

9965D

UC-NRLF



B 2 828 226

Q  
171  
S39  
1866  
MAIN

LIBRARY  
UNIVERSITY OF  
CALIFORNIA





*o*  
*all*

A

NEW CHEMICAL  
NOMENCLATURE.

---

*Samuel*  
*Dyer*  
S. D. TILLMAN, A. M.,  
Professor of Technology in the American Institute of the  
City of New York.

---

ALBANY :  
C. VAN BENTHUYSEN & SONS, PRINTERS.  
1866.

LOAD STACK

GIFT

9965D

Q171  
539  
1866  
MAIN

# A NEW CHEMICAL NOMENCLATURE.\*

By S. D. TILLMAN, A. M.,

PROFESSOR OF TECHNOLOGY IN THE AMERICAN INSTITUTE  
OF THE CITY OF NEW YORK.



THE present seems very opportune for the introduction of a Nomenclature which will more completely methodize the Science of Chemistry. By such aid, students, who formerly deserted the study because they found themselves gradually sinking into a quagmire of incongruous names, may advance on firm ground, and view with satisfaction and profit the fair fields opened on every side by the distinguished chemists of our own time. The old nomenclature, based on the joint production of DEMORVEAU, LAVOISIER, BERTHOLLET and FOURCROY, published in 1787, has been frequently amended and enlarged; yet, to preserve the connection and consistency of the whole, names and classifications were retained long after they had lost their original significance. Even the broad line of distinction between acids and salts (made when oxygen acids and neutral salts only were known), gradually diminished with the successive discoveries of acid salts and the promulgation of new views by DAVY and DULONG, until it is now no longer recognized by those who regard the whole class of hydracids as true salts. A fatal error was committed at the outset, in attempting to define the acids containing most and least oxygen, by adopting as terminals (rendered into English) *ic* and *ous*, and the corresponding terminals *ate* and *ite* for salts. Subsequent discoveries of higher and lower oxides involved the necessity of using, as prefixes to the words in general use, the terms *hyper* or *per* and *hypo*. Still these amendments have not obviated the difficulty, as will be seen by reference to the combinations of oxygen with sulphur. This conflict of terms was not, however, the greatest evil. The *ic* and *ous* terminals are worse than useless for expressing the degrees of oxidation, because the same terminal has a different signification in almost every series of oxides. Similar objection may be made to the use of the terminal *a* in the names of oxides; for example, Soda, now  $\text{Na}_2\text{O}$ ; Magnesia,  $\text{MgO}$ ; Alumina,  $\text{Al}_2\text{O}_3$ ; and Silica, formerly  $\text{SiO}_2$ , by many now written  $\text{SiO}_2$ . Early in the present century, the words *protoxide*, *deutoxide*, etc. were used to distinguish the several degrees of oxidation having the simple ratio of combining proportions, i. e. 1 : 2, 1 : 3, 1 : 4. No more complex ratios than 2 : 3 were provided for.

\* Read at the meeting of the American Association for the Advancement of Science, held in the city of Buffalo, Aug. 16th, 1866.

Many of these, and similar names applied to electro-negative elements, are often misused by distinguished authors who have adopted the atomic notation; for instance, *sesqui* to designate the combination of six atoms of a halogen with two atoms of carbon, or of a biatomic metal.

The comparatively recent discovery of a great number of organic compounds, so called, required the coinage of many new names to designate radicals. Simultaneously the attempt was first made by German chemists to state definitely by prefixes the number of "equivalents" of each element in combination, which has resulted in the formation of names of a frightful length, scarcely pronounceable and seldom remembered. A complete catalogue of the chemical bodies now known would embrace several thousand terms. The novice, misled at first by common and commercial names, like "milk of lime," "sugar of lead," "cream of tartar," "oil of vitriol," and "butter of antimony," but who had advanced far enough to find no sulphur in sulphuric ether, no copper in copperas, no lead in black lead, no soda in soda water, and to be assured that "Dutch liquid" is not imported from Holland, might look with interest and wonder on the accumulated names approved by the highest authorities, and enquire whether this magnificent patchwork could be of much service as a chemical chart. To a negative reply, should be added "Yet a substitute for the whole has been provided by the Notation."

The introduction of chemical symbols by BERZELIUS marks an era of progress quite as plainly as the first employment of Arabic signs and numerals in the mathematics. The notation is now frequently employed to the exclusion of chemical names, in oral as well as written communications. Its general adoption forty years ago, with the atomic signification originally attached to it by BERZELIUS, would have prevented the confusion of terms and signs now consequent upon the conformation of the atomic volume of gaseous elements to the one standard. BERZELIUS barred certain letters, to signify that one-half the combining weight was the atomic weight; in other words, that the so-called "equivalent" contained two atoms. GERHARDT, on the other hand, used the same mark to denote that the combining weight must be doubled to express the atomic weight. MILLER, in the third edition of his "Elements of Chemistry," designates the old notation in the usual way, and the new notation by italic capitals; while WATT§ in his "Dictionary of Chemistry," still in process of publication, just reverses MILLER'S arrangement.

The following symbols, representing a molecule of water according to three different views, will explain what induced BERZELIUS, who measured volume and atomic weight on the oxygen scale, to halve the symbols representing the combining proportion of hydrogen; and why GERHARDT, who simplified measurements by making the hydrogen atom the unit of weight and bulk, was led to double the value of the symbol for oxygen, without knowing to how many other symbols the doubling process would finally be applied.

DALTON.	BERZELIUS.	GERHARDT.
(2 vol.) H O (1 vol.)	$\frac{1}{2}$ vol. H } O 1 vol.	$\frac{1}{2}$ vol. H } $\mathbf{O}$ 1 vol. = H <sub>2</sub> O <sub>2</sub> .
1 + 8 = 9.	.5 + .5 + 8 = 9.	1 + 1 + 16 = 18.

No inconsistency arises in the interpretation of these symbols; and although grave objections have been made by HERSCHEL and ODLING to the mingling of

mathematical and chemical signs in chemical equations, it must be admitted that the symbol of a compound is universally regarded as the real body which may be clothed with synonymes more or less expanded to suit the peculiar views of different schools.

Quite a serious derangement of the nomenclature has followed the introduction of the atomic notation. A majority of the old names have thus become inappropriate; and chiefly for this reason, many well-known European chemists, and nearly all American chemists, still prefer to use the old system expressing combining proportions. No sweeping innovation which changes or perverts the meaning of old terms, rendering old and familiar works on chemistry comparatively worthless, and which tends to eradicate fundamental ideas, will be accepted by the present generation. How utterly futile would be the unanimous resolve of a World's Convention to change the value of our common numerals so as to represent a unit by the figure 2! Yet if they should propose to leave the old signs undisturbed, and to use new characters having the same numerical value with other important significations, the project could perhaps be carried into practical operation. Thus in any science it will be found most feasible to designate new views, or new structures, by new and appropriate names. This subject has commanded the attention of all advanced chemists. At the meetings of the London Chemical Society, the question has been discussed by GRAHAM, WILLIAMSON, MILLER, BRODIE, FRANKLAND, ODLING, HOFMANN and other distinguished members. GMELIN'S names, as modified by WATT and his compeers, seem to be received with most favor. WILLIAMSON, FOSTER and WILLIAMS have suggested valuable alterations. One would, however, be safe in predicting that while the *ic* and *ous* system predominates, the root of the perplexity will not be reached.

The nomenclature now presented is the result of an attempt to obviate the continual embarrassment attending the prosecution of chemical studies. Failing to remember the exact composition of certain compounds, the writer resorted to mnemonical methods; and, after repeated trials, devised, in the year 1850, a system of words, generally unlike any found in dictionaries, which, with certain modifications, he has constantly employed since that time. It was originally adapted to the old classification of acids, bases and salts, but was so arranged as to be most conveniently used in defining combinations of hydrogen or a metal with a radical according to the binary system. It was also early employed in explaining the now discarded Nucleus theory, as advocated by LÆWIG in 1851.

Although the importance of the Typical system of classification was clearly set forth by HUNT in 1848 (*Am. Jour. Science*, V, 265; VI, 173), not until after memorable experiments and discoveries by European chemists had demonstrated its great value, was the decision made to modify this nomenclature so as to be used with facility in expressing the new views. In attempting to take this step, however, another serious obstacle was encountered in the diversity of opinion regarding atomic weights. KOPP and REGNAULT had thrown new light on the subject; yet chemists of the Unitary school still agreed with the views originally advanced by GERHARDT, and recognized many metals, besides silver and those of the alkaline class, as monatomic. In 1861, however, GIBBS made it manifest that if the atomic weights of carbon, oxygen and sulphur be taken respectively at 12, 16 and 32, the received numbers of at least

fifty elements must be doubled (*Am. Jour. Science*, XXXI, 246). More recently, prompted by CANIZZARO, the disciples of GERHARDT have almost unanimously renounced such opinions on comparative atomic weights as are at variance with those of BERZELIUS.

The meaning of the new notation having thus been definitely fixed, while the nomenclature may be said to be still in the transition state, an atomic system of names, intended to supply the place *both of the notation and the old nomenclature*, is submitted for candid and critical examination. A leading consideration has been to produce a system which will assist the student in acquiring and retaining a knowledge of fundamental laws: also to provide such brief technical terms as will enable chemists generally to express their views with more conciseness.

Doubtless the most rapid advance has been made by students who have daily witnessed the operations of the laboratory. No oral description of chemical experiments could make so deep and permanent an impression. This principle of retention was well appreciated and expressed by HORACE:

Segnius irritant animos demissa per aures,  
Quam quæ sunt oculis subjecta fidelibus.

Next in importance to experimental knowledge, must be ranked a system of words and symbols which will convey, at sight, by means of their combinations, a clear idea of the union of the elements, without denoting in every instance by rational formulæ the manner of such union. The ear also should be brought into service in such a system, by making the very sound of the symbols so excite the power of association as to bring before "the mind's eye" the whole series of similar and nearly related compounds. To accomplish these objects, it was necessary to construct an entirely new scheme, by providing for every well-investigated chemical body a name which should at once designate the kind and number of atoms composing it, and to a certain extent its typical and functional characteristics. This work was accomplished in a true conservative spirit, by building the new structure from old materials, and upon a foundation which is the result of the combined labors of those truly great men who have devoted their lives to the advancement of Chemical science.

The method of construction will be briefly explained under the following heads:

1. The system is based on abbreviations of the universally received names of the metals, and on the chemical symbols of the metalloids or non-metallic elements, with such modifications as were imperatively required.

2. The name of each chemical element relates, not to its mass, but only to a minimum combining proportion termed an atom, or to some multiple of it. The atom is therefore the unit of measurement, and the starting point of the scale in each series of compounds.

3. The atomic name of each metal consists of two syllables, and ends with the consonant *m*.

4. The name of each of the thirteen metalloids terminates with a different consonant. Arsenic and tellurium, classed by French chemists among the metalloids, have in this arrangement the terminal letter common to the metals.

5. The number of atoms of any element is designated by the vowel immediately preceding its terminal consonant. The numerical power of the vowels

advances with the order in which they are placed in the alphabet. *One, two, three, four* and *five* are respectively expressed by *a, e, i, o* and *u*, having the short or stopped sound as heard in *bat, bet, bit, hot, hut*; and *six, seven, eight, nine* and *ten* by the same vowels having a long or full sound. In foreign languages, it may be best to designate the long sound by a sign placed *over* the vowel; but in our language, it is found by experience more convenient to place *e* before each of the vowels, which invariably indicates their long or full sound as heard in the words *great, greet, sleight, yeoman, euphony*. These ten distinctive sounds may be illustrated by a single example. From one to ten atoms of iron, inclusive, have the following names :

*Fe, Ferram; Fe<sub>2</sub> Ferrem; Fe<sub>3</sub>, Ferrim; Fe<sub>4</sub>, Ferrom; Fe<sub>5</sub>, Ferrum; Fe<sub>6</sub>, Ferream; Fe<sub>7</sub>, Ferreem; Fe<sub>8</sub>, Ferreim; Fe<sub>9</sub>, Ferreom; Fe<sub>10</sub>, Ferreum.*

The proper diphthongs are sometimes used for the even numbers between 10 and 20. These will be remembered from the fact that their value is the sum of their vowel-values, either short or long : thus, *oi* is  $12 = 9 + 3$ ; *ou* is  $14 = 9 + 5$ ; *au* is  $16 = 6 + 10$ ; *oo* is  $18 = 9 + 9$ . The consonant *y* is 10, and used only in connection with vowels, which will express all the numbers to and including 20 : *w* is 20, and, with the usual appendage, will express the numbers to and including 30. *X* is also used, and when preceded by a vowel, which thus has the power of an exponent, will express a progression by tens to one hundred; thus, 10, *ax*; 20, *ex*; 30, *ix*; 40, *ox*; 50, *ux*; 60, *eax*; 70, *eex*; 80, *eix*; 90, *eox*; 100, *eux*. In the same manner, these vowels preceding *qu* express the hundreds to and including one thousand, and the intermediate numbers are represented by suffixing some of the characters previously explained.

Very few chemical compounds, now known, have a composition represented by atomic numbers higher than one hundred. A large majority of the bodies of known composition do not require numbers as high as ten. The following selections will show more clearly the numerical value of each letter, and the extent to which this numerative system may be carried.

a, 1	ea, 6	aa <sup>*</sup> , 11	y, 10	w, 20	ax, 10	aqu, 100
e, 2	ee, 7	oi, 12	ya, 11	wi, 23	eq, 20	equ, 200
i, 3	ei, 8	ou, 14	yi, 13	wee, 27	ix, 30	eiqu, 800
o, 4	eo, 9	au, 16	yeo, 19	weo, 29	eix, 80	eoquix, 930
u, 5	eu, 10	oo, 18	yeu, 20	weu, 30	eux, 100	euqueix, 1080

6. The following metalloids have names terminating with their well-known symbolic letters : one atom of each is here denoted.

Fluorine, <i>fluraf</i> or <i>af</i> ;	Bromine, <i>bromab</i> or <i>ab</i> ;
Nitrogen, <i>nitran</i> or <i>an</i> ;	Phosphorus, <i>phosap</i> or <i>ap</i> ;
Carbon, <i>carbac</i> or <i>ac</i> ;	Sulphur, <i>sulphas</i> or <i>as</i> .

In a few instances where the symbolic letter could not be used, the terminal letter adopted may be associated with some prominent characteristic of the element. Thus *l* represents the *lightest* of substances, an atom of hydrogen is *hydral* or *al*; *d* represents the *densest* of the gaseous elements, an atom of chlorine is *chlorad* or *ad*; *v* represents a *volatile* producing a *violet* vapor, one atom of iodine is *idav* or *av*. The atom *par excellence* is *at* : oxygen, exceeding in quantity all other elements of the Earth's crust, has for the name of a single atom *oxat* or *at*. An atom of selenium is *selaz* or *az* : it bears a strong resemblance in its reactions to *as*. Boron and silicon or silicium, like carbon, are

\* Having the sound of *ah*.

permanent solids when isolated : their terminals may be remembered by the association of *j* and *k* in the alphabet ; an atom of boron is *boraj* or *aj*, an atom of silicon is *silak* or *ak*.

The compounds of carbon and hydrogen are so numerous that it has been found essential to provide an additional character to represent each. The letter *r* may be associated with the radiating and refracting power of carbon ; and *carbar* or *ar*, as well as *ac*, will represent an atom of carbon. As *ac* might be mistaken for *ak*, in radical compounds, the carbon component is denoted generally by *r*.

The only case in which it has been found advantageous to use one letter to designate two atoms, is that of *h* for two atoms of hydrogen, or *hydrel* ; thus preserving the ratio of the old combining numbers,  $C_2H_2O_2$  being *cht*. It will be noted that *ach* corresponds with  $C_2H_2$  in the old notation, and with  $CH_2$  in the new : it is the key to a series of radicals, i. e. methyl,  $CH_3$ , is *achal* ; ethyl,  $C_2H_5$ , *echal*.

7. Metalloid terminal syllables express as much as the full name, and are used as suffixes to names of metallic atoms to denote a metallic compound ; for example, the protoxide of iron is *ferramat*, which indicates very clearly that one atom of iron is united with one atom of oxygen. A combination of metalloid syllables represents a non-metallic compound. In numerous cases, the number of syllables forming such a word is less than the number of different elements in the compound, because two or more terminal characters may be united, and the vowel or diphthong preceding the whole will be applicable to each ; for instance, *elt* =  $H_2O_2$  is a molecule of oxygenated water, or peroxide of hydrogen ; *arn* =  $CN$  is an atom of cyanogen, and *ant* =  $N_2O$  is a molecule of binoxide of nitrogen. It will be seen presently that the names of salts containing one atom of a metal are sometimes slightly abbreviated, by omitting the *a* which should precede *m* ; also that *m*, with a vowel preceding it, is applied to multiples of any radical playing the part of a metal.

The following table embraces all the chemical elements known with certainty, and their atomic numbers corresponding with the systems of BERZELIUS and GERHARDT, to each of which the new names are equally applicable. The highest and lowest known oxides of each element are also added. Names included in brackets are hydrates containing three elements. In twelve cases, where the same metal is known by two names, each name has been adapted to the new system ; the first name in each couplet is derived from that recognised by chemists of every nation.

SYMBOLS.	At. wt. al.—5.	At. wt. al.→ 1.	Name of one atom.	Name of a molecule (2 at)	Name of lowest oxide.	Name of highest oxide.
H	.5	1.	Hydral	Hydrel	$H_2O$ <i>hydrelat</i>	$H_2O_2$ <i>hydrellt</i>
N	7.	14.	nitran	nitren	$N_2O$ <i>nitrenat</i>	$N_2O_5$ <i>nitrenut</i>
O	8.	16.	oxat	oxet		
{ C	6.	12.	carbac	carbec	} $CO$ <i>carbart</i>	} $CO_2$ <i>carbaret</i> $SO_2$ <i>silaket</i>
{ Si	14.	28.	carbar	carber		
B	5.45	10.9	silak	silek		$B_2O_3$ <i>borejit</i>
P	15.5	31.	boraj	borej	$PO$ <i>phosapt</i>	$P_2O_5$ <i>phoseput</i>
S	16.	32.	phosap	phosep	$SO_2$ <i>sulphaset</i>	$SO_3$ <i>sulphasit</i>
Se	39.75	79.5	selaz	selez	$SeO_2$ <i>selazet</i>	( <i>alazot</i> )
F	9.5	19.	fluraf	fluref		
Cl	17.73	35.46	chlorad	chloređ	$Cl_2O$ <i>chloređat</i>	( <i>aladot</i> )
Br	40.	80.	bromab	bromeb		( <i>alabit</i> )
I	63.5	127.	idav	idev	$HIO$ ( <i>alavat</i> )	$I_2O_7$ <i>ideveť</i>

TABLE—(Continued).

SYMBOLS.	At. wt. al. = 5.	At. wt. al. = 1.	Name of one atom.	Name of a molecule (2 at)	Name of lowest oxide.	Name of highest oxide.
<b>METALS.</b>						
Cs	66.5	133.	Coesam	Coesem	<b>Cs<sub>2</sub>O</b> coesemat	(coesamalt)
Rb	42.5	85.	rubam	rubem	rubemat	(rubamalt)
K	19.5	39.	kalam or	kalem	kalemai	(kalamalt)
{ "	"	"	potam	potem	potemat	(potamalt)
{ Na	11.5	23.	natam or	natem	natemat	(natamalt)
{ "	"	"	sodam	sodem	sodemat	(sodamalt)
L	3.5	7.	litham	lithem	lithemat	(lithamalt)
Ba	68.5	137.	baram	barem	<b>BaO</b> baramat	baramet
Sr	43.8	87.6	stronam	stronem	stronamat	stronamet
Ca	20.	40.	calcam	calcem	calcamat	
Mg	12.15	24.3	magam	magem	magamat	
Al	13.7	27.4	alam	alem	alemit	
G	4.7	9.4	glucam	glucem	glucemit	
Zr	44.75	89.5	ziram	zirem	ziremit	
Th	119.	238.	thoram	thorem	thoramat	
Yt	30.85	61.7	yttram	yttrem	yttramat	
E	56.30	112.6	erbam	erbem	erbamet	
Tb			terbam	terbem	terbamet?	
Ce	46.	92.	ceram	cerem	ceramat	cerimet
La	46.47	92.94	lanam	lanem	lanamat	
Di	48.	96.	didam	didem	didamat	
Zn	32.75	62.5	zinam	zinem	zinamat	(zinamelt)
In	35.91	71.82	indam	indem	indamat	
Cd	56.	112.	cadam	cadem	cadamat	
Co	29.50	59.	cobam	cobem	cobamat	cobemit
Ni	29.87	58.74	nikam	nikem	nikamat	nikemit
U	60.	120.	uram	urem	uramat	uremit
{ Fe	28.	56.	ferram or	ferrem	ferramat	ferremet
{ "	"	"	iram	irem	iramet	iremit
Cr	26.27	52.54	chram	chrem	(chramalt)	chramet
Mn	27.50	55.	manam	manem	manamat	manamet
{ Sn	59.	118.	stanam or	stanem	stanamat	stanamet
{ "	"	"	tinam	tinem	tinamat	tinamet
Ti	25.	50.	titam	titem	titamat	titamet
{ Nb	49.13	98.26	nobam or	nobem	nobemit	nobamet
{ Cl	"	"	colam	colem	colemet	colamet
Ta	91.?	182.?	tanam	tanem	tanemit	tanamet
Mo	48.	96.	molam	molem	molamat	molamit
V	68.46	136.92	vanam	vanem	vanamat	vanemit
{ W	92.	184.	wolam	wolem	wolamat	wolamit
{ "	"	"	tunam	tunem	tunamat	tunamit
As	37.5	75.	arsam	arsem	arsamat	arsamut
{ Sb	60.15	120.3	stibam or	stibem	stibamat	stibamut
{ "	"	"	antam	antem	antamat	antamut
Bi	105.	210.	bisam	bisem	bisamat	bisamot
{ Cu	31.75	62.5	cupam or	cupem	<b>C<sub>2</sub>O</b> cupemat	cupamet
{ "	"	"	coppam	coppem	coppemat	coppamet
{ Pb	103.5	207.	plubam or	plubem	plubemat	plubamet
{ "	"	"	leadam	leadem	leadamat	leadamet
Tl	101.75	203.5	thallam	thallem		thallamit
Te	64.5	129.	tellam	tellem	tellamet	tellamit
{ Hg	100.	200.	hygam or	hygem	hygemat	hygamat
{ "	"	"	mercam	mercem	mercemat	mercamat
{ Ag	54.	108.	argam or	argem	argemat	argamet
{ "	"	"	silvam	silvem	silvemmat	silvamet
{ Au	98.33	196.66	auram or	aurem	auremat	auremit
{ "	"	"	goldam	goldem	goldemat	goldemit
Pt	98.56	199.12	platom	platem	platomat	platomet
Pd	53.24	106.48	pallam	pallam	pallamat	pallamet
Ro	52.16	104.32	rhodam	rhodem	rhodamat	rhodemit
Ru	52.11	104.22	rutham	ruthem	ruthamat	ruthamet
Os	99.41	198.82	osmam	osmem	osmammat	osmamot
Ir	98.56	197.12	irdam	irdem	irdamat	irdamet

As a whole, the old symbols, representing combining proportions, are applicable to neither column of atomic weights. Fewer changes are required by adopting the weights of the first column; yet the advantages derived from estimating  $H = 1$  are so obvious, that the symbols used in the remainder of this paper will represent the numbers in the second column. Those having the old value will be denoted by the usual letters, and symbols of doubled value by full-faced type.

A complete series of known oxides of several metals (excluding hydrates) are here presented, for the purpose of comparing the old and new system as to brevity and precision.

1. Protoxide of iron (Ferrous oxide),	<b>FeO</b> :	<i>Ferramat.</i>
Sesquioxide or Peroxide of iron (Ferric oxide),	<b>Fe<sub>2</sub>O<sub>3</sub></b> :	<i>Ferremit.</i>
INTERMEDIATE OXIDES.		
Black or Magnetic oxide of iron (Ferroso-ferric oxide),	<b>Fe<sub>3</sub>O<sub>4</sub></b> :	<i>Ferrimot.</i>
A nameless oxide of iron (auct. BERTHIER & GLASSON),	$4 \text{ FeO } \text{Fe}_2\text{O}_3 = \text{Fe}_6\text{O}_7$ :	<i>Ferreameet.</i>
Scale oxide of iron (inner layer),	$6 \text{ FeO } \text{Fe}_2\text{O}_3 = \text{Fe}_8\text{O}_9$ :	<i>Ferreimeot.</i>
The name of the latter, expressing the supposed rational formula, is <i>Ferreameat</i> — <i>Ferremit</i> .		
2. Protoxide of manganese (Manganous oxide),	<b>MnO</b> :	<i>Manamat.</i>
Red oxide of manganese (Manganoso-manganic oxide),	<b>Mn<sub>2</sub>O<sub>3</sub></b> :	<i>Manimot.</i>
Sesquioxide of manganese (Manganic oxide),	<b>Mn<sub>2</sub>O<sub>3</sub></b> :	<i>Manemit.</i>
Peroxide of manganese (Dioxide of M.),	<b>MnO<sub>2</sub></b> :	<i>Manamet.</i>
3. The Chromium atom, properly <i>Chromam</i> , may be contracted to		
<i>Chram</i> ; which is especially convenient in denoting chromates.		
Protoxide of chromium (Chromous oxide),	<b>CrO</b> :	<i>Chramat.</i>
Magnetic oxide of chrome (Chromoso-chromic oxide),	<b>Cr<sub>2</sub>O<sub>4</sub></b> :	<i>Chrimot.</i>
Sesquioxide of chromium (Chromic oxide),	<b>Cr<sub>2</sub>O<sub>3</sub></b> :	<i>Chremit.</i>
Monochromate of sesquioxide of chromium,	<b>Cr<sub>3</sub>O<sub>8</sub></b> :	<i>Chrimeot.</i>
Bichromate of sesquioxide of chromium,	<b>Cr<sub>4</sub>O<sub>9</sub></b> :	<i>Chromeot.</i>
Neutral chromate of sesquioxide of chromium,	<b>Cr<sub>5</sub>O<sub>12</sub></b> :	<i>Chrumoit.</i>
Acid chromate of sesquioxide of chromium,	<b>Cr<sub>6</sub>O<sub>15</sub></b> :	<i>Chreamyut.</i>
Chromic acid.....	<b>CrO<sub>3</sub></b> :	<i>Chramit.</i>

Including hydrates, the oxides of metals, metalloids and organic radicals now known may be estimated in round numbers at 400. The following oxides of a halogen are adduced to show the inadequacy of the old nomenclature in defining the higher combining ratios of only two elements :

Iodic anhydride,  $\text{I}_2\text{O}_5$ , *evut* ; Hypoiodic acid,  $\text{I}_2\text{O}_4$ , *evot* ; Intermediate oxide (auct. KEMMERER),  $\text{I}_6\text{O}_{13}$ , *eavyit* ; Subhypoiodic acid (auct. MILLON),  $\text{I}_{10}\text{O}_{19}$ , *euyeat*.

A few brief observations will perhaps aid in apprehending the purport of numerous new combinations, illustrating the doctrine of types and substitutions.

1. An atom has a definite maximum power of holding other atoms in chemical union. The normal quantivalence or highest saturating capacity of an atom, that is, its so-called atomicity, decreases as it is duplicated and condensed.

2. *Chlorad* is ranked in the class of elements having the lowest saturating power : therefore *ad* may be taken as the unit of measurement, and thus words already in use in this connection are made peculiarly appropriate ; for example, *hydral* is a monad, *oxat* is a dyad, *nitran* is a triad (often a pentad), *carbar* is a tetrad, *phosap* is a pentad and often a triad. *Carber*, *ferrem*, *alem*, *chromem*, and other DOUBLE-ATOMS forming sesquioxides, behave like hexads, while *manam* appears to be a heptad. *Arsam*, *bisam* and *stibam* are either triads or pentads.

3. A molecule is a complete chemical structure, capable of existing in a

separate state : that part of it which can unite with various monad radicals—known as the residue or remainder of a molecule—being regarded as a broken structure or imperfect body, may be called a *torso*.

4. The atomicity of a torso, or of a radical containing one atom of an element united to one or more atoms of another element, is equal to the difference between the normal saturating power of its components. The following are examples :

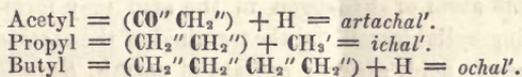
COMPOUND MONADS : Ammonium,  $H_4N''' = olan$  or *ilanal'* ; Hydroxyl,  $H'O'' = all'$  ;  
Amidogen,  $H_2N''' = elan'$  ; Nitric oxide,  $N'''O_2'' = anel'$  ;  
Cyanogen,  $C^vN''' = arn'$ .

COMPOUND DYADS : Carbonyl (Carbonic oxide),  $C^vO'' = arat$  or *art''* ;  
Monamine,  $HN''' = alan'$  ; Methylene,  $C^vH_2 = arel$  or *ach''*.

COMPOUND TRIADS : Formene,  $C_3H = arl'''$  ; Phosphil,  $P^vO'' = apt''$ .

5. The researches of KEKULÉ have shown that the same number of carbon and hydrogen atoms, having different saturating powers, are related to different hydrocarbon series; and the equivalence of such isomers may be determined by the number of hydrogen atoms they contain. For example, glyceryl,  $C_3H_6$  (*echarl'''*), having three less hydrogen atoms than the hydride of propyl (*ichel*),  $C_3H_8$ , is a triad; while allyl,  $C_3H_6$  (*arechal'*), having one atom of hydrogen less than propylene,  $C_3H_6$  (*ir'il''*), is a monad. Thus also to the series of highest saturation of carbon belongs acetylene,  $C_2H_2$  (*erel* or *erl''*); and, having four atoms of hydrogen less than the hydride of ethyl,  $C_2H_6$  (*echel*), it is a tetrad. If two atoms of the monad bromine be added, the saturating power of the compound will be diminished two degrees; therefore the dibromide of acetylene,  $C_2H_2Br_2$  (*erleb*), is a dyad. The late brilliant elucidations of atomicity by WURTZ have thrown light on many points, to which reference cannot now be made.

6. A complex hydrocarbon monad radical may be regarded as the combination of a monad with an even number of radicals or torsoes *in equilibrio*. The following are examples :



7. GERHARDT classified chemical compounds under four types, two of which, the hydrogen and the hydrochloric-acid types, are molecules consisting of two monads : one molecule should therefore be taken as the primal type, and the other as a sub-type. The use of only three types would, at first sight, be commended for its simplicity; yet the vast diversity of Nature's combinations involves the necessity of many multiples, and the formation of mixed types as proposed by ODLING, in which the saturating power of the several parts is distinguished by the signs used in this paper. Valid arguments may be urged in favor of using at least five types, in each of which, one-half the saturating power expended to form the molecule is derived from a single atom. The atom-holding power of one half being balanced by that of the other half of each molecule, it is proposed to distinguish each type by the name expressing the equivalence of one-half of it. The following will show the value of the new characters in typical expressions :

MONAD TYPE.	DIYAD TYPE.	TRIAD TYPE.	TETRAD TYPE.	PENTAD TYPE.
Hydrochloric acid.	Water.	Ammonia.	Marsh gas.	Chloride of phosphorus.
$al \} ad.$	$al \} at.$	$al \} an.$	$al \} ar.$	$al \} ap.$

In representing the most important bodies formed by the replacement of one or more atoms of hydrogen by one or more monad radicals, the change consists, as will presently be shown, simply in substituting for *al* the name of a radical ending with *al*. The different views of chemists respecting the typical form of the same body may be distinctly illustrated by the new characters; take for example, acetic acid,  $C_4H_4O_4 = C_2H_4O_2$ . KOLBE'S carbonic-acid type, being essentially the same as the water type, is omitted, and the so-called radical type is added in the following table :

EMPIRICAL.	GERHARDT.	DEBUS.	FRANKLAND & DUPPA.
$alert$ or $echet.$	$al \} at.$ $artachal \}$	$ar \} aachal'$ $at''$ $alt'.$	$ar \} al$ $al$ $al$ $ar \} at''$ $alt'.$

The empirical name *echet* is the second in a series of which *achet* (formic acid) is the first; *ichet* (propylic acid), the third; *ochet* (butylic acid), the fourth; *uchet* (amylic acid), the fifth; and so on to the highest or most condensed molecule *weuchet* (melissic acid), represented in the old notation by  $HO C_{60} H_{60} O_3$ , and in the new by  $C_{30} H_{60} O_2$ . These short and simple names, formed by changes in the first syllable, represent these acids as the result of successive additions of *ach* ( $CH_2$ ); but they cannot be made available in illustrating the changes which occur when an atom of hydrogen is replaced by a metal or a radical. The other empirical name may be used by those who prefer to express no opinion as to the actual constitution of the acid. To carry out this view, the replaceable atom of hydrogen in the acid may form the first syllable, and the remaining syllables will be the terminal of the acetates formed by monad metals, e.g. acetic acid, *alilert*; acetate of potash, *Kalmilert*. The terminal syllables must be doubled in value, to denote acetates of dyad metals; for example, acetate of lead, *Plubmealort*. In consideration of the existence of numerous important bodies, into the construction of which an acid-forming radical of this series enters, it has been found most desirable to designate the acids by names which bring the radical more clearly to view. Preference is therefore given to those which are readily resolved into the water or dyad type; thus, acetic acid, as *alartachalt* or *lartachalt*, is easily separated into syllables which reveal its typical structure [*al-artachal*]at. When *al* is replaced by a monad metal, the typical form is still apparent [*am-artachal*]at. An atom of a dyad metal replaces the hydrogen atom in two molecules of acid: therefore the torso *artachalt* is doubled, which is indicated by the suffix *e* having the sound of *eh*, thus, *artachalte*. In the sesquiacetates, the double-torso *artachalte* is trebled, and indicated by the suffix *ea* = 6; for example, the acetate of alumina =  $Al_2 C_{12} H_{18} O_{12}$ , is *Alem-artachalte*.

All the types previously enumerated may be regarded as subtypes, embraced

in a regular series of types consisting of condensed molecules of hydrogen, according to the suggestion originally made by HUNT. In the following table, containing several new types, the condensed hydrogen molecules are connected with the types of substantially the same significance by the mathematical symbol of equivalency. Atoms in brackets in the first series are replaced by other atoms in the second.

RATIOS.	HYDROGEN MOLECULES.	OLD NAMES.	NEW NAMES.
1	: I al-[al]	⊖ HCl,	Hydrochloric acid = <i>alad</i> .
2	: I el-[el]	⊖ H <sub>2</sub> O,	Water = <i>elat</i> .
3	: I il-[il]	⊖ H <sub>2</sub> N,	Ammonia = <i>ilan</i> .
I	: 4 [ol]-ol	⊖ CH <sub>4</sub> ,	Marsh gas = <i>arol</i> .
I	: 5 [ul]-ul	⊖ PCl <sub>5</sub> ,	Pentachloride of phosphorus = <i>apud</i> .
I	: 6 [eal]-eal	⊖ CrF <sub>6</sub> ,	Perfluoride of chromium = <i>chrameaf</i> .
I	: 7 [eel]-eel	⊖ MnCl <sub>7</sub> ,	Perchloride of manganese = <i>manameed</i> .
I	: 4 [ol]-ol	⊖ CH <sub>3</sub> H,	Hydride of methyl ( <i>achal-al</i> ) = <i>achel</i> .
II	: 6 [eal]-eal	⊖ C <sub>2</sub> H <sub>5</sub> H,	Hydride of ethyl ( <i>echal-al</i> ) = <i>echel</i> .
III	: 8 [eil]-eil	⊖ C <sub>3</sub> H <sub>7</sub> H,	Hydride of propyl ( <i>ichal-al</i> ) = <i>ichel</i> .
IV	: 10 [eul]-eul	⊖ C <sub>4</sub> H <sub>9</sub> H,	Hydride of butyl ( <i>ochal-al</i> ) = <i>ochel</i> .
V	: 12 [yel]-yel	⊖ C <sub>5</sub> H <sub>11</sub> H,	Hydride of amyl ( <i>uchal-al</i> ) = <i>uchel</i> .
VI	: 14 [yol]-yol	⊖ C <sub>6</sub> H <sub>13</sub> H,	Hydride of caproyl ( <i>eachal-al</i> ) = <i>eachel</i> .
VII	: 16 [yeal]-yeal	⊖ C <sub>7</sub> H <sub>15</sub> H,	Hydride of œnanthyl ( <i>eechal-al</i> ) = <i>eechel</i> .
VIII	: 18 [yeil]-yeil	⊖ C <sub>8</sub> H <sub>17</sub> H,	Hydride of capryl ( <i>eichal-al</i> ) = <i>eichel</i> .
XII	: 26 [weal]-weal	⊖ C <sub>12</sub> H <sub>25</sub> H,	Hydride of lauryl ( <i>oichal-al</i> ) = <i>oichel</i> .
XVI	: 34 [ixol]-ixol	⊖ C <sub>16</sub> H <sub>33</sub> H,	Hydride of cetyl ( <i>auchal-al</i> ) = <i>auchel</i> .
XXVII	: 56 [uxeal]-uxeal	⊖ C <sub>27</sub> H <sub>55</sub> H,	Hydride of ceryl ( <i>weechal-al</i> ) = <i>weechel</i> .
XXX	: 62 [eaxel]-eaxel	⊖ C <sub>30</sub> H <sub>61</sub> H,	Hydride of melissyl ( <i>weuchal-al</i> ) = <i>weuchel</i> .

It is evident that the so-called "atomicity" does not prevent the union of atoms in a regular progressive series of ratios. In such cases, the atom-holding energy has different degrees of development as the result of the reflex influence of combination. Apparent abnormal action, for instance in the case of I<sub>2</sub>O<sub>7</sub>, *evect*, may be accounted for by supposing an even number of atoms of oxygen, O<sub>6</sub>, in alternately opposite polar conditions, to be united with I<sub>2</sub>O. When mercury and chlorine form calomel, *mercamad*, the anomaly is explained by the fact that the volume of the compound corresponds with that of a molecule of hydrogen; thus in this, as well as the case of the hydride of copper, *cupamal*, a dyad metal plays the part of a monad.

The new names of acids and salts, of simple as well as intricate constructions, are so framed that they may readily be resolved into syllables expressing their typical relations. This is accomplished by making the replaceable hydrogen of an acid the prefix which determines the type on which the compound is constructed, as explained previously in speaking of acetic acid. The typical name of an acid or salt embraces, in fact, three terms; the first consists of the replaceable hydrogen, the second is another portion of the compound of equal equivalence to the first, and the remaining oxygen atoms will constitute a third term having the atomic equivalence of the first and second terms combined. In chemical reactions, the second and third terms generally remain unchanged, and may therefore be included as one name, and the whole name may be said to represent the combination of a radical with a torso. Examples;

Nitric acid, "monatomic" [al'-anet']at<sup>iv</sup> = *alanit*.  
 Sulphuric acid, "biatomic" [el''-aset']et<sup>iv</sup> = *elasot*.  
 Phosphoric acid, "triatomic" [il'''-apt''']it<sup>vi</sup> = *ilapot*.

The halogens are powerful electro-negative elements. Having the best struc-

tural adaptability, as monads, they are found among the components of many bodies. Those well investigated may be estimated in round numbers thus : Chlorides 750, iodides 320, fluorides 160, bromides 150; to which may be added another class of very similar structure, the cyanides 220 : total, 1630. In this estimate, several hundred chlorhydrates, bromhydrates and iodhydrates are not included. Their new names will be so readily understood, it is only essential to present such examples as will explain the changes required by the atomic notation and the typical classification.

## MONAD TYPE.

Hydrofluoric acid,	HF,	<i>alaf</i> :	Fluoride of thallium,	<i>Thalamaf</i> .
Hydrochloric acid,	HCl,	<i>alad</i> :	Chloride of sodium,	<i>Sodamad</i> .
Hydrobromic acid,	HBr,	<i>alab</i> :	Bromide of ammonium,	<i>Olanab</i> .
Hydriodic acid,	HI,	<i>alav</i> :	Iodide of potassium,	<i>Potamav</i> .
Hydrocyanic acid,	HCy,	<i>alurn</i> :	Cyanide of silver,	<i>Argamarn</i> .

## DYAD TYPE.

Fluor spar,	<i>Calcamef</i> .		Corrosive sublimate,	<i>Mercamed</i> .
Chloride of thorium,	<i>Thoramed</i> .		Bromide of cadmium,	<i>Cadameb</i> .
Bromide of yttrium,	<i>Yttrameb</i> .		Iodide of zinc,	<i>Zinamev</i> .
Cyanide of iron,	<i>Ferramern</i> .		Cyanide of magnesium,	<i>Magamern</i> .

## TRIAD TYPE.

Fluoride of arsenic,	<i>Arsamif</i> .		Chloride of antimony,	<i>Stibamid</i> .
Bromide of gold,	<i>Auramib</i> .		Iodide of bismuth,	<i>Bisamiv</i> .
Bromide of nitrogen,	<i>Anib</i> .		Solid chloride of cyanogen,	<i>Irnid</i> .
Fluoride of boron,	<i>Ajif</i> .		Bromide of boron,	<i>Ajib</i> .

## TETRAD TYPE.

Perfluoride of titanium,	<i>Titamof</i> .		Perchloride of tin,	<i>Stannamod</i> .
Perbromide of tellurium,	<i>Tellamob</i> .		Periodide of platinum,	<i>Platamov</i> .
Perchloride of tantalum,	<i>Tanamod</i> .		Percyanide of palladium,	<i>Pallamorn</i> .

## PENTAD TYPE.

Pentachloride of antimony,	<i>Stibamud</i> .		Quinqueiodide of arsenic?	<i>Arsamuv</i> .
Pentabromide of phosphorus,	<i>apud</i> .		Quinquebromide of iodine,	<i>avub</i> .
Quinqueiodide of tetraethyl-ammonium,	<i>echalomanuv</i> .			

## HEXAD TYPE.

Perfluoride of vanadium,	<i>Vanameaf</i> .		Periodide of tellurium,	<i>Tellameav</i> .
Perchloride of molybdenum,	<i>Molamead</i> .		Perfluoride of chromium,	<i>Chrameaf</i> .
Perbromide of tungsten,	<i>Wolameab</i> .		Perfluoride of silicon,	<i>Akeaf</i> .
Perfluoride of selenium,	<i>Azeaf</i> .		Perbromide of silicon,	<i>Akeab</i> .

## SUBTYPE, OR RADICAL TYPE.

Chloride of aluminium,	<i>Alemead</i> .		Perchloride of iron,	<i>Ferreamead</i> .
Perchloride of cerium,	<i>Ceremead</i> .		Perfluoride of ruthenium,	<i>Ruthemeaf</i> .
Perfluoride of glucinum,	<i>Glucemeaf</i> .		Chloride of osmium,	<i>Osamead</i> .

## HEPTAD TYPE.

Perchloride of manganese,	<i>Manameed</i> .	Perfluoride of manganese,	<i>Manameef</i> .
---------------------------	-------------------	---------------------------	-------------------

The sulphides, selenides and tellurides resemble in constitution the oxides. From nearly 300 well-known sulphides, the following are selected :

Sulphuretted hydrogen,	<i>elas</i> .	Persulphide of hydrogen,	<i>elus</i> .
Bisulphide of carbon,	<i>ares</i> .	Bisulphide of nitrogen,	<i>enes</i> .
Monosulphide of potassium (old name) KS = K <sub>2</sub> S.			<i>Kalemas</i> .
Monosulphide of mercury (cinnabar).			<i>Mercmas</i> or <i>Hygamas</i> .
Bisulphide of iron (pyrites),			<i>Ferrames</i> .
Tersulphide of gold,			<i>Auramis</i> .
Quadrisulphide of molybdenum,			<i>Molamos</i> .
Pentasulphide of antimony,			<i>Antamus</i> or <i>Stibamus</i> .
Sesquisulphide of rhodium,			<i>Rhodemis</i> .
A magnetic iron pyrites (with no systematic name), Fe <sub>3</sub> S <sub>4</sub> ,			<i>Ferrimos</i> .
Another variety of pyrites, Fe <sub>7</sub> S <sub>8</sub> (no name),			<i>Ferreeneis</i> .

The next table contains the known combinations of oxygen with sulphur, forming oxides and acids :

Sulphurous anhydride,	<i>aset.</i>	Hyposulphurous acid,	<i>elesit.</i>
Sulphurous acid,	<i>elasit.</i>	Hyposulphuric acid,	<i>eleseat.</i>
Sulphuric anhydride,	<i>asit.</i>	Trithionic acid,	<i>eliseat.</i>
Nordhausen sulphuric acid,	<i>aleseat.</i>	Tetrathionic acid,	<i>eloseat.</i>
Sulphuric acid (oil of vitriol),	<i>elasot.</i>	Pentathionic acid,	<i>eluseat.</i>
Trithionic anhydride,	<i>isut.</i>		

In these acids or salts of hydrogen, *el* may be replaced by a dyad metal, or, atom for atom, by a monad metal, thus forming metallic salts.

From nearly 700 known varieties of sulphates, the following are selected :

Sulphate of protoxide of iron,	<i>fermasot.</i>	Sulphate of copper,	<i>cupmasot.</i>
Sulphate of magnesia,	<i>magmasot.</i>	Sulphate of baryta,	<i>barmasot.</i>
Sulphate of soda,	<i>natemasot.</i>	Sulphate of lithium.	<i>lithemasot.</i>

Of nearly 200 sulphites, only two will be mentioned :

Sulphite of cerium,	<i>cermasit.</i>	Sulphite of potash,	<i>kalemasit.</i>
---------------------	------------------	---------------------	-------------------

From nearly 200 carbonates, only the following are selected :

Carbonate of lime,	<i>calcmarit.</i>	Carbonate of magnesia,	<i>magmarit.</i>
Carbonate of soda,	<i>natemarit.</i>	Bicarbonate of soda,	<i>natmalarit.</i>

Of 300 oxalates, only two are here cited :

Oxalate of baryta,	<i>barmerot.</i>	Salt of sorrel,	<i>potmalerot.</i>
--------------------	------------------	-----------------	--------------------

From 100 varieties of silicates, only the following will be noted :

Silicate of alumina (sillimanite),	$\text{Al}_2\text{SiO}_5$ ,	<i>alemakut.</i>	
Silicate of alumina (kaolin),	$\text{Al}_2\text{Si}_2\text{O}_7$ ,	<i>alemekeet.</i>	
Silicate of potash,	<i>potemakit.</i>	Silicate of lime,	<i>calcmakit.</i>
Silicate of magnesia,	<i>magmakit.</i>		

From about 50 nitrites, only two are presented :

Nitrite of soda,	<i>sodmanet.</i>	Nitrite of strontia,	<i>stronmenot.</i>
------------------	------------------	----------------------	--------------------

From 400 varieties of nitrates, the following are selected :

Nitrate of potash,	<i>kalmanit.</i>	Nitrate of silver,	<i>argmanit.</i>
Nitrate of uranium,	<i>urmeneat.</i>	Protonitrate of iron,	<i>fermeneat.</i>
Nitrate of sesquioxide of iron,	$\text{Fe}_2\text{O}_3 \cdot \text{N}_2\text{O}_{15}$ ,	<i>ferremanoot.</i>	

Of 370 phosphates, only the following :

Triphosphate of lime (in bones),	$\text{Ca}_3\text{P}_2\text{O}_8$ ,	<i>calcimepeit.</i>
Acid or Superphosphate of lime,	$\text{CaH}_2\text{P}_3\text{O}_8$ ,	<i>calcmelepeit.</i>
Bibasic phosphate of lime,	$\text{CaHP}_2\text{O}_8$ .	<i>calcmalepeit.</i>

From 90 sulphocyanides, only one will be mentioned :

Sulphocyanide of mercury,	$\text{HgCy}_2\text{S}$ ,	<i>mercmernas.</i>
---------------------------	---------------------------	--------------------

A few other terminals of salts may be thus briefly enumerated, a monad metal being denoted by *am* :

210 tartrates,	<i>em-orleat.</i>	40 chlorates have the terminal <i>amadiit.</i>
60 molates,	<i>em-orlut.</i>	60 iodates have the terminal <i>amaviv.</i>
100 citrates,	<i>im-earuleet.</i>	330 chlorhydrates have the prefix <i>ald.</i>
120 chromates,	<i>em-chramot.</i>	50 bromhydrates have the prefix <i>alb.</i>
270 chloroplatinates,	<i>am-platamid.</i>	100 iodhydrates have the prefix <i>alv.</i>

Ferro-cyanhydrates or -cyanides, *em-ferramirn.*  
 Ferri-cyanhydrates or -cyanides, *im-ferremearn.*

The monad radicals forming the largest class of alcohols, and the corresponding monad radicals of the fatty-acid series, are in the next table placed side by side :

ALCOHOL-FORMING RADICALS,			ACID-FORMING RADICALS.		
Methyl,	$\text{CH}_3 = \text{CH}_2\text{H}$ ,	<i>achal.</i>	Formyl,	$\text{COH}$ ,	<i>artal.</i>
Ethyl,	$\text{C}_2\text{H}_5 = \text{C}_2\text{H}_4\text{H}$ ,	<i>echal.</i>	Acetyl,	$\text{COCH}_3$ ,	<i>artachal.</i>
Propyl,	$\text{C}_3\text{H}_7 = \text{C}_3\text{H}_6\text{H}$ ,	<i>ichal.</i>	Propionyl,	$\text{COC}_2\text{H}_5$ ,	<i>arteachal.</i>
Butyl,	$\text{C}_4\text{H}_9 = \text{C}_4\text{H}_8\text{H}$ ,	<i>ochal.</i>	Butyryl,	$\text{COC}_3\text{H}_7$ ,	<i>artichal.</i>
Amyl,	$\text{C}_5\text{H}_{11} = \text{C}_5\text{H}_{10}\text{H}$ ,	<i>uchal.</i>	Valeryl,	$\text{COC}_4\text{H}_9$ ,	<i>artochal.</i>
Caproyl,	$\text{C}_6\text{H}_{13} = \text{C}_6\text{H}_{12}\text{H}$ ,	<i>eachal.</i>	Caproylyl,	$\text{COC}_5\text{H}_{11}$ ,	<i>artuchal.</i>
Enanthyl,	$\text{C}_7\text{H}_{15} = \text{C}_7\text{H}_{14}\text{H}$ ,	<i>eeachal.</i>	Enanthoyl,	$\text{COC}_6\text{H}_{13}$ ,	<i>arteeachal.</i>
Capryl,	$\text{C}_8\text{H}_{17} = \text{C}_8\text{H}_{16}\text{H}$ ,	<i>eichal.</i>	Caprylyl,	$\text{COC}_7\text{H}_{15}$ ,	<i>arteeachal.</i>
Wanting.			Pelargonyl,	$\text{COC}_8\text{H}_{17}$ ,	<i>arteichal.</i>
"			Rutyl,	$\text{COC}_9\text{H}_{19}$ ,	<i>arteochal.</i>
"			Enodilyl,	$\text{COC}_{10}\text{H}_{21}$ ,	<i>arteuchal.</i>
Lauryl,	$\text{C}_{12}\text{H}_{25} = \text{C}_{12}\text{H}_{24}\text{H}$ ,	<i>yechal.</i>	Laurilyl,	$\text{COC}_{11}\text{H}_{23}$ ,	<i>artaxachal.</i>
Wanting.			Cocciyl,	$\text{COC}_{12}\text{A}_{23}$ ,	<i>artaxeachal.</i>
"			Meristyl,	$\text{COC}_{13}\text{H}_{27}$ ,	<i>artaxichal.</i>
"			Benyl,	$\text{COC}_{14}\text{H}_{29}$ ,	<i>artaxochal.</i>
Cetyl,	$\text{C}_{16}\text{H}_{33} = \text{C}_{16}\text{H}_{32}\text{H}$ ,	<i>yeachal.</i>	Palmityl,	$\text{COC}_{15}\text{H}_{31}$ ,	<i>artaxuchal.</i>
Wanting.			Margaryl,	$\text{COC}_{16}\text{H}_{33}$ ,	<i>artaxeeachal.</i>
"			Stearyl,	$\text{COC}_{17}\text{H}_{35}$ ,	<i>artaxeeeachal.</i>
"			Balenyl,	$\text{COC}_{18}\text{H}_{37}$ ,	<i>artaxeichal.</i>
"			Arachidyl,	$\text{COC}_{19}\text{H}_{39}$ ,	<i>artaxeochal.</i>
"			Nardyl,	$\text{COC}_{20}\text{H}_{41}$ ,	<i>artaxeuchal.</i>
Ceryl,	$\text{C}_{27}\text{H}_{55} = \text{C}_{27}\text{H}_{54}\text{H}$ ,	<i>weeachal.</i>	Cerotyl,	$\text{COC}_{26}\text{H}_{53}$ ,	<i>artexeeachal.</i>
Melissyl,	$\text{C}_{30}\text{H}_{61} = \text{C}_{30}\text{H}_{60}\text{H}$ ,	<i>weuchal.</i>	Melissilyl,	$\text{COC}_{29}\text{H}_{59}$ ,	<i>artexeeachal.</i>

In the acid-forming series, the presence of *art'* makes the sum of the increments of *ach'* one less than in the corresponding alcohol-forming radical.

An alcohol formed on the dyad type, like water, contains one monad radical, and the corresponding ether two. Two examples of each will suffice to show the manner of illustrating by the new characters their typical form :

ALCOHOLS.		
Hydrate of methyl or Wood spirit,	} <i>Achal</i>	} <i>at = Achelat.</i>
Hydrate of ethyl or Common alcohol,	} <i>Echal</i>	} <i>at = Echelat.</i>
ETHERS.		
Methylic oxide or Methylic ether,	} <i>Achal</i>	} <i>at = Achalemat.</i>
Ethylic oxide or Ethylic ether,	} <i>Echal</i>	} <i>at = Echalemat.</i>

The sulphhydrates and sulphides of such radicals have structures similar to these alcohols and ethers. The following table of names shows the compound containing oxygen, and the corresponding compound containing sulphur :

	ALCOHOLS.	MERCAPTANS.	ETHERS.	SULPHIDES.
1. Methylic	<i>Achelat.</i>	<i>Achelas.</i>	<i>Achalemat.</i>	<i>Achalemas.</i>
2. Ethylic	<i>Echelat.</i>	<i>Echelas.</i>	<i>Echalemat.</i>	<i>Echalemas.</i>
3. Propylic	<i>Ichelat.</i>	<i>Ichelas.</i>	<i>Ichalemat.</i>	<i>Ichalemas.</i>
4. Butylic	<i>Ochelat.</i>	<i>Ochelas.</i>	<i>Ochalemat.</i>	<i>Ochalemas.</i>
5. Amylic	<i>Uchelat.</i>	<i>Uchelas.</i>	<i>Uchalemat.</i>	<i>Uchalemas.</i>
6. Caproylic	<i>Echelat.</i>	<i>Echelas.</i>	<i>Echalemat.</i>	<i>Echalemas.</i>
7. Enanthylic	<i>Echelat.</i>	<i>Echelas.</i>	<i>Echalemat.</i>	<i>Echalemas.</i>
8. Caprylic	<i>Eichelat.</i>	<i>Eichelas.</i>	<i>Eichalemat.</i>	<i>Eichalemas.</i>

As a specimen of the new names of more than 500 compounds containing an alcohol-forming radical, a few combinations with the most important Ethyl, *echal*, are presented :

Fluoride of ethyl,	<i>echalf.</i>	Chloride of ethyl,	<i>echald.</i>
Bromide of ethyl,	<i>echalb.</i>	Iodide of ethyl,	<i>echalv.</i>
Cyanide of ethyl,	<i>echalarn.</i>	Hydride of ethyl,	<i>echel.</i>
Acetate of ethyl,	$C_2H_5-COCH_3-O_2,$		<i>echal-artachalt.</i>
Monethylic oxalate,	$C_2H_5-H-C_2O_2O_2,$		<i>echelerot.</i>
Diethylic oxalate.	$(C_2H_5)^2-C_2O_2O_2,$		<i>echalemerot.</i>
Methyl-ethylic ether,	$CH_3 + C_2H_5-O,$		<i>achal-echalt.</i>
Methyl-amyllic ether,	$CH_3 + C_5H_{11}O,$		<i>achal-uchalt.</i>
Ethyl-butylic ether,	$C_2H_5 + C_4H_9O,$		<i>echal-ochalt.</i>
Ethyl-amyllic ether,	$C_2H_5 + C_5H_{11}O,$		<i>echal-uchalt.</i>

Acid-forming radicals form anhydrides, corresponding in structure with simple ethers; and hydrates (acids) corresponding with alcohols. Examples of the names of acids of this class are here given: for the first term *al*, *l* is used to shorten the word.

Formic acid,	H-COH-O,	<i>Lartalt</i>	= <i>achet.</i>
Acetic acid,	H-COCH <sub>3</sub> -O,	<i>Lartachalt</i>	= <i>echet.</i>
Propionic acid,	H-COC <sub>2</sub> H <sub>5</sub> -O,	<i>Lartechalt</i>	= <i>ichet.</i>
Butyric acid,	H-COC <sub>3</sub> H <sub>7</sub> -O,	<i>Lartichalt</i>	= <i>ochet.</i>
Valeric acid,	H-COC <sub>4</sub> H <sub>9</sub> -O,	<i>Lartochalt</i>	= <i>uchet.</i>
Caproic acid,	H-COC <sub>5</sub> H <sub>11</sub> -O,	<i>Lartuchalt</i>	= <i>eatchet.</i>
Capnanthylic acid,	H-COC <sub>6</sub> H <sub>13</sub> -O,	<i>Lartechalt</i>	= <i>echet.</i>
Caprylic acid,	H-COC <sub>7</sub> H <sub>15</sub> -O,	<i>Larteechalt</i>	= <i>eichet.</i>
Pelargonic acid,	H-COC <sub>8</sub> H <sub>17</sub> -O,	<i>Larteichalt</i>	= <i>eochet.</i>
Rutilic acid,	H-COC <sub>9</sub> H <sub>19</sub> -O,	<i>Larteochalt</i>	= <i>euchet.</i>

Other combinations containing an acid-forming radical, which have been or may yet be formed, are illustrated by the names of compounds containing *artachal* (acetyl).

Chloride of acetyl,	<i>artachald.</i>	Bromide of acetyl,	<i>artachalb.</i>
Aldehyde,	<i>artachel.</i>	Acetic anhydride,	<i>artachalemät</i>
Sulphhydrate of acetyl,	<i>lartachals.</i>	Sulphide of acetyl,	<i>artachalemäs.</i>
Hydrate of chloracetyl,	<i>lartachadat.</i>	Hydrate of bromacetyl,	<i>lartachabat.</i>
Hydride of tribromacetyl,	<i>artacibel.</i>	Chloride of trichloracetyl,	<i>artacod.</i>

Twenty-two other radicals, similar to *artachal*, may form hundreds of compounds by uniting with electro-negative elements.

ACETONES or KETONES, composed of an acid-forming radical and an alcohol-forming radical, have the constitution of the monad type. Of the fifteen bodies now known, seven are here cited :

Methyl-acetyl (Acetone),	$CH_3, C_2H_5O,$	<i>achal-artachal.</i>
Methyl-butyryl,	$CH_3, C_4H_7O,$	<i>achal-artichal.</i>
Methyl-valyl,	$CH_3, C_5H_9O,$	<i>achal-artochal.</i>
Ethyl-propionyl (Propione),	$C_2H_5, C_3H_5O,$	<i>echal-artechal.</i>
Ethyl-butyryl,	$C_2H_5, C_4H_7O,$	<i>echal-artichal.</i>
Propyl-butyryl (Butyrone),	$C_3H_7, C_4H_7O,$	<i>ichal-artichal.</i>
Butyl-valyl (Valerone),	$C_4H_9, C_5H_9O,$	<i>ochal-artochal.</i>

In the following hydrocarbon homologous series, formed by multiples of *ach* and known as the olefiant-gas series, one atom of carbon saturates but two atoms of hydrogen, the equivalence being thus expressed:  $ar \rightleftharpoons el$ . These bodies are dyads, each taking the place of two atoms of hydrogen in the water type.

Methylene (not yet isolated),	} CH <sub>2</sub> , C <sub>3</sub> H <sub>6</sub> , C <sub>6</sub> H <sub>10</sub> , C <sub>7</sub> H <sub>14</sub> , C <sub>9</sub> H <sub>18</sub> ,	} <i>arlat.</i> <i>irlil.</i> <i>urlul.</i> <i>eerleel.</i> <i>eorleol.</i>	Ethylene or	} C <sub>2</sub> H <sub>4</sub> , C <sub>4</sub> H <sub>8</sub> , C <sub>6</sub> H <sub>12</sub> , C <sub>8</sub> H <sub>16</sub> , C <sub>10</sub> H <sub>20</sub> ,	} <i>erlel.</i> <i>orlol.</i> <i>earleal.</i> <i>eirleil.</i> <i>eurleul.</i>
Propylene,			Butylene (Oil gas),		
Amylene,			Caprolyene,		
Enanthylene,			Caprylene,		
Elaene,			Paramylene,		

This series unite with dyads, and also with two atoms of a monad, of which the annexed are specimens :

Oxide of ethylene	or Glycolic ether,	<i>erlelat</i> or <i>echat.</i>
Oxide of propylene	or Propyl-glycolic ether,	<i>irlilat</i> or <i>ichat.</i>
Oxide of butylene	or Butyl-glycolic ether,	<i>orlolat</i> or <i>ochat.</i>
Oxide of amylen	or Amyl-glycolic ether,	<i>urlulat</i> or <i>uchat.</i>
Hydrate of ethylene	or Ethylic glycol,	<i>erlelelt</i> or <i>echelt.</i>
Hydrate of propylene	or Propylic glycol,	<i>irlilelt</i> or <i>ichelt.</i>
Hydrate of butylene	or Butylic glycol,	<i>orlolelt</i> or <i>ochelt.</i>
Hydrate of amylen	or Amylic glycol,	<i>urlulelt</i> or <i>uchelt.</i>

The hydrate of glyceryl, [C<sub>3</sub>H<sub>5</sub>-H<sub>3</sub>]O<sub>3</sub> = *echarlilt*, is a triad alcohol. If *il*, the second term, is replaced by three atoms of the monad *anet* = *ineat*, the interesting explosive compound Nitroglycerine is formed, the three terms of the type being [*echarl-ineat*]*it* = *echarlineot*. On the other hand, if *il* in *echarlilt* be replaced by three atoms of the monad-acid radical COC<sub>17</sub>H<sub>35</sub>, *artaxeechal*, the compound known as Tristearin is formed, containing . . . . . C<sub>67</sub>H<sub>110</sub>O<sub>6</sub> = *uxuchereat*. In like manner, only two or one atom of hydrogen may be replaced by two or one atom of the acid-radical.

Artificial fats have been formed by the action of acids on glycerin, *echarlilt*; and the following from among the glycerides are presented, with their new empirical names :

Monacetin,	C <sub>6</sub> H <sub>10</sub> O <sub>4</sub> ,	<i>uchot.</i>	Monolein,	C <sub>21</sub> H <sub>40</sub> O <sub>4</sub> ,	<i>axeucharot.</i>
Monobutyryn,	C <sub>7</sub> H <sub>14</sub> O <sub>4</sub> ,	<i>eechot.</i>	Monopalmitin,	C <sub>19</sub> H <sub>38</sub> O <sub>4</sub> ,	<i>axeechot.</i>
Monovalerin,	C <sub>8</sub> H <sub>16</sub> O <sub>2</sub> ,	<i>eichot.</i>	Monostearin,	C <sub>21</sub> H <sub>42</sub> O <sub>2</sub> ,	<i>exachot.</i>

That modification of sugar known as glucose or starch sugar, C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>, has lately been regarded by some chemists as a hexatomic or hexad alcohol. According to this view, its new name is *earlealt*. There are about thirty varieties of sugars and gums of nearly the same composition, to which new names should not be given until there is a general agreement among chemists as to their composition and constitution.

Artificial alkaloids, or compound ammonias of WURTZ and HOFMANN, formed on the triad or ammonia type [*al-al-al*]*an*, in which an atom of hydrogen is replaced by a radical, are thus illustrated :

METHYLAMINE.	ETHYLAMINE.	AMYLAMINE.	PHENYLAMINE.
<i>achal</i> } <i>al</i> } <i>an</i> , <i>al</i> }	<i>echal</i> } <i>al</i> } <i>an</i> , <i>al</i> }	<i>uchal</i> } <i>al</i> } <i>an</i> , <i>al</i> }	(Aniline). <i>earolal</i> } <i>al</i> } <i>an</i> , <i>al</i> }
<i>achilan.</i>	<i>echilan.</i>	<i>uchilan.</i>	<i>earolilan</i> or <i>eareelan.</i>
DIMETHYLAMINE.	DIETHYLAMINE.	DIAMYLAMINE.	DIPHENYLAMINE.
<i>achal</i> } <i>achal</i> } <i>an</i> , <i>al</i> }	<i>echal</i> } <i>echal</i> } <i>an</i> , <i>al</i> }	<i>uchal</i> } <i>al</i> } <i>an</i> , <i>al</i> }	<i>earolal</i> } <i>earolal</i> } <i>an</i> , <i>al</i> }
<i>achalemalan.</i>	<i>echalemalan.</i>	<i>uchalemalan.</i>	<i>earulemalan.</i>

TRIMETHYLAMINE.	TRIETHYLAMINE.	TRIAMYLAMINE.	TRIPHENYLAMINE.
<i>achal</i> } <i>achal</i> } <i>an</i> , <i>achal</i> } <i>achaliman</i> .' }	<i>echal</i> } <i>echal</i> } <i>an</i> , <i>echal</i> } <i>echaliman</i> .	<i>uchal</i> } <i>uchal</i> } <i>an</i> , <i>uchal</i> } <i>uchaliman</i> .	<i>earolal</i> } <i>earolal</i> } <i>an</i> , <i>earolal</i> } <i>earuliman</i> .

Three different radicals may be found in the same compound. To denote this, requires names somewhat longer than the preceding: thus,

Methyl-ethyl-phenylamine,  $[\text{CH}_3\text{-C}_2\text{H}_5\text{-C}_6\text{H}_5]\text{N}$ , is *achal-echal-earulan*.  
Diethyl-chloro-phenylamine,  $[(\text{C}_2\text{H}_5)_2\text{C}_6\text{H}_4\text{Cl}]\text{N}$ , is *echalem-earoladan*.

Other triad elements form similar compounds. From the tertiary derivations are selected the following two:

Bromide of bromethyl-triethyl-phosphonium = *echeb-echalimap*.  
Bromide of ethylene-hexethyl-diphosphonium = *echeb-echaleamep*.

Some of the denser molecules of hydrocarbons are here presented:

Cetylene = $\text{C}_{16}\text{H}_{32}$ , <i>yeach</i> .	Melissylic alcohol = $\text{C}_{30}\text{H}_{62}\text{O}$ , <i>weuchelat</i> .
Cetylic alcohol = $\text{C}_{16}\text{H}_{34}\text{O}$ , <i>yeachelat</i> .	Spermaceti (pure) = $\text{C}_{32}\text{H}_{64}\text{O}_2$ , <i>irechet</i> .
Cerene (paraffin) = $\text{C}_{27}\text{H}_{56}$ , <i>weech</i> .	Myrcin = $\text{C}_{16}\text{H}_{32}\text{O}_2$ , <i>ozeachet</i> .
Cerylic alcohol = $\text{C}_{27}\text{H}_{58}\text{O}$ , <i>weechelat</i> .	Chinese wax = $\text{C}_{64}\text{H}_{130}\text{O}_2$ , <i>uxochet</i> .
Melene (paraffin) = $\text{C}_{30}\text{H}_{60}$ , <i>weach</i> .	

Combinations of metals with alcohol-forming radicals, or metallic derivatives of alcohols:

Kakodyl (auct. BUNSEN),	$\text{As}(\text{CH}_3)_2$ , <i>Arsmereal</i> or <i>achalem-arsam</i> .
Arsenio-monomethyl (auct. BAEYER),	$\text{AsCH}_3$ , <i>Arsmaril</i> or <i>achal-arsam</i> .
Arsenio-trimethyl,	$\text{As}(\text{CH}_3)_3$ , <i>Arsmireol</i> or <i>achalim-arsam</i> .
Arsenio-tetramethyl, <sup>1</sup>	$\text{As}(\text{CH}_3)_4$ , <i>Arsmoroil</i> or <i>achalom-arsam</i> .
Quadrichloride of arsenio-monomethyl,	$\text{AsCH}_2\text{Cl}$ , <i>Arsmarilod</i> or <i>achal-arsamod</i> .
Triethyl-bismuthene,	$(\text{C}_2\text{H}_5)_3\text{Bi}$ , <i>echalim-bisam</i> .
Trimethyl-stibio,	$(\text{CH}_3)_3\text{Sb}$ , <i>Stibmareol</i> or <i>achalim-stibam</i> .
Stibio-tetramethylum,	$(\text{CH}_3)_4\text{Sb}$ , <i>achalom-stibam</i> .
Chloride of stibio-tetramethylum,	$(\text{CH}_3)_4\text{SbCl}$ , <i>achalom-stibmad</i> .
Oxide of stibio-tetramethylum,	$(\text{CH}_3)_4\text{SbO}$ , <i>achaleim-stibemat</i> .
Nitrate of stibio-tetramethylum,	$(\text{CH}_3)_4\text{SbNO}_3$ , <i>achalom-stibmanit</i> .
Neutral Sulphate of stibio-tetramethylum,	<i>achaleim-stibemasot</i> .
Zinc-dimethyl,	$(\text{CH}_3)_2\text{Zn}$ , <i>Zinmereal</i> or <i>achalem-zinam</i> .
Zinc-diethyl,	$(\text{C}_2\text{H}_5)_2\text{Zn}$ , <i>echalem-zinam</i> .
Zinc-diamyl,	$(\text{C}_6\text{H}_{11})_2\text{Zn}$ , <i>uchalem-zinam</i> .
Cadmium-diethyl,	$(\text{C}_2\text{H}_5)_2\text{Cd}$ , <i>echalem-cadam</i> .
Magnesium-diethyl,	$(\text{C}_2\text{H}_5)_2\text{Mg}$ , <i>echalem-magam</i> .
Stannic ethide,	$(\text{C}_2\text{H}_5)_4\text{Sn}$ , <i>echalom-stannam</i> .
Plumbo-tetraethyl,	$(\text{C}_2\text{H}_5)_4\text{Pb}$ , <i>echalom-plubam</i> .
Hydrargo-dimethyl,	$(\text{CH}_3)_2\text{Hg}$ , <i>achalem-hygam</i> .

From the products of destructive distillation, the following homologous series is selected, which must be recognized principally by the first syllable denoting the amount of carbon; for by substitutions and combinations, the hydrogen of these bodies may all be displaced, and numerous compounds formed which are indicated by terms having no part of the original name except that defining the carbon.

Benzol or Benzene, or Hydride of phenyl, $\text{C}_6\text{H}_6$	<i>earl</i> or <i>earolel</i> .
Toluol, $\text{C}_7\text{H}_8$	<i>eerealel</i> , $\text{C}_8\text{H}_{10}$ , <i>eirlel</i> .
Cumol, $\text{C}_9\text{H}_{12}$	<i>eereulel</i> , $\text{C}_{10}\text{H}_{14}$ , <i>euoilel</i> .

Compounds related to the first body only of this series will be noted :

The Hydride of phenyl,  $C_6H_6$ , *earolel*, is formed on the monad type.

Chloride of phenyl or Monochloride of benzene, is *earolald*; and

Bromide of phenyl or Monobromide of benzene, *earolalb*.

The Hydrate of phenyl, better known as Carbohic or Phenic acid, sometimes called Phenic alcohol and Phenol, has the empirical name of *earlat*. As an alcohol, its new name would be *earolelat*; as an acid, *learolalt*. Its relation with aniline will be recognized by the empirical name of aniline (as well as of picodine), *earuelan*, the typical name being *earolilan*; or if the radical is expressed in two syllables, *earulelan*, i. e. Monophylamine; thus Triphenylamine is expressed by *earuliman*.

In the following table are embraced the known dyad homologues of the carbonic-acid and the oxalic-acid series, formed by the increment *ach* :

Carbonic acid (hypothetical hydrate),	$H_2CO_3$ ,	<i>el-arit</i> .
Glycolic acid,	$C_2H_4O_3 = H_2 CH_2 CO_3$ ,	<i>el-acharit</i> .
Lactic acid,	$C_3H_6O_3 = H_2 C_2H_4 CO_3$ ,	<i>el-echarit</i> .
Butilactic acid,	$C_4H_8O_3 = H_2 C_3H_6 CO_3$ ,	<i>el-icharit</i> .
Phocic acid,	$C_6H_{10}O_3 = H_2 C_4H_8 CO_3$ ,	<i>el-ocharit</i> .
Leucic acid,	$C_8H_{12}O_3 = H_2 C_6H_{10} CO_3$ ,	<i>el-ucharit</i> .
Oxalic acid,	$H_2C_2O_4$ ,	<i>el-erot</i> .
Malonic acid,	$C_3H_4C_4 = H_2 CH_2 C_2O_4$ ,	<i>el-acherot</i> .
Succinic acid,	$C_4H_6O_4 = H_2 C_2H_4 C_2O_4$ ,	<i>el-echerot</i> .
Pyrotartaric acid,	$C_5H_8O_4 = H_2 C_3H_6 C_2O_4$ ,	<i>el-icherot</i> .
Adiptic acid,	$C_6H_{10}O_4 = H_2 C_4H_8 C_2O_4$ ,	<i>el-ocherot</i> .
Pimelic acid,	$C_7H_{12}O_4 = H_2 C_5H_{10} C_2O_4$ ,	<i>el-ucherot</i> .
Suberic acid,	$C_8H_{14}O_4 = H_2 C_6H_{12} C_2O_4$ ,	<i>el-eacherot</i> .
Anchoic acid,	$C_9H_{16}O_4 = H_2 C_7H_{14} C_2O_4$ ,	<i>el-echerot</i> .
Sebacic acid,	$C_{10}H_{18}O_4 = H_2 C_8H_{16} C_2O_4$ ,	<i>el-eicherot</i> .

The substitution of a dyad metal, or two atoms of a monad metal, for *el* in this series, will form the corresponding metallic salts.

In a similar manner may be classified alkaloids; for instance, those obtained by dry distillation of animal matter :

Pyridine,	$C_5H_5N$ ,	<i>urlan</i> .
Picoline,	$C_6H_7N = CH_2 C_5H_5N$ ,	<i>achurlan</i> .
Lutidine,	$C_7H_9N = (CH_2)^2 C_5H_5N$ ,	<i>echurlan</i> .
Collidine,	$C_8H_9N = (CH_2)^3 C_5H_5N$ ,	<i>ichurlan</i> .
Pavoline,	$C_9H_{10}N = (CH_2)^4 C_5H_5N$ ,	<i>ochurlan</i> .

**Substitutions.** DUMAS'S doctrine of substitutions is very clearly set forth in the following examples

- Marsh gas = *arol*. Chloride of methyl (*achald*) = *arild*.  
 Monochlorinated chloride of methyl, *areld*.  
 Dichlorinated chloride of methyl (chloroform), *arlid*.  
 Perchlorinated chloride of methyl, *arod*.
- Ethylene, *erel*. Chlorinated ethylene, *erlald*.  
 Dichlorinated ethylene,  $C_2H_2Cl_2$ , *erled*.  
 Trichlorinated ethylene,  $C_2HCl_3$ , *ervalid*.  
 Perchlorinated ethylene,  $C_2Cl_4$ , *erod*.
- The action of chlorine on ethylene and chloride of ethyl produces metameric compounds having widely different boiling points, thus distinguished :  
 { Dichloride of ethylene (Dutch liquid),  $C_2H_3 HCl_2$ , = *erled*.  
 { Monochloretted chloride of ethyl,  $C_2H_4 ClCl$ , = *eched*.  
 { Monochlorinated ethylene,  $C_2H_3 ClCl_2$ , = *erlald*.  
 { Dichlorinated chloride of ethyl,  $C_2H_3 Cl_3$ , = *ecilid*.  
 { Dichlorinated ethylene,  $C_2H_2 Cl_2Cl_2$ , = *erlod*.  
 { Trichlorinated chloride of ethyl,  $C_2H_2 Cl_4$ , = *eclod*.  
 { Trichlorinated ethylene,  $C_2H Cl_2Cl_3$ , = *eralud*.  
 { Tetrachlorinated chloride of ethyl,  $C_2H Cl_5$ , = *ecalud*.  
 { Perchlorinated ethylene,  $C Cl_4Cl_2$ , = *eread*.  
 { Perchlorinated chloride of ethyl,  $C_2 Cl_6$ , identical with *eread*.

4. Naphthalene, $C_{10}H_8$ , <i>eureil</i> .	(Paranaphthaline, $C_{14}H_{10}$ , <i>yoreul</i> .)	
Chloronaphthaline, <i>eurelad</i> .	Bromonaphthaline,	<i>eurelab</i> .
Dichloronaphthaline, <i>eureled</i> .	Dibromonaphthaline,	<i>eurealeb</i> .
Trichloronaphthaline, <i>eurelid</i> .	Tribromonaphthaline,	<i>eurelib</i> .
Tetrachloronaphthaline, <i>eurold</i> .	Tetrabromonaphthaline,	<i>euroleb</i> .
Hexachloronaphthalene, <i>eurelead</i> .	Perchloronaphthaline,	<i>eureid</i> .

5. CHLORIDES and BROMIDES of NAPHTHALINE, with Gmelin's names and formulæ:

Hydrochlorate of chloronaphthaline,	$C_{10}H_7Cl$ HCl.	= <i>eureiled</i> .
Hydrochlorate of chlorobromonaphthaline,	$C_{10}H_6BrCl$ HCl	= <i>eureleabed</i> .
Hydrobromate of quadribromonaphthaline,	$C_{10}H_4Br_4$ HBr	= <i>eurelb</i> .
Bihydrochlorate of bichloronaphthaline,	$C_{10}H_6Cl_2$ 2 HCl	= <i>eureilod</i> .
Bihydrochlorate of bromochloronaphthaline,	$C_{10}H_5BrCl$ 2 HCl	= <i>eureilabid</i> .
Bihydrochlorate of terchloronaphthaline,	$C_{10}H_4Cl_3$ 2 HCl	= <i>eureelud</i> .
Bihydrochlorate of quadrichloronaphthaline,	$C_{10}H_3Cl_4$ 2 HCl	= <i>eureald</i> .
Bihydrochlorate of bibromobichloronaphthaline,	$C_{10}H_4Br_2Cl_2$ 2 HCl	= <i>eurealebod</i> .
Bihydrobromate of bibromobichloronaphthaline,	$C_{10}H_4Br_2Cl_2$ 2 HBr	= <i>eurealedob</i> .
Bihydrobromate of terbromochloronaphthaline,	$C_{10}H_4Br_3Cl$ 2 HBr	= <i>eurealadub</i> .
Bihydrobromate of quadribromonaphthaline,	$C_{10}H_4Br_4$ 2 HBr	= <i>eurealb</i> .
Bihydrochlorate of bibromoterchloronaphthaline,	$C_{10}H_5Br_2Cl_2$ 2 HCl	= <i>eureulebod</i> .
Bihydrobromate of pentabromonaphthaline,	$C_{10}H_3Br_5$ 2 HBr	= <i>eureuleeb</i> .

**Isomerism.** By applying the principle of permutation in the arrangement of letters, the same name is never given to metameric bodies having the same ultimate composition. A few examples will sufficiently prove the adaptation of the new system to cases of isomerism. Each of the following ten bodies has the empirical formula  $C_{10}H_{20}O_2$  :

Rutic or Capric acid,	H CO $C_9H_{19}O$ ,	<i>Larteochoalt</i> .
Formiate of elayl,	$C_9H_{19}$ CO HO,	<i>eochoal-artalt</i> .
Acetate of capryl,	$C_8H_{17}$ CO $CH_3O$ ,	<i>eichoal-artachalt</i> .
Propionate of œnanthyl,	$C_7H_{15}$ CO $C_2H_5O$ ,	<i>eechoal-artechalt</i> .
Butyrate of caproyl,	$C_6H_{13}$ CO $C_3H_7O$ ,	<i>eechoal-artichalt</i> .
Valerate of amyl,	$C_6H_{11}$ CO $C_4H_9O$ ,	<i>uchal-artochoalt</i> .
Caproate of butyl,	$C_4H_9$ CO $C_5H_{11}O$ ,	<i>ochoal-artuchalt</i> .
œnanthate of propyl,	$C_5H_9$ CO $C_6H_{13}O$ ,	<i>ichoal-arteechoalt</i> .
Caprylate of ethyl,	$C_2H_5$ CO $C_7H_{15}O$ ,	<i>eechoal-arteechoalt</i> .
Pelargonate of methyl,	$CH_3$ CO $C_8H_{17}O$ ,	<i>achal-arteeichoalt</i> .

Each of the seven following compound ammonias has the same ultimate composition,  $C_6H_{15}N$  :

Triethylamine,	$(C_2H_5)^3 N$ ,	<i>eechalian</i> .
Dipropylamine,	$(C_3H_7)^2 HN$ ,	<i>iechalemalan</i> .
Caproylamine,	$C_6H_{13} H_2N$ ,	<i>eechilan</i> .
Amyl-methylamine,	$C_5H_{11} CH_3 HN$ ,	<i>uchal-achealan</i> .
Butyl-dimethylamine,	$C_4H_9 (CH_3)^2 N$ ,	<i>ochoal-acheleman</i> .
Butyl-ethylamine,	$C_4H_9 C_2H_5 HN$ ,	<i>ochoal-echelan</i> .
Propyl-ethyl-methylamine,	$C_3H_7 C_2H_5 CH_3 N$ ,	<i>ichoal-eechal-achalan</i> .

TWO AMMONIA-COBALT METAMERS, empirical formula  $(H_3N)_6 \overset{C}{\underset{Cl}{Cl_3}}$  :

Roseo-pentammonia-cobaltic chloride,	<i>ilanum-cobamid</i> .
Purpureo-pentammonia-cobaltic chloride,	<i>yulun-cobamid</i> .

It has already been admitted that the improved names, as found in WATT'S New Dictionary, have the merit of more precision than the old nomenclature in designating the proportions of non-metallic elements ; but this precision is not always observed in that portion of the name defining the metal. For the purpose of comparison, a few of the names given as examples under the article

on Nomenclature, page 125, are here inserted, with the symbols and the proposed new names :

Platinic dichloride	= $\text{PbCl}_2$ ,	<i>Platamed.</i>
Diplumbic trioxide	= $\text{Pb}_2\text{O}_3$ ,	<i>plubemit.</i>
Triplumbic tetroxide	= $\text{Pb}_3\text{O}_4$ ,	<i>plubimot.</i>
Diplumbo-dihydric trioxide	= $[\text{Pb}_2\text{H}_2]\text{O}_3$ ,	<i>plubemelit.</i>
Triplumbo-dihydric tetroxide,	= $[\text{Pb}_2\text{H}_2]\text{O}_4$ ,	<i>plubimelot.</i>
Bismuthic oxichloride	= $\text{BiClO}$ ,	<i>bisamadat.</i>
Diplumbic oxidichloride	= $\text{Pb}_2\text{Cl}_2\text{O}$ ,	<i>plubemedat.</i>
Triplumbic dioxidichloride	= $\text{Pb}_3\text{Cl}_2\text{O}_2$ ,	<i>plubimedet.</i>
Trimercurio-dioxidichloride	= $\text{Hg}_3\text{Cl}_2\text{O}_2$ ,	<i>hygimedet.</i>
Hydrargyro-dihydric-chloronitride	= $\text{HgCl H}_2\text{N}$ ,	<i>hygmadelan.</i>
Tetramercurio-tetrahydric-trioxidinitride	= $\text{H}_4\text{N}_2 \text{Hg}_4\text{O}_3$ ,	<i>olen-hygomit.</i>
Tetramercurio-tetrahydric-dioxidichlorodinitride	= $\text{Hg}_4\text{H}_4\text{Cl}_2\text{N}_2\text{O}_2$ ,	<i>hygomoledent.</i>

WATER has three distinct functions recognized in the notation, but not in the common nomenclature, which are clearly defined in the new system.

1. Water as a true chemical component : it is thus designated by *elat*, *alalt* or *lalt*. The first of these names, when forming a part of another name, may denote the typical structure and the rational formula of the compound : it may indicate, likewise, that precisely the same number and kind of atoms, by another arrangement, would form two independent and stable bodies ; for instance, *echelat* denotes that alcohol is formed by the combination of the radical *echal* with the water torso *alat* or *alt*, and is modeled after the dyad type ; it also indicates the fact proved by the synthetic process of BERTHELOT, that alcohol contains all and precisely the components forming olefiant gas and water. The other name of water, *alalt* or *lalt*, shows more clearly how the torso *alt*, torn from *al*, will unite with a monad radical or metal and form a perfect body, like, for example, hydrate of potash, *potamalt* ; hydrate of lime ; *calcamelt*.

2. Water as a mechanical component of certain crystals. Under the plastic trowel of symmetry, it fills the interstices, so to speak, builds up and completes the structure. During this mysterious process of construction, the pair of hydrogen atoms are supposed to still cling to oxygen ; and the molecule having such close atomic ties is distinguished by the term *allt*. This is the only case where the same consonants are found side by side : the relation in which the word is used will prevent its being confounded with the torso *alt*. By changing the vowel prefix, any number of molecules, either of water of crystallization, or of constitutional water as GRAHAM styles it, may be denoted. As a general rule, this name precedes the essential name of the compound ; for example,

Crystallized periodic acid, with 4 atoms of water,	<i>ollt-alavot.</i>
Crystallized oxalic acid with 2 aqua,	<i>clt-elerot.</i>
Prismatic nitrate of copper with 3 aqua,	<i>illt-cupmeneat.</i>
Rhomboidal nitrate of copper with 6 aqua,	<i>eallt-cupmeneat.</i>
Nitrate of lime with 4 aqua,	<i>ollt-calcmeneat.</i>
Nitrate of strontia with 5 aqua,	<i>ullt-stronmeneat.</i>
Nitrate of lithia with 5 aqua,	<i>ullt-lithmanit.</i>
Protonitrate of iron with 6 aqua,	<i>eallt-fermeneat.</i>
Hyposulphite of soda with 5 aqua,	<i>ullt-sodemasiit.</i>
Sulphate of soda with 10 aqua,	<i>eullt-sodemasiit. o/</i>
Carbonate of soda with 10 aqua,	<i>eullt-sodemarit.</i>
Sulphate of alumina and potash with 24 aqua,	<i>wolltalem-potemosoit.</i>
Sulphate of alumina and thallium with 24 aqua,	<i>wolltalem-thallemosoit.</i>

3. Water as a solvent or menstruum, modifying, in proportion to its quantity, the chemical power and functions of the compound held in solution. The complete and equable diffusion of a soluble body, by which its characteristics are manifested through the medium of this fluid, may be regarded as the effect of a contiguity resulting from molecular rather than atomic attraction. In this case, the pair of hydrogen atoms are designated by the letter *h*, and the oxygen atom by *t*; and *th*, as a prefix to the name of a compound, denotes that such compound is held in solution by an indefinite quantity of water. Any amount corresponding to a definite number of molecules of water may be represented by the usual vowels placed before *th*. The following brief exhibit of names will show the economy and precision of expression applicable to substances now commonly called and recognized only by misnomers.

A solution of hydrochloric acid and water,	<i>thalad.</i>
Fuming solution containing 43 per cent of HCl or 6 aqua,	<i>eathalad.</i>
Solution of HCl which distils unchanged (20 per cent acid, or 16 aqua),	<i>authalad.</i>
Hydrate of chlorine, $5(H_2OCl)$	<i>uthad.</i>
Sulphuric acid, distinguished as oil of vitriol,	<i>elasot.</i>
Sulphuric acid with indefinite quantity of water,	<i>thelasot.</i>
Glacial sulphuric acid,	<i>athelasot.</i>
Nitric acid, indefinite solution by water,	<i>thalanit.</i>
Nitric acid, solution containing 60 per cent $NO_3$ or 3 aqua,	<i>ithalanit.</i>
Solution of ammonia and water,	<i>thilan.</i>
Solution of alcohol and water,	<i>thechelad.</i>
Solution of carbonic anhydride (soda water),	<i>tharet.</i>

In the further progress of chemical investigations, increasing significance must be given to the state of dilatation of the body under examination. On passing from the solid to the liquid state, its bulk will undergo but comparatively little change. In either state, the restless particles which make up the apparently unmoved mass are still obedient to the law of cohesion, although in the liquid the league of homogeneity is not so binding as to prevent the admission of foreign matter; but when, by the irresistible power of the almost infinitesimal motions of a subtle medium, heat accelerates and amplifies the excursions of particles until they fly simultaneously beyond the dominion of a common attraction, it must be admitted that the mass thus expanded to the gaseous state — in reality a vast reservoir of molecular momentum — requires some distinctive appellation. It is therefore proposed to denote every gaseous compound, and every volatile body after it has fumed into vapor, by simply prefixing to its new name the letter *g*.

Were it desirable to show the degree of condensation of gases produced by their combination, the number of volumes included in one molecule could be indicated by the usual vowels before *g*; but as the number of atoms now conforms to the number of volumes of gaseous elements, in most cases, the amount of condensation can be easily estimated. At present it seems essential only to indicate that the molecule has assumed a state of gas or vapor.

The succeeding names are illustrations :

## GASES at ordinary temperatures.

Carbonic oxide,	<i>gart.</i>
Carbonic anhydride,	<i>garet.</i>
Olefiant gas,	<i>gerlel.</i>
Oil gas,	<i>gorlol.</i>
Nitrous oxide,	<i>genat.</i>
Binoxide of nitrogen,	<i>gant.</i>
Nitrous anhydride,	<i>ganit.</i>
Sulphuretted hydrogen,	<i>gelas.</i>
Ammonia,	<i>gilan.</i>
Phosphuretted hydrogen,	<i>gilap.</i>
Arseniuretted hydrogen,	<i>gil-arsam.</i>
Antimoniuretted hydrogen,	<i>gil-stibam.</i>
Cyanogen (molecule),	<i>gern.</i>
Sulphurous anhydride,	<i>gaset.</i>
Hypochlorous anhydride,	<i>gedat.</i>
Euchlorine,	<i>gadadat.</i>
Chlorous anhydride,	<i>gedit.</i>
Hydrochloric acid gas,	<i>galad.</i>
Hydrobromic acid,	<i>galab.</i>
Hydriodic acid,	<i>galav.</i>
Oxychloride of carbon,	<i>garded.</i>
Carburetted hydrogen,	<i>garol.</i>
Hydride of ethyl,	<i>gechel.</i>
Ethylide of ethyl,	<i>gehalem.</i>
Chloride of methyl,	<i>gachald.</i>
Methylic ether,	<i>gachalemat.</i>

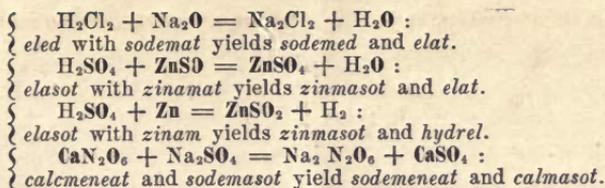
## VAPORS at heat stated on centigrade scale.

Chloride of ethyl	11°, <i>gechald.</i>
Bromide of methyl	13°, <i>gachalb.</i>
Oxide of ethylene	13°.5, <i>gechat.</i>
Hydrofluoric acid	16°, <i>galaf.</i>
Peroxide of nitrogen	27°, <i>ganet.</i>
Sulphuric anhydride	27°, <i>gasit.</i>
Prussic acid	33°, <i>galarn.</i>
Ethylic ether	34°, <i>gachalemat.</i>
Amylene	39°, <i>gurlul.</i>
Chloride of methylene	40°, <i>gached.</i>
Protosulphide of methyl,	41°, <i>gachelemas.</i>
Iodide of methyl	42°, <i>gachalv.</i>
Nitric anhydride	45°, <i>ganut.</i>
Bisulphide of carbon	47°, <i>gares.</i>
Bromide of ethyl	47°.7, <i>gechalb.</i>
Hydride of methyl	60°, <i>gachelat.</i>
Chloroform	61°, <i>gartid.</i>
Sulphochloride of carbon,	70°, <i>garsed.</i>
Caproylene	71°, <i>gearleal.</i>
Iodide of ethyl	72°, <i>gechalv.</i>
Bichloride of carbon	78°, <i>garod.</i>
Perchloride of phosphorus	78°, <i>gapid.</i>
Absolute alcohol	78°, <i>gechelal.</i>
Dichloride of ethylene	85°, <i>gerleld.</i>
Önanthylene	99°, <i>geerleel.</i>
Steam	100°, <i>gelat.</i>

In anticipation of an inquiry as to the feasibility of applying the new nomenclature to all known chemical bodies, it may be here observed that new names have been framed for a large majority of the compounds enumerated in STORER'S Dictionary of Solubilities, as well as for many modifications described in DANA'S Mineralogy; yet as these names form a lexicon of chemical compounds, they cannot properly be applied to the large class about the composition of which there is still a wide diversity of opinion, particularly to those treated of in zoochemistry, from whose percentage-analysis no satisfactory formulæ have thus far been deduced. No objection can be made, however, to the application of new terms to those compounds now designated only by symbols, or to new bodies not yet named; such, for example, as  $\text{LOW}_{\text{O}}$ 's new combination of hydrogen with the sesquisulphide of carbon, *aleris*.

Should the proposed system be favorably received, the most effectual mode of bringing it into general use would be to add to the old name of a body the new name in italics, in lieu of the ordinary symbols which now involve the use of very small figures not always read with facility. These symbols have been aptly termed the *short-hand* of the chemist; yet in a large majority of instances, the corresponding new names contain a smaller number of syllables; for example,  $\text{CO}_2$  is pronounced with three syllables, and *garet* with two;  $\text{H}_2\text{O}$  with three syllables, *elat* with two;  $\text{HO}$  with two, *alt* with one;  $\text{COCl}$  with five, and *garded* with two.

Those objecting to the use of chemical equations, will observe how readily the new names may be substituted for such expressions by the following examples:



WILLIAMSON'S original view of the constitution of ethers is illustrated by the following substitute for the equation explaining the reactions which produce the oxide of diethyl :

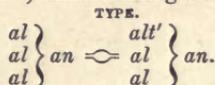
*Sodam-echalt* with *echalv*, yields *Sodamav* and *echalemat*.

The use of the new nomenclature in conversations on chemical subjects would correct very soon many vulgar errors, and inculcate, by mere imitation and habit, clearer views of combinations. He who knows why he calls chloroform *arlid*, knows on the instant, and knows for life, that it is composed of one of carbon, one of hydrogen and three atoms of chlorine; or when he designates laughing gas by *genat*, he announces at once several facts not indicated by the old names, nitrous oxide or protoxide of nitrogen.

Chemical writers, who are obliged to study brevity of expression, will fully appreciate the saving of pen and type-work resulting from the use of the new nomenclature, which may often be as marked as in the following announcement of a late scientific achievement in old and new phrase placed side by side :

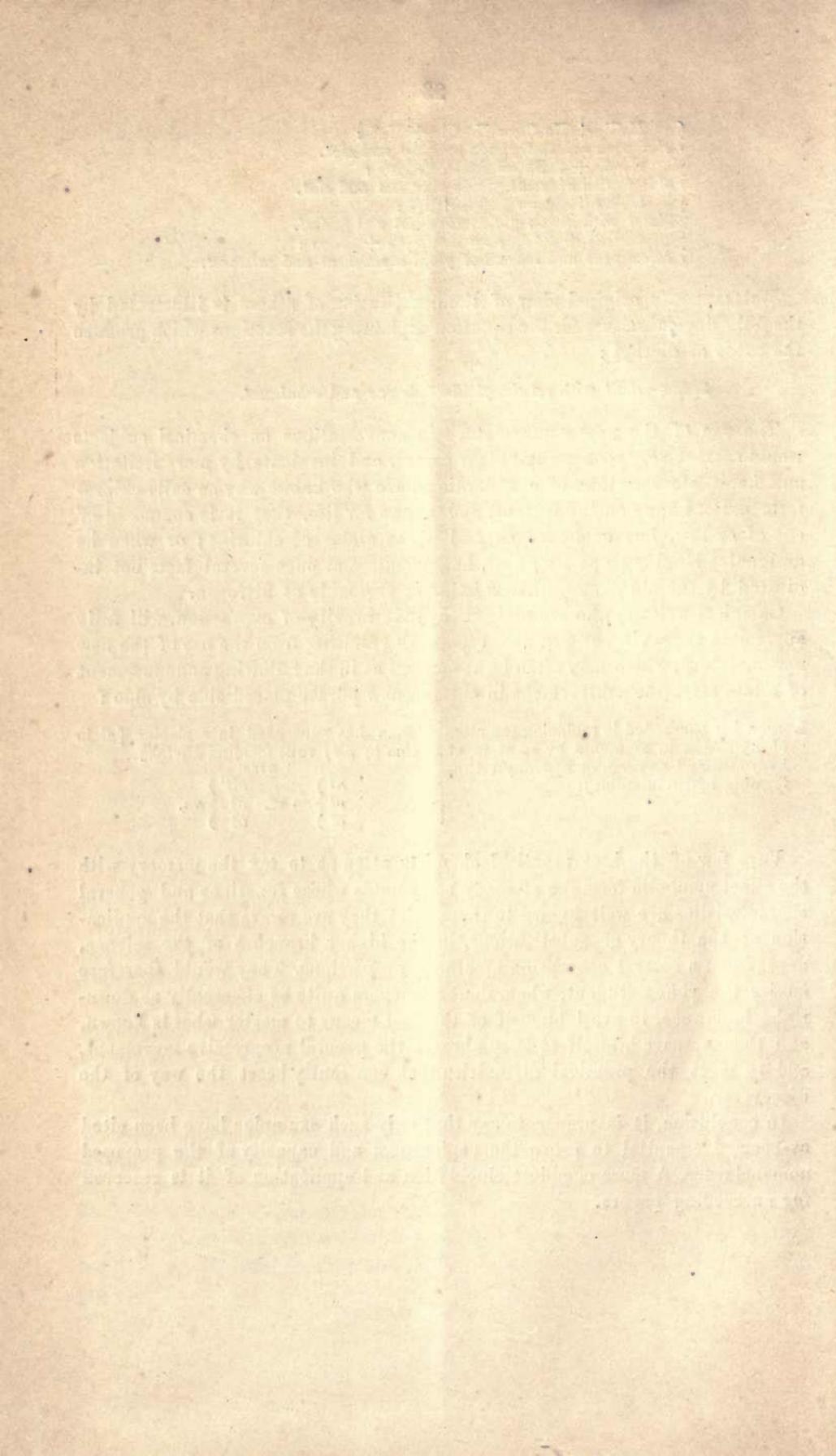
LOSSEN has succeeded in replacing [an atom of hydrogen in ammonia by an atom of hydrogen and oxygen, or hydroxyl; thus forming hydroxalamine].

LOSSEN has succeeded in replacing [*al* in *ilan* by *alt*; thus forming *altelan*].

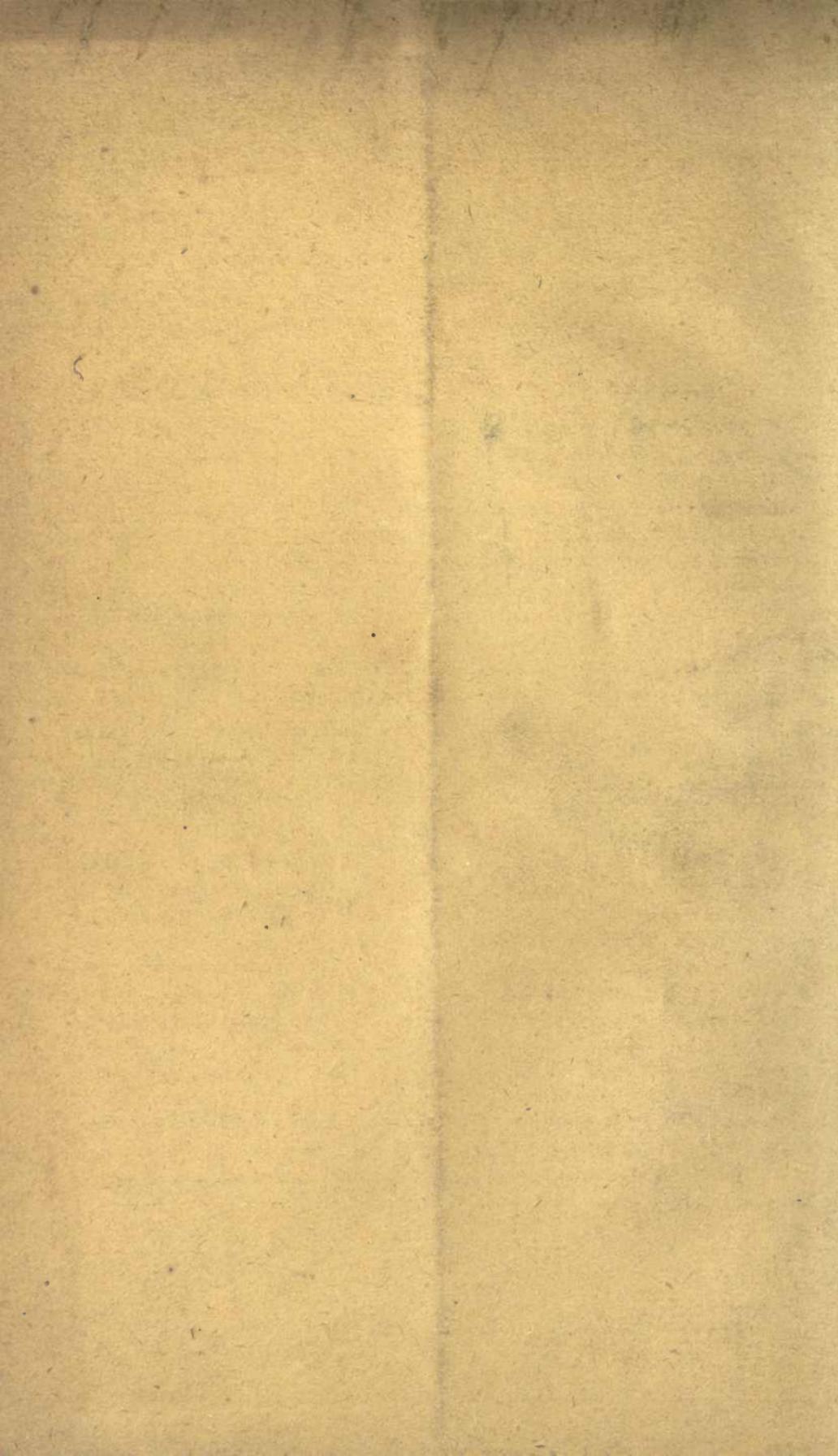


Very few of the best practical chemists attempt to tax the memory with the exact symbolic formulæ of many compounds whose functions and general characteristics are well known to them; yet they are aware that the application of the theory of substitutions, in the higher branches of the science, depends on a correct conception of atomic proportions. They would therefore advise the young student, whom doubt hampers quite as effectually as downright ignorance, to avail himself of the best means to master what is known, and thus prepare himself to keep abreast the general progressive movement, and to meet the practical difficulties that constantly beset the way of the discoverer.

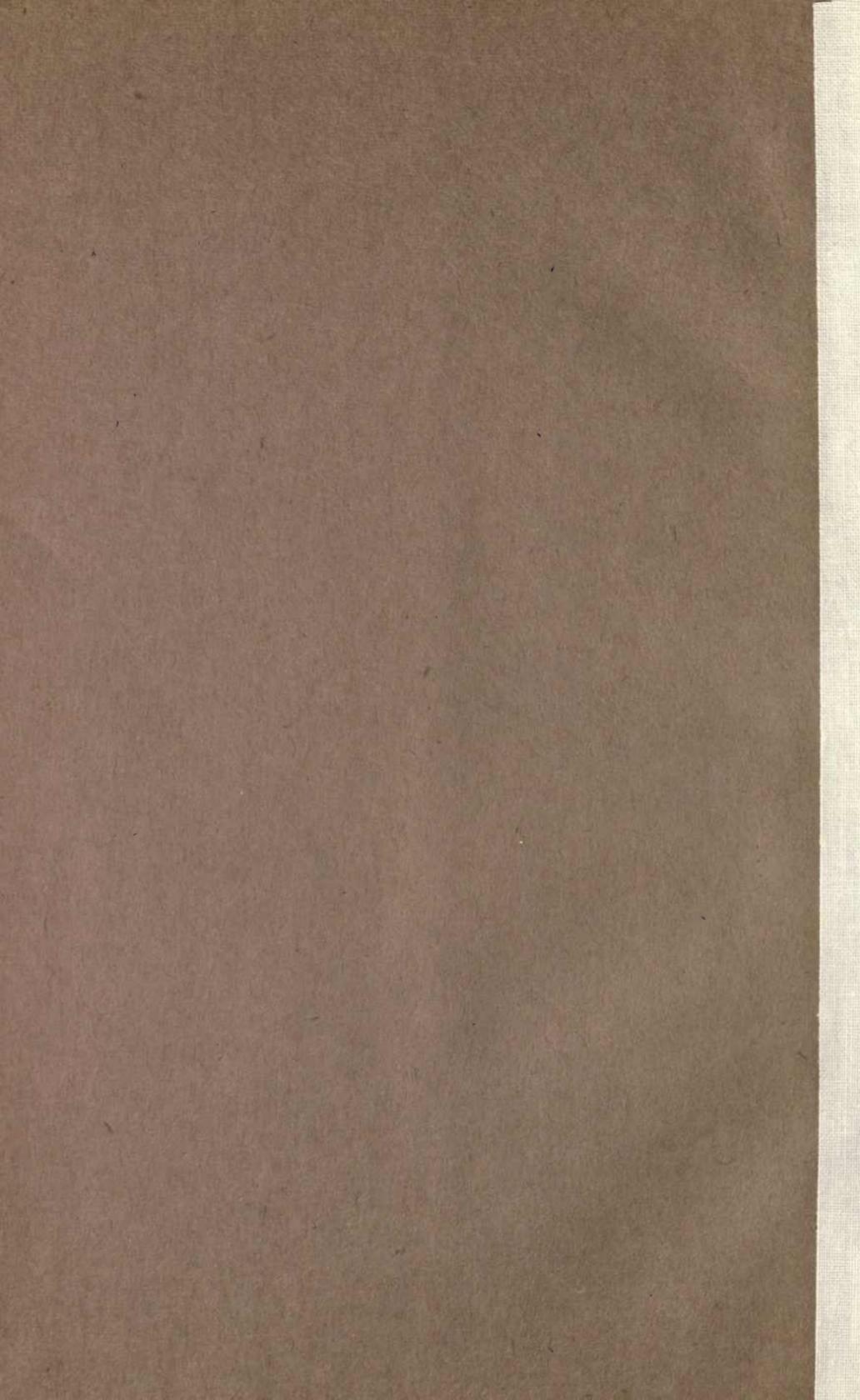
In conclusion, it is proper to say that only such examples have been cited as seemed essential to prove the copiousness and capacity of the proposed nomenclature. A more complete elucidation and application of it is reserved for succeeding papers.











GAYLAMOUNT<sup>®</sup>  
PAMPHLET BINDER  
Syracuse, N.Y.  
Stockton, Calif.

U. C. BERKELEY LIBRARIES



C042071899

