1941, 24, 63, 1449.

### Couminginic Acid

$C_{25}H_{38}O_6$  MW, 434

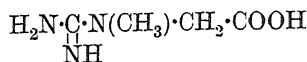
Obtained by hyd. of coumingine. Cryst. from  $C_6H_6$ . M.p. 200°.  $[\alpha]_D^{20}$   $-81^\circ$ .

*Me ester*: m.p. 217–18°.  $[\alpha]_D^{20}$   $-83^\circ$  in EtOH.

*Oxime*: m.p. 124–5°.

Ruzicka, Dalma, Scott, *Helv. Chim. Acta*, 1941, 24, 63, 1449.

### Creatine (*Methylguanidinoacetic acid*)



$C_4H_9O_2N_3$  MW, 131

Constituent of blood, muscle, flesh, etc. Prisms +  $1H_2O$ . M.p. 303°. Mod. sol. boiling  $H_2O$ . Spar. sol. EtOH. Insol.  $Et_2O$ . Min. acids  $\rightarrow$  creatinine.  $Ba(OH)_2 \rightarrow$  urea + sarcosine.

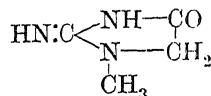
*N:N-Diacetyl*: m.p. 165°.

*Picrate*: needles from  $H_2O$ . M.p. 218–20°.

Steudel, *Z. physiol. Chem.*, 1921, 112, 54.

King, *J. Chem. Soc.*, 1930, 2374.

### Creatinine



$C_4H_7ON_3$  MW, 113

Constituent of urine, muscle, etc. Rhombic prisms. M.p. 260° (305°) decomp. Sol. hot  $H_2O$ . Spar. sol. EtOH. Forms stable add. comp. with  $ZnCl_2$ .

*B,H AuCl<sub>4</sub>*: m.p. anhyd. 170–4°.

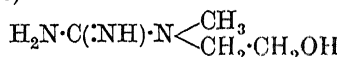
*Picrate*: pale yellow needles. M.p. 220–21°.

Greenwald, *J. Biol. Chem.*, 1929, 81, 73.

Edgar, Hinegardner, *Organic Syntheses*, Collective Vol. I, 166.

King, *J. Chem. Soc.*, 1930, 2377.

### Creatinol (*N-Methyl-N-[2-hydroxyethyl]-guanidine*)



$C_4H_{11}ON_3$  MW, 117

Unstable syrup. Decomp. at 171°. Absorbs  $CO_2$ .

*B,HCl*: m.p. 78°.

*B,HBr*: m.p. 101–3°.

*B,HCl,6HgCl<sub>2</sub>*: m.p. 220–1° decomp.

*B,HCl,CdCl<sub>2</sub>*: m.p. 190–1°.

*B,H AuCl<sub>4</sub>*: m.p. 125–6°.

*B<sub>2</sub>H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 185–6° decomp.

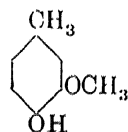
*Tribenzoyl deriv.*: m.p. 98–8°.

*Picrate*: m.p. 166°.

*Picolonate*: m.p. 236–7° decomp.

Schotte, Priewe, Roescheisen, *Z. physiol. Chem.*, 1928, 174, 119.

### Creosol (4-Methylcatechol 2-methyl ether, 5-methylguaiacol, homocatechol 3-methyl ether, 3:4-dihydroxytoluene 3-methyl ether)



$C_8H_{10}O_2$

MW, 138

Constituent of Ylang-ylang oil, wood tar, etc. M.p. 5.5°. B.p. 221°, 113.5°/22 mm. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. Spar. sol. H<sub>2</sub>O. D<sub>4</sub><sup>25</sup> 1.0919. n<sub>D</sub><sup>25</sup> 1.5353.

*Acetyl*: b.p. 136°/12 mm.

*Picrate*: yellow needles. M.p. 112°.

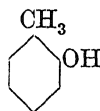
Steinkopf, Klopfer, *Ber.*, 1931, 64, 990.

Ono, Imoto, *J. Chem. Soc. Japan*, 1936, 57, 112.

### Cresidine.

See under 3-Amino-*p*-cresol.

***o*-Cresol** (*o*-Hydroxytoluene, *o*-methylphenol)



C<sub>7</sub>H<sub>8</sub>O

MW, 108

Colourless cryst. M.p. 30°. B.p. 191–2°, 182°/600 mm., 175°/500 mm., 168°/400 mm., 150°/228 mm., 140°/163 mm., 130°/112 mm., 120°/76 mm., 110°/49 mm., 70°/6 mm. Sol. prac. all ord. org. solvents. Sol. to 3% in H<sub>2</sub>O at 40°, 5.3% at 100°. Sol. caustic alkalis. Volatile in steam. D<sub>4</sub><sup>20</sup> 1.0465. n<sub>D</sub><sup>20</sup> 1.5453. Heat of comb. C<sub>p</sub> 883 Cal. Zn dust → toluene. Forms add. comps. at low temps. with pyridine and naphthalene.

*Acetyl*: *o*-tolyl acetate. B.p. 208°.

*p*-Nitrophenylacetyl: m.p. 71.5–2.3°.

*Butyryl*: b.p. 127–8°/5 mm.

*Carbonate*: di-*o*-tolyl carbonate. CH<sub>3</sub>-C<sub>6</sub>H<sub>4</sub>-O-CO-O-C<sub>6</sub>H<sub>4</sub>-CH<sub>3</sub>. M.p. 60°.

*Me ether*: methyl *o*-tolyl ether. C<sub>8</sub>H<sub>10</sub>O. MW, 122. B.p. 171–2°. Sol. EtOH, Et<sub>2</sub>O. Prac. insol. H<sub>2</sub>O. D<sub>4</sub><sup>15</sup> 0.9851.

*Et ether*: ethyl *o*-tolyl ether. C<sub>9</sub>H<sub>12</sub>O. MW, 136. B.p. 184°. D<sub>4</sub><sup>15</sup> 0.9592.

*Propyl ether*: propyl *o*-tolyl ether. C<sub>10</sub>H<sub>14</sub>O. MW, 150. B.p. 204°.

*n*-Butyl ether: *n*-butyl *o*-tolyl ether. C<sub>11</sub>H<sub>16</sub>O. MW, 164. B.p. 223°.

*Phenyl ether*: phenyl *o*-tolyl ether. C<sub>13</sub>H<sub>12</sub>O. MW, 184. Needles. M.p. 22°. B.p. 267°/738 mm.

*Picrate*: orange needles. M.p. 88°.

Brückner, *Z. anal. Chem.*, 1928, 75, 289.

Société Chimiques des Usines du Rhône, D.R.P. 167,211, (*Chem. Zentr.*, 1906, I, 721).

***m*-Cresol** (*m*-Hydroxytoluene, *m*-methylphenol).

M.p. 11–12°. B.p. 202°, 193°/600 mm., 187°/500 mm., 170°/305 mm., 160°/220 mm., 140°/110 mm., 120°/48 mm., 100°/19 mm., 80°/6 mm. Sol. ord. org. solvents. Sol. to 2.5% in H<sub>2</sub>O at 40°, 5.5% at 100°. Sol. caustic alkalis. D<sub>4</sub><sup>20</sup> 1.0336. n<sub>D</sub><sup>20</sup> 1.5398. Heat of comb. C<sub>p</sub> 881 Cal. Volatile in steam. Zn dust → toluene.

*Acetyl*: *m*-tolyl acetate. M.p. 12°. B.p. 212°.

*p*-Nitrophenylacetyl: m.p. 60.2–1.2°.

*Benzoyl*: *m*-tolyl benzoate. M.p. 54°.

*Carbonate*: di-*m*-tolyl carbonate. M.p. 111°.

*Me ether*: methyl *m*-tolyl ether. B.p. 177°. D<sub>4</sub><sup>15</sup> 0.9766. KMnO<sub>4</sub> → *m*-methoxybenzoic acid.

*Et ether*: ethyl *m*-tolyl ether. B.p. 192°.

*Propyl ether*: propyl *m*-tolyl ether. B.p. 210–11°.

*n*-Butyl ether: *n*-butyl *m*-tolyl ether. B.p. 229°.

*Phenyl ether*: phenyl *m*-tolyl ether. B.p. 274°/738 mm.

Darzens, *Compt. rend.*, 1931, 192, 1657.

Brückner, *Z. anal. Chem.*, 1928, 75, 289.

Schering-Kahlbaum, D.R.P. 541,037, (*Chem. Abstracts*, 1932, 26, 1947); B.P. 309,865, (*Chem. Abstracts*, 1930, 24, 626).

***p*-Cresol** (*p*-Hydroxytoluene, *p*-methylphenol).

Colourless cryst. M.p. 34°. B.p. 202.5°, 193°/600 mm., 187°/500 mm., 179°/400 mm., 160°/217 mm., 140°/106 mm., 120°/47 mm., 90°/11 mm. Sol. ord. org. solvents. Sol. to 2.3% in H<sub>2</sub>O at 40°, to 5% at 100°. Sol. caustic alkalis. Volatile in steam. D<sub>4</sub><sup>20</sup> 1.0341. n<sub>D</sub><sup>20</sup> 1.5395. Heat of comb. C<sub>p</sub> 883 Cal. Zn dust → toluene. Forms add. comps. at low temps. with pyridine and naphthalene.

*Acetyl*: *p*-tolyl acetate. Narceol. B.p. 212–13°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>. Spar. sol. H<sub>2</sub>O. Volatile in steam. n<sub>D</sub><sup>20</sup> 1.4991.

*p*-Nitrophenylacetyl: m.p. 80.5–1.6°.

*Benzoyl*: *p*-tolyl benzoate. M.p. 71–2°.

*p*-Nitrobenzoyl: m.p. 225° decomp.

*Carbonate*: di-*p*-tolyl carbonate. Needles. M.p. 115°. Spar. sol. H<sub>2</sub>O, EtOH.

*Me ether*: methyl *p*-tolyl ether. B.p. 175–6°. D<sub>4</sub><sup>15</sup> 0.9757. CrO<sub>3</sub> → anisic acid.

*Et ether*: ethyl *p*-tolyl ether. B.p. 188–9°.

*Propyl ether*: propyl *p*-tolyl ether. B.p. 210–4°.

*n*-Butyl ether: *n*-butyl *p*-tolyl ether. B.p. 229–5°.

*Allyl ether*: C<sub>10</sub>H<sub>12</sub>O. MW, 148. B.p. 214.5°. D<sub>4</sub><sup>15</sup> 0.9728.

*Phenyl ether*: phenyl *p*-tolyl ether. B.p. 277–8°/745 mm.

Brückner, *Z. anal. Chem.*, 1928, 75, 289.

Hartman, *Organic Syntheses*, Collective Vol. I, 169.

Schering-Kahlbaum, D.R.P. 541,037, (*Chem. Abstracts*, 1932, 26, 1947).

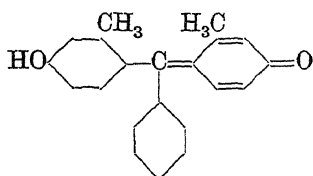
Jordan, U.S.P. 1,778,858, (*Chem. Abstracts*, 1931, 25, 115).

I.G., B.P. 308,220, (*Chem. Abstracts*, 1930, 24, 130).

### Cresol-aldehyde.

See Hydroxytoluic Aldehyde.

m-Cresolbenzein

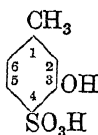


$C_{21}H_{18}O_2$  MW, 302  
Yellowish-brown cryst. M.p. 180° decomp.  
Illari, Orsolini, *Gazz. chim. ital.*, 1948, 78, 813.

Cresol-carboxylic Acid.

See Hydroxytoluic Acid.

m-Cresol-4-sulphonic Acid



$C_7H_8O_4S$  MW, 188  
Needles. M.p. 109-10°. Sol.  $H_2O$ , MeOH,  $Me_2CO$ . Mod. sol. EtOH. Insol.  $Et_2O$ ,  $CHCl_3$ . Hygroscopic.

Zehenter, Bohunek, Nowotny, *J. prakt. Chem.*, 1929, 121, 233.

Haworth, Lapworth, *J. Chem. Soc.*, 1923, 123, 2982; 1924, 125, 1299.

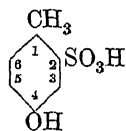
m-Cresol-6-sulphonic Acid.

Cryst. +  $2H_2O$ . M.p. anhyd. 118°. Sol.  $H_2O$ , EtOH,  $Et_2O$ ,  $C_6H_6$ .

Zehenter, Bohunek, Nowotny, *J. prakt. Chem.*, 1929, 121, 233.

Haworth, Lapworth, *J. Chem. Soc.*, 1923, 123, 2982; 1924, 125, 1299.

p-Cresol-2-sulphonic Acid



$C_7H_8O_4S$  MW, 188  
Needles +  $5H_2O$ . M.p. 98.5°, anhyd. 187-8°. Sol.  $H_2O$ , EtOH,  $Et_2O$ .

Me ether:  $C_8H_{10}O_4S$ . MW, 202. Chloride:  $C_8H_9O_3ClS$ . MW, 220.5. B.p. 173-5°/17 mm.  $D_4^{25}$  1.321.  $n_D^{25}$  1.5685. p-Toluidine salt: m.p. 204-5°.

Jenssen, *Ann.*, 1874, 172, 237.

Suter, McKenzie, *J. Am. Chem. Soc.*, 1934, 56, 2470.

p-Cresol-3-sulphonic Acid.

Cryst. Very hygroscopic.  
Me ester:  $C_8H_{10}O_4S$ . MW, 202. M.p. 93°. B.p. 200°/1 mm. Acetyl: m.p. 56°. Benzoyl: m.p. 82°.

Phenylester:  $C_{13}H_{12}O_4S$ . MW, 264. M.p. 55°.

Ethylanilide: m.p. 65°.

Me ether: prisms from EtOH. M.p. 105-8°.

Anschütz, *Ann.*, 1918, 415, 74.

Frèrejacque, *Ann. chim.*, 1930, 14, 147.

Cresoltricarboxylic Acid.

See Cochenillic Acid and Isocochenillic Acid.

Cresorcinol.

See 2:4-Dihydroxytoluene.

Cresotic Acid.

See Hydroxytoluic Acid.

Cresotinic Acid.

See Hydroxytoluic Acid.

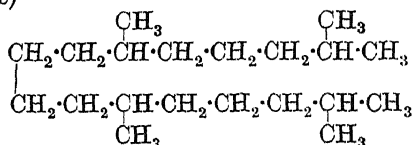
Crithmene.

See  $\Delta^{1(7), 4(8)}$ -Menthadiene.

Crocein Acid.

See 2-Naphthol-8-sulphonic Acid.

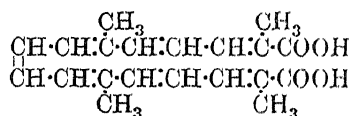
Crocetane (2:6:11:15-Tetramethylhexadecane)



$C_{20}H_{42}$  MW, 282  
B.p. 135°/0.5 mm. Sol.  $CHCl_3$ , pet. ether,  $CS_2$ . Spar. sol. EtOH, AcOH.  $D_4^{20}$  0.8027.  $n_D^{20}$  1.44937. Identical with, or stereoisomer of, phytane.

Karrer et al., *Helv. Chim. Acta*, 1932, 15, 1399.

Crocetin (Gardenin)



$C_{20}H_{24}O_4$  MW, 328  
Occurs in two forms.

a. Stable form (Crocetin I, *trans*-crocetin,  $\alpha$ -crocetin). Occurs as glycoside ( $\alpha$ -crocin) in varieties of gardenia and members of crocus family (particularly saffron). Brick red rhombohedra from  $Ac_2O$ . M.p. 285-7° corr. Insol. most org. solvents. Sol. Py. Unstable to light and air. Conc.  $H_2SO_4 \rightarrow$  blue col. changing to violet and then brown.

Mono-Me ester:  $\beta$ -crocetin.  $C_{21}H_{26}O_4$ . MW, 342. Plates from  $CHCl_3$ . M.p. 218°.

Di-Me ester:  $\gamma$ -crocetin.  $C_{22}H_{28}O_4$ . MW, 356. Orange red plates from  $CHCl_3$ -MeOH. M.p. 222.5°. Mod. sol.  $Me_2CO$ , AcOH,  $C_6H_6$ ,  $CHCl_3$ , Py. Absorption maxima in petrol, 450, 424.5  $m\mu$ , in  $CHCl_3$ , 463, 434.5 (437)  $m\mu$ .

b. Labile form (Crocetin II, *cis*-crocetin). Occurs as glycoside in saffron.

Di-Me ester: plates from MeOH. M.p. 141°. Absorption maxima in petrol, 445, 422  $m\mu$ , in



CHCl<sub>3</sub>, 458, 432.5 mμ. Irradiation of sol. in various org. solvents → stable form.

Kuhn, Winterstein, *Ber.*, 1933, **66**, 209; 1934, **67**, 349.

Kuhn, Winterstein, Weygand, *Helv. Chim. Acta*, 1928, **11**, 716.

Karrer *et al.*, *Helv. Chim. Acta*, 1933, **16**, 297; 1932, **15**, 1218, 1399; 1930, **13**, 392.

**α-Crocin** (α-Crocetin digentiobioside, gentiobiose di-ester of α-crocetin)

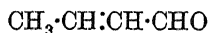
C<sub>44</sub>H<sub>64</sub>O<sub>24</sub> MW, 976

Occurs in varieties of gardenia and members of crocus family (particularly saffron). Red needles from MeOH. M.p. 186° (215°). Spar. sol. cold H<sub>2</sub>O. Absorption maxima in MeOH, 464, 434 mμ. Crocin itself and the *cis*- and *trans*-crocetin di-Me esters are of significance in the sexual processes of certain green algæ.

Karrer, Salomon, *Helv. Chim. Acta*, 1933, **16**, 643; 1928, **11**, 513.

Karrer, Miki, *Helv. Chim. Acta*, 1929, **12**, 985.

**Crotonaldehyde**



C<sub>4</sub>H<sub>6</sub>O MW, 70

B.p. 104-5°. Mod. sol. H<sub>2</sub>O. Volatile in steam. D<sub>4</sub><sup>15</sup> 0.8575. n<sub>D</sub><sup>15</sup> 1.4436. Heat of comb. 542.3 Cal. Absorbs O → crotonic acid. Br → 1:2-dibromobutyraldehyde. HCl → 2-chlorobutyraldehyde. Forms a bisulphite comp.

*Orime*: prisms. M.p. 119-20°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. NaHg in dil. AcOH → crotylamino.

*Di-Et acetal*: b.p. 147-8°, 40-44°/10 mm. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Insol. H<sub>2</sub>O. D<sub>4</sub><sup>18</sup> 0.8473. n<sub>D</sub><sup>18</sup> 1.4162 (1.4187).

*Semicarbazone*: m.p. 198-9° (184°). Sol. AcOH. Mod. sol. EtOH.

*Phenylhydrazone*: b.p. 169-71°/25 mm., 156-8°/11 mm.

*p-Nitrophenylhydrazone*: brown needles from EtOH. M.p. 184-5°.

*2:4-Dinitrophenylhydrazone*: crimson needles from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 190°.

*m-Nitrobenzoylhydrazone*: cryst. from MeOH. M.p. 173°.

Hibbert, *J. Am. Chem. Soc.*, 1915, **37**, 1759.

Auwers, Eisenlohr, *J. prakt. Chem.*, 1910, **82**, 115.

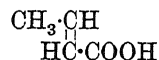
Bloomfield, Townsend, B.P., 370,252, (*Chem. Abstracts*, 1933, **27**, 2966).

Usines de Mèlle, D.R.P., 598,015, (*Chem. Abstracts*, 1934, **28**, 5475).

Backès, *Compt. rend.*, 1935, **200**, 1669.

Kagan, Lyubarskii, Fedorov, *J. Applied Chem. U.S.S.R.*, 1934, **7**, 135.

**Crotonic Acid** (2-Methylacrylic acid, ethylideneacetic acid, α-crotonic acid, 1-propylene-1-carboxylic acid)



C<sub>4</sub>H<sub>6</sub>O<sub>2</sub> MW, 86

*Trans*-.

Needles from H<sub>2</sub>O or ligroin. M.p. 72°. B.p. 189°. Sol. H<sub>2</sub>O, hot ligroin. *k* = 2.04 × 10<sup>-5</sup> at 25°. Reduces NH<sub>3</sub>.AgNO<sub>3</sub>. Zn + H<sub>2</sub>SO<sub>4</sub> → butyric acid. HBr → 2-bromobutyric acid. Cl or Br → 1:2-dichloro or dibromo butyric acid. KOH fusion → acetic acid. HNO<sub>3</sub> → acetic + oxalic acids. Alk. KMnO<sub>4</sub> → 1:2-dihydroxybutyric acid.

*Me ester*: C<sub>5</sub>H<sub>8</sub>O<sub>2</sub>. MW, 100. B.p. 121°.

*Et ester*: C<sub>6</sub>H<sub>10</sub>O<sub>2</sub>. MW, 114. B.p. 138°. D<sub>4</sub><sup>20</sup> 0.9175. n<sub>D</sub><sup>20</sup> 1.42524.

*Chloride*: C<sub>4</sub>H<sub>5</sub>OCl. MW, 104.5. B.p. 124-5°, 35°/18 mm.

*Amide*: C<sub>4</sub>H<sub>7</sub>ON. MW, 85. Needles. M.p. 158°. Sol. EtOH, C<sub>6</sub>H<sub>6</sub>.

*Anhydride*: C<sub>8</sub>H<sub>10</sub>O<sub>3</sub>. MW, 154. B.p. 246-8°, 129°/19 mm. D<sub>20</sub><sup>20</sup> 1.0397. n<sub>D</sub><sup>20</sup> 1.47446.

*Nitrile*: C<sub>4</sub>H<sub>5</sub>N. MW, 67. B.p. 118-19°.

*Anilide*: m.p. 115°.

*Cis*:- see Isocrotonic Acid.

Auwers, Wissebach, *Ber.*, 1923, **56**, 715.

Kaufler, *Monatsh.*, 1929, **53**, 121.

Scheibler, Magasanik, *Ber.*, 1915, **48**, 1814.

**Crotonophenone** (Propenyl phenyl ketone, 1-benzoylpropylene)



C<sub>10</sub>H<sub>10</sub>O MW, 146

M.p. 20-1°. B.p. 111-12°/9 mm. D<sub>15</sub><sup>15</sup> 1.025. n<sub>D</sub><sup>15</sup> 1.5626.

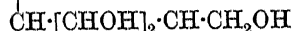
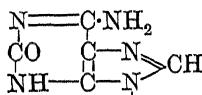
*Phenylsemicarbazone*: needles from EtOH. M.p. 212°.

*Phenylthiosemicarbazone*: cryst. from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 140°.

Dufraisse, Demontignier, *Bull. soc. chim.*, 1927, **41**, 843.

Fuson, Christ, Whitman, *J. Am. Chem. Soc.*, 1936, **58**, 2450.

**Crotonoside**



Suggested formula

C<sub>10</sub>H<sub>13</sub>O<sub>5</sub>N<sub>5</sub> MW, 283

A *d*-riboside of isoguanine, the nucleoside of the seeds of *Croton tiglium*, Linn. Needles + 2H<sub>2</sub>O from H<sub>2</sub>O. Anhyd. at 100° in vac. M.p.

243–5° decomp.  $[\alpha]_D^{20}$  – 60.2° in N/10 NaOH.  
Dil.  $H_2SO_4 \rightarrow$  isoguanine + *d*-ribose.

*Picrate*: yellow needles from  $H_2O$ . M.p. 210–15° decomp.

Falconer, Gulland, Story, *J. Chem. Soc.*, 1939, 1784.

Spies, *J. Am. Chem. Soc.*, 1939, 61, 350.

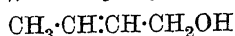
Spies, Drake, *J. Am. Chem. Soc.*, 1935, 57, 774.

Cherbulièz, Bernhard, *Helv. Chim. Acta*, 1932, 15, 464, 978.

### Crotonylene.

See 2-Butyne.

**Crotyl Alcohol** (*Propenylcarbinol*, 1-hydroxy-2-butylene), 3-methylallyl alcohol)



$C_4H_8O$

MW, 72

*Cis*-.

B.p. 120.5°/752 mm.  $D_4^{20}$  0.8662.  $n_D^{25}$  1.4342.  
3 : 5-Dinitrobenzoyl : m p. 51.0°.

*Trans*-.

B.p. 121.2°/754 mm.  $D_4^{25}$  0.8454.  $n_D^{25}$  1.4262.  
3 : 5-Dinitrobenzoyl : m p. 70.5°.

Hatch, Nesbitt, *J. Am. Chem. Soc.*, 1950, 72, 727.

Young, Andrews, *J. Am. Chem. Soc.*, 1944, 66, 421.

Young, Hartung, Crossley, *J. Am. Chem. Soc.*, 1936, 58, 100.

**Crotylamine** (1-Amino-2-butylene, 1-amino-2-butene)



$C_4H_9N$

MW, 71

B.p. 85–8°. Mod. sol.  $H_2O$ .

$B_2H_2PtCl_6$ : yellow plates. M.p. 195–6° decomp.

Schindler, *Monatsh.*, 1891, 12, 416.

Bookman, *Ber.*, 1895, 28, 3114.

### Crotyl bromide.

See 1-Bromo-2-butylene.

### Crotyl chloride.

See 1-Chloro-2-butylene.

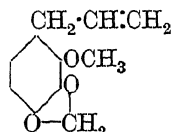
### Crotylideneacetone.

See 2 : 4-Heptadienone-6.

### Crotyl iodide.

See 1-Iodo-2-butylene.

**Croweacin** (2-Methoxy-3 : 4-methylenedioxy-1-allylbenzene, 2-methoxysafrol)



$C_{11}H_{12}O_3$

MW, 192

Main constituent of essential oil from leaves and terminal branches of *Eriostemon crowei*

(*Crowei saligna*). B.p. 256–8°/766 mm., 130–1°/10 mm.  $D_{15}^{20}$  1.1346.  $n_D^{19}$  1.5346.

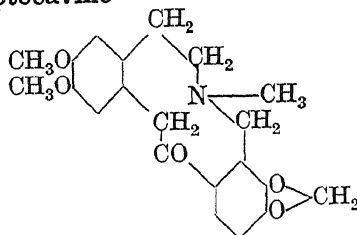
Baker, Penfold, Simonsen, *J. Chem. Soc.*, 1939, 439.

Penfold, Ramage, Simonsen, *J. Chem. Soc.*, 1938, 756.

### Cryogenin.

See Kryogenin.

### Cryptocavine



Suggested structure

$C_{21}H_{23}O_5N$

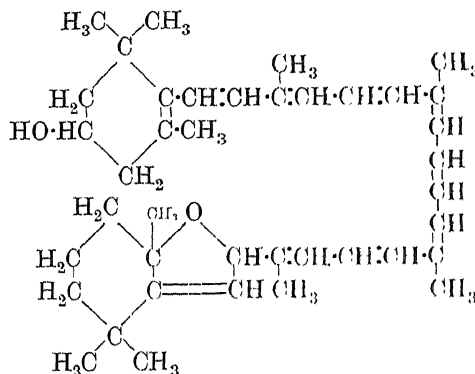
MW, 369

Alkaloid from *Corydalis ochotensis*, *C. ophiocarpa*, *Fumaria officinalis* and *Dicentra chrysantha*. M.p. 223° corr. Optically inactive in  $CHCl_3$ .

*Methosulphate*: m.p. 210–11°.

Manske, Marion, *J. Am. Chem. Soc.*, 1940, 62, 2042.

### Cryptoflavin



$C_{40}H_{56}O_2$

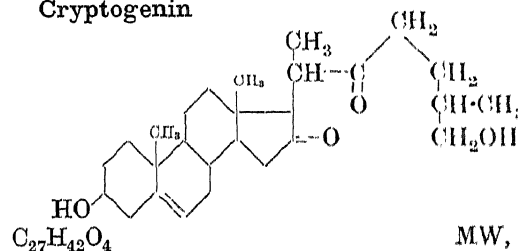
MW, 568

Cryst. from  $C_6H_6$ -pet. ether. M.p. 171°. No vitamin A activity.

Karrer, Jucker, *Helv. Chim. Acta*, 1946, 29, 229.

Euler, Karrer, Jucker, *Helv. Chim. Acta*, 1947, 30, 1159.

### Cryptogenin



$C_{27}H_{42}O_4$

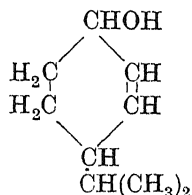
MW, 430

Sapogenin isolated from *Beth* root. M.p. 187-9°.

*Dioxime*: m.p. 250-3° decomp.

Wagner, Goldsmith, Ulshafer, *J. Am. Chem. Soc.*, 1943, **65**, 739, 1658.

**Cryptol (4-Isopropyl- $\Delta^2$ -cyclohexenol-1)**



$C_{19}H_{16}O$  MW, 140

*l.*

B.p. 97°/8 mm.  $n_D^{20}$  1.4771.  $[\alpha]_D -139.3^\circ$  (c, 2.3 in EtOH).

*p*-Nitrobenzoyl: needles from MeOH. M.p. 84°.  $[\alpha]_D -168.5^\circ$  (c, 2.1 in  $CHCl_3$ ).

3:5-Dinitrobenzoyl: cryst. from AcOEt-EtOH. M.p. 115°.  $[\alpha]_D -136.5^\circ$  (c, 1.3 in  $CHCl_3$ ).

*Phenylurethane*: needles from pet. ether. M.p. 105°.  $[\alpha]_D^{21} -147.7^\circ$  (c, 3.15 in EtOH).

$\alpha$ -Naphthylurethane: needles from pet. ether. M.p. 118°.  $[\alpha]_D^{21} -130.1^\circ$  (c, 1.61 in EtOH).

*Trans-d.*

B.p. 72°/2 mm.  $n_D^{20}$  1.4796.  $[\alpha]_D^{25} +146.4^\circ$  (c, 2.0 in EtOH).

*p*-Nitrobenzoyl: cryst. from MeOH. M.p. 84°.  $[\alpha]_D^{25} +174^\circ$  (c, 2.0 in  $CHCl_3$ ).

$\alpha$ -Naphthylurethane: cryst. from pet. ether. M.p. 118.5°.  $[\alpha]_D^{21} +136.2^\circ$  (c, 1.47 in EtOH).

*Trans-dl.*

B.p. 90°/4 mm.  $D_{30}^{20}$  0.9247.  $n_D^{20}$  1.4761.

*p*-Nitrobenzoyl: needles from MeOH. M.p. 76.5°.

3:5-Dinitrobenzoyl: plates from MeOH. M.p. 108°.

*Phenylurethane*: needles from pet. ether. M.p. 108°.

$\alpha$ -Naphthylurethane: needles from pet. ether. M.p. 136°.

*Cis-dl.*

B.p. 86°/6 mm.  $D_{30}^{20}$  0.9282.  $n_D^{20}$  1.4752.

*p*-Nitrobenzoyl: plates from MeOH. M.p. 34.5-5.5°.

3:5-Dinitrobenzoyl: needles from MeOH. M.p. 96.5°.

$\alpha$ -Naphthylurethane: needles from pet. ether. M.p. 105.5°.

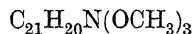
Gillespie, Macbeth, *J. Chem. Soc.*, 1939, 1531.

Macbeth, Wenzel, *ibid.*, 264.

Gillespie, Macbeth, Swanson, *J. Chem. Soc.*, 1938, 1820.

Galloway, Dewar, Read, *J. Chem. Soc.*, 1936, 1595.

**Cryptoleurine**



$C_{24}H_{29}O_3N$  MW, 379

Alkaloid of *Cryptocarya pleurosperma*. Long prisms from  $Me_2CO$ , EtOH or MeOH. M.p. 195-6°. Skin irritant.

*B, HCl*: needles from EtOH. M.p. 260°.

*B, HI*: needles from AcOEt. M.p. 254-5°.

*Picrate*: needles from EtOH. M.p. 220-1°.

Lande, *Australian Journal of Experimental Biology and Medical Science*, 1948, **26**, 181, (*Chem. Abstracts*, 1948, **42**, 7490).

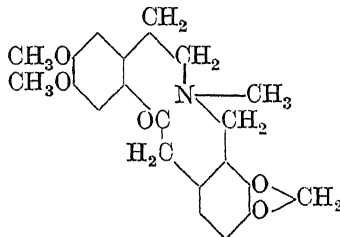
**Cryptomeriol**

$C_{15}H_{26}O$  MW, 222

Pleasant-smelling oil from *Cryptomeria japonica*, Don. B.p. 162-3°/0.10 mm.  $D$  0.964.  $[\alpha]_D -37.5^\circ$ .

Kimura, *Chem. Zentr.*, 1910, I, 276.

**Cryptopine**



$C_{21}H_{23}O_5N$  MW, 369

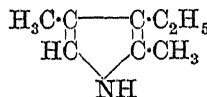
One of the opium alkaloids. Prisms. M.p. 220-1°. Sol. hot Py, hot isoamyl alcohol, acetophenone. Spar. sol. most ord. org. solvents. Optically inactive.  $NaHg \rightarrow$  dihydrocryptopine, m.p. 187-8°.

*B, H<sub>2</sub>AuCl<sub>4</sub>*: m.p. 205° decomp.

*B<sub>2</sub>, H<sub>2</sub>PtCl<sub>6</sub>*: m.p. 204° decomp.

Haworth, Perkin, *J. Chem. Soc.*, 1926, 1769.

**Cryptopyrrole (Haemopyrrole-C, 2:4-dimethyl-3-ethylpyrrole)**



$C_8H_{13}N$  MW, 123

B.p. 118°/37 mm., 96°/16 mm. Sol. EtOH,  $Et_2O$ ,  $CHCl_3$ ,  $C_6H_6$ . Spar. sol.  $H_2O$ .

*Picrate*: m.p. 135° (131-2°).

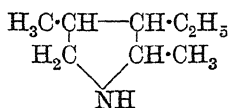
Fischer, Walach, *Ber.*, 1925, **58**, 2822.

Knorr, Hess, *Ber.*, 1911, **44**, 2765.

Siedel, *Z. physiol. Chem.*, 1935, **231**, 167.

Fischer, *Organic Syntheses*, 1941, XXI, 67.

**Cryptopyrrolidine** (2 : 4-Dimethyl-3-ethylpyrrolidine)



$\text{C}_8\text{H}_{17}\text{N}$

MW, 127

Strongly basic liq. with ammoniacal odour.

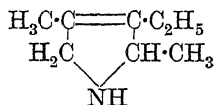
*Picrate* : m.p. 135°.

*Picrolonate* : m.p. 213°.

*Styphmate* : m.p. 152°.

Fischer, Höfelmann, *Z. physiol. Chem.*, 1938, 251, 193.

**Cryptopyrroline** (2 : 4-Dimethyl-3-ethylpyrroline)



$\text{C}_8\text{H}_{15}\text{N}$

MW, 125

B.p. 59°/11 mm.

*Picrate* : m.p. 166°.

*Picrolonate* : m.p. 203°.

*Styphmate* : m.p. 131°.

Fischer, Höfelmann, *Z. physiol. Chem.*, 1938, 251, 192.

**Cryptostadiene.**

See Lanostadiene.

**Cryptostene.**

See Lanostene.

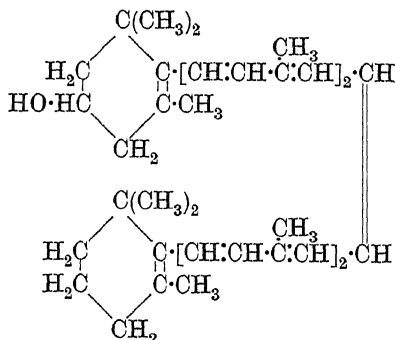
**Cryptostenone.**

See Lanostenone.

**Cryptosterol.**

See Lanosterol.

**Cryptoxanthin**



$\text{C}_{40}\text{H}_{56}\text{O}$

MW, 552

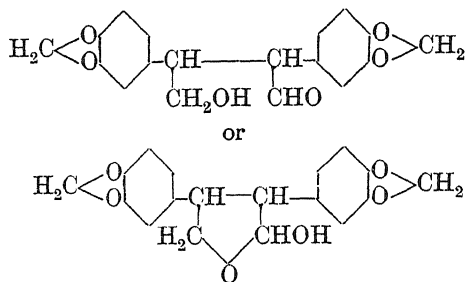
Prisms from  $\text{C}_6\text{H}_6$ -EtOH. M.p. 169° corr. Functions as a pro-vitamin A.

*Acetyl* : cryst. from  $\text{C}_6\text{H}_6$ -MeOH. M.p. 117-8° corr.

Kuhn, Grundmann, *Ber.*, 1933, 66, 1746.

Zechmeister, Lemmon, *J. Am. Chem. Soc.*, 1944, 66, 317.

**Cubebin** (*Hinokinin*)



$\text{C}_{18}\text{H}_{16}\text{O}_6$

MW, 328

Obtained from unripe fruit of *Piper cubeba*, Linn. Needles from EtOH or  $\text{C}_6\text{H}_6$ . M.p. 131-2°. Spar. sol. ether. Lævorotatory. Sol. conc.  $\text{H}_2\text{SO}_4$  to red sol. Reduces  $\text{NH}_3$   $\text{AgNO}_3$  and warm Fehling's.

*Semicarbazone* : m.p. 143-4°.

Mameli, *Gazz. chim. ital.*, 1935, 65, 886.

Ishiguro, *Chem. Abstracts*, 1937, 31, 2269.

Haworth, Kelly, *Chemistry and Industry*, 1936, 901.

**Cumalin.**

See Coumalin.

**Cumaraldehyde.**

See Coumaraldehyde.

**Cumaric Acid.**

See Coumaric Acid.

**Cumarone.**

See Coumarone.

**Cumene** (*Isopropylbenzene*, *cumol*, *2-phenylpropane*)



$\text{C}_9\text{H}_{12}$

MW, 120

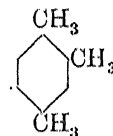
M.p. -96.03°. B.p. 152-3°.  $D_4^{20}$  0.8620.  $n_D^{20}$  1.4911. Heat of comb.  $\text{C}_p$  1251.6 Cal. Crit. temp. 363°. Crit. press. 32 atm.  $\text{CrO}_3$  or dil.  $\text{HNO}_3 \rightarrow$  benzoic acid.  $\text{HNO}_3 + \text{H}_2\text{SO}_4 \rightarrow$  *p*-nitro deriv. Conc. or fuming  $\text{H}_2\text{SO}_4 \rightarrow$  *p*-sulphonic acid.

Meyer, Bernhauer, *Monatsh.*, 1929, 53-54, 725.

Slanina, Sowa, Nieuwland, *J. Am. Chem. Soc.*, 1935, 57, 1547.

Universal Oil Products, U.S.P., 2,006,695, (*Chem. Abstracts*, 1935, 29, 5456).

$\psi$ -Cumene (*Pseudocumene*, 1 : 2 : 4-trimethylbenzene)



$\text{C}_9\text{H}_{12}$

MW, 120

M.p. -43.91°. B.p. 168-9°.  $D_4^0$  0.8888.  $n_D^{20}$  1.50441. Heat of comb.  $\text{C}_p$  1244.5 Cal.  $\text{CrO}_3$  in AcOH  $\rightarrow$  trimellitic acid.

*Picrate* : m.p. 96–7°.

Morgan, Coulson, *J. Chem. Soc.*, 1929, 2553.

Maxwell, Adams, *J. Am. Chem. Soc.*, 1930, 52, 2962.

Smith, Lund, *ibid.*, 4147.

ψ-Cumeneazoanisole.

See under 4-Hydroxy-2' : 4' : 5'-trimethylazobenzene.

ψ-Cumeneazophenol.

See 4-Hydroxy-2' : 4' : 5'-trimethylazobenzene.

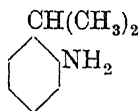
ψ-Cumenol.

See 5-Hydroxy-ψ-cumene.

Cumic Acid.

See Cuminic Acid.

**o-Cumidine** (*o*-Aminocumene, *o*-aminoisopropylbenzene)



$C_9H_{13}N$  MW, 135

B.p. 214°/732 mm., 95°/13 mm.  $D_4^{20}$  0.9760.

$B_2(COOH)_2, 1H_2O$  : prisms. M.p. 173°.

*N*-Acetyl : *o*-isopropylacetanilide. Cryst. from  $H_2O$ . M.p. 72°.

*Picrate* : m.p. 160°.

Braun, Bayer, Blessing, *Ber.*, 1924, 57, 397.

Constam, Goldschmidt, *Ber.*, 1888, 21, 1160.

**p-Cumidine** (*4*-Aminoisopropylbenzene).

B.p. 225°.  $D_4^{20}$  0.953.

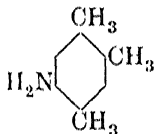
*N*-Acetyl : *p*-isopropylacetanilide. Leaflets. M.p. 102.5°.

*N*-Benzoyl : *p*-isopropylbenzanilide. Cryst. from EtOH. M.p. 162°.

Sachs, Weigert, *Ber.*, 1907, 40, 4360.

Constam, Goldschmidt, *Ber.*, 1888, 21, 1160.

ψ-Cumidine (*5*-Amino-1 : 2 : 4-trimethylbenzene)



$C_9H_{13}N$  MW, 135

Needles from  $H_2O$ . M.p. 68°. B.p. 234–5°. 1 part  $H_2O$  dissolves 1.198 parts at 19°.  $CrO_3$  → *p*-xyloquinone.

*N*-Acetyl : acet-ψ-cumidide. Needles from EtOH. Aq. M.p. 162° (165.6°).

*N*-Diacyl : m.p. 59.5°. Insol.  $H_2O$ .

Noelting, Forel, *Ber.*, 1885, 18, 2680.

Hofmann, *Ber.*, 1882, 15, 2895.

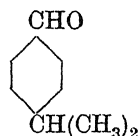
Cuminal.

See Cuminaldehyde.

Cuminalacetic Acid.

See *p*-Isopropylcinnamic Acid.

Cuminaldehyde (*Cuminal*, *cuminol*, *p*-isopropylbenzaldehyde)



$C_{10}H_{12}O$  MW, 148

Constituent of eucalyptus, myrrh, cassia, cumin and other essential oils. B.p. 235–6°, 141°/57 mm., 103–4°/10 mm.  $D^{20}$  0.9775.  $n_D^{20}$  1.5301.  $CrO_3$ , cold conc.  $HNO_3$  or alk.  $KMnO_4$  → cuminic acid.  $KCN$  → cuminoïn.

Alc.  $KOH$  → cuminic acid + cuminyl alcohol.

*Di-Me acetal* :  $C_{12}H_{18}O_2$ . MW, 194. B.p. 244–5°.  $D^{15}$  1.0633.

*Di-Et acetal* :  $C_{14}H_{22}O_2$ . MW, 222. B.p. 263°/724 mm., 142–3°/18.5 mm.  $D_4^{19}$  0.944.  $n_D^{19}$  1.484.

*α*-Oxime : cryst. from EtOH. M.p. 52°

(61°).

*β*-Oxime : prisms. M.p. 112°. Sol.  $Et_2O$ .

*p*-Tolylloxime : lustrous yellow cryst. M.p. 167°. Becomes red in the presence of light.

*Semicarbazone* : leaflets. M.p. 210–11° (222°).

*Phenylhydrazone* : needles from ligroïn or EtOH. M.p. 129°.

*o*-Chlorophenylhydrazone : yellow needles from EtOH. M.p. 67°.

*m*-Chlorophenylhydrazone : needles from EtOH. M.p. 131°.

*p*-Chlorophenylhydrazone : yellow needles from EtOH. M.p. 131°.

*p*-Bromophenylhydrazone : yellow needles from EtOH. M.p. 135°.

*p*-Nitrophenylhydrazone : cryst. from EtOH. M.p. 190°.

*2* : 4-Dinitrophenylhydrazone : red needles from  $C_6H_6$ . M.p. 241°.

*o*-Tolylhydrazone : yellow needles from EtOH. M.p. 91°.

*m*-Tolylhydrazone : yellowish needles from EtOH. M.p. 136°.

*p*-Tolylhydrazone : yellow needles from EtOH. M.p. 137°.

Bert, *Bull. soc. chim.*, 1925, 37, 1408.

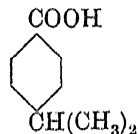
Penfold, *J. Chem. Soc.*, 1922, 121, 266.

Bert, *Compt. rend.*, 1942, 215, 276.

Cuminalmalonic Acid.

See *p*-Isopropylbenzylidenemalonic Acid.

Cuminic Acid (*p*-Isopropylbenzoic acid, *cumic acid*)



$C_{10}H_{12}O_2$  MW, 164

Plates from EtOH. M.p. 117–18° (115–16°). Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O. D<sub>4</sub> 1.162. Heat of comb. C<sub>p</sub> 1237.7 Cal.  $k = 5.0 \times 10^{-5}$  at 25°. CrO<sub>3</sub> or KMnO<sub>4</sub> → terephthalic acid

*Et ester*: C<sub>12</sub>H<sub>16</sub>O<sub>2</sub>. MW, 192. B.p. 263–4°, 134–5°/13.5 mm. Sol. EtOH, Et<sub>2</sub>O. D<sub>20</sub> 0.9953.  $n_D^{17}$  1.508.

*Chloride*: C<sub>10</sub>H<sub>11</sub>OCl. MW, 182.5. B.p. 256–8°.

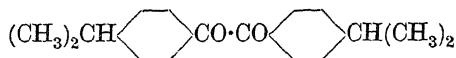
*Amide*: C<sub>10</sub>H<sub>13</sub>ON. MW, 163. M.p. 153° (155–60°). Sol. EtOH, hot C<sub>6</sub>H<sub>6</sub>. Spar. sol. Et<sub>2</sub>O, hot H<sub>2</sub>O.

*Nitrile*: *p*-isopropylbenzotrile. C<sub>10</sub>H<sub>11</sub>N. MW, 145. B.p. 243–4°/734 mm. Misc. with EtOH, Et<sub>2</sub>O, in all proportions.

Meyer, *Ann.*, 1883, 219, 244.

Bert, *Bull. soc. chim.*, 1925, 37, 1400.

**Cuminiil** (*pp'*-*Di-isopropylbenzil*, 4:4'-*di-isopropylidibenzoyl*, *di-p-isopropylphenyl diketone*)



C<sub>20</sub>H<sub>22</sub>O<sub>2</sub> MW, 294

Pale yellow prisms. M.p. 84°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Mod. sol. ligroin. KOH fusion → cuminic acid.

$\alpha$ -*Dioxime*: leaflets. M.p. 249°. Insol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

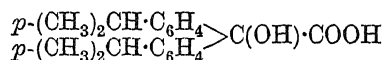
$\beta$ -*Dioxime*: needles. M.p. 227°. Sol. EtOH.

*Di-semicarbazone*: leaflets from AcOH.Aq. M.p. 251–2°.

Bösler, *Ber.*, 1881, 14, 325.

Hofmann, *Ber.*, 1890, 23, 2065.

**Cuminiilic Acid** (*Di-p-isopropylbenzilic acid*)

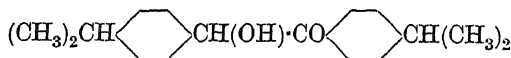


C<sub>20</sub>H<sub>24</sub>O<sub>3</sub> MW, 312

Needles from EtOH.Aq. M.p. 119–20°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O.

Bösler, *Ber.*, 1881, 14, 325.

**Cuminoil** (*pp'*-*Di-isopropylbenzoin*)



C<sub>20</sub>H<sub>24</sub>O<sub>2</sub> MW, 296

Needles from EtOH. M.p. 100–1°. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O, ligroin. Reduces Fehling's in the cold.

*Oxime*: needles from EtOH. M.p. 137°.

*Semicarbazone*: needles from EtOH. M.p. 210° decomp.

*Acetyl*: prisms. M.p. 75°.

Feigl, Sicher, Singer, *Ber.*, 1925, 53, 2300.

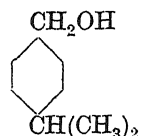
**Cuminol.**

See Cuminaldehyde.

**Cuminylacetic Acid.**

See *p*-Isopropylhydrocinnamic Acid.

**Cuminyl Alcohol** (*p*-*Isopropylbenzyl alcohol*)



C<sub>10</sub>H<sub>14</sub>O MW, 150

B.p. 246°, 140°/20 mm., 122.5°/13 mm. Misc. in all proportions with EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. D<sub>15</sub> 0.9805, D<sub>4</sub><sup>25</sup> 0.9818.  $n_D^{19}$  1.5210,  $n_D^{24}$  1.522. Slightly volatile in steam. Zn dust → *p*-cymene.

*Acetyl*: b.p. 136°/16.5 mm. D<sub>4</sub><sup>25</sup> 0.995.  $n_D^{19}$  1.497.

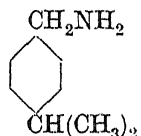
*Benzoyl*: b.p. 220°/20.5 mm. D<sub>4</sub><sup>19</sup> 1.076.

*Phenylurethane*: m.p. 62.5°.

Bert, *Bull. soc. chim.*, 1925, 37, 1406, 1579.

Palfray, Sabetay, Mastagli, *Compt. rend.*, 1936, 203, 1523.

**Cuminylamine** ( $\omega$ -*Aminomethyl-4-isopropylbenzene*, *p-isopropylbenzylamine*)



C<sub>10</sub>H<sub>15</sub>N MW, 149

B.p. 226–8°. Sol. EtOH, Et<sub>2</sub>O. Prac. insol. H<sub>2</sub>O. Absorbs CO<sub>2</sub> from the air.

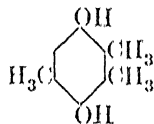
*B.HNO<sub>3</sub>*: m.p. 155–7°. Sol. H<sub>2</sub>O.

*N-Acetyl*: cryst. from ligroin. M.p. 65°.

*N-Benzoyl*: leaflets from C<sub>6</sub>H<sub>6</sub>. M.p. 93°.

Goldschmidt, Gessner, *Ber.*, 1887, 20, 2414.

**$\psi$ -Cumohydroquinone** (2:3:5-*Trimethylhydroquinone*,  $\psi$ -*cumquinol*, 3:6-*dihydroxy- $\psi$ -cumene*)



C<sub>9</sub>H<sub>12</sub>O<sub>2</sub> MW, 152

Needles from H<sub>2</sub>O. M.p. 168–70° decomp. Sol. hot H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. cold H<sub>2</sub>O.

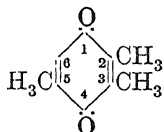
*Di-Me ether*: C<sub>11</sub>H<sub>14</sub>O<sub>2</sub>. MW, 180. M.p. 35.5–6.0°. B.p. 144°/30 mm.

*Diacetyl*: needles from 50% EtOH. M.p. 108.5–10° (112°).

*Dibenzoyl*: needles from CHCl<sub>3</sub>-EtOH. M.p. 179.5-80.5°.

Smith, *J. Am. Chem. Soc.*, 1934, 56, 473.

ψ-Cumoquinone (2 : 3 : 5-Trimethyl-p-benzoquinone)



C<sub>9</sub>H<sub>10</sub>O<sub>2</sub> MW, 150

Yellow needles. M.p. 32° (11°). Volatile in steam. SO<sub>2</sub> → ψ-cumohydroquinone.

1-Oxime: yellow needles from EtOH. M.p. 184°.

4-Oxime: yellow needles. M.p. 172° (134°).

Noelting, Baumann, *Ber.*, 1885, 18, 1152.  
Nietzki, Schneider, *Ber.*, 1894, 27, 1430.

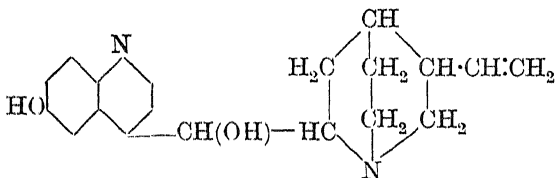
5-ψ-Cumylacetic Acid.

See 2 : 4 : 5-Trimethylphenylacetic Acid.

Cupferron.

See under β-Phenylhydroxylamine.

Cupreine



C<sub>19</sub>H<sub>22</sub>O<sub>2</sub>N<sub>2</sub> MW, 310

Alkaloid from *Remijia pedunculata*, Flueck., (Cuprea bark). M.p. anhyd. 198°. Sol. EtOH, excess NaOH. Spar. sol. Et<sub>2</sub>O, CHCl<sub>3</sub>. [α]<sub>D</sub><sup>20</sup> -175.5° in EtOH.

B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>: needles from H<sub>2</sub>O. M.p. 257° decomp.

*Diacetyl*: plates. M.p. 88°.

*Mono-Me ether*: see Quinine.

*Mono-Et ether*: quinethyline. C<sub>21</sub>H<sub>26</sub>O<sub>2</sub>N<sub>2</sub>. MW, 338. M.p. 160°. [α]<sub>D</sub><sup>20</sup> -169.4° in EtOH. Strong febrifugal action but more toxic than quinine. B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>: m.p. 224-5°.

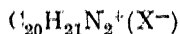
*Monopropylether*: quinpropyline. C<sub>22</sub>H<sub>28</sub>O<sub>2</sub>N<sub>2</sub>. MW, 352. M.p. 164°. B<sub>2</sub>H<sub>2</sub>SO<sub>4</sub>: m.p. 223-4°.

*Monoisopropyl ether*: quinisopropyl. M.p. 154°.

*Monoisoamyl ether*: quinoisamyl. C<sub>24</sub>H<sub>32</sub>O<sub>2</sub>N<sub>2</sub>. MW, 380. M.p. 166.5-167°.

Giemsas, Halberkann, *Ber.*, 1918, 51, 1325.  
Grimaux, Arnaud, *Bull. soc. chim.*, 1892, 7, 308.

C-Curarine I



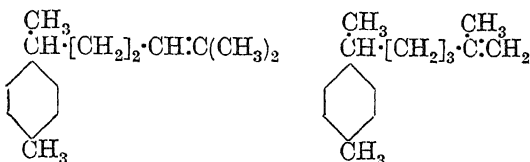
C<sub>20</sub>H<sub>21</sub>N<sub>2</sub> MW, 289

Calabash alkaloid.

*Chloride trihydrate*: HCl → reddish-violet col. HNO<sub>3</sub> → green col. H<sub>2</sub>SO<sub>4</sub> → yellowish-orange col. Acidic K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> → blue col. Heat to 100° in high vac. → monohydrate.

Karrer et al., *Helv. Chim. Acta*, 1946, 29, 1853; 1947, 30, 2081; 1952, 35, 1864.

α-Curcumene (2-Methyl-6-p-tolyl-Δ<sup>2</sup>-, and -Δ<sup>1</sup>-heptenes)



Mixture of isomers

C<sub>15</sub>H<sub>22</sub> MW, 202

*l*-

Hydrocarbon in essential oil from rhizomes of *Curcuma aromatica* and *Curcuma longa*. B.p. 137°/17 mm. D<sub>20</sub><sup>20</sup> 0.8821. n<sub>D</sub><sup>20</sup> 1.4989. [α]<sub>D</sub><sup>20</sup> -34.3°.

*Nitrosate*: needles from MeOH. M.p. 101°. [α]<sub>D</sub><sup>20</sup> -20.3° in CHCl<sub>3</sub>.

*Nitrobenzylamine deriv.*: leaflets from EtOH.Aq. M.p. 102-4°. [α]<sub>D</sub><sup>20</sup> -19.5° in MeOH.

*dl*-

B.p. 134°/16 mm. D<sub>20</sub><sup>20</sup> 0.8802. n<sub>D</sub><sup>20</sup> 1.5002.

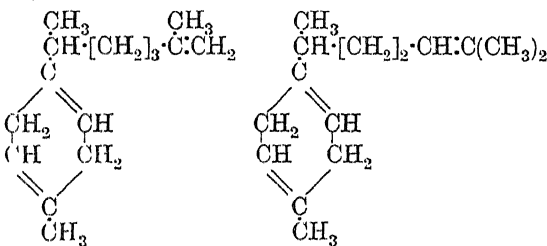
*Nitrosate*: needles from Me<sub>2</sub>CO-MeOH. De-comp. at 114°.

Carter, Simonsen, Williams, *J. Chem. Soc.*, 1940, 451.

Carter, Copp, Rao, Simonsen, *J. Chem. Soc.*, 1939, 1504.

Keil, Dobhe, D.R.P. 700,765.

β-Curcumene



Mixture of isomers

C<sub>15</sub>H<sub>24</sub> MW, 204

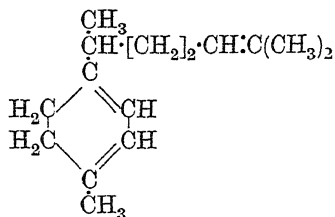
Occurs along with α-curcumene in the rhizomes of *Curcuma aromatica*. B.p. 142°/19 mm., 128-30°/6 mm. D<sub>25</sub><sup>25</sup> 0.8670. n<sub>D</sub><sup>25</sup> 1.491. [α]<sub>D</sub><sup>25</sup> -48.2°. Unstable and readily isomerised.

*Trihydrochloride*: b.p. 129-30°/7 mm. D<sub>20</sub><sup>20</sup> 0.8780. n<sub>D</sub><sup>20</sup> 1.4936.

Carter, Copp, Rao, Simonsen, *J. Chem. Soc.*, 1939, 1504.

Birch, Mukherji, *J. Chem. Soc.*, 1949, 2531.

γ-Curcumene



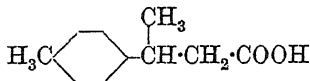
$\text{C}_{15}\text{H}_{24}$  MW, 204

The main sesquiterpene component of the essential oil of *Libocedrus bidwillii*, Hook. B.p.  $94^\circ/3$  mm.  $D_4^{20}$  0.8810.  $n_D^{25}$  1.4975.  $[\alpha]_D^{20} + 31.78^\circ$ .

Batt, Slater, *J. Chem. Soc.*, 1949, 838.

Birch, Mukherji, *ibid.*, 2531.

Curcumatic Acid (2-p-Tolylbutyric acid).



$\text{C}_{11}\text{H}_{14}\text{O}_2$  MW, 178

d.-

Needles from  $\text{H}_2\text{O}$ . M.p.  $43^\circ$ . B.p.  $163\text{--}4^\circ/10$  mm. Sol. most ord. org. solvents. Spar. sol. cold  $\text{H}_2\text{O}$ . Slightly volatile in steam.  $[\alpha]_D^{20} + 62.29^\circ$ .

Ca salt: needles from  $\text{H}_2\text{O}$ . Decomp. at  $98\text{--}100^\circ$ .

Et ester:  $\text{C}_{13}\text{H}_{18}\text{O}_2$ . MW, 206. B.p.  $134^\circ/11.5$  mm.

r.-

M.p.  $91^\circ$ . B.p.  $165^\circ/10$  mm. Sol. most ord. org. solvents. Spar. sol. cold  $\text{H}_2\text{O}$ . Slightly volatile in steam.

Et ester: b.p.  $133\text{--}5^\circ/10$  mm.

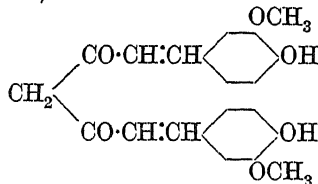
Chloride:  $\text{C}_{11}\text{H}_{13}\text{OCl}$ . MW, 196.5. B.p.  $125^\circ/9$  mm.

p-Toluidide: leaflets from EtOH. M.p.  $112\text{--}13^\circ$ .

Rupe, Steinbach, *Ber.*, 1910, **43**, 3465; 1911, **44**, 584.

Rupe, Wiederkehr, *Helv. Chim. Acta*, 1924, **7**, 661.

Curcumin (Di-4-hydroxy-3-methoxycinnamoylmethane)



$\text{C}_{21}\text{H}_{20}\text{O}_6$  MW, 368

Constituent of turmeric, *Curcuma longa*, Linn. Reddish-yellow prisms. M.p.  $183^\circ$ . Mod. sol. EtOH, AcOH. Spar. sol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ ,  $\text{CS}_2$ . Insol.  $\text{H}_2\text{O}$ , ligroin. Sol. alkalis to deep reddish-brown sols.

Diacetyl deriv.: needles. M.p.  $170\text{--}1^\circ$ .

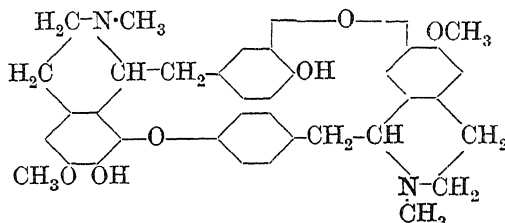
Lampe, *Ber.*, 1918, **51**, 1347.

Dieterle, Kaiser, *Arch. Pharm.*, 1932, **270**, 413.

Curesol.

See under Resorcinol.

Curine (Bebeerine)



$\text{C}_{36}\text{H}_{38}\text{O}_6\text{N}_2$  MW, 594

Constituent of *Radix Pareirae bravae* and *Chondodendron tomentosum*

l. Curine.

Cryst. from  $\text{CHCl}_3\text{--MeOH}$ . M.p.  $221^\circ$  ( $165\text{--}7^\circ$ ). Cryst. from MeOH + solvent.  $[\alpha]_D^{20} - 328^\circ$  in Py.

B,HCl: m.p.  $271\text{--}3^\circ$  decomp.

d. Bebeerine.

Cryst. from  $\text{CHCl}_3\text{--MeOH}$ . M.p.  $221^\circ$ . Cryst. from MeOH + solvent.  $[\alpha]_D^{20} - 332^\circ$  in Py.

B,HCl: m.p.  $259\text{--}60^\circ$ .

dl.-

Cryst. from  $\text{CHCl}_3$ . M.p.  $300^\circ$ .

Spath, Leithe, Ladeck, *Ber.*, 1928, **61**, 1698.

Spath, Kuffner, *Ber.*, 1934, **67**, 55.

King, *J. Chem. Soc.*, 1939, 1157; 1947, 936.

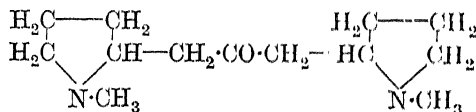
Cuscohygrine.

See Cuskygrine.

Cusconine.

See Aricine.

Cuskygrine (Cuscohygrine)



$\text{C}_{13}\text{H}_{24}\text{ON}_2$  MW, 224

Alkaloid of Cusco leaves and *Convolvulus homadae*. B.p.  $169\text{--}70^\circ/23$  mm.,  $152^\circ/14$  mm.  $D_4^{15}$  0.9782.

B,HBr: m.p.  $234^\circ$ .

B,HNO<sub>3</sub>: m.p.  $209^\circ$  decomp.

Oxime: m.p.  $53\text{--}4^\circ$ . B.p.  $200\text{--}10^\circ/14$  mm.

Methiodide: m.p.  $244^\circ$ .

Dipicrate: m.p.  $200\text{--}215^\circ$ .

Dipicrolonate: m.p.  $218\text{--}20^\circ$ .



*Distyphnate*: m.p. 206–8°.

Sohl, Shriner, *J. Am. Chem. Soc.*, 1933, 55, 3828.

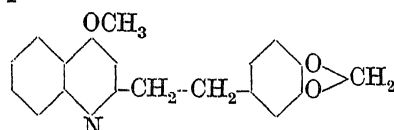
Lazur'erskiĭ, *Chem. Abstracts*, 1941, 35, 4029.

Späth, Tuppy, *Monatsh.*, 1948, 79, 119.

Anet, Hughes, Ritchie, *Nature*, 1949, 163, 289.

Rapoport, Jorgensen, *J. Org. Chem.*, 1949, 14, 664.

### Cusparine



$C_{19}H_{17}O_3N$  MW, 307

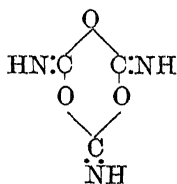
Alkaloid from bark of *Angostura cuspare*, Rocm. & Schult. Needles. M.p. 91–2°. Sol. EtOH, Et<sub>2</sub>O.

*B, HCl*: needles from hot H<sub>2</sub>O. M.p. 193–4°.

*B, H<sub>2</sub>AuCl<sub>4</sub>*: m.p. 190°.

Späth, Brunner, *Ber.*, 1924, 57, 1243.

### Cyamelide



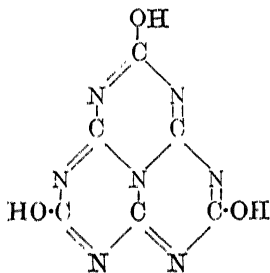
$C_3H_3O_3N_3$  MW, 129

White, amorphous mass. Insol. ord. org. solvents, dil. min. acids. Prac. insol. H<sub>2</sub>O. Sol. conc. H<sub>2</sub>SO<sub>4</sub>. Sol. conc. NaOH forming trisodium cyanurate. Decomp. by hot NaOH. Aq. and by hot conc. H<sub>2</sub>SO<sub>4</sub>.

Hantzsch, *Ber.*, 1905, 38, 1017.

Werner, *J. Chem. Soc.*, 1913, 103, 1016.

### Cyameluric Acid



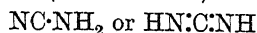
$C_6H_3O_3N_7$  MW, 221

Cryst. + 3H<sub>2</sub>O from H<sub>2</sub>O. Forms spar. sol. metallic salts.

*Trichloride*: C<sub>6</sub>N<sub>7</sub>Cl<sub>3</sub>. MW, 276.5. Very spar. sol. org. solvents.

Redemann, Lucas, *J. Am. Chem. Soc.*, 1939, 61, 3420; 1940, 62, 842.

### Cyanamide (Carbodiimide)



CH<sub>2</sub>N<sub>2</sub> MW, 42

Colourless cryst. M.p. 42°. B.p. 140°/19 mm. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Volatile in steam. H<sub>2</sub>SO<sub>4</sub> or HCl → urea. H<sub>2</sub>S → thiourea. NH<sub>3</sub> → guanidine. Polymerises to dicyandiamide and melamine on heating. Zn + HCl → methylamine + ammonia. Forms stable metallic salts (cyanamides) with Na, K, Ca, Ba, Mg, Ag, Hg, Cu and Pb.

Traube, Kegel, Schulz, *Z. angew. Chem.* 1926, 39, 1469.

Osterberg, Kendall, *J. Biol. Chem.*, 1917, 32, 297.

Viditz, D.R.P., 648,541–2, (*Chem. Abstracts*, 1937, 31, 8844).

Liebknicht, D.R.P., 601,465, (*Chem. Abstracts*, 1934, 28, 7439); *Angew. chem.*, 1932, 45, 584.

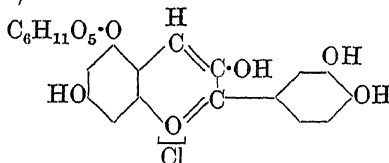
I.G., B.P., 360,621, (*Chem. Abstracts*, 1933, 27, 1107).

Union Carbide, U.S.P., 1,835,070, (*Chem. Abstracts*, 1932, 26, 1073).

### Cyananilide.

See Phenylcyanamide.

### Cyanenin chloride (5-β-Glucosidylcyanidin chloride)



$C_{21}H_{21}O_{11}Cl$  MW, 484.5

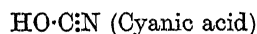
Monoglucosidic first hydrolytic product of cyanin chloride. Prismatic needles with weak green lustre from 4% HCl. Aq. Sol. Na<sub>2</sub>CO<sub>3</sub>. Aq. → bluish-green col. Faintly acid dil. sol. rapidly ox. by FeCl<sub>3</sub> (distinction from chrysanthemine chloride).

Léon, Robinson, *J. Chem. Soc.*, 1932, 2221.

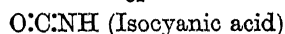
### Cyanethine.

See 4-Amino-5-methyl-2:6-diethylpyrimidine.

### Cyanic Acid



or



CHON MW, 43

Liq. below 0°. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>. D<sup>0</sup> 1.140. *k* = 1.2 × 10<sup>-4</sup> at 0°. Polymerises to cyamelide and at higher temps. to cyanuric acid. H<sub>2</sub>O sol. decomp. on standing to CO<sub>2</sub> and NH<sub>3</sub>. Alcohols → allophanic acid esters.

*NH<sub>4</sub> salt*: sol. H<sub>2</sub>O. Isomerises rapidly to urea.

*K salt*: sol. H<sub>2</sub>O, with decomp. to K<sub>2</sub>CO<sub>3</sub> + NH<sub>3</sub>.  
*Ag salt*: spar. sol. H<sub>2</sub>O.

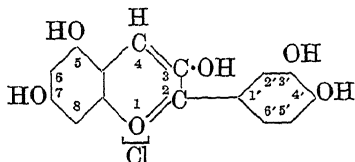
Gattermann, Rossolymò, *Ber.*, 1890, 23, 1192.

Gattermann, *ibid.*, 1224.

Fosse, de Graeve, Thomas, *Compt. rend.*, 1936, 202, 1544.

Birkenbach, Kolb, Goubeau, *Ber.*, 1935, 68, 895.

**Cyanidin chloride** (3:5:7:3':4'-Penta-hydroxyflavylium chloride)

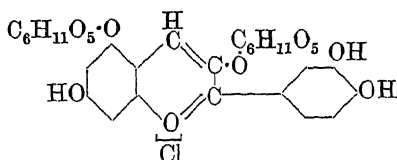


C<sub>15</sub>H<sub>11</sub>O<sub>6</sub>Cl MW, 322.5

Glycosides of cyanidin occur in many flowers and fruits, e.g. cornflower, peony, chrysanthemum, cherry and cranberry. Usually isolated in form of its chloride. Chocolate-brown needles or prisms from EtOH-HCl.

Robertson, Robinson, *J. Chem. Soc.*, 1928, 1528.

**Cyanin chloride**



C<sub>27</sub>H<sub>31</sub>O<sub>16</sub>Cl MW, 646.5

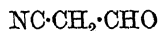
Pigment of the cornflower and dahlia. Brownish-violet prisms with bronze lustre. M.p. 205° decomp.

Robinson, Todd, *J. Chem. Soc.*, 1932, 2494.  
 Robinson, *Ber.*, 1934, 67, 85.

**Cyanmethine.**

See 4-Amino-2:6-dimethylpyrimidine.

**Cyanoacetaldehyde** (*Formylacetonitrile*, *malonaldehydic nitrile*)



C<sub>3</sub>H<sub>3</sub>ON MW, 69

B.p. 71-2°. Misc. with EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub> in all proportions. D<sub>15</sub> 0.881. HNO<sub>3</sub> → cyanoacetic acid.

*Di-Et acetal*: C<sub>7</sub>H<sub>13</sub>O<sub>2</sub>N. MW, 143. B.p. 99°/14 mm. D<sub>20</sub> 0.9496. n<sub>D</sub><sup>20</sup> 1.4155.

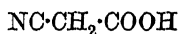
*p-Nitrophenylhydrazone*: m.p. 153-4°.

Claisen, *Ber.*, 1903, 36, 3665.

Hartung, Adkins, *J. Am. Chem. Soc.*, 1927, 49, 2520.

Uhle, Jacobs, *J. Org. Chem.*, 1945, 10, 76.

**Cyanoacetic Acid** (*Malonic acid mononitrile*)



C<sub>3</sub>H<sub>3</sub>O<sub>2</sub>N MW, 85

M.p. 66°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. *k* = 3.7 × 10<sup>-3</sup> at 25°. Deliquescent. Conc. HCl or KOH → malonic acid. Decomp. at 160° to CO<sub>2</sub> + acetonitrile.

*Me ester*: C<sub>4</sub>H<sub>5</sub>O<sub>2</sub>N. MW, 99. B.p. 200°, 115°/36 mm. D<sub>4</sub><sup>25</sup> 1.0962.

*Et ester*: see Ethyl cyanoacetate.

*Amide*: cyanoacetamide, malonic amide-nitrile. C<sub>3</sub>H<sub>4</sub>ON<sub>2</sub>. MW, 84. M.p. 119-20°. Sol. H<sub>2</sub>O. Mod. sol. EtOH.

*Nitrile*: see Malonitrile.

*Anilide*: cyanoacetanilide. M.p. 198-9°.

*Phenylhydrazide*: m.p. 105-6°. *Acetyl deriv.*, m.p. 149-50°.

Corson, Scott, Vose, *Organic Syntheses*, Collective Vol. I, 173.

Inglis, *ibid.*, 249.

**Cyanoacetone.**

See under Acetoacetic Acid.

**Cyanoacetophenone.**

See under Acetophenone-carboxylic Acid and Benzoylacetic Acid.

**3-Cyanoacetylacetone.**

See under Diacetoacetic Acid.

**Cyanoacetylene.**

See under Propiolic Acid.

**Cyanoacetylurea.**

See under Malonic Acid.

**Cyanobenzenesulphonic Acid.**

See under Sulphobenzoic Acid.

**o-Cyanobenzoic Acid** (*Phthalic acid mononitrile*)



C<sub>8</sub>H<sub>5</sub>O<sub>2</sub>N MW, 147

Needles. M.p. 187° (192°) → phthalimide. Sol. Me<sub>2</sub>CO, hot H<sub>2</sub>O, hot EtOH. Mod. sol. Et<sub>2</sub>O. Spar. sol. C<sub>6</sub>H<sub>6</sub>, pet. ether.

*Me ester*: C<sub>9</sub>H<sub>7</sub>O<sub>2</sub>N. MW, 161. Needles. M.p. 51°. Sol. MeOH.

*Et ester*: C<sub>10</sub>H<sub>9</sub>O<sub>2</sub>N. MW, 175. Needles. M.p. 70° (65-6°). Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>, ligroin. Mod. sol. hot H<sub>2</sub>O.

*Amide*: o-cyanobenzamide, phthalamic nitrile. C<sub>8</sub>H<sub>6</sub>ON<sub>2</sub>. MW, 146. Needles. M.p. 173°. Sol. EtOH, Me<sub>2</sub>CO, hot MeOH. Insol. H<sub>2</sub>O.

Hoogewerff, van Dorp, *Rec. trav. chim.*, 1892, 11, 84.

Rupe, Bernstein, *Helv. Chim. Acta*, 1930, 13, 468.

Braun, Tcherniac, *Ber.*, 1907, 40, 2710.

**m-Cyanobenzoic Acid** (*Isophthalic acid mononitrile*).

Needles. M.p. 217°. Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O. Sublimes with part. decomp. *k* = 1.99 × 10<sup>-4</sup> at 25°. Hot conc. NaOH.Aq. → isophthalic acid.

*Me ester*: m.p. 65°. Sol. EtOH, Et<sub>2</sub>O, CS<sub>2</sub>, C<sub>6</sub>H<sub>6</sub>.

*Et ester*: m.p. 56°. B.p. 140-1°/10 mm. Sol. EtOH, Et<sub>2</sub>O.

*Amide*: *m*-cyanobenzamide, isophthalamic nitrile. M.p. above 300°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

Brömme, *Ber.*, 1887, 20, 524.

Rupe, Bernstein, *Helv. Chim. Acta*, 1930, 13, 468.

**p-Cyanobenzoic Acid** (*Terephthalic acid mononitrile*).

Leaflets. M.p. 219°. Sol. EtOH, Et<sub>2</sub>O, hot AcOH, hot H<sub>2</sub>O. Hot alkalis → terephthalic acid.

*Me ester*: leaflets from EtOH. M.p. 62°. Volatile in steam.

*Et ester*: needles. M.p. 54°. B.p. 139-40°/11 mm. Sol. EtOH, Et<sub>2</sub>O.

*Amide*: *p*-cyanobenzamide, terephthalamic nitrile. Needles. M.p. 223°.

Kattwinkel, Wolfenstein, *Ber.*, 1904, 37, 3221.

Rupe, Bernstein, *Helv. Chim. Acta*, 1930, 13, 468.

**p-Cyanobenzophenone.**

See under *p*-Benzoylbenzoic Acid.

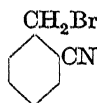
**o-Cyanobenzotrichloride.**

See under  $\omega$ -Trichloro-*o*-toluic Acid.

**Cyanobenzyl Alcohol.**

See under Hydroxymethyl-benzoic Acid.

**o-Cyanobenzyl bromide** (*o*-Bromomethylbenzonitrile,  $\omega$ -bromo-*o*-toluic nitrile)



C<sub>8</sub>H<sub>6</sub>NBr MW, 196

Prisms. M.p. 71-2°. B.p. 124°/4 mm. Sol. EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Spar. sol. hot H<sub>2</sub>O. Volatile in steam.

Fuson, *J. Am. Chem. Soc.*, 1926, 48, 833.

**m-Cyanobenzyl bromide.**

Cryst. from EtOH. M.p. 93°.

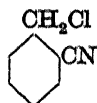
v. Braun, Reich, *Ann.*, 1925, 445, 237.

**p-Cyanobenzyl bromide.**

Prisms from EtOH. M.p. 115-16°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

Bauro, *Ber.*, 1894, 27, 2169.

**o-Cyanobenzyl chloride** (*o*-Chloromethylbenzonitrile,  $\omega$ -chloro-*o*-toluic nitrile)



C<sub>8</sub>H<sub>6</sub>NCl

MW, 151.5

Dlet. of Org. Comp.—I.

Prisms. M.p. 61°. B.p. 252°. Sol. EtOH, hot H<sub>2</sub>O. Conc. H<sub>2</sub>SO<sub>4</sub> at 90° → *o*-chloromethylbenzamide.

Barkenbus, Holtzclaw, *J. Am. Chem. Soc.*, 1925, 47, 2191.

**m-Cyanobenzyl chloride.**

Cryst. from hot EtOH. M.p. 67°. B.p. 258-60°.

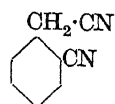
Reinglass, *Ber.*, 1891, 24, 2416.

**p-Cyanobenzyl chloride.**

Prisms from EtOH. M.p. 79-80°. B.p. 263°.

Barkenbus, Holtzclaw, *J. Am. Chem. Soc.*, 1925, 47, 2190.

**o-Cyanobenzyl cyanide** (*Homophthalic acid di-nitrile*,  $\omega$ -cyano-*o*-tolunitrile)



C<sub>9</sub>H<sub>6</sub>N<sub>2</sub>

MW, 142

Leaflets from EtOH. M.p. 81°. Sol. Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>. Hot conc. min. acids → homophthalimide.

Gabriel, Otto, *Ber.*, 1887, 20, 2224.

**m-Cyanobenzyl cyanide** (*Homoisophthalic acid di-nitrile*).

Needles from hot H<sub>2</sub>O. M.p. 84°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

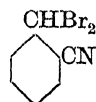
Reinglass, *Ber.*, 1891, 24, 2417.

**p-Cyanobenzyl cyanide** (*Homoterephthalic acid di-nitrile*).

Needles from EtOH. M.p. 100°. Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Mod. sol. hot H<sub>2</sub>O.

Mellinghoff, *Ber.*, 1889, 22, 3209.

**o-Cyanobenzylidene bromide** (*o*-Dibromomethylbenzonitrile,  $\omega$ -dibromo-*o*-tolunitrile)



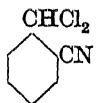
C<sub>8</sub>H<sub>5</sub>NBr<sub>2</sub>

MW, 275

Cryst. from EtOH. M.p. 62-3°. Volatile in steam. Dil. H<sub>2</sub>SO<sub>4</sub> → *o*-aldehydobenzoic acid.

Fuson, *J. Am. Chem. Soc.*, 1926, 48, 1096.

**o-Cyanobenzylidene chloride** (*o*-Dichloromethylbenzonitrile,  $\omega$ -dichloro-*o*-tolunitrile)



C<sub>8</sub>H<sub>5</sub>NCl<sub>2</sub>

MW, 186

B.p. 260°. Hyd. by conc. HCl at 170° to *o*-aldehydobenzoic acid.

Gabriel, Weise, *Ber.*, 1887, 20, 3197.

**m-Cyanobenzylidene chloride.**

B.p. 272-5°.

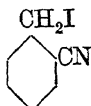
Reinglass, *Ber.*, 1891, 24, 2416.

**p-Cyanobenzylidene chloride.**

B.p. 273-6°/770 mm.

Reinglass, *Ber.*, 1891, 24, 2416.

**o-Cyanobenzyl iodide (o-Iodomethylbenzotrile, ω-iodo-o-tolunitrile)**



C<sub>8</sub>H<sub>6</sub>NI

MW, 243

Leaflets from EtOH.Aq. M.p. 76-8°. Sol. Et<sub>2</sub>O.

Fuson, *J. Am. Chem. Soc.*, 1926, 48, 834.

**p-Cyanobenzyl iodide (ω-Iodo-p-tolunitrile).**

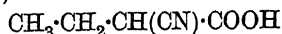
Needles from EtOH. M.p. 143-4°. Sol. Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

Freund, Reitz, *Ber.*, 1906, 39, 2235.

**1-Cyano-1 : 3-butadiene.**

See Cyanoprene.

**1-Cyanobutyric Acid (Ethylmalonic acid mononitrile)**



C<sub>5</sub>H<sub>7</sub>O<sub>2</sub>N

MW, 113

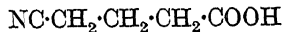
B.p. 161°/24 mm. decomp., 153-5°/15 mm. Very viscous. Hygroscopic. Heat → butyronitrile.

*Et ester*: C<sub>7</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 141. B.p. 207-9°, 84-5°/7 mm. D<sub>4</sub><sup>20</sup> 1.009. n<sub>D</sub><sup>20</sup> 1.4163.

*Amide*: C<sub>5</sub>H<sub>9</sub>ON<sub>2</sub>. MW, 112. M.p. 113°. B.p. 276°/775 mm., 180-90°/24 mm. Sol. H<sub>2</sub>O. EtOH. Insol. C<sub>6</sub>H<sub>6</sub>.

Hadley, *J. Am. Chem. Soc.*, 1912, 34, 925. Nishikawa, *Chem. Zentr.*, 1935, II, 1550.

**3-Cyanobutyric Acid (Glutaric acid mononitrile)**



C<sub>5</sub>H<sub>7</sub>O<sub>2</sub>N

MW, 113

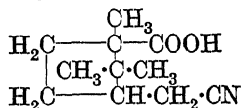
Deliquescent cryst. M.p. 45°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O, C<sub>6</sub>H<sub>6</sub>.

*Et ester*: b.p. 245°. D<sub>19</sub><sup>19</sup> 1.0062.

*Amide*: leaflets. M.p. 69-70° (in sealed tube).

Dieckmann, *Ber.*, 1900, 33, 588.

**Cyanocampholic Acid (Homocamphoric acid mononitrile, 1 : 2 : 2-trimethyl-3-cyanomethylcyclopentane-1-carboxylic acid)**



C<sub>11</sub>H<sub>17</sub>O<sub>2</sub>N

MW, 195

*d.*

Cryst. M.p. 164°. Sol. EtOH, Et<sub>2</sub>O. [α]<sub>D</sub><sup>20</sup> +64.41° in EtOH.

*Me ester*: C<sub>12</sub>H<sub>19</sub>O<sub>2</sub>N. MW, 209. Cryst. from Et<sub>2</sub>O. M.p. 77°.

*Et ester*: C<sub>13</sub>H<sub>21</sub>O<sub>2</sub>N. MW, 223. Cryst. from Et<sub>2</sub>O. M.p. 58°. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O. [α]<sub>D</sub><sup>20</sup> +57.7° in EtOH.

*Benzyl ester*: C<sub>18</sub>H<sub>23</sub>O<sub>2</sub>N. MW, 285. Plates. M.p. 71°. Sol. C<sub>6</sub>H<sub>6</sub>, hot EtOH.

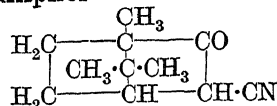
*dl.*

Plates from C<sub>6</sub>H<sub>6</sub>-ligroin. M.p. 178-9°.

Komppa, *Ber.*, 1908, 41, 4472.

Haller, *Compt. rend.*, 1896, 122, 446.

**Cyanocamphor**



C<sub>11</sub>H<sub>15</sub>ON

MW, 177

Monoclinic prisms. M.p. 127-8°. B.p. 250° decomp. Mod. sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, AcOH. Spar. sol. hot H<sub>2</sub>O. Dextrorotatory.

2 : 4-Dinitrophenylhydrazone: m.p. 225°.

Palfray, *Ann. chim.*, 1923, 20, 307.

Lapworth, *J. Chem. Soc.*, 1900, 77, 1058.

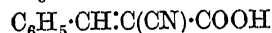
**1-Cyanocaproic Acid.**

See under n-Butylmalonic Acid.

**Cyanocinchonic Acid.**

See under Quinoline-2 : 4-dicarboxylic Acid.

**α-Cyanocinnamic Acid (Benzylidenecyanoacetic acid, benzylidenemalonic acid mononitrile)**



C<sub>10</sub>H<sub>7</sub>O<sub>2</sub>N

MW, 173

Cryst. from EtOH. M.p. 183°. Heat above m.p. → cinnamic nitrile.

*Me ester*: C<sub>11</sub>H<sub>9</sub>O<sub>2</sub>N. MW, 187. M.p. 89° (80°). Sol. Et<sub>2</sub>O, CHCl<sub>3</sub>. Mod. sol. EtOH, C<sub>6</sub>H<sub>6</sub>.

*Et ester*: C<sub>12</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 201. Exists in two forms. (1) Oil, b.p. 118-22°/0.4 mm. D 1.0762. n<sub>D</sub><sup>20</sup> 1.5033. (2) Cryst. from EtOH. M.p. 51°. Sol. Et<sub>2</sub>O, AcOH, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.

*Amide*: C<sub>10</sub>H<sub>8</sub>ON<sub>2</sub>. MW, 172. Prisms. M.p. 123°.

Lapworth, Baker, *Organic Syntheses*, Collective Vol. I, 175.

Alexander, Cope, *J. Am. Chem. Soc.*, 1944, 66, 886.

**Cyanocinnamic Acid.**

See under Carboxycinnamic Acid.

**Cyanocobalamin.**

See Vitamin B<sub>12</sub>.

**Cyanodiphenylarsine.**

See Diphenylcyanarsine.

**Cyanodiphenylmethane.**

See under Diphenylmethane-carboxylic Acid.

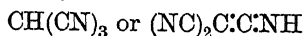
**1-Cyanoecosanonic Acid.**

See under Octadecylmalonic Acid.

**Cyanoethylene.**

See under Acrylic Acid.

**Cyanoforn** (*Tricyanomethane, methanetricarboxylic nitrile*)



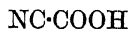
$\text{C}_4\text{HN}_3$  MW, 91

Aq. sol. reacts strongly acid. Forms Na,  $\text{NH}_4$ , Ag, etc. salts.

$\text{NH}_4$  salt:  $(\text{NC})_2\text{C}:\text{C}:\text{N}\cdot\text{NH}_4$ . M.p. 183°.

Birkenbach, Huttner, *Ber.*, 1929, 62, 157.

**Cyanofornic Acid** (*Oxalic mononitrile*)



$\text{C}_2\text{HO}_2\text{N}$  MW, 71

The mononitrile of oxalic acid of the above formula does not exist in the free state, but polymerises to the trimeride, *sym.*-triazine-tricarboxylic acid.

*Me ester*:  $\text{NC}\cdot\text{COOCH}_3$ .  $\text{C}_3\text{H}_3\text{O}_2\text{N}$ . MW, 85. Fuming liq. B.p. 101°.  $D_4^{20}$  1.0719.  $n_D^{20}$  1.37378.

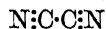
*Et ester*:  $\text{C}_4\text{H}_5\text{O}_2\text{N}$ . MW, 99. Fuming liq. B.p. 115–16°.  $D_4^{20}$  1.0034.  $n_D^{20}$  1.3821. Hyd. by conc. HCl  $\rightarrow$  oxalic acid,  $\text{NH}_3$ , and  $\text{C}_2\text{H}_5\text{OH}$ . Alkalis  $\rightarrow$  HCN,  $\text{CO}_2$ , and  $\text{C}_2\text{H}_5\text{OH}$ .

*Amide*: oxalic amide-nitrile.  $\text{C}_2\text{H}_2\text{ON}_2$ . MW, 70. M.p. 60°. Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ . Heat  $\rightarrow$  HCN + cyanuric acid. Conc. HCl  $\rightarrow$  oxamide.

Ott, *Ber.*, 1919, 52, 660.

Wallach, *Ann.*, 1877, 184, 12.

**Cyanogen** (*Oxalonitrile*)



$\text{C}_2\text{N}_2$  MW, 52

Colourless poisonous gas. M.p.  $-34^\circ$ . B.p.  $-21^\circ$ .  $D_4^{21}$  0.9537,  $D$  1.804 (air = 1).  $\text{H}_2\text{O}$  dissolves 4 vols. Burns with violet flame  $\rightarrow$   $\text{CO}_2$  +  $\text{N}_2$ . Vapour press., 2.4 atm. at  $0^\circ$ , 4 atm. at  $17^\circ$ , 7.5 atm. at  $39^\circ$ . Heat of comb.  $C_p$  259.6 Cal. Heat above  $400^\circ$   $\rightarrow$  paracyanogen, a polymer, insol.  $\text{H}_2\text{O}$ , EtOH. At  $800\text{--}60^\circ$  paracyanogen reverts to cyanogen. Above this temp. cyanogen begins to decompose into carbon and nitrogen. Combines with heated metals to give cyanides. Aq. sols. turn brown and deposit azulmic acid. Conc. HCl  $\rightarrow$  oxamide  $\rightarrow$  oxalic acid.

Walden, Audrieth, *Chemical Reviews*, 1928, 5, 339; *Chem. Abstracts*, 1928, 22, 4396.

Noir, Tchong-Datchang, *Compt. rend.*, 1928, 187, 126.

Cook, Robinson, *J. Chem. Soc.*, 1935, 1001.

Slatineanu, Belg. P., 378,694, (*Chem. Abstracts*, 1932, 26, 2021).

Heimann, *Z. angew. Chem.*, 1931, 44, 378. Tzontnershver, Szper, *Chem. Abstracts*, 1933, 27, 2625.

**Cyanogen bromide**



CNBr

MW, 106

Cryst. M.p.  $52^\circ$ . B.p.  $61\text{--}2^\circ$ .  $D_4^{21}$  1.8633. Br or HBr  $\rightarrow$  cyanuric bromide.

Grignard, Crouzier, *Bull. soc. chim.*, 1921, 29, 214.

Cook, Robinson, *J. Chem. Soc.*, 1935, 1001.

Slotta, *Ber.*, 1934, 67, 1028.

Zappi, Elorza, *Bull. soc. chim.*, 1931, 49, 397.

Hartman, Dreger, *Organic Syntheses*, 1931, XI, 30.

**Cyanogen chloride**



CNCl

MW, 61.5

Gas at ord. temps. B.p.  $12^\circ$ . Solidifies at  $-6^\circ$ . Gas very sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{H}_2\text{O}$ . Liq. sol. EtOH. Spar. sol.  $\text{H}_2\text{O}$ .  $D_4^{12}$  1.1963. Cl or HCl  $\rightarrow$  cyanuric chloride.  $\text{NH}_3$   $\rightarrow$  cyanamide.

Price, Green, *J. Soc. Chem. Ind.*, 1920, 39, 98r.

Cook, Robinson, *J. Chem. Soc.*, 1935, 1001.

I.C.I., B.P., 347,989, (*Chem. Abstracts*, 1932, 26, 2021).

National Aniline, U.S.P., 1,938,324, (*Chem. Abstracts*, 1934, 28, 1148).

I.G., D.R.P., 574,804, (*Chem. Abstracts*, 1933, 27, 4636).

**Cyanogen iodide**



CNI

MW, 153

Cryst. from  $\text{Et}_2\text{O}$  or EtOH. F.p.  $142^\circ$ . M.p. (in sealed tube)  $146\text{--}7^\circ$ .  $D$  about 2.59. Sol. hot  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ . Sublimes.

Grignard, Crouzier, *Bull. soc. chim.*, 1921, 29, 214.

Cook, Robinson, *J. Chem. Soc.*, 1935, 1001.

**Cyanogen sulphide.**

See Cyanogen thiocyanate.

**Cyanogen thiocyanate** (*Cyanogen sulphide, thiocyanic anhydride*)



$\text{C}_2\text{N}_2\text{S}$

MW, 84

M.p.  $65^\circ$ . Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ . Sublimes at  $30^\circ$ .

Walden, Audrieth, *Chemical Reviews*, 1928, 5, 339; *Chem. Abstracts*, 1928, 22, 4396.

**Cyanoguanidine.**

See Dicyandiamide.

**$\alpha$ -Cyanohydrocinnamic Acid** (*Benzyl-cyanoacetic acid, benzylmalonic mononitrile*)



$\text{C}_{10}\text{H}_9\text{O}_2\text{N}$

MW, 175

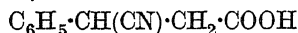
M.p.  $101\text{--}2^\circ$  ( $75^\circ$ ) from  $\text{C}_6\text{H}_6$ . Sol. EtOH,  $\text{H}_2\text{O}$ ,  $\text{Et}_2\text{O}$ .

*Et ester*: C<sub>12</sub>H<sub>13</sub>O<sub>2</sub>N. MW, 203. B.p. 176–85°/21 mm. Misc. with most org. solvents.

*Amide*: C<sub>10</sub>H<sub>10</sub>ON<sub>2</sub>. MW, 174. Prisms. M.p. 130°.

Hessler, *J. Am. Chem. Soc.*, 1916, 38, 914.  
Wideqvist, *Chem. Abstracts*, 1941, 35, 3993.

**β-Cyanohydrocinnamic Acid** (*Phenylsuccinic α-nitrile*)



C<sub>10</sub>H<sub>9</sub>O<sub>2</sub>N MW, 175  
*dl.*

Needles from EtOH.Aq. M.p. 150°. B.p. 215–8°/10 mm. Spar. sol. H<sub>2</sub>O.

*Me ester*: C<sub>11</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 189. Prisms from C<sub>6</sub>H<sub>6</sub>-pet. ether, or EtOH. M.p. 55°. B.p. 155–9°/10 mm.

*Et ester*: b.p. 176°/16 mm.

*l.*

*Et ester*: b.p. 78–9°/<0.1 mm. D<sub>4</sub><sup>17</sup> 1.1811. n<sub>D</sub><sup>15</sup> 1.5243. [α]<sub>D</sub><sup>17</sup><sub>461</sub> – 0.53° (l = 0.25).

Bredt, Kallen, *Ann.*, 1896, 293, 345.

Anschütz, *Ann.*, 1907, 354, 123.

Kenyon, Phillips, Shutt, *J. Chem. Soc.*, 1935, 1667.

**Cyanohydrocinnamic Acid.**

See also under Carboxyhydrocinnamic Acid.

**1-Cyanoisoamylacetic Acid.**

See under Isoamylmalonic Acid.

**1-Cyanoisopropyl Alcohol.**

See under 2-Hydroxybutyric Acid.

**1-Cyanoisoquinoline** (*Isoquinaldinic nitrile*)



C<sub>10</sub>H<sub>6</sub>N<sub>2</sub> MW, 154

M.p. 78° (93°). Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O. Hyd. → isoquinaldinic acid.

Zincke, Krollpfeiffer, *Ann.*, 1915, 408, 338.

Kaufmann, Dändliker, *Ber.*, 1913, 46, 2928.

**5- (or 8)-Cyanoisoquinoline.**

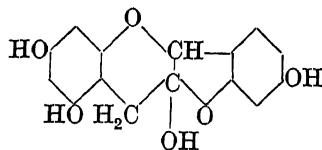
Needles from H<sub>2</sub>O. M.p. 135°. Very sol. dil. acids.

Jeiteles, *Monatsh.*, 1894, 15, 809.

**1-Cyanoisovaleric Acid.**

See under Isopropylmalonic Acid.

**Cyanomaclurin**



C<sub>15</sub>H<sub>12</sub>O<sub>6</sub>

MW, 288

Present in *Artocarpus integrifolia*. Prisms from AcOH.Aq. M.p. 290° decomp. Sol. AcOH, AcOEt. Spar. sol. H<sub>2</sub>O. [α]<sub>D</sub><sup>20</sup> + 215° in AcOEt, [α]<sub>D</sub><sup>20</sup> + 192° in H<sub>2</sub>O. Alkali fusion → phloroglucinol. Gives characteristic blue cols. on heating alk. sols.

*Tri-Me ether*: C<sub>18</sub>H<sub>18</sub>O<sub>6</sub>. MW, 330. Amorph. M.p. 73–85°.

*Tetra-acetyl*: m.p. 136–8°. [α]<sub>D</sub><sup>19</sup> + 95°.

*Tetrabenzoyl*: m.p. 171–3°.

Perkin, *J. Chem. Soc.*, 1905, 87, 715.

Appel, Robinson, *J. Chem. Soc.*, 1935, 752.

**Cyanomalonic Ester.**

See Diethyl cyanomalonate.

**Cyanomethane.**

See Acetonitrile.

**Cyanonaphthalene.**

See Naphthonitrile.

**2-Cyano-oxanilic Acid.**

See under Kynuric Acid.

**2-Cyano-oxanilide.**

See under Kynuric Acid.

**1-Cyanopalmitic Acid.**

See under Tetradecylmalonic Acid.

**Cyanophenol.**

See under Hydroxybenzoic Acid and Salicylic Acid.

**α-Cyanophenylacetic Acid.**

See Phenylcyanoacetic Acid.

**p-Cyanophenylacetic Acid.**

See under Homoterephthalic Acid.

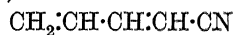
**o-Cyanophenylthioglycolic Acid.**

See under Phenylthioglycolic Acid o-carboxylic Acid.

**3-Cyanopicolinic Acid.**

See under Quinolinic Acid.

**Cyanoprene** (*1-Cyano-1 : 3-butadiene, 2-vinylacrylonitrile*)



C<sub>5</sub>H<sub>5</sub>N MW, 79

B.p. 135–8° with polymerisation, 50°/28 mm. D<sub>4</sub><sup>20</sup> 0.8444. n<sub>D</sub><sup>20</sup> 1.4880. Polymerisation product one of the many synthetic rubbers.

*Cis.*

B.p. 49.5°/31.5 mm. n<sub>D</sub><sup>20</sup> 1.4852.

*Trans.*

B.p. 57.3°/31.5 mm. n<sub>D</sub><sup>20</sup> 1.4960.

Bissinger *et al.*, *J. Am. Chem. Soc.*, 1947, 69, 2955.

Gudgeon, Can. P. 398,840, (*Chem. Abstracts*, 1941, 35, 7423).

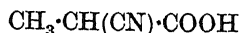
Carter, Johnson, U.S.P. 2,276,156, (*Chem. Abstracts*, 1942, 36, 4524).

Hanford, U.S.P. 2,334,192, (*Chem. Abstracts*, 1944, 38, 2668).

Snyder *et al.*, *J. Am. Chem. Soc.*, 1949, 71, 1055, 1057.

Charlish, Davies, Rose, *J. Chem. Soc.*, 1948, 227, 232.

Charlish, Davies, *J. Chem. Soc.*, 1950, 1385.

**1-Cyanopropionic Acid** (*Methylmalonic mononitrile*)

$\text{C}_4\text{H}_5\text{O}_2\text{N}$  MW, 99  
M.p. 35°. B.p. 142.5°/11 mm. (93.4°/10.5 mm.). Strongly hygroscopic.

*Et ester*: methylmalonic ethyl ester-nitrile.  $\text{C}_6\text{H}_9\text{O}_2\text{N}$ . MW, 127. B.p. 192-3°, 89-90°/20 mm.  $D^{20}_D$  0.998. Forms Na deriv.

*Amide*: methylmalonic amide-nitrile.  $\text{C}_4\text{H}_6\text{ON}_2$ . MW, 98. M.p. 105° (81°). B.p. 267° decomp. Sol.  $\text{H}_2\text{O}$ , EtOH. Insol.  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ .

Wideqvist, *Chem. Abstracts*, 1947, 41, 2693.

Hessler, *J. Am. Chem. Soc.*, 1913, 35, 990.  
Beccari, *Chem. Zentr.*, 1903, II, 713.

de Hoffmann, Barbier, *Bull. soc. chim. Belg.*, 1936, 45, 565.

Nishikawa, *Chem. Abstracts*, 1935, 29, 7947.

**2-Cyanopropionic Acid** (*Succinic mononitrile*)

$\text{C}_4\text{H}_5\text{O}_2\text{N}$  MW, 99  
Prisms. M.p. 48-50°. Sol.  $\text{H}_2\text{O}$  and most org. solvents.

*Me ester*: succinic methyl ester-nitrile.  $\text{C}_5\text{H}_7\text{O}_2\text{N}$ . MW, 113. B.p. 215°.  $D^{20}_D$  1.0792.  $n^{20}_D$  1.42427.

*Et ester*: succinic ethyl ester-nitrile.  $\text{C}_6\text{H}_9\text{O}_2\text{N}$ . MW, 127. B.p. 220°/754 mm.  $D^{20}$  1.0353.

*Amide*: succinic amide-nitrile.  $\text{C}_4\text{H}_6\text{ON}_2$ . MW, 98. Leaflets. M.p. 97° (sealed tube).

Dakin, *Biochem. J.*, 1917, 11, 79.

Merck, D.R.P. 597,305, (*Chem. Abstracts*, 1934, 28, 5078).

**3-Cyanopropyl Alcohol.**

*See under 3-Hydroxybutyric Acid.*

**2-Cyanopyridine** (*Picolinic nitrile*)

$\text{C}_6\text{H}_4\text{N}_2$  MW, 104

Needles from  $\text{Et}_2\text{O}$ . M.p. 26°. B.p. 212-15°. Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ .

*B, HAuCl*<sub>4</sub>: yellow needles. M.p. 190°.

Meyer, *Monatsh*, 1902, 23, 437, 897.

**3-Cyanopyridine** (*Nicotinic nitrile*).

Cryst from ligroin. M.p. 50°. B.p. 240-5° (201°).

*Benzenesulphonate*: m.p. 132°.

*B, HAuCl*<sub>4</sub>: yellow needles. M.p. 196-8°.

Räth, *Ann.*, 1931, 486, 102.

Laforge, *J. Am. Chem. Soc.*, 1928, 50, 2480.

McElvain, Goese, *J. Am. Chem. Soc.*, 1941, 63, 2282.

Oxley, Partridge, Robson, Short, *J. Chem. Soc.*, 1946, 763.

**4-Cyanopyridine** (*Isonicotinic nitrile*).

Needles. M.p. 83° (79°). Sol.  $\text{H}_2\text{O}$ , EtOH,  $\text{Et}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ . Spar. sol. ligroin. HCl at 110° → isonicotinic acid.

*B, HCl*: needles. M.p. 199° decomp.

*B, HAuCl*<sub>4</sub>: yellow needles. M.p. 208-10°.

Camps, *Chem. Zentr.*, 1902, II, 649.

Meyer, *Monatsh.*, 1902, 23, 897.

**Cyanoquinaldine.**

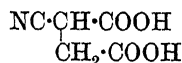
*See under Quinaldine-carboxylic Acid.*

**Cyanoquinoline.**

*See under Cinchoninic Acid, Quinaldine Acid and Quinoline-carboxylic Acid.*

**4-Cyanoresorcinol.**

*See under β-Resorcylic Acid.*

**Cyanosuccinic Acid**

$\text{C}_5\text{H}_5\text{O}_4\text{N}$  MW, 143

*Di-Me ester*:  $\text{C}_7\text{H}_9\text{O}_4\text{N}$ . MW, 171. B.p. 196-204°/45 mm. Sol. EtOH, alkalis. Insol.  $\text{H}_2\text{O}$ .

*Di-Et ester*:  $\text{C}_9\text{H}_{13}\text{O}_4\text{N}$ . MW, 199. B.p. 280-90°, 159°/14 mm. Sol. EtOH,  $\text{Et}_2\text{O}$ , alkalis. Insol.  $\text{H}_2\text{O}$ .  $D^{20}_D$  1.1135.

Barthe, *Ann. chim.*, 1892, 27, 239.

**Cyanothioformamide** (*Flaveanic acid*)

$\text{C}_2\text{H}_2\text{N}_2\text{S}$  MW, 86

Yellow needles. M.p. 87-90° decomp. Unstable. Sol.  $\text{H}_2\text{O}$ . Dil. KOH → oxalic acid,  $\text{H}_2\text{S}$ , and  $\text{NH}_3$ .

Anschütz, *Ann.*, 1889, 254, 263.

**Cyanothiophene.**

*See under Thiophenic Acid.*

**Cyanotoluene.**

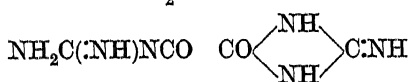
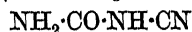
*See Tolunitrile.*

**ω-Cyanotolunitrile.**

*See Cyanobenzyl cyanide.*

**α-Cyanotriphenylmethane.**

*See under Triphenylacetic Acid.*

**Cyanourea** (*Amidodicyanic acid*)

$\text{C}_2\text{H}_3\text{ON}_3$  MW, 85

Tautomer of the three structures given above. Needles or rosettes from  $\text{H}_2\text{O}$ . Decomp. on heating to 100°. Strong acid, forming salts with metals. Dil.  $\text{H}_2\text{SO}_4$  → biuret, guanidine, cyanic acid, and urea.

Hallwachs, *Ann.*, 1870, 153, 293.

Madelung, Kern, *Ann.*, 1922, 427, 25.

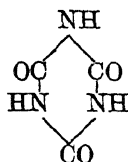
Blair, Smith, *J. Am. Chem. Soc.*, 1934, 56, 907.

**1-Cyanovaleric Acid.**

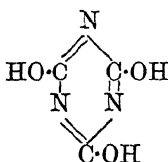
See under Propylmalonic Acid.

**Cyanuramide.**

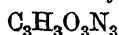
See Melamine.

**Cyanuric Acid**

Isocyanuric acid



Normal cyanuric acid



MW, 129

Cryst. +  $2H_2O$  from  $H_2O$ . Sol. hot EtOH. Mod. sol.  $H_2O$ . Sol. conc.  $H_2SO_4$  without decomp.  $D^{20} 1.768$ . Decomp. to cyanic acid on heating (without melting). Reacts as mono-, di-, or tri-basic acid.

O-*Tri-Me ester (normal)*:  $C_6H_9O_3N_3$ . MW, 171. M.p.  $135^\circ$ . B.p.  $265^\circ$ .

N-*Tri-Me ester (iso)*: prisms. M.p.  $175-6^\circ$ . B.p.  $274^\circ$ . Sol. EtOH.

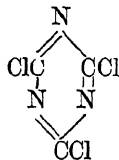
O-*Tri-Et ester (normal)*:  $C_9H_{15}O_3N_3$ . MW, 213. M.p.  $30^\circ$ . B.p.  $275^\circ$ .

N-*Tri-Et ester (iso)*: prisms. M.p.  $95^\circ$ . B.p.  $276^\circ$ . Sol. EtOH. Volatile in steam.

Amides: see Ammelide, Ammeline and Melamine.

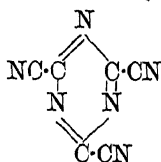
Schaum, *Ber.*, 1923, 56, 2460.Béhal, *Bull. soc. chim.*, 1914, 15, 149.

I.G., D.R.P., 620,906, (*Chem. Abstracts*, 1936, 30, 1808); F.P., 769,920, (*Chem. Abstracts*, 1935, 29, 480).

**Cyanuric chloride**

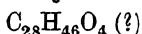
MW, 184.5

Cryst. from  $C_6H_6$ . M.p.  $154^\circ$ . B.p.  $190^\circ/720$  mm. Insol.  $H_2O$ . Cl very reactive. Alkalis  $\rightarrow$  alkali salts of cyanuric acid. NaOR  $\rightarrow$  normal tri-R ester cyanurates. Slowly hyd. by hot  $H_2O$  to cyanuric acid. Hyd. by conc.  $H_2SO_4$  at  $150^\circ$  to HCl,  $NH_3$ , and  $CO_2$ . Reacts with  $NH_3$ , amines, phenols, etc.

Diels, *Ber.*, 1899, 32, 693.Fierz-David, Matter, *J. Soc. Dyers Colourists*, 1937, 53, 424.**Cyanuric cyanide (Hexacyanogen)**

MW, 156

Prisms. M.p.  $119^\circ$ . B.p.  $262^\circ/771$  mm.  $H_2O \rightarrow$  cyanuric acid. Alcohols  $\rightarrow$  cyanuric esters.

Ott, *Ber.*, 1919, 52, 656.**Cyclamen Aldehyde.**See  $\alpha$ -Methyl-*p*-isopropylhydrocinnamaldehyde.**Cyclamiretin**

MW, 446

Triterpenoid sapogenin from tubercles of *Cyclamen europeum*, Linn. Powder from  $C_6H_6-Et_2O$ . M.p.  $231^\circ$ . Slight hæmolytic properties.

Oxime: m.p.  $208^\circ$  decomp.Semicarbazone: m.p.  $275^\circ$ .Diacetyl deriv.: m.p.  $216^\circ$ .Dibenzoyl deriv.: m.p.  $214-6^\circ$ .Ruzicka, Brünger, Egli, Ehmann, Furrer, Hosli, *Helv. Chim. Acta*, 1932, 15, 431.Bures, Bergauer, *Chem. Abstracts*, 1930, 24, 1387.Dafert, Bauer, Bauer, Capesius, Greifinger, *Chem. Abstracts*, 1934, 28, 5176.**Cyclene.**

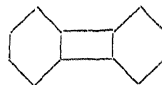
See Tricyclene.

**Cycloartenol**

MW, 426

Constituent of latex of *Euphorbia balsamifera* and fruits of *Artocarpus integrifolia*. Cryst. M.p.  $80-105^\circ$ .

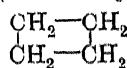
Acetyl deriv.: m.p.  $119-20^\circ$ . Dihydro deriv.: m.p.  $132.5-133^\circ$ .

Chapon, David, *Bull. soc. chim. France*, 1952, 456.Barton, *J. Chem. Soc.*, 1951, 1444.**Cyclobutadibenzene (Cyclopent- $\alpha$ -indene, diphenylene)**

MW, 152

Straw-coloured prisms from EtOH. M.p.  $110^\circ$ . Volatile in steam.  $CrO_3 \rightarrow$  phthalic acid.

Picrate: scarlet needles from EtOH. M.p.  $122^\circ$ .

Lothrop, *J. Am. Chem. Soc.*, 1941, 63, 1187.Baker, *Nature*, 1942, 150, 210; *J. Chem. Soc.*, 1945, 258.Waser, Chia-Si, Lu, *J. Am. Chem. Soc.*, 1944, 66, 2035.**Cyclobutane (Tetramethylene)**

MW, 56



Gas. Condenses to liq. at  $-15^{\circ}$ . Burns with luminous flame. Sol. EtOH, Me<sub>2</sub>CO. Insol. H<sub>2</sub>O.  $D_4^0$  0.703.  $n_D^{20}$  1.3752. H + Ni at  $200^{\circ} \rightarrow$  butane.

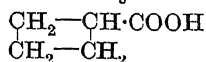
Willstätter, Bruce, *Ber.*, 1907, 40, 3988.

Heissig, *J. Am. Chem. Soc.*, 1941, 63, 1698.

Cason, Way, *J. Org. Chem.*, 1949, 14, 31.

Pajenkamp, *Z. Elektrochem.*, 1948, 52, 104.

## Cyclobutane-carboxylic Acid



C<sub>5</sub>H<sub>8</sub>O<sub>2</sub> MW, 100

B.p.  $195^{\circ}$ ,  $96^{\circ}/15$  mm. Misc. with EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O.  $D_4^{20}$  1.0599.  $n_D^{25}$  1.4403.  $k = 1.82 (1.80) \times 10^{-5}$  at  $25^{\circ}$ . HI  $\rightarrow$  *n*-valeric acid.

*Me ester*: C<sub>6</sub>H<sub>10</sub>O<sub>2</sub>. MW, 114. B.p.  $136-6.5^{\circ}$ .

*Et ester*: C<sub>7</sub>H<sub>12</sub>O<sub>2</sub>. MW, 128. B.p.  $159-62^{\circ}$ .

*Cyclobutyl ester*: C<sub>9</sub>H<sub>14</sub>O<sub>2</sub>. MW, 154. B.p.  $89-0-89-1^{\circ}/16$  mm.  $n_D^{25}$  1.4542.  $D^{20}$  0.995.

*Chloride*: C<sub>5</sub>H<sub>7</sub>OCl. MW, 118.5. B.p.  $142-3^{\circ}$ .

*Amide*: C<sub>5</sub>H<sub>9</sub>ON. MW, 99. M.p.  $152-3^{\circ}$ . Sol. H<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Sublimes.

*Nitrile*: C<sub>5</sub>H<sub>7</sub>N. MW, 81. B.p.  $150^{\circ}$ .

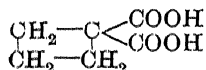
Perkin, Sinclair, *J. Chem. Soc.*, 1892, 61, 40.

Dem'yanov, Shuikina, *Chem. Abstracts*, 1936, 30, 1032.

Heissig, Stodola, *Organic Syntheses*, 1943, XXIII, 16.

Cason, Way, *J. Org. Chem.*, 1949, 14, 31.

## Cyclobutane-1 : 1-dicarboxylic Acid



C<sub>6</sub>H<sub>8</sub>O<sub>4</sub> MW, 144

Prisms from H<sub>2</sub>O or Et<sub>2</sub>O. M.p.  $157^{\circ}$ . Sol. H<sub>2</sub>O, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>.  $k$  (first) =  $7.7 \times 10^{-4}$  at  $25^{\circ}$ ; (second) =  $3.0 \times 10^{-7}$  at  $100^{\circ}$ . Heat at  $210-20^{\circ} \rightarrow$  cyclobutane-carboxylic acid.

*Di-Et ester*: C<sub>10</sub>H<sub>16</sub>O<sub>4</sub>. MW, 200. B.p.  $222-6^{\circ}$ ,  $104^{\circ}/12$  mm.  $D_4^{20}$  1.0456.  $n_D^{25}$  1.4330.

*Mononitrile*: 1-cyanocyclobutane-1-carboxylic acid. C<sub>6</sub>H<sub>7</sub>O<sub>2</sub>N. MW, 125. M.p.  $69-70^{\circ}$ .

Heat at  $160^{\circ} \rightarrow$  cyanocyclobutane. *Et ester*: C<sub>8</sub>H<sub>11</sub>O<sub>2</sub>N. MW, 153. B.p.  $218^{\circ}/762$  mm.

*Diamide*: C<sub>6</sub>H<sub>10</sub>O<sub>2</sub>N<sub>2</sub>. MW, 142. Needles. M.p.  $275-7^{\circ}$ .

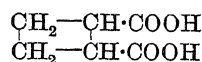
*Anilide*: m.p.  $214-15^{\circ}$ .

*Dihydrazide*: plates from EtOH.Aq. M.p.  $109-10^{\circ}$ .

Carpenter, Perkin, *J. Chem. Soc.*, 1899, 75, 931.

Dem'yanov, Shuikina, *Chem. Abstracts*, 1936, 30, 1032.

Heissig, Stodola, *Organic Syntheses*, 1943, XXIII, 16.

Cyclobutane-1 : 2-dicarboxylic Acid  
(Ethylenesuccinic acid)

C<sub>6</sub>H<sub>8</sub>O<sub>4</sub> MW, 144

*Cis*-.

M.p.  $138^{\circ}$ . Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Spar. sol. C<sub>6</sub>H<sub>6</sub>.  $k = 0.66 \times 10^{-4}$  at  $25^{\circ}$ . Conc. HCl at  $190^{\circ} \rightarrow$  *trans* form.

*Di-Me ester*: C<sub>8</sub>H<sub>12</sub>O<sub>4</sub>. MW, 172. B.p.  $225^{\circ}$ ,  $114-4.5^{\circ}/20$  mm.  $D_4^{17.5}$  1.1191.  $n_D^{17.5}$  1.4430.

*Di-Et ester*: C<sub>10</sub>H<sub>16</sub>O<sub>4</sub>. MW, 200. B.p.  $238-42^{\circ}/720$  mm.

*Diamide*: C<sub>6</sub>H<sub>10</sub>O<sub>2</sub>N<sub>2</sub>. MW, 142. Prisms from H<sub>2</sub>O. M.p. about  $228^{\circ}$ .

*Anhydride*: C<sub>6</sub>H<sub>6</sub>O<sub>3</sub>. MW, 126. M.p.  $75^{\circ}$  ( $71-3^{\circ}$ ). Hyd. by boiling H<sub>2</sub>O.

*Trans*-.

*dl*-.

Needles from C<sub>6</sub>H<sub>6</sub>. M.p.  $131^{\circ}$ . Sol. H<sub>2</sub>O.  $k = 0.28 \times 10^{-4}$  at  $25^{\circ}$ .

*Di-Me ester*: b.p.  $105-7^{\circ}/13$  mm.  $D_4^{20}$  1.1276.  $n_D^{20}$  1.4450.

*d*-.

M.p.  $105^{\circ}$ .  $[\alpha]_D^{20} +123.3^{\circ}$  in H<sub>2</sub>O.

*Di-Et ester*: b.p.  $236^{\circ}$ .  $[\alpha]_D^{20} +77.9^{\circ}$  in Me<sub>2</sub>CO.

*l*-.

M.p.  $105^{\circ}$ .  $[\alpha]_D^{20} -124.3^{\circ}$  in H<sub>2</sub>O.

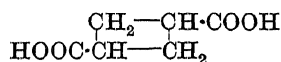
Kuhn, Wassermann, *Helv. Chim. Acta*, 1928, 11, 600.

Goldsworthy, *J. Chem. Soc.*, 1924, 125, 2012.

Bode, *Ber.*, 1934, 67, 332.

See also Lennon, Perkin, *J. Chem. Soc.*, 1928, 1523.

## Cyclobutane-1 : 3-dicarboxylic Acid



C<sub>6</sub>H<sub>8</sub>O<sub>4</sub> MW, 144

*Cis*-.

Prisms from H<sub>2</sub>O. M.p.  $143^{\circ}$  ( $138^{\circ}$ ). B.p.  $252^{\circ}$ . Sol. H<sub>2</sub>O, EtOH. Spar. sol. Et<sub>2</sub>O.

*Di-Me ester*: b.p.  $110-11^{\circ}/20$  mm.

*p*-Bromophenacyl ester: m.p.  $121.5^{\circ}$ .

*Anhydride*: m.p.  $50-1^{\circ}$ . B.p.  $175-7^{\circ}/20$  mm.

*Dihydrazide*: m.p.  $172-4^{\circ}$ .

*Trans*-.

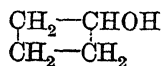
Prisms. M.p.  $171^{\circ}$ . Sol. EtOH, hot H<sub>2</sub>O. Spar. sol. Et<sub>2</sub>O. Sublimes.

Haworth, Perkin, *J. Chem. Soc.*, 1898, 73, 336.

Bottomley, Perkin, *J. Chem. Soc.*, 1900, 77, 294, 308.

Buchman, Reims, Schlatter, *J. Am. Chem. Soc.*, 1942, 64, 2703.

**Cyclobutanol** (*Hydroxycyclobutane, cyclobutyl alcohol*)



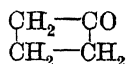
$\text{C}_4\text{H}_8\text{O}$

MW, 72

B.p. 123°/733 mm.  $D_{15}^{20}$  0.9226.  $n_D^{20}$  1.4339.  
*Phenylurethane*: m.p. 110–1°.

Demjanow, *Chem. Zentr.*, 1930, I, 3297.  
Demjanow, Dojarenko, *Ber.*, 1907, 40, 2594.

**Cyclobutanone** (*Ketotetramethylene, ketocyclobutane*)



$\text{C}_4\text{H}_6\text{O}$

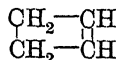
MW, 70

B.p. 99°. Sol.  $\text{H}_2\text{O}$ .  $D_0^0$  0.9548.  $n_D^{16}$  1.4220.  
 $\text{HNO}_3 \rightarrow$  succinic acid.  
2:4-*Dinitrophenylhydrazone*: m.p. 147° (132°).  
*Semicarbazone*: m.p. 204°.

Demjanow, Dojarenko, *Ber.*, 1908, 41, 43.

Lipp, Köster, *Ber.*, 1931, 64, 2823.

**Cyclobutene** (*Cyclobutylene*)



$\text{C}_4\text{H}_6$

MW, 54

B.p. 2° (–3 to +1°). Sol.  $\text{Me}_2\text{CO}$ .  $D_4^0$  0.733.  
Absorbs Cl and Br and reduces permanganate instantaneously.

*N-Bromosuccinimide add. comp.*: b.p. 107–9°/11 mm.

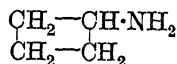
Willstätter, Bruce, *Ber.*, 1908, 41, 1486; 1907, 40, 3985.

Michiels, *Chem. Zentr.*, 1911, I, 67.

**Cyclobutyl Alcohol.**

See Cyclobutanol.

**Cyclobutylamine** (*Aminocyclobutane*)



$\text{C}_4\text{H}_9\text{N}$

MW, 71

B.p. 82°.  $D_4^{20}$  0.8328.  $n_D^{20}$  1.4363. Absorbs  $\text{CO}_2$  from the air.

$\text{B}_2\text{H}_3\text{PO}_4$ : m.p. 177–9°.

$\text{B}_2\text{H}_2\text{PtCl}_6$ : decomp. at 210–5°.

Zelinsky, Gutt, *Ber.*, 1907, 40, 4746.

Dem'yanov, Shuikina, *Chem. Abstracts*, 1936, 30, 1032.

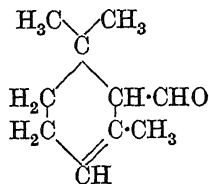
**Cyclobutylbenzene.**

See Phenylcyclobutane.

**Cyclobutylene.**

See Cyclobutene.

**$\alpha$ -Cyclocitral** (2:2:6-*Trimethyl- $\Delta^5$ -tetrahydrobenzaldehyde,  $\Delta^2$ -cyclocitral, 2:6:6-trimethyl-2-cyclohexene-1-aldehyde*)



$\text{C}_{10}\text{H}_{16}\text{O}$

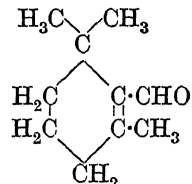
MW, 152

B.p. 75–7°/10 mm.  $n_D^{18}$  1.4744.  
*Di-Et acetal*: b.p. 67–8°/1.3 mm.,  $n_D^{21}$  1.4710.  
*Semicarbazone*: m.p. 206°.  
*p-Nitrophenylhydrazone*: m.p. 125°.

Kuhn, Wendt, *Ber.*, 1936, 69, 1555.

Tiemann, *Ber.*, 1900, 33, 3719.

**$\beta$ -Cyclocitral** (2:2:6-*Trimethyl- $\Delta^6$ -tetrahydrobenzaldehyde,  $\Delta^1$ -cyclocitral, 2:6:6-trimethyl-1-cyclohexene-1-aldehyde*)



$\text{C}_{10}\text{H}_{16}\text{O}$

MW, 152

B.p. 95–100°/15 mm., 90–2°/10 mm.  $D^{16}$  0.959.  $n_D^{15}$  1.49715 ( $n_D^{18}$  1.4955). Condensed with  $\text{Me}_2\text{CO} \rightarrow \beta$ -ionone.

2:4-*Dinitrophenylhydrazone*: m.p. 171–2°.

*Semicarbazone*: m.p. 166–7°.

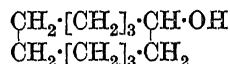
*Thiosemicarbazone*: cryst. from  $\text{MeOH.Aq}$ . M.p. 202° decomp.

Kuhn, Wendt, *Ber.*, 1936, 69, 1555.

Strain, *J. Biol. Chem.*, 1933, 102, 137.

Tiemann, *Ber.*, 1900, 33, 3719.

**Cyclodecanol**



$\text{C}_{10}\text{H}_{20}\text{O}$

MW, 156

M.p. 40–41°. B.p. 125°/12 mm.

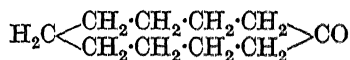
*Acetyl*: b.p. 120–1°/11 mm.  $D_4^{20}$  0.9747.  $n_D^{20}$  1.4682.

*p-Nitrobenzoyl*: m.p. 116°.

*Phenylurethane*: m.p. 83°.

Kobelt, Barman, Prelog, Ruzicka, *Helv. Chim. Acta*, 1949, 32, 256.

**Cyclodecanone** (*Ketocyclodecane*)



$\text{C}_{10}\text{H}_{18}\text{O}$

MW, 154

B.p. 100–2°/12 mm.

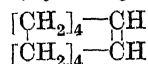
*Oxime*: m.p. 80°.

Semicarbazone : m.p. 200–1°.

Ruzicka, Stoll, Schinz, *Helv. Chim. Acta*, 1926, 9, 252.

Ruzicka et al., *Helv. Chim. Acta*, 1949, 32, 544.

### Cyclodecene (Cyclodecylene)



$\text{C}_{10}\text{H}_{18}$  MW, 138

*Cis*-.

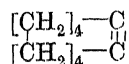
B.p. 194–5°/740 mm.  $D_4^{20}$  0.8770.  $n_D^{20}$  1.4854.  
Strainless.  $\text{O}_3 \rightarrow$  sebacia acid.

*Trans*-.

B.p. 68–70°/10 mm.  $D_4^{20}$  0.8672.  $n_D^{20}$  1.4822.  
Strainless.  $\text{O}_3 \rightarrow$  sebacia acid.

Blomquist, Burge, Sucsy, *J. Am. Chem. Soc.*, 1952, 74, 3636.

### Cyclodecyne

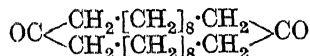


$\text{C}_{10}\text{H}_{16}$  MW, 136

Oil. B.p. 203–4°/740 mm.  $D_4^{20}$  0.8975.  $n_D^{20}$  1.4903.

Blomquist, Burge, Sucsy, *J. Am. Chem. Soc.*, 1952, 74, 3636.

### Cyclodocosane-1 : 12-dione (Diketocyclodocosane)



$\text{C}_{22}\text{H}_{40}\text{O}_2$  MW, 336

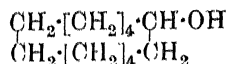
Needles from EtOH. M.p. 55–6°.  $D_4^{20}$  0.9114.  $n_D^{20}$  1.4633.

*Dioxime* : m.p. 151–3°.

*Disemicarbazone* : m.p. 228–30°.

Ruzicka, Stoll, Schinz, *Helv. Chim. Acta*, 1928, 11, 683.

### Cyclododecanol



$\text{C}_{12}\text{H}_{24}\text{O}$  MW, 184

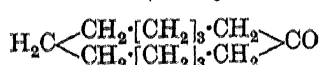
Cryst. M.p. 80°.

*Acetyl* : b.p. 141–2°/11 mm.  $D_4^{20}$  0.9734.  $n_D^{20}$  1.4702.

*Phenylurethane* : m.p. 128–9°.

Kobelt, Barman, Prelog, Ruzicka, *Helv. Chim. Acta*, 1949, 32, 256.

### Cyclododecanone (Ketocyclododecane)



$\text{C}_{12}\text{H}_{22}\text{O}$  MW, 182

M.p. 59°. B.p. 125°/12 mm.

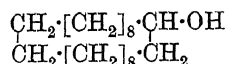
*Oxime* : m.p. 182°.

Semicarbazone : m.p. 226–7°.

Ruzicka, Stoll, Schinz, *Helv. Chim. Acta*, 1926, 9, 256.

Ruzicka et al., *Helv. Chim. Acta*, 1949, 32, 544.

### Cycloeicosadecanol



$\text{C}_{20}\text{H}_{40}\text{O}$  MW, 296

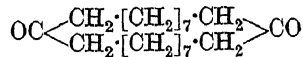
Cryst. M.p. 69°.

*Acetyl* : b.p. 170°/0.5 mm.  $D_4^{20}$  0.9111.  $n_D^{20}$  1.4611.

*Phenylurethane* : m.p. 72°.

Kobelt, Barman, Prelog, Ruzicka, *Helv. Chim. Acta*, 1949, 32, 256.

### Cycloeicosane-1 : 11-dione (Diketocycloeicosane)



$\text{C}_{20}\text{H}_{36}\text{O}_2$  MW, 308

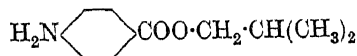
Cryst. from EtOH. M.p. 49–51°.  $D_4^{20}$  0.9232.  $n_D^{20}$  1.4662.

*Dioxime* : m.p. 147–8°.

*Disemicarbazone* : m.p. 228°.

Ruzicka, Stoll, Schinz, *Helv. Chim. Acta*, 1928, 11, 676.

### Cycloform (Isobutyl ester of p-aminobenzoic acid)



$\text{C}_{11}\text{H}_{15}\text{O}_2\text{N}$  MW, 193

Needles from ligroin. M.p. 65°. Sol.  $\text{H}_2\text{O}$  at 20° to 0.022%. Sol. most ord. org. solvents. Local anæsthetic.

Bayer, D.R.P. 218,389, (*Chem. Zentr.*, 1910, I, 782).

Watanabe, *Chem. Abstracts*, 1926, 20, 1612.

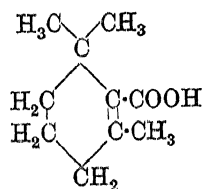
### Cyclogallipharic Acid.

See Hydroginkgolic Acid.

### Cyclogallipharol.

See Hydroginkgol.

### $\Delta^1$ -Cyclogeranic Acid ( $\beta$ -Cyclogeranic acid, 1 : 3 : 3-trimethylcyclohexene-2-carboxylic acid)



$\text{C}_{10}\text{H}_{16}\text{O}_2$  MW, 168

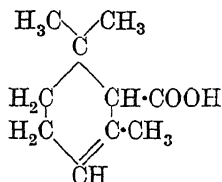
Prisms or plates from ligroin. M.p. 104–6°. Sol. EtOH, Et<sub>2</sub>O, CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>. Spar. sol. H<sub>2</sub>O.

Anilide : m.p. 157–8°.

o-Toluidide : m.p. 149–50°.

Ruzicka, Brugger, *J. prakt. Chem.*, 1941, 158, 125.

$\Delta^2$ -Cyclogeranic Acid ( $\alpha$ -Cyclogeranic acid, 1 : 5 : 5-trimethylcyclohexene-6-carboxylic acid)



$C_{10}H_{16}O_2$  MW, 168

Needles from ligroin. M.p. 106°. B.p. 138°/11 mm. Sol. EtOH, Et<sub>2</sub>O. Spar. sol. H<sub>2</sub>O.

Et ester :  $C_{12}H_{20}O_2$ . MW, 196. B.p. 101–2°/10 mm.

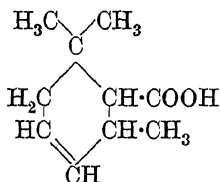
Amide :  $C_{10}H_{17}ON$ . MW, 167. Cryst. from C<sub>6</sub>H<sub>6</sub>-pet. ether. M.p. 120–1°.

Bouveault, *Bull. soc. chim.*, 1910, 7, 352.

Bernhauer, Forster, *J. prakt. Chem.*, 1936, 147, 199.

Tiemann, *Ber.*, 1900, 33, 3712, 3723.

$\Delta^3$ -Cyclogeranic Acid (3 : 5 : 5-Trimethylcyclohexene-4-carboxylic acid)



$C_{10}H_{16}O_2$  MW, 168

Exists in two modifications.

(a). M.p. 75–6°.

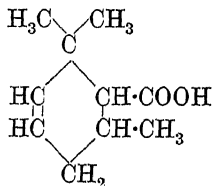
(b). M.p. 83–4°.

Et ester :  $C_{12}H_{20}O_2$ . MW, 196. B.p. 87–8°/8 mm.

Merling, *Ber.*, 1908, 41, 2066.

Merling, Welde, *Ann.*, 1909, 366, 174.

$\Delta^4$ -Cyclogeranic Acid (3 : 3 : 5-Trimethylcyclohexene-4-carboxylic acid)

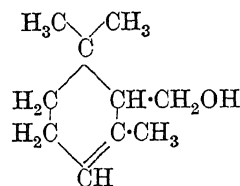


$C_{10}H_{16}O_2$  MW, 168

Prisms from AcOEt or ligroin. M.p. 102°. B.p. 123°/6 mm. Sol. EtOH, Et<sub>2</sub>O, Me<sub>2</sub>CO, C<sub>6</sub>H<sub>6</sub>.

Et ester : b.p. 94°/6 mm.

Merling, D.R.P. 175,587, (*Chem. Zentr.*, 1906, II, 1694).

 $\alpha$ -Cyclogeraniol

$C_{10}H_{18}O$  MW, 154

Viscous oil with pleasant odour. B.p. 213–7°. 97–8°/12 mm., 91–3°/10 mm., 73°/4 mm.  $D^{20}$  0.9382.  $n_D^{20}$  1.4843,  $n_D^{25}$  1.4820.

Acetyl : b.p. 115°/20 mm.  $n_D^{21}$  1.4664. Dibromide : m.p. 112°.

Butyryl : b.p. 106°/6 mm.  $D^{20}$  0.9435.  $n_D^{20}$  1.4660.

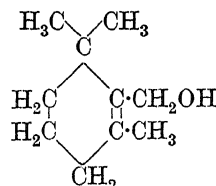
Caproyl : b.p. 126°/5 mm.  $D^{20}$  0.9344.  $n_D^{20}$  1.4662.

Phenylurethane : m.p. 75°.

Bouveault, *Bull. soc. chim.*, 1910, 7, 354.

Kuhn, Wendt, *Ber.*, 1936, 69, 1553, 1555.

Isagulyants, Serebrennikov, *Chem. Abstracts*, 1940, 34, 370.

 $\beta$ -Cyclogeraniol

$C_{10}H_{18}O$  MW, 154

Needles with odour resembling eucalyptus. M.p. 43–4°. B.p. 101–2°/11 mm.  $D_4^{20}$  0.941–0.945 approx.  $n_D^{20}$  1.487–1.492 approx.

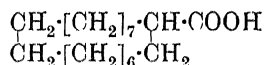
$\beta$ -d-Glucoside : needles. M.p. 74–5°. Tetraacetyl : needles. M.p. 104°.

Kuhn, Hoffer, *Ber.*, 1934, 67, 357.

 $\alpha$ -Cyclogeraniolene.

See 1 : 5 : 5-Trimethylcyclohexene.

## Cycloheptadecane-carboxylic Acid



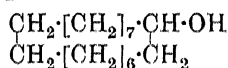
$C_{18}H_{34}O_2$  MW, 282

Oil.

Amide : cryst. from Et<sub>2</sub>O. M.p. 165–7°.

Blomquist, Holley, *J. Am. Chem. Soc.*, 1948, 70, 38.

## Cycloheptadecanol



$C_{17}H_{34}O$  MW, 254

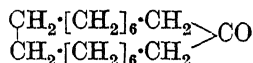
Cryst. M.p. 81°.

Acetyl : b.p. 132°/0.1 mm.  $D_4^{20}$  0.9321.  $n_D^{20}$  1.4708.

*Phenylurethane* : m.p. 79°.

Kobelt, Barman, Prelog, Ruzicka, *Helv. Chim. Acta*, 1949, **32**, 256.

**Cycloheptadecanone** (*Dihydrocivetone, keto-cycloheptadecane*)



C<sub>17</sub>H<sub>32</sub>O

MW, 252

M.p. 63°. B.p. 145°/0.3 mm.

*Semicarbazone* : m.p. 191°.

Ruzicka, Stoll, Schinz, *Helv. Chim. Acta*, 1926, **9**, 262.

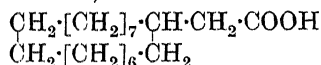
**Cycloheptadecenol.**

*See* Civetol.

**Cycloheptadecenone.**

*See* Civetone.

**Cycloheptadecylacetic Acid** (*Cycloheptadecaneacetic acid*)



C<sub>19</sub>H<sub>36</sub>O<sub>2</sub>

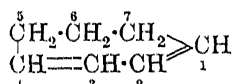
MW, 296

Cryst. from Me<sub>2</sub>CO. M.p. 27-8°.

*Amide* : m.p. 134-134.8°.

Blomquist, Holley, *J. Am. Chem. Soc.*, 1948, **70**, 38.

**Δ<sup>1,3</sup>-Cycloheptadiene** (*Dihydrotropilidene, hydrotropilidene*)



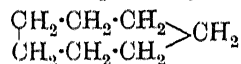
C<sub>7</sub>H<sub>10</sub>

MW, 94

B.p. 121°/724 mm. D<sub>4</sub><sup>20</sup> 0.8929. Absorbs O from the air and resinifies. Absorbs Br and HBr. H + Ni at 180° → cycloheptane.

Willstätter, *Ber.*, 1901, **34**, 131.

**Cycloheptane** (*Heptamethylene, suberane*)



C<sub>7</sub>H<sub>14</sub>

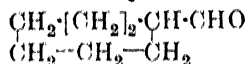
MW, 98

Oil. Freezes to solid, m.p. -12°. B.p. 118-20°. D<sub>4</sub><sup>20</sup> 0.8099. n<sub>D</sub><sup>20</sup> 1.4440. Heat of comb. C<sub>p</sub> 1096.3 Cal. AlCl<sub>3</sub> → methylocyclohexane.

Markownikow, *Ann.*, 1903, **327**, 63.

Willstätter, Kametaka, *Ber.*, 1908, **41**, 1483.

**Cycloheptane-aldehyde**



C<sub>8</sub>H<sub>14</sub>O

MW, 126

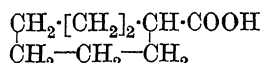
Oil. B.p. 187°/752 mm., 60-2°/8 mm.

*Semicarbazone* : cryst. from C<sub>6</sub>H<sub>6</sub>. M.p. 155-6°.

*Trimer* : cryst. from Me<sub>2</sub>CO or AcOH. M.p. 112-13°.

Reppe, Schichting, Klager, Toepel, *Ann.*, 1948, **560**, 1.

**Cycloheptane-carboxylic Acid**



C<sub>8</sub>H<sub>14</sub>O<sub>2</sub>

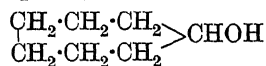
MW, 142

Oil. B.p. 130-1°/8 mm. D<sub>4</sub><sup>20</sup> 1.0423. n<sub>D</sub><sup>20</sup> 1.4753.

*Amide* : C<sub>8</sub>H<sub>15</sub>ON. MW, 141. Leaflets from chlorobenzene. M.p. 195°.

Reppe, Schichting, Klager, Toepel, *Ann.*, 1948, **560**, 1.

**Cycloheptanol** (*Suberol, suberyl alcohol, hydroxycycloheptane*)



C<sub>7</sub>H<sub>14</sub>O

MW, 114

M.p. 2°. B.p. 184-5°, 83-4°/14 mm. Sol. EtOH. Prac. insol. H<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 0.9554 n<sub>D</sub><sup>20</sup> 1.4705. Heat of comb. C<sub>v</sub> 1059.0 Cal., C<sub>p</sub> 1060.7 Cal. P<sub>2</sub>O<sub>5</sub> → cycloheptene.

*Acetyl* : b.p. 76-8°/11 mm. D<sub>4</sub><sup>20</sup> 0.9765. n<sub>D</sub><sup>20</sup> 1.4510.

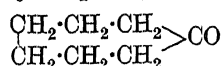
*Allophanate* : m.p. 184°.

Willstätter, *Ann.*, 1901, **317**, 218.

Ruzicka, Plattner, Wild, *Helv. Chim. Acta*, 1945, **28**, 395.

Kobelt, Barman, Prelog, Ruzicka, *Helv. Chim. Acta*, 1949, **32**, 256.

**Cycloheptanone** (*Suberone, ketoheptamethylene, ketocycloheptane*)



C<sub>7</sub>H<sub>12</sub>O

MW, 112

B.p. 179-80°. Prac. insol. H<sub>2</sub>O. D<sub>4</sub><sup>20</sup> 0.9508. n<sub>D</sub><sup>20</sup> 1.4608. Heat of comb. C<sub>v</sub> 1000.4 (1005.1) Cal., C<sub>p</sub> 1006.6 Cal. Na + EtOH → cycloheptanol. HNO<sub>3</sub> → pimelic acid.

*Oxime* : suberoxime. Prisms. M.p. 23°. B.p. 230°, 150-2°/20 mm. Sol. EtOH, Et<sub>2</sub>O. Insol. H<sub>2</sub>O.

*Semicarbazone* : m.p. 163-4°.

*Hydrazone* : b.p. 109-10°/11 mm. D<sub>4</sub><sup>19</sup> 0.9795. n<sub>D</sub><sup>19</sup> 1.5132.

2 : 4-*Dinitrophenylhydrazone* : m.p. 148°.

Mosettig, Burger, *J. Am. Chem. Soc.*, 1930, **52**, 3462.

Roazanow, Belikow, *Chem. Abstracts*, 1930, **24**, 3765.

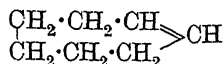
Müller, Bleier, *Monatsh.*, 1930, **56**, 397.

Ruzicka, Kobelt, Hafliger, Prelog, *Helv. Chim. Acta*, 1949, **32**, 544.

Blicke, Doorenóos, Cox, *J. Am. Chem. Soc.*, 1952, **74**, 2924.

**Cycloheptatriene.**

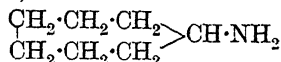
See Tropilidene.

**Cycloheptene** (*Suberene, suberylene*) $\text{C}_7\text{H}_{12}$ 

MW, 96

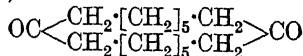
B.p. 115°.  $D_4^{20}$  0.8228.  $n_D^{20}$  1.4552. Heat of comb.  $C_v$  1058.7 Cal.Harries, Tank, *Ber.*, 1908, 41, 1709.**Cycloheptenone-3.**

See Tropilene.

**Cycloheptylamine** (*Aminocycloheptane, suberylamine*) $\text{C}_7\text{H}_{15}\text{N}$ 

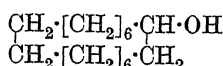
MW, 113

B.p. 169°.

Willstätter, *Ann.*, 1901, 317, 219.**Cyclohexadecane-1 : 9-dione** (*Diketocyclohexadecane*) $\text{C}_{16}\text{H}_{28}\text{O}_2$ 

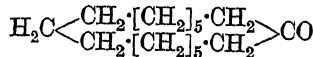
MW, 252

Cryst. from MeOH. M.p. 83-4°.

*Dioxime*: m.p. 185-6°.*Disemicarbazone*: m.p. 240° decomp.Ruzicka, Brugger, Seidel, Schinz, *Helv. Chim. Acta*, 1928, 11, 501.**Cyclohexadecanol** $\text{C}_{16}\text{H}_{32}\text{O}$ 

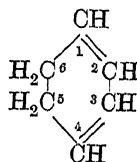
MW, 240

Cryst. M.p. 79-80°.

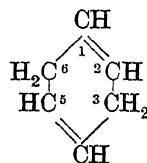
*Acetyl*: b.p. 122°/0.1 mm.  $D_4^{20}$  0.9332.  $n_D^{20}$  1.4694.*Phenylurethane*: m.p. 97.5°.Kobelt, Barman, Prelog, Ruzicka, *Helv. Chim. Acta*, 1949, 32, 256.**Cyclohexadecanone** (*Ketocyclohexadecane*) $\text{C}_{16}\text{H}_{30}\text{O}$ 

MW, 238

M.p. 56°. B.p. 138°/0.5 mm.

*Semicarbazone*: m.p. 180°.Ruzicka, Stoll, Schinz, *Helv. Chim. Acta*, 1926, 9, 261.Schering-Kahlbaum, D.R.P. 620,904, (*Chem. Abstracts*, 1936, 30, 735). $\Delta^{1,3}$ -Cyclohexadiene (1 : 2-Dihydrobenzene) $\text{C}_6\text{H}_8$ 

MW, 80

B.p. 80.5° (83-4°).  $D_4^{20}$  0.8404.  $n_D^{20}$  1.4758 (1.4744).  $\text{KMnO}_4 \rightarrow$  succinic + oxalic acids.*Dibromide*: m.p. 102-4°.*Tetrabromide*: m.p. 184°.*Maleic anhydride add. comp.*: needles from n-heptane. M.p. 145-6°.Senderens, *Compt. rend.*, 1923, 177, 1183.Arbuzov, Zelinskii, Shuikin, *Chem. Abstracts*, 1946, 40, 3409.See also Lely, *Chem. Abstracts*, 1926, 20, 369. $\Delta^{1,4}$ -Cyclohexadiene (1 : 4-Dihydrobenzene) $\text{C}_6\text{H}_8$ 

MW, 80

B.p. 86-7° (81-2°).  $D_4^{20}$  0.8471.  $n_D^{20}$  1.4729 ( $n_D^{19}$  1.46806).*Dibromide*: m.p. 95°.*Tetrabromide*: m.p. 188°.Senderens, *Compt. rend.*, 1923, 177, 1183.See also Lely, *Chem. Abstracts*, 1926, 20, 369.**Cyclohexadiene-carboxylic Acid.**

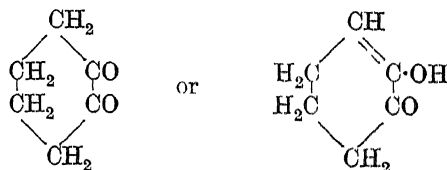
See Dihydrobenzoic Acid.

**Cyclohexadiene-dicarboxylic Acid.**

See Dihydrophthalic Acid, Dihydroisophthalic Acid, and Dihydroterephthalic Acid.

**Cyclohexandiol.**

See Hexahydrocatechol, Hexahydroresorcinol, and Quinitol.

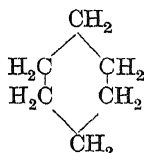
**Cyclohexandione-1 : 2** (*Cyclohexenolone-1 : 6, dihydrocatechol, 1 : 2-diketocyclohexane*) $\text{C}_6\text{H}_8\text{O}_2$ 

MW, 112

Cryst. from petrol. M.p. 38-40°. B.p. 193-5°, 96-7°/25 mm.  $n_D^{20}$  1.4995. Mod. sol.  $\text{H}_2\text{O}$ . Reduces Fehling's on warming. Violet col. with  $\text{FeCl}_3$ .*Dioxime*: nioxime. Needles from  $\text{H}_2\text{O}$ . M.p. 187-8°. Gives intensely red ppt. with Ni salts. Used as analytical reagent for Ni.*Mono-phenylurethane*: m.p. 124°.*Di-phenylhydrazone*: m.p. 152-3°.Wallach, *Ann.*, 1924, 437, 173.Butz, Davis, Gaddis, *J. Org. Chem.*, 1947, 12, 122.Rauh, Smith, Banks, Diehl, *J. Org. Chem.*, 1945, 10, 199.

**Cyclohexandione-1 : 3.**

See Dihydroresorcinol.

**Cyclohexandione-1 : 4.**See Tetrahydro-*p*-benzoquinone.**Cyclohexane** (*Hexamethylene, hexahydrobenzene*) $C_6H_{12}$ 

MW, 84

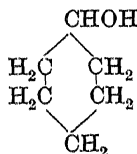
M.p.  $6.5^\circ$ . B.p.  $81^\circ$  ( $80.6^\circ$ ,  $80.738^\circ$ ).  $D_4^{20}$  0.7791.  $n_D^{20}$  1.42900,  $n_D^{30}$  1.42623. Mol. b.p. elevation, 26.9. Mol. f.p. depression, 200. Heat of comb.  $C_p$  945.1 Cal.,  $C_v$  945.4 (936.5) Cal.

Zolinsky, *Ber.*, 1911, 44, 3123.Fischer, Klemm, *Z. physiol. Chem.*, 1930, 147A, 275.Schoorel, Tulleners, Waterman, *Journal of the Institute of Petroleum Technology*, 1932, 18, 179.**Cyclohexane-carboxylic Acid.**

See Hexahydrobenzoic Acid.

**Cyclohexane-dicarboxylic Acid.**

See Hexahydrophthalic Acid, Hexahydroisophthalic Acid, and Hexahydroterephthalic Acid.

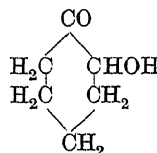
**Cyclohexanol** (*Hexahydrophenol, Hexalin*) $C_6H_{12}O$ 

MW, 100

Needles. M.p.  $24^\circ$  ( $22-5^\circ$ ). B.p.  $161^\circ$ . Misc. all proportions with  $C_6H_6$ ,  $CS_2$ , turpentine. Sol. EtOH, Et<sub>2</sub>O. Mod. sol. H<sub>2</sub>O. Hygroscopic.  $D_4^{20}$  0.9624.  $n_D^{20}$  1.4650. Heat of comb.  $C_p$  898.8 Cal.,  $C_v$  897.3 Cal.  $CrO_3 \rightarrow$  cyclohexanone.  $HNO_3$  or alk.  $KMnO_4 \rightarrow$  adipic acid.  $P_2O_5$ ,  $AlCl_3$ ,  $ZnCl_2$ , etc.  $\rightarrow$  cyclohexene. Cl or Br  $\rightarrow$  2-chloro or bromocyclohexane. Used as a camphor substitute in celluloid, and as a solvent for soaps, waxes, gums, resins, rubber, etc.

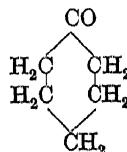
*Formyl*: b.p.  $162.5^\circ$ .  $D_4^0$  1.010.*Acetyl*: b.p.  $175^\circ$ .  $D_4^{20}$  0.9688.  $n_D^{20}$  1.4510.*p*-Nitrobenzoyl: m.p.  $52^\circ$ .3 : 5-Dinitrobenzoyl: m.p.  $109-11^\circ$ .3 : 5-Dinitro-*p*-toluyl: m.p.  $121^\circ$ .*p*-Toluenesulphonyl: m.p.  $45-6^\circ$ .*Me ether*: hexahydroanisole.  $C_7H_{14}O$ . MW, 114. B.p.  $135-6^\circ$ . Sol. EtOH, Et<sub>2</sub>O.  $D_4^0$  0.902.*Et ether*: hexahydrophenetole.  $C_8H_{16}O$ .MW, 128. B.p.  $149-50^\circ$ . Sol. EtOH, Et<sub>2</sub>O.  $D_4^0$  0.891.Sabatier, Senderens, *Compt. rend.*, 1903, 137, 1025.Brunel, *Ann. chim.*, 1905, 6, 207.Demjanow, *Chem. Zentr.*, 1930, I, 3297.Bataafsche Petroleum Maatschappij, F.P. 700,067, (*Chem. Abstracts*, 1931, 25, 3358).Lund, *Ber.*, 1937, 70, 1520.Bag, Egupov, Volokitin, *Org. Chem. Ind. U.S.S.R.*, 1936, 2, 141.Kobelt, Barman, Prelog, Ruzicka, *Helv. Chim. Acta*, 1949, 32, 256.**Cyclohexanol-carboxylic Acid.**

See Hexahydroisosalicylic Acid and Hydroxyhexahydrobenzoic Acid.

**2-Cyclohexanolone-1** (*2-Hydroxycyclohexanone, adipoin*) $C_6H_{10}O_2$ 

MW, 114

Cryst. from EtOH. M.p.  $113^\circ$  ( $92^\circ$ ). Sol. hot EtOH. Insol. Et<sub>2</sub>O,  $C_6H_6$ , pet. ether. Volatile in steam.  $KMnO_4 \rightarrow$  adipic acid.

*Acetyl*: b.p.  $109-15^\circ/12$  mm.Bouveault, Chereau, *Compt. rend.*, 1906, 142, 1086.**4-Cyclohexanolone-1** (*4-Hydroxycyclohexanone*).B.p.  $83-5^\circ/0.6$  mm.*Acetyl*: b.p.  $112-14^\circ/11$  mm.*Benzoyl*: m.p.  $63-4^\circ$ . B.p.  $142^\circ/0.02$  mm  
2 : 4-Dinitrophenylhydrazone: yellow needles from EtOH-AcOEt. M.p.  $161^\circ$ .*Semicarbazone*: m.p.  $182^\circ$ .2 : 4-Dinitrophenylhydrazone: cryst. from EtOH. M.p.  $176^\circ$ .Aldersley, Burkhardt, Gillam, Hindley, *J. Chem. Soc.*, 1940, 13.Dimroth, Schmeil, Daake, *Ber.*, 1942, 75, 321.**Cyclohexanone** (*Ketohexamethylene, keto-cyclohexane, pimelinketone*) $C_6H_{10}O$ 

MW, 98

F.p.  $-45^\circ$ . B.p.  $155^\circ$ ,  $47^\circ/15$  mm. Mod. sol.  $H_2O$ .  $D_4^{20}$  0.9478.  $n_D^{20}$  1.4507.  $HNO_3 \rightarrow$  adipic acid.

*Oxime*: prisms. M.p.  $89-90^\circ$ . B.p.  $206-10^\circ$ . Sol.  $H_2O$ , EtOH, Et<sub>2</sub>O.

*Semicarbazone*: m.p.  $166-7^\circ$ .

2:4-*Dinitrophenylhydrazone*: m.p.  $160^\circ$ .

*Cyanhydrin*: see under 1-Hydroxyhexahydrobenzoic Acid.

Demjanow, *Chem. Zentr.*, 1930, I, 3297.

Holleman, van der Laan, *Rec. trav. chim.*, 1905, 24, 20.

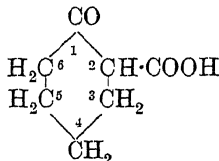
Baeyer, *Ber.*, 1893, 26, 231.

Bousquet, *Organic Syntheses*, 1931, XI, 54.

du Pont, U.S.P. 2,015,751, (*Chem. Abstracts*, 1935, 29, 8002).

Schering-Kahlbaum, U.S.P. 1,877,203, (*Chem. Abstracts*, 1933, 27, 101).

**Cyclohexanone-2-carboxylic Acid** (2-*Ketohexahydrobenzoic acid*)



$C_7H_{10}O_3$  MW, 142

Needles from Et<sub>2</sub>O. Decomp. at  $81-2^\circ \rightarrow$  cyclohexanone. Sol.  $H_2O$ , EtOH,  $C_6H_6$ , pet. ether. Decomp. slowly at ord. temp. Alc. sol. +  $FeCl_3 \rightarrow$  blue col.

*Et ester*:  $C_9H_{14}O_3$ . MW, 170. B.p.  $159-60^\circ/100$  mm.,  $107-8^\circ/12$  mm.  $D_4^{17.5}$  1.0741.  $n_D^{17.5}$  1.4750.

Kötz, Grethe, *J. prakt. Chem.*, 1909, 80, 505.

Dieckmann, *Ann.*, 1901, 317, 93, 98.

Gardner, Perkin, Watson, *J. Chem. Soc.*, 1910, 97, 1756

Pandya, Nargund, Bokil, *Chem. Abstracts*, 1942, 37, 615.

**Cyclohexanone-3-carboxylic Acid** (3-*Ketohexahydrobenzoic acid*).

Prisms from  $C_6H_6$ . M.p.  $75-6^\circ$  ( $73-5^\circ$ ). B.p.  $205^\circ/30$  mm.,  $195-7^\circ/20$  mm. Sol.  $H_2O$ , EtOH.

*Et ester*: b.p.  $138^\circ/18$  mm

*Oxime*: cryst. from  $H_2O$ . M.p.  $170^\circ$  decomp.

*Semicarbazone*: cryst. powder from EtOH. M.p.  $183-4^\circ$ .

*Phenylhydrazone*: yellow cryst. powder. M.p.  $125^\circ$ .

Perkin, Tattersall, *J. Chem. Soc.*, 1907, 91, 491.

Goodwin, Perkin, *J. Chem. Soc.*, 1905, 87, 852.

**Cyclohexanone-4-carboxylic Acid** (4-*Ketohexahydrobenzoic acid*).

Needles +  $1H_2O$  from  $H_2O$ . Cryst. from  $C_6H_6$ -pet. ether. M.p.  $67-8^\circ$ . B.p.  $210^\circ/30$  mm. Sol. EtOH, Et<sub>2</sub>O.

*Me ester*:  $C_8H_{12}O_3$ . MW, 156. B.p.  $140^\circ/20$  mm.

*Et ester*: b.p.  $158^\circ/40$  mm.  $n_D^{18.5}$  1.4591.

*Oxime*: cryst. from Et<sub>2</sub>O. M.p. about  $147^\circ$ . Can be resolved, but racemisation rapid.

*Semicarbazone*: cryst. powder. Decomp. about  $200^\circ$ .

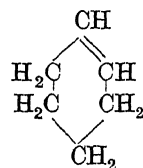
Perkin, *J. Chem. Soc.*, 1904, 85, 424.

Lumsden, *J. Chem. Soc.*, 1905, 87, 88.

**Cyclohexantriol-1 : 3 : 5.**

See Phloroglucitol.

**Cyclohexene** (*Tetrahydrobenzene*)



$C_6H_{10}$  MW, 82

B.p.  $83^\circ$ .  $D_4^{20}$  0.8102.  $n_D^{20}$  1.44507. Heat of comb.  $C_p$  892 Cal.

*Nitroschloride*: m.p.  $153^\circ$  decomp.

I.G., B.P. 317,500, (*Chem. Abstracts*, 1930, 24, 2139).

Waterman, van Westen, *Rec. trav. chim.*, 1929, 48, 637.

Hershberg, Ruhoff, *Organic Syntheses*, Collective Vol. I, 184.

**Cyclohexene-aldehyde.**

See Tetrahydrobenzaldehyde.

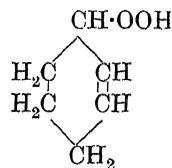
**Cyclohexene-carboxylic Acid.**

See Tetrahydrobenzoic Acid.

**Cyclohexene-dicarboxylic Acid.**

See Tetrahydrophthalic Acid, Tetrahydroisophthalic Acid, and Tetrahydroterephthalic Acid.

**Cyclohexene hydroperoxide** (*Cyclohexene peroxide*)

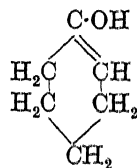


$C_6H_{10}O_2$  MW, 114

Cryst. M.p.  $50^\circ$ . B.p.  $48-51^\circ/1$  mm.  $D_4^{20}$  1.042.

Hock, Gänicke, *Ber.*, 1938, 71, 1430.

**$\Delta^1$ -Cyclohexenol** (1-*Cyclohexenol-2*,  $\Delta^1$ -*tetrahydrophenol*)



$C_6H_{10}O$

MW, 98



Desmotropic with cyclohexanone. Its esters are obtained by prolonged boiling of cyclohexanone with the appropriate acid anhydride.

*Acetyl*: b.p. 180–2°, 74–6°/17 mm.  $D_4^{25}$  1.002.  $n_D^{25}$  1.4585.

*Propionyl*: b.p. 195–7°.

*Butyryl*: b.p. 214–6°.

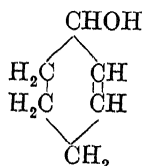
*Carbetoxyyl*: b.p. 108–110°/20 mm.

Mannich, *Ber.*, 1906, 39, 1594.

Mannich, Hâncu, *Ber.*, 1908, 41, 567.

Haller, Bauer, *Compt. rend.*, 1911, 152, 557.

$\Delta^2$ -Cyclohexenol (1-Cyclohexenol-3,  $\Delta^2$ -tetrahydrophenol)



$C_6H_{10}O$  MW, 98

B.p. 164°, 63–5°/12 mm.  $D_4^{15}$  0.9923.

*Me ether*: tetrahydroanisole.  $C_7H_{12}O$ . MW, 112. B.p. 140°.  $D_0$  0.928.

*Et ether*: tetrahydrophenetole.  $C_8H_{14}O$ . MW, 126. B.p. 154.5°.

*Acetyl*: b.p. 68–71°/12 mm.

*Phenylurethane*: m.p. 107°.

$\alpha$ -Naphthylurethane: m.p. 156°.

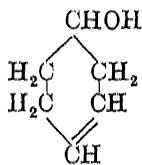
Willstätter, Sonnenfeld, *Ber.*, 1913, 46, 2957.

Crieger, *Ann.*, 1930, 481, 263.

Schering-Kahlbaum, D.R.P. 550,704 (*Chem. Abstracts*, 1932, 26, 4824).

Bedos, Ruyer, *Compt. rend.*, 1937, 204, 1350.

$\Delta^3$ -Cyclohexenol (1-Cyclohexenol-4,  $\Delta^3$ -tetrahydrophenol)



$C_6H_{10}O$  MW, 98

B.p. 164–5°, 119–121°/14 mm. Mod. sol.  $H_2O$ .  $D_4^{25}$  0.9845.  $n_D^{22}$  1.4851.

*Acetyl*: b.p. 35°/0.4 mm.

*Benzoyl*: oil. B.p. 149–50°/12 mm.  $D_4^{20}$  1.083.  $n_D^{20}$  1.5360.

*Me ether*: b.p. 135.5–136.5°/760 mm.  $D_4^{20}$  0.9009.  $n_D^{20}$  1.4566.

*Phenylurethane*: m.p. 83°.

$\alpha$ -Naphthylurethane: m.p. 127°.

Baeyer, *Ann.*, 1893, 278, 97.

Lindemann, Baumann, *Ann.*, 1930, 477, 78.

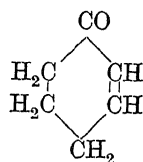
Zelinsky, Titowa, *Ber.*, 1931, 64, 1399.

Gogok, Moir, Purves, *Can. J. Chem.*, 1951, 29, 946.

### Cyclohexenolone.

See Cyclohexandione-1:2 and Dihydroresorcinol.

### $\Delta^2$ -Cyclohexenone



$C_6H_8O$  MW, 96

B.p. 169–71°, 61–3°/14 mm.  $n_D^{18}$  1.4842.

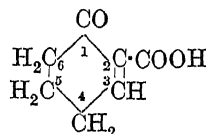
*Oxime*: needles from  $H_2O$ . M.p. 89–90°.

*Semicarbazone*: cryst. from MeOH. M.p. 171–2° decomp. (161°).

2:4-Dinitrophenylhydrazones: orange needles from EtOH.Aq. M.p. 168° (163°).

Bartlett, Woods, *J. Am. Chem. Soc.*, 1940, 62, 2933.

### $\Delta^2$ -Cyclohexenone-2-carboxylic Acid



$C_7H_8O_3$  MW, 140

Cryst. from  $H_2O$ . M.p. 128°. Phenolic odour. Skin irritant. Sublimes. Does not form semicarbazone.

*Et ester*:  $C_9H_{12}O_3$ . MW, 168. B.p. 103–4°/13 mm.

Kötz, Grethe, *J. prakt. Chem.*, 1909, 80, 495.

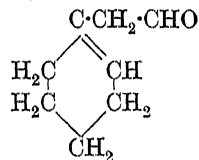
### $\Delta^2$ -Cyclohexenone-6-carboxylic Acid.

Gives violet col. with  $FeCl_3$ . Heat. with  $H_2SO_4 \rightarrow \Delta^2$ -cyclohexenone.

*Et ester*: b.p. 115–17°/15 mm.

Kötz, Grethe, *J. prakt. Chem.*, 1909, 80, 506.

### $\Delta^1$ -Cyclohexenylacetaldehyde (Tetrahydrophenylacetaldehyde)



$C_8H_{12}O$  MW, 124

B.p. 58–62°/16 mm.

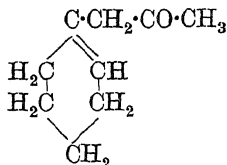
*Semicarbazone*: plates from MeOH. M.p. 186° (177°).

Dimroth, *Ber.*, 1938, 71, 1342.

Aldersley, Burkhardt, *J. Chem. Soc.*, 1938, 545; 1940, 14.

Mazurewitsch, *J. Russ. Phys. Chem. Soc.*, 1911, 43, 973.

**Cyclohexenylacetone** (1-Acetonycyclohexene, tetrahydrophenylacetone, methyl tetrahydrobenzyl ketone)



$\text{C}_9\text{H}_{14}\text{O}$  MW, 138

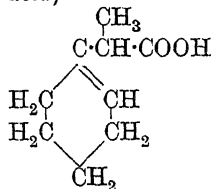
B.p. 203–4°, 89–90°/24 mm.  $D_4^{20}$  0.93711.  $n_D^{20}$  1.47251.

Semicarbazone: two forms. (i) M.p. 145°. (ii) M.p. 136–7°.

Birch, Kon, Norris, *J. Chem. Soc.*, 1923, 123, 1361.

Wallach, *Ann.*, 1912, 394, 376.

$\alpha$ - $\Delta^1$ -Cyclohexenylpropionic Acid ( $\alpha$ -Methylcyclohexenylacetic acid, 1-tetrahydrophenylpropionic acid)



$\text{C}_9\text{H}_{14}\text{O}_2$  MW, 154

Cryst. from pentane. M.p. 38°. B.p. 152.7°/22 mm., 120–4°/1 mm.  $D_4^{20}$  1.0332.  $n_D^{20}$  1.48405.

Me ester:  $\text{C}_{10}\text{H}_{16}\text{O}_2$ . MW, 168. B.p. 108–8.5°/18 mm.  $D_4^{19.2}$  0.9857.  $n_D^{19.3}$  1.4665.

Et ester:  $\text{C}_{11}\text{H}_{18}\text{O}_2$ . MW, 182. B.p. 104°/13 mm.  $D_4^{20}$  0.9618.  $n_D^{20}$  1.4613.

Nitrile:  $\text{C}_9\text{H}_{13}\text{N}$ . MW, 135. B.p. 113°/13 mm.  $D_4^{16}$  0.9382.  $n_D^{15}$  1.4761.

Anilide:  $\text{C}_{15}\text{H}_{19}\text{ON}$ . MW, 229. Needles from MeOH. M.p. 123–4°.

p-Toluidide:  $\text{C}_{16}\text{H}_{21}\text{ON}$ . MW, 243. Needles from AcOEt–pet. ether. M.p. 108°.

Kon, Thakur, *J. Chem. Soc.*, 1930, 2221.

Kon, Linstead, MacLennan, *J. Chem. Soc.*, 1932, 2460.

#### Cyclohexylacetic Acid.

See Hexahydrophenylacetic Acid.

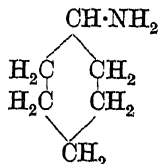
#### 2-Cyclohexyl- $\alpha$ -alanine.

See Hexahydrophenyl- $\alpha$ -alanine.

#### Cyclohexyl Aldehyde.

See Hexahydrobenzaldehyde.

**Cyclohexylamine** (Aminocyclohexane, hexahydroaniline)



$\text{C}_6\text{H}_{13}\text{N}$  MW, 99

B.p. 134°.  $D_4^{20}$  0.8191.  $n_D^{20}$  1.43716.

B, HCl: m.p. 206–7°. Sol.  $\text{H}_2\text{O}$ , EtOH.

B, HAcCl<sub>4</sub>, 1H<sub>2</sub>O: m.p. 190–1°.

N-Acetyl: hexahydroacetanilide. M.p. 104°.

N-Benzoyl: hexahydrobenzanilide. M.p. 147°.

Cie. des Produits Chimiques, B.P. 317,079, (*Chem. Abstracts*, 1930, 24, 1866).

Guyot, Fournier, *Bull. soc. chim.*, 1930, 47, 205.

I.G., U.S.P. 1,862,599, (*Chem. Abstracts*, 1932, 26, 4068).

Adkins, Cramer, U.S.P. 2,092,525, (*Chem. Abstracts*, 1937, 31, 7884).

Tseng, Chang, *Sci. reps. Natl. Univ., Peking*, 1936, 1, No. 3, 19.

Lycan, Puntambeker, Mareul, *Organic Syntheses*, 1931, XI, 58.

#### Cyclohexylamine-carboxylic Acid.

See p-Aminohexahydrobenzoic Acid and Hexahydroanthranilic Acid.

#### Cyclohexylaniline.

See Phenylcyclohexylamine.

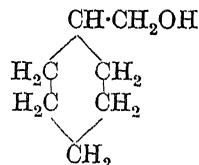
#### Cyclohexylbenzene.

See Phenylcyclohexane.

#### Cyclohexyl bromide.

See Bromocyclohexane.

**Cyclohexylcarbinol** (Hexahydrobenzyl alcohol)



$\text{C}_7\text{H}_{14}\text{O}$  MW, 114

B.p. 182°, 88–9°/23 mm., 91°/18 mm.  $D_4^{20}$  0.9280.  $n_D^{20}$  1.4649.

Acetyl: b.p. 199–201°/740 mm.

Gilman, Catlin, *Organic Syntheses*, Collective Vol. I, 182.

#### Cyclohexyl chloride.

See Chlorocyclohexane.

#### Cyclohexyl 2:4-dihydroxyphenyl Ketone.

See 4-Hexahydrobenzoylresorcinol.

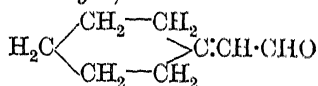
#### Cyclohexyl - 2 : 4 - dihydroxyphenylme - thane.

See 4-Hexahydrobenzylresorcinol.

#### Cyclohexylethylene.

See Vinylcyclohexane.

**Cyclohexylideneacetaldehyde** ( $\Delta^{1,\alpha}$ -Cyclohexane-acetaldehyde)



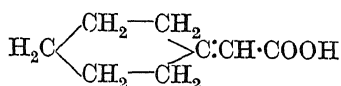
$\text{C}_8\text{H}_{12}\text{O}$  MW, 124

B.p. 86–92°/13.5 mm., 80–85°/16 mm. Absorption maximum at 239  $\mu$  in EtOH.

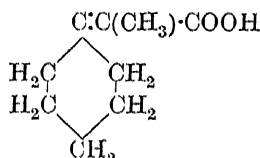
Semicarbazone: cryst. from MeOH. M.p. 210° decomp. (205°).

Dimroth, *Ber.*, 1938, 71, 1342.

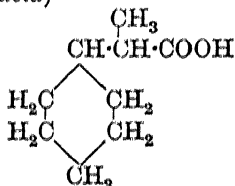
Aldersley, Burkhardt, *J. Chem. Soc.*, 1940, 14.

**Cyclohexylideneacetic Acid** ( $\Delta^{1,\alpha}$ -Cyclohexane-acetic acid) $\text{C}_8\text{H}_{12}\text{O}_2$  MW, 140

Cryst. from EtOH.Aq. M.p. 92°.

*Me ester*:  $\text{C}_9\text{H}_{14}\text{O}_2$ . MW, 154. B.p. 98.4–99.4°/19.5 mm.  $D_4^{20}$  1.0021.  $n_D^{20}$  1.4838.*Et ester*:  $\text{C}_{10}\text{H}_{16}\text{O}_2$ . MW, 168. B.p. 108°/15 mm.  $D_4^{20}$  0.9825.  $n_D^{20}$  1.4808.Beesley, Ingold, Thorpe, *J. Chem. Soc.*, 1915, 107, 1099.Auwers, Ellinger, *Ann.*, 1912, 387, 234.Hope, Perkin, *J. Chem. Soc.*, 1909, 95, 1366.**1-Cyclohexylidenepropionic Acid** ( $\alpha$ -Methylcyclohexylideneacetic acid) $\text{C}_9\text{H}_{14}\text{O}_2$  MW, 154

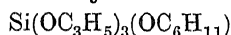
Needles from EtOH.Aq. M.p. 79°. Volatile in steam.

*Et ester*:  $\text{C}_{11}\text{H}_{18}\text{O}_2$ . MW, 182. B.p. 109°/10 mm.  $D_4^{20}$  0.9720.  $n_D^{20}$  1.4773.*Anilide*:  $\text{C}_{15}\text{H}_{19}\text{ON}$ . MW, 229. Needles from MeOH.Aq. M.p. 126°.*p-Toluidide*:  $\text{C}_{16}\text{H}_{21}\text{ON}$ . MW, 243. Needles from MeOH or  $\text{C}_6\text{H}_6$ . M.p. 161°.Kon, Thakur, *J. Chem. Soc.*, 1930, 2220.**Cyclohexyl iodide.***See* Iodocyclohexane.**Cyclohexylmalonic Acid.***See* Hexahydrophenylmalonic Acid.**Cyclohexylmethylamine.***See* Hexahydrobenzylamine.**Cyclohexylnaphthalene.***See* Naphthylcyclohexane.**Cyclohexylnitromethane.***See*  $\alpha$ -Nitromethylcyclohexane.**Cyclohexyl phenyl Ketone.***See* Hexahydrobenzophenone.**Cyclohexylpropionic Acid.***See* Hexahydrophenylpropionic Acid.**1-Cyclohexylpropionic Acid** ( $\alpha$ -Methylcyclohexylacetic acid) $\text{C}_9\text{H}_{16}\text{O}_2$  MW, 156

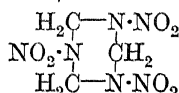
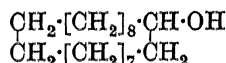
Dict. of Org. Comp.—I.

*d.*B.p. 120–1°/4.7 mm., 105°/3 mm.  $[\alpha]_D^{25} + 7.8^\circ$  in  $\text{Et}_2\text{O}$ .*l.* $[\alpha]_D^{25} - 12.5^\circ$  in  $\text{Et}_2\text{O}$ ,  $-11.2^\circ$  in 75% EtOH.*Chloride*:  $\text{C}_9\text{H}_{15}\text{OCl}$ . MW, 174.5. B.p. 54°/12 mm.  $[\alpha]_D^{25} - 7.6^\circ$  in  $\text{Et}_2\text{O}$ .*Amide*:  $\text{C}_9\text{H}_{17}\text{ON}$ . MW, 155. Cryst. from EtOH. M.p. 138–9°.  $[\alpha]_D^{25} - 9.9^\circ$  in 75% EtOH.*Nitrile*:  $\text{C}_9\text{H}_{15}\text{N}$ . MW, 137. B.p. 80°/3 mm.  $[\alpha]_D^{25} - 13.3^\circ$  in  $\text{Et}_2\text{O}$ ,  $-14.8^\circ$  in EtOH.*dl.*

Cryst. M.p. 62°. Volatile in steam.

*Chloride*: b.p. 91–4°/12 mm.*Amide*: needles from  $\text{C}_6\text{H}_6$  or MeOH.Aq. M.p. 156–7°. Spar. sol. hot  $\text{H}_2\text{O}$ .*Anilide*: cryst. from  $\text{C}_6\text{H}_6$ . M.p. 135–6°.*p-Toluidide*: m.p. 155–6°.Levene, Mikeska, Passoth, *J. Biol. Chem.*, 1930, 88, 27.Thakur, *J. Chem. Soc.*, 1933, 1483.**2-Cyclohexylpropionic Acid.***See* Hexahydrohydrocinnamic Acid.**3-Cyclohexylpropylene.***See* Allylcyclohexane.**Cyclohexyl triallyl orthosilicate** $\text{C}_{15}\text{H}_{26}\text{O}_4\text{Si}$  MW, 298

B.p. 104.5–105.5°/3 mm.

Peppard, Brown, Johnson, *J. Am. Chem. Soc.*, 1946, 68, 70.**Cyclonite** (*Hexogen, cyclotrimethylenetrinitramine, 1 : 3 : 5-trinitrohexahydro-1 : 3 : 5-triazine, trimethylenetrinitroamine, trinitrotrimethylenetriamine, R.D.X.*) $\text{C}_3\text{H}_6\text{O}_6\text{N}_6$  MW, 222Cryst. from  $\text{Me}_2\text{CO}$ . M.p. 203.5° (201.2° decomp.). Sol.  $\text{Me}_2\text{CO}$ , AcOH. Spar. sol. MeOH,  $\text{Et}_2\text{O}$ , AcOEt. Insol.  $\text{H}_2\text{O}$ ,  $\text{CCl}_4$ ,  $\text{CS}_2$ , dil. acids and alkalis. Powerful high explosive.Hale, *J. Am. Chem. Soc.*, 1925, 47, 2754.Sollazzo, *Chem. Zentr.*, 1935, II, 315.Desvergnès, *Chem. Zentr.*, 1933, I, 1448.Wyler, U.S.P. 2,395,773, *Chem. Abstracts*, 1946, 40, 4090.Chute *et al.*, *Can. J. Research*, 1948, 26B, 114.Pardo, *Chem. Zentr.*, 1942, II, 2760, (Review).**Cyclononadecanol** $\text{C}_{19}\text{H}_{38}\text{O}$  MW, 282

41

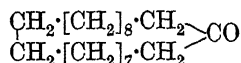
Cryst. M.p. 88–9°.

Acetyl: b.p. 155–7°/0.6 mm.  $D_4^{20}$  0.9167.  $n_D^{20}$  1.4682.

Phenylurethane: m.p. 67°.

Kobelt, Barman, Prelog, Ruzicka, *Helv. Chim. Acta*, 1949, **32**, 256.

### Cyclononadecanone



$C_{19}H_{38}O$  MW, 282

Present in American muskrat oil. Cryst. M.p. 72°. B.p. 160°/0.3 mm., 153°/0.2 mm.

Oxime: cryst. M.p. 58°.

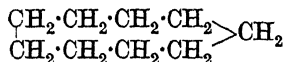
Semicarbazone: m.p. 184°.

Ruzicka, Stoll, Schinz, *Helv. Chim. Acta*, 1928, **11**, 1174.

Stevens, *J. Am. Chem. Soc.*, 1945, **67**, 907.

Ruzicka et al., *Helv. Chim. Acta*, 1949, **32**, 544.

### Cyclononane (Enneamethylene, nonamethylene)



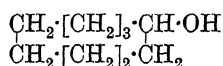
$C_9H_{18}$  MW, 126

M.p. 9.7°. B.p. 170–2°, 69°/14 mm.  $D_4^{15.2}$  0.8534.  $n_D^{16}$  1.4328.

Zelinsky, *Ber.*, 1907, **40**, 3279.

Ruzicka, Plattner, Wild, *Helv. Chim. Acta*, 1945, **28**, 395.

### Cyclononanol



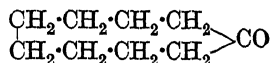
$C_9H_{18}O$  MW, 142

B.p. 115°/7 mm.

Acetyl: b.p. 108–9°/11 mm.  $D_4^{20}$  0.9802.  $n_D^{20}$  1.4644.

Kobelt, Barman, Prelog, Ruzicka, *Helv. Chim. Acta*, 1949, **32**, 256.

### Cyclononanone (Ketocyclononanone)



$C_9H_{16}O$  MW, 140

M.p. 34°. B.p. 145.5°/24 mm., 93–5°/12 mm.  $D_4^{20}$  0.9560.  $n_D^{20}$  1.4729.  $\text{CrO}_3 \rightarrow$  azelaic acid.

Oxime: m.p. 79°.

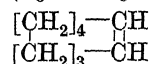
Semicarbazone: m.p. 184–5°.

Ruzicka, Plattner, Wild, *Helv. Chim. Acta*, 1943, **26**, 1631.

Zeigler, Aurnhammer, *Ann.*, 1934, **513**, 43.

Ruzicka et al., *Helv. Chim. Acta*, 1949, **32**, 544.

### Cyclononene (Cyclononylene)



$C_9H_{16}$  MW, 124

*Cis*-.

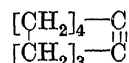
B.p. 167–9°/740 mm.  $D_4^{20}$  0.8671.  $n_D^{20}$  1.4805. Strainless.

*Trans*-.

B.p. 73–4°/30 mm.  $D_4^{20}$  0.8615.  $n_D^{20}$  1.4799. Labile; isomerised thermally to *cis*-form. Phenylazide add. comp.: m.p. 97.8–98.2°.

Blomquist, Liu, Bohrer, *J. Am. Chem. Soc.*, 1952, **74**, 3643.

### Cyclononyne

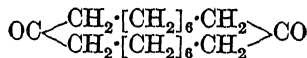


$C_9H_{14}$  MW, 122

B.p. 177–8°/740 mm.  $D_4^{20}$  0.8972.  $n_D^{20}$  1.4890.

Blomquist, Liu, Bohrer, *J. Am. Chem. Soc.*, 1952, **74**, 3643.

### Cyclo-octadecane-1 : 10-dione (Diketocyclo-octadecane)



$C_{18}H_{32}O_2$  MW, 280

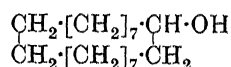
Leaflets from EtOH. M.p. 96–7°.

Dioxime: m.p. 166–8°.

Disemicarbazone: m.p. above 230° decomp.

Ruzicka, Brugger, Seidel, Schinz, *Helv. Chim. Acta*, 1928, **11**, 506.

### Cyclo-octadecanol



$C_{18}H_{36}O$  MW, 268

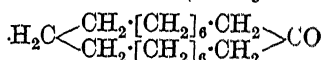
Cryst. M.p. 81°.

Acetyl: b.p. 152–4°/0.5 mm.  $D_4^{20}$  0.9254.  $n_D^{20}$  1.4699.

Phenylurethane: m.p. 88.5°.

Kobelt, Barman, Prelog, Ruzicka, *Helv. Chim. Acta*, 1949, **32**, 256.

### Cyclo-octadecanone (Ketocyclo-octadecane)



$C_{18}H_{34}O$  MW, 266

M.p. 71°. B.p. 158°/0.3 mm.

Semicarbazone: m.p. 184°.

Ruzicka, Stoll, Schinz, *Helv. Chim. Acta*, 1926, **9**, 263.

### 1 : 5-Cyclo-octadiene

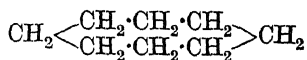


$C_8H_{12}$  MW, 108

B.p. 148-9°.  $D_4^{25}$  0.8818.  $n_D^{25}$  1.4905.

Cope, Bailey, *J. Am. Chem. Soc.*, 1948, 70, 2305.

### Cyclo-octane (Octamethylene)



$\text{C}_8\text{H}_{16}$  MW, 112

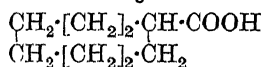
M.p. 14.3°. B.p. 148-9°/749 mm., 62-3°/50 mm.  $D_4^{20}$  0.8349.  $n_D^{20}$  1.4586. Camphoraceous odour.

Zelinsky, Freimann, *Ber.*, 1930, 63, 1485.

Ruzicka, Plattner, Wild, *Helv. Chim. Acta*, 1945, 28, 395.

Reppe *et al.*, *Ann.*, 1948, 560, 1.

### Cyclo-octane-carboxylic Acid

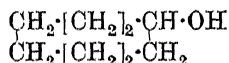


$\text{C}_9\text{H}_{16}\text{O}_2$  MW, 156

Oil. B.p. 135-8°/3.3 mm.

Reppe, Schlichting, Klager, Toepel, *Ann.*, 1948, 560, 1.

### Cyclo-octanol



$\text{C}_8\text{H}_{16}\text{O}$  MW, 128

B.p. 100-101°/15 mm.  $D_4^{20}$  0.9740.  $n_D^{20}$  1.487.  $\text{HNO}_3 \rightarrow$  suberic acid.

Acetyl: b.p. 95-6°/11 mm., 80°/4 mm.  $D_4^{20}$  0.9813.  $n_D^{20}$  1.4593.

p-Nitrobenzoyl: m.p. 64°.

Phenylurethane: m.p. 57° (60°).

Kobelt, Barman, Prelog, Ruzicka, *Helv. Chim. Acta*, 1949, 32, 256.

Reppe, Schlichting, Klager, Toepel, *Ann.*, 1948, 560, 1.

### Cyclo-octanone.

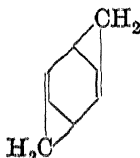
See Azelaone.

### Cyclo-octatetraene



$\text{C}_8\text{H}_8$  MW, 104

F.p. -7.0°. B.p. 142-3°, 42.0-2.5°/17 mm.  $D_4^{20}$  0.9206.  $n_D^{20}$  1.5290. Heat of comb. Cp 1069 Cal. Reacts chemically in 3 forms:



Perbenzoic acid  $\rightarrow$  oxide.  $\text{HgSO}_4$ -MeOH  $\rightarrow$  phenylacetaldehyde dimethyl acetal. Air

at 370° + catalyst  $\rightarrow$  benzoic acid.  $\text{AcOH} + \text{HBr} \rightarrow \text{C}_6\text{H}_5\text{CHBrCH}_3$ .  $\text{SO}_2\text{Cl}_2 \rightarrow$  7:8-dichlorobicyclo[4:2:0]2:4-octadiene.

Maleic anhydride add. comp.: m.p. 167-8°.

Acrylic acid add. comp.: cryst. from ligroin. M.p. 112-13°.

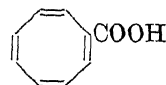
Benzoquinone add. comp.: yellow needles from EtOH. M.p. 141°.

Reppe, Schlichting, Klager, Toepel, *Ann.*, 1948, 560, 1.

Reppe, *Experientia*, 1949, 5, 93, (Review).

Bailey, Cope, *J. Am. Chem. Soc.*, 1948, 70, 2305.

### Cyclo-octatetraene-carboxylic Acid



$\text{C}_9\text{H}_8\text{O}_2$  MW, 148

Yellow needles from  $\text{Et}_2\text{O}$ . M.p. 72-3°.

Me ester: yellow oil. B.p. 75-76.2°/5 mm.  $D_4^{25}$  1.092.  $n_D^{25}$  1.5398.

Quinine salt: cryst. from AcOEt or  $\text{H}_2\text{O}$ . M.p. 200.6-202° decomp.  $[\alpha]_D^{25} -122.5^\circ$  in EtOH.

Cope, Burg, Fenton, *J. Am. Chem. Soc.*, 1952, 74, 173.

### Cyclo-octatriene



$\text{C}_8\text{H}_{10}$  MW, 106

B.p. 145-6°/760 mm., 76°/90 mm.  $D_4^{25}$  0.8971.  $n_D^{25}$  1.5187.

Maleic anhydride add. comp.: m.p. 144-5°.

Reppe, Schlichting, Klager, Toepel, *Ann.*, 1948, 560, 1.

Cope, Bailey, *J. Am. Chem. Soc.*, 1948, 70, 2309.

### Cyclo-octene



$\text{C}_8\text{H}_{14}$  MW, 110

B.p. 34°/12 mm.  $D_4^{20}$  0.8500.  $n_D^{20}$  1.4704.  $\text{H}/\text{Pd}/\text{C} \rightarrow$  cyclo-octane.  $\text{KMnO}_4 \rightarrow$  suberic acid.  $\text{AcOH} \rightarrow$  cyclo-octyl acetate.  $\text{H}_2\text{SO}_4 \rightarrow$  dimer.

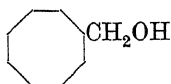
Dimer:  $\text{C}_{16}\text{H}_{28}$ . MW, 220. B.p. 135-40°/2 mm.

Reppe, Schlichting, Klager, Toepel, *Ann.*, 1948, 560, 1.

### Cyclo-octenone.

See Granatal.

**Cyclo-octylcarbinol** (*Hydroxymethylcyclo-octane*)



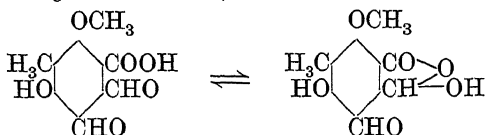
$C_9H_{18}O$  MW, 142

B.p.  $106^\circ/7$  mm. Ox.  $\rightarrow$  suberic acid.

*Phenylurethane*: cryst. from ligroin. M.p.  $49-50^\circ$ . B.p.  $190-200^\circ/0.2$  mm.

Reppe, Schichting, Klager, Toepel, *Ann.*, 1948, 560, 1.

**Cyclopaldic Acid** (*Hydroxy-methoxy-methyl-dialdehydobenzoic acid*)



$C_{11}H_{10}O_6$  MW, 238

Antifungal metabolic product of *Penicillium cyclopium*, Westling. Needles from  $H_2O$  or by sublimation *in vacuo*. M.p.  $224-5^\circ$ . Sol. MeOH, EtOH, AcOEt. Spar. sol.  $Et_2O$ ,  $CHCl_3$ , hot  $C_6H_6$ . Very spar. sol. boiling light petroleum (b.p.  $80-100^\circ$ ). Yellow sol. in alkalis.  $FeCl_3 \rightarrow$  deep ruby-red col. Fluoresces green under UV. light.

*Tetra-acetyl deriv.*: needles from EtOH.Aq. M.p.  $159^\circ$ .

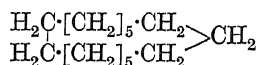
2 : 4-Dinitrophenylhydrazone: needles from Py. M.p.  $231-2^\circ$ .

Birkinshaw, Raistrick, Ross, Stickings, *Biochem. J.*, 1952, 50, 610.

**Cyclopentacycloheptene.**

See Azulene.

**Cyclopentadecane**

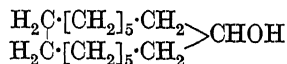


$C_{15}H_{30}$  MW, 210

Needles from MeOH. M.p.  $60-1^\circ$ .  $D_4^{61.5}$  0.8364.  $n_D^{61.5}$  1.4592. Heat of comb.  $C_v$  2356 Cal.

Ruzicka, Brugger, Pfeiffer, Schinz, Stoll, *Helv. Chim. Acta*, 1926, 9, 517.

**Cyclopentadecanol** (*Hydroxycyclopentadecane, cyclopentadecyl alcohol, normuscol*)



$C_{15}H_{30}O$  MW, 226

Occurs in musk of *La. muskrat* (*Ondatra zibethicus rivalicicus*). Cryst. from MeOH. M.p.  $80-1^\circ$ . B.p.  $175-80^\circ/11$  mm.,  $145^\circ/0.3$  mm.  $D_4^{20}$  0.930,  $D_4^{28}$  0.8795.  $n_D^{28}$  1.4555.

*Acetyl*: b.p.  $106-7^\circ/0.15$  mm.  $D_4^{20}$  0.9445.  $n_D^{20}$  1.4725.

*Phenylurethane*: m.p.  $143^\circ$ .

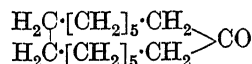
Ruzicka, Schinz, *Helv. Chim. Acta*, 1930, 13, 1172.

Ruzicka, Boekenoggen, *Helv. Chim. Acta*, 1931, 14, 1330.

Stevens, Erickson, *J. Am. Chem. Soc.*, 1942, 64, 144.

Kobelt, Barman, Prelog, Ruzicka, *Helv. Chim. Acta*, 1949, 32, 256

**Cyclopentadecanone** (*Exaltone, ketocyclopentadecane, normuscone*)



$C_{15}H_{28}O$  MW, 224

M.p.  $63^\circ$ . B.p.  $120^\circ/0.3$  mm.

*Oxime*: m.p.  $75-6^\circ$ .  $D_4^{80}$  0.9273.  $n_D^{80}$  1.4830.

*Semicarbazone*: m.p.  $187-8^\circ$ .

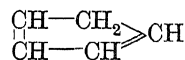
2 : 4-Dinitrophenylhydrazone: m.p.  $105^\circ$ .

Ruzicka, Stoll, Schinz, *Helv. Chim. Acta*, 1926, 9, 260.

Gerhardt, *Seifenseider Zeitung*, 1935, 62, 169.

Stevens, Erickson, *J. Am. Chem. Soc.*, 1942, 64, 144.

**Cyclopentadiene**



$C_5H_6$  MW, 66

B.p.  $41-2^\circ$ . Misc. in all proportions with EtOH,  $Et_2O$ ,  $C_6H_6$ . Insol.  $H_2O$ .  $D_4^{20}$  0.80475.  $n_D^{20}$  1.4446. Polymerises at ord. temp. to dicyclopentadiene. Reduces  $NH_3$ .  $AgNO_3$ . II + Ni  $\rightarrow$  cyclopentane.

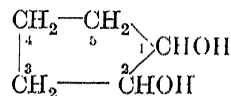
Bruson, Staudinger, *Ind. Eng. Chem.*, 1926, 18, 381.

Stobbe, Dünnhaupt, *Ber.*, 1919, 52, 1436.

Thiele, *Ann.*, 1901, 314, 302.

Wilson, Wells, *Chem. Reviews*, 1944, 34, 1.

**Cyclopentandiol-1 : 2** (1 : 2-Dihydroxycyclopentane)



$C_5H_{10}O_2$  MW, 102

*Cis*-.

M.p.  $30^\circ$ . B.p.  $123.5^\circ/29$  mm.,  $106^\circ/10$  mm.

*Diacyl*: m.p.  $-5^\circ$ . B.p.  $80^\circ/2$  mm.

*Dibenzoyl*: m.p.  $47^\circ$ .

*Trans*-.

*d*-.

$[\alpha]_{546}^{20}$   $-11.5^\circ$  (1.5% sol. in  $C_6H_6$ ).

*Phenylurethane*: m.p.  $213-15^\circ$ .

*dl*-.

M.p.  $55^\circ$ . B.p.  $136^\circ/22$  mm.

*Diacyl*: m.p.  $-4^\circ$ . B.p.  $86^\circ/3.5$  mm.

*Dibenzoyl* : m.p. 63°.

Bösesken, *Rec. trav. chim.*, 1928, 47, 684, 689.

Verkade, *Ann.*, 1930, 477, 279, 289.

Mousseron, Winternitz, Combes, *Compt. rend.*, 1946, 222, 1503.

Owen, Smith, *J. Chem. Soc.*, 1952, 4026.

See also Godchot, Taboury, *Bull. soc. chim.*, 1913, 13, 539.

**Cyclopentandiol-1 : 3** (1 : 3-*Dihydroxycyclopentane*).

*Cis*-.

M.p. 30-32°. B.p. 105°/5 mm., 90°/1 mm.  $D_{16}^{20}$  1.100.  $n_D^{20}$  1.4792.

*Di-p-nitrobenzoyl* : m.p. 186°.

*Diphenylurethane* : m.p. 172°.

*Trans*-.

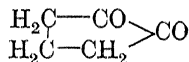
M.p. 40°. B.p. 80-85°/0.1 mm.

*Di-p-nitrobenzoyl* : m.p. 153°.

*Diphenylurethane* : m.p. 162-3°.

Owen, Smith, *J. Chem. Soc.*, 1952, 4026.

**Cyclopentandione-1 : 2** (1 : 2-*Diketocyclopentane*)



$\text{C}_5\text{H}_6\text{O}_2$

MW, 98

Cryst. with feeble quinone odour. M.p. 55-6°. B.p. 105°/20 mm. Spar. volatile in steam. Sol.  $\text{H}_2\text{O}$ , EtOH, Et<sub>2</sub>O. Spar. sol. CS<sub>2</sub>, ligroin. Aq. sol. acid to litmus.  $\text{FeCl}_3$  + ethereal sol. → reddish-violet col. Pptd by  $\text{NH}_3$  from ethereal sol. as  $\text{NH}_4$  salt. Reduces Fehling's and  $\text{NiH}_3\text{AgNO}_3$ .  $\text{KMnO}_4$  → succinic acid.  $\text{H}_2\text{O}_2$  → glutaric acid.

*Oxime* : cryst. from  $\text{H}_2\text{O}$ . M.p. 210° decomp.

*Phenylhydrazone* : m.p. 203°.

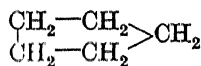
*Osazone* : m.p. 146°.

*Monoanil* : m.p. 112-3°.

Dieckmann, *Ber.*, 1897, 30, 1471.

Hesse, Bucking, *Ann.*, 1949, 563, 31.

**Cyclopentane** (*Pentamethylene*)



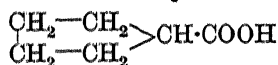
$\text{C}_5\text{H}_{10}$

MW, 70

B.p. 50°.  $D_4^{20}$  0.7510.  $n_D^{20}$  1.4039.

Wislicenus, Hentzschel, *Ann.*, 1893, 275, 327.

**Cyclopentane-carboxylic Acid**



$\text{C}_6\text{H}_{10}\text{O}_2$

MW, 114

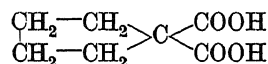
F.p. -9° to -7° (-4 to -3°). B.p. 215-16°, 104°/11 mm.  $D_4^{20}$  1.051.  $n_D^{20}$  1.4534.  $k = 1.24 \times 10^{-5}$  at 25°.

*Chloride* :  $\text{C}_6\text{H}_9\text{OCl}$ . MW, 132.5. B.p. 160-2°. *Amide* :  $\text{C}_6\text{H}_{11}\text{ON}$ . MW, 113. M.p. 179°. *Nitrile* :  $\text{C}_6\text{H}_9\text{N}$ . MW, 95. B.p. 170-1°. *Anhydride* :  $\text{C}_{12}\text{H}_{18}\text{O}_3$ . MW, 210. B.p. 157-8°/18 mm.

Zelinsky, *Ber.*, 1908, 41, 2627.

Rupe, Lotz, *Ann.*, 1903, 327, 183.

**Cyclopentane-1 : 1-dicarboxylic Acid**



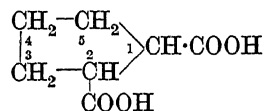
$\text{C}_7\text{H}_{10}\text{O}_4$

MW, 158

Prisms from  $\text{H}_2\text{O}$ . M.p. 184-5° (176-8°) → cyclopentane-carboxylic acid. Sol. EtOH, Et<sub>2</sub>O, hot  $\text{H}_2\text{O}$ . Spar. sol.  $\text{C}_6\text{H}_6$ .

Haworth, Perkin, *J. Chem. Soc.*, 1894, 65, 96.

**Cyclopentane-1 : 2-dicarboxylic Acid**



$\text{C}_7\text{H}_{10}\text{O}_4$

MW, 158

*Cis*-.

Needles from  $\text{H}_2\text{O}$ . M.p. 140°. Sol.  $\text{H}_2\text{O}$ .  $k = 1.58 \times 10^{-4}$ .

*Trans*-.

*d*-.

Cryst. from  $\text{H}_2\text{O}$ . M.p. 181°.  $[\alpha]_D + 87.6^\circ$  in  $\text{H}_2\text{O}$ .

*Di-Et ester* :  $\text{C}_{11}\text{H}_{18}\text{O}_4$ . MW, 214. B.p. 170°/100 mm.  $[\alpha]_D + 70.3^\circ$  in  $\text{Me}_2\text{CO}$ .

*l*-.

Cryst. from  $\text{H}_2\text{O}$ . M.p. 180-1°.  $[\alpha]_D - 85.9^\circ$  in  $\text{H}_2\text{O}$ .

*Di-Et ester* : b.p. 170°/100 mm.  $[\alpha]_D - 69.8^\circ$  in  $\text{Me}_2\text{CO}$ .

*dl*-.

M.p. 162-3°. Sol. EtOH, AcOEt, hot  $\text{H}_2\text{O}$ . Spar. sol. Et<sub>2</sub>O,  $\text{C}_6\text{H}_6$ ,  $\text{CHCl}_3$ , pet. ether.  $k$  (first) =  $1.20$  ( $1.13$ )  $\times 10^{-4}$  at 25°; (second) =  $3.7 \times 10^{-7}$  at 100°. Heat of comb.  $\text{C}_p$  776.0 Cal.,  $\text{C}_v$  775.7 Cal.

*Me ester* :  $\text{C}_8\text{H}_{12}\text{O}_4$ . MW, 172. Needles from EtOH.Aq. M.p. 45°.

*Di-Me ester* :  $\text{C}_9\text{H}_{14}\text{O}_4$ . MW, 186. B.p. 118.5-9°/17 mm.  $D_4^{20}$  1.1130.  $n_D^{20}$  1.4498.

*Di-Et ester* :  $\text{C}_{11}\text{H}_{18}\text{O}_4$ . MW, 214. B.p. 249-52°.

*Chloride* : b.p. 97°/6 mm.

Wassermann, *Helv. Chim. Acta*, 1930, 13, 213, 228.

Goldsworthy, Perkin, *J. Chem. Soc.*, 1914, 105, 2642.

Stoermer, Ladewig, *Ber.*, 1914, 47, 1805.

Fusan, Fleming, Worfield, Coles, *J. Org. Chem.*, 1945, 10, 121.

**Cyclopentane-1 : 3-dicarboxylic Acid.***Cis.*

Prisms from  $\text{H}_2\text{O}$ . M.p.  $121^\circ$ . Sol. EtOH,  $\text{Et}_2\text{O}$ ,  $\text{CHCl}_3$ ,  $\text{Me}_2\text{CO}$ , hot  $\text{H}_2\text{O}$ , hot  $\text{C}_6\text{H}_6$ .  $k = 5.36 \times 10^{-5}$ .

*Me ester*:  $\text{C}_8\text{H}_{12}\text{O}_4$ . MW, 172. B.p.  $156^\circ/4$  mm. *Chloride*:  $\text{C}_8\text{H}_{11}\text{O}_3\text{Cl}$ . MW, 190.5. B.p.  $109^\circ/3$  mm. *p-Toluidide*: m.p.  $118.5^\circ$ .

*Di-Me ester*:  $\text{C}_9\text{H}_{14}\text{O}_4$ . MW, 186. B.p.  $138^\circ/25$  mm.

*Diamide*:  $\text{C}_7\text{H}_{12}\text{O}_2\text{N}_2$ . MW, 156. M.p.  $224-6^\circ$ . *Anhydride*:  $\text{C}_7\text{H}_8\text{O}_3$ . MW, 140. M.p.  $161^\circ$ . B.p.  $178-80^\circ/25$  mm.

*Trans.**d.*M.p.  $93.5^\circ$ .  $[\alpha]_D + 5.86^\circ$  in  $\text{H}_2\text{O}$ .*Et ester*: b.p.  $145^\circ/20$  mm.  $[\alpha]_D + 5.01^\circ$ .*l.*M.p.  $93^\circ$ .  $[\alpha]_D - 5.29^\circ$  in  $\text{H}_2\text{O}$ .*dl.*

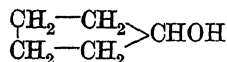
Prisms from  $\text{CCl}_4$ . M.p.  $88^\circ$ . Sol.  $\text{H}_2\text{O}$ .  $k = 5.04 \times 10^{-5}$ .

*Di-Me ester*: b.p.  $118-20^\circ/9$  mm.  $D^{20} 1.137$ .  $n_D^{20} 1.4576$ .

Perkin, Scarborough, *J. Chem. Soc.*, 1921, 119, 1405.

Guha, Ranganathan, *Ber.*, 1936, 69, 1199.  
Wassermann, *Helv. Chim. Acta*, 1930, 13, 213, 228.

**Cyclopentanol** (*Hydroxycyclopentane, cyclopentyl alcohol*)

 $\text{C}_5\text{H}_{10}\text{O}$ 

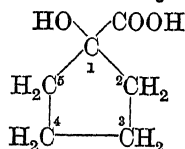
MW, 86

B.p.  $139-40^\circ$ . Sol. EtOH. Spar. sol.  $\text{H}_2\text{O}$ .  $D_4^{20} 0.9488$ .  $n_D^{20} 1.41530$ .  $\text{P}_2\text{O}_5 \rightarrow$  cyclopentene.

*Et ether*:  $\text{C}_7\text{H}_{14}\text{O}$ . MW, 114. B.p.  $126-7^\circ$ .*Acetyl*: b.p.  $52-3^\circ/12$  mm.  $D^{16} 0.9522$ .*Benzoyl*: b.p.  $145^\circ/12$  mm.*Phenylurethane*: m.p.  $132^\circ$ .

Noller, Adams, *J. Am. Chem. Soc.*, 1926, 48, 1084.

Venus-Danilova, *Chem. Abstracts*, 1937, 31, 665.

**Cyclopentanol-1-carboxylic Acid** $\text{C}_6\text{H}_{10}\text{O}_3$ 

MW, 130

Needles from  $\text{H}_2\text{O}$ . M.p.  $103^\circ$ . Sol. EtOH,  $\text{Et}_2\text{O}$ . Insol. pet. ether.

*Me ester*:  $\text{C}_7\text{H}_{12}\text{O}_3$ . MW, 144. B.p.  $84^\circ/16$  mm.  $D_4^{17.4} 1.1043$ .  $n_D^{17} 1.457$ .

*Et ester*:  $\text{C}_8\text{H}_{14}\text{O}_3$ . MW, 158. B.p.  $99^\circ/20$  mm.  $D_4^{16.1} 1.0603$ .  $n_D^{16} 1.452$ .

Auwers, Krollpfeiffer, *Ber.*, 1915, 48, 1394.

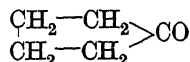
Meerwein, Unkel, *Ann.*, 1910, 376, 156.

Wislicenus, Gärtner, *Ann.*, 1893, 275, 333.

**Cyclopentanol-2-carboxylic Acid.**Viscous oil. Sol.  $\text{H}_2\text{O}$ .*Et ester*: b.p.  $110-1^\circ/12$  mm.

Dieckmann, *Ann.*, 1901, 317, 64.

**Cyclopentanone** (*Ketopentamethylene, ketocyclopentane, adipin ketone, dumasine*)

 $\text{C}_5\text{H}_8\text{O}$ 

MW, 84

B.p.  $130^\circ$ . Spar. sol.  $\text{H}_2\text{O}$ .  $D_4^{20} 0.9480$ .  $n_D^{20} 1.4366$ .  $\text{HNO}_3 \rightarrow$  glutaric acid. Forms bisulphite comp.

*Oxime*: prisms. M.p.  $56.5^\circ$ . B.p.  $196^\circ, 120-1^\circ/45$  mm. Sol. EtOH,  $\text{Et}_2\text{O}$ . Mod. sol.  $\text{H}_2\text{O}$ .

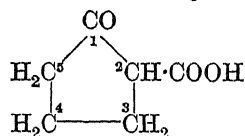
*Semicarbazone*: m.p.  $203^\circ$  ( $212-3^\circ$  rapid heat.).*Phenylsemicarbazone*: m.p.  $164-5^\circ$ .*p-Nitrophenylhydrazone*: m.p.  $154^\circ$ .

*2 : 4-Dinitrophenylhydrazone*: m.p.  $145.5-146.5^\circ$ .

Thorpe, Kon, *Organic Syntheses*, Collective Vol. I, 187.

Vayon, Apchié, *Bull. soc. chim.*, 1928, 43, 668.

Boedtker, *J. pharm. Chim.*, 1932, 15, 225.

**Cyclopentanone-2-carboxylic Acid** $\text{C}_6\text{H}_8\text{O}_3$ 

MW, 128

*Me ester*:  $\text{C}_7\text{H}_{10}\text{O}_3$ . MW, 142. B.p.  $105^\circ/19$  mm.  $D_4^0 1.145$ . *Semicarbazone*: cryst. M.p.  $167^\circ$ .

*Et ester*:  $\text{C}_8\text{H}_{12}\text{O}_3$ . MW, 156. Decomp. on dist. at ord. press. B.p.  $218^\circ/704$  mm.,  $110^\circ/16$  mm.  $D_4^0 1.0781$ .  $n_D^{20} 1.4517$ . *Semicarbazone*: needles. M.p.  $143^\circ$ . *Phenylhydrazone*: cryst. from EtOH. M.p.  $93^\circ$ .

Dobson, Ferns, Perkin, *J. Chem. Soc.*, 1909, 95, 2015.

Bouveault, Locquin, *Bull. soc. chim.*, 1908, 3, 434.

Pinkney, *Organic Syntheses*, Collective Vol. II, 1943, 116.

**Cyclopentanone-3-carboxylic Acid.**

Cryst. from  $\text{H}_2\text{O}$  or  $\text{C}_6\text{H}_6$ . M.p.  $64-5^\circ$ . B.p.  $197^\circ/30$  mm. Sol. most org. solvents.

*Me ester*: b.p.  $130-40^\circ/10$  mm.

*Et ester*: b.p.  $142-3^\circ/40$  mm.,  $109-11^\circ/10$  mm. *Semicarbazone*: m.p.  $153.5^\circ$ .



*Oxime*: two forms. (a) Cryst. from Et<sub>2</sub>O. M.p. 141°. (b) M.p. 177-9°.

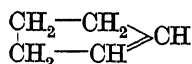
*Semicarbazone*: cryst. from H<sub>2</sub>O. M.p. 197-8° decomp.

Ingold, Thorpe, *J. Chem. Soc.*, 1921, 119, 501.

Hope, *J. Chem. Soc.*, 1912, 101, 905.

Kay, Perkin, *J. Chem. Soc.*, 1906, 89, 1646.

## Cyclopentene



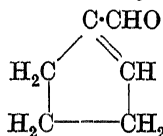
C<sub>5</sub>H<sub>8</sub> MW, 68

M.p. -135.07°. B.p. 45-6° (44°). D<sub>4</sub><sup>18</sup> 0.7743. n<sub>D</sub><sup>18</sup> 1.4218.

Schmidt, Hochschwender, Eichler, U.S.P. 1,221,382, (*Chem. Abstracts*, 1917, 11, 1885).

Meiser, *Ber.*, 1899, 32, 2050.

Rothstein, Rothstein, *Compt. rend.*, 1939, 209, 761.

Δ<sup>1</sup>-Cyclopentene-aldehyde

C<sub>6</sub>H<sub>8</sub>O MW, 96

M.p. -32°. B.p. 146°, 52°/20 mm. D<sub>4</sub><sup>21</sup> 0.970. n<sub>D</sub><sup>17</sup> 1.4892.

*Semicarbazone*: m.p. 208°.

*p-Nitrophenylhydrazone*: m.p. 188°.

Jones *et al.*, *J. Chem. Soc.*, 1950, 3634.

Δ<sup>2</sup>-Cyclopentene-aldehyde.

Oil.

*Semicarbazone*: m.p. 145°.

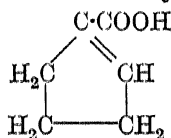
Tiffeneau, Tchoubar, *Compt. rend.*, 1941, 212, 581.

Δ<sup>3</sup>-Cyclopentene-aldehyde.

Oil.

*Semicarbazone*: m.p. 213°.

Tiffeneau, Tchoubar, *Compt. rend.*, 1941, 212, 581.

Δ<sup>1</sup>-Cyclopentene-carboxylic Acid

C<sub>6</sub>H<sub>8</sub>O<sub>2</sub> MW, 112

Leaflets or needles from H<sub>2</sub>O. M.p. 123-4°. B.p. 210°. Sol. EtOH, Et<sub>2</sub>O, hot H<sub>2</sub>O. Volatile in steam. Sublimes. KOH fusion → adipic acid.

*Et ester*: C<sub>8</sub>H<sub>12</sub>O<sub>2</sub>. MW, 140. B.p. 92°/25 mm., 75°/10 mm.

*Nitrile*: C<sub>6</sub>H<sub>7</sub>N. MW, 93. B.p. 81°/30 mm., 69°/15 mm.

*Anilide*: m.p. 126°.

*p-Toluidide*: m.p. 122°.

Cook, Linstead, *J. Chem. Soc.*, 1934, 959.

Bokil, Nargund, *Brit. Chem. Abstracts*, 1940, II, 308.

Urion, *Compt. rend.*, 1930, 190, 1512.

Δ<sup>2</sup>-Cyclopentene-carboxylic Acid.

Cryst. from H<sub>2</sub>O. M.p. 118°. B.p. 65°/15 mm.

*Anilide*: m.p. 120°.

David, Dupont, Paquot, *Bull. soc. chim.*, 1944, 11, 561.

Tiffeneau, Tchoubar, *Compt. rend.*, 1941, 212, 581.

Δ<sup>3</sup>-Cyclopentene-carboxylic Acid (*Aleprolic acid*).

*dl.*- (*r*-Aleprolic acid).

B.p. 97-8°/7 mm. (67°/14 mm.).

*Et ester*: C<sub>8</sub>H<sub>12</sub>O<sub>2</sub>. MW, 140. B.p. 62°/10 mm.

*Anilide*: m.p. 134-5° (140°).

*p-Toluidide*: m.p. 126-7°.

*d.*- (*Aleprolic acid*).

Present in small amount in *Hydnocarpus wightiana* oil. [α]<sub>D</sub><sup>25</sup> +120.5°.

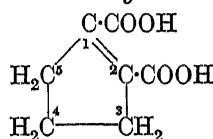
*Et ester*: b.p. 70°/10 mm. [α]<sub>D</sub><sup>25</sup> +102°.

Cole, Cardoso, *J. Am. Chem. Soc.*, 1939, 61, 2350.

Bokil, Nargund, *Brit. Chem. Abstracts*, 1940, II, 308.

David, Dupont, Paquot, *Bull. soc. chim.*, 1944, 11, 561.

Tiffeneau, Tchoubar, *Compt. rend.*, 1941, 212, 581.

Cyclopentene-1 : 2-dicarboxylic Acid (Δ<sup>1</sup>-Cyclopentene-1 : 2-dicarboxylic acid)

C<sub>7</sub>H<sub>8</sub>O<sub>4</sub> MW, 156

Needles from H<sub>2</sub>O. M.p. 178°. Distills without decomp. on rapid heating. Sol. EtOH, AcOH. Mod. sol. Et<sub>2</sub>O. Spar. sol. C<sub>6</sub>H<sub>6</sub>, CS<sub>2</sub>, ligroin. Heat. with alkali → adipic acid.

*Di-Et ester*: C<sub>11</sub>H<sub>16</sub>O<sub>4</sub>. MW, 212. B.p. 140°/16 mm. D<sub>4</sub><sup>20</sup> 1.0805. n<sub>D</sub><sup>20</sup> 1.4652.

Nandi, *J. Indian Chem. Soc.*, 1934, 11, 213.

Willstätter, *Ber.*, 1895, 28, 660.

Haworth, Perkin, *J. Chem. Soc.*, 1894, 65, 983.

Cyclopentene-1 : 3-dicarboxylic Acid (Δ<sup>1</sup>-Cyclopentene-1 : 3-dicarboxylic acid).

M.p. 150.5°.

*Di-Et ester*: b.p. 168°/21 mm.  $D_4^{25}$  1.1121.  $n_D^{20}$  1.4564.

Nandi, *J. Indian Chem. Soc.*, 1934, 11, 277.

**Cyclopentene-2 : 3-dicarboxylic Acid** ( $\Delta^2$ -Cyclopentene-1 : 2-dicarboxylic acid).

M.p. 146°.

Nandi, *J. Indian Chem. Soc.*, 1934, 11, 213.

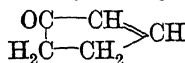
**Cyclopentene-3 : 5-dicarboxylic Acid** ( $\Delta^4$ -Cyclopentene-1 : 3-dicarboxylic acid).

M.p. 160-1°.

*Di-Et ester*: b.p. 185-8°/80 mm.

Guha, Sankaran, *Ber.*, 1937, 70, 2109.

**$\Delta^2$ -Cyclopentenone** (3-Ketocyclopentene)



$\text{C}_5\text{H}_6\text{O}$  MW, 82

B.p. 135-7°, 40°/12 mm. Sol. EtOH, Et<sub>2</sub>O. Mod. sol. H<sub>2</sub>O.  $D^{15}$  0.989.  $n_D^{15}$  1.4629.

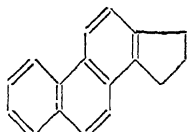
*Oxime*: needles. M.p. 52-3°.

*Semicarbazone*: leaflets. M.p. 214-5°.

Godchot, Taboury, *Bull. soc. chim.*, 1913, 13, 548.

Kötz, Blendermann, Mähner, Rosenbusch, *Ann.*, 1913, 400, 73.

**1 : 2-Cyclopentenophenanthrene**



$\text{C}_{17}\text{H}_{14}$  MW, 218

Cryst. from light petroleum. M.p. 135-6°.

*Picrate*: orange needles from C<sub>6</sub>H<sub>6</sub>. M.p. 133-4°.

1 : 3 : 5-Trinitrobenzene *add. comp.*: yellow needles from MeOH. M.p. 165.5°.

*Trinitrotoluene add. comp.*: greenish-yellow needles from EtOH. M.p. 101°.

Cook, Hewett, *J. Soc. Chem. Ind.*, 1933, 52, 451.

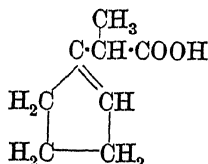
Kon, *J. Chem. Soc.*, 1933, 1081.

Ruzicka, Ehmann, Goldberg, Hösli, *Helv. Chim. Acta*, 1933, 16, 838.

**$\omega$ -Cyclopentenyldodecylamine.**

See Homohydnocarpylamine.

**$\alpha$ - $\Delta^1$ -Cyclopentylpropionic Acid** ( $\alpha$ -Methyl- $\Delta^1$ -cyclopentenylic acid)



$\text{C}_8\text{H}_{12}\text{O}_2$  MW, 140

B.p. 150°/28 mm., 113-15°/1 mm.  $D_4^{17}$  1.050988.  $n_D^{17}$  1.4792.

*Et ester*: C<sub>10</sub>H<sub>16</sub>O<sub>2</sub>. MW, 168. B.p. 108-10°/30 mm., 79°/6 mm.  $D_4^{20}$  0.9611.  $n_D^{20}$  1.4534.

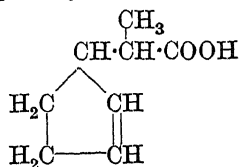
*Chloride*: C<sub>8</sub>H<sub>11</sub>OCl. MW, 158.5. B.p. 86-8°/20 mm.

Bardhan, *J. Chem. Soc.*, 1928, 2604.

Kon, Thakur, *J. Chem. Soc.*, 1930, 2217.

Kon, Linstead, MacLennan, *J. Chem. Soc.*, 1932, 2454.

**$\alpha$ - $\Delta^2$ -Cyclopentenylpropionic Acid** ( $\alpha$ -Methyl- $\Delta^2$ -cyclopentenylacetic acid)



$\text{C}_8\text{H}_{12}\text{O}_2$  MW, 140

B.p. 135-7°/20 mm. Esters used as perfumes.

*Et ester*: C<sub>10</sub>H<sub>16</sub>O<sub>2</sub>. MW, 168. B.p. 68°/3 mm.

*Isobutyl ester*: C<sub>12</sub>H<sub>20</sub>O<sub>2</sub>. MW, 196. B.p. 74-8°/2 mm.

*Benzyl ester*: C<sub>15</sub>H<sub>18</sub>O<sub>2</sub>. MW, 230. B.p. 135-6°/2 mm.

*Chloride*: C<sub>8</sub>H<sub>11</sub>OCl. MW, 158.5. B.p. 83-4°/19 mm.

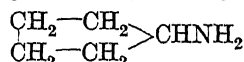
Compagnie de Bethune, U.S.P. 1,965,792, (*Chem. Abstracts*, 1934, 28, 5603).

Horclois, *Chem. Abstracts*, 1935, 29, 141.

**Cyclopent- $\alpha$ -indene.**

See Cyclobutadibenzene.

**Cyclopentylamine** (Aminocyclopentane)



$\text{C}_5\text{H}_{11}\text{N}$  MW, 85

B.p. 107-8°. Misc. with H<sub>2</sub>O in all proportions.

Wislicenus, Hentzschel, *Ann.*, 1893, 275, 325.

**Cyclopentylbenzene.**

See Phenylcyclopentane.

**Cyclopentyl bromide.**

See Bromocyclopentane.

**Cyclopentyl chloride.**

See Chlorocyclopentane.

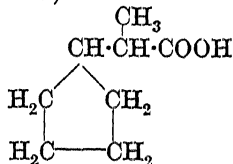
**Cyclopentyl iodide.**

See Iodocyclopentane.

**Cyclopentylnitromethane.**

See  $\alpha$ -Nitromethylcyclopentane.

**1-Cyclopentylpropionic Acid** ( $\alpha$ -Methyl-cyclopentylacetic acid)



$\text{C}_8\text{H}_{14}\text{O}_2$

MW, 142

B.p. 238.5–41°.  $D_4^{20}$  1.0191,  $D_{19}^{19}$  1.0065.

*Me ester*:  $C_9H_{16}O_2$ . MW, 156. B.p. 189.5–191°.  $D_4^{20}$  0.9716,  $D_{19}^{19}$  0.954.

*Amide*:  $C_8H_{15}ON$ . MW, 141. M.p. 136.5–7°.

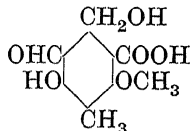
*Chloride*:  $C_8H_{13}OCl$ . MW, 160.5. B.p. 107°/49 mm.  $D_4^{20}$  1.0621,  $D_{21}^{21}$  1.0463.

*Anilide*: m.p. 115–6°.

*p-Nitroanilide*: m.p. 167–8°.

Chichibabin, Koryagin, *Chem. Abstracts*, 1933, 27, 3701.

**Cyclopolic Acid** (*Hydroxy-methoxy-methyl-hydroxymethylaldehydobenzoic acid*)



$C_{11}H_{12}O_6$  MW, 240

Metabolic product of *Penicillium cyclopium*, Westling. Cryst. from AcOEt– $C_6H_6$ . M.p. 147–8° decomp. Sol.  $H_2O$ , MeOH, AcOEt,  $Et_2O$ ,  $Me_2CO$ . Spar. sol.  $C_6H_6$ , light petroleum.  $FeCl_3$  → deep purple col. Reduces  $NH_3 \cdot AgNO_3$ .  $H_2SO_4$ . Aq. → cyclopolide. Ox. → cyclopaldic acid.

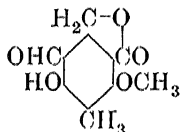
*Me ester*: *Me ether*:  $C_{13}H_{16}O_6$ . MW, 268. Plates from  $H_2O$ . M.p. 87.5–88°.

*Thiosemicarbazone*: cryst. from EtOH. M.p. 180.5–182° decomp.

2 : 4-Dinitrophenylhydrazone: deep yellow prisms. M.p. 190.5–191°.

Birkinshaw, Raistrick, Ross, Stickings, *Biochem. J.*, 1952, 50, 610.

### Cyclopolide



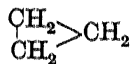
$C_{11}H_{10}O_5$  MW, 222

Needles from EtOH.Aq. M.p. 169°. Spar. sol.  $H_2O$ .  $FeCl_3$  → red col.

*Me ether*:  $C_{12}H_{12}O_5$ . MW, 236. Needles from MeOH.Aq. M.p. 169–70°. *Diacetyl deriv.*: cryst. from MeOH.Aq. M.p. 133.5–134°. 2 : 4-Dinitrophenylhydrazone: needles from Py. De-comp. above 280°.

Birkinshaw, Raistrick, Ross, Stickings, *Biochem. J.*, 1952, 50, 610.

### Cyclopropane (Trimethylene)



$C_3H_6$  MW, 42

Gas at ord. temps. M.p. –126–7°. B.p. –34°. Heat of comb.  $C_p$  499.4 Cal. Stable to

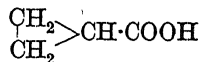
permanganate.  $H + Ni$  at 120° → propane. Conc.  $H_2SO_4$  absorbs the gas readily. By diluting and distilling the  $H_2SO_4$  sol. → propyl alcohol. Used as anæsthetic.

Lott, Christiansen, *Chem. Abstracts*, 1930, 24, 4767.

Hass, McBee, Hinds, Gluesenkamp, *Ind. Eng. Chem.*, 1936, 28, 1178.

Duquenois, *J. pharm. chim.*, 1937, 25, 69 (Review).

**Cyclopropane-carboxylic Acid** (*Ethylene-acetic acid, trimethylenecarboxylic acid*)



$C_4H_6O_2$  MW, 86

M.p. 18–19°. B.p. 182–4° (181°). Mod. sol. hot  $H_2O$ .  $D_4^{20}$  1.0885.  $n_D^{20}$  1.43901.  $k = 1.71 (1.44) \times 10^{-5}$  at 25°.

*Me ester*:  $C_5H_8O_2$ . MW, 100. B.p. 119°/764 mm.  $D_4^{20}$  1.09848.  $n_D^{20}$  1.4144.

*Et ester*:  $C_6H_{10}O_2$ . MW, 114. B.p. 134°.  $D_4^{20}$  0.96078.  $n_D^{20}$  1.41902.

*Isobutyl ester*:  $C_7H_{14}O_2$ . MW, 142. B.p. 173–4°/761 mm.  $D_4^{20}$  0.9972.

*Chloride*:  $C_4H_5OCl$ . MW, 104.5. B.p. 120–2°.  $D_4^{20}$  1.1518.

*Amide*:  $C_4H_7ON$ . MW, 85. M.p. 125° (120°). Sol. EtOH,  $Et_2O$ .

*Nitrile*:  $C_4H_5N$ . MW, 67. Colourless, fuming liq. B.p. 135°.  $D_4^{20}$  0.89461.  $n_D^{20}$  1.42293.

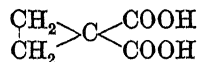
Bruylants, *Chem. Abstracts*, 1929, 23, 4443.

Cloke, Anderson, Lachmann, Smith, *J. Am. Chem. Soc.*, 1931, 53, 2791.

Schlatter, *Organic Syntheses*, 1943, XXIII, 20.

McCloskey, Coleman, *Organic Syntheses*, 1944, XXIV, 36.

**Cyclopropane-1 : 1-dicarboxylic Acid** (*Ethylenemalononic acid, vinaconic acid*)



$C_5H_6O_4$  MW, 130

Prisms or needles from  $CHCl_3$ . Prisms +  $1H_2O$  from  $H_2O$ . M.p. 140°. Sol.  $H_2O$ ,  $Et_2O$ ,  $CHCl_3$ .  $k$  (first) = 2.0 (2.14)  $\times 10^{-2}$  at 25°; (second) = 1.2  $\times 10^{-7}$  at 100°. Heat of comb.  $C_p$  483.2 Cal.,  $C_v$  483.5 Cal. Dist. → cyclopropane-carboxylic acid. Mod. stable to ox. and red. agents.

*Di-Me ester*:  $C_7H_{10}O_4$ . MW, 158. B.p. 198°/764 mm.  $D_4^{20}$  1.1509.

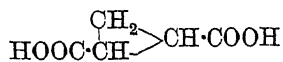
*Di-Et ester*:  $C_9H_{14}O_4$ . MW, 186. B.p. 213°, 130°/70 mm.  $D_4^{20}$  1.06455.  $n_D^{20}$  1.4399.

*Mononitrile*:  $C_5H_5O_2N$ . MW, 111. M.p. 149° (140°). Sol.  $H_2O$ ,  $Et_2O$ ,  $C_6H_6$ . *Et ester*:  $C_7H_9O_2N$ . MW, 139. B.p. 210–1°, 137°/80 mm.

D<sub>4</sub><sup>1</sup> 1.0783. *Amide*: C<sub>5</sub>H<sub>8</sub>ON<sub>2</sub>. MW, 110. Needles. M.p. 160°.

Perkin, *J. Chem. Soc.*, 1885, 47, 807, 817.

## Cyclopropane-1 : 2-dicarboxylic Acid



C<sub>6</sub>H<sub>6</sub>O<sub>4</sub> MW, 130

*Cis*-(*Meso*-).

Prisms from H<sub>2</sub>O or Et<sub>2</sub>O. M.p. 139°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Spar. sol. CHCl<sub>3</sub>, C<sub>6</sub>H<sub>6</sub>, pet. ether.  $k = 4.0 \times 10^{-4}$  at 25°. KOH fusion of K salt  $\rightarrow$  *trans*-form.

*Di-Me ester*: C<sub>7</sub>H<sub>10</sub>O<sub>4</sub>. MW, 158. B.p. 219–20°/760 mm. D<sub>4</sub><sup>15</sup> 1.1584.  $n_D^{14.5}$  1.4472.

*Trans*-.

*d*-.

M.p. 175°.  $[\alpha]_D^{25} + 84.87^\circ$ .

*l*-.

M.p. 175°.  $[\alpha]_D^{25} - 84.40^\circ$ .

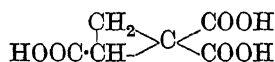
*dl*-.

Needles. M.p. 175°. Sol. H<sub>2</sub>O, EtOH, Et<sub>2</sub>O. Spar. sol. C<sub>6</sub>H<sub>6</sub>.  $k = 2.06 \times 10^{-4}$  at 25°. Heated with Ac<sub>2</sub>O to 200°  $\rightarrow$  *cis*-anhydride.

Wassermann, *Helv. Chim. Acta*, 1930, 13, 213, 229.

Guthzeit, *Dressel, Ann.*, 1890, 256, 197.

## Cyclopropane-1 : 1 : 2-tricarboxylic Acid



C<sub>6</sub>H<sub>6</sub>O<sub>6</sub> MW, 174

*d*-.

Decomp. at 187°.  $[\alpha]_D^{25} + 84.57^\circ$ .

*l*-.

Decomp. at 187°.  $[\alpha]_D^{25} - 84.65^\circ$ .

*dl*-.

Prisms from H<sub>2</sub>O. M.p. 184° decomp.  $k$  (first) =  $9.1 \times 10^{-3}$  at 25°; (second) =  $4.1 \times 10^{-5}$  at 25°.

*Mono-Me ester*: C<sub>7</sub>H<sub>8</sub>O<sub>6</sub>. MW, 188. M.p. 169°.

*Tri-Me ester*: C<sub>9</sub>H<sub>12</sub>O<sub>6</sub>. MW, 216. B.p. 160°/10 mm., 109°/0.8 mm.

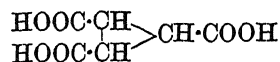
*Tri-Et ester*: C<sub>12</sub>H<sub>18</sub>O<sub>6</sub>. MW, 258. B.p. 276°, 124°/2 mm. D<sub>15</sub><sup>15</sup> 1.127.

*Triamide*: C<sub>6</sub>H<sub>9</sub>O<sub>3</sub>N<sub>3</sub>. MW, 171. M.p. 238° decomp.

Wassermann, *Helv. Chim. Acta*, 1930, 13, 229.

Conrad, Guthzeit, *Ber.*, 1884, 17, 1186.

Buchner, van der Heide, *Ber.*, 1905, 38, 3118.

Cyclopropane-1 : 2 : 3-tricarboxylic Acid (*Aceconitic acid*)

C<sub>6</sub>H<sub>6</sub>O<sub>6</sub> MW, 174

*Trans*-.

Needles from H<sub>2</sub>O. M.p. 220°. Sol. H<sub>2</sub>O, EtOH. Spar. sol. CHCl<sub>3</sub>.

*Tri-Me ester*: needles. M.p. 58°. B.p. 224°/180 mm. Sol. EtOH, Et<sub>2</sub>O.

*Di-Me ester-amide*: C<sub>8</sub>H<sub>11</sub>O<sub>5</sub>N. MW, 201. M.p. 185°.

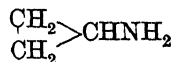
*Tri-Et ester*: C<sub>12</sub>H<sub>18</sub>O<sub>6</sub>. MW, 258. B.p. 159–60°/9 mm.

*Trinitrile*: (*cis*- or *trans*-?). C<sub>6</sub>H<sub>3</sub>N<sub>3</sub>. MW, 117. M.p. 188–9°.

Buchner, Witter, *Ber.*, 1890, 23, 2584.

Darapsky, *Ber.*, 1910, 43, 1121.

Grundmann, *Ann.*, 1943, 555, 77.

Cyclopropylamine (*Aminocyclopropane*, *aminotrimethylene*)

C<sub>3</sub>H<sub>7</sub>N MW, 57

B.p. 50°. Misc. with H<sub>2</sub>O in all proportions. D<sub>4</sub><sup>20</sup> 0.8240.  $n_D^{20}$  1.4210. HNO<sub>2</sub>  $\rightarrow$  allyl alcohol.

*B, HCl*: m.p. 100–1°.

*B, HBr*: needles. M.p. 153.5–155°.

*N-Benzoyl*: m.p. 98.5°.

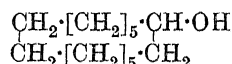
*Di-N-Benzenesulphonyl*: m.p. 120°.

Kishner, *Chem. Zentr.*, 1905, I, 1704.

## Cyclopropylbenzene.

See Phenylcyclopropane.

## Cyclotetradecanol



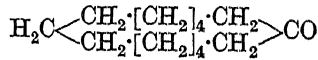
C<sub>14</sub>H<sub>28</sub>O MW, 212

Cryst. M.p. 79–80°.

*Acetyl*: b.p. 113°/0.6 mm. D<sub>4</sub><sup>20</sup> 0.9516.  $n_D^{20}$  1.4721.

*Phenylurethane*: m.p. 132–3°.

Kobelt, Barman, Prelog, Ruzicka, *Helv. Chim. Acta*, 1949, 32, 256.

Cyclotetradecanone (*Ketocyclotetradecane*)

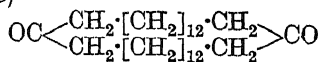
C<sub>14</sub>H<sub>26</sub>O MW, 210

M.p. 52°. B.p. 156°/12 mm.

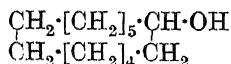
*Semicarbazone*: m.p. 197–8°.

Ruzicka, Stoll, Schinz, *Helv. Chim. Acta*, 1926, 9, 258.

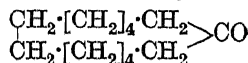
Schering-Kahlbaum, D.R.P. 620,904, (*Chem. Abstracts*, 1936, 30, 735).

**Cyclotriacontane-1 : 16-dione** (*Diketocyclotriacontane*)C<sub>30</sub>H<sub>56</sub>O<sub>2</sub> MW, 448

Cryst. from MeOH. M.p. 74-5°.

*Dioxime* : m.p. 130-1°.*Disemicarbazone* : m.p. 218-9°.Ruzicka, Brugger, Seidel, Schinz, *Helv. Chim. Acta*, 1928, 11, 510.**Cyclotridecanol**C<sub>13</sub>H<sub>26</sub>O MW, 198

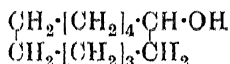
Cryst. M.p. 60-60.5°.

*Acetyl* : b.p. 148-9°/20 mm. D<sub>4</sub><sup>20</sup> 0.9553. n<sub>D</sub><sup>20</sup> 1.4719.*Phenylurethane* : m.p. 84-5°.Kobelt, Barman, Prelog, Ruzicka, *Helv. Chim. Acta*, 1949, 32, 256.**Cyclotridecanone** (*Ketocyclotridecane*)C<sub>13</sub>H<sub>24</sub>O MW, 196

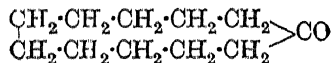
M.p. 32°. B.p. 138°/12 mm.

*Semicarbazone* : m.p. 207-8°.Ruzicka, Stoll, Schinz, *Helv. Chim. Acta*, 1926, 9, 257.**Cyclotrimethylenetrinitramine.**

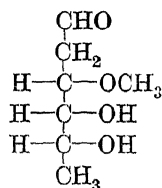
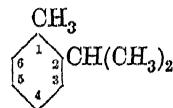
See Cyclonite.

**Cycloundecanol**C<sub>11</sub>H<sub>22</sub>O MW, 170

M.p. 4°. B.p. 128-31°/20 mm.

*Acetyl* : 128°/20 mm. D<sub>4</sub><sup>20</sup> 0.9718. n<sub>D</sub><sup>20</sup> 1.4705.*Phenylurethane* : m.p. 58-9°.Kobelt, Barman, Prelog, Ruzicka, *Helv. Chim. Acta*, 1949, 32, 256.**Cyclo-undecanone** (*Ketocycloundecane*)C<sub>11</sub>H<sub>20</sub>O MW, 168

B.p. 110°/12 mm.

*Semicarbazone* : m.p. 200°.Ruzicka, Stoll, Schinz, *Helv. Chim. Acta*, 1926, 9, 254.**Cymarine**C<sub>30</sub>H<sub>42</sub>O<sub>8</sub> MW, 530Glycoside occurring in *Apocynum androsaemifolium*, Linn., *Apocynum venetum*, Linn., and *Adonis vernalis*. Cryst. + 1H<sub>2</sub>O from EtOH.Aq. or MeOH. Sinters at 138°. M.p. 148° decomp., anhyd. 185-7°. Sol. EtOH,CHCl<sub>3</sub>, AcOEt. Less sol. MeOH, Me<sub>2</sub>CO. Spar. sol. H<sub>2</sub>O, Et<sub>2</sub>O. Insol. pet. ether. [α]<sub>D</sub><sup>20</sup> + 37.8° in CHCl<sub>3</sub>, + 37.5° in EtOH. Hyd. → strophanthidin + cymarose.*Acetyl deriv.* : m.p. 168-75° and again at 202°. [α]<sub>D</sub><sup>20</sup> + 49° in EtOH.Jacobs, *J. Biol. Chem.*, 1930, 88, 519, (*Bibl.*).Jacobs, Hoffmann, *J. Biol. Chem.*, 1926, 67, 609.Searle, *Chem. Abstracts*, 1931, 25, 4247, (*Review & Bibl.*).Reichstein, Rosenmond, *Pharm. Acta Helv.*, 1940, 15, 150.Blome, Reichstein, *Pharm. Acta Helv.*, 1947, 22, 235.von Euw, Reichstein, *Helv. Chim. Acta*, 1948, 31, 883.**Cymarose**C<sub>7</sub>H<sub>14</sub>O<sub>4</sub> MW, 162*d.*From cymarine. Active principle of *Apocynum cannabinum*. Needles from Me<sub>2</sub>CO. Prisms from Et<sub>2</sub>O-pet. ether. M.p. 92-4°. Sol. H<sub>2</sub>O, EtOH. Spar. sol. CHCl<sub>3</sub>. Insol. C<sub>6</sub>H<sub>6</sub>. [α]<sub>D</sub><sup>14</sup> + 55° (0.583% sol. in H<sub>2</sub>O).*Phenylhydrazide* : m.p. 155-6° from MeOH-Et<sub>2</sub>O.Prins, *Helv. Chim. Acta*, 1946, 29, 378.Elderfield, *J. Biol. Chem.*, 1935, 111, 527; *Science*, 1935, 81, 440.Shoppee, Reichstein, *Helv. Chim. Acta*, 1942, 25, 1611.**o-Cymene** (*1-Methyl-2-isopropylbenzene, o-isopropyltoluene*)C<sub>10</sub>H<sub>14</sub> MW, 134B.p. 175°. D<sub>4</sub><sup>20</sup> 0.876. n<sub>D</sub><sup>20</sup> 1.500.Auwers, *Ann.*, 1919, 419, 99.Sprinkmeyer, *Ber.*, 1901, 34, 1951.**m-Cymene** (*1-Methyl-3-isopropylbenzene*).B.p. 176°, 66.5°/18 mm. D<sub>4</sub><sup>20</sup> 0.8606. n<sub>D</sub><sup>20</sup> 1.4920. Dil. HNO<sub>3</sub> → *m*-toluic acid. KMnO<sub>4</sub> → isophthalic acid.Richter, Wolff, *Ber.*, 1930, 63, 1724.Lacourt, *Chem. Abstracts*, 1930, 24, 3999.

**p-Cymene** (1-Methyl-4-isopropylbenzene, ordinary cymene).

M.p.  $-72^{\circ}$ . B.p.  $177^{\circ}$ .  $D_4^{20}$  0.8570.  $n_D^{20}$  1.4904. Rapidly discolours on standing. Heat of comb.  $C_p$  1413.7 Cal.  $CrO_3 \rightarrow$  terephthalic acid. Dil.  $HNO_3 \rightarrow$  p-toluic acid.

Austerweil, *Chimie et Industrie*, 1928, *Suppl. No.*, 568, (Review).

Richter, Wolff, *Ber.*, 1930, **63**, 1723.

Meyer, Bernhauer, *Monatsh.*, 1929, **53**—**54**, 729.

Mückenberger, D.R.P. 597,972, (*Chem. Abstracts*, 1934, **28**, 5476).

Malishev, *J. Am. Chem. Soc.*, 1935, **57**, 883.

Bergström, Cederquist, Trobeck, Swedish P. 85,993-4, (*Chem. Abstracts*, 1936, **30**, 6012).

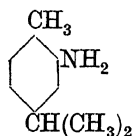
Raymond, *Bull. soc. chim.*, 1934, **1**, 1470.

Plate, Tarasora, *J. Applied Chem., U.S.S.R.*, 1944, **17**, 576.

### Cymene-carboxylic Acid.

See Isopropyltoluic Acid.

**p-Cymidine** (Carvacrylamine, 2-amino-p-cymene, 2-amino-1-methyl-4-isopropylbenzene, 2-methyl-5-isopropylaniline)



$C_{10}H_{15}N$

MW, 149

F.p.  $-16^{\circ}$ . B.p.  $241^{\circ}$ ,  $118^{\circ}/12$  mm. Sol. EtOH, Et<sub>2</sub>O. Prac. insol. H<sub>2</sub>O.  $D^{20}$  0.9942.  $n_D^{19}$  1.543.

B.HCl: m.p.  $207^{\circ}$ .

N-Acetyl: m.p.  $71^{\circ}$ .

N-Diacetyl: m.p.  $66^{\circ}$ .

N-Benzoyl: m.p.  $102^{\circ}$ .

Söderbaum, Widman, *Ber.*, 1888, **21**, 2127.

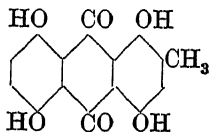
Demonbreun, Kremers, *Chem. Abstracts*, 1923, **17**, 3906.

Allen, Van Allan, *Organic Syntheses*, 1942, **XXII**, 9.

### Cymophenol.

See Carvacrol.

**Cynodontin** (1:4:5:8-Tetrahydroxy-2-methyl-anthraquinone, 1-hydroxyhelminthosporin)



$C_{15}H_{10}O_6$

MW, 286

Pigment of *Helminthosporium cynodontis* Magnoni, *H. euchaenae* Zimmermann, and *H. avenae* Eidam. Brown leaflets with bronze lustre from Py. M.p.  $260-1^{\circ}$ . Alkalis  $\rightarrow$  bluish violet sols.  $H_2SO_4 \rightarrow$  blue sol. with red fluor.

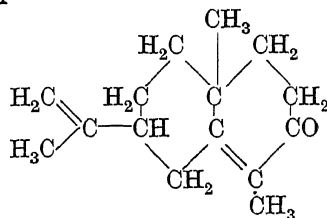
*Tetra-acetyl*: yellow needles from AcOH. M.p.  $224-5^{\circ}$ .

I.C.I., B.P. 420,362: F.P. 770,972, (*Chem. Abstracts*, 1935, **29**, 816).

Raistrick, Robinson, Todd, *Biochem. J.*, 1933, **27**, 1170.

Anslow, Raistrick, *Biochem. J.*, 1940, **34**, 1546.

### α-Cyperone



$C_{15}H_{22}O$

MW, 218

Main constituent of oil from *Cyperus rotundus*. B.p.  $177^{\circ}$ .  $D_{25}^{25}$  0.9946.  $n_D^{25}$  1.5283.  $[\alpha]_{5461}^{25} + 138^{\circ}$ ,  $[\alpha]_{5780}^{25} + 118.6^{\circ}$ . Aq. oxalic acid or KOH-MeOH  $\rightarrow$  β-cyperone.

*Oxime*: m.p.  $150.5^{\circ}$ .

*Semicarbazone*: m.p.  $216^{\circ}$ .

2:4-Dinitrophenylhydrazone: red cryst. with bronze reflex. M.p.  $209-10^{\circ}$ .

*Nitroguanylhudrazone*: m.p.  $203-4^{\circ}$  decomp.

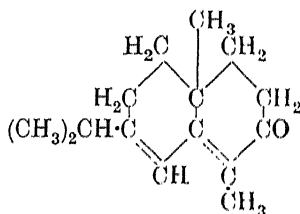
Bradfield, Pritchard, Simonsen, *J. Chem. Soc.*, 1937, 760.

Bradfield, Hedge, Rao, Simonsen, Gillam, *J. Chem. Soc.*, 1936, 667.

Hedge, Rao, *J. Soc. Chem. Ind.*, 1935, **54**, 387T.

Adamson, McQuillin, Robinson, Simonsen, *J. Chem. Soc.*, 1937, 1576.

### β-Cyperone



$C_{15}H_{22}O$

MW, 218

B.p.  $175-6^{\circ}$ .  $D_{25}^{25}$  0.9945.  $n_D^{25}$  1.5414.  $[\alpha]_{5461}^{25} + 239^{\circ}$ .

*Oxime*: m.p.  $138^{\circ}$ .  $[\alpha]_{5461}^{25} + 217^{\circ}$  in EtOH.

*Semicarbazone*: m.p.  $207^{\circ}$  decomp.

2:4-Dinitrophenylhydrazone: red cryst. with metallic reflex. M.p.  $218-9^{\circ}$  decomp.

*Nitroguanylylhydrazone*: m.p. 197°.  $[\alpha]_D^{20} + 220^\circ$  in  $\text{CHCl}_3$ .

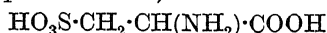
Bradfield, Hedge, Rao, Simonsen, Gillam, *J. Chem. Soc.*, 1936, 667.

Bradfield, Jones, Simonsen, *J. Chem. Soc.*, 1936, 1137.

Adamson, McQuillin, Robinson, Simonsen, *J. Chem. Soc.*, 1937, 1576.

McQuillin, *J. Chem. Soc.*, 1951, 716.

**Cysteic Acid** (1-Amino-2-sulphopropionic acid, 2-sulpho- $\alpha$ -alanine)



$\text{C}_3\text{H}_7\text{O}_5\text{NS}$  MW, 169

Needles from EtOH.Aq., decomp. at 260°. Needles +  $1\text{H}_2\text{O}$  from  $\text{H}_2\text{O}$ , m.p. 289°.  $[\alpha]_D^{24.5} + 9.4^\circ$ . Heat under pressure with  $\text{H}_2\text{O} \rightarrow$  taurine.

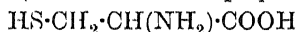
*Di-phenacyl ester*: needles from EtOH.Aq. M.p. 203–4°.

Friedmann, *Beiträge für Chemische Physiologie und Pathologie*, 1902, 3, 1.

Gortner, Hoffmann, *J. Biol. Chem.*, 1927, 72, 433.

Schöberl, D.R.P. 604,016, (*Chem. Abstracts*, 1935, 29, 818); *Z. physiol. Chem.*, 1933, 216, 193.

**Cysteine** (1-Amino-2-mercaptopropionic acid)



$\text{C}_3\text{H}_7\text{O}_2\text{NS}$  MW, 121

*l.*

Cryst. Sol.  $\text{H}_2\text{O}$ , AcOH,  $\text{NH}_3$ .Aq. Oxidises rapidly to *l*-cystine.  $\text{FeCl}_3$  on aq. sol.  $\rightarrow$  deep blue col.

*B, HCl*: m.p. 175–8° decomp.

*S-Et*:  $\text{C}_5\text{H}_{11}\text{O}_2\text{NS}$ . MW, 149. Leaflets. M.p. 228–30°. Sol.  $\text{H}_2\text{O}$ .

*S-Phenyl*: see *S-Phenylcysteine*.

*dl.*

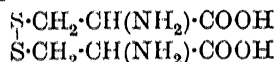
Cryst. Sol.  $\text{H}_2\text{O}$ , AcOH,  $\text{NH}_3$ .Aq. Easily oxidised in air.

*Me ester*: hydrochloride, m.p. 138°. Sol. MeOH,  $\text{H}_2\text{O}$ . Insol. Et $_2\text{O}$ , Me $_2\text{CO}$ ,  $\text{C}_6\text{H}_6$ , pet. ether. Red col. with Na nitroprusside.

Nicolet, *J. Am. Chem. Soc.*, 1931, 53, 3066.

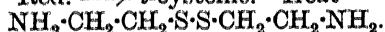
du Vigneaud, Audrieth, Loring, *J. Am. Chem. Soc.*, 1930, 52, 4500.

***l*-Cystine**



$\text{C}_6\text{H}_{12}\text{O}_4\text{N}_2\text{S}_2$  MW, 240

Plates or prisms. Decomp. at 258–61° without melting, when heated in a closed tube. Mod. sol. hot  $\text{H}_2\text{O}$ . Sol. conc. min. acids, and aq. alkalis. Insol. EtOH.  $[\alpha]_D^{20} - 206^\circ$  in dil. HCl. Red.  $\rightarrow$  *l*-cysteine. Heat  $\rightarrow$



*B, 2HCl*: decomp. by  $\text{H}_2\text{O}$ .

*Di-Me ester*:  $\text{C}_8\text{H}_{16}\text{O}_4\text{N}_2\text{S}_2$ . MW, 268. Syrup. Hydrochloride: m.p. 173°. Sol.  $\text{H}_2\text{O}$ .

*Di-Et ester*:  $\text{C}_{10}\text{H}_{20}\text{O}_4\text{N}_2\text{S}_2$ . MW, 296. Trihydrochloride: decomp. at 185°.

Gortner, Hofmann, *Organic Syntheses*, Collective Vol. I, 188.

Okabe, *Chem. Abstracts*, 1928, 22, 2958.

Gabriel, *Ber.*, 1905, 38, 639.

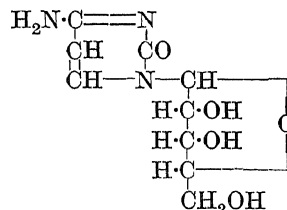
Gerwe, *J. Biol. Chem.*, 1931, 91, 57, (*Bibl.*). Robertson, *Australia Council Scientific Industrial Research Bulletin*, 1928, 39, 5, (*Bibl.*).

Okuda, Kobayashi, *Chem. Abstracts*, 1931, 25, 310.

Forstl, B.P. 411,009, (*Chem. Abstracts*, 1934, 28, 6446).

Wood, du Vigneaud, *J. Biol. Chem.*, 1939, 131, 267.

**Cytidine** (Cytosine-3- $\beta$ -*d*-ribofuranoside)



$\text{C}_9\text{H}_{13}\text{O}_5\text{N}_3$  MW, 243

Nucleoside obtained by hyd. of yeast nucleic acid. Needles from EtOH.Aq. M.p. 230° decomp.  $[\alpha]_D^{21} + 29.6^\circ$  in  $\text{H}_2\text{O}$ .

*B, HCl*: cryst. from  $\text{H}_2\text{O}$ . M.p. 218°.

*B, HNO3*: cryst. from  $\text{H}_2\text{O}$ . M.p. 197°.

*B, H2SO4*: cryst. from  $\text{H}_2\text{O}$ . M.p. 233°.  $[\alpha]_D^{30} + 29.7^\circ$  in dil.  $\text{H}_2\text{SO}_4$ .

*Triphenylmethyl ether*: m.p. 234–5°.

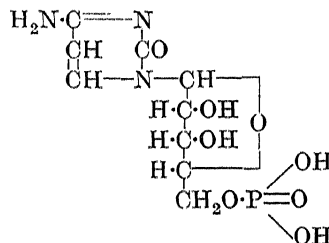
*Picrate*: cryst. from EtOH. M.p. 185–7°.

Levene, Jacobs, *Ber.*, 1910, 43, 3150.

Levene, La Forge, *Ber.*, 1912, 45, 608.

Bredereck, *Ber.*, 1932, 65, 1830; 1933, 66, 198.

**Cytidine-5'-phosphate**



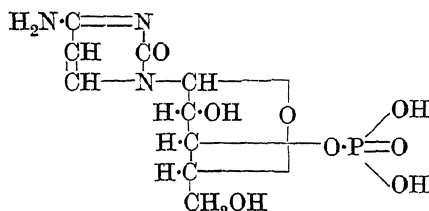
$\text{C}_9\text{H}_{14}\text{O}_8\text{N}_3\text{P}$  MW, 323

Plates. M.p. 233° decomp. Purified via Ba salt.

*Dibrucine salt*: cryst. from  $H_2O$ . Decomp. at  $215^\circ$ .

Michelson, Todd, *J. Chem. Soc.*, 1949, 2476.

## Cytidylic Acid

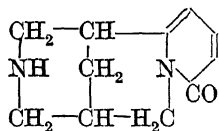


$C_9H_{14}O_8N_3P$  MW, 323

Nucleotide obtained from cold alk. hyd. or enzymic hyd. of yeast nucleic acid. Cryst. from EtOH. M.p.  $230^\circ$ .  $[\alpha]_D^{20} +49.1^\circ$  in  $H_2O$ . Purified via Pb salt.

Levene, *J. Biol. Chem.*, 1920, 41, 483.

Bredereck, Richter, *Ber.*, 1938, 71, 718.

Cytisine (*Ulexine, baptitoxine, sophorine*)

$C_{11}H_{14}ON_2$  MW, 190

Alkaloid occurring in laburnum (*Cytisus laburnum*, Linn.), gorse, etc. M.p.  $152-3^\circ$ . Sol.  $H_2O$ , EtOH,  $CHCl_3$ ,  $C_6H_6$ . Insol.  $CS_2$ ,  $Et_2O$ , ligroin,  $CCl_4$ . Sublimes.  $[\alpha]_D^{25} -119^\circ$  in  $H_2O$ . Dist. with soda lime  $\rightarrow$  pyrrole. Red. with HI + P  $\rightarrow$  cytosoline.

*B,HAuCl\_4*: m.p.  $220^\circ$ .

*B,HCl,3HgCl\_2*: m.p.  $124-5^\circ$ .

*N-Acetyl*: m.p.  $208^\circ$ .

*N-Nitroso*: m.p.  $174^\circ$ .

*Methiodide*: m.p.  $270^\circ$ .

*N-Me*: caulophylline.  $C_{12}H_{16}ON_2$  MW, 204. Alkaloid occurring in *Caulophyllum thalict-*

*roides*, Michx. Prisms from EtOH. M.p.  $137^\circ$ .  $[\alpha]_D -221.6^\circ$ . *Picrate*: m.p.  $193^\circ$ . *Perchlorate*: m.p.  $282^\circ$ .

*B,HAuCl\_4*: m.p.  $205^\circ$  decomp.

*Picrate*: m.p.  $228^\circ$ .

Ing, *J. Chem. Soc.*, 1931, 2195, (*Bibl.*); 1932, 2778.

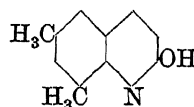
Davy, Chu, *Chem. Abstracts*, 1927, 21, 4025.

Späth, Galinowsky, *Ber.*, 1932, 65, 1526.

 $\beta$ -Cytisolidine.

See 6 : 8-Dimethylquinoline.

**Cytosoline** (2-Hydroxy-6 : 8-dimethylquinoline, 6 : 8-dimethylcarbostyryl)



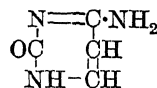
$C_{11}H_{11}ON$  MW, 173

Cryst. from hot EtOH. M.p.  $199^\circ$ .

Freund, *Ber.*, 1904, 37, 16.

Späth, *Monatsh.*, 1919, 40, 18.

**Cytosine** (4-Aminopyrimidone-2, 6-aminouracil)



$C_4H_5ON_3$  MW, 111

Hydrolysis product of nucleic acids. Plates +  $5H_2O$  from  $H_2O$ . Decomp. at  $320-5^\circ$ . Sol. hot  $H_2O$ . Spar. sol. EtOH. Insol.  $Et_2O$ .  $HNO_2 \rightarrow$  uracil. Gives murexide reaction.

*Picrate*: m.p.  $265-6^\circ$  decomp.

Hilbert, Johnson, *J. Am. Chem. Soc.*, 1930, 52, 1152, (*Bibl.*).

Hilbert, Jansen, Hendricks, *J. Am. Chem. Soc.*, 1935, 57, 552.

Hunter, Hlynka, *Biochem. J.*, 1937, 31, 486.

















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