HANDBOOK
OF
CHEMISTRY AND PHYSICS

A READY-REFERENCE POCKET BOOK OF CHEMICAL AND PHYSICAL DATA

ELEVENTH EDITION

COMPILED FROM THE MOST RECENT AUTHORITATIVE SOURCES

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PREFACE

THE Handbook of Chemistry and Physics, continuing the policy of the past, is being revised at frequent intervals.

The general features and scheme of arrangement, which have received extensive endorsement in former editions have been retained. The aim throughout has been to present in condensed form as large an amount of accurate, reliable and up-to-date informaton in the fields of chemistry and physics as was consistent with convenience in form and the possibility of wide utility and distribution. A very large proportion of the tables have been compiled especially for the Handbook from various authoritative collections of data and from the current journals.

Since the beginning special consideration has been given to the requests and suggestions of those who have used former editions. In this way it has been hoped to develop the book along lines most acceptable to those interested in a volume of this type. Suggestions have been received from more than a thousand members of high standing in the chemical and physical profession. We believe this coöperation to have been of very great value in the growth and development of the work.

An attempt has been made to include material on all branches of chemistry and physics and the closely allied sciences, which would be likely to find any extended use. On the other hand, in order to retain the convenience of moderate dimensions and at the same time allow for natural growth due to the extension of knowledge in these sciences, and logical additions along lines already developed, it has seemed necessary to exclude types of material of use only in certain highly specialized lines of work.

Chemistry and physics, always closely related sciences, have been brought into much more intimate relations by the more recent developments of research. To an increasing extent the student of either science should have a knowledge of the other. It would seem that there should be a large field for a single volume containing the constants and formulæ of the two sciences together with mathematical and conversion tables adequate for accurate computation. The generous response which the previous editions have met indicates that the volumes have been found useful and it is with the hope of even more completely meeting the needs of the chemists and physicists of the English-speaking world that succeeding editions are offered.

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PREFACE TO THE ELEVENTH EDITION

The extensive changes in the atomic weights of the elements as authorized by the International Committee on Atomic Weights have entailed a very large revision of numerical values. Tables of atomic weights, molecular weights, gravimetric factors and other quantities dependent on the atomic weights have been fully revised.

The table Physical Constants of Inorganic Compounds has been completely rewritten and much enlarged, now including data on considerably over two thousand compounds.

The table Physical Constants of the Elements has been changed in form and now gives, in addition to the information previously included considerably more detail in regard to the discovery and occurrence of the elements besides other facts of importance and interest.

The table of gravimetric factors has been entirely recomputed and a large number of factors added.

In response to several requests a table of four-place logarithms has been added.

Important revisions have been made in the following tables:

Periodic Arrangement of the Elements
Qualitative Analysis Scheme
Indicators
Solubility Product
Degree of Ionization
Dissociation Constants
Mathematical Tables

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ANTIDOTES OF POISONS

Acetic Acid.—Emetics, magnesia, chalk, soap, oil.

Arsenic, Rat Poison, Paris Green.—Milk, raw egg, sweet oil, lime water, flour and water.

Carbolic Acid.—Any soluble non-toxic sulphate, after provoking vomiting with zinc sulphate; uncooked white of egg in abundance, milk of lime, saccharate of calcium, olive or castor oil with magnesia in suspension, ice, washing the stomach with equal parts water and vinegar; give alcohol or whiskey or about four fluid ounces camphorated oil at one dose.

Chloroform, Chloral, Ether.—Dash cold water on head and chest, artificial respiration.

Hydrochloric Acid.—Magnesia, alkali carbonates, albumen, ice.

Hydrocyanic or Prussic Acid.—Hydrogen peroxide internally, and artificial respiration, breathing ammonia or chlorine from chlorinated lime, ferrous sulphate followed by potassium carbonate, emetics, warmth.

Iodine.—Emetics, stomach siphon, starchy foods in abundance, sodium thiosulphate.

Lead Acetate.—Emetics, stomach siphon, sodium, potassium or magnesium sulphates, milk, albumen.

Mercuric Chloride or Corrosive Sublimate.—Zinc sulphate, emetics, stomach siphon, white of egg, milk, chalk, castor oil, table salt, reduced iron.

Nitrate of Silver.—Salt and water.

Nitric Acid.—Same as for hydrochloric acid.

Opium, Morphine, Laudanum, Paregoric, etc.—Strong coffee, hot bath. Keep awake and moving at any cost.

Phosphoric Acid.—Same as for hydrochloric.

Sodium Hydroxide or Potassium Hydroxide.—Vinegar, lemon juice, orange juice, oil, milk.

Sulphuric Acid.—Same as for hydrochloric acid with the addition of soap or oil.

Sulphurous Acid or Sulphur Dioxide.—Mustard plaster on chest; narcotics, expectorants.

BURNS AND SCALDS

Exclude air by thin paste of starch, flour, or baking soda. Ordinary oils such as vaseline, olive or castor oil, lard or cream may also be used. Lime water mixed with an equal part of raw linseed oil makes an excellent dressing. An especially valuable material for all burns is picric acid gauze which may be applied in the form of a compress.

After treatment with any of the above materials, cover with a cloth or with cotton and hold in place with a light bandage.

ACID AND ALKALI BURNS

With either, wash off as quickly as possible with a large quantity of water. Water from a tap may be allowed to flow over burns.

Acids

While the injury is being washed, have procured, lime water or lime water and raw linseed oil mixed together in equal proportions or a mixture of baking soda and water or soap suds and apply freely. For acid in the eye wash as quickly as possible with water and then with lime water.

Alkalis

Wash with a large quantity of water as for acid burns. Neutralize with weak vinegar, hard cider or lemon juice. For lime or other strong alkali burns in the eye wash with weak solution of vinegar or with olive oil or a saturated solution of boric acid.

MATHEMATICAL TABLES

ALGEBRA

Factors and Expansions

$$(a \pm b)^2 = a^2 \pm 2ab + b^2.$$
$$(a \pm b)^3 = a^3 \pm 3a^2b + 3ab^2 \pm b^3.$$
$$(a \pm b)^4 = a^4 \pm 4a^3b + 6a^2b^2 \pm 4ab^3 + b^4.$$
$$a^2 - b^2 = (a - b)(a + b).$$
$$a^2 + b^2 = (a + b\sqrt{-1})(a - b\sqrt{-1}).$$
$$a^3 - b^3 = (a - b)(a^2 + ab + b^2).$$
$$a^3 + b^3 = (a + b)(a^2 - ab + b^2).$$
$$a^4 + b^4 = (a^2 + ab\sqrt{2} + b^2)(a^2 - ab\sqrt{2} + b^2).$$
$$a^n - b^n = (a - b)(a^{n-1} + a^{n-2}b + \ldots + b^{n-1}).$$
$$a^n - b^n = (a + b)(a^{n-1} - a^{n-2}b + \ldots - b^{n-1}),$$
for even values of n.
$$a^n + b^n = (a + b)\ (a^{n-1} - a^{n-2}b + \ldots + b^{n-1}),$$
for odd values of n.
$$a^4 + a^2b^2 + b^4 = (a^2 + ab + b^2)(a^2 - ab + b^2).$$
$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2ac + 2bc.$$
$$(a + b + c)^3 = a^3 + b^3 + c^3 + 3a^2(b + c) + 3b^2(a + c) + 3c^2(a + b) + 6abc.$$
$$(a + b + c + d + \ldots)^2 = a^2 + b^2 + c^2 + d^2 + \ldots + 2a(b + c + d + \ldots) + 2b(c + d + \ldots) + 2c(d + \ldots) + \ldots$$

See also under Series

Powers and Roots

$$a^x \times a^y = a^{(x+y)}. \qquad a^0 = 1. \qquad (ab)^x = a^xb^x.$$

$$\frac{a^x}{a^y} = a^{(x-y)}. \qquad a^{-x} = \frac{1}{a^x}. \qquad \left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}.$$

$$(a^x)^y = a^{xy}. \qquad a^{\frac{1}{x}} = \sqrt[x]{a}. \qquad \sqrt[x]{ab} = \sqrt[x]{a}\,\sqrt[x]{b}.$$

$$\sqrt[x]{\sqrt[y]{a}} = \sqrt[xy]{a}. \qquad a^{\frac{x}{y}} = \sqrt[y]{a^x}. \qquad \sqrt[x]{\frac{a}{b}} = \frac{\sqrt[x]{a}}{\sqrt[x]{b}}.$$

Proportion

If $\dfrac{a}{b} = \dfrac{c}{d}$, then $\dfrac{a + b}{b} = \dfrac{c + d}{d}$,

$$\frac{a - b}{b} = \frac{c - d}{d}, \qquad \frac{a - b}{a + b} = \frac{c - d}{c + d}.$$

ALGEBRA (Continued)

Sums of Numbers

The sum of the first n numbers, —

$$\Sigma(n) = 1 + 2 + 3 + 4 + 5 \ldots . + n = \frac{n(n+1)}{2}$$

The sum of the squares of the first n numbers,

$$\Sigma(n^2) = 1^2 + 2^2 + 3^2 + 4^2 + 5^2 \ldots . + n^2 = \frac{n(n+1)(2n+1)}{6}$$

The sum of the cubes of the first n numbers,

$$\Sigma(n^3) = 1^3 + 2^3 + 3^3 + 4^3 + 5^3 \ldots . + n^3 = \frac{n^2(n+1)^2}{4}$$

Arithmetical Progression

If a is the first term; l, the last term; d, the common difference; n, the number of terms and s, the sum of n terms, —

$$l = a + (n-1)d$$

$$s = \frac{n}{2}(a + l)$$

$$s = \frac{n}{2}\left\{2a + (n-1)d\right\}$$

Geometrical Progression

If a is the first term; l, the last term; r, the common ratio; n, the number of terms and s, the sum of n terms, —

$$l = ar^{n-1}$$

$$s = \frac{a(r^n - 1)}{r - 1}$$

$$s = \frac{a(1 - r^n)}{1 - r}$$

If n is infinity and r^2 less than unity, —

$$s = \frac{a}{1 - r}$$

Permutations

If M denote the number of permutations of n things taken p at a time, —

$$M = n(n-1)(n-2) \ldots . (n - p + 1)$$

Combinations

If M denote the number of combinations of n things taken p at a time, —

$$M = \frac{n(n-1)(n-2) \ldots . (n-p+1)}{\underline{|p}}$$

$$M = \frac{\underline{|n}}{\underline{|p}\ \underline{|n-p}}$$

ALGEBRA (Continued)

Quadratic Equations

Any quadratic equation may be reduced to the form, —

$$ax^2 + bx + c = 0$$

Then $$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

If $b^2 - 4ac$ is positive the roots are real and unqual.
If $b^2 - 4ac$ is zero the roots are real and equal.
If $b^2 - 4ac$ is negative the roots are imaginary and unequal.
If $b^2 - 4ac$ is a perfect square the roots are rational and unequal.

Cubic Equations

A cubic equation, $y^3 + py^2 + qy + r = 0$ may be reduced to the form, —

$$x^3 + ax + b = 0$$

by substituting for y the value, $x - \frac{p}{3}$. Here

$$a = \tfrac{1}{3}(3q - p^2) \text{ and } b = \tfrac{1}{27}(2p^3 - 9pq + 27r).$$

For solution let, —

$$A = \sqrt[3]{-\frac{b}{2} + \sqrt{\frac{b^2}{4} + \frac{a^3}{27}}}, \qquad B = \sqrt[3]{-\frac{b}{2} - \sqrt{\frac{b^2}{4} + \frac{a^3}{27}}},$$

then the values of x will be given by,

$$x = A + B, \quad -\frac{A+B}{2} + \frac{A-B}{2}\sqrt{-3}, \quad -\frac{A+B}{2} - \frac{A-B}{2}\sqrt{-3}$$

If $\frac{b^2}{4} + \frac{a^3}{27} > 0$, there will be one real root and two conjugate imaginary roots.

If $\frac{b^2}{4} + \frac{a^3}{27} = 0$, there will be three real roots of which two are equal.

If $\frac{b^2}{4} + \frac{a^3}{27} < 0$, there will be three real and unequal roots.

In the last case a trigonometric solution is useful. Compute the value of the angle ϕ in the expression, —

$$\cos\phi = \sqrt{\frac{b^2}{4} \div \left(-\frac{a^3}{27}\right)},$$

then x will have the following values: —

$$\mp 2\sqrt{-\frac{a}{3}}\cos\frac{\phi}{3}, \qquad \mp 2\sqrt{-\frac{a}{3}}\cos\left(\frac{\phi}{3} + 120^\circ\right),$$

$$\mp 2\sqrt{-\frac{a}{3}}\cos\left(\frac{\phi}{3} + 240^\circ\right).$$

ALGEBRA (Continued)

Approximations

If a and b are small quantities, the following relations are approximately true, —

$$(1 \pm a)^m = 1 \pm ma$$

$$(1 \pm a)^m(1 \pm b)^n = 1 \pm ma \pm nb$$

If n is nearly equal to m,

$$\sqrt{mn} = \frac{n + m}{2}, \text{ approximately.}$$

If θ is a very small angle expressed in radians, —

$$\frac{\sin \theta}{\theta} = 1 \text{ and } \frac{\tan \theta}{\theta} = 1, \text{ approximately.}$$

Series

The expression in parentheses following certain of the series indicates the region of convergence. If not otherwise indicated it is to be understood that the series converges for all finite values of x.

Binomial

$$(x + y)^n = x^n + nx^{n-1}y + \frac{n(n-1)}{\underline{|2}}x^{n-2}y^2 + \dots .$$

$$\frac{n(n-1)\dots(n-m+1)}{\underline{|m}}x^{(n-m)}y^m + \dots \qquad (y^2 < x^2)$$

$$(1 \pm x)^n = 1 \pm nx + \frac{n(n-1)x^2}{\underline{|2}} \pm \frac{n(n-1)(n-2)x^3}{\underline{|3}} + \dots \text{ etc.} \qquad (x^2 < 1)$$

$$(1 \pm x)^{-n} = 1 \mp nx + \frac{n(n+1)x^2}{\underline{|2}} \mp \frac{n(n-1)(n-2)x^3}{\underline{|3}} + \dots \text{ etc.} \qquad (x^2 < 1)$$

$$(1 \pm x)^{-1} = 1 \mp x + x^2 \mp x^3 + x^4 \mp x^5 + \dots \qquad (x^2 < 1)$$

$$(1 \pm x)^{-2} = 1 \mp 2x + 3x^2 \mp 4x^3 + 5x^4 \mp 6x^5 + \dots \qquad (x^2 < 1)$$

Taylor's Series

$$f(x + h) = f(x) + hf'(x) + \frac{h^2}{\underline{|2}}f''(x) + \frac{h^3}{\underline{|3}}f'''(x) + \dots$$

$$= f(h) + xf'(h) + \frac{x^2}{\underline{|2}}f''(h) + \frac{x^3}{\underline{|3}}f'''(h) + \dots$$

Maclaurin's Series

$$f(x) = f(o) + xf'(o) + \frac{x^2}{\underline{|2}}f''(o) + \frac{x^3}{\underline{|3}}f'''(o) + \dots$$

Exponential

$$e = 1 + \frac{1}{1} + \frac{1}{\underline{|2}} + \frac{1}{\underline{|3}} + \frac{1}{\underline{|4}} + \dots$$

$$e^x = 1 + x + \frac{x^2}{\underline{|2}} + \frac{x^3}{\underline{|3}} + \frac{x^4}{\underline{|4}} + \dots$$

$$a^x = 1 + x \log a + \frac{(x \log a)^2}{\underline{|2}} + \frac{(x \log a)^3}{\underline{|3}} + \dots$$

ALGEBRA (Continued)

Logarithmic

$$\log_e x = \frac{x-1}{x} + \frac{1}{2}\left(\frac{x-1}{x}\right)^2 + \frac{1}{3}\left(\frac{x-1}{x}\right)^3 + \ldots \qquad (x > \tfrac{1}{2})$$

$$\log_e x = (x-1) - \tfrac{1}{2}(x-1)^2 + \tfrac{1}{3}(x-1)^3 - \ldots \qquad (2 > x > 0)$$

$$\log_e x = 2\left[\frac{x-1}{x+1} + \frac{1}{3}\left(\frac{x-1}{x+1}\right)^3 + \frac{1}{5}\left(\frac{x-1}{x+1}\right)^5 + \ldots\right] \qquad (x > 0)$$

$$\log_e(1+x) = x - \tfrac{1}{2}x^2 + \tfrac{1}{3}x^3 - \tfrac{1}{4}x^4 + \ldots \qquad (-1 < x < 1)$$

$$\log_e(n+1) - \log_e(n-1) = 2\left[\frac{1}{n} + \frac{1}{3n^3} + \frac{1}{5n^5} + \ldots\right]$$

$$\log_{10}(n+1) - \log_{10} n = \frac{k}{n} + \frac{k}{2n^2} + \frac{k}{3n^3} + \ldots \quad \text{where } k = .4343\ldots$$

$$\log_e(a+x) = \log_e a + 2\left[\frac{x}{2a+x} + \frac{1}{3}\left(\frac{x}{2a+x}\right)^3 + \frac{1}{5}\left(\frac{x}{2a+x}\right)^5 + \ldots\right] \qquad (a > 0,\ -a < x < +\infty)$$

Trigonometric

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots$$

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \ldots$$

$$\tan x = x + \frac{x^3}{3} + \frac{2x^5}{15} + \frac{17x^7}{315} + \frac{62x^9}{2835} + \ldots \qquad \left(x^2 < \frac{\pi^2}{4}\right)$$

$$\sin^{-1} x = x + \frac{x^3}{6} + \frac{1}{2}\cdot\frac{3}{4}\cdot\frac{x^5}{5} + \frac{1}{2}\cdot\frac{3}{4}\cdot\frac{5}{6}\cdot\frac{x^7}{7} + \ldots \qquad (x^2 < 1)$$

$$\tan^{-1} x = x - \tfrac{1}{3}x^3 + \tfrac{1}{5}x^5 - \tfrac{1}{7}x^7 + \ldots \qquad (x^2 < 1)$$

$$= \frac{\pi}{2} - \frac{1}{x} + \frac{1}{3x^3} - \frac{1}{5x^5} + \ldots \qquad (x^2 > 1)$$

$$\log_e \sin x = \log_e x - \frac{x^2}{6} - \frac{x^4}{180} - \frac{x^6}{2835} - \ldots \qquad (x^2 < \pi^2)$$

$$\log_e \cos x = -\frac{x^2}{2} - \frac{x^4}{12} - \frac{x^6}{45} - \frac{17x^8}{2520} - \ldots \qquad \left(x^2 < \frac{\pi^2}{4}\right)$$

$$\log_e \tan x = \log_e x + \frac{x^2}{3} + \frac{7x^4}{90} + \frac{62x^6}{2835} + \ldots \qquad \left(x^2 < \frac{\pi^2}{4}\right)$$

$$e^{\sin x} = 1 + x + \frac{x^2}{2!} - \frac{3x^4}{4!} - \frac{8x^5}{5!} + \frac{3x^6}{6!}$$

$$e^{\cos x} = e\left(1 - \frac{x^2}{2!} + \frac{4x^4}{4!} - \frac{31x^6}{6!} + \ldots\right)$$

$$e^{\tan x} = 1 + x + \frac{x^2}{2!} + \frac{3x^3}{3!} + \frac{9x^4}{4!} + \frac{37x^5}{5!} + \ldots \qquad \left(x^2 < \frac{\pi^2}{4}\right)$$

MENSURATION FORMULÆ

Plain Figures Bounded by Straight Lines

The area of a triangle whose base is b and altitude h

$$= \frac{hb}{2}.$$

The area of a triangle with angles A, B, and C and sides opposite a, b, and c, respectively

$$= \tfrac{1}{2}ab \sin C.$$

or

$$= \sqrt{s(s-a)(s-b)(s-c)},$$

where $s = \frac{1}{2}(a + b + c)$.

A rectangle with sides a and b has an area $= ab$.

The area of a parallelogram with side b and the perpendicular distance to the parallel side h

$$= bh.$$

The area of a parallelogram with sides a and b and the included angle θ

$$= ab \sin \theta.$$

The area of a rhombus with diagonals c and d,

$$= \tfrac{1}{2}cd.$$

The area of a trapezoid whose parallel sides are a and b and altitude h

$$= \tfrac{1}{2}(a + b)h$$

The area of any quadrilateral with diagonals a and b and the angle between them θ

$$= \tfrac{1}{2}ab \sin \theta.$$

The area of a regular polygon with n sides, each of length l,

$$= \tfrac{1}{4}nl^2 \cot \frac{180}{n}.$$

For a regular polygon of n sides, each side of length l, the radius of the inscribed circle,

$$= \frac{l}{2} \cot \frac{180}{n}.$$

The radius of the circumscribed circle,

$$= \frac{l}{2} \operatorname{cosec} \frac{180}{n}.$$

Area, Radius of Inscribed and Circumscribed Circles for Regular Polygons

l = length of one side.

Name.	Number of sides.	Area.	Radius of inscribed circle.	Radius of circumscribed circle.
Triangle, equilateral	3	$0.43301l^2$	$0.28867l$	$0.57735l$
Square	4	$1.00000l^2$	$0.50000l$	$0.70710l$
Pentagon	5	$1.72048l^2$	$0.68819l$	$0.85065l$
Hexagon	6	$2.59808l^2$	$0.86602l$	$1.0000l$
Heptagon	7	$3.63391l^2$	$1.0383l$	$1.1523l$
Octagon	8	$4.82843l^2$	$1.2071l$	$1.3065l$
Nonagon	9	$6.18182l^2$	$1.3737l$	$1.4619l$
Decagon	10	$7.69421l^2$	$1.5388l$	$1.6180l$
Undecagon	11	$9.36564l^2$	$1.7028l$	$1.7747l$
Dodecagon	12	$11.19615l^2$	$1.8660l$	$1.9318l$

Radius of circle inscribed in any triangle, whose sides are a, b, and c, where $s = \frac{1}{2}(a + b + c)$

$$= \frac{\sqrt{s(s-a)(s-b)(s-c)}}{s}.$$

The radius of the circumscribed circle

$$= \frac{abc}{4\sqrt{s(s-a)(s-b)(s-c)}}.$$

The perimeter of a polygon inscribed in a circle of radius r, where n is the number of sides,

$$= 2nr \sin\frac{\pi}{n}. \qquad (\pi = 3.14159)$$

The area of the inscribed polygon,

$$= \tfrac{1}{2}nr^2 \sin\frac{2\pi}{n}.$$

The perimeter of a polygon circumscribed about a circle of radius r, number of sides n

$$= 2nr \tan\frac{\pi}{n}.$$

The area of the circumscribed polygon

$$= nr^2 \tan\frac{\pi}{n}.$$

Plane Figures Bounded by Curved Lines

The circumference of a circle whose radius is r and diameter $d(d = 2r)$

$$= 2\pi r = \pi d. \qquad (\pi = 3.14159)$$

The area of a circle

$$= \pi r^2 = \tfrac{1}{4}\pi d^2 = .7854d^2.$$

The length of an arc of a circle for an arc of θ degrees

$$= \frac{\pi r\theta}{180}.$$

NOTE. — In this and following similar formulæ r denotes the radius of the circle, (OC, Fig. 1).

For an arc of θ radians the length

$$= r\theta.$$

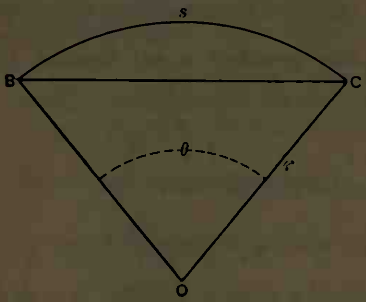


FIG 1.

The length of a chord subtending an angle θ

$$= 2r \sin \tfrac{1}{2}\theta.$$

The area of a sector where θ is the angle between the radii in degrees

$$= \frac{\pi r^2\theta}{360}.$$

If s is the length of the arc, the area of the sector

$$= \frac{sr}{2}.$$

The area of a segment where θ is the angle between the two radii in degrees

$$= \frac{\pi r^2\theta}{360} - \frac{r^2 \sin \theta}{2}.$$

If θ is in radians the area

$$= \tfrac{1}{2}r^2(\theta - \sin\theta).$$

The area of the ring between two circles of radius r_1 and r_2, one of which encloses the other,

$$= \pi(r_1 + r_2)(r_1 - r_2).$$

The two circles are not necessarily concentric.

Area of the sector of an annulus. (Fig. 2.) — If angle $GOH = \theta$ and the lines GO and $JO = r^1$ and r^2 respectively, the area $GHIJ$

$$= \tfrac{1}{2}\theta(r_1 + r_2)(r_1 - r_2).$$

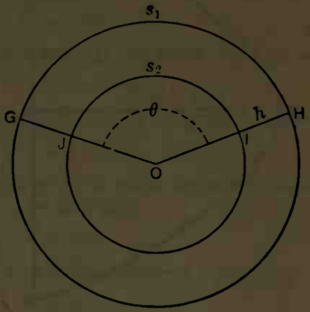


Fig. 2.

If $s_1 =$ the length of the arc GH and $s_2 =$ the arc JI and $h = HI = r_1 - r_2$, the area $GHIJ$

$$= \tfrac{1}{2}h(s_1 + s_2).$$

The circumference of an ellipse whose semiaxes are a and b

$$= 2\pi\sqrt{\frac{a^2 + b^2}{2}}, \text{ approximately.}$$

The area of an ellipse

$$= \pi ab.$$

The length of the arc of a parabola, as arc SPQ in Fig. 3, where $x = PR$, and $y = QR$

$$= 2\sqrt{y^2 + \frac{4x^2}{3}}.$$

The area of the section of the parabola $PQRS$,

$$= \tfrac{4}{3}xy.$$

Solids Bounded by Planes

The lateral area of a regular prism = perimeter of a right section × the length.

The volume of a regular prism = area of base × the altitude.

The lateral area of a regular pyramid, slant height l, length of one side of base a, and a number of sides n,

$$= \tfrac{1}{2}nal.$$

The volume of a pyramid = $\tfrac{1}{3}$ area of base × altitude.

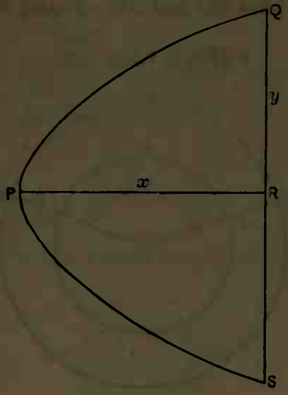


FIG. 3.

Surface and Volume of Regular Polyhedra

Surface and volume of regular polyhedra in terms of the length of one edge l.

Name.	Nature of surface.	Surface.	Volume.
Tetrahedron . . .	4 equilateral triangles	$1.73205l^2$	$0.11785l^3$
Hexahedron or cube	6 squares	$6.00000l^2$	$1.00000l^3$
Octahedron . . .	8 equilateral triangles	$3.46410l^2$	$0.47140l^3$
Dodecahedron .	10 pentagons	$20.64578l^2$	$7.66312l^3$
Icosahedron . . .	20 equilateral triangles	$8.66025l^2$	$2.18170l^3$

Solids Bounded by Curved Surfaces

The surface of a sphere of radius r and diameter $d(= 2r)$

$$= 4\pi r^2 = \pi d^2 = 12.57r^2.$$

The volume of a sphere

$$= \tfrac{4}{3}\pi r^3 = \tfrac{1}{6}\pi d^3 = 4.189r^3.$$

The area of a lune on the surface of a sphere of radius r, included between two great circles whose inclination is θ radians

$$= 2r^2\theta.$$

The area of a spherical triangle whose angles are A, B, and C (radians) on a sphere of radius r

$$= (A + B + C - \pi)r^2.$$

The area of a spherical polygon of n sides where θ is the sum of its angles in radians

$$= [\theta - (n - 2)\pi]r^2.$$

The area of the curved surface of a spherical segment of height h, radius of sphere r

$$= 2\pi rh.$$

The volume of a spherical segment, data as above

$$= \tfrac{1}{3}\pi h^2(3r - h).$$

If a = radius of the base of the segment, the volume

$$= \tfrac{1}{6}\pi h(h^2 + 3a^2).$$

The curved surface of a right cylinder where r = the radius of the base and h, the altitude,

$$= 2\pi rh.$$

The volume of a cylinder, data as above,

$$= \pi r^2 h.$$

The curved surface of a right cone whose altitude is h and radius of base r

$$= \pi r\sqrt{r^2 + h^2}.$$

The volume of a cone, data as above,

$$= \frac{\pi}{3}r^2 h = 1.047r^2 h.$$

The curved surface of the frustum of a right cone, radius of base r_1, of top r_2 and altitude h,

$$= \pi(r_1 + r_2)\sqrt{h^2 + (r_1^2 - r_2^2)}.$$

The volume of the frustum of a cone, data as above,

$$= \pi\frac{h}{3}(r_1^2 + r_1 r_2 + r_2^2).$$

The oblate spheroid is formed by the rotation of an ellipse about its minor axis. If a and b are the major and minor semi-axes respectively, and e the eccentricity, the surface

$$= 2\pi a^2 + \pi\frac{b^2}{e}\log_e\frac{1 + e}{1 - e},$$

and volume $= \tfrac{4}{3}\pi a^2 b.$

The prolate spheroid is formed by the rotation of an ellipse about its major axis ($2a$), data as above.

Surface $= 2\pi b^2 + 2\pi \frac{ab}{e} \sin^{-1} e$,

volume $= \frac{4}{3}\pi ab^2$.

TRIGONOMETRIC FUNCTIONS IN A RIGHT-ANGLED TRIANGLE

If A, B, and C are the vertices (C the right angle), and a, b, and h the sides opposite respectively,

$\sin A = \frac{a}{h}$, $\cos A = \frac{b}{h}$,

$\tan A = \frac{a}{b}$, $\cot A = \frac{b}{a}$,

$\text{secant } A = \frac{h}{b}$, $\text{cosec } A = \frac{h}{a}$.

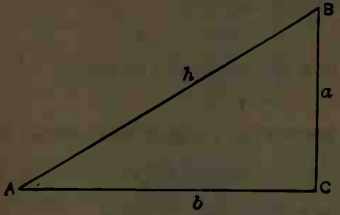


FIG. 4.

SIGNS AND LIMITS OF VALUE ASSUMED BY THE FUNCTIONS

Function.	Quadrant I.		Quadrant II.		Quadrant III.		Quadrant IV.	
	Sign.	Value.	Sign.	Value.	Sign.	Value.	Sign.	Value.
sin	+	0 to 1	+	1 to 0	−	0 to 0	−	1 to 0
cos	+	1 to 0	−	0 to 1	−	1 to 0	+	0 to 1
tan	+	0 to ∞	−	∞ to 0	+	0 to ∞	−	∞ to 0
cot	+	∞ to 0	−	0 to ∞	+	∞ to 0	−	0 to ∞
sec	+	1 to ∞	−	∞ to 1	−	1 to ∞	+	∞ to 1
cosec . . .	+	∞ to 1	+	1 to ∞	−	∞ to 1	−	1 to ∞

VALUE OF THE FUNCTIONS OF VARIOUS ANGLES

	0°	30°	45°	60°	90°	180°	270°
sin........	0	$\frac{1}{2}$	$\frac{1}{2}\sqrt{2}$	$\frac{1}{2}\sqrt{3}$	1	0	−1
cos........	1	$\frac{1}{2}\sqrt{3}$	$\frac{1}{2}\sqrt{2}$	$\frac{1}{2}$	0	−1	0
tan........	0	$\frac{1}{3}\sqrt{3}$	1	$\sqrt{3}$	∞	0	∞
cot........	∞	$\sqrt{3}$	1	$\frac{1}{3}\sqrt{3}$	0	∞	0

RELATIONS OF THE FUNCTIONS

$$\sin x = \frac{1}{\operatorname{cosec} x}. \qquad \operatorname{cosec} x = \frac{1}{\sin x}.$$

$$\cos x = \frac{1}{\sec x}. \qquad \sec x = \frac{1}{\cos x}.$$

$$\tan x = \frac{1}{\cot x} = \frac{\sin x}{\cos x}.$$

$$\cot x = \frac{1}{\tan x} = \frac{\cos x}{\sin x}.$$

$$\sin x = \sqrt{1 - \cos^2 x}. \qquad \cos x = \sqrt{1 - \sin^2 x}.$$

$$\tan x = \sqrt{\sec^2 x - 1}. \qquad \sec x = \sqrt{\tan^2 x + 1}.$$

$$\cot x = \sqrt{\operatorname{cosec}^2 x - 1}. \qquad \operatorname{cosec} x = \sqrt{\cot^2 x + 1}.$$

$$\sin x = \cos (90 - x) = \sin (180 - x).$$

$$\cos x = \sin (90 - x) = -\cos (180 - x).$$

$$\tan x = \cot (90 - x) = -\tan (180 - x).$$

$$\cot x = \tan (90 - x) = -\cot (180 - x).$$

FUNCTIONS OF SUMS OF ANGLES

$$\sin (x + y) = \sin x \cos y + \cos x \sin y.$$

$$\sin (x - y) = \sin x \cos y - \cos x \sin y.$$

$$\cos (x + y) = \cos x \cos y - \sin x \sin y.$$

$$\cos (x - y) = \cos x \cos y + \sin x \sin y.$$

$$\tan (x + y) = \frac{\tan x + \tan y}{1 - \tan x \tan y}.$$

$$\tan (x - y) = \frac{\tan x - \tan y}{1 + \tan x \tan y}.$$

FUNCTIONS OF MULTIPLE ANGLES

$\sin 2x = 2 \sin x \cos x.$
$\cos 2x = \cos^2 x - \sin^2 x = 2 \cos^2 x - 1 = 1 - 2 \sin^2 x.$
$\sin 3x = 3 \sin x - 4 \sin^3 x.$
$\cos 3x = 4 \cos^3 x - 3 \cos x.$
$\sin 4x = 8 \cos^3 x \sin x - 4 \cos x \sin x.$
$\cos 4x = 8 \cos^4 x - 8 \cos^2 x \times 1.$
$\sin 5x = 5 \sin x - 20 \sin^3 x + 16 \sin^5 x.$
$\cos 5x = 16 \cos^5 x - 20 \cos^3 x + 5 \cos x.$
$\sin 6x = 32 \cos^5 x \sin x - 32 \cos^3 x \sin x + 6 \cos x \sin x.$
$\cos 6x = 32 \cos^6 x - 48 \cos^4 x + 18 \cos^2 x - 1.$

$$\tan 2x = \frac{2 \tan x}{1 - \tan^2 x}.$$

$$\cot 2x = \frac{\cot^2 x - 1}{2 \cot x}.$$

$$\tan 3x = \frac{3 \tan x - \tan^3 x}{1 - 3 \tan^2 x}.$$

$$\sin \tfrac{1}{2}x = \pm \sqrt{\frac{1 - \cos x}{2}}.$$

$$\cos \tfrac{1}{2}x = \pm \sqrt{\frac{1 + \cos x}{2}}.$$

$$\tan \tfrac{1}{2}x = \pm \sqrt{\frac{1 - \cos x}{1 + \cos x}} = \frac{1 - \cos x}{\sin x} = \frac{\sin x}{1 + \cos x}.$$

MISCELLANEOUS RELATIONS

$\sin x \pm \sin y = 2 \sin \tfrac{1}{2} (x \pm y) \cdot \cos \tfrac{1}{2} (x \pm y).$
$\cos x + \cos y = 2 \cos \tfrac{1}{2} (x + y) \cdot \cos \tfrac{1}{2} (x - y).$
$\cos x - \cos y = -2 \sin \tfrac{1}{2} (x + y) \cdot \sin \tfrac{1}{2} (x - y).$

$$\tan x \pm \tan y = \frac{\sin (x \pm y)}{\cos x \cdot \cos y}.$$

$$\cot x \pm \cot y = \frac{\pm \sin (x \pm y)}{\sin x \cdot \sin y}.$$

$$\frac{\sin x \pm \sin y}{\cos x + \cos y} = \tan \tfrac{1}{2} (x \pm y).$$

$$\frac{\sin x \pm \sin y}{\cos x - \cos y} = -\cot \tfrac{1}{2} (x \mp y).$$

$$\frac{\sin x + \sin y}{\sin x - \sin y} = \frac{\tan \tfrac{1}{2} (x + y)}{\tan \tfrac{1}{2} (x - y)}.$$

$\sin^2 x - \sin^2 y = \sin (x + y) \cdot \sin (x - y).$
$\cos^2 x - \cos^2 y = - \sin (x + y) \sin (x - y).$
$\cos^2 x - \sin^2 y = \cos (x + y) \cos (x - y).$

RELATIONS BETWEEN SIDES AND ANGLES OF ANY PLANE TRIANGLE

In a triangle with angles A, B, and C and sides opposite a, b, and c respectively,

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}.$$

$$a^2 = b^2 + c^2 - 2bc \cos A.$$

$$a = b \cos C + c \cos B.$$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}.$$

$$\tan \frac{A - B}{2} = \frac{a - b}{a + b} \cot \frac{C}{2}.$$

$$\sin A = \frac{2}{bc} \sqrt{s(s-a)(s-b)(s-c)},$$

where $s = \frac{1}{2}(a + b + c)$.

$$\sin \frac{A}{2} = \sqrt{\frac{(s-b)(s-c)}{bc}}.$$

$$\cos \frac{A}{2} = \sqrt{\frac{s(s-a)}{bc}}.$$

$$\tan \frac{A}{2} = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}}.$$

$$\frac{a+b}{a-b} = \frac{\sin A + \sin B}{\sin A - \sin B} = \frac{\tan \frac{1}{2}(A+B)}{\tan \frac{1}{2}(A-B)} = \frac{\cot \frac{1}{2} C}{\tan \frac{1}{2}(A-B)}.$$

RELATIONS IN ANY SPHERICAL TRIANGLE

If A, B and C be the three angles and a, b, and c the opposite sides,

$$\frac{\sin A}{\sin a} = \frac{\sin B}{\sin b} = \frac{\sin C}{\sin c}.$$

$$\cos a = \cos b \cos c + \sin b \sin c \cos A.$$

$$\cos A = -\cos B \cos C + \sin B \sin C \cos a.$$

$$\sin \tfrac{1}{2} A = \sqrt{\frac{\sin(s-b) \cdot \sin(s-c)}{\sin b \sin c}}$$

where $s = \frac{1}{2}(a + b + c)$.

$$\cos \tfrac{1}{2} A = \sqrt{\frac{\sin s \cdot \sin(s-a)}{\sin b \sin c}}.$$

$$\tan \tfrac{1}{2} A = \frac{r}{\sin(s-a)}$$

where $r = \sqrt{\frac{\sin(s-a)\sin(s-b)\sin(s-c)}{\sin s}}.$

$$\cos \tfrac{1}{2} a = \sqrt{\frac{\cos (S - B) \cos (S - C)}{\sin B \sin C}}$$

where $$S = \tfrac{1}{2}(A + B + C).$$

$$\sin \tfrac{1}{2} a = \sqrt{- \frac{\cos S \cos (S - A)}{\sin B \sin C}}.$$

$$\tan \tfrac{1}{2} a = R \cos (S - A)$$

where $$R = \sqrt{\frac{- \cos S}{\cos (S - A) \cos (S - B) \cos (S - C)}}.$$

CALCULUS

Differentials

$$d\,ax = a\,dx$$
$$d\,uv = u\,dv + v\,du$$
$$d\frac{u}{v} = \frac{v\,du - u\,dv}{v^2}$$
$$dx^n = n\,x^{n-1}dx$$
$$d\,e^x = e^x dx$$
$$d\,e^{ax} = a\,e^{ax}dx$$
$$d\log_e x = \frac{1}{x}dx$$
$$d\,x^x = x^x(1 + \log_e x)\,dx$$
$$d\sin x = \cos x\,dx$$
$$d\cos x = -\sin x\,dx$$
$$d\tan x = \sec^2 x\,dx$$
$$d\cot x = -\csc^2 x\,dx$$
$$d\sec x = \tan x\sec x\,dx$$
$$d\csc x = -\cot x\cdot\csc x\,dx$$
$$d\sin^{-1}x = (1 - x^2)^{-\frac{1}{2}}dx$$
$$d\cos^{-1}x = -(1 - x^2)^{-\frac{1}{2}}dx$$
$$d\tan^{-1}x = (1 + x^2)^{-1}dx$$
$$d\cot^{-1}x = -(1 + x^2)^{-1}dx$$
$$d\sec^{-1}x = x^{-1}(x^2 - 1)^{-\frac{1}{2}}dx$$
$$d\csc^{-1}x = -x^{-1}(x^2 - 1)^{-\frac{1}{2}}dx$$

Integrals

$$\int x^n\,dx = \frac{x^{n+1}}{n+1} \qquad \text{except } n = -1$$
$$\int \frac{dx}{x} = \log x$$
$$\int e^x dx = e^x$$
$$\int e^{ax}dx = \frac{1}{a}e^{ax}$$
$$\int x\,e^{ax}dx = \frac{e^{ax}}{a^2}(ax - 1)$$
$$\int \log x\,dx = x\log x - x$$
$$\int u\,dv = uv - \int v\,du$$
$$\int (a + bx)^n dx = \frac{(a + bx)^{n+1}}{(n+1)b} \qquad \text{except } n = -1$$
$$\int (a^2 + x^2)^{-1}dx = \frac{1}{a}\tan^{-1}\frac{x}{a} = \frac{1}{a}\sin^{-1}\frac{x}{\sqrt{x^2 + a^2}}$$
$$\int (a^2 - x^2)^{-1}dx = \frac{1}{2a}\log\frac{a + x}{a - x}$$
$$\int (a^2 - x^2)^{-\frac{1}{2}}dx = \sin^{-1}\frac{x}{a} = -\cos^{-1}\frac{x}{a}$$

Integrals (Continued)

$$\int x(a^2 \pm x^2)^{-\frac{1}{2}}dx = \pm (a^2 \pm x^2)^{\frac{1}{2}}$$

$$\int \sin^2 x\, dx = -\tfrac{1}{2} \cos x \sin x + \tfrac{1}{2}x$$

$$\int \cos^2 x\, dx = \tfrac{1}{2} \sin x \cos x + \tfrac{1}{2}x$$

$$\int \sin x \cos x\, dx = \tfrac{1}{2} \sin^2 x$$

$$\int (\sin x \cos x)^{-1} dx = \log \tan x$$

$$\int \tan x\, dx = -\log \cos x$$

$$\int \tan^2 x\, dx = \tan x - x$$

$$\int \cot x\, dx = \log \sin x$$

$$\int \cot^2 x\, dx = -\cot x - x$$

$$\int \csc x\, dx = \log \tan \tfrac{1}{2}x$$

$$\int x \sin x\, dx = \sin x - x \cos x$$

$$\int x \cos x\, dx = \cos x + x \sin x$$

ANALYTICAL GEOMETRY

The distance between two points x_1, y_1, and x_2, y_2, — rectangular coördinates:

$$d = \pm \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

For polar coördinates and points r_1, θ_1, and r_2, θ_2:

$$d = \pm \sqrt{r_1^2 + r_2^2 - 2r_1r_2 \cos (\theta_1 - \theta)_2}$$

The area of a triangle whose vertices are x_1, y_1; x_2, y_2, and x_3, y_3:

$$A = \tfrac{1}{2}(x_1y_2 - x_2y_1 + x_2y_3 - x_3y_2 + x_3y_1 - x_1y_3)$$

For polar coördinates and vertices, r_1, θ_1; r_2, θ_2, and r_3, θ_3:

$$A = \tfrac{1}{2}\{(r_1r_2 \sin (\theta_2 - \theta_1) + r_2r_3 \sin (\theta_3 - \theta_2) + r_3r_1 \sin (\theta_1 - \theta_3)\}$$

The equation of a straight line where m is the tangent of the angle of inclination and c, the distance of intersection with the Y axis from the origin:

$$y = mx + c$$

If a line of inclination m passes through the point x_1, y_1 its equation is:

$$y - y_1 = m(x - x_1)$$

The equation of a line through the points x_1, y_1, and x_2, y_2 is:

$$\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1}$$

If the intercepts on the X and Y axes are a and b respectively, the equation is:

$$\frac{x}{a} + \frac{y}{b} = 1$$

If the length of the perpendicular from the origin is p and its angle of inclination θ the equation is:

$$x \cos \theta + y \sin \theta = p$$

General equation of the straight line:

$$Ax + By + C = 0$$

The equation of a circle whose center is at a, b, and whose radius is c:

$$(x - a)^2 + (y - b)^2 = c^2$$

If the origin is at the center:

$$x^2 + y^2 = c^2$$

The polar equation of a circle with the origin on the circumference and its center at point c, α:

$$r = 2c \cos (\theta - \alpha).$$

If the origin is not on the circumference, the radius a and the center at a point l, α, the equation becomes:

$$a^2 = r^2 + l^2 - 2rl \cos (\theta - \alpha)$$

The equation of a parabola with the origin at the vertex, where p is the distance from the focus to the vertex:

$$y^2 = 4px$$

The polar equation where the pole is at the focus and l the semi-latus rectum is:

$$\frac{l}{r} = 1 - \cos\theta$$

If the pole is at the vertex and p as above:

$$r = \frac{4p\cos\theta}{\sin^2\theta}$$

The equation of the ellipse with the origin at the center and semi-axes a and b:

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

Polar equation where the pole is at the center:

$$r^2 = \frac{a^2b^2}{a^2\sin^2\theta + b^2\cos^2\theta}$$

The equation of the hyperbola with the origin at the center, semi-axes a and b:

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

Polar equation, pole at center:

$$r^2 = \frac{a^2b^2}{a^2\sin^2\theta - b^2\cos^2\theta}$$

EXPLANATION OF LOGARITHM TABLES

The logarithm of a number is the exponent of that power to which another number, the base, must be raised to give the number first named. The base commonly used is 10 and as most numbers are incommensurable powers of ten a common logarithm, in general, consists of an integer which is called the characteristic and an endless decimal, the mantissa.

It is to be observed that the common logarithms of all numbers expressed by the same figures in the same order with the decimal point in different positions have different characteristics but the same mantissa. To illustrate: — if the decimal point stand after the first figure of a number, counting from the left, the characteristic is 0; if after two figures, it is 1; if after three figures, it is 2, and so forth. If the decimal point stand before the first significant figure the characteristic is -1, usually written $\bar{1}$; if there is one zero between the decimal point and the first significant figure it is $\bar{2}$ and so on. For example: log 256 = 2.40824, log 2.56 = 0.40824, log 0.256 = $\bar{1}.40824$, log 0.00256 = $\bar{3}.40824$. Inasmuch as the characteristic may be determined by inspection the mantissas only are given in tables of common logarithms.

To find the logarithm of a number.

For a number of four figures take out the tabular mantissa on a line with the first three figures of the number and under its fourth figure. The characteristic is determined as previously explained.

For a number of less than four figures supply zeros to make a four figure number and take the value of the mantissa from the tables as before. For example: log 2 = log 2.000 = 0.30103.

For a number of more than four figures take the tabular value of the mantissa for the first four figures; find the difference between this mantissa and the next greater tabular mantissa and multiply the difference so found by the remaining figures of the number as a decimal and add the product to the mantissa of the first four figures. For example: to find log 46.762.

$$\log 46.76 = 1.66987$$

Tabular difference between this mantissa and that for 4677 is .00010.

$$\begin{aligned}\therefore \log 46.762 &= 1.66987 + .2 \times .00010 \\ &= 1.66987 + .00002 \\ &= 1.66989\end{aligned}$$

To find the number corresponding to a given logarithm.

If the mantissa is found exactly in the table, join the figure at the top which is directly above the given mantissa to the three figures on the line at the left and place the decimal point according to the characteristic of the logarithm. For example, $\log^{-1}$ (antilogarithm) 3.39967 = 2510.

If the mantissa is not found exactly in the table it is necessary to interpolate. For example, $\log^{-1} 3.40028 = 2513. + \frac{9}{18} = 2513.5$.

The column of proportional parts at the right of each page of the table shows, under the heading of the various tabular differences, the parts of these differences which correspond to the digits from 1 to 9 in the fifth place. This makes it possible to take out a logarithm for a five figure number or to find an antilogarithm of the same number of significant figures with increased facility, usually by inspection.

The following formulæ express the relations on which the use of logarithms is based.

$$\log ab = \log a + \log b$$

$$\log \frac{a}{b} = \log a - \log b$$

$$\log a^n = n \times \log a$$

$$\log \sqrt[n]{a} = \frac{\log a}{n}$$

FOUR-PLACE LOGARITHMS

N	0	1	2	3	4	5	6	7	8	9	Proportional Parts 1	2	3	4	5
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374	4	8	12	17	21
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	4	8	11	15	19
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	3	7	10	14	17
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430	3	6	10	13	16
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	3	6	9	12	15
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	3	6	8	11	14
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	3	5	8	11	13
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	2	5	7	10	12
18	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765	2	5	7	9	12
19	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989	2	4	7	9	11
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	2	4	6	8	11
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	2	4	6	8	10
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	2	4	6	8	10
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	2	4	6	7	9
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	2	4	5	7	9
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	2	3	5	7	9
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	2	3	5	7	8
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	2	3	5	6	8
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	2	3	5	6	8
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	1	3	4	6	7
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	1	3	4	6	7
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	1	3	4	6	7
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	1	3	4	5	7
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	1	3	4	5	6
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	1	3	4	5	6
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	1	2	4	5	6
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	1	2	4	5	6
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	1	2	3	5	6
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	1	2	3	5	6
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	1	2	3	4	5
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	1	2	3	4	5
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	1	2	3	4	5
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	1	2	3	4	5
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	1	2	3	4	5
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	1	2	3	4	5
45	6352	6542	6551	6561	6571	6580	6590	6599	6609	6618	1	2	3	4	5
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	1	2	3	4	5
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	1	2	3	4	5
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	1	2	3	4	4
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	1	2	3	4	4
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	1	2	3	3	4
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	1	2	3	3	4
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	1	2	2	3	4
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	1	2	2	3	4
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	1	2	2	3	4
N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5

FOUR-PLACE LOGARITHMS (Continued)

N	0	1	2	3	4	5	6	7	8	9	Proportional Parts 1	2	3	4	5
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	1	2	2	3	4
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	1	2	2	3	4
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	1	2	2	3	4
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	1	1	2	3	4
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	1	1	2	3	4
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	1	1	2	3	4
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	1	1	2	3	4
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	1	1	2	3	3
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	1	1	2	3	3
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	1	1	2	3	3
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	1	1	2	3	3
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	1	1	2	3	3
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	1	2	3	3
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	1	1	2	3	3
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	1	1	2	2	3
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	1	1	2	2	3
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	1	1	2	2	3
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	1	1	2	2	3
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	1	1	2	2	3
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	1	1	2	2	3
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	1	2	2	3
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	1	1	2	2	3
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	1	1	2	2	3
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	1	1	2	2	3
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	1	1	2	2	3
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	1	1	2	2	3
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	1	2	2	3
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	1	1	2	2	3
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	1	2	2	3
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	1	2	2	3
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	1	2	2	3
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	1	2	2	3
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	0	1	1	2	2
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	1	2	2
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	1	2	2
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	1	2	2
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	1	2	2
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	1	2	2
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	1	2	2
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	1	2	2
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	1	2	2
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	1	2	2
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	1	2	2
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	0	1	1	2	2
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	1	2	2
N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5

FIVE-PLACE LOGARITHMS

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts			
100	00 000	043	087	130	173	217	260	303	346	389		**44**	**43**	**42**
101	432	475	518	561	604	647	689	732	775	817	1	4,4	4,3	4,2
102	860	903	945	988	*030	*072	*115	*157	*199	*242	2	8,8	8,6	8,4
103	01 284	326	368	410	452	494	536	578	620	662	3	13,2	12,9	12,6
104	703	745	787	828	870	912	953	995	*036	*078	4	17,6	17,2	16,8
105	02 119	160	202	243	284	325	366	407	449	490	5	22,0	21,5	21,0
106	531	572	612	653	694	735	776	816	857	898	6	26,4	25,8	25,2
107	938	979	*019	*060	*100	*141	*181	*222	*262	*302	7	30,8	30,1	29,4
108	03 342	383	423	463	503	543	583	623	663	703	8	35,2	34,4	33,6
109	743	782	822	862	902	941	981	*021	*060	*100	9	39,6	38,7	37,8
110	04 139	179	218	258	297	336	376	415	454	493		**41**	**40**	**39**
111	532	571	610	650	689	727	766	805	844	883	1	4,1	4,0	3,9
112	922	961	999	*038	*077	*115	*154	*192	*231	*269	2	8,2	8,0	7,8
113	05 308	346	385	423	461	500	538	576	614	652	3	12,3	12,0	11,7
114	690	729	767	805	843	881	918	956	994	*032	4	16,4	16,0	15,6
115	06 070	108	145	183	221	258	296	333	371	408	5	20,5	20,0	19,5
116	446	483	521	558	595	633	670	707	744	781	6	24,6	24,0	23,4
117	819	856	893	930	967	*004	*041	*078	*115	*151	7	28,7	28,0	27,3
118	07 188	225	262	298	335	372	408	445	482	518	8	32,8	32,0	31,2
119	555	591	628	664	700	737	773	809	846	882	9	36,9	36,0	35,1
120	918	954	990	*027	*063	*099	*135	*171	*207	*243		**38**	**37**	**36**
121	08 279	314	350	386	422	458	493	529	565	600	1	3,8	3,7	3,6
122	636	672	707	743	778	814	849	884	920	955	2	7,6	7,4	7,2
123	991	*026	*061	*096	*132	*167	*202	*237	*272	*807	3	11,4	11,1	10,8
124	09 342	377	412	447	482	517	552	587	621	656	4	15,2	14,8	14,4
125	691	726	760	795	830	864	899	934	968	*003	5	19,0	18,5	18,0
126	10 037	072	106	140	175	209	243	278	312	346	6	22,8	22,2	21,6
127	380	415	449	483	517	551	585	619	653	687	7	26,6	25,9	25,2
128	721	755	789	823	857	890	924	958	992	*025	8	30,4	29,6	28,8
129	11 059	093	126	160	193	227	261	294	327	361	9	34,2	33,3	32,4
130	394	428	461	494	528	561	594	628	661	694		**35**	**34**	**33**
131	727	760	793	826	860	893	926	959	992	*024	1	3,5	3,4	3,3
132	12 057	090	123	156	189	222	254	287	320	352	2	7,0	6,8	6,6
133	385	418	450	483	516	548	581	613	646	678	3	10,5	10,2	9,9
134	710	743	775	808	840	872	905	937	969	*001	4	14,0	13,6	13,2
135	13 033	066	098	130	162	194	226	258	290	322	5	17,5	17,0	16,5
136	354	386	418	450	481	513	545	577	609	640	6	21,0	20,4	19,8
137	672	704	735	767	799	830	862	893	925	956	7	24,5	23,8	23,1
138	988	*019	*051	*082	*114	*145	*176	*208	*239	*270	8	28,0	27,2	26,4
139	14 301	333	364	395	426	457	489	520	551	582	9	31,5	30,6	29,7
140	613	644	675	706	737	768	799	829	860	891		**32**	**31**	**30**
141	922	953	983	*014	*045	*076	*106	*137	*168	*198	1	3,2	3,1	3,0
142	15 229	259	290	320	351	381	412	442	473	503	2	6,4	6,2	6,0
143	534	564	594	625	655	685	715	746	776	806	3	9,6	9,3	9,0
144	836	866	897	927	957	987	*017	*047	*077	*107	4	12,8	12,4	12,0
145	16 137	167	197	227	256	286	316	346	376	406	5	16,0	15,5	15,0
146	435	465	495	524	554	584	613	643	673	702	6	19,2	18,6	18,0
147	732	761	791	820	850	879	909	938	967	997	7	22,4	21,7	21,0
148	17 026	056	085	114	143	173	202	231	260	289	8	25,6	24,8	24,0
149	319	348	377	406	435	464	493	522	551	580	9	28,8	27,9	27,0
150	609	638	667	696	725	754	782	811	840	869				
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts			

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts		
150	17 609	638	667	696	725	754	782	811	840	869		**29**	**28**
151	898	926	955	984	*013	*041	*070	*099	*127	*156	1	2,9	2,8
152	18 184	213	241	270	298	327	355	384	412	441	2	5,8	5,6
153	469	498	526	554	583	611	639	667	696	724	3	8,7	8,4
154	752	780	808	837	865	893	921	949	977	*005	4	11,6	11,2
155	19 033	061	089	117	145	173	201	229	257	285	5	14,5	14,0
156	312	340	368	396	424	451	479	507	535	562	6	17,4	16,8
157	590	618	645	673	700	728	756	783	811	838	7	20,3	19,6
158	866	893	921	948	976	*003	*030	*058	*085	*112	8	23,2	22,4
159	20 140	167	194	222	249	276	303	330	358	385	9	26,1	25,2
160	412	439	466	493	520	548	575	602	629	656		**27**	**26**
161	683	710	737	763	790	817	844	871	898	925	1	2,7	2,6
162	952	978	*005	*032	*059	*085	*112	*139	*165	*192	2	5,4	5,2
163	21 219	245	272	299	325	352	378	405	431	458	3	8,1	7,8
164	484	511	537	564	590	617	643	669	696	722	4	10,8	10,4
165	748	775	801	827	854	880	906	932	958	985	5	13,5	13,0
166	22 011	037	063	089	115	141	167	194	220	246	6	16,2	15,6
167	272	298	324	350	376	401	427	453	479	505	7	18,9	18,2
168	531	557	583	608	634	660	686	712	737	763	8	21,6	20,8
169	789	814	840	866	891	917	943	968	994	*019	9	24,3	23,4
170	23 045	070	096	121	147	172	198	223	249	274		**25**	
171	300	325	350	376	401	426	452	477	502	528	1	2,5	
172	553	578	603	629	654	679	704	729	754	779	2	5,0	
173	805	830	855	880	905	930	955	980	*005	*030	3	7,5	
174	24 055	080	105	130	155	180	204	229	254	279	4	10,0	
175	304	329	353	378	403	428	452	477	502	527	5	12,5	
176	551	576	601	625	650	674	699	724	748	773	6	15,0	
177	797	822	846	871	895	920	944	969	993	*018	7	17,5	
178	25 042	066	091	115	139	164	188	212	237	261	8	20,0	
179	285	310	334	358	382	406	431	455	479	503	9	22,5	
180	527	551	575	600	624	648	672	696	720	744		**24**	**23**
181	768	792	816	840	864	888	912	935	959	983	1	2,4	2,3
182	26 007	031	055	079	102	126	150	174	198	221	2	4,8	4,6
183	245	269	293	316	340	364	387	411	435	458	3	7,2	6,9
184	482	505	529	553	576	600	623	647	670	694	4	9,6	9,2
185	717	741	764	788	811	834	858	881	905	928	5	12,0	11,5
186	951	975	998	*021	*045	*068	*091	*114	*138	*161	6	14,4	13,8
187	27 184	207	231	254	277	300	323	346	370	393	7	16,8	16,1
188	416	439	462	485	508	531	554	577	600	623	8	19,2	18,4
189	646	669	692	715	738	761	784	807	830	852	9	21,6	20,7
190	875	898	921	944	967	989	*012	*035	*058	*081		**22**	**21**
191	28 103	126	149	171	194	217	240	262	285	307	1	2,2	2,1
192	330	353	375	398	421	443	466	488	511	533	2	4,4	4,2
193	556	578	601	623	646	668	691	713	735	758	3	6,6	6,3
194	780	803	825	847	870	892	914	937	959	981	4	8,8	8,4
195	29 003	026	048	070	092	115	137	159	181	203	5	11,0	10,5
196	226	248	270	292	314	336	358	380	403	425	6	13,2	12,6
197	447	469	491	513	535	557	579	601	623	645	7	15,4	14,7
198	667	688	710	732	754	776	798	820	842	863	8	17,6	16,8
199	885	907	929	951	973	994	*016	*038	*060	*081	9	19,8	18,9
200	30 103	125	146	168	190	211	233	255	276	298			
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts		

FIVE-PLACE LOGARITHMS (Continued)

N.		0	1	2	3	4	5	6	7	8	9
200	30	103	125	146	168	190	211	233	255	276	298
201		320	341	363	384	406	428	449	471	492	514
202		535	557	578	600	621	643	664	685	707	728
203		750	771	792	814	835	856	878	899	920	942
204		963	984	*006	*027	*048	*069	*091	*112	*133	*154
205	31	175	197	218	239	260	281	302	323	345	366
206		387	408	429	450	471	492	513	534	555	576
207		597	618	639	660	681	702	723	744	765	785
208		806	827	848	869	890	911	931	952	973	994
209	32	015	035	056	077	098	118	139	160	181	201
210		222	243	263	284	305	325	346	366	387	408
211		428	449	469	490	510	531	552	572	593	613
212		634	654	675	695	715	736	756	777	797	818
213		838	858	879	899	919	940	960	980	*001	*021
214	33	041	062	082	102	122	143	163	183	203	224
215		244	264	284	304	325	345	365	385	405	425
216		445	465	486	506	526	546	566	586	606	626
217		646	666	686	706	726	746	766	786	806	826
218		846	866	885	905	925	945	965	985	*005	*025
219	34	044	064	084	104	124	143	163	183	203	223
220		242	262	282	301	321	341	361	380	400	420
221		439	459	479	498	518	537	557	577	596	616
222		635	655	674	694	713	733	753	772	792	811
223		830	850	869	889	908	928	947	967	986	*005
224	35	025	044	064	083	102	122	141	160	180	199
225		218	238	257	276	295	315	334	353	372	392
226		411	430	449	468	488	507	526	545	564	583
227		603	622	641	660	679	698	717	736	755	774
228		793	813	832	851	870	889	908	927	946	965
229		984	*003	*021	*040	*059	*078	*097	*116	*135	*154
230	36	173	192	211	229	248	267	286	305	324	342
231		361	380	399	418	436	455	474	493	511	530
232		549	568	586	605	624	642	661	680	698	717
233		736	754	773	791	810	829	847	866	884	903
234		922	940	959	977	996	*014	*033	*051	*070	*088
235	37	107	125	144	162	181	199	218	236	254	273
236		291	310	328	346	365	383	401	420	438	457
237		475	493	511	530	548	566	585	603	621	639
238		658	676	694	712	731	749	767	785	803	822
239		840	858	876	894	912	931	949	967	985	*003
240	38	021	039	057	075	093	112	130	148	166	184
241		202	220	238	256	274	292	310	328	346	364
242		382	399	417	435	453	471	489	507	525	543
243		561	578	596	614	632	650	668	686	703	721
244		739	757	775	792	810	828	846	863	881	899
245		917	934	952	970	987	*005	*023	*041	*058	*076
246	39	094	111	129	146	164	182	199	217	235	252
247		270	287	305	322	340	358	375	393	410	428
248		445	463	480	498	515	533	550	568	585	602
249		620	637	655	672	690	707	724	742	759	777
250		794	811	829	846	863	881	898	915	933	950
N.		0	1	2	3	4	5	6	7	8	9

Proportional parts

	22	**21**
1	2,2	2,1
2	4,4	4,2
3	6,6	6,3
4	8,8	8,4
5	11,0	10,5
6	13,2	12,6
7	15,4	14,7
8	17,6	16,8
9	19,8	18,9

	20
1	2,0
2	4,0
3	6,0
4	8,0
5	10,0
6	12,0
7	14,0
8	16,0
9	18,0

	19
1	1,9
2	3,8
3	5,7
4	7,6
5	9,5
6	11,4
7	13,3
8	15,2
9	17,1

	18
1	1,8
2	3,6
3	5,4
4	7,2
5	9,0
6	10,8
7	12,6
8	14,4
9	16,2

	17
1	1,7
2	3,4
3	5,1
4	6,8
5	8,5
6	10,2
7	11,9
8	13,6
9	15,3

Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	
250	39 794	811	829	846	863	881	898	915	933	950		**18**
251	967	985	*002	*019	*037	*054	*071	*088	*106	*123	1	1,8
252	40 140	157	175	192	209	226	243	261	278	295	2	3,6
253	312	329	346	364	381	398	415	432	449	466	3	5,4
254	483	500	518	535	552	569	586	603	620	637	4	7,2
255	654	671	688	705	722	739	756	773	790	807	5	9,0
256	824	841	858	875	892	909	926	943	960	976	6	10,8
257	993	*010	*027	*044	*061	*078	*095	*111	*128	*145	7	12,6
258	41 162	179	196	212	229	246	263	280	296	313	8	14,4
259	330	347	363	380	397	414	430	447	464	481	9	16,2
260	497	514	531	547	564	581	597	614	631	647		**17**
261	664	681	697	714	731	747	764	780	797	814	1	1,7
262	830	847	863	880	896	913	929	946	963	979	2	3,4
263	996	*012	*029	*045	*062	*078	*095	*111	*127	*144	3	5,1
264	42 160	177	193	210	226	243	259	275	292	308	4	6,8
265	325	341	357	374	390	406	423	439	455	472	5	8,5
266	488	504	521	537	553	570	586	602	619	635	6	10,2
267	651	667	684	700	716	732	749	765	781	797	7	11,9
268	813	830	846	862	878	894	911	927	943	959	8	13,6
269	975	991	*008	*024	*040	*056	*072	*088	*104	*120	9	15,3
270	43 136	152	169	185	201	217	233	249	265	281		**16**
271	297	313	329	345	361	377	393	409	425	441	1	1,6
272	457	473	489	505	521	537	553	569	584	600	2	3,2
273	616	632	648	664	680	696	712	727	743	759	3	4,8
274	775	791	807	823	838	854	870	886	902	917	4	6,4
275	933	949	965	981	996	*012	*028	*044	*059	*075	5	8,0
276	44 091	107	122	138	154	170	185	201	217	232	6	9,6
277	248	264	279	295	311	326	342	358	373	389	7	11,2
278	404	420	436	451	467	483	498	514	529	545	8	12,8
279	560	576	592	607	623	638	654	669	685	700	9	14,4
280	716	731	747	762	778	793	809	824	840	855		**15**
281	871	886	902	917	932	948	963	979	994	*010	1	1,5
282	45 025	040	056	071	086	102	117	133	148	163	2	3,0
283	179	194	209	225	240	255	271	286	301	317	3	4,5
284	332	347	362	378	393	408	423	439	454	469	4	6,0
285	484	500	515	530	545	561	576	591	606	621	5	7,5
286	637	652	667	682	697	712	728	743	758	773	6	9,0
287	788	803	818	834	849	864	879	894	909	924	7	10,5
288	939	954	969	984	*000	*015	*030	*045	*060	*075	8	12,0
289	46 090	105	120	135	150	165	180	195	210	225	9	13,5
290	240	255	270	285	300	315	330	345	359	374		**14**
291	389	404	419	434	449	464	479	494	509	523	1	1,4
292	538	553	568	583	598	613	627	642	657	672	2	2,8
293	687	702	716	731	746	761	776	790	805	820	3	4,2
294	835	850	864	879	894	909	923	938	953	967	4	5,6
295	982	997	*012	*026	*041	*056	*070	*085	*100	*114	5	7,0
296	47 129	144	159	173	188	202	217	232	246	261	6	8,4
297	276	290	305	319	334	349	363	378	392	407	7	9,8
298	422	436	451	465	480	494	509	524	538	553	8	11,2
299	567	582	596	611	625	640	654	669	683	698	9	12,6
300	712	727	741	756	770	784	799	813	828	842		
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9
300	47 712	727	741	756	770	784	799	813	828	842
301	857	871	885	900	914	929	943	958	972	986
302	48 001	015	029	044	058	073	087	101	116	130
303	144	159	173	187	202	216	230	244	259	273
304	287	302	316	330	344	359	373	387	401	416
305	430	444	458	473	487	501	515	530	544	558
306	572	586	601	615	629	643	657	671	686	700
307	714	728	742	756	770	785	799	813	827	841
308	855	869	883	897	911	926	940	954	968	982
309	996	*010	*024	*038	*052	*066	*080	*094	*108	*122
310	49 136	150	164	178	192	206	220	234	248	262
311	276	290	304	318	332	346	360	374	388	402
312	415	429	443	457	471	485	499	513	527	541
313	554	568	582	596	610	624	638	651	665	679
314	693	707	721	734	748	762	776	790	803	817
315	831	845	859	872	886	900	914	927	941	955
316	969	982	996	*010	*024	*037	*051	*065	*079	*092
317	50 106	120	133	147	161	174	188	202	215	229
318	243	256	270	284	297	311	325	338	352	365
319	379	393	406	420	433	447	461	474	488	501
320	515	529	542	556	569	583	596	610	623	637
321	651	664	678	691	705	718	732	745	759	772
322	786	799	813	826	840	853	866	880	893	907
323	920	934	947	961	974	987	*001	*014	*028	*041
324	51 055	068	081	095	108	121	135	148	162	175
325	188	202	215	228	242	255	268	282	295	308
326	322	335	348	362	375	388	402	415	428	441
327	455	468	481	495	508	521	534	548	561	574
328	587	601	614	627	640	654	667	680	693	706
329	720	733	746	759	772	786	799	812	825	838
330	851	865	878	891	904	917	930	943	957	970
331	983	996	*009	*022	*035	*048	*061	*075	*088	*101
332	52 114	127	140	153	166	179	192	205	218	231
333	244	257	270	284	297	310	323	336	349	362
334	375	388	401	414	427	440	453	466	479	492
335	504	517	530	543	556	569	582	595	608	621
336	634	647	660	673	686	699	711	724	737	750
337	763	776	789	802	815	827	840	853	866	879
338	892	905	917	930	943	956	969	982	994	*007
339	53 020	033	046	058	071	084	097	110	122	135
340	148	161	173	186	199	212	224	237	250	263
341	275	288	301	314	326	339	352	364	377	390
342	403	415	428	441	453	466	479	491	504	517
343	529	542	555	567	580	593	605	618	631	643
344	656	668	681	694	706	719	732	744	757	769
345	782	794	807	820	832	845	857	870	882	895
346	908	920	933	945	958	970	983	995	*008	*020
347	54 033	045	058	070	083	095	108	120	133	145
348	158	170	183	195	208	220	233	245	258	270
349	283	295	307	320	332	345	357	370	382	394
350	407	419	432	444	456	469	481	494	506	518
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	15		**14**		**13**		**12**
1	1,5	1	1,4	1	1,3	1	1,2
2	3,0	2	2,8	2	2,6	2	2,4
3	4,5	3	4,2	3	3,9	3	3,6
4	6,0	4	5,6	4	5,2	4	4,8
5	7,5	5	7,0	5	6,5	5	6,0
6	9,0	6	8,4	6	7,8	6	7,2
7	10,5	7	9,8	7	9,1	7	8,4
8	12,0	8	11,2	8	10,4	8	9,6
9	13,5	9	12,6	9	11,7	9	10,8

Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9
350	54 407	419	432	444	456	469	481	494	506	518
351	531	543	555	568	580	593	605	617	630	642
352	654	667	679	691	704	716	728	741	753	765
353	777	790	802	814	827	839	851	864	876	888
354	900	913	925	937	949	962	974	986	998	*011
355	55 023	035	047	060	072	084	096	108	121	133
356	145	157	169	182	194	206	218	230	242	255
357	267	279	291	303	315	328	340	352	364	376
358	388	400	413	425	437	449	461	473	485	497
359	509	522	534	546	558	570	582	594	606	618
360	630	642	654	666	678	691	703	715	727	739
361	751	763	775	787	799	811	823	835	847	859
362	871	883	895	907	919	931	943	955	967	979
363	991	*003	*015	*027	*038	*050	*062	*074	*086	*098
364	56 110	122	134	146	158	170	182	194	205	217
365	229	241	253	265	277	289	301	312	324	336
366	348	360	372	384	396	407	419	431	443	455
367	467	478	490	502	514	526	538	549	561	573
368	585	597	608	620	632	644	656	667	679	691
369	703	714	726	738	750	761	773	785	797	808
370	820	832	844	855	867	879	891	902	914	926
371	937	949	961	972	984	996	*008	*019	*031	*043
372	57 054	066	078	089	101	113	124	136	148	159
373	171	183	194	206	217	229	241	252	264	276
374	287	299	310	322	334	345	357	368	380	392
375	403	415	426	438	449	461	473	484	496	507
376	519	530	542	553	565	576	588	600	611	623
377	634	646	657	669	680	692	703	715	726	738
378	749	761	772	784	795	807	818	830	841	852
379	864	875	887	898	910	921	933	944	955	967
380	978	990	*001	*013	*024	*035	*047	*058	*070	*081
381	58 092	104	115	127	138	149	161	172	184	195
382	206	218	229	240	252	263	274	286	297	309
383	320	331	343	354	365	377	388	399	410	422
384	433	444	456	467	478	490	501	512	524	535
385	546	557	569	580	591	602	614	625	636	647
386	659	670	681	692	704	715	726	737	749	760
387	771	782	794	805	816	827	838	850	861	872
388	883	894	906	917	928	939	950	961	973	984
389	995	*006	*017	*028	*040	*051	*062	*073	*084	*095
390	59 106	118	129	140	151	162	173	184	195	207
391	218	229	240	251	262	273	284	295	306	318
392	329	340	351	362	373	384	395	406	417	428
393	439	450	461	472	483	494	506	517	528	539
394	550	561	572	583	594	605	616	627	638	649
395	660	671	682	693	704	715	726	737	748	759
396	770	780	791	802	813	824	835	846	857	868
397	879	890	901	912	923	934	945	956	966	977
398	988	999	*010	*021	*032	*043	*054	*065	*076	*086
399	60 097	108	119	130	141	152	163	173	184	195
400	206	217	228	239	249	260	271	282	293	304
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	13	**12**	**11**	**10**
1	1,3	1,2	1,1	1,0
2	2,6	2,4	2,2	2,0
3	3,9	3,6	3,3	3,0
4	5,2	4,8	4,4	4,0
5	6,5	6,0	5,5	5,0
6	7,8	7,2	6,6	6,0
7	9,1	8,4	7,7	7,0
8	10,4	9,6	8,8	8,0
9	11,7	10,8	9,9	9,0

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9
400	60 206	217	228	239	249	260	271	282	293	304
401	314	325	336	347	358	369	379	390	401	412
402	423	433	444	455	466	477	487	498	509	520
403	531	541	552	563	574	584	595	606	617	627
404	638	649	660	670	681	692	703	713	724	735
405	746	756	767	778	788	799	810	821	831	842
406	853	863	874	885	895	906	917	927	938	949
407	959	970	981	991	*002	*013	*023	*034	*045	*055
408	61 066	077	087	098	109	119	130	140	151	162
409	172	183	194	204	215	225	236	247	257	268
410	278	289	300	310	321	331	342	352	363	374
411	384	395	405	416	426	437	448	458	469	479
412	490	500	511	521	532	542	553	563	574	584
413	595	606	616	627	637	648	658	669	679	690
414	700	711	721	731	742	752	763	773	784	794
415	805	815	826	836	847	857	868	878	888	899
416	909	920	930	941	951	962	972	982	993	*003
417	62 014	024	034	045	055	066	076	086	097	107
418	118	128	138	149	159	170	180	190	201	211
419	221	232	242	252	263	273	284	294	304	315
420	325	335	346	356	366	377	387	397	408	418
421	428	439	449	459	469	480	490	500	511	521
422	531	542	552	562	572	583	593	603	613	624
423	634	644	655	665	675	685	696	706	716	726
424	737	747	757	767	778	788	798	808	818	829
425	839	849	859	870	880	890	900	910	921	931
426	941	951	961	972	982	992	*002	*012	*022	*033
427	63 043	053	063	073	083	094	104	114	124	134
428	144	155	165	175	185	195	205	215	225	236
429	246	256	266	276	286	296	306	317	327	337
430	347	357	367	377	387	397	407	417	428	438
431	448	458	468	478	488	498	508	518	528	538
432	548	558	568	579	589	599	609	619	629	639
433	649	659	669	679	689	699	709	719	729	739
434	749	759	769	779	789	799	809	819	829	839
435	849	859	869	879	889	899	909	919	929	939
436	949	959	969	979	988	998	*008	*018	*028	*038
437	64 048	058	068	078	088	098	108	118	128	137
438	147	157	167	177	187	197	207	217	227	237
439	246	256	266	276	286	296	306	316	326	335
440	345	355	365	375	385	395	404	414	424	434
441	444	454	464	473	483	493	503	513	523	532
442	542	552	562	572	582	591	601	611	621	631
443	640	650	660	670	680	689	699	709	719	729
444	738	748	758	768	777	787	797	807	816	826
445	836	846	856	865	875	885	895	904	914	924
446	933	943	953	963	972	982	992	*002	*011	*021
447	65 031	040	050	060	070	079	089	099	108	118
448	128	137	147	157	167	176	186	196	205	215
449	225	234	244	254	263	273	283	292	302	312
450	321	331	341	350	360	369	379	389	398	408
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	11
1	1,1
2	2,2
3	3,3
4	4,4
5	5,5
6	6,6
7	7,7
8	8,8
9	9,9

	10
1	1,0
2	2,0
3	3,0
4	4,0
5	5,0
6	6,0
7	7,0
8	8,0
9	9,0

	9
1	0,9
2	1,8
3	2,7
4	3,6
5	4,5
6	5,4
7	6,3
8	7,2
9	8,1

Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.		0	1	2	3	4	5	6	7	8	9
450	65	321	331	341	350	360	369	379	389	398	408
451		418	427	437	447	456	466	475	485	495	504
452		514	523	533	543	552	562	571	581	591	600
453		610	619	629	639	648	658	667	677	686	696
454		706	715	725	734	744	753	763	772	782	792
455		801	811	820	830	839	849	858	868	877	887
456		896	906	916	925	935	944	954	963	973	982
457		992	*001	*011	*020	*030	*039	*049	*058	*068	*077
458	66	087	096	106	115	124	134	143	153	162	172
459		181	191	200	210	219	229	238	247	257	266
460		276	285	295	304	314	323	332	342	351	361
461		370	380	389	398	408	417	427	436	445	455
462		464	474	483	492	502	511	521	530	539	549
463		558	567	577	586	596	605	614	624	633	642
464		652	661	671	680	689	699	708	717	727	736
465		745	755	764	773	783	792	801	811	820	829
466		839	848	857	867	876	885	894	904	913	922
467		932	941	950	960	969	978	987	997	*006	*015
468	67	025	034	043	052	062	071	080	089	099	108
469		117	127	136	145	154	164	173	182	191	201
470		210	219	228	237	247	256	265	274	284	293
471		302	311	321	330	339	348	357	367	376	385
472		394	403	413	422	431	440	449	459	468	477
473		486	495	504	514	523	532	541	550	560	569
474		578	587	596	605	614	624	633	642	651	660
475		669	679	688	697	706	715	724	733	742	752
476		761	770	779	788	797	806	815	825	834	843
477		852	861	870	879	888	897	906	916	925	934
478		943	952	961	970	979	988	997	*006	*015	*024
479	68	034	043	052	061	070	079	088	097	106	115
480		124	133	142	151	160	169	178	187	196	205
481		215	224	233	242	251	260	269	278	287	296
482		305	314	323	332	341	350	359	368	377	386
483		395	404	413	422	431	440	449	458	467	476
484		485	494	502	511	520	529	538	547	556	565
485		574	583	592	601	610	619	628	637	646	655
486		664	673	681	690	699	708	717	726	735	744
487		753	762	771	780	789	797	806	815	824	833
488		842	851	860	869	878	886	895	904	913	922
489		931	940	949	958	966	975	984	993	*002	*011
490	69	020	028	037	046	055	064	073	082	090	099
491		108	117	126	135	144	152	161	170	179	188
492		197	205	214	223	232	241	249	258	267	276
493		285	294	302	311	320	329	338	346	355	364
494		373	381	390	399	408	417	425	434	443	452
495		461	469	478	487	496	504	513	522	531	539
496		548	557	566	574	583	592	601	609	618	627
497		636	644	653	662	671	679	688	697	705	714
498		723	732	740	749	758	767	775	784	793	801
499		810	819	827	836	845	854	862	871	880	888
500		897	906	914	923	932	940	949	958	966	975
N.		0	1	2	3	4	5	6	7	8	9

Proportional parts

	10
1	1,0
2	2,0
3	3,0
4	4,0
5	5,0
6	6,0
7	7,0
8	8,0
9	9,0

	9
1	0,9
2	1,8
3	2,7
4	3,6
5	4,5
6	5,4
7	6,3
8	7,2
9	8,1

	8
1	0,8
2	1,6
3	2,4
4	3,2
5	4,0
6	4,8
7	5,6
8	6,4
9	7,2

Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9
500	69 897	906	914	923	932	940	949	958	966	975
501	984	992	*001	*010	*018	*027	*036	*044	*053	*062
502	70 070	079	088	096	105	114	122	131	140	148
503	157	165	174	183	191	200	209	217	226	234
504	243	252	260	269	278	286	295	303	312	321
505	329	338	346	355	364	372	381	389	398	406
506	415	424	432	441	449	458	467	475	484	492
507	501	509	518	526	535	544	552	561	569	578
508	586	595	603	612	621	629	638	646	655	663
509	672	680	689	697	706	714	723	731	740	749
510	757	766	774	783	791	800	808	817	825	834
511	842	851	859	868	876	885	893	902	910	919
512	927	935	944	952	961	969	978	986	995	*003
513	71 012	020	029	037	046	054	063	071	079	088
514	096	105	113	122	130	139	147	155	164	172
515	181	189	198	206	214	223	231	240	248	257
516	265	273	282	290	299	307	315	324	332	341
517	349	357	366	374	383	391	399	408	416	425
518	433	441	450	458	466	475	483	492	500	508
519	517	525	533	542	550	559	567	575	584	592
520	600	609	617	625	634	642	650	659	667	675
521	684	692	700	709	717	725	734	742	750	759
522	767	775	784	792	800	809	817	825	834	842
523	850	858	867	875	883	892	900	908	917	925
524	933	941	950	958	966	975	983	991	999	*008
525	72 016	024	032	041	049	057	066	074	082	090
526	099	107	115	123	132	140	148	156	165	173
527	181	189	198	206	214	222	230	239	247	255
528	263	272	280	288	296	304	313	321	329	337
529	346	354	362	370	378	387	395	403	411	419
530	428	436	444	452	460	469	477	485	493	501
531	509	518	526	534	542	550	558	567	575	583
532	591	599	607	616	624	632	640	648	656	665
533	673	681	689	697	705	713	722	730	738	746
534	754	762	770	779	787	795	803	811	819	827
535	835	843	852	860	868	876	884	892	900	908
536	916	925	933	941	949	957	965	973	981	989
537	997	*006	*014	*022	*030	*038	*046	*054	*062	*070
538	73 078	086	094	102	111	119	127	135	143	151
539	159	167	175	183	191	199	207	215	223	231
540	239	247	255	263	272	280	288	296	304	312
541	320	328	336	344	352	360	368	376	384	392
542	400	408	416	424	432	440	448	456	464	472
543	480	488	496	504	512	520	528	536	544	552
544	560	568	576	584	592	600	608	616	624	632
545	640	648	656	664	672	679	687	695	703	711
546	719	727	735	743	751	759	767	775	783	791
547	799	807	815	823	830	838	846	854	862	870
548	878	886	894	902	910	918	926	933	941	949
549	957	965	973	981	989	997	*005	*013	*020	*028
550	74 036	044	052	060	068	076	084	092	099	107
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	9
1	0,9
2	1,8
3	2,7
4	3,6
5	4,5
6	5,4
7	6,3
8	7,2
9	8,1

	8
1	0,8
2	1,6
3	2,4
4	3,2
5	4,0
6	4,8
7	5,6
8	6,4
9	7,2

	7
1	0,7
2	1,4
3	2,1
4	2,8
5	3,5
6	4,2
7	4,9
8	5,6
9	6,3

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
550	74 036	044	052	060	068	076	084	092	099	107	
551	115	123	131	139	147	155	162	170	178	186	
552	194	202	210	218	225	233	241	249	257	265	
553	273	280	288	296	304	312	320	327	335	343	
554	351	359	367	374	382	390	398	406	414	421	
555	429	437	445	453	461	468	476	484	492	500	
556	507	515	523	531	539	547	554	562	570	578	
557	586	593	601	609	617	624	632	640	648	656	
558	663	671	679	687	695	702	710	718	726	733	
559	741	749	757	764	772	780	788	796	803	811	
560	819	827	834	842	850	858	865	873	881	889	**8**
561	896	904	912	920	927	935	943	950	958	966	1 0,8
562	974	981	989	997	*005	*012	*020	*028	*035	*043	2 1,6
563	75 051	059	066	074	082	089	097	105	113	120	3 2,4
564	128	136	143	151	159	166	174	182	189	197	4 3,2
565	205	213	220	228	236	243	251	259	266	274	5 4,0
566	282	289	297	305	312	320	328	335	343	351	6 4,8
567	358	366	374	381	389	397	404	412	420	427	7 5,6
568	435	442	450	458	465	473	481	488	496	504	8 6,4
569	511	519	526	534	542	549	557	565	572	580	9 7,2
570	587	595	603	610	618	626	633	641	648	656	
571	664	671	679	686	694	702	709	717	724	732	
572	740	747	755	762	770	778	785	793	800	808	
573	815	823	831	838	846	853	861	868	876	884	
574	891	899	906	914	921	929	937	944	952	959	
575	967	974	982	989	997	*005	*012	*020	*027	*035	
576	76 042	050	057	065	072	080	087	095	103	110	
577	118	125	133	140	148	155	163	170	178	185	
578	193	200	208	215	223	230	238	245	253	260	
579	268	275	283	290	298	305	313	320	328	335	
580	343	350	358	365	373	380	388	395	403	410	**7**
581	418	425	433	440	448	455	462	470	477	485	1 0,7
582	492	500	507	515	522	530	537	545	552	559	2 1,4
583	567	574	582	589	597	604	612	619	626	634	3 2,1
584	641	649	656	664	671	678	686	693	701	708	4 2,8
585	716	723	730	738	745	753	760	768	775	782	5 3,5
586	790	797	805	812	819	827	834	842	849	856	6 4,2
587	864	871	879	886	893	901	908	916	923	930	7 4,9
588	938	945	953	960	967	975	982	989	997	*004	8 5,6
589	77 012	019	026	034	041	048	056	063	070	078	9 6,3
590	085	093	100	107	115	122	129	137	144	151	
591	159	166	173	181	188	195	203	210	217	225	
592	232	240	247	254	262	269	276	283	291	298	
593	305	313	320	327	335	342	349	357	364	371	
594	379	386	393	401	408	415	422	430	437	444	
595	452	459	466	474	481	488	495	503	510	517	
596	525	532	539	546	554	561	568	576	583	590	
597	597	605	612	619	627	634	641	648	656	663	
598	670	677	685	692	699	706	714	721	728	735	
599	743	750	757	764	772	779	786	793	801	808	
600	815	822	830	837	844	851	859	866	873	880	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
600	77 815	822	830	837	844	851	859	866	873	880	
601	887	895	902	909	916	924	931	938	945	952	
602	960	967	974	981	988	996	*003	*010	*017	*025	
603	78 032	039	046	053	061	068	075	082	089	097	
604	104	111	118	125	132	140	147	154	161	168	
605	176	183	190	197	204	211	219	226	233	240	
606	247	254	262	269	276	283	290	297	305	312	
607	319	326	333	340	347	355	362	369	376	383	**8**
608	390	398	405	412	419	426	433	440	447	455	1 | 0,8
609	462	469	476	483	490	497	504	512	519	526	2 | 1,6
											3 | 2,4
610	533	540	547	554	561	569	576	583	590	597	4 | 3,2
611	604	611	618	625	633	640	647	654	661	668	5 | 4,0
612	675	682	689	696	704	711	718	725	732	739	6 | 4,8
613	746	753	760	767	774	781	789	796	803	810	7 | 5,6
614	817	824	831	838	845	852	859	866	873	880	8 | 6,4
615	888	895	902	909	916	923	930	937	944	951	9 | 7,2
616	958	965	972	979	986	993	*000	*007	*014	*021	
617	79 029	036	043	050	057	064	071	078	085	092	
618	099	106	113	120	127	134	141	148	155	162	
619	169	176	183	190	197	204	211	218	225	232	
620	239	246	253	260	267	274	281	288	295	302	**7**
621	309	316	323	330	337	344	351	358	365	372	1 | 0,7
622	379	386	393	400	407	414	421	428	435	442	2 | 1,4
623	449	456	463	470	477	484	491	498	505	511	3 | 2,1
624	518	525	532	539	546	553	560	567	574	581	4 | 2,8
625	588	595	602	609	616	623	630	637	644	650	5 | 3,5
626	657	664	671	678	685	692	699	706	713	720	6 | 4,2
627	727	734	741	748	754	761	768	775	782	789	7 | 4,9
628	796	803	810	817	824	831	837	844	851	858	8 | 5,6
629	865	872	879	886	893	900	906	913	920	927	9 | 6,3
630	934	941	948	955	962	969	975	982	989	996	
631	80 003	010	017	024	030	037	044	051	058	065	
632	072	079	085	092	099	106	113	120	127	134	
633	140	147	154	161	168	175	182	188	195	202	
634	209	216	223	229	236	243	250	257	264	271	
635	277	284	291	298	305	312	318	325	332	339	**6**
636	346	353	359	366	373	380	387	393	400	407	1 | 0 6
637	414	421	428	434	441	448	455	462	468	475	2 | 1,2
638	482	489	496	502	509	516	523	530	536	543	3 | 1,8
639	550	557	564	570	577	584	591	598	604	611	4 | 2,4
											5 | 3,0
640	618	625	632	638	645	652	659	665	672	679	6 | 3,6
641	686	693	699	706	713	720	726	733	740	747	7 | 4,2
642	754	760	767	774	781	787	794	801	808	814	8 | 4,8
643	821	828	835	841	848	855	862	868	875	882	9 | 5,4
644	889	895	902	909	916	922	929	936	943	949	
645	956	963	969	976	983	990	996	*003	*010	*017	
646	81 023	030	037	043	050	057	064	070	077	084	
647	090	097	104	111	117	124	131	137	144	151	
648	158	164	171	178	184	191	198	204	211	218	
649	224	231	238	245	251	258	265	271	278	285	
650	291	298	305	311	318	325	331	338	345	351	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.		0	1	2	3	4	5	6	7	8	9	Proportional parts
650	81	291	298	305	311	318	325	331	338	345	351	
651		358	365	371	378	385	391	398	405	411	418	
652		425	431	438	445	451	458	465	471	478	485	
653		491	498	505	511	518	525	531	538	544	551	
654		558	564	571	578	584	591	598	604	611	617	
655		624	631	637	644	651	657	664	671	677	684	
656		690	697	704	710	717	723	730	737	743	750	
657		757	763	770	776	783	790	796	803	809	816	
658		823	829	836	842	849	856	862	869	875	882	
659		889	895	902	908	915	921	928	935	941	948	
660		954	961	968	974	981	987	994	*000	*007	*014	7
661	82	020	027	033	040	046	053	060	066	073	079	1 0,7
662		086	092	099	105	112	119	125	132	138	145	2 1,4
663		151	158	164	171	178	184	191	197	204	210	3 2,1
664		217	223	230	236	243	249	256	263	269	276	4 2,8
665		282	289	295	302	308	315	321	328	334	341	5 3,5
666		347	354	360	367	373	380	387	393	400	406	6 4,2
667		413	419	426	432	439	445	452	458	465	471	7 4,9
668		478	484	491	497	504	510	517	523	530	536	8 5,6
669		543	549	556	562	569	575	582	588	595	601	9 6,3
670		607	614	620	627	633	640	646	653	659	666	
671		672	679	685	692	698	705	711	718	724	730	
672		737	743	750	756	763	769	776	782	789	795	
673		802	808	814	821	827	835	840	847	853	860	
674		866	872	879	885	892	898	905	911	918	924	
675		930	937	943	950	956	963	969	975	982	988	
676		995	*001	*008	*014	*020	*027	*033	*040	*046	*052	
677	83	059	065	072	078	085	091	097	104	110	117	
678		123	129	136	142	149	155	161	168	174	181	
679		187	193	200	206	213	219	225	232	238	245	
680		251	257	264	270	276	283	289	296	302	308	6
681		315	321	327	334	340	347	353	359	366	372	1 0,6
682		378	385	391	398	404	410	417	423	429	436	2 1,2
683		442	448	455	461	467	474	480	487	493	499	3 1,8
684		506	512	518	525	531	537	544	550	556	563	4 2,4
685		569	575	582	588	594	601	607	613	620	626	5 3,0
686		632	639	645	651	658	664	670	677	683	689	6 3,6
687		696	702	708	715	721	727	734	740	746	753	7 4,2
688		759	765	771	778	784	790	797	803	809	816	8 4,8
689		822	828	835	841	847	853	860	866	872	879	9 5,4
690		885	891	897	904	910	916	923	929	935	942	
691		948	954	960	967	973	979	985	992	998	*004	
692	84	011	017	023	029	036	042	048	055	061	067	
693		073	080	086	092	098	105	111	117	123	130	
694		136	142	148	155	161	167	173	180	186	192	
695		198	205	211	217	223	230	236	242	248	255	
696		261	267	273	280	286	292	298	305	311	317	
697		323	330	336	342	348	354	361	367	373	379	
698		386	392	398	404	410	417	423	429	435	442	
699		448	454	460	466	473	479	485	491	497	504	
700		510	516	522	528	535	541	547	553	559	566	
N.		0	1	2	3	4	5	6	7	8	9	Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9
700	84 510	516	522	528	535	541	547	553	559	566
701	572	578	584	590	597	603	609	615	621	628
702	634	640	646	652	658	665	671	677	683	689
703	696	702	708	714	720	726	733	739	745	751
704	757	763	770	776	782	788	794	800	807	813
705	819	825	831	837	844	850	856	862	868	874
706	880	887	893	899	905	911	917	924	930	936
707	942	948	954	960	967	973	979	985	991	997
708	85 003	009	016	022	028	034	040	046	052	058
709	065	071	077	083	089	095	101	107	114	120
710	126	132	138	144	150	156	163	169	175	181
711	187	193	199	205	211	217	224	230	236	242
712	248	254	260	266	272	278	285	291	297	303
713	309	315	321	327	333	339	345	352	358	364
714	370	376	382	388	394	400	406	412	418	425
715	431	437	443	449	455	461	467	473	479	485
716	491	497	503	509	516	522	528	534	540	546
717	552	558	564	570	576	582	588	594	600	606
718	612	618	625	631	637	643	649	655	661	667
719	673	679	685	691	697	703	709	715	721	727
720	733	739	745	751	757	763	769	775	781	788
721	794	800	806	812	818	824	830	836	842	848
722	854	860	866	872	878	884	890	896	902	908
723	914	920	926	932	938	944	950	956	962	968
724	974	980	986	992	998	*004	*010	*016	*022	*028
725	86 034	040	046	052	058	064	070	076	082	088
726	094	100	106	112	118	124	130	136	141	147
727	153	159	165	171	177	183	189	195	201	207
728	213	219	225	231	237	243	249	255	261	267
729	273	279	285	291	297	303	308	314	320	326
730	332	338	344	350	356	362	368	374	380	386
731	392	398	404	410	415	421	427	433	439	445
732	451	457	463	469	475	481	487	493	499	504
733	510	516	522	528	534	540	546	552	558	564
734	570	576	581	587	593	599	605	611	617	623
735	629	635	641	646	652	658	664	670	676	682
736	688	694	700	705	711	717	723	729	735	741
737	747	753	759	764	770	776	782	788	794	800
738	806	812	817	823	829	835	841	847	853	859
739	864	870	876	882	888	894	900	906	911	917
740	923	929	935	941	947	953	958	964	970	976
741	982	988	994	999	*005	*011	*017	*023	*029	*035
742	87 040	046	052	058	064	070	075	081	087	093
743	099	105	111	116	122	128	134	140	146	151
744	157	163	169	175	181	186	192	198	204	210
745	216	221	227	233	239	245	251	256	262	268
746	274	280	286	291	297	303	309	315	320	326
747	332	338	344	349	355	361	367	373	379	384
748	390	396	402	408	413	419	425	431	437	442
749	448	454	460	466	471	477	483	489	495	500
750	506	512	518	523	529	535	541	547	552	558
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	7
1	0,7
2	1,4
3	2,1
4	2,8
5	3,5
6	4,2
7	4,9
8	5,6
9	6,3

	6
1	0,6
2	1,2
3	1,8
4	2,4
5	3,0
6	3,6
7	4,2
8	4,8
9	5,4

	5
1	0,5
2	1,0
3	1,5
4	2,0
5	2,5
6	3,0
7	3,5
8	4,0
9	4,5

Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
750	87 506	512	518	523	529	535	541	547	552	558	
751	564	570	576	581	587	593	599	604	610	616	
752	622	628	633	639	645	651	656	662	668	674	
753	679	685	691	697	703	708	714	720	726	731	
754	737	743	749	754	760	766	772	777	783	789	
755	795	800	806	812	818	823	829	835	841	846	
756	852	858	864	869	875	881	887	892	898	904	
757	910	915	921	927	933	938	944	950	955	961	
758	967	973	978	984	990	996	*001	*007	*013	*018	
759	88 024	030	036	041	047	053	058	064	070	076	
760	081	087	093	098	104	110	116	121	127	133	6
761	138	144	150	156	161	167	173	178	184	190	1 | 0,6
762	195	201	207	213	218	224	230	235	241	247	2 | 1,2
763	252	258	264	270	275	281	287	292	298	304	3 | 1,8
764	309	316	321	326	332	338	343	349	355	360	4 | 2,4
765	366	372	377	383	389	395	400	406	412	417	5 | 3,0
766	423	429	434	440	446	451	457	463	468	474	6 | 3,6
767	480	485	491	497	502	508	513	519	525	530	7 | 4,2
768	536	542	547	553	559	564	570	576	581	587	8 | 4,8
769	593	598	604	610	615	621	627	632	638	643	9 | 5,4
770	649	655	660	666	672	677	683	689	694	700	
771	705	711	717	722	728	734	739	745	750	756	
772	762	767	773	779	784	790	795	801	807	812	
773	818	824	829	835	840	846	852	857	863	868	
774	874	880	885	891	897	902	908	913	919	925	
775	930	936	941	947	953	958	964	969	975	981	
776	986	992	997	*003	*009	*014	*020	*025	*031	*037	
777	89 042	048	053	059	064	070	076	081	087	092	
778	098	104	109	115	120	126	131	137	143	148	
779	154	159	165	170	176	182	187	193	198	204	
780	209	215	221	226	232	237	243	248	254	260	5
781	265	271	276	282	287	293	298	304	310	315	1 | 0,5
782	321	326	332	337	343	348	354	360	365	371	2 | 1,0
783	376	382	387	393	398	404	409	415	421	426	3 | 1,5
784	432	437	443	448	454	459	465	470	476	481	4 | 2,0
785	487	492	498	504	509	515	520	526	531	537	5 | 2,5
786	542	548	553	559	564	570	575	581	586	592	6 | 3,0
787	597	603	609	614	620	625	631	636	642	647	7 | 3,5
788	653	658	664	669	675	680	686	691	697	702	8 | 4,0
789	708	713	719	724	730	735	741	746	752	757	9 | 4,5
790	763	768	774	779	785	790	796	801	807	812	
791	818	823	829	834	840	845	851	856	862	867	
792	873	878	883	889	894	900	905	911	916	922	
793	927	933	938	944	949	955	960	966	971	977	
794	982	988	993	998	*004	*009	*015	*020	*026	*031	
795	90 037	042	048	053	059	064	069	075	080	086	
796	091	097	102	108	113	119	124	129	135	140	
797	146	151	157	162	168	173	179	184	189	195	
798	200	206	211	217	222	227	233	238	244	249	
799	255	260	266	271	276	282	287	293	298	304	
800	309	314	320	325	331	336	342	347	352	358	
N.	0	1	2	3	4	5	6	7	8	9	Propo p

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
800	90 309	314	320	325	331	336	342	347	352	358	
801	363	369	374	380	385	390	396	401	407	412	
802	417	423	428	434	439	445	450	455	461	466	
803	472	477	482	488	493	499	504	509	515	520	
804	526	531	536	542	547	553	558	563	569	574	
805	580	585	590	596	601	607	612	617	623	628	
806	634	639	644	650	655	660	666	671	677	682	
807	687	693	698	703	709	714	720	725	730	736	
808	741	747	752	757	763	768	773	779	784	789	
809	795	800	806	811	816	822	827	832	838	843	
810	849	854	859	865	870	875	881	886	891	897	**6**
811	902	907	913	918	924	929	934	940	945	950	1 0,6
812	956	961	966	972	977	982	988	993	998	*004	2 1,2
813	91 009	014	020	025	030	036	041	046	052	057	3 1,8
814	062	068	073	078	084	089	094	100	105	110	4 2,4
815	116	121	126	132	137	142	148	153	158	164	5 3,0
816	169	174	180	185	190	196	201	206	212	217	6 3,6
817	222	228	233	238	243	249	254	259	265	270	7 4,2
818	275	281	286	291	297	302	307	312	318	323	8 4,8
819	328	334	339	344	350	355	360	365	371	376	9 5,4
820	381	387	392	397	403	408	413	418	424	429	
821	434	440	445	450	455	461	466	471	477	482	
822	487	492	498	503	508	514	519	524	529	535	
823	540	545	551	556	561	666	572	577	582	587	
824	593	598	603	609	614	619	624	630	635	640	
825	645	651	656	661	666	672	677	682	687	693	
826	698	703	709	714	719	724	730	735	740	745	
827	751	756	761	766	772	777	782	787	793	798	
828	803	808	814	819	824	829	834	840	845	850	
829	855	861	866	871	876	882	887	892	897	903	
830	908	913	918	924	929	934	939	944	950	955	**5**
831	960	965	971	976	981	986	991	997	*002	*007	1 0,5
832	92 012	018	023	028	033	038	044	049	054	059	2 1,0
833	065	070	075	080	085	091	096	101	106	111	3 1,5
834	117	122	127	132	137	143	148	153	158	163	4 2,0
835	169	174	179	184	189	195	200	205	210	215	5 2,5
836	221	226	231	236	241	247	252	257	262	267	6 3,0
837	273	278	283	288	293	298	304	309	314	319	7 3,5
838	324	330	335	340	345	350	355	361	366	371	8 4,0
839	376	381	387	392	397	402	407	412	418	423	9 4,5
840	428	433	438	443	449	454	459	464	469	474	
841	480	485	490	495	500	505	511	516	521	526	
842	531	536	542	547	552	557	562	567	572	578	
843	583	588	593	598	603	609	614	619	624	629	
844	634	639	645	650	655	660	665	670	675	681	
845	686	691	696	701	706	711	716	722	727	732	
846	737	742	747	752	758	763	768	773	778	783	
847	788	793	799	804	809	814	819	824	829	834	
848	840	845	850	855	860	865	870	875	881	886	
849	891	896	901	906	911	916	921	927	932	937	
850	942	947	952	957	962	967	973	978	983	988	
N.	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Proportional parts**

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts	
850	92 942	947	952	957	962	967	973	978	983	988		
851	993	998	*003	*008	*013	*018	*024	*029	*034	*039		
852	93 044	049	054	059	064	069	075	080	085	090		
853	095	100	105	110	115	120	125	131	136	141		
854	146	151	156	161	166	171	176	181	186	192		
855	197	202	207	212	217	222	227	232	237	242		
856	247	252	258	263	268	273	278	283	288	293		**6**
857	298	303	308	313	318	323	328	334	339	344	1	0,6
858	349	354	359	364	369	374	379	384	389	394	2	1,2
859	399	404	409	414	420	425	430	435	440	445	3	1,8
											4	2,4
860	450	455	460	465	470	475	480	485	490	495	5	3,0
861	500	505	510	515	520	526	531	536	541	546	6	3,6
862	551	556	561	566	571	576	581	586	591	[illegible]	7	4,2
863	601	606	611	616	621	626	631	636	641	646	8	4,8
864	651	656	661	666	671	676	682	687	692	697	9	5,4
865	702	707	712	717	722	727	732	737	742	747		
866	752	757	762	767	772	777	782	787	792	797		
867	802	807	812	817	822	827	832	837	842	847		
868	852	857	862	867	872	877	882	887	892	897		
869	902	907	912	917	922	927	932	937	942	947		
870	952	957	962	967	972	977	982	987	992	997		**5**
871	94 002	007	012	017	022	027	032	037	042	047	1	0,5
872	052	057	062	067	072	077	082	086	091	096	2	1,0
873	101	106	111	116	121	126	131	136	141	146	3	1,5
874	151	156	161	166	171	176	181	186	191	196	4	2,0
875	201	206	211	216	221	226	231	236	240	245	5	2,5
876	250	255	260	265	270	275	280	285	290	295	6	3,0
877	300	305	310	315	320	325	330	335	340	345	7	3,5
878	349	354	359	364	369	374	379	384	389	394	8	4,0
879	399	404	409	414	419	424	429	433	438	443	9	4,5
880	448	453	458	463	468	473	478	483	488	493		
881	498	503	507	512	517	522	527	532	537	542		
882	547	552	557	562	567	571	576	581	586	591		
883	596	601	606	611	616	621	626	630	635	640		
884	645	650	655	660	665	670	675	680	685	689		**4**
885	694	699	704	709	714	719	724	729	734	738	1	0,4
886	743	748	753	758	763	768	773	778	783	787	2	0,8
887	792	797	802	807	812	817	822	827	832	836	3	1,2
888	841	846	851	856	861	866	871	876	880	885	4	1,6
889	890	895	900	905	910	915	919	924	929	934	5	2,0
											6	2,4
890	939	944	949	954	959	963	968	973	978	983	7	2,8
891	988	993	998	*002	*007	*012	*017	*022	*027	*032	8	3,2
892	95 036	041	046	051	056	061	066	071	075	080	9	3,6
893	085	090	095	100	105	109	114	119	124	129		
894	134	139	143	148	153	158	163	168	173	177		
895	182	187	192	197	202	207	211	216	221	226		
896	231	236	240	245	250	255	260	265	270	274		
897	279	284	289	294	299	303	308	313	318	323		
898	328	332	337	342	347	352	357	361	366	371		
899	376	381	386	390	395	400	405	410	415	419		
900	424	429	434	439	444	448	453	458	463	468		
N.	0	1	2	3	4	5	6	7	8	9	Propor pa	

FIVE-PLACE LOGARITHMS (Continued)

N.	0	1	2	3	4	5	6	7	8	9	Proportional parts
900	95 424	429	434	439	444	448	453	458	463	468	
901	472	477	482	487	492	497	501	506	511	516	
902	521	525	530	535	540	545	550	554	559	564	
903	569	574	578	583	588	593	598	602	607	612	
904	617	622	626	631	636	641	646	650	655	660	
905	665	670	674	679	684	689	694	698	703	708	
906	713	718	722	727	732	737	742	746	751	756	
907	761	766	770	775	780	785	789	794	799	804	
908	809	813	818	823	828	832	837	842	847	852	
909	856	861	866	871	875	880	885	890	895	899	
910	904	909	914	918	923	928	933	938	942	947	**5**
911	952	957	961	966	971	976	980	985	990	995	1 0,5
912	999	*004	*009	*014	*019	*023	*028	*033	*038	*042	2 1,0
913	96 047	052	057	061	066	071	076	080	085	090	3 1,5
914	095	099	104	109	114	118	123	128	133	137	4 2,0
915	142	147	152	156	161	166	171	175	180	185	5 2,5
916	190	194	199	204	209	213	218	223	227	232	6 3,0
917	237	242	246	251	256	261	265	270	275	280	7 3,5
918	284	289	294	298	303	308	313	317	322	327	8 4,0
919	332	336	341	346	350	355	360	365	369	374	9 4,5
920	379	384	388	393	398	402	407	412	417	421	
921	426	431	435	440	445	450	454	459	464	468	
922	473	478	483	487	492	497	501	506	511	515	
923	520	525	530	534	539	544	548	553	558	562	
924	567	572	577	581	586	591	595	600	605	609	
925	614	619	624	628	633	638	642	647	652	656	
926	661	666	670	675	680	685	689	694	699	703	
927	708	713	717	722	727	731	736	741	745	750	
928	755	759	764	769	774	778	783	788	792	797	
929	802	806	811	816	820	825	830	834	839	844	
930	848	853	858	862	867	872	876	881	886	890	**4**
931	895	900	904	909	914	918	923	928	932	937	1 0,4
932	942	946	951	956	960	965	970	974	979	984	2 0,8
933	988	993	997	*002	*007	*011	*016	*021	*025	*030	3 1,2
934	97 035	039	044	049	053	058	063	067	072	077	4 1,6
935	081	086	090	095	100	104	109	114	118	123	5 2,0
936	128	132	137	142	146	151	155	160	165	169	6 2,4
937	174	179	183	188	192	197	202	206	211	216	7 2,8
938	220	225	230	234	239	243	248	253	257	262	8 3,2
939	267	271	276	280	285	290	294	299	304	308	9 3,6
940	313	317	322	327	331	336	340	345	350	354	
941	359	364	368	373	377	382	387	391	396	400	
942	405	410	414	419	424	428	433	437	442	447	
943	451	456	460	465	470	474	479	483	488	493	
944	497	502	506	511	516	520	525	529	534	539	
945	543	548	552	557	562	566	571	575	580	585	
946	589	594	598	603	607	612	617	621	626	630	
947	635	640	644	649	653	658	663	667	672	676	
948	681	685	690	695	699	704	708	713	717	722	
949	727	731	736	740	745	749	754	759	763	768	
950	772	777	782	786	791	795	800	804	809	813	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

FIVE-PLACE LOGARITHMS (Continued)

N	0	1	2	3	4	5	6	7	8	9	Proportional parts
950	97 772	777	782	786	791	795	800	804	809	813	
951	818	823	827	832	836	841	845	850	855	859	
952	864	868	873	877	882	886	891	896	900	905	
953	909	914	918	923	928	932	937	941	946	950	
954	955	959	964	968	973	978	982	987	991	996	
955	98 000	005	009	014	019	023	028	032	037	041	
956	046	050	055	059	064	068	073	078	082	087	
957	091	096	100	105	109	114	118	123	127	132	
958	137	141	146	150	155	159	164	168	173	177	
959	182	186	191	195	200	204	209	214	218	223	
960	227	232	236	241	245	250	254	259	263	268	**5**
961	272	277	281	286	290	295	299	304	308	313	1 | 0,5
962	318	322	327	331	336	340	345	349	354	358	2 | 1,0
963	363	367	372	376	381	385	390	394	399	403	3 | 1,5
964	408	412	417	421	426	430	435	439	444	448	4 | 2,0
965	453	457	462	466	471	475	480	484	489	493	5 | 2,5
966	498	502	507	511	516	520	525	529	534	538	6 | 3,0
967	543	547	552	556	561	565	570	574	579	583	7 | 3,5
968	588	592	597	601	605	610	614	619	623	628	8 | 4,0
969	632	637	641	646	650	655	659	664	668	673	9 | 4,5
970	677	682	686	691	695	700	704	709	713	717	
971	722	726	731	735	740	744	749	753	758	762	
972	767	771	776	780	784	789	793	798	802	807	
973	811	816	820	825	829	834	838	843	847	851	
974	856	860	865	869	874	878	883	887	892	896	
975	900	905	909	914	918	923	927	932	936	941	
976	945	949	954	958	963	967	972	976	981	985	
977	989	994	998	*003	*007	*012	*016	*021	*025	*029	
978	99 034	038	043	047	052	056	061	065	069	074	
979	078	083	087	092	096	100	105	109	114	118	
980	123	127	131	136	140	145	149	154	158	162	**4**
981	167	171	176	180	185	189	193	198	202	207	1 | 0,4
982	211	216	220	224	229	233	238	242	247	251	2 | 0,8
983	255	260	264	269	273	277	282	286	291	295	3 | 1,2
984	300	304	308	313	317	322	326	330	335	339	4 | 1,6
985	344	348	352	357	361	366	370	374	379	383	5 | 2,0
986	388	392	396	401	405	410	414	419	423	427	6 | 2,4
987	432	436	441	445	449	454	458	463	467	471	7 | 2,8
988	476	480	484	489	493	498	502	506	511	515	8 | 3,2
989	520	524	528	533	537	542	546	550	555	559	9 | 3,6
990	564	568	572	577	581	585	590	594	599	603	
991	607	612	616	621	625	629	634	638	642	647	
992	651	656	660	664	669	673	677	682	686	691	
993	695	699	704	708	712	717	721	726	730	734	
994	739	743	747	752	756	760	765	769	774	778	
995	782	787	791	795	800	804	808	813	817	822	
996	826	830	835	839	843	848	852	856	861	865	
997	870	874	878	883	887	891	896	900	904	909	
998	913	917	922	926	930	935	939	944	948	952	
999	957	961	965	970	974	978	983	987	991	996	
1000	00 000	004	009	013	017	022	026	030	035	039	
N.	0	1	2	3	4	5	6	7	8	9	Proportional parts

NATURAL LOGARITHMS

NATURAL OR NAPERIAN LOGARITHMS OF THE NUMBERS FROM 1 TO 1109

To find the logarithm of a number which is $\frac{1}{10}$ or 10 times etc. a number whose logarithm is given, subtract from or add to the given logarithm the logarithm of 10.

Thus log 1.6 = log 16 − log 10
log 160 = log 16 + log 10 etc.

N	Log	N	Log	N	Log	N	Log	N	Log
0	—	**20**	2. 99 573	**40**	3. 68 888	**60**	4. 09 434	**80**	4. 38 203
1	0. 00 000	21	3. 04 452	41	3. 71 357	61	4. 11 087	81	4. 39 445
2	0. 69 315	22	3. 09 104	42	3. 73 767	62	4. 12 713	82	4. 40 672
3	1. 09 861	23	3. 13 459	43	3. 76 120	63	4. 14 313	83	4. 41 884
4	1. 38 629	24	3. 17 805	44	3. 78 419	64	4. 15 888	84	4. 43 082
5	1. 60 944	25	3. 21 888	45	3. 80 666	65	4. 17 439	85	4. 44 265
6	1. 79 176	26	3. 25 810	46	3. 82 864	66	4. 18 965	86	4. 45 435
7	1. 94 591	27	3. 29 584	47	3. 85 015	67	4. 20 469	87	4. 46 591
8	2. 07 944	28	3. 33 220	48	3. 87 120	68	4. 21 951	88	4. 47 734
9	2. 19 722	29	3. 36 730	49	3. 89 182	69	4. 23 411	89	4. 48 864
10	2. 30 259	**30**	3. 40 120	**50**	3. 91 202	**70**	4. 24 850	**90**	4. 49 981
11	2. 39 790	31	3. 43 399	51	3. 93 183	71	4. 26 268	91	4. 51 086
12	2. 48 491	32	3. 46 574	52	3. 95 124	72	4. 27 667	92	4. 52 179
13	2. 56 495	33	3. 49 651	53	3. 97 029	73	4. 29 046	93	4. 53 260
14	2. 63 906	34	3. 52 636	54	3. 98 898	74	4. 30 407	94	4. 54 329
15	2. 70 805	35	3. 55 535	55	4. 00 733	75	4. 31 749	95	4. 55 388
16	2. 77 259	36	3. 58 352	56	4. 02 535	76	4. 33 073	96	4. 56 435
17	2. 83 321	37	3. 61 092	57	4. 04 305	77	4. 34 381	97	4. 57 471
18	2. 89 037	38	3. 63 759	58	4. 06 044	78	4. 35 671	98	4. 58 497
19	2. 94 444	39	3. 66 356	59	4. 07 754	79	4. 36 945	99	4. 59 512
20	2. 99 573	**40**	3. 68 888	**60**	4. 09 434	**80**	4. 38 203	**100**	4. 60 517

NATURAL LOGARITHMS (Continued)

N	Log	0	1	2	3	4	5	6	7	8	9
10	4. 6	0517	1512	2497	3473	4439	5396	6344	7283	8213	9135
11	4. 7	0048	0953	1850	2739	3620	4493	5359	6217	7068	7912
12		8749	9570	*0402	*1218	*2028	*2831	*3628	*4419	*5203	*5981
13	4. 8	6753	7520	8280	9035	9784	*0527	*1265	*1998	*2725	*3447
14	4. 9	4164	4876	5583	6284	6981	7673	8361	9043	9721	*0395
15	5. 0	1064	1728	2388	3044	3695	4343	4986	5625	6260	6890
16		7517	8140	8760	9375	9987	*0595	*1199	*1799	*2396	*2990
17	5. 1	3580	4166	4749	5329	5906	6479	7048	7615	8178	8739
18		9296	9850	*0401	*0949	*1494	*2036	*2575	*3111	*3644	*4175
19	5. 2	4702	5227	5750	6269	6786	7300	7811	8320	8827	9330
20		9832	*0330	*0827	*1321	*1812	*2301	*2788	*3272	*3754	*4233
21	5. 3	4711	5186	5659	6129	6598	7064	7528	7990	8450	8907
22		9363	9816	*0268	*0717	*1165	*1610	*2053	*2495	*2935	*3372
23	5. 4	3808	4242	4674	5104	5532	5959	6383	6806	7227	7646
24		8064	8480	8894	9306	9717	*0126	*0533	*0939	*1343	*1745
25	5. 5	2146	2545	2943	3339	3733	4126	4518	4908	5296	5683
26		6068	6452	6834	7215	7595	7973	8350	8725	9099	9471
27		9842	*0212	*0580	*0947	*1313	*1677	*2040	*2402	*2762	*3121
28	5. 6	3479	3835	4191	4545	4897	5249	5599	5948	6296	6643
29		6988	7332	7675	8017	8358	8698	9036	9373	9709	*0044
30	5. 7	0378	0711	1043	1373	1703	2031	2359	2685	3010	3334
31		3657	3979	4300	4620	4939	5257	5574	5890	6205	6519
32		6832	7144	7455	7765	8074	8383	8690	8996	9301	9606
33		9909	*0212	*0513	*0814	*1114	*1413	*1711	*2008	*2305	*2600
34	5. 8	2895	3188	3481	3773	4064	4354	4644	4932	5220	5507
35		5793	6079	6363	6647	6930	7212	7493	7774	8053	8332
36		8610	8888	9164	9440	9715	9990	*0263	*0536	*0808	*1080
37	5. 9	1350	1620	1889	2158	2426	2693	2959	3225	3489	3754
38		4017	4280	4542	4803	5064	5324	5584	5842	6101	6358
39		6615	6871	7126	7381	7635	7889	8141	8394	8645	8899
40		9146	9396	9645	9894	*0141	*0389	*0635	*0881	*1127	*1372
41	6. 0	1616	1859	2102	2345	2587	2828	3069	3309	3548	3787
42		4025	4263	4501	4737	4973	5209	5444	5678	5912	6146
43		6379	6611	6843	7074	7304	7535	7764	7993	8222	8450
44		8677	8904	9131	9357	9582	9807	*0032	*0256	*0479	*0702
45	6. 1	0925	1147	1368	1589	1810	2030	2249	2468	2687	2905
46		3123	3340	3556	3773	3988	4204	4419	4633	4847	5060
47		5273	5486	5698	5910	6121	6331	6542	6752	6961	7170
48		7379	7587	7794	8002	8208	8415	8621	8826	9032	9236
49		9441	9644	9848	*0051	*0254	*0456	*0658	*0859	*1060	*1261
50	6. 2	1461	1661	1860	2059	2258	2456	2654	2851	3048	3245
51		3441	3637	3832	4028	4222	4417	4611	4804	4998	5190
52		5383	5575	5767	5958	6149	6340	6530	6720	6910	7099
53		7288	7476	7664	7852	8040	8227	8413	8600	8786	8972
54		9157	9342	9527	9711	9895	*0079	*0262	*0445	*0628	*0810
55	6. 3	0992	1173	1355	1536	1716	1897	2077	2257	2436	2615
56		2794	2972	3150	3328	3505	3683	3859	4036	4212	4388
57		4564	4739	4914	5089	5263	5437	5611	5784	5957	6130
58		6303	6475	6647	6819	6990	7161	7332	7502	7673	7843
59		8012	8182	8351	8519	8688	8856	9024	9192	9359	9526
60		9693	9859	*0026	*0192	*0357	*0523	*0688	*0853	*1017	*1182
N	Log	0	1	2	3	4	5	6	7	8	9

NATURAL LOGARITHMS (Continued)

N	Log	0	1	2	3	4	5	6	7	8	9
60	6. 3	9693	9859	*0026	*0192	*0357	*0523	*0688	*0853	*1017	*1182
61	6. 4	1346	1510	1673	1836	1999	2162	2325	2487	2649	2811
62		2972	3133	3294	3455	3615	3775	3935	4095	4254	4413
63		4572	4731	4889	5047	5205	5362	5520	5677	5834	5990
64		6147	6303	6459	6614	6770	6925	7080	7235	7389	7543
65		7697	7851	8004	8158	8311	8464	8616	8768	8920	9072
66		9224	9375	9527	9677	9828	9979	*0129	*0279	*0429	*0578
67	6. 5	0728	0877	1026	1175	1323	1471	1619	1767	1915	2062
68		2209	2356	2503	2649	2796	2942	3088	3233	3379	3524
69		3669	3814	3959	4103	4247	4391	4535	4679	4822	4965
70		5108	5251	5393	5536	5678	5820	5962	6103	6244	6386
71		6526	6667	6808	6948	7088	7228	7368	7508	7647	7786
72		7925	8064	8203	8341	8479	8617	8755	8893	9030	9167
73		9304	9441	9578	9715	9851	9987	*0123	*0259	*0394	*0530
74	6. 6	0665	0800	0935	1070	1204	1338	1473	1607	1740	1874
75		2007	2141	2274	2407	2539	2672	2804	2936	3068	3200
76		3332	3463	3595	3726	3857	3988	4118	4249	4379	4509
77		4639	4769	4898	5028	5157	5286	5415	5544	5673	5801
78		5929	6058	6185	6313	6441	6568	6696	6823	6950	7077
79		7203	7330	7456	7582	7870	7834	7960	8085	8211	8336
80		8461	8586	8711	8835	8960	9084	9208	9332	9456	9580
81		9703	9827	9950	*0073	*0196	*0319	*0441	*0564	*0686	*0808
82	6. 7	0930	1052	1174	1296	1417	1538	1659	1780	1901	2022
83		2143	2263	2383	2503	2623	2743	2863	2982	3102	3221
84		3340	3459	3578	3697	3815	3934	4052	4170	4288	4406
85		4524	4641	4759	4876	4993	5110	5227	5344	5460	5577
86		5693	5809	5926	6041	6157	6273	6388	6504	6619	6734
87		6849	6964	7079	7194	7308	7422	7537	7651	7765	7878
88		7992	8106	8219	8333	8446	8559	8672	8784	8897	9010
89		9122	9234	9347	9459	9571	9682	9794	9906	*0017	*0128
90	6. 8	0239	0351	0461	0572	0683	0793	0904	1014	1124	1235
91		1344	1454	1564	1674	1783	1892	2002	2111	2220	2329
92		2437	2546	2655	2763	2871	2979	3087	3195	3303	3411
93		3518	3626	3733	3841	3948	4055	4162	4268	4375	4482
94		4588	4694	4801	4907	5013	5118	5224	5330	5435	5541
95		5646	5751	5857	5961	6066	6171	6276	6380	6485	6589
96		6693	6797	6901	7005	7109	7213	7316	7420	7523	7626
97		7730	7833	7936	8038	8141	8244	8346	8449	8551	8653
98		8755	8857	8959	9061	9163	9264	9366	9467	9568	9669
99		9770	9871	9972	*0073	*0174	*0274	*0375	*0475	*0575	*0675
100	6. 9	0776	0875	0975	1075	1175	1274	1374	1473	1572	1672
101		1771	1870	1968	2067	2166	2264	2363	2461	2560	2658
102		2756	2854	2952	3049	3147	3245	3342	3440	3537	3634
103		3731	3828	3925	4022	4119	4216	4312	4409	4505	4601
104		4698	4794	4890	4986	5081	5177	5273	5368	5464	5559
105		5655	5750	5845	5940	6035	6130	6224	6319	6414	6508
106		6602	6697	6791	6885	6979	7073	7167	7261	7354	7448
107		7541	7635	7728	7821	7915	8008	8101	8193	8286	8379
108		8472	8564	8657	8749	8841	8934	9026	9118	9210	9302
109		9393	9485	9577	9668	9760	9851	9942	*0033	*0125	*0216
110	7. 0	0307	0397	0488	0579	0670	0760	0851	0941	1031	1121
N	Log	0	1	2	3	4	5	6	7	8	9

EXPONENTIALS

This table gives the values of e^n for the values of n shown at the side and top.

	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	1.000	1.010	1.020	1.030	1.041	1.051	1.062	1.073	1.083	1.094
0.1	1.105	1.116	1.127	1.139	1.150	1.162	1.174	1.185	1.197	1.209
0.2	1.221	1.234	1.246	1.259	1.271	1.284	1.297	1.310	1.323	1.336
0.3	1.350	1.363	1.377	1.391	1.405	1.419	1.433	1.448	1.462	1.477
0.4	1.492	1.507	1.522	1.537	1.553	1.568	1.584	1.600	1.616	1.632
0.5	1.649	1.665	1.682	1.699	1.716	1.733	1.751	1.768	1.786	1.804
0.6	1.822	1.840	1.859	1.878	1.896	1.916	1.935	1.954	1.974	1.994
0.7	2.014	2.034	2.054	2.075	2.096	2.117	2.138	2.160	2.181	2.203
0.8	2.226	2.248	2.270	2.293	2.316	2.340	2.363	2.387	2.411	2.435
0.9	2.460	2.484	2.509	2.535	2.560	2.586	2.612	2.638	2.664	2.691

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	2.718	3.004	3.320	3.669	4.055	4.482	4.953	5.474	6.050	6.686
2	7.389	8.166	9.025	9.974	11.02	12.18	13.46	14.88	16.44	18.17
3	20.09	22.20	24.53	27.11	29.96	33.12	36.60	40.45	44.70	49.40
4	54.60	60.34	66.69	73.70	81.45	90.02	99.48	110.0	121.5	134.3
5	148.4	164.0	181.3	200.3	221.4	244.7	270.4	298.9	330.3	365.0
6	403.4	445.9	492.8	544.6	601.9	665.1	735.1	812.4	897.9	992.3
7	1097	1212	1339	1480	1636	1808	1998	2208	2441	2697
8	2981	3295	3641	4024	4447	4915	5432	6003	6634	7332
9	8103	8955	9897	10938	12088	13360	14765	16318	18034	19930
10	22026									

EXPONENTIALS (Continued)

This table gives the values of e^{-n} for the values of n shown at the side and top.

	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	1.000	0.990	0.980	0.970	0.961	0.951	0.942	0.932	0.923	0.914
0.1	0.905	0.896	0.887	0.878	0.869	0.861	0.852	0.844	0.835	0.827
0.2	0.819	0.811	0.803	0.795	0.787	0.779	0.771	0.763	0.756	0.748
0.3	0.741	0.733	0.726	0.719	0.712	0.705	0.698	0.691	0.684	0.677
0.4	0.670	0.664	0.657	0.651	0.644	0.638	0.631	0.625	0.619	0.613
0.5	0.607	0.600	0.595	0.589	0.583	0.577	0.571	0.566	0.560	0.554
0.6	0.549	0.543	0.538	0.533	0.527	0.522	0.517	0.512	0.507	0.502
0.7	0.497	0.492	0.487	0.482	0.477	0.472	0.468	0.463	0.458	0.454
0.8	0.449	0.445	0.440	0.436	0.432	0.427	0.423	0.419	0.415	0.411
0.9	0.407	0.403	0.399	0.395	0.391	0.387	0.383	0.379	0.375	0.372
1.0	0.368									

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1.0	0.368	0.333	0.301	0.273	0.247	0.223	0.202	0.183	0.165	0.150
2.0	0.135	0.122	0.111	0.100	0.0907	0.0821	0.0743	0.0672	0.0608	0.0550
3.0	0.0498	0.0450	0.0408	0.0369	0.0334	0.0302	0.0273	0.0247	0.0224	0.0202
4.0	0.0183	0.0166	0.0150	0.0136	0.0123	0.0111	0.0101	0.00910	0.00823	0.00745
5.0	0.00674	0.00610	0.00552	0.00499	0.00452	0.00409	0.00370	0.00335	0.00303	0.00274
6.0	0.00248	0.00224	0.00203	0.00184	0.00166	0.00150	0.00136	0.00123	0.00111	0.00101
7.0	0.000912	0.000825	0.000747	0.000676	0.000611	0.000553	0.000500	0.000453	0.000410	0.000371
8.0	0.000335	0.000304	0.000275	0.000249	0.000225	0.000203	0.000184	0.000167	0.000151	0.000136
9.0	0.000123	0.000112	0.000101	0.000091	0.000083	0.000075	0.000068	0.000061	0.000055	0.000050
10.0	0.000045									

NATURAL SINES, COSINES, TANGENTS AND COTANGENTS

Degrees.	Sin.	Cos.	Tan.	Cot.	Degrees.
0° 00′	0.0000	1.0000	0.0000	∞	90° 00′
10	.0029	1.0000	.0029	343.77	50
20	.0058	1.0000	.0058	171.89	40
30	.0087	1.0000	.0087	114.59	30
40	.0116	.9999	.0116	85.940	20
50	.0145	.9999	.0145	68.750	10
1° 00′	0.0175	0.9998	0.0175	57.290	89° 00′
10	.0204	.9998	.0204	49.104	50
20	.0233	.9997	.0233	42.964	40
30	.0262	.9997	.0262	38.188	30
40	.0291	.9996	.0291	34.368	20
50	.0320	.9995	.0320	31.242	10
2° 00′	0.0349	0.9994	0.0349	28.636	88° 00′
10	.0378	.9993	.0378	26.432	50
20	.0407	.9992	.0407	24.542	40
30	.0436	.9990	.0437	22.904	30
40	.0465	.9989	.0466	21.470	20
50	.0494	.9988	.0495	20.206	10
3° 00′	0.0523	0.9986	0.0524	19.081	87° 00′
10	.0552	.9985	.0553	18.075	50
20	.0581	.9983	.0582	17.169	40
30	.0610	.9981	.0612	16.350	30
40	.0640	.9980	.0641	15.605	20
50	.0669	.9978	.0670	14.924	10
4° 00′	0.0698	0.9976	0.0699	14.301	86° 00′
10	.0727	.9974	.0729	13.727	50
20	.0756	.9971	.0758	13.197	40
30	.0785	.9969	.0787	12.706	30
40	.0814	.9967	.0816	12.251	20
50	.0843	.9964	.0846	11.826	10
5° 00′	0.0872	0.9962	0.0875	11.430	85° 00′
10	.0901	.9959	.0904	11.059	50
20	.0929	.9957	.0934	10.712	40
30	.0958	.9954	.0963	10.385	30
40	.0987	.9951	.0992	10.078	20
50	.1016	.9948	.1022	9.7882	10
6° 00′	0.1045	0.9945	0.1051	9.5144	84° 00′
10	.1074	.9942	.1080	9.2553	50
20	.1103	.9939	.1110	9.0098	40
30	.1132	.9936	.1139	8.7769	30
40	.1161	.9932	.1169	8.5555	20
50	.1190	.9929	.1198	8.3450	10
7° 00′	0.1219	0.9925	0.1228	8.1443	83° 00′
10	.1248	.9922	.1257	7.9530	50
20	.1276	.9918	.1287	7.7704	40
30	.1305	.9914	.1317	7.5958	30
40	.1334	.9911	.1346	7.4287	20
50	.1363	.9907	.1376	7.2687	10
8° 00′	0.1392	0.9903	0.1405	7.1154	82° 00′
10	.1421	.9899	.1435	6.9682	50
20	.1449	.9894	.1465	6.8269	40
30	.1478	.9890	.1495	6.6912	30
40	.1507	.9886	.1524	6.5606	20
50	.1536	.9881	.1554	6.4348	10
9° 00′	0.1564	0.9877	0.1584	6.3138	81° 00′
Degrees.	Cos.	Sin.	Cot.	Tan.	Degrees.

NATURAL SINES, COSINES, TANGENTS AND COTANGENTS (Continued)

Degrees.	Sin.	Cos.	Tan.	Cot.	Degrees.
9° 00′	0.1564	0.9877	0.1584	6.3138	81° 00′
10	.1593	.9872	.1614	6.1970	50
20	.1622	.9868	.1644	6.0844	40
30	.1650	.9863	.1673	5.9758	30
40	.1679	.9858	.1703	5.8708	20
50	.1708	.9853	.1733	5.7694	10
10° 00′	0.1736	0.9848	0.1763	5.6713	80° 00
10	.1765	.9843	.1793	5.5764	50
20	.1794	.9838	.1823	5.4845	40
30	.1822	.9833	.1853	5.3955	30
40	.1851	.9827	.1883	5.3093	20
50	.1880	.9822	.1914	5.2257	10
11° 00′	0.1908	0.9816	0.1944	5.1446	79° 00′
10	.1937	.9811	.1974	5.0658	50
20	.1965	.9805	.2004	4.9894	40
30	.1994	.9799	.2035	4.9152	30
40	.2022	.9793	.2065	4.8430	20
50	.2051	.9787	.2095	.7729	10
12° 00′	0.2079	0.9781	0.2126	4.7046	78° 00′
10	.2108	.9775	.2156	4.6382	50
20	.2136	.9769	.2186	4.5736	40
30	.2164	.9763	.2217	4.5107	30
40	.2193	.9757	.2247	4.4494	20
50	.2221	.9750	.2278	4.3897	10
13° 00′	0.2250	0.9744	0.2309	4.3315	77° 00′
10	.2278	.9737	.2339	4.2747	50
20	.2306	.9730	.2370	4.2193	40
30	.2334	.9724	.2401	4.1653	30
40	.2363	.9717	.2432	4.1126	20
50	.2391	.9710	.2462	4.0611	10
14° 00′	0.2419	0.9703	0.2493	4.0108	76° 00′
10	.2447	.9696	.2524	3.9617	50
20	.2476	.9689	.2555	3.9136	40
30	.2504	.9681	.2586	3.8667	30
40	.2532	.9674	.2617	3.8208	20
50	.2560	.9667	.2648	3.7760	10
15° 00′	0.2588	0.9659	0.2679	3.7321	75° 00′
10	.2616	.9652	.2711	3.6891	50
20	.2644	.9644	.2742	3.6470	40
30	.2672	.9636	.2773	3.6059	30
40	.2700	.9628	.2805	3.5656	20
50	.2728	.9621	.2836	3.5261	10
16° 00′	0.2756	0.9613	0.2867	3.4874	74° 00′
10	.2784	.9605	.2899	3.4495	50
20	.2812	.9596	.2931	3.4124	40
30	.2840	.9588	.2962	3.3759	30
40	.2868	.9580	.2994	3.3402	20
50	.2896	.9572	.3026	3.3052	10
17° 00′	0.2924	0.9563	0.3057	3.2709	73° 00′
10	.2952	.9555	.3089	3.2371	50
20	.2979	.9546	.3121	3.2041	40
30	.3007	.9537	.3153	3.1716	30
40	.3035	.9528	.3185	3.1397	20
50	.3062	.9520	.3217	3.1084	10
18° 00′	0.3090	0.9511	0.3249	3.0777	72° 00′
Degrees.	Cos.	Sin.	Cot.	Tan.	Degrees.

NATURAL SINES, COSINES, TANGENTS AND COTANGENTS (Continued)

Degrees.	Sin.	Cos.	Tan.	Cot.	Degrees.
18° 00′	0.3090	0.9511	0.3249	3.0777	72° 00′
10	.3118	.9502	.3281	3.0475	50
20	.3145	.9492	.3314	3.0178	40
30	.3173	.9483	.3346	2.9887	30
40	.3201	.9474	.3378	2.9600	20
50	.3228	.9465	.3411	2.9319	10
19° 00′	0.3256	0.9455	0.3443	2.9042	71° 00′
10	.3283	.9446	.3476	2.8770	50
20	.3311	.9436	.3508	2.8502	40
30	.3338	.9426	.3541	2.8239	30
40	.3365	.9417	.3574	2.7980	20
50	.3393	.9407	.3607	2.7725	10
20° 00′	0.3420	0.9397	0.3640	2.7475	70° 00′
10	.3448	.9387	.3673	2.7228	50
20	.3475	.9377	.3706	2.6985	40
30	.3502	.9367	.3739	2.6746	30
40	.3529	.9356	.3772	2.6511	20
50	.3557	.9346	.3805	2.6279	10
21° 00′	0.3584	0.9336	0.3839	2.6051	69° 00′
10	.3611	.9325	.3872	2.5826	50
20	.3638	.9315	.3906	2.5605	40
30	.3665	.9304	.3939	2.5386	30
40	.3692	.9293	.3973	2.5172	20
50	.3719	.9283	.4006	2.4960	10
22° 00′	0.3746	0.9272	0.4040	2.4751	68° 00′
10	.3773	.9261	.4074	2.4545	50
20	.3800	.9250	.4108	2.4342	40
30	.3827	.9239	.4142	2.4142	30
40	.3854	.9228	.4176	2.3945	20
50	.3881	.9216	.4210	2.3750	10
23° 00′	0.3907	0.9205	0.4245	2.3559	67° 00′
10	.3934	.9194	.4279	2.3369	50
20	.3961	.9182	.4314	2.3183	40
30	.3987	.9171	.4348	2.2998	30
40	.4014	.9159	.4383	2.2817	20
50	.4041	.9147	.4417	2.2637	10
24° 00′	0.4067	0.9135	0.4452	2.2460	66° 00′
10	.4094	.9124	.4487	2.2286	50
20	.4120	.9112	.4522	2.2113	40
30	.4147	.9100	.4557	2.1943	30
40	.4173	.9088	.4592	2.1775	20
50	.4200	.9075	.4628	2.1609	10
25° 00	0.4226	0.9063	0.4663	2.1445	65° 00
10	.4253	.9051	.4699	2.1283	50
20	.4279	.9038	.4734	2.1123	40
30	.4305	.9026	.4770	2.0965	30
40	.4331	.9013	.4806	2.0809	20
50	.4358	.9001	.4841	2.0655	10
26° 00′	0.4384	0.8988	0.4877	2.0503	64° 00′
10	.4410	.8975	.4913	2.0353	50
20	.4436	.8962	.4950	2.0204	40
30	.4462	.8949	.4986	2.0057	30
40	.4488	.8936	.5022	1.9912	20
50	.4514	.8923	.5059	1.9768	10
27° 00′	0.4540	0.8910	0.5095	1.9626	63° 00′
Degrees.	Cos.	Sin.	Cot.	Tan.	Degrees.

NATURAL SINES, COSINES, TANGENTS AND COTANGENTS (Continued)

Degrees.	Sin.	Cos.	Tan.	Cot.	Degrees.
27° 00	0.4540	0.8910	0.5095	1.9626	63° 00′
10	.4566	.8897	.5132	1.9486	50
20	.4592	.8884	.5169	1.9347	40
30	.4617	.8870	.5206	1.9210	30
40	.4643	.8857	.5243	1.9074	20
50	.4669	.8843	.5280	1.8940	10
28° 00′	0.4695	0.8829	0.5317	1.8807	62° 00′
10	.4720	.8816	.5354	1.8676	50
20	.4746	.8802	.5392	1.8546	40
30	.4772	.8788	.5430	1.8418	30
40	.4797	.8774	.5467	1.8291	20
50	.4823	.8760	.5505	1.8165	10
29° 00′	0.4848	0.8746	0.5543	1.8040	61° 00′
10	.4874	.8732	.5581	1.7917	50
20	.4899	.8718	.5619	1.7796	40
30	.4924	.8704	.5658	1.7675	30
40	.4950	.8689	.5696	1.7556	20
50	.4975	.8675	.5735	1.7437	10
30° 00′	0.5000	0.8660	0.5774	1.7321	60° 00′
10	.5025	.8646	.5812	1.7205	50
20	.5050	.8631	.5851	1.7090	40
30	.5075	.8616	.5890	1.6977	30
40	.5100	.8601	.5930	1.6864	20
50	.5125	.8587	.5969	1.6753	10
31° 00′	0.5150	0.8572	0.6009	1.6643	59° 00′
10	.5175	.8557	.6048	1.6534	50
20	.5200	.8542	.6088	1.6426	40
30	.5225	.8526	.6128	1.6319	30
40	.5250	.8511	.6168	1.6212	20
50	.5275	.8496	.6208	1.6107	10
32° 00′	0.5299	0.8480	0.6249	1.6003	58° 00′
10	.5324	.8465	.6289	1.5900	50
20	.5348	.8450	.6330	1.5798	40
30	.5373	.8434	.6371	1.5697	30
40	.5398	.8418	.6412	1.5597	20
50	.5422	.8403	.6453	1.5497	10
33° 00′	0.5446	0.8387	0.6494	1.5399	57° 00′
10	.5471	.8371	.6536	1.5301	50
20	.5495	.8355	.6577	1.5204	40
30	.5519	.8339	.6619	1.5108	30
40	.5544	.8323	.6661	1.5013	20
50	.5568	.8307	.6703	1.4919	10
34° 00′	0.5592	0.8290	0.6745	1.4826	56° 00′
10	.5616	.8274	.6787	1.4733	50
20	.5640	.8258	.6830	1.4641	40
30	.5664	.8241	.6873	1.4550	30
40	.5688	.8225	.6916	1.4460	20
50	.5712	.8208	.6959	1.4370	10
35° 00′	0.5736	0.8192	0.7002	1.4281	55° 00′
10	.5760	.8175	.7046	1.4193	50
20	.5783	.8158	.7089	1.4106	40
30	.5807	.8141	.7133	1.4019	30
40	.5831	.8124	.7177	1.3934	20
50	.5854	.8107	.7221	1.3848	10
36° 00′	0.5878	0.8090	0.7265	1.3764	54° 00′
Degrees.	Cos.	Sin.	Cot.	Tan.	Degrees.

NATURAL SINES, COSINES, TANGENTS AND TANGENTS (Continued)

Degrees.	Sin.	Cos.	Tan.	Cot.	Degrees.
36° 00′	0.5878	0.8090	0.7265	1.3764	54° 00′
10	.5901	.8073	.7310	1.3680	50
20	.5925	.8056	.7355	1.3597	40
30	.5948	.8039	.7400	1.3514	30
40	.5972	.8021	.7445	1.3432	20
50	.5995	.8004	.7490	1.3351	10
37° 00′	.6018	.7986	.7536	1.3270	53° 00′
10	.6041	.7969	.7581	1.3190	50
20	.6065	.7951	.7627	1.3111	40
30	.6088	.7934	.7673	1.3032	30
40	.6111	.7916	.7720	1.2954	20
50	.6134	.7898	.7766	1.2876	10
38° 00′	0.6157	0.7880	0.7813	1.2799	52° 00′
10	.6180	.7862	.7860	1.2723	50
20	.6202	.7844	.7907	1.2647	40
30	.6225	.7826	.7954	1.2572	30
40	6248	.7808	.8002	1.2497	20
50	.6271	.7790	.8050	1.2423	10
39° 00′	0.6293	0.7771	0.8098	1.2349	51° 00′
10	.6316	.7753	.8146	1.2276	50
20	.6338	.7735	.8195	1.2203	40
30	.6361	.7716	.8243	1.2131	30
40	.6383	.7698	.8292	1.2059	20
50	.6406	.7679	.8342	1.1988	10
40° 00′	0.6428	0.7660	0.8391	1.1918	50° 00′
10	.6450	.7642	.8441	1.1847	50
20	.6472	.7623	.8491	1.1778	40
30	.6494	.7604	.8541	1.1708	30
40	.6517	.7585	.8591	1.1640	20
50	.6539	.7566	.8642	1.1571	10
41° 00′	0.6561	0.7547	0.8693	1.1504	49° 00′
10	.6583	.7528	.8744	1.1436	50
20	.6604	.7509	.8796	1.1369	40
30	.6626	.7490	.8847	1.1303	30
40	.6648	.7470	.8899	1.1237	20
50	.6670	.7451	.8952	1.1171	10
42° 00′	0.6691	0.7431	0.9004	1.1106	48° 00′
10	.6713	.7412	.9057	1.1041	50
20	.6734	.7392	.9110	1.0977	40
30	.6756	.7373	.9163	1.0913	30
40	.6777	.7353	.9217	1.0850	20
50	.6799	.7333	.9271	1.0786	10
43° 00′	0.6820	0.7314	0.9325	1.0724	47° 00′
10	.6841	.7294	.9380	1.0661	50
20	.6862	.7274	.9435	1.0599	40
30	.6884	.7254	.9490	1.0538	30
40	.6905	.7234	.9545	1.0477	20
50	.6926	.7214	.9601	1.0416	10
44° 00′	0.6947	0.7193	0.9657	1.0355	46° 00′
10	.6967	.7173	.9713	1.0295	50
20	.6988	.7163	.9770	1.0235	40
30	.7009	.7133	.9827	1.0176	30
40	.7030	.7112	.9884	1.0117	20
50	.7050	.7092	.9942	1.0058	10
45° 00′	0.7071	0.7071	1.0000	1.0000	45° 00′
Degrees.	**Cos.**	**Sin.**	**Cot.**	**Tan.**	**Degrees.**

LOGARITHMS OF THE TRIGONOMETRICAL FUNCTIONS

Degrees.	Log sin	Log cos	Log tan	Log cot	Degrees.
0° 00′	∞	0.0000	∞	∞	90° 00′
10	7.4637	.0000	7.4637	2.5363	50
20	.7648	.0000	.7648	.2352	40
30	.9408	.0000	.9409	.0591	30
40	8.0658	.0000	8.0658	1.9342	20
50	.1627	.0000	.1627	.8373	10
1° 00′	8.2419	9.9999	8.2419	1.7581	89° 00′
10	.3088	.9999	.3089	.6911	50
20	.3668	.9999	.3669	.6331	40
30	.4179	.9999	.4181	.5819	30
40	.4637	.9998	.4638	.5362	20
50	.5050	.9998	.5053	.4947	10
2° 00′	8.5428	9.9997	8.5431	1.4569	88° 00′
10	.5776	.9997	.5779	.4221	50
20	.6097	.9996	.6101	.3899	40
30	.6397	.9996	.6401	.3599	30
40	.6677	.9995	.6682	.3318	20
50	.6940	.9995	.6945	.3055	10
3° 00′	8.7188	9.9994	8.7194	1.2806	87° 00′
10	.7423	.9993	.7429	.2571	50
20	.7645	.9993	.7652	.2348	40
30	.7857	.9992	.7865	.2135	30
40	.8059	.9991	.8067	.1933	20
50	.8251	.9990	.8261	.1739	10
4° 00′	8.8436	9.9989	8.8446	1.1554	86° 00′
10	.8613	.9989	.8624	.1376	50
20	.8783	.9988	.8795	.1205	40
30	.8946	.9987	.8960	.1040	30
40	.9104	.9986	.9118	.0882	20
50	.9256	.9985	.9272	.0728	10
5° 00′	8.9403	9.9983	8.9420	1.0580	85° 00′
10	.9545	.9982	.9563	.0437	50
20	.9682	.9981	.9701	.0299	40
30	.9816	.9980	.9836	.0164	30
40	.9945	.9979	.9966	.0034	20
50	9.0070	.9977	9.0093	0.9907	10
6° 00′	9.0192	9.9976	9.0216	0.9784	84° 00′
10	.0311	.9975	.0336	.9664	50
20	.0426	.9973	.0453	.9547	40
30	.0539	.9972	.0567	.9433	30
40	.0648	.9971	.0678	.9322	20
50	.0755	.9969	.0786	.9214	10
7° 00′	9.0859	9.9968	9.0891	0.9109	83° 00′
10	.0961	.9966	.0995	.9005	50
20	.1060	.9964	.1096	.8904	40
30	.1157	.9963	.1194	.8806	30
40	.1252	.9961	.1291	.8709	20
50	.1345	.9959	.1385	.8615	10
8° 00′	9.1436	9.9958	9.1478	0.8522	82° 00′
10	.1525	.9956	.1569	.8431	50
20	.1612	.9954	.1658	.8342	40
30	.1697	.9952	.1745	.8255	30
40	.1781	.9950	.1831	.8169	20
50	.1863	.9948	.1915	.8085	10
9° 00′	9.1943	9.9946	9.1997	0.8003	81° 00′
Degrees.	Log cos	Log sin	Log cot	Log tan	Degrees.

LOGARITHMS OF THE TRIGONOMETRICAL FUNCTIONS
(Continued)

Degrees.	Log sin	Log cos	Log tan	Log cot	Degrees.
9° 00′	9.1943	9.9946	9.1997	0.8003	81° 00′
10	.2022	.9944	.2078	.7922	50
20	.2100	.9942	.2158	.7842	40
30	.2176	.9940	.2236	.7764	30
40	.2251	.9938	.2313	.7687	20
50	.2324	.9936	.2389	.7611	10
10° 00′	9.2397	9.9934	9.2463	0.7537	80° 00′
10	.2468	.9931	.2536	.7464	50
20	.2538	.9929	.2609	.7391	40
30	.2606	.9927	.2680	.7320	30
40	.2674	.9924	.2750	.7250	20
50	.2740	.9922	.2819	.7181	10
11° 00′	9.2806	9.9919	9.2887	0.7113	79° 00′
10	.2870	.9917	.2953	.7047	50
20	.2934	.9914	.3020	.6980	40
30	.2997	.9912	.3085	.6915	30
40	.3058	.9909	.3149	.6851	20
50	.3119	.9907	.3212	.6788	10
12° 00′	9.3179	9.9904	9.3275	0.6725	78° 00′
10	.3238	.9901	.3336	.6664	50
20	.3296	.9899	.3397	.6603	40
30	.3353	.9896	.3458	.6542	30
40	.3410	.9893	.3517	.6483	20
50	.3466	.9890	.3576	.6424	10
13° 00′	9.3521	9.9887	9.3634	0.6366	77° 00′
10	.3575	.9984	.3691	.6309	50
20	.3629	.9881	.3748	.6252	40
30	.3682	.9878	.3804	.6196	30
40	.3734	.9875	.3859	.6141	20
50	.3786	.9872	.3914	.6086	10
14° 00′	9.3837	9.9869	9.3968	0.6032	76° 00
10	.3887	.9866	.4021	.5979	50
20	.3937	.9863	.4074	.5926	40
30	.3986	.9859	.4127	.5873	30
40	.4035	.9856	.4178	.5822	20
50	.4083	.9853	.4230	.5770	10
15° 00′	9.4130	9.9849	9.4281	0.5719	75° 00′
10	.4177	.9846	.4331	.5669	50
20	.4223	.9843	.4381	.5619	40
30	.4269	.9839	.4430	.5570	30
40	.4314	.9836	.4479	.5521	20
50	.4359	.9832	.4527	.5473	10
16° 00′	9.4403	9.9828	9.4575	0.5425	74° 00′
10	.4447	.9825	.4622	.5378	50
20	.4491	.9821	.4669	.5331	40
30	.4533	.9817	.4716	.5284	30
40	.4576	.9814	.4762	.5238	20
50	.4618	.9810	.4808	.5192	10
17° 00′	9.4659	9.9806	9.4853	0.5147	73° 00′
10	.4700	.9802	.4898	.5102	50
20	.4741	.9798	.4943	.5057	40
30	.4781	.9794	.4987	.5013	30
40	.4821	.9790	.5031	.4969	20
50	.4861	.9786	.5075	.4925	10
18° 00′	9.4900	9.9782	9.5118	0.4882	72° 00′
Degrees.	Log cos	Log sin	Log cot	Log tan	Degrees.

LOGARITHMS OF THE TRIGONOMETRICAL FUNCTIONS (Continued)

Degrees.	Log sin	Log cos	Log tan	Log cot	Degrees.
18° 00′	9.4900	9.9782	9.5118	0.4882	72° 00′
10	.4939	.9778	.5161	.4839	50
20	.4977	.9774	.5203	.4797	40
30	.5015	.9770	.5245	.4755	30
40	.5052	.9765	.5287	.4713	20
50	.5090	.9761	.5329	.4671	10
19° 00′	9.5126	9.9757	9.5370	0.4630	71° 00′
10	.5163	.9752	.5411	.4589	50
20	.5199	.9748	.5451	.4549	40
30	.5235	.9743	.5491	.4509	30
40	.5270	.9739	.5531	.4469	20
50	.5306	.9734	.5571	.4429	10
20° 00′	9.5341	9.9730	9.5611	0.4389	70° 00′
10	.5375	.9725	.5650	.4350	50
20	.5409	.9721	.5689	.4311	40
30	.5443	.9716	.5727	.4273	30
40	.5477	.9711	.5766	.4234	20
50	.5510	.9706	.5804	.4196	10
21° 00′	9.5543	9.9702	9.5842	0.4158	69° 00′
10	.5576	.9697	.5879	.4121	50
20	.5609	.9692	.5917	.4083	40
30	.5641	.9687	.5954	.4046	30
40	.5673	.9682	.5991	.4009	20
50	.5704	.9677	.6028	.3972	10
22° 00′	9.5736	9.9672	9.6064	0.3936	68° 00′
10	.5767	.9667	.6100	.3900	50
20	.5798	.9661	.6136	.3864	40
30	.5828	.9656	.6172	.3828	30
40	.5859	.9651	.6208	.3792	20
50	.5889	.9646	.6243	.3757	10
23° 00′	9.5919	9.9640	9.6279	0.3721	67° 00′
10	.5948	.9635	.6314	.3686	50
20	.5978	.9629	.6348	.3652	40
30	.6007	.9624	.6383	.3617	30
40	.6036	.9618	.6417	.3583	20
50	.6065	.9613	.6452	.3548	10
24° 00′	9.6093	9.9607	9.6486	0.3514	66° 00′
10	.6121	.9602	.6520	.3480	50
20	.6149	.9596	.6553	.3447	40
30	.6177	.9590	.6587	.3413	30
40	.6205	.9584	.6620	.3380	20
50	.6232	.9579	.6654	.3346	10
25° 00′	9.6259	9.9573	9.6687	0.3313	65° 00′
10	.6286	.9567	.6720	.3280	50
20	.6313	.9561	.6752	.3248	40
30	.6340	.9555	.6785	.3215	30
40	.6366	.9549	.6817	.3183	20
50	.6392	.9543	.6850	.3150	10
26° 00′	9.6418	9.9537	9.6882	0.3118	64° 00′
10	.6444	.9530	.6914	.3086	50
20	.6470	.9524	.6946	.3054	40
30	.6495	.9518	.6977	.3023	30
40	.6521	.9512	.7009	.2991	20
50	.6546	.9505	.7040	.2960	10
27° 00′	9.6570	9.9499	9.7072	0.2928	63° 00′
Degrees.	Log cos	Log sin	Log cot	Log tan	Degrees.

LOGARITHMS OF THE TRIGONOMETRICAL FUNCTIONS (Continued)

Degrees.	Log sin	Log cos	Log tan	Log cot	Degrees.
27° 00′	9.6570	9.9499	9.7072	0.2928	63° 00′
10	.6595	.9492	.7103	.2897	50
20	.6620	.9486	.7134	.2866	40
30	.6644	.9479	.7165	.2835	30
40	.6668	.9473	.7196	.2804	20
50	.6692	.9466	.7226	.2774	10
28° 00′	9.6716	9.9459	9.7257	0.2743	62° 00′
10	.6740	.8453	.7287	.2713	50
20	.6763	.9446	.7317	.2683	40
30	.6787	.9439	.7348	.2652	30
40	.6810	.9432	.7378	.2622	20
50	.6833	.9425	.7408	.2592	10
29° 00′	9.6856	9.9418	9.7438	0.2562	61° 00′
10	.6878	.9411	.7467	.2533	50
20	.6901	.9404	.7497	.2503	40
30	.6923	.9397	.7526	.2474	30
40	.6946	.9390	.7556	.2444	20
50	.6968	.9383	.7585	.2415	10
30° 00′	9.6990	9.9375	9.7614	0.2386	60° 00′
10	.7012	.9368	.7644	.2356	50
20	.7033	.9361	.7673	.2327	40
30	.7055	.9353	.7701	.2299	30
40	.7076	.9346	.7730	.2270	20
50	.7097	.9338	.7759	.2241	10
31° 00′	9.7118	9.9331	9.7788	0.2212	59° 00′
10	.7139	.9323	.7816	.2184	50
20	.7160	.9315	.7845	.2155	40
30	.7181	.9308	.7873	.2127	30
40	.7201	.9300	.7902	.2098	20
50	.7222	.9292	.7930	.2070	10
32° 00′	9.7242	9.9284	9.7958	0.2042	58° 00′
10	.7262	.9276	.7986	.2014	50
20	.7282	.9268	.8014	.1986	40
30	.7302	.9260	.8042	.1958	30
40	.7322	.9252	.8070	.1930	20
50	.7342	.9244	.8097	.1903	10
33° 00	9.7361	9.9236	9.8125	0.1875	57° 00′
10	.7380	.9228	.8153	.1847	50
20	.7400	.9219	.8180	.1820	40
30	.7419	.9211	.8208	.1792	30
40	.7438	.9203	.8235	.1765	20
50	.7457	.9194	.8263	.1737	10
34° 00′	9.7476	9.9186	9.8290	0.1710	56° 00′
10	.7494	.9177	.8317	.1683	50
20	.7513	.9169	.8344	.1656	40
30	.7531	.9160	.8371	.1629	30
40	.7550	.9151	.8398	.1602	20
50	.7568	.9142	.8425	.1575	10
35° 00′	9.7586	9.9134	9.8452	0.1548	55° 00′
10	.7604	.9125	.8479	.1521	50
20	.7622	.9116	.8506	.1494	40
30	.7640	.9107	.8533	.1467	30
40	.7657	.9098	.8559	.1441	20
50	.7675	.9089	.8586	.1414	10
36° 00′	9.7692	9.9080	9.8613	0.1387	54° 00′
Degrees.	Log cos	Log sin	Log cot	Log tan	Degrees.

LOGARITHMS OF THE TRIGONOMETRICAL FUNCTIONS (Continued)

Degrees.	Log sin	Log cos	Log tan	Log cot	Degrees.
36° 00′	9.7692	9.9080	9.8613	0.1387	54° 00′
10	.7710	.9070	.8639	.1361	50
20	.7727	.9061	.8666	.1334	40
30	.7744	.9052	.8692	.1308	30
40	.7761	.9042	.8718	.1282	20
50	.7778	.9033	.8745	.1255	10
37° 00′	9.7795	9.9023	9.8771	0.1229	53° 00′
10	.7811	.9014	.8797	.1203	50
20	.7828	.9004	.8824	.1176	40
30	.7844	.8995	.8850	.1150	30
40	.7861	.8985	.8876	.1124	20
50	.7877	.8975	.8902	.1098	10
38° 00′	9.7893	9.8965	9.8928	0.1072	52° 00′
10	.7910	.8955	.8954	.1046	50
20	.7926	.8945	.8980	.1020	40
30	.7941	.8935	.9006	.0994	30
40	.7957	.8925	.9032	.0968	20
50	.7973	.8915	.9058	.0942	10
39° 00′	9.7989	9.8905	9.9084	0.0916	51° 00′
10	.8004	.8895	.9110	.0890	50
20	.8020	.8884	.9135	.0865	40
30	.8035	.8874	.9161	.0839	30
40	.8050	.8864	.9187	.0813	20
50	.8066	.8853	.9212	.0788	10
40° 00′	9.8081	9.8843	9.9238	0.0762	50° 00′
10	.8096	.8832	.9264	.0736	50
20	.8111	.8821	.9289	.0711	40
30	.8125	.8810	.9315	.0685	30
40	.8140	.8800	.9341	.0659	20
50	.8155	.8789	.9366	.0634	10
41° 00′	9.8169	9.8778	9.9392	0.0608	49° 00′
10	.8184	.8767	.9417	.0583	50
20	.8198	.8756	.9443	.0557	40
30	.8213	.8745	.9468	.0532	30
40	.8227	.8733	.9494	.0506	20
50	.8241	.8722	.9519	.0481	10
42° 00′	9.8255	9.8711	9.9544	0.0456	48° 00′
10	.8269	.8699	.9570	.0430	50
20	.8283	.8688	.9595	.0405	40
30	.8297	.8676	.9621	.0379	30
40	.8311	.8665	.9646	.0354	20
50	.8324	.8653	.9671	.0329	10
43° 00′	9.8338	9.8641	9.9697	0.0303	47° 00′
10	.8351	.8629	.9722	.0278	50
20	.8365	.8618	.9747	.0253	40
30	.8378	.8606	.9773	.0228	30
40	.8391	.8594	.9798	.0202	20
50	.8405	.8582	.9823	.0177	10
44° 00′	9.8418	9.8569	9.9848	0.0152	46° 00′
10	.8431	.8557	.9874	.0126	50
20	.8444	.8545	.9899	.0101	40
30	.8457	.8532	.9927	.0076	30
40	.8469	.8520	.9949	.0051	20
50	.8482	.8507	.9975	.0025	10
45° 00′	9.8495	9.8495	0.0000	0.0000	45° 00′
Degrees.	Log cos	Log sin	Log cot	Log tan	Degrees.

DEGREES — RADIANS

The table gives in radians the angle which is expressed in degrees and minutes at the side and top.

°	00′	10	20	30	40	50
0	0.0000	0.0029	0.0058	0.0087	0.0116	0.0145
1	0.0175	0.0204	0.0233	0.0262	0.0291	0.0320
2	0.0349	0.0378	0.0407	0.0436	0.0465	0.0495
3	0.0524	0.0553	0.0582	0.0611	0.0640	0.0669
4	0.0698	0.0727	0.0756	0.0785	0.0814	0.0844
5	0.0873	0.0902	0.0931	0.0960	0.0989	0.1018
6	0.1047	0.1076	0.1105	0.1134	0.1164	0.1193
7	0.1222	0.1251	0.1280	0.1309	0.1338	0.1367
8	0.1396	0.1425	0.1454	0.1484	0.1513	0.1542
9	0.1571	0.1600	0.1629	0.1658	0.1687	0.1716
10	0.1745	0.1774	0.1804	0.1833	0.1862	0.1891
11	0.1920	0.1949	0.1978	0.2007	0.2036	0.2065
12	0.2094	0.2123	0.2153	0.2182	0.2211	0.2240
13	0.2269	0.2298	0.2327	0.2356	0.2385	0.2414
14	0.2443	0.2473	0.2502	0.2531	0.2560	0.2589
15	0.2618	0.2647	0.2676	0.2705	0.2734	0.2763
16	0.2793	0.2822	0.2851	0.2880	0.2909	0.2938
17	0.2967	0.2996	0.3025	0.3054	0.3083	0.3113
18	0.3142	0.3171	0.3200	0.3229	0.3258	0.3287
19	0.3316	0.3345	0.3374	0.3403	0.3432	0.3462
20	0.3491	0.3520	0.3549	0.3578	0.3607	0.3636
21	0.3665	0.3694	0.3723	0.3752	0.3782	0.3811
22	0.3840	0.3869	0.3898	0.3927	0.3956	0.3985
23	0.4014	0.4043	0.4072	0.4102	0.4131	0.4160
24	0.4189	0.4218	0.4247	0.4276	0.4305	0.4334
25	0.4363	0.4392	0.4422	0.4451	0.4480	0.4509
26	0.4538	0.4567	0.4596	0.4625	0.4654	0.4683
27	0.4712	0.4741	0.4771	0.4800	0.4829	0.4858
28	0.4887	0.4916	0.4945	0.4974	0.5003	0.5032
29	0.5061	0.5091	0.5120	0.5149	0.5178	0.5207
30	0.5236	0.5265	0.5294	0.5323	0.5352	0.5381
31	0.5411	0.5440	0.5469	0.5498	0.5527	0.5556
32	0.5585	0.5614	0.5643	0.5672	0.5701	0.5730
33	0.5760	0.5789	0.5818	0.5847	0.5876	0.5905
34	0.5934	0.5963	0.5992	0.6021	0.6050	0.6080
35	0.6109	0.6138	0.6167	0.6196	0.6225	0.6254
36	0.6283	0.6312	0.6341	0.6370	0.6400	0.6429
37	0.6458	0.6487	0.6516	0.6545	0.6574	0.6603
38	0.6632	0.6661	0.6690	0.6720	0.6749	0.6778
39	0.6807	0.6836	0.6865	0.6894	0.6923	0.6952
40	0.6981	0.7010	0.7039	0.7069	0.7098	0.7127
41	0.7156	0.7185	0.7214	0.7243	0.7272	0.7301
42	0.7330	0.7359	0.7389	0.7418	0.7447	0.7476
43	0.7505	0.7534	0.7563	0.7592	0.7621	0.7650
44	0.7679	0.7709	0.7738	0.7767	0.7796	0.7825

DEGREES — RADIANS (Continued)

°	00′	10	20	30	40	50
45	0.7854	0.7883	0.7912	0.7941	0.7970	0.7999
46	0.8029	0.8058	0.8087	0.8116	0.8145	0.8174
47	0.8203	0.8232	0.8261	0.8290	0.8319	0.8348
48	0.8378	0.8407	0.8436	0.8465	0.8494	0.8523
49	0.8552	0.8581	0.8610	0.8639	0.8668	0.8698
50	0.8727	0.8756	0.8785	0.8814	0.8843	0.8872
51	0.8901	0.8930	0.8959	0.8988	0.9018	0.9047
52	0.9076	0.9105	0.9134	0.9163	0.9192	0.9221
53	0.9250	0.9279	0.9308	0.9338	0.9367	0.9396
54	0.9425	0.9454	0.9483	0.9512	0.9541	0.9570
55	0.9599	0.9628	0.9657	0.9687	0.9716	0.9745
56	0.9774	0.9803	0.9832	0.9861	0.9890	0.9919
57	0.9948	0.9977	1.0007	1.0036	1.0065	1.0094
58	1.0123	1.0152	1.0181	1.0210	1.0239	1.0268
59	1.0297	1.0327	1.0356	1.0385	1.0414	1.0443
60	1.0472	1.0501	1.0530	1.0559	1.0588	1.0617
61	1.0647	1.0676	1.0705	1.0734	1.0763	1.0792
62	1.0821	1.0850	1.0879	1.0908	1.0937	1.0966
63	1.0996	1.1025	1.1054	1.1083	1.1112	1.1141
64	1.1170	1.1199	1.1228	1.1257	1.1286	1.1316
65	1.1345	1.1374	1.1403	1.1432	1.1461	1.1490
66	1.1519	1.1548	1.1577	1.1606	1.1636	1.1665
67	1.1694	1.1723	1.1752	1.1781	1.1810	1.1839
68	1.1868	1.1897	1.1926	1.1956	1.1985	1.2014
69	1.2043	1.2072	1.2101	1.2130	1.2159	1.2188
70	1.2217	1.2246	1.2275	1.2305	1.2334	1.2363
71	1.2392	1.2421	1.2450	1.2479	1.2508	1.2537
72	1.2566	1.2595	1.2625	1.2654	1.2683	1.2712
73	1.2741	1.2770	1.2799	1.2828	1.2857	1.2886
74	1.2915	1.2945	1.2974	1.3003	1.3032	1.3061
75	1.3090	1.3119	1.3148	1.3177	1.3206	1.3235
76	1.3265	1.3294	1.3323	1.3352	1.3381	1.3410
77	1.3439	1.3468	1.3497	1.3526	1.3555	1.3584
78	1.3614	1.3643	1.3672	1.3701	1.3730	1.3759
79	1.3788	1.3817	1.3846	1.3875	1.3904	1.3934
80	1.3963	1.3992	1.4021	1.4050	1.4079	1.4108
81	1.4137	1.4166	1.4195	1.4224	1.4254	1.4283
82	1.4312	1.4341	1.4370	1.4399	1.4428	1.4457
83	1.4486	1.4515	1.4544	1.4574	1.4603	1.4632
84	1.4661	1.4690	1.4719	1.4748	1.4777	1.4806
85	1.4835	1.4864	1.4893	1.4923	1.4952	1.4981
86	1.5010	1.5039	1.5068	1.5097	1.5126	1.5155
87	1.5184	1.5213	1.5243	1.5272	1.5301	1.5330
88	1.5359	1.5388	1.5417	1.5446	1.5475	1.5504
89	1.5533	1.5563	1.5592	1.5621	1.5650	1.5679
90	1.5708					

DEGREES — RADIANS (Concluded)

Deg.	Radians.	Deg.	Radians.	Deg.	Radians.	Deg.	Radians.
90	1.5708	160	2.7925	230	4.0143	300	5.2360
100	1.7453	170	2.9671	240	4.1888	310	5.4105
110	1.9199	180	3.1416	250	4.3633	320	5.5851
120	2.0944	190	3.3161	260	4.5379	330	5.7596
130	2.2689	200	3.4907	270	4.7124	340	5.9341
140	2.4435	210	3.6652	280	4.8869	350	6.1087
150	2.6180	220	3.8397	290	5.0615	360	6.2832

NUMERICAL CONSTANTS

$\pi = 3.14159$ $\qquad \log \pi = 0.497150$

$4\pi = 12.56637$ $\qquad \log 4\pi = 1.099210$

$\frac{\pi}{2} = 1.57080$ $\qquad \log \frac{\pi}{2} = 0.196120$

$\frac{\pi}{3} = 1.04720$ $\qquad \log \frac{\pi}{3} = 0.020029$

$\frac{4}{3}\pi = 4.18879$ $\qquad \log \frac{4}{3}\pi = 0.622089$

$\frac{\pi}{4} = 0.78540$ $\qquad \log \frac{\pi}{4} = 9.895090 - 10$

$\frac{1}{\pi} = 0.31831$ $\qquad \log \frac{1}{\pi} = 9.502850 - 10$

$\pi^2 = 9.86960$ $\qquad \log \pi^2 = 0.994300$

$4\pi^2 = 39.47840$ $\qquad \log 4\pi^2 = 1.596360$

$\frac{1}{\pi^2} = 0.10132$ $\qquad \log \frac{1}{\pi^2} = 9.005700 - 10$

$\sqrt{\pi} = 1.77245$ $\qquad \log \sqrt{\pi} = 0.248575$

$\frac{1}{\sqrt{\pi}} = 0.56419$ $\qquad \log \frac{1}{\sqrt{\pi}} = 9.751425 - 10$

$\sqrt[3]{\pi} = 1.46549$ $\qquad \log \sqrt[3]{\pi} = 0.165717$

BASE OF NATURAL LOGARITHMS

$e = 2.71828 \qquad \log_{10} e = 0.434294$

Natural log of $x = \log_e x = 2.30259 \log_{10} x$.

For conversion or reduction factors see under *Measures and Units.*
For miscellaneous physical constants see under *Miscellaneous Tables.*

NUMERICAL TABLE

Reciprocals, Powers and Roots of Numbers, Circumferences and Areas for Numbers (Diameters) from 1 to 1000

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
1	000.00	1	1	1.	1.00000	3.14159	.79
2	500.00	4	8	1.414	1.25992	6.28319	3.14
3	333.33	9	27	1.732	1.44225	9.42478	7.07
4	250.00	16	64	2.000	1.58740	12.5664	12.57
5	200.00	25	125	2.236	1.70998	15.7080	19.64
6	166.67	36	216	2.449	1.81712	18.8496	28.27
7	142.86	49	343	2.646	1.91293	21.9911	38.49
8	125.00	64	512	2.828	2.00000	25.1327	50.27
9	111.11	81	729	3.000	2.08008	28.2743	63.62
10	100.00	100	1000	3.162	2.15443	31.4159	78.5
11	90.9091	121	1331	3.3166	2.22398	34.5575	95.0
12	83.3333	144	1728	3.4641	2.28943	37.6991	113.1
13	76.9231	169	2197	3.6056	2.35133	40.8407	132.7
14	71.4286	196	2744	3.7417	2.41014	43.9823	153.9
15	66.6667	225	3375	3.8730	2.46621	47.1239	176.7
16	62.5000	256	4096	4.0000	2.51984	50.2655	201.1
17	58.8235	289	4913	4.1231	2.57128	53.4071	227.0
18	55.5556	324	5832	4.2426	2.62074	56.5487	254.5
19	52.6316	361	6859	4.3589	2.66840	59.6903	283.5
20	50.0000	400	8000	4.4721	2.71442	62.8319	314.2
21	47.6190	441	9261	4.5826	2.75892	65.9734	346.4
22	45.4545	484	10648	4.6904	2.80204	69.1150	380.1
23	43.4783	529	12167	4.7958	2.84387	72.2566	415.5
24	41.6667	576	13824	4.8990	2.88450	75.3982	452.4
25	40.0000	625	15625	5.0000	2.92402	78.5398	490.9
26	38.4615	676	17576	5.0990	2.96250	81.6814	530.9
27	37.0370	729	19683	5.1962	3.00000	84.8230	572.6
28	35.7143	784	21952	5.2915	3.03659	87.9646	615.8
29	34.4828	841	24389	5.3852	3.07232	91.1062	660.5
30	33.3333	900	27000	5.4772	3.10723	94.2478	706.9
31	32.2581	961	29791	5.5678	3.14138	97.3894	754.8
32	31.2500	1024	32768	5.6569	3.17480	100.531	804.3
33	30.3030	1089	35937	5.7446	3.20753	103.673	855.3
34	29.4118	1156	39304	5.8310	3.23961	106.814	907.9
35	28.5714	1225	42875	5.9161	3.27107	109.956	962.1
36	27.7778	1296	46656	6.0000	3.30193	113.097	1017.9
37	27.0270	1369	50653	6.0828	3.33222	116.239	1075.2
38	26.3158	1444	54872	6.1644	3.36198	119.381	1134.1
39	25.6410	1521	59319	6.2450	3.39121	122.522	1194.6
40	25.0000	1600	64000	6.3246	3.41995	125.664	1256.6
41	24.3902	1681	68921	6.4031	3.44822	128.805	1320.3
42	23.8095	1764	74088	6.4807	3.47603	131.947	1385.4
43	23.2558	1849	79507	6.5574	3.50340	135.088	1452.2
44	22.7273	1936	85184	6.6332	3.53035	138.230	1520.5
45	22.2222	2025	91125	6.7082	3.55689	141.372	1590.4
46	21.7391	2116	97336	6.7823	3.58305	144.513	1661.9
47	21.2766	2209	103823	6.8557	3.60883	147.655	1734.9
48	20.8333	2304	110592	6.9282	3.63424	150.796	1809.6
49	20.4082	2401	117649	7.0000	3.65931	153.938	1885.7
50	20.0000	2500	125000	7.0711	3.68403	157.080	1963.5

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
51	19.6078	2601	132651	7.1414	3.70843	160.221	2042.8
52	19.2308	2704	140608	7.2111	3.73251	163.363	2123.7
53	18.8679	2809	148877	7.2801	3.75628	166.504	2206.2
54	18.5185	2916	157464	7.3485	3.77976	169.646	2290.2
55	18.1818	3025	166375	7.4162	3.80295	172.788	2375.8
56	17.8571	3136	175616	7.4833	3.82586	175.929	2463.0
57	17.5439	3249	185193	7.5498	3.84850	179.071	2551.8
58	17.2414	3364	195112	7.6158	3.87088	182.212	2642.1
59	16.9492	3481	205379	7.6811	3.89300	185.354	2734.0
60	16.6667	3600	216000	7.7460	3.91487	188.496	2827.4
61	16.3934	3721	226981	7.8102	3.93650	191.637	2922.5
62	16.1290	3844	238328	7.8740	3.95789	194.779	3019.1
63	15.8730	3969	250047	7.9373	3.97906	197.920	3117.3
64	15.6250	4096	262144	8.0000	4.00000	201.062	3217.0
65	15.3846	4225	274625	8.0623	4.02073	204.204	3318.3
66	15.1515	4356	287496	8.1240	4.04124	207.345	3421.2
67	14.9254	4489	300763	8.1854	4.06155	210.487	3525.7
68	14.7059	4624	314432	8.2462	4.08166	213.628	3631.7
69	14.4928	4761	328509	8.3066	4.10157	216.770	3739.3
70	14.2857	4900	343000	8.3666	4.12129	219.911	3848.5
71	14.0845	5041	357911	8.4261	4.14082	223.053	3959.2
72	13.8889	5184	373248	8.4853	4.16017	226.195	4071.5
73	13.6986	5329	389017	8.5440	4.17934	229.336	4185.4
74	13.5135	5476	405224	8.6023	4.19834	232.478	4300.8
75	13.3333	5625	421875	8.6603	4.21716	235.619	4417.9
76	13.1579	5776	438976	8.7178	4.23582	238.761	4536.5
77	12.9870	5929	456533	8.7750	4.25432	241.903	4656.6
78	12.8205	6084	474552	8.8318	4.27266	245.044	4778.4
79	12.6582	6241	493039	8.8882	4.29084	248.186	4901.7
80	12.5000	6400	512000	8.9443	4.30887	251.327	5026.6
81	12.3457	6561	531441	9.0000	4.32675	254.469	5153.0
82	12.1951	6724	551368	9.0554	4.34448	257.611	5281.0
83	12.0482	6889	571787	9.1104	4.36207	260.752	5410.6
84	11.9048	7056	592704	9.1652	4.37952	263.894	5541.8
85	11.7647	7225	614125	9.2195	4.39683	267.035	5674.5
86	11.6279	7396	636056	9.2736	4.41400	270.177	5808.8
87	11.4943	7569	658503	9.3274	4.43105	273.319	5944.7
88	11.3636	7744	681472	9.3808	4.44796	276.460	6082.1
89	11.2360	7921	704969	9.4340	4.46475	279.602	6221.1
90	11.1111	8100	729000	9.4868	4.48140	282.743	6361.7
91	10.9890	8281	753571	9.5394	4.49794	285.885	6503.9
92	10.8696	8464	778688	9.5917	4.51436	289.027	6647.6
93	10.7527	8649	804357	9.6437	4.53065	292.168	6792.9
94	10.6383	8836	830584	9.6954	4.54684	295.310	6939.8
95	10.5263	9025	857375	9.7468	4.56290	298.451	7088.2
96	10.4167	9216	884736	9.7980	4.57886	301.593	7238.2
97	10.3093	9409	912673	9.8489	4.59470	304.734	7389.8
98	10.2041	9604	941192	9.8995	4.61044	307.876	7543.0
99	10.1010	9801	970299	9.9499	4.62607	311.018	7697.7
100	10.0000	10000	1000000	10.0000	4.64159	314.159	7854.0

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
101	9.90099	10201	1030301	10.0499	4.65701	317.301	8011.9
102	9.80392	10404	1061208	10.0995	4.67233	320.442	8171.3
103	9.70874	10609	1092727	10.1489	4.68755	323.584	8332.3
104	9.61538	10816	1124864	10.1980	4.70267	326.726	8494.9
105	9.52381	11025	1157625	10.2470	4.71769	329.867	8659.0
106	9.43396	11236	1191016	10.2956	4.73262	333.009	8824.7
107	9.34579	11449	1225043	10.3441	4.74746	336.150	8992.0
108	9.25926	11664	1259712	10.3923	4.76220	339.292	9160.9
109	9.17431	11881	1295029	10.4403	4.77686	342.434	9331.3
110	9.09091	12100	1331000	10.4881	4.79142	345.575	9503.3
111	9.00901	12321	1367631	10.5357	4.80590	348.717	9676.9
112	8.92857	12544	1404928	10.5830	4.82028	351.858	9852.0
113	8.84956	12769	1442897	10.6301	4.83459	355.000	10028.8
114	8.77193	12996	1481544	10.6771	4.84881	358.142	10207.0
115	8.69565	13225	1520875	10.7238	4.86294	361.283	10386.9
116	8.62069	13456	1560896	10.7703	4.87700	364.425	10568.3
117	8.54701	13689	1601613	10.8167	4.89097	367.566	10751.3
118	8.47458	13924	1643032	10.8628	4.90487	370.708	10935.9
119	8.40336	14161	1685159	10.9087	4.91868	373.850	11122.0
120	8.33333	14400	1728000	10.9545	4.93242	376.991	11309.7
121	8.26446	14641	1771561	11.0000	4.94609	380.133	11499.0
122	8.19672	14884	1815848	11.0454	4.95968	383.274	11689.9
123	8.13008	15129	1860867	11.0905	4.97319	386.416	11882.3
124	8.06452	15376	1906624	11.1355	4.98663	389.557	12076.3
125	8.00000	15625	1953125	11.1803	5.00000	392.699	12271.9
126	7.93651	15876	2000376	11.2250	5.01330	395.841	12469.0
127	7.87402	16129	2048383	11.2694	5.02653	398.982	12667.7
128	7.81250	16384	2097152	11.3137	5.03968	402.124	12868.0
129	7.75194	16641	2146689	11.3578	5.05277	405.265	13069.8
130	7.69231	16900	2197000	11.4018	5.06580	408.407	13273.2
131	7.63359	17161	2248091	11.4455	5.07875	411.549	13478.2
132	7.57576	17424	2299968	11.4891	5.09164	414.690	13684.8
133	7.51880	17689	2352637	11.5326	5.10447	417.832	13892.9
134	7.46269	17956	2406104	11.5758	5.11723	420.973	14102.6
135	7.40741	18225	2460375	11.6190	5.12993	424.115	14313.9
136	7.35294	18496	2515456	11.6619	5.14256	427.257	14526.7
137	7.29927	18769	2571353	11.7047	5.15514	430.398	14741.1
138	7.24638	19044	2628072	11.7473	5.16765	433.540	14957.1
139	7.19424	19321	2685619	11.7898	5.18010	436.681	15174.7
140	7.14286	19600	2744000	11.8322	5.19249	439.823	15393.8
141	7.09220	19881	2803221	11.8743	5.20483	442.965	15614.5
142	7.04225	20164	2863288	11.9164	5.21710	446.106	15836.8
143	6.99301	20449	2924207	11.9583	5.22932	449.248	16060.6
144	6.94444	20736	2985984	12.0000	5.24148	452.389	16286.0
145	6.89655	21025	3048625	12.0416	5.25359	455.531	16513.0
146	6.84932	21316	3112136	12.0830	5.26564	458.673	16741.6
147	6.80272	21609	3176523	12.1244	5.27763	461.814	16971.7
148	6.75676	21904	3241792	12.1655	5.28957	464.956	17203.4
149	6.71141	22201	3307949	12.2066	5.30146	468.097	17436.6
150	6.66667	22500	3375000	12.2474	5.31329	471.239	17671.5

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
151	6.62252	22801	3442951	12.2882	5.32507	474.380	17907.9
152	6.57895	23104	3511808	12.3288	5.33680	477.522	18145.8
153	6.53595	23409	3581577	12.3693	5.34848	480.664	18385.4
154	6.49351	23716	3652264	12.4097	5.36011	483.805	18626.5
155	6.45161	24025	3723875	12.4499	5.37169	486.947	18869.2
156	6.41026	24336	3796416	12.4900	5.38321	490.088	19113.5
157	6.36943	24649	3869893	12.5300	5.39469	493.230	19359.3
158	6.32911	24964	3944312	12.5698	5.40612	496.372	19606.7
159	6.28931	25281	4019679	12.6095	5.41750	499.513	19855.7
160	6.25000	25600	4096000	12.6491	5.42884	502.655	20106.2
161	6.21118	25921	4173281	12.6886	5.44012	505.796	20358.3
162	6.17284	26244	4251528	12.7279	5.45136	508.938	20612.0
163	6.13497	26569	4330747	12.7671	5.46256	512.080	20867.2
164	6.09756	26896	4410944	12.8062	5.47370	515.221	21124.1
165	6.06061	27225	4492125	12.8452	5.48481	518.363	21382.5
166	6.02410	27556	4574296	12.8841	5.49586	521.504	21642.4
167	5.98802	27889	4657463	12.9228	5.50688	524.646	21904.0
168	5.95238	28224	4741632	12.9615	5.51785	527.788	22167.1
169	5.91716	28561	4826809	13.0000	5.52877	530.929	22431.8
170	5.88235	28900	4913000	13.0384	5.53966	534.071	22698.0
171	5.84795	29241	5000211	13.0767	5.55050	537.212	22965.8
172	5.81395	29584	5088448	13.1149	5.56130	540.354	23235.2
173	5.78035	29929	5177717	13.1529	5.57205	543.496	23506.2
174	5.74713	30276	5268024	13.1909	5.58277	546.637	23778.7
175	5.71429	30625	5359375	13.2288	5.59344	549.779	24052.8
176	5.68182	30976	5451776	13.2665	5.60408	552.920	24328.5
177	5.64972	31329	5545233	13.3041	5.61467	556.062	24605.7
178	5.61798	31684	5639752	13.3417	5.62523	559.203	24884.6
179	5.58659	32041	5735339	13.3791	5.63574	562.345	25164.9
180	5.55556	32400	5832000	13.4164	5.64622	565.487	25446.9
181	5.52486	32761	5929741	13.4536	5.65665	568.628	25730.4
182	5.49451	33124	6028568	13.4907	5.66705	571.770	26015.5
183	5.46448	33489	6128487	13.5277	5.67741	574.911	26302.2
184	5.43478	33856	6229504	13.5647	5.68773	578.053	26590.4
185	5.40541	34225	6331625	13.6015	5.69802	581.195	26880.3
186	5.37634	34596	6434856	13.6382	5.70827	584.336	27171.6
187	5.34759	34969	6539203	13.6748	5.71850	587.478	27464.6
188	5.31915	35344	6644672	13.7113	5.72865	590.619	27759.1
189	5.29101	35721	6751269	13.7477	5.73879	593.761	28055.2
190	5.26316	36100	6859000	13.7840	5.74890	596.903	28352.9
191	5.23560	36481	6967871	13.8203	5.75897	600.044	28652.1
192	5.20833	36864	7077888	13.8564	5.76900	603.186	28952.9
193	5.18135	37249	7189057	13.8924	5.77900	606.327	29255.3
194	5.15464	37636	7301384	13.9284	5.78896	609.469	29559.3
195	5.12821	38025	7414875	13.9642	5.79889	612.611	29864.8
196	5.10204	38416	7529536	14.0000	5.80879	615.752	30171.9
197	5.07614	38809	7645373	14.0357	5.81865	618.894	30480.5
198	5.05051	39204	7762392	14.0712	5.82848	622.035	30790.8
199	5.02513	39601	7880599	14.1067	5.83827	625.177	31102.6
200	5.00000	40000	8000000	14.1421	5.84804	628.319	31415.9

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
201	4.97512	40401	8120601	14.1774	5.85777	631.460	31730.9
202	4.95050	40804	8242408	14.2127	5.86746	634.602	32047.4
203	4.92611	41209	8365427	14.2478	5.87713	637.743	32365.5
204	4.90196	41616	8489664	14.2829	5.88677	640.885	32685.1
205	4.87805	42025	8615125	14.3178	5.89637	644.026	33006.4
206	4.85437	42436	8741816	14.3527	5.90594	647.168	33329.2
207	4.83092	42849	8869743	14.3875	5.91548	650.310	33653.5
208	4.80769	43264	8998912	14.4222	5.92499	653.451	33979.5
209	4.78469	43681	9129329	14.4568	5.93447	656.593	34307.0
210	4.76190	44100	9261000	14.4914	5.94392	659.734	34636.1
211	4.73934	44521	9393931	14.5258	5.95334	662.876	34966.7
212	4.71698	44944	9528128	14.5602	5.96273	666.018	35298.9
213	4.69484	45369	9663597	14.5945	5.97209	669.159	35632.7
214	4.67290	45796	9800344	14.6287	5.98142	672.301	35968.1
215	4.65116	46225	9938375	14.6629	5.99073	675.442	36305.0
216	4.62963	46656	10077696	14.6969	6.00000	678.584	36643.5
217	4.60829	47089	10218313	14.7309	6.00925	681.726	36983.6
218	4.58716	47524	10360232	14.7648	6.01846	684.867	37325.3
219	4.56621	47961	10503459	14.7986	6.02765	688.009	37668.5
220	4.54545	48400	10648000	14.8324	6.03681	691.150	38013.3
221	4.52489	48841	10793861	14.8661	6.04594	694.292	38359.6
222	4.50450	49284	10941048	14.8997	6.05505	697.434	38707.6
223	4.48430	49729	11089567	14.9332	6.06413	700.575	39057.1
224	4.46429	50176	11239424	14.9666	6.07318	703.717	39408.1
225	4.44444	50625	11390625	15.0000	6.08220	706.858	39760.8
226	4.42478	51076	11543176	15.0333	6.09120	710.000	40115.0
227	4.40529	51529	11697083	15.0665	6.10017	713.142	40470.8
228	4.38529	51984	11852352	15.0997	6.10911	716.283	40828.1
229	4.36681	52441	12008989	15.1327	6.11803	719.425	41187.1
230	4.34783	52900	12167000	15.1658	6.12693	722.566	41547.6
231	4.32900	53361	12326391	15.1987	6.13579	725.708	41909.6
232	4.31034	53824	12487168	15.2315	6.14463	728.849	42273.3
233	4.29185	54289	12649337	15.2643	6.15345	731.991	42638.5
234	4.27350	54756	12812904	15.2971	6.16224	735.133	43005.3
235	4.25532	55225	12977875	15.3297	6.17101	738.274	43373.6
236	4.23729	55696	13144256	15.3623	6.17975	741.416	43743.5
237	4.21941	56169	13312053	15.3948	6.18846	744.557	44115.0
238	4.20168	56644	13481272	15.4272	6.19715	747.699	44488.1
239	4.18410	57121	13651919	15.4596	6.20582	750.841	44862.7
240	4.16667	57600	13824000	15.4919	6.21447	753.982	45238.9
241	4.14938	58081	13997521	15.5242	6.22308	757.124	45616.7
242	4.13223	58564	14172488	15.5563	6.23168	760.265	45996.1
243	4.11523	59049	14348907	15.5885	6.24025	763.407	46377.0
244	4.09836	59536	14526784	15.6205	6.24880	766.549	46759.5
245	4.08163	60025	14706125	15.6525	6.25732	769.690	47143.5
246	4.06504	60516	14886936	15.6844	6.26583	772.832	47529.2
247	4.04858	61009	15069223	15.7162	6.27431	775.973	47916.4
248	4.03226	61504	15252992	15.7480	6.28276	779.115	48305.1
249	4.01606	62001	15438249	15.7797	6.29119	782.257	48695.5
250	4.00000	62500	15625000	15.8114	6.29961	785.398	49087.4

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
251	3.98406	63001	15813251	15.8430	6.30799	788.540	49480.9
252	3.96825	63504	16003008	15.8745	6.31636	791.681	49875.9
253	3.95257	64009	16194277	15.9060	6.32470	794.823	50272.6
254	3.93701	64516	16387064	15.9374	6.33303	797.965	50670.8
255	3.92157	65025	16581375	15.9687	6.34133	801.106	51070.5
256	3.90625	65536	16777216	16.0000	6.34960	804.248	51471.9
257	3.89105	66049	16974593	16.0312	6.35786	807.389	51874.8
258	3.87597	66564	17173512	16.0624	6.36610	810.531	52279.2
259	3.86100	67081	17373979	16.0935	6.37431	813.672	52685.3
260	3.84615	67600	17576000	16.1245	6.38250	816.814	53092.9
261	3.83142	68121	17779581	16.1555	6.39068	819.956	53502.1
262	3.81679	68644	17984728	16.1864	6.39883	823.097	53912.9
263	3.80228	69169	18191447	16.2173	6.40696	826.239	54325.2
264	3.78788	69696	18399744	16.2481	6.41507	829.380	54739.1
265	3.77358	70225	18609625	16.2788	6.42316	832.522	55154.6
266	3.75940	70756	18821096	16.3095	6.43123	835.664	55571.6
267	3.74532	71289	19034163	16.3401	6.43928	838.805	55990.3
268	3.73134	71824	19248832	16.3707	6.44731	841.947	56410.4
269	3.71747	72361	19465109	16.4012	6.45531	845.088	56832.2
270	3.70370	72900	19683000	16.4317	6.46330	848.230	57255.5
271	3.69004	73441	19902511	16.4621	6.47127	851.372	57680.4
272	3.67647	73984	20123648	16.4924	6.47922	854.513	58106.9
273	3.66300	74529	20346417	16.5227	6.48715	857.655	58534.9
274	3.64964	75076	20570824	16.5529	6.49507	860.796	58964.6
275	3.63636	75625	20796875	16.5831	6.50296	863.938	59395.7
276	3.62319	76176	21024576	16.6132	6.51083	867.080	59828.5
277	3.61011	76729	21253933	16.6433	6.51868	870.221	60262.8
278	3.59712	77284	21484952	16.6733	6.52652	873.363	60698.7
279	3.58423	77841	21717639	16.7033	6.53434	876.504	61136.2
280	3.57143	78400	21952000	16.7332	6.54213	879.646	61575.2
281	3.55872	78961	22188041	16.7631	6.54991	882.788	62015.8
282	3.54610	79524	22425768	16.7929	6.55767	885.929	62458.0
283	3.53357	80089	22665187	16.8226	6.56541	889.071	62901.8
284	3.52113	80656	22906304	16.8523	6.57314	892.212	63347.1
285	3.50877	81225	23149125	16.8819	6.58084	895.354	63794.0
286	3.49650	81796	23393656	16.9115	6.58853	898.495	63242.4
287	3.48432	82369	23639903	16.9411	6.59620	901.637	64692.5
288	3.47222	82944	23887872	16.9706	6.60385	904.779	65144.1
289	3.46021	83521	24137569	17.0000	6.61150	907.920	65597.2
290	3.44828	84100	24389000	17.0294	6.61911	911.062	66052.0
291	3.43643	84681	24642171	17.0587	6.62671	914.203	66508.3
292	3.42466	85264	24897088	17.0880	6.63429	917.345	66966.2
293	3.41297	85849	25153757	17.1172	6.64185	920.487	67425.7
294	3.40136	86436	25412184	17.1464	6.64940	923.628	67886.7
295	3.38983	87025	25672375	17.1756	6.65693	926.770	68349.3
296	3.37838	87616	25934336	17.2047	6.66444	929.911	68813.5
297	3.36700	88209	26198073	17.2337	6.67194	933.053	69279.2
298	3.35570	88804	26463592	17.2627	6.67942	936.195	69746.5
299	3.34448	89401	26730899	17.2916	6.68688	939.336	70215.4
300	3.33333	90000	27000000	17.3205	6.69433	942.478	70685.8

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
301	3.32226	90601	27270901	17.3494	6.70186	945.619	71157.9
302	3.31126	91204	27543608	17.3781	6.70917	948.761	71631.5
303	3.30033	91809	27818127	17.4069	6.71657	951.903	72106.6
304	3.28947	92416	28094464	17.4356	6.72395	955.044	72583.4
305	3.27869	93025	28372625	17.4642	6.73132	958.186	73061.7
306	3.26797	93636	28652616	17.4929	6.73866	961.327	73541.5
307	3.25733	94249	28934443	17.5214	6.74600	964.469	74023.0
308	3.24675	94864	29218112	17.5499	6.75331	967.611	74506.0
309	3.23625	95481	29503629	17.5784	6.76061	970.752	74990.6
310	3.22581	96100	29791000	17.6068	6.76790	973.894	75476.8
311	3.21543	96721	30080231	17.6352	6.77517	977.035	75964.5
312	3.20513	97344	30371328	17.6635	6.78242	980.177	76453.8
313	3.19489	97969	30664297	17.6918	6.78966	983.318	76944.7
314	3.18471	98596	30959144	17.7200	6.79688	986.460	77437.1
315	3.17460	99225	31255875	17.7482	6.80409	989.602	77931.1
316	3.16456	99856	31554496	17.7764	6.81128	992.743	78426.7
317	3.15457	100489	31855013	17.8045	6.81846	995.885	78923.9
318	3.14465	101124	32157432	17.8326	6.82562	999.026	79422.6
319	3.13480	101761	32461759	17.8606	6.83277	1002.17	79922.9
320	3.12500	102400	32768000	17.8885	6.83990	1005.31	80424.8
321	3.11526	103041	33076161	17.9165	6.84702	1008.45	80928.2
322	3.10559	103684	33386248	17.9444	6.85412	1011.59	81433.2
323	3.09598	104329	33698267	17.9722	6.86121	1014.73	81939.8
324	3.08642	104976	34012224	18.0000	6.86829	1017.88	82448.0
325	3.07692	105625	34328125	18.0278	6.87534	1021.02	82957.7
326	3.06748	106276	34645976	18.0555	6.88239	1024.16	83469.0
327	3.05810	106929	34965783	18.0831	6.88942	1027.30	83981.8
328	3.04878	107584	35287552	18.1108	6.89643	1030.44	84496.3
329	3.03951	108241	35611289	18.1384	6.90344	1033.58	85012.3
330	3.03030	108900	35937000	18.1659	6.91042	1036.73	85529.9
331	3.02115	109561	36264691	18.1934	6.91740	1039.87	86049.0
332	3.01205	110224	36594368	18.2209	6.92436	1043.01	86569.7
333	3.00300	110889	36926037	18.2483	6.93130	1046.15	87092.0
334	2.99401	111556	37259704	18.2757	6.93823	1049.29	87615.9
335	2.98507	112225	37595375	18.3030	6.94515	1052.43	88141.3
336	2.97619	112896	37933056	18.3303	6.95205	1055.58	88668.3
337	2.96736	113569	38272753	18.3576	6.95894	1058.72	89196.9
338	2.95858	114244	38614472	18.3848	6.96582	1061.86	89727.0
339	2.94985	114921	38958219	18.4120	6.97268	1065.00	90258.7
340	2.94118	115600	39304000	18.4391	6.97953	1068.14	90792.0
341	2.93255	116281	39651821	18.4662	6.98637	1071.28	91326.9
342	2.92398	116964	40001688	18.4932	6.99319	1074.42	91863.3
343	2.91545	117649	40353607	18.5203	7.00000	1077.57	92401.3
344	2.90698	118336	40707584	18.5472	7.00680	1080.71	92940.9
345	2.89855	119025	41063625	18.5742	7.01358	1083.85	93482.0
346	2.89017	119716	41421736	18.6011	7.02035	1086.99	94024.7
347	2.88184	120409	41781923	18.6279	7.02711	1090.13	94569.0
348	2.87356	121104	42144192	18.6548	7.03385	1093.27	95114.9
349	2.86533	121801	42508549	18.6815	7.04058	1096.42	95662.3
350	2.85714	122500	42875000	18.7083	7.04730	1099.56	96211.3

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
351	2.84900	123201	43243551	18.7350	7.05400	1102.70	96761.8
352	2.84091	123904	43614208	18.7617	7.06070	1105.84	97314.0
353	2.83286	124600	43986977	18.7883	7.06738	1108.98	97867.7
354	2.82486	125316	44361864	18.8149	7.07404	1112.12	98423.0
355	2.81690	126025	44738875	18.8414	7.08070	1115.27	98979.8
356	2.80899	126736	45118016	18.8680	7.08734	1118.41	99538.2
357	2.80112	127449	45499293	18.8944	7.09397	1121.55	100098.
358	2.79330	128164	45882712	18.9209	7.10059	1124.69	100660.
359	2.78552	128881	46268279	18.9473	7.10719	1127.83	101223.
360	2.77778	129600	46656000	18.9737	7.11379	1130.97	101788.
361	2.77008	130321	47045881	19.0000	7.12037	1134.11	102354.
362	2.76243	131044	47437928	19.0263	7.12694	1137.26	102922.
363	2.75482	131769	47832147	19.0526	7.13349	1140.40	103491.
364	2.74725	132496	48228544	19.0788	7.14004	1143.54	104062.
365	2.73973	133225	48627125	19.1050	7.14657	1146.68	104635.
366	2.73224	133956	49027896	19.1311	7.15309	1149.82	105209.
367	2.72480	134689	49430863	19.1572	7.15960	1152.96	105784.
368	2.71739	135424	49836032	19.1833	7.16610	1156.11	106362.
369	2.71003	136161	50243409	19.2094	7.17258	1159.25	106941.
370	2.70270	136900	50653000	19.2354	7.17905	1162.39	107521.
371	2.69542	137641	51064811	19.2614	7.18552	1165.53	108103.
372	2.68817	138384	51478848	19.2873	7.19197	1168.67	108687.
373	2.68097	139129	51895117	19.3132	7.19841	1171.81	109272.
374	2.67380	139876	52313624	19.3391	7.20483	1174.96	109858.
375	2.66667	140625	52734375	19.3649	7.21125	1178.10	110447.
376	2.65957	141376	53157376	19.3907	7.21765	1181.24	111036.
377	2.65252	142129	53582633	19.4165	7.22405	1184.38	111628.
378	2.64550	142884	54010152	19.4422	7.23043	1187.52	112221.
379	2.63852	143641	54439939	19.4679	7.23680	1190.66	112815.
380	2.63158	144400	54872000	19.4936	7.24316	1193.81	113411.
381	2.62467	145161	55306341	19.5192	7.24950	1196.95	114009.
382	2.61780	145924	55742968	19.5448	7.25581	1200.09	114608.
383	2.61097	146689	56181887	19.5704	7.26217	1203.23	115209.
384	2.60417	147456	56623104	19.5959	7.26848	1206.37	115812.
385	2.59740	148225	57066625	19.6214	7.27479	1209.51	116416.
386	2.59067	148996	57512456	19.6469	7.28108	1212.65	117021.
387	2.58398	149769	57960603	19.6723	7.28736	1215.80	117628.
388	2.57732	150544	58411072	19.6977	7.29363	1218.94	118237.
389	2.57069	151321	58863869	19.7231	7.29989	1222.08	118847.
390	2.56410	152100	59319000	19.7484	7.30614	1225.22	119459.
391	2.55754	152881	59776471	19.7737	7.31238	1228.36	120072.
392	2.55102	153664	60236288	19.7990	7.31861	1231.50	120687.
393	2.54453	154449	60698457	19.8242	7.32483	1234.65	121304.
394	2.53807	155236	61162984	19.8494	7.33104	1237.79	121922.
395	2.53165	156025	61629875	19.8746	7.33723	1240.93	122542.
396	2.52525	156816	62099136	19.8997	7.34342	1244.07	123163.
397	2.51889	157609	62570773	19.9249	7.34960	1247.21	123786.
398	2.51256	158404	63044792	19.9499	7.35576	1250.35	124410.
399	2.50627	159201	63521199	19.9750	7.36192	1253.50	125036.
400	2.50000	160000	64000000	20.0000	7.36806	1256.64	125664.

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
401	2.49377	160801	64481201	20.0250	7.37420	1259.78	126293.
402	2.48756	161604	64964808	20.0499	7.38032	1262.92	126923.
403	2.48139	162409	65450827	20.0749	7.38644	1266.06	127556.
404	2.47525	163216	65939264	20.0998	7.39254	1269.20	128190.
405	2.46914	164025	66430125	20.1246	7.39864	1272.35	128825.
406	2.46305	164836	66923416	20.1494	7.40472	1275.49	129462.
407	2.45700	165649	67419143	20.1742	7.41080	1278.63	130100.
408	2.45098	166464	67917312	20.1990	7.41686	1281.77	130741.
409	2.44499	167281	68417929	20.2237	7.42291	1284.91	131382.
410	2.43902	168100	68921000	20.2485	7.42896	1288.05	132025.
411	2.43309	168921	69426531	20.2731	7.43499	1291.19	132670.
412	2.42718	169744	69934528	20.2978	7.44102	1294.34	133317.
413	2.42131	170569	70444997	20.3224	7.44703	1297.48	133965.
414	2.41546	171396	70957944	20.3470	7.45304	1300.62	134614.
415	2.40964	172225	71473375	20.3715	7.45904	1303.76	135265.
416	2.40385	173056	71991296	20.3961	7.46502	1306.90	135918.
417	2.39808	173889	72511713	20.4206	7.47100	1310.04	136572.
418	2.39234	174724	73034632	20.4450	7.47697	1313.19	137228.
419	2.38663	175561	73560059	20.4695	7.48292	1316.33	137885.
420	2.38095	176400	74088000	20.4939	7.48887	1319.47	138544.
421	2.37530	177241	74618461	20.5183	7.49481	1322.61	139205.
422	2.36967	178084	75151448	20.5426	7.50074	1325.75	139867.
423	2.36407	178929	75686967	20.5670	7.50666	1328.89	140531.
424	2.35849	179776	76225024	20.5913	7.51257	1332.04	141196.
425	2.35294	180625	76765625	20.6155	7.51847	1335.18	141863.
426	2.34742	181476	77308776	20.6398	7.52437	1338.32	142531.
427	2.34192	182329	77854483	20.6640	7.53025	1341.46	143201.
428	2.33645	183184	78402752	20.6882	7.53612	1344.60	143872.
429	2.33100	184041	78953589	20.7123	7.54199	1347.74	144545.
430	2.32558	184900	79507000	20.7364	7.54784	1350.88	145220.
431	2.32019	185761	80062991	20.7605	7.55369	1354.03	145896.
432	2.31481	186624	80621568	20.7846	7.55953	1357.17	146574.
433	2.30947	187489	81182737	20.8087	7.56535	1360.31	147254.
434	2.30415	188356	81746504	20.8327	7.57117	1363.45	147934.
435	2.29885	189225	82312875	20.8567	7.57698	1366.59	148617.
436	2.29358	190096	82881856	20.8806	7.58279	1369.73	149301.
437	2.28833	190969	83453453	20.9045	7.58858	1372.88	149987.
438	2.28311	191844	84027672	20.9284	7.59436	1376.02	150674.
439	2.27790	192721	84604519	20.9523	7.60014	1379.16	151363.
440	2.27273	193600	85184000	20.9762	7.60590	1382.30	152053.
441	2.26757	194481	85766121	21.0000	7.61166	1385.44	152745.
442	2.26244	195364	86350888	21.0238	7.61741	1388.58	153439.
443	2.25734	196249	86938307	21.0476	7.62315	1391.73	154134.
444	2.25225	197136	87528384	21.0713	7.62888	1394.87	154830.
445	2.24719	198025	88121125	21.0950	7.63461	1398.01	155528.
446	2.24215	198916	88716536	21.1187	7.64032	1401.15	156228.
447	2.23714	199809	89314623	21.1424	7.64603	1404.29	156930.
448	2.23214	200704	89915392	21.1660	7.65172	1407.43	157633.
449	2.22717	201601	90518849	21.1896	7.65741	1410.58	158337.
450	2.22222	202500	91125000	21.2132	7.66309	1413.72	159043.

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
451	2.21729	203401	91733851	21.2368	7.66877	1416.86	159751
452	2.21239	204304	92345408	21.2603	7.67443	1420.00	160460
453	2.20751	205209	92959677	21.2838	7.68009	1423.14	161171
454	2.20264	206116	93576664	21.3073	7.68573	1426.28	161883
455	2.19780	207025	94196375	21.3307	7.69137	1429.42	162597
456	2.19298	207936	94818816	21.3542	7.69700	1432.57	163313
457	2.18818	208849	95443993	21.3776	7.70262	1435.71	164030
458	2.18341	209764	96071912	21.4009	7.70824	1438.85	164748
459	2.17865	210681	96702579	21.4243	7.71384	1441.99	165468
460	2.17391	211600	97336000	21.4476	7.71944	1445.13	166190
461	2.16920	212521	97972181	21.4709	7.72503	1448.27	166914
462	2.16450	213444	98611128	21.4942	7.73061	1451.42	167639
463	2.15983	214369	99252847	21.5174	7.73619	1454.56	168365
464	2.15517	215296	99897344	21.5407	7.74175	1457.70	169093
465	2.15054	216225	100544625	21.5639	7.74731	1460.84	169823
466	2.14592	217156	101194696	21.5870	7.75286	1463.98	170554
467	2.14133	218098	101847563	21.6102	7.75840	1467.12	171287
468	2.13675	219024	102503232	21.6333	7.76394	1470.27	172021
469	2.13220	219961	103161709	21.6564	7.76946	1473.41	172757
470	2.12766	220900	103823000	21.6795	7.77498	1476.55	173494
471	2.12314	221841	104487111	21.7025	7.78049	1479.69	174234
472	2.11864	222784	105154048	21.7256	7.78599	1482.83	174974
473	2.11416	223729	105823817	21.7486	7.79149	1485.97	175716
474	2.10970	224676	106496424	21.7715	7.79697	1489.11	176460
475	2.10526	225625	107171875	21.7945	7.80245	1492.26	177205
476	2.10084	226576	107850176	21.8174	7.80793	1495.40	177952
477	2.09644	227529	108531333	21.8403	7.81339	1498.54	178701
478	2.09205	228484	109215352	21.8632	7.81885	1501.68	179451
479	2.08768	229441	109902239	21.8861	7.82429	1504.82	180203
480	2.08333	230400	110592000	21.9089	7.82974	1507.96	180956
481	2.07900	231361	111284641	21.9317	7.83517	1511.11	181711
482	2.07469	232324	111980168	21.9545	7.84059	1514.25	182467
483	2.07039	233289	112678587	21.9773	7.84601	1517.39	183225
484	2.06612	234256	113379904	22.0000	7.85142	1520.53	183984
485	2.06186	235225	114084125	22.0227	7.85683	1523.67	184745
486	2.05761	236196	114791256	22.0454	7.86222	1526.81	185508
487	2.05339	237169	115501303	22.0681	7.86761	1529.96	186272
488	2.04918	238144	116214272	22.0907	7.87299	1533.10	187038
489	2.04499	239121	116930169	22.1133	7.87837	1536.24	187805
490	2.04082	240100	117649000	22.1359	7.88374	1539.38	188574
491	2.03666	241081	118370771	22.1585	7.88909	1542.52	189345
492	2.03252	242064	119095488	22.1811	7.89445	1545.66	190117
493	2.02840	243049	119823157	22.2036	7.89979	1548.81	190890
494	2.02429	244036	120553784	22.2261	7.90513	1551.95	191665
495	2.02020	245025	121287375	22.2486	7.91046	1555.09	192442
496	2.01613	246016	122023936	22.2711	7.91578	1558.23	193221
497	2.01207	247009	122763473	22.2935	7.92110	1561.37	194000
498	2.00803	248004	123505992	22.3159	7.92641	1564.51	194782
499	2.00401	249001	124251499	22.3383	7.93179	1567.65	195565
500	2.00000	250000	125000000	22.3607	7.93701	1570.80	196350

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
501	1.99601	251001	125751501	22.3830	7.94229	1573.94	197136
502	1.99203	252004	126506008	22.4054	7.94757	1577.80	197923
503	1.98807	253009	127263527	22.4277	7.95285	1580.22	198713
504	1.98413	254016	128024064	22.4499	7.95811	1583.36	199504
505	1.98020	255025	128787625	22.4722	7.96337	1586.50	200296
506	1.97628	256036	129554216	22.4944	7.96863	1589.65	201090
507	1.97239	257049	130323843	22.5167	7.97387	1592.79	201886
508	1.96850	258064	131096512	22.5389	7.97911	1595.93	202683
509	1.96464	259081	131872229	22.5610	7.98434	1599.07	203482
510	1.96078	260100	132651000	22.5832	7.98957	1602.21	204282
511	1.95695	261121	133432831	22.6053	7.99479	1605.35	205084
512	1.95312	262144	134217728	22.6274	8.00000	1608.50	205887
513	1.94932	263169	135005697	22.6495	8.00520	1611.64	206692
514	1.94553	264196	135796744	22.6716	8.01040	1614.78	207499
515	1.94175	265225	136590875	22.6936	8.01559	1617.92	208307
516	1.93798	266256	137388096	22.7156	8.02078	1621.06	209117
517	1.93424	267289	138188413	22.7376	8.02596	1624.20	209928
518	1.93050	268324	138991832	22.7596	8.03113	1627.34	210741
519	1.92678	269361	139798359	22.7816	8.03629	1630.49	211556
520	1.92308	270400	140608000	22.8035	8.04145	1633.63	212372
521	1.91939	271441	141420761	22.8254	8.04660	1636.77	213189
522	1.91571	272484	142236648	22.8473	8.05175	1639.91	214008
523	1.91205	273529	143055667	22.8692	8.05689	1643.05	214829
524	1.90840	274576	143877824	22.8910	8.06202	1646.19	215651
525	1.90476	275625	144703125	22.9129	8.06714	1649.34	216475
526	1.90114	276676	145531576	22.9347	8.07226	1652.48	217301
527	1.89753	277729	146363183	22.9565	8.07737	1655.62	218128
528	1.89394	278784	147197952	22.9783	8.08248	1658.76	218956
529	1.89036	279841	148035889	23.0000	8.08758	1661.90	219787
530	1.88679	280900	148877000	23.0217	8.09267	1665.04	220618
531	1.88324	281961	149722291	23.0434	8.09776	1668.19	221452
532	1.87970	283024	150568768	23.0651	8.10284	1671.33	222287
533	1.87617	284089	151419437	23.0868	8.10791	1674.47	223123
534	1.87266	285156	152273304	23.1084	8.11298	1677.61	223961
535	1.86916	286225	153130375	23.1301	8.11804	1680.75	224801
536	1.86567	287296	153990656	23.1517	8.12310	1683.89	225642
537	1.86220	288369	154854153	23.1733	8.12814	1687.04	226484
538	1.85874	289444	155720872	23.1948	8.13319	1690.18	227329
539	1.85529	290521	156590819	23.2164	8.13822	1693.32	228175
540	1.85185	291600	157464000	23.2379	8.14325	1696.46	229022
541	1.84843	292681	158340421	23.2594	8.14828	1699.60	229871
542	1.84502	293764	159220088	23.2809	8.15329	1702.74	230722
543	1.84162	294849	160103007	23.3024	8.15831	1705.88	231574
544	1.83824	295936	166989184	23.3238	8.16331	1709.03	232428
545	1.83486	297025	161878625	23.3452	8.16831	1712.17	233283
546	1.83150	298116	162771336	23.3666	8.17330	1715.31	234140
547	1.82815	299209	163667323	23.3880	8.17829	1718.45	234998
548	1.82482	300304	164566592	23.4094	8.18327	1721.59	235858
549	1.82149	301401	165469149	23.4307	8.18824	1724.73	236720
550	1.81818	302500	166375000	23.4521	8.19321	1727.88	237583

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
551	1.81488	303601	167284151	23.4734	8.19818	1731.02	238448
552	1.81159	304704	168196608	23.4947	8.20313	1734.16	239314
553	1.80832	305809	169112377	23.5160	8.20808	1737.30	240182
554	1.80505	306916	170031464	23.5372	8.21303	1740.44	241051
555	1.80180	308025	170953875	23.5584	8.21797	1743.58	241922
556	1.79856	309136	171879616	23.5797	8.22290	1746.73	242795
557	1.79533	310249	172808693	23.6008	8.22783	1749.87	243669
558	1.79211	311364	173741112	23.6220	8.23275	1753.01	244545
559	1.78891	312481	174676879	23.6432	8.23766	1756.15	245422
560	1.78571	313600	175616000	23.6643	8.24257	1759.29	246301
561	1.78253	314721	176558481	23.6854	8.24747	1762.43	247181
562	1.77936	315844	177504328	23.7065	8.25237	1765.58	248063
563	1.77620	316969	178453547	23.7276	8.25726	1768.72	248947
564	1.77305	318096	179406144	23.7487	8.26215	1771.86	249832
565	1.76991	319225	180362125	23.7697	8.26703	1775.00	250719
566	1.76678	320356	181321496	23.7908	8.27190	1778.14	251607
567	1.76367	321489	182284263	23.8118	8.27677	1781.28	252497
568	1.76056	322624	183250432	23.8328	8.28164	1784.42	253388
569	1.75747	323761	184220009	23.8537	8.28649	1787.57	254281
570	1.75439	324900	185193000	23.8747	8.29134	1790.71	255176
571	1.75131	326041	186169411	23.8956	8.29619	1793.85	256072
572	1.74825	327184	187149248	23.9165	8.30103	1796.99	256970
573	1.74520	328329	188132517	23.9374	8.30587	1800.13	257869
574	1.74216	329476	189119224	23.9583	8.31069	1803.27	258770
575	1.73913	330625	190109375	23.9792	8.31552	1806.42	259672
576	1.73611	331776	191102976	24.0000	8.32034	1809.56	260576
577	1.73310	332929	192100033	24.0208	8.32515	1812.70	261482
578	1.73010	334084	193100552	24.0416	8.32995	1815.84	262389
579	1.72712	335241	194104539	24.0624	8.33476	1818.98	263298
580	1.72414	336400	195112000	24.0832	8.33955	1822.12	264208
581	1.72117	337561	196122941	24.1039	8.34434	1825.27	265120
582	1.71821	338724	197137368	24.1247	8.34913	1828.31	266033
583	1.71527	339889	198155287	24.1454	8.35390	1831.55	266948
584	1.71233	341056	199176704	24.1661	8.35868	1834.69	267865
585	1.70940	342225	200201625	24.1868	8.36345	1837.83	268783
586	1.70648	343396	201230056	24.2074	8.36821	1840.98	269703
587	1.70358	344569	202262003	24.2281	8.37297	1844.11	270624
588	1.70068	345744	203297472	24.2487	8.37772	1847.26	271547
589	1.69779	346921	204336469	24.2693	8.38247	1850.40	272471
590	1.69492	348100	205379000	24.2899	8.38721	1853.54	273397
591	1.69205	349281	206425071	24.3105	8.39194	1856.68	274325
592	1.68919	350464	207474688	24.3311	8.39667	1859.82	275254
593	1.68634	351649	208527857	24.3516	8.40140	1862.96	276184
594	1.68350	352836	209584584	24.3721	8.40612	1866.11	277117
595	1.68067	354025	210644875	24.3926	8.41083	1869.25	278051
596	1.67785	355216	211708736	24.4131	8.41554	1872.39	278986
587	1.67504	356409	212776173	24.4336	8.42025	1875.53	279923
598	1.67224	357604	213847192	24.4540	8.42494	1878.67	280862
599	1.66945	358801	214921799	24.4745	8.42964	1881.81	281802
600	1.66667	360000	216000000	24.4949	8.43433	1884.96	282743

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
601	1.66389	361201	217081801	24.5153	8.43901	1888.10	283687
602	1.66113	362404	218167208	24.5357	8.44369	1891.24	284631
603	1.65837	363609	219256227	24.5561	8.44836	1894.38	285578
604	1.65563	364816	220348864	24.5764	8.45303	1897.52	286526
605	1.65289	366025	221445125	24.5967	8.45769	1900.66	287475
606	1.65017	367236	222545016	24.6171	8.46235	1903.81	288426
607	1.64745	368449	223648543	24.6374	8.46700	1906.95	289379
608	1.64474	369664	224755712	24.6577	8.47165	1910.09	290333
609	1.64204	370881	225866529	24.6779	8.47629	1913.23	291289
610	1.63934	372100	226981000	24.6982	8.48093	1916.37	292247
611	1.63666	373321	228099131	24.7184	8.48556	1919.51	293206
612	1.63399	374544	229220928	24.7386	8.49018	1922.65	294166
613	1.63132	375769	230346397	24.7588	8.49481	1925.80	295128
614	1.62866	376996	231475544	24.7790	8.49942	1928.94	296092
615	1.62602	378225	232608375	24.7992	8.50404	1932.08	297057
616	1.62338	379456	233744896	24.8193	8.50864	1935.22	298024
617	1.62075	380689	234885113	24.8395	8.51324	1938.36	298992
618	1.61812	381924	236029032	24.8596	8.51784	1941.50	299962
619	1.61551	383161	237176659	24.8797	8.52243	1944.65	300934
620	1.61290	384400	238328000	24.8998	8.52702	1947.79	301907
621	1.61031	385641	239483061	24.9199	8.53160	1950.93	302882
622	1.60772	386884	240641848	24.9399	8.53618	1954.07	303858
623	1.60514	388129	241804367	24.9600	8.54075	1957.21	304836
624	1.60256	389376	242970624	24.9800	8.54532	1960.35	305815
625	1.60000	390625	244140625	25.0000	8.54988	1963.50	306796
626	1.59744	391876	245314376	25.0200	8.55444	1966.64	307779
627	1.59490	393129	246491883	25.0400	8.55899	1969.78	308763
628	1.59236	394384	247673152	25.0599	8.56354	1972.92	309748
629	1.58983	395641	248858189	25.0799	8.56808	1976.06	310736
630	1.58730	396900	250047000	25.0998	8.57262	1979.20	311725
631	1.58479	398161	251239591	25.1197	8.57715	1982.34	312715
632	1.58228	399424	252435968	25.1396	8.58168	1985.49	313707
633	1.57978	400689	253636137	25.1595	8.58620	1988.63	314700
634	1.57729	401956	254840104	25.1794	8.59072	1991.77	315696
635	1.57480	403225	256047875	25.1992	8.59524	1994.91	316692
636	1.57233	404496	257259456	25.2190	8.59975	1998.05	317690
637	1.56986	405769	258474853	25.2389	8.60425	2001.19	318690
638	1.56740	407044	259694072	25.2587	8.60875	2004.34	319692
639	1.56495	408321	260917119	25.2784	8.61325	2007.48	320695
640	1.56250	409600	262144000	25.2982	8.61774	2010.62	321699
641	1.56006	410881	263374721	25.3180	8.62222	2013.76	322705
642	1.55763	412164	264609288	25.3377	8.62671	2016.90	323713
643	1.55521	413449	265847707	25.3574	8.63118	2020.04	324722
644	1.55280	414736	267089984	25.3772	8.63566	2023.19	325733
645	1.55039	416025	268336125	25.3969	8.64012	2026.33	326745
646	1.54799	417316	269586136	25.4165	8.64459	2029.47	327759
647	1.54560	418609	270840023	25.4362	8.64904	2032.61	328775
648	1.54321	419904	272097792	25.4558	8.65350	2035.75	329792
649	1.54083	421201	273359449	25.4755	8.65795	2038.89	330810
650	1.53846	422500	274625000	25.4951	8.66239	2042.04	331831

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
651	1.53610	423801	275894451	25.5147	8.66683	2045.18	332853
652	1.53374	425104	277167808	25.5343	8.67127	2048.32	333876
653	1.53139	426409	278445077	25.5539	8.67570	2051.46	334901
654	1.52905	427716	279726264	25.5734	8.68012	2054.60	335927
655	1.52672	429025	281011375	25.5930	8.68455	2057.74	336955
656	1.52439	430336	282300416	25.6125	8.68896	2060.88	337985
657	1.52207	431649	283593393	25.6320	8.69338	2064.03	339016
658	1.51976	432964	284890312	25.6515	8.69778	2067.17	340049
659	1.51745	434281	286191179	25.6710	8.70219	2070.31	341084
660	1.51515	435600	287496000	25.6905	8.70659	2073.45	342119
661	1.51286	436921	288804781	25.7099	8.71098	2076.59	343157
662	1.51057	438244	290117528	25.7294	8.71537	2079.73	344196
663	1.50830	439569	291434247	25.7488	8.71976	2082.88	345237
664	1.50602	440896	292754944	25.7682	8.72414	2086.02	346279
665	1.50376	442225	294079625	25.7876	8.72852	2089.16	347323
666	1.50150	443556	295408296	25.8070	8.73289	2092.30	348368
667	1.49925	444889	296740963	25.8263	8.73726	2095.44	349415
668	1.49701	446224	298077632	25.8457	8.74162	2098.58	350464
669	1.49477	447561	299418309	25.8650	8.74598	2101.73	351514
670	1.49254	448900	300763000	25.8844	8.75034	2104.87	352565
671	1.49031	450241	302111711	25.9037	8.75469	2108.01	353618
672	1.48810	451584	303464448	25.9230	8.76904	2111.15	354673
673	1.48885	452929	304821217	25.9422	8.76338	2114.29	355730
674	1.48368	454276	306182024	25.9156	8.76772	2117.43	356788
675	1.48148	455625	307546875	25.9808	8.77205	2120.58	357847
676	1.47929	456976	308915776	26.0000	8.77638	2123.72	358908
677	1.47710	458329	310288733	26.0192	8.78071	2126.86	359971
678	1.47493	459684	311665752	26.0384	8.78503	2130.00	361035
679	1.47275	461041	313046839	26.0576	8.78935	2133.14	362101
680	1.47059	462400	314432000	26.0768	8.79366	2136.28	363168
681	1.46843	463761	315821241	26.0960	8.79797	2139.42	364237
682	1.46628	465124	317214558	26.1151	8.80227	2142.57	365308
683	1.46413	466489	318611987	26.1343	8.80657	2145.71	366380
684	1.46199	467856	320013504	26.1534	8.81087	2148.85	367453
685	1.45985	469225	321419125	26.1725	8.81516	2151.99	368528
686	1.45773	470596	322828856	26.1916	8.81945	2155.13	369605
687	1.45560	471969	324242703	26.2107	8.82373	2158.27	370684
688	1.45349	473344	325660672	26.2298	8.82801	2161.42	371764
689	1.45138	474721	327082769	26.2488	8.83229	2164.56	372845
690	1.44928	476100	328509000	26.2679	8.83656	2167.70	373928
691	1.44718	477481	329939371	26.2869	8.84082	2170.84	375031
692	1.44509	478864	331373888	26.3059	8.84509	2173.98	376099
693	1.44300	480249	332812557	26.3249	8.84934	2177.12	377187
694	1.44092	481636	334255384	26.3439	8.85360	2180.27	378276
695	1.43885	483025	335702375	26.3629	8.85785	2183.41	379367
696	1.43678	484416	337153536	26.3818	8.86210	2186.55	380459
697	1.43472	485809	338608873	26.4008	8.86634	2189.69	381554
698	1.43266	487204	340068392	26.4197	8.87058	2192.83	382649
699	1.43062	488601	341532099	26.4386	8.87481	2195.97	383746
700	1.42857	490000	343000000	26.4575	8.87904	2199.11	384845

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
701	1.42653	491401	344472101	26.4764	8.88327	2202.26	385945
702	1.42450	492804	345948408	26.4953	8.88749	2205.40	387047
703	1.42248	494209	347428927	26.5141	8.89171	2208.54	388151
704	1.42045	495616	348913664	26.5330	8.89592	2211.68	389256
705	1.41844	497025	350402625	26.5518	8.90013	2214.82	390363
706	1.41643	498436	351895816	26.5707	8.90434	2217.96	391471
707	1.41443	499849	353393243	26.5895	8.90854	2221.11	392580
708	1.41243	501264	354894912	26.6083	8.91274	2224.25	393692
709	1.41044	502681	356400829	26.6271	8.91693	2227.39	394805
710	1.40845	504100	357911000	26.6458	8.92112	2230.53	395919
711	1.40647	505521	359425431	26.6646	8.92531	2233.67	397035
712	1.40449	506944	360944128	26.6833	8.92949	2236.81	398153
713	1.40252	508369	362467097	26.7021	8.93367	2239.96	399272
714	1.40056	509796	363994344	26.7208	8.93784	2243.10	400393
715	1.39860	511225	365525875	26.7395	8.94201	2246.24	401515
716	1.39665	512656	367061696	26.7582	8.94618	2249.38	402639
717	1.39470	514089	368601813	26.7769	8.95034	2252.52	403765
718	1.39276	515524	370146232	26.7955	8.95450	2255.66	404892
719	1.39082	516961	371694959	26.8142	8.95866	2258.81	406020
720	1.38889	518400	373248000	26.8328	8.95281	2261.95	407150
721	1.38696	519841	374805361	26.8514	8.96696	2265.09	408282
722	1.38504	521284	376367048	26.8701	8.97110	2268.23	409416
723	1.38313	522729	377933067	26.8887	8.97524	2271.37	410550
724	1.38122	524176	379503424	26.9072	8.97938	2274.51	411687
725	1.37931	525625	381078125	26.9258	8.98351	2277.65	412825
726	1.37741	527076	382657176	26.9444	8.98764	2280.80	413965
727	1.37552	528529	384240583	26.9629	8.99176	2283.94	415106
728	1.37363	529984	385828352	26.9815	8.99588	2287.08	416248
729	1.37174	531441	387420489	27.0000	9.00000	2290.22	417393
730	1.36986	532900	389017000	27.0185	9.00411	2293.36	418539
731	1.36799	534361	390617891	27.0370	9.00822	2296.50	419686
732	1.36612	535824	392223168	27.0555	9.01233	2299.65	420835
733	1.36426	537289	393832837	27.0740	9.01643	2302.79	421986
734	1.36240	538756	395446904	27.0224	9.02043	2305.93	423138
735	1.36054	540225	397065375	27.1109	9.02462	2309.07	424292
736	1.35870	541696	398688256	27.1293	9.02871	2312.21	425447
737	1.35685	543169	400315553	27.1477	9.03280	2315.35	426604
738	1.35501	544644	401947272	27.1662	9.03689	2318.50	427762
739	1.35318	546121	403583419	27.1846	9.04097	2321.64	428922
740	1.35135	547600	405224000	27.2029	9.04504	2324.78	430084
741	1.34953	549081	406869021	27.2213	9.04911	2327.92	431247
742	1.34771	550564	408518488	27.2397	9.05318	2331.06	432412
743	1.34590	552049	410172407	27.2580	9.05725	2334.20	433578
744	1.34409	553536	411830784	27.2764	9.06131	2337.34	434746
745	1.34228	555025	413493625	27.2947	9.06537	2340.49	435916
746	1.34048	556516	415160936	27.3130	9.06942	2343.63	437087
747	1.33869	558009	416832723	27.3313	9.07347	2346.77	438259
748	1.33690	559504	418508992	27.3496	9.07752	2349.91	439433
749	1.33511	561001	420189749	27.3679	9.08156	2353.05	440609
750	1.33333	562500	421875000	27.3861	9.08560	2356.19	441786

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
751	1.33156	564001	423564751	27.4044	9.08964	2359.34	442965
752	1.32979	565504	425259008	27.4226	9.09367	2362.48	444146
753	1.32802	567009	426957777	27.4408	9.09770	2365.62	445328
754	1.32626	568516	428661064	27.4591	9.10173	2368.76	446511
755	1.32450	570025	430368875	27.4773	0.10575	2371.90	447697
756	1.32275	571536	432081216	27.4955	9.10977	2375.04	448883
757	1.32100	573049	433797093	27.5136	9.11378	2378.19	450072
758	1.31926	574564	435519512	27.5318	9.11779	2381.33	451262
759	1.31752	576081	437245479	27.5500	9.12180	2384.47	452453
760	1.31579	577600	438976000	27.5681	9.12581	2387.61	453646
761	1.31406	579121	440711081	27.5862	9.12981	2390.75	454841
762	1.31234	580644	442450728	27.6043	9.13380	2393.89	456037
763	1.31062	582169	444194947	27.6225	9.13780	2397.04	457234
764	1.30890	583696	445943744	27.6405	9.14179	2400.18	458434
765	1.30719	585225	447697125	27.6586	9.14577	2403.32	459635
766	1.30548	586756	449455096	27.6767	9.14976	2406.46	460837
767	1.30378	588289	451217663	27.6948	9.15374	2409.60	462041
768	1.30208	589824	452984832	27.7128	9.15771	2412.74	463247
769	1.30039	591361	454756609	27.7308	9.16169	2415.88	464454
770	1.29870	592900	456533000	27.7489	9.16566	2419.03	465663
771	1.29702	594441	458314011	27.7669	9.16962	2422.17	466873
772	1.29534	595984	460099648	27.7849	9.17359	2425.31	468085
773	1.29366	587529	461889917	27.8029	9.17754	2428.45	469298
774	1.29199	599076	463684824	27.8209	9.18150	2431.59	470513
775	1.29032	600625	465484375	27.8388	9.18545	2434.73	471730
776	1.28866	602176	467288576	27.8568	9.18940	2437.88	472948
777	1.28700	603729	469097433	27.8747	9.19335	2441.02	474168
778	1.28535	605284	470910952	27.8927	9.19729	2444.16	475389
779	1.28370	606841	472729139	27.9106	9.20123	2447.30	476612
780	1.28205	608400	474552000	27.9285	9.20516	2450.44	477836
781	1.28041	609961	476379541	27.9464	9.20910	2453.58	479062
782	1.27877	611524	478211768	27.9643	9.21303	2456.73	480290
783	1.27714	613089	480048687	27.9821	9.21695	2459.87	481519
784	1.27551	614656	481890304	28.0000	9.22087	2463.01	482750
785	1.27389	616225	483736625	28.0179	9.22479	2466.15	483982
786	1.27226	617796	485587656	28.0357	9.22871	2469.29	485216
787	1.27065	619369	487443403	28.0535	9.23262	2472.43	486451
788	1.26904	620944	489303872	28.0713	9.23653	2475.58	487688
789	1.26743	622521	491169069	28.0891	9.24043	2478.72	488927
790	1.26582	624100	493039000	28.1069	9.24434	2481.86	490167
791	1.26422	625681	494913671	28.1247	9.24823	2485.00	491409
792	1.26263	627264	496793088	28.1425	9.25213	2488.14	492652
793	1.26103	628849	498677257	28.1603	9.25602	2491.28	493897
794	1.25945	630436	500566184	82.1780	9.25991	2494.42	495143
795	1.25786	632025	502459875	28.1957	9.26380	2497.57	496391
796	1.25628	633616	504358336	28.2135	9.26758	2500.71	497641
797	1.25471	635209	506261573	28.2312	9.27156	2503.85	498892
798	1.25313	636812	508169592	28.2489	9.27544	2506.99	500145
799	1.25166	638401	510082399	28.2666	0.27931	2510.13	501399
800	1.25000	640000	512000000	28.2843	9.28318	2513.27	502655

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
801	1.24844	641601	513922401	28.3019	9.28704	2516.42	503912
802	1.24688	643204	515849608	28.3196	9.29091	2519.56	505171
803	1.24533	644809	517781627	28.3373	9.29477	2522.70	506432
804	1.24378	646416	519718464	28.3549	9.29862	2525.84	507694
805	1.24224	648025	521660125	28.3725	9.30248	2528.98	508958
806	1.24069	649636	523606616	28.3901	9.30633	2532.12	510223
807	1.23916	651249	525557943	28.4077	9.31018	2535.27	511490
808	1.23762	652864	527514112	28.4253	9.31402	2538.41	512758
809	1.23609	654481	529475129	28.4429	9.31786	2541.55	514028
810	1.23457	656100	531441000	28.4605	9.32170	2544.69	515300
811	1.23305	657721	533411731	28.4781	9.32553	2547.83	516573
812	1.23153	659344	535387328	28.4956	9.32936	2550.97	517848
813	1.23001	660969	537367797	28.5132	9.33319	2554.11	519124
814	1.22850	662596	539353144	28.5307	9.33702	2557.26	520402
815	1.22699	664225	541343375	28.5482	9.34084	2560.40	521681
816	1.22549	665856	543338496	28.5657	9.34466	2563.54	522962
817	1.22399	667489	545338513	28.5832	9.34847	2566.68	524245
818	1.22249	669124	547343432	28.6007	9.35229	2569.82	525529
819	1.22100	670761	549353259	28.6182	9.35610	2572.96	526814
820	1.21951	672400	551368000	28.6356	9.35990	2576.11	528102
821	1.21803	674041	553387661	28.6531	9.35370	2579.25	529391
822	1.21655	675684	555412248	28.6705	9.36751	2582.39	530681
823	1.21507	677329	557441767	28.6880	9.37130	2585.53	531973
824	1.21359	678976	559476224	28.7054	9.37510	2588.67	533267
825	1.21212	680625	561515625	28.7228	9.37889	2591.81	534562
826	1.21065	682276	563559976	28.7402	9.38268	2594.96	535858
827	1.20919	683929	565609283	28.7576	9.38646	2598.10	537157
828	1.20773	685584	567663552	28.7750	9.39024	2601.24	538456
829	1.20627	687241	569722789	28.7924	9.39402	2604.38	539758
830	1.20482	688900	571787000	28.8097	9.39780	2607.52	541061
831	1.20337	690561	573856191	28.8271	9.40157	2610.66	542365
832	1.20192	692224	575930368	28.8444	9.40534	2613.81	543671
833	1.20048	693889	578009537	28.8617	9.40911	2616.95	544979
834	1.19904	695556	580093704	28.8791	9.41287	2620.09	546288
835	1.19760	697225	582182875	28.8964	9.41663	2623.23	547599
836	1.19617	698896	584277056	28.9137	9.42039	2626.37	548912
837	1.19474	700569	586376253	28.9310	9.42414	2629.51	550226
838	1.19332	702244	588480472	28.9482	9.42789	2632.65	551541
839	1.19190	703921	590589719	28.9655	9.43164	2635.80	552858
840	1.19048	705600	592704000	28.9828	9.43539	2638.94	554177
841	1.18906	707281	594823321	29.0000	9.43913	2642.08	555497
842	1.18765	708964	596947688	29.0172	9.44287	2645.22	556819
843	1.18624	710649	599077107	29.0345	9.44661	2648.36	558142
844	1.18483	712336	601211584	29.0517	9.45034	2651.50	559467
845	1.18343	714025	603351125	29.0689	9.45407	2654.65	560794
846	1.18203	715716	605495736	29.0861	9.45780	2657.79	562122
847	1.18064	717409	607645423	29.1033	9.46152	2660.93	563452
848	1.17925	719104	609800192	29.1204	9.46525	2664.07	564783
849	1.17786	720801	611960049	29.1376	9.46897	2667.21	566116
850	1.17647	722500	614125000	29.1548	9.47268	2670.35	567450

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
851	1.17509	724201	616295051	29.1719	9.47640	2673.50	568786
852	1.17371	725904	618470208	29.1890	9.48011	2676.64	570124
853	1.17233	727609	620650477	29.2062	9.48381	2679.78	571463
854	1.17096	729136	622835864	29.2233	9.48752	2682.92	572803
855	1.16959	731025	625026375	29.2404	9.49122	2686.06	574146
856	1.16822	732736	627222016	29.2575	9.49492	2689.20	575490
857	1.16686	734449	629422973	29.2746	9.49861	2692.34	576835
858	1.16550	736164	631628712	29.2916	9.50231	2695.49	578182
859	1.16414	737881	633839779	29.3087	9.50600	2698.63	579530
860	1.16279	739600	636056000	29.3258	9.50969	2701.77	580880
861	1.16144	741321	638277381	29.3428	9.51337	2704.91	582232
862	1.16009	743044	640503928	29.3598	9.51705	2708.05	583585
863	1.15875	744769	642735647	29.3769	9.52073	2711.19	584940
864	1.15741	746496	644972544	29.3939	9.52441	2714.34	586297
865	1.15607	748225	647214625	29.4109	9.52808	2717.48	587655
866	1.15473	749956	649461896	29.4279	9.53175	2720.62	589014
867	1.15340	751689	651714363	29.4449	9.53542	2723.76	590375
868	1.15207	753424	653972032	29.4618	9.53908	2726.90	591738
869	1.15075	755161	656234909	29.4788	9.54274	2730.04	593102
870	1.14943	766900	658503000	29.4958	9.54640	2733.19	594468
871	1.14811	758641	660776311	29.5127	9.55006	2736.33	595835
872	1.14679	760384	663054848	29.5296	9.55371	2739.47	597204
873	1.14548	762129	665338617	29.5466	9.55736	2742.61	598575
874	1.14416	763876	667627624	29.5635	9.56101	2745.75	599947
875	1.14286	765625	669921875	29.5804	9.56466	2748.89	601320
876	1.14155	767376	672221376	29.5973	9.56830	2752.04	602696
877	1.14025	769129	674526133	29.5142	9.57194	2755.18	604073
878	1.13895	770884	676836152	29.6311	9.57557	2758.32	605451
879	1.13766	772641	679151439	29.6479	9.57921	2761.46	606831
880	1.13636	774400	681472000	29.6648	9.58284	2764.60	608212
881	1.13507	776161	683797841	29.6816	9.58646	2767.74	609595
882	1.13379	777924	686128968	29.6985	9.59009	2770.88	610980
883	1.13250	779689	688465387	29.7153	9.59372	2774.03	612366
884	1.13122	781456	690807104	29.7321	9.59734	2777.17	613754
885	1.12994	783225	693154125	29.7489	9.60095	2780.31	615143
886	1.12867	784996	695506456	29.7658	9.60457	2783.45	616534
887	1.12740	786769	697864103	29.7825	9.60818	2786.59	617927
888	1.12613	788544	700227072	29.7993	9.61179	2789.70	619321
889	1.12486	790321	702595369	29.8161	9.61540	2792.88	620717
890	1.12360	792100	704969000	29.8329	9.61900	2796.02	622114
891	1.12233	793881	707347971	29.8496	9.62260	2799.16	623513
892	1.12108	795664	709732288	29.8664	9.62620	2802.30	624913
893	1.11982	797449	712121957	29.8831	9.62980	2805.44	626315
894	1.11857	799236	714516984	29.8998	9.63339	2808.58	627718
895	1.11732	801025	716917375	29.9166	9.63698	2811.73	629124
896	1.11607	802816	719323136	29.9333	9.64057	2814.87	630530
897	1.11483	804609	721734273	29.9500	9.64415	2818.01	631938
898	1.11359	806404	724150792	29.9666	9.64774	2821.15	633348
899	1.11235	808201	726572699	29.9833	9.65132	2824.29	634760
900	1.11111	810000	729000000	30.0000	9.65489	2827.43	636173

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
901	1.10988	811801	731432701	30.0167	9.65847	2830.57	637587
902	1.10865	813604	733870808	30.0333	9.66204	2833.72	639003
903	1.10742	815409	736314327	30.0500	9.66561	2836.96	640421
904	1.10619	817216	738763264	30.0666	9.66918	2840.00	641840
905	1.10497	819025	741217625	30.0832	9.67274	2843.14	643261
906	1.10375	820836	743677416	30.0998	9.67630	2846.28	644683
907	1.10254	822649	746142643	30.1164	9.67986	2849.42	646107
908	1.10132	824464	748613312	30.1330	9.68342	2852.57	647533
909	1.10011	826281	751089429	30.1496	9.68697	2855.71	648960
910	1.09890	828100	753571000	30.1662	9.69052	2858.85	650388
911	1.09769	829921	756058031	30.1828	9.69407	2861.99	651818
912	1.09649	831744	758550528	30.1993	9.69762	2865.13	653250
913	1.09529	833569	761048497	30.2159	9.70116	2868.27	654684
914	1.09409	835396	763551944	30.2324	9.70470	2871.42	656118
915	1.09290	837225	766060875	30.2490	9.70824	2874.56	657555
916	1.09170	839056	768575296	30.2655	9.71177	2877.70	658993
917	1.09051	840889	771095213	30.2820	9.71531	2880.84	660433
918	1.08932	842724	773620632	30.2985	9.71884	2883.98	661874
919	1.08814	844561	776151559	30.3150	9.72236	2887.12	663317
920	1.08696	846400	778688000	30.3315	9.72589	2890.27	664761
921	1.08578	848241	781229961	30.3480	9.72941	2893.41	666207
922	1.08460	850084	783777448	30.3645	9.73293	2996.55	667654
923	1.08342	851929	786330467	30.3809	9.73645	2899.69	669103
924	1.08225	853776	788889024	30.3974	9.73996	2902.83	670554
925	1.08108	855625	791453125	30.4138	9.74348	2905.97	672006
926	1.07991	857476	794022776	30.4302	9.74699	2909.11	673460
927	1.07875	859329	796597983	30.4467	9.75049	2912.26	674915
928	1.07759	861184	799178752	30.4631	9.75400	2915.40	676372
929	1.07643	863041	801765089	20.4795	9.75750	2918.54	677831
930	1.07527	864900	804357000	30.4959	9.76100	2921.68	679291
931	1.07411	866761	806954491	30.5123	9.76450	2924.82	680753
932	1.07296	868624	809557568	30.5287	9.76799	2927.96	682216
933	1.07181	870489	812166237	30.5450	9.77148	2931.11	683680
934	1.07066	872356	814780504	30.5614	9.77497	2934.25	685147
935	1.06952	874225	817400375	30.5778	9.77846	2937.39	686615
936	1.06838	876096	820025856	30.5941	9.78195	2940.53	688084
937	1.06724	877969	822656953	30.6105	9.78543	2943.67	689555
938	1.06610	879844	825293672	30.6268	9.78891	2946.81	691028
939	1.06496	881721	827936019	30.6431	9.79239	2949.96	692502
940	1.06383	883600	830584000	30.6594	9.79586	2953.10	693978
941	1.06270	885481	833237621	30.6757	9.79933	2956.24	695455
942	1.06157	887364	835896888	30.6920	9.80280	2959.38	696934
943	1.06045	889249	838561807	30.7083	9.80627	2962.52	698415
944	1.05932	891136	841232384	30.7246	9.80974	2965.66	699897
945	1.05820	893025	843908625	30.7409	9.81320	2968.81	701380
946	1.05708	894916	846590536	30.7571	9.81666	2971.95	702865
947	1.05597	896809	849278123	30.7734	9.82012	2975.09	704352
948	1.05485	898704	851971392	30.7896	9.82357	2978.23	705840
949	1.05374	900601	854670349	30.8058	9.82703	2981.37	707330
950	1.05263	902500	857375000	30.8221	9.83048	2984.51	708822

NUMERICAL TABLE (Continued)

n	$1000\frac{1}{n}$	n^2	n^3	$\sqrt{n}$	$\sqrt[3]{n}$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
951	1.05152	904401	860085351	30.8383	9.83392	2987.65	710315
952	1.05042	906304	862801408	30.8545	9.83737	2990.80	711810
953	1.04932	908209	865523177	30.8707	9.84081	2993.94	713306
954	1.04822	910116	868250664	30.8869	9.84425	2997.08	714803
955	1.04712	912025	870983875	30.9031	9.84769	3000.22	716303
956	1.04603	913936	873722816	30.9192	9.85113	3003.36	717804
957	1.04493	915849	876467493	30.9354	9.85456	3006.50	719306
958	1.04384	917764	879217912	30.9516	9.85799	3009.65	720810
959	1.04275	919681	881974079	30.9677	9.86142	3012.79	722316
960	1.04167	921600	884736000	30.9839	9.86485	3015.93	723823
961	1.04058	923521	887503681	31.0000	9.86827	3019.07	725332
962	1.03950	925444	890277128	31.0161	9.87169	3022.21	726842
963	1.03842	927369	893056347	31.0322	9.87511	3025.35	728354
964	1.03734	929296	895841344	31.0483	9.87853	3028.50	729867
965	1.03627	931225	898632125	31.0644	9.88195	3031.64	731382
966	1.03520	933156	901428696	31.0805	9.88536	3034.78	732899
967	1.03413	935089	904231063	31.0966	9.88877	3037.92	734417
968	1.03306	937024	907039232	31.1127	9.89217	3041.06	735937
969	1.03199	938961	909853209	31.1288	9.89558	3044.20	737458
970	1.03093	940900	912673000	31.1448	9.89898	3047.34	738981
971	1.02987	942841	915498611	31.1609	9.90235	3050.49	740506
972	1.02881	944784	918330048	31.1769	9.90578	3053.63	742032
973	1.02775	946729	921167317	31.1929	9.90918	3056.77	743559
974	1.02669	948676	924010424	31.2090	9.91257	3059.91	745088
975	1.02564	950625	926859375	31.2250	9.91596	3063.05	746619
976	1.02459	952576	929714176	31.2410	9.91935	3066.19	748151
977	1.02354	954529	932574833	31.2570	9.92274	3069.34	749685
978	1.02249	956484	935441352	31.2730	9.92612	3072.48	751221
979	1.02145	958441	938313739	31.2890	9.92950	3075.62	752758
980	1.02041	960400	941192000	31.3050	9.93288	3078.76	754296
981	1.01937	962361	944076141	31.3209	9.93626	3081.90	755837
982	1.01833	964324	946966168	31.3369	9.93964	3085.04	757378
983	1.01729	966289	949862087	31.3528	9.94301	3088.19	758922
984	1.01626	968256	952763904	31.3688	9.94638	3091.33	760466
985	1.01523	970225	955671625	31.3847	9.94975	3094.47	762013
986	1.01420	972196	958585256	31.4006	9.95311	3097.61	763561
987	1.01317	974169	961504803	31.4166	9.95648	3100.75	765111
988	1.01215	976144	964430272	31.4325	9.95984	3103.89	766662
989	1.01112	978121	967361669	31.4484	9.96320	3107.04	768214
990	1.01010	980100	970299000	31.4643	9.96655	3110.18	769769
991	1.00908	982081	973242271	31.4802	9.96991	3113.32	771325
992	1.00806	984064	976191488	31.4960	9.97326	3116.46	772882
993	1.00705	986049	979146657	31.5119	9.97661	3119.60	774441
994	1.00604	988036	982107784	31.5278	9.97996	3122.74	776002
995	1.00503	990025	985074875	31.5436	9.98331	3125.88	777564
996	1.00402	992016	988047936	31.5595	9.98665	3129.03	779128
997	1.00301	994009	991026973	31.5753	9.98999	3132.17	780693
998	1.00200	996004	994011992	31.5911	9.99333	3135.31	782260
999	1.00100	998001	997002999	31.6070	9.99667	3138.45	783828

GENERAL CHEMICAL TABLES

* INTERNATIONAL ATOMIC WEIGHTS

1925

Name	Symbol	At. No.	At. Wt.	Valence
Aluminum	Al	13	26.97	3
Antimony, stibium	Sb	51	121.77	3, 5
Argon	A	18	39.91	0
Arsenic	As	33	74.96	3, 5
Barium	Ba	56	137.37	2
Beryllium, glucinum	Be	4	9.02	2
Bismuth	Bi	83	209.00	3, 5
Boron	B	5	10.82	3
Bromine	Br	35	79.916	1
Cadmium	Cd	48	112.41	2
Calcium	Ca	20	40.07	2
Cæsium	Cs	55	132.81	1
Carbon	C	6	12.000	2, 4
Cerium	Ce	58	140.25	4, 3
Chlorine	Cl	17	35.457	1
Chromium	Cr	24	52.01	2, 3, 6
Cobalt	Co	27	58.94	2, 3
Columbium, niobium	Cb	41	93.1	3, 5
Copper	Cu	29	63.57	1, 2
Dysprosium	Dy	66	162.52	3
Erbium	Er	68	167.7	3
Europium	Eu	63	152.0	3
Fluorine	F	9	19.00	1
Gadolinium	Gd	64	157.26	3
Gallium	Ga	31	69.72	3
Germanium	Ge	32	72.60	4
Gold, aurum	Au	79	197.2	1, 3
Hafnium, celtium †	Hf	72	180.8	
Helium	He	2	4.00	0
Holmium	Ho	67	163.4	3
Hydrogen	H	1	1.008	1
Indium	In	49	114.8	3
Iodine	I	53	126.932	1
Iridium	Ir	77	193.1	3, 4
Iron, ferrum	Fe	26	55.84	2, 3
Krypton	Kr	36	82.9	0
Lanthanum	La	57	138.90	3
Lead, plumbum	Pb	82	207.20	2, 4
Lithium	Li	3	6.940	1
Lutecium	Lu	71	175.0	3
Magnesium	Mg	12	24.32	2
Manganese	Mn	25	54.93	2, 4, 6, 7

Name	Symbol	At. No.	At. Wt.	Valence
Mercury, hydrargyrum	Hg	80	200.61	1, 2
Molybdenum	Mo	42	96.0	3, 4, 6
Neodymium	Nd	60	144.27	3
Neon	Ne	10	20.2	0
Nickel	Ni	28	58.69	2, 3
Nitrogen	N	7	14.008	3, 5
Osmium	Os	76	190.8	2, 3 4, 8
Oxygen	O	8	16.000	2
Palladium	Pd	46	106.7	2, 4
Phosphorus	P	15	31.027	3, 5
Platinum	Pt	78	195.23	2, 4
Potassium, kalium	K	19	39.096	1
Praseodymium	Pr	59	140.92	3
Radium	Ra	88	225.95	2
Radon, niton	Rn	86	222.	
Rhodium	Rh	45	102.091	3
Rubidium	Rb	37	85.44	1
Ruthenium	Ru	44	101.7	3, 4, 6, 8
Samarium	Sa	62	150.43	3
Scandium	Sc	21	45.10	3
Selenium	Se	34	79.2	2, 4, 6
Silicon	Si	14	28.06	4
Silver, argentum	Ag	47	107.880	1
Sodium, natrium	Na	11	22.997	1
Strontium	Sr	38	87.63	2
Sulfur	S	16	32.064	2, 4, 6
Tantalum	Ta	73	181.5	5
Tellurium	Te	52	127.5	2, 4, 6
Terbium	Tb	65	159.2	3
Thallium	Tl	81	204.39	1, 3
Thorium	Th	90	232.15	4
Thulium	Tm	69	169.4	3
Tin, stannum	Sn	50	118.70	2, 4
Titanium	Ti	22	48.1	3, 4
Tungsten, wolframium	W	74	184.0	6
Uranium	U	92	238.17	4, 6
Vanadium	V	23	50.96	3, 5
Xenon	Xe	54	130.2	0
Ytterbium	Yb	70	173.6	3
Yttrium	Y	39	88.9	3
Zinc	Zn	30	65.38	2
Zirconium	Zr	40	91.	4

* Jour. Amer. Chem. Soc. March, 1925.

† Hafnium is not included in the International Table.

MOLECULAR WEIGHTS AND THEIR LOGARITHMS

Compound	Mol. wt.	Log.
Aluminum, Al	26.97	1.43088
Al_2O_3	101.94	2.00834
$Al(OH)_3$	77.99	1.89204
$AlCl_3$	133.34	2.12496
Al_2S_3	150.13	2.17647
$Al_2(SO_4)_3$	342.13	2.53419
$Al_2(SO_4)_3.K_2SO_4.24H_2O$	948.77	2.97716
$Al_2(SO_4)_3.Na_2SO_4.24H_2O$	916.57	2.96217
Ammonium		
NH_4Cl	53.50	1.72835
NH_4NO_3	80.05	1.90336
$(NH_4)_2SO_4$	132.14	2.12103
Antimony, Sb	121.77	2.08909
$SbCl_3$	228.14	2.35820
$SbCl_5$	299.06	2.47576
Sb_2O_3	291.54	2.46470
Sb_2O_5	323.54	2.50993
Sb_2S_3	339.73	2.53113
Sb_2S_5	403.86	2.60623
Arsenic, As_4	299.84	2.47689
$AsCl_3$	181.33	2.25847
As_2O_3	197.92	2.29649
As_2O_5	229.92	2.36158
As_2S_3	246.11	2.39113
As_2S_5	309.24	2.49030
Barium, Ba	137.37	2.13789
$BaCO_3$	197.37	2.29528
$BaCl_2$	208.28	2.31865
$BaCrO_4$	253.38	2.40377
BaO	153.37	2.18574
$BaSO_4$	233.43	2.36876
$BaSiF_6$	279.43	2.44627
Bismuth, Bi	209.00	2.32015
Bi_2O_3	466.00	2.66839
BiOCl	260.46	2.41574
Bi_2S_3	514.19	2.71112
Bromine, Br_2	159.83	2.20366
HBr	80.92	1.90806
Cadmium, Cd	112.41	2.05080
$CdCl_2$	183.32	2.26321
CdO	128.41	2.10860
CdS	144.47	2.15978
$CdSO_4$	208.47	2.31904
Calcium, Ca	40.07	1.60282
$CaCO_3$	100.07	2.00030
$CaCl_2$	110.98	2.04524
CaO	56.07	1.74873
$CaSO_4$	136.13	2.13395
Carbon, C	12.00	1.07918
CO	28.00	1.44716
CO_2	44.00	1.64345
C_2N_2	52.02	1.71617
HCN	27.02	1.43169
Chlorine, Cl_2	70.91	1.85071
HCl	36.47	1.56194
Chromium, Cr	52.01	1.71609
$CrCl_3$	158.38	2.19970
Cr_2O_3	152.02	2.18190
CrO	68.01	1.83257
CrO_3	100.01	2.00004
$Cr_2(SO_4)_3$	392.21	2.59352
Cobalt, Co	58.94	1.77041
$CoCl_2$	129.85	2.11344
CoO	74.94	1.87471
Co_2O_3	165.88	2.21979
Co_3O_4	240.82	2.38169
Copper, Cu	63.57	1.80325
CuCl	149.03	2.17327
$CuCl_2$	134.48	2.12866
CuO	79.57	1.90075
Cu_2O	143.14	2.15576
CuS	95.63	1.98059
Cu_2S	159.20	2.20194
$CuSO_4$	159.61	2.20306
Fluorine, F_2	38.00	1.57978
HF	20.01	1.30125
H_2SiF_6	144.08	2.15860
Gold, Au	197.2	2.29491
AuCl	232.66	2.36672
$AuCl_3$	303.57	2.48226
Hydrogen, H_2	2.016	0.30449
H_2O	18.02	1.25575
H_2O_2	34.02	1.53173
Iodine, I_2	253.86	2.40459
HI	127.94	2.10700
Iron, Fe	55.84	1.74695
$FeCl_2$	126.75	2.10295
$FeCl_3$	162.21	2.21008
$Fe(OH)_2$	89.86	1.95357
$Fe(OH)_3$	106.86	2.02882
FeO	71.84	1.85637
Fe_2O_3	159.68	2.20325
FeS	87.90	1.94399
FeS_2	119.97	2.07907
Fe_2S_3	207.87	2.31779
$FeSO_4$	151.80	2.18127
$Fe_2(SO_4)_3$	399.87	2.60192
Lead, Pb	207.20	2.31639
$PbCl_2$	278.11	2.44422
$PbCrO_4$	323.21	2.50948
Pb_3O_4	685.60	2.83607
PbO	223.20	2.34869
Pb_2O_3	462.40	2.66502
PbO_2	239.20	2.37876
Pb_2O	430.40	2.63387
$PbSO_4$	303.26	2.48182
Lithium, Li	6.94	0.84136
Li_2CO_3	73.88	1.86853
LiCl	42.40	1.62737
Li_2O	29.88	1.47538
Li_3PO_4	115.85	2.06390
Magnesium, Mg	24.32	1.38614
$MgCl_2$	95.23	1.97877
$Mg(NH_4)AsO_4.6H_2O$	289.42	2.46153
$MgAs_2O_7$	252.24	2.40181
MgO	40.32	1.60552
MgP_2O_7	222.69	2.34770
$MgSO_4$	120.38	2.08055
Manganese, Mn	54.93	1.73981
MnO	70.93	1.85083
Mn_2O_3	157.86	2.19827

MOLECULAR WEIGHTS AND THEIR LOGARITHMS (Cont.)

Compound	Mol. wt.	Log.	Compound	Mol. wt.	Log.
Mn_3O_4	227.79	2.35753	K_2SiF_6	220.25	2.34292
MnS	86.99	1.93947	K_2SO_4	174.26	2.24120
MnS_2	119.06	2.07577	Silicon, Si	26.06	1.41597
$MnSO_4$	150.99	2.17895	SiO_2	60.06	1.77859
$Mn_2(SO_4)_3$	398.05	2.59994	H_2SiF_6	144.08	2.15860
Mercury, Hg	200.61	2.30235	Silver, Ag	107.88	2.03294
HgCl	236.07	2.37304	AgBr	187.80	2.27370
$HgCl_2$	271.52	2.43380	AgCl	143.34	2.15637
HgO	216.61	2.33568	AgCN	133.89	2.12675
Hg_2O	417.22	2.62037	AgI	234.81	2.37072
HgS	232.67	2.36674	Ag_2O	231.76	2.36504
Hg_2S	433.28	2.63677	Ag_3PO_4	418.67	2.62187
Nickel, Ni	58.69	1.76856	$Ag_4P_2O_7$	605.57	2.78216
$NiCl_2$	129.60	2.11260	Sodium, Na	23.00	1.36173
NiO	74.69	1.87326	NaBr	102.91	2.01246
Ni_2O_3	165.38	2.21848	Na_2CO_3	105.99	2.02526
Ni_3O_4	240.07	2.38034	NaCl	58.45	1.76678
NiS	90.75	1.95785	NaOH	40.01	1.60217
$NiSO_4$	154.75	2.18963	NaI	149.93	2.17589
Nitrogen, N_2	28.02	1.44747	Na_2O	61.99	1.79232
NH_3	17.03	1.23121	Na_2SO_4	142.06	2.15247
NO	30.01	1.47727	Strontium, Sr	87.63	1.94265
N_2O_3	76.02	1.88093	$SrCO_3$	147.63	2.16917
N_2O_5	108.02	2.03350	$SrCl_2$	158.54	2.20014
Oxygen, O_2	32.00	1.50515	SrO	103.63	2.01549
O_3	48.00	1.68124	$SrSO_4$	183.69	2.26409
Phosphorous, P_4	124.11	2.09381	Sulfur, S_8	256.51	2.40910
PH_3	34.05	1.53212	H_2S	34.08	1.53250
P_2O_3	110.05	2.04159	SO_2	64.06	1.80659
P_2O_5	142.05	2.15244	SO_3	80.06	1.90342
Platinum, Pt	195.23	2.29055	H_2SO_4	98.08	1.99158
$PtCl_4$	337.06	2.52771	Tin, Sn	118.70	2.07445
Potassium, K	39.10	1.59218	$SnCl_4$	260.53	2.41586
KBr	119.01	2.07558	SnO	134.70	2.12937
KCl	74.55	1.87245	SnO_2	150.70	2.17811
KI	166.03	2.22019	Zinc, Zn	65.38	1.81544
KNO_3	101.10	2.00475	$ZnCl_2$	136.29	2.13446
K_2O	94.20	1.97405	ZnO	81.37	1.91046
KOH	56.10	1.74896	ZnS	97.43	1.98869
K_2PtCl_6	486.16	2.68678	$ZnSO_4$	161.44	2.20801

THE ELEMENTS

Aluminum [L. *alumen*, alum], Al; at.wt. 26.97; at. no. 13; m.p. 658.7°C.; b.p. 1800°C.; sp. gr. 2.70 (20°C.); valence 3. Discovered in 1827 by Wöhler and again in 1854 by St. Claire Deville; the first really practical electrical method of extraction was patented by Cowles in England and the United States in 1885 but this was finally supplanted by methods of Heroult in France and Hall in America; in 1856 the price was about $90 a pound, and in 1925, 25 to 30¢ a pound. Aluminum is not found in the metallic form but occurs as silicate in clays, feldspar, etc., and is extracted chiefly from bauxite, an impure hydrated oxide, by electrolysis of the solution in molten cryolite. Aluminum is a white, somewhat soft metal resembling tin in appearance; among the metals it stands second in the scale of malleability and sixth in ductility. It is but slightly magnetic and is strongly electro-positive, so that in contact with most other metals it rapidly corrodes; the electrical conductivity is about 60% that of copper; it is highly sonorous in the bar but has a weak, cracked sound when cast into a bell. It takes a high polish but this is likely to become frosted in appearance due to formation of an oxide coating. Alloys with the following metals have been prepared and used: zinc, copper, magnesium, cerium, beryllium, cobalt, tungsten and molybdenum. The compounds of aluminum of greatest importance are its oxide and its sulfate. The oxide, alumina, occurs naturally as ruby, sapphire, corundum and emery and is very hard, ranking next to the diamond.

Antimony [L. *antimonium*], Sb (stibium); at. wt. 121.77; at. no. 51; m.p. 630° C.; b.p. 1440° C.; sp. gr. 6.62 (20° C.); valence 3 or 5. Discovered in 1450 by Valentine. Antimony is a metallic element occuring native in rare instances but derived chiefly from *stibnite* or gray antimony ore (Sb_2S_3), *kermesite* or red antimony ($2Sb_2S_3.Sb_2O_3$), *valentinite* or white antimony (Sb_2O_3), *senarmontite* (Sb_2O_3), cervantite ($Sb_2O_3.Sb_2O_5$), and certain ores of gold, silver and lead. It is extracted from the sulfide ores by roasting to the oxide which is reduced by salt and scrap iron; from the oxides the metal is also prepared by reduction with carbon. In 1925 the price of antimony was about 15–20¢ a pound. Antimony is an extremely brittle metal of a flaky, crystalline texture, blue-white color and metallic lustre; hardness, 3 to 3.5: not acted on by air at room temperature but when heated it burns brilliantly with the formation of white fumes of the oxide Sb_2O_3. It is a poor conductor of heat or electricity. Its property of expanding on cooling, a property which is also found in its alloys makes it useful in the preparation of fine and sharp castings. The most important alloys include type metal, stereotype metal and Babbitt metal. The principle compounds of antimony are the sulfides, chlorides and tartar emetic.

Argon [Gr. *argos*, inactive], A; at. wt. 39.91; at. no. 18; m. p. −189.6°C.; b.p. −186.1° C.; sp. gr. 1.38A; valence 0 (does not combine with any other element); a gas existing in the atmosphere in the proportion of about 0.8 %; it is $2\frac{1}{2}$ times as soluble in water as nitrogen and has approximately the same solubility as oxygen; it is best recognized by the characteristic lines in the red end of the spectrum. Its presence in air was suspected by Cavendish in 1785; discovered by Lord Rayleigh and Sir William Ramsay in 1894. The best known method of obtaining argon on a large scale is from liquid oxygen. It is used as a filler for incandescent electric lamps.

Arsenic [L. *arsenicum*, Gr. *arsenikon* yellow orpiment (identified with *arsenikos* male, from belief that metals were of different sexes,) Arab. *az-zernikh* the orpiment from Persian *zerni* (or gold)], As; at. wt. 74.96; at. no. 33; m. p. sublimes (500° C., m. p. under pressure); b.p. 450° C.; sp. gr. 5.73; valence 3 or 5. Discovered in 1694 by Schroder. Arsenic is a steel-gray, very brittle, crystalline, semi-metallic solid, which sublimes on heating, being deposited partly as crystals and partly as a black, amorphous solid; it tarnishes in air and when heated is rapidly oxidized to arsenious oxide (As_2O_3). It is rarely found native occuring mostly as *realgar* (As_2S_2), arsenical iron and mispickel or arsenical pyrites (FeSAs); it is usually prepared by heating mispickel, the arsenic subliming leaving ferrous sulfide. The free element is not considered poisonous (altho many of its compounds are extremely so) and is used in bronzing, pyrotechny and for hardening and improving the sphericity of shot. The most important compounds are white arsenic or arsenious oxide (As_2O_3), cupric arsenite or Paris green ($CuHAsO_3$), and, *orpiment* (As_2S_3). The amorphous form of arsenic has a sp. gr. of 3.70.

Barium [Gr. *barys*, heavy], Ba; at. wt. 137.37; at. no. 56; m.p. 850°C.; b.p. 950°C.; sp. gr. 3.80 (0°C.); valence 2. Barium is a metallic element, soft and silvery white like lead; it belongs to the alkaline earth group resembling calcium chemically and is found only in combination with other elements, chiefly in heavy spar (sulfate) and witherite (carbonate) and is prepared by electrolysis. It was discovered by Sir Humphry Davy in 1808. The most important compounds of barium are the peroxide, (BaO_2), chloride ($BaCl_2$), sulfate (permanent white or *blanc fixé*, $BaSO_4$), nitrate ($Ba(NO_3)_2$) and chlorate ($Ba(ClO_3)_2$); the nitrate and chlorate are used in pyrotechny for production of green colors; the sulfate in paint manufacture. The sulfide (BaS) phosphoresces after exposure to light.

Beryllium [L. fr. *beryl;* also called *Glucinum* Gr. *glykys*, sweet], Be or Gl; at. wt. 9.02; at. no. 4; m. p. 1280° C; b. p. . . . ; sp. gr. 1.85; valence 2. Beryllium is a rare metallic element occuring in beryl and other silicates discovered in 1828 by Wöhler. It resembles magnesium in appearance and chemical properties; it may be prepared from its chloride by displacement with sodium. The chief compounds of beryllium are the oxide, nitrate, sulfate, chloride, basic acetate and carbonate.

Bismuth [etymology dubious; Ger. *Wismuth*], Bi; at. wt. 209.00; at. no. 83; m.p. 269.2° C., b.p. 1436° C.; sp. gr. 9.78 (20°); valence 3 or 5. Bismuth is a white, crystalline, brittle metal with a pinkish tinge that occurs in many places free as well as in combination as sulfide, oxide and carbonate; it is extracted from the ore by melting out the free metal, the oxides and sulfides being decomposed by the addition of carbon and iron. It was discovered in 1450 by Valentine. It is a poor conductor of electricity, is very diamagnetic, solidifies with expansion, heated in air it burns with a blue flame forming yellow fumes of the oxide; its soluble salts are characterised by forming insoluble basic salts on the addition of water — a property sometimes used in its detection. Bismuth forms many alloys with metals which are often used for their property of low melting point and because of their expansion on cooling are particularly suited for making sharp castings of objects subject to damage by high temperatures. The important compounds of bismuth are the trioxide (Bi_2O_3), and the subnitrate of medicinal use (*pearl white, pearl powder, blanc de fard* and *blanc d'Espagne*). Bismuth is found native in England, France, Peru, and Siberia, but is mostly obtained from Saxony. The price of the metal in 1925 was about $2.25 a pound.

Boron [Ar. *būraq*, Pers. *būrah*], B; at. wt. 10.82; at. no. 5; m.p. 2000–2500° C.; b.p. sublimes 3500° C.; sp. gr. of crystals 2.54, of amorphous variety 2.45; valence 3. Boron is an element found in combination in boric acid, native borax or tincal, boracite and several other minerals. Boron is obtained by heating boron trioxide with magnesium powder; it has no commercial value. The element was discovered in 1808 by Sir Humphrey Davy. The most important compounds are boric acid or boracic acid (H_3BO_3), and borax ($Na_2B_4O_7$).

Bromine [Gr. *bromos*, stench], Br; at. wt. 79.916; at. no. 35; m.p. −7.3° C.; b.p. 61.1° C.; sp. gr. of gas 5.87A and of the liquid 3.12(20°); valence 3 or 5. Bromine, a member of the halogen group of elements, is obtained from natural brines by displacement with chlorine or electrolytically; it is the only liquid nonmetallic element, a heavy, mobile, reddish-brown liquid, volatilizing readily at room temperatures to a red vapor with a strong disagreeable odor resembling chlorine and having a very irritating effect on the eyes and throat; it is readily soluble in water or carbon disulfide forming a red solution; it is less active than chlorine but more so than iodine; it unites readily with many elements and has a bleaching action; when spilled on the skin it produces painful sores. It is chiefly employed for the preparation of its compounds which are useful in photography, medicine, coal tar derivatives, etc. The most important compounds are the bromides of sodium and potassium. The element was discovered in 1826 by Balard but it was not prepared in any quantity till 1860. The price in 1925 was about 50¢ a pound.

Cadmium [Gr. *kadmia*, Cadmean (earth)], Cd; at. wt. 112.41; at. no. 48; m.p. 320.9° C.; b.p. 778° C.; sp. gr. 8.65 (20°); valence 2. Cadmium is a soft, bluish-white metal which is malleable and ductile, occuring in small quantities associated with zinc. It comes off before zinc in the preparation of the metal, condensing as the brown oxide which is then reduced with carbon. It tarnishes in air and burns when heated forming the oxide.

It was discovered in 1817 by Stromeyer. It forms a number of salts of which the sulfate ($CdSO_4$) is the most common. Cadmium is a component of one of the lowest melting alloys and is alloyed with silver in electroplating. The price of cadmium in 1925 was about 75¢ a pound.

Calcium [L. *calx*, lime], Ca; at. wt. 40.07; at. no. 20; m.p. 810° C.; b.p. ......; sp. gr. 1.54 (29°); valence 2. Calcium is a metallic element, fifth in abundance in the earth's crust of which it forms 3.5%, an essential constituent in leaves, bones, teeth and shells. It is prepared by electrolysis of the fused chloride. Chemically it is one of the alkaline earth elements; it tarnishes readily in air, reacts with water, burns with a brilliant crimson flame to the oxide and forms many compounds of which the following are the most important: carbide (CaC_2), carbonate in the various forms known as limestone, marble, *calcite*, *aragonite*, stalactites and stalagmites ($CaCO_3$), chloride ($CaCl_2$), cyanamide ($CaCN_2$), fluoride (CaF_2), hydroxide or slaked lime ($Ca(OH)_2$), hypochlorite or bleaching powder ($Ca(Cl0)_2$ or $CaClOCl$), nitrate ($Ca(NO_3)_2$), oxide or quick lime (CaO), phosphate or *apatite* ($Ca_3(PO_4)_2$) sulfate or *gypsum* ($CaSO_4$), and sulfide (CaS). It was discovered in 1808 by Davy.

Carbon [L. *carbo*, charcoal], C.; at. wt. 12.000; at. no. 6; m.p. above 3500° C.; b.p. sublimes above 3500° C.; sp. gr. amorphous 1.88, graphite 2.25, diamond 3.51; valence 2 or 4. Carbon, an element of prehistoric discovery is very widely distributed in nature, occuring free as diamond and graphite, and in an impure form as coal; in combination it occurs as carbon dioxide, carbonates and as a constituent of all living things. It occurs in three allotropic forms, the diamond, graphite and amorphous, all forms being solids, insoluble in any common solvent but dissolving in melted metals from which they crystallize on cooling in the form of graphite; when the cooling takes place under pressure some of the carbon is obtained as diamond. Carbon is unique in forming an almost infinite number of compounds, there being at the present time almost one quarter of a million known compounds; the compounds most common are the carbonates, carbon dioxide (CO_2); carbon monoxide (CO), carbon disulfide (CS_2), chloroform ($CHCl_3$), carbon tetrachloride (CCl_4), alcohol (C_2H_6O), acetic acid ($HC_2H_3O_2$) and oxalic acid ($H_2C_2O_4$).

Cerium [Named after the planet *Ceres* which was discovered in 1801 only a short time before the element], Ce; at. wt. 140.25; at. no. 58; m.p. 640° C.; b.p. ....; sp. gr. 7.02; valence 3 or 4. Cerium is found in a few rare minerals, *orthite*, *cerite* and the *samarskite* of North Carolina. It is a steel-gray lustrous metal prepared by electrolysis of the chloride. It was discovered by Berzelius in 1803 and is used chiefly as the oxide as an important constituent of incandescent gas mantles.

Caesium [L. *caesius*, sky blue], Cs; at. wt. 132.81; at. no. 55; m.p. 26.4° C.; b.p. 670° C.; sp. gr. 1.87 (26°); valence 1. Caesium is an alkaline metal occuring in lepidolite, pollucite and some mineral springs; it is isolated by electrolysis of the fused cyanide. It was discovered in 1860 by Bunsen in mineral water from Dürkheim, in the Palatinate. Caesium is characterized by a spectrum containing two bright lines in the blue along with several others in the red, yellow and green.

Chlorine [Gr. *chloros*, green], Cl; at. wt. 35.457; at. no. 17; m.p. −40° C.; b.p. −33.6° C.; sp. gr. gas 2.49 A and 1.51 (−34°); valence 1, 3, 5 or 7. Chlorine, a member of the halogen group of elements, is obtained from chlorides by the action of oxidizing agents or by electrolysis; it is a greenish-yellow gas, with an irritating and suffocating odor, attacking the respiratory tract producing symptoms of pneumonia (war gas), combining directly with nearly all elements; in nature it is found in the combined state only, chiefly with sodium as common salt ($NaCl$), carnallite ($KMgCl_3.6H_2O$) and sylvin (KCl). At 10° C., one volume of water dissolves 2.58 volumes of chlorine while at 25° C. 1.95 volumes of chlorine are dissolved. The most important compounds are the chlorides, hypochlorites and chlorates. The element was discovered by Scheele in 1774. In 1925 the price was about 5–10¢ a pound.

Chromium [Gr. *chroma*, color], Cr; at. wt. 52.01; at. no. 24; m.p. 1615° C.; b.p. 2200° C.; sp. gr. 6.92 (20°); valence 2, 3 or 6. Chromium is a metallic element resembling iron occuring chiefly in chrome iron ore ($FeOCr_2O_3$) and is prepared by the reduction of the oxide (Cr_2O_3) with aluminum; it is a very infusible, hard, gray metal used to harden steel. The most important compounds are the sodium and potassium chromates (K_2CrO_4), dichromates ($K_2Cr_2O_7$) and the potassium and ammonium chrome alums ($Cr_2(SO_4)_3.K_2SO_4.24H_2O$)). It was discovered by Vauquelin in 1797.

Cobalt [G. *Kobold*, goblin or evil spirit], Co; at. wt. 58.94; at. no. 27; m.p. 1480° C.; b.p. . . . .; sp. gr. 8.72 (21°); valence 2 or 3. Cobalt is a metallic element occuring in ores which are sparingly distributed; it occurs most frequently in *smaltite* ($CoAs_3$), linnaeite, wad, or cobalt bloom (Co_3S_4) and cobalite or cobalt glance ($CoSAs$); it is brittle, hard, very magnetic and of a gray color with a reddish tinge. It is used to alloy with other metals and the salts are used chiefly for the production of brilliant and permanent blue colors in porcelain, glass, pottery, tiles, and enamels, being the principle ingredient in *Serres Blue* and *Thenard's Blue*. It was discovered by Brandt in 1773. The chief compounds are the oxide (CoO), the chloride ($CoCl_2.6H_2O$) and the nitrate ($Co(NO_3)_2.6H_2O$). The price of the metal in 1925 was about $3 a pound.

Columbium [*Columbia*, also called Niobium], Cb. or Nb. at. wt. 93.1; at. no. 41; m.p. 1950° C.; b.p. . . . .; sp. gr. 8.4; valence 3 or 5. Columbium is a very rare metallic element, occuring chiefly in niobite or columbite; it is prepared by reduction with carbon in the electric furnace and is a gray metal, forming an acid oxide, Cb_2O_5, from which the salts are derived. It was discovered in 1801 by Hatchett.

Copper [L. *Cyprium*], Cu (cuprum); at. wt. 63.57; at. no. 29; m.p. 1083° C.; b.p. 2310° C.; sp. gr. 8.93–8.95; valence 1 or 2. Copper is a metallic element, reddish-colored, bright, metallic luster, malleable, ductile, good conductor of heat and electricity (second to silver in electrical conductivity) occurring native and in various ores: chalcocite (Cu_2S), chalcopyrite ($CuFeS_2$), bornite (Cu_3FeS_3), covelite (CuS), malachite ($CuCO_3.Cu(OH)_2$), azurite ($Cu_3(OH)_2(CO_3)_2$), cuprite (Cu_2O), tenorite (CuO), chrysocolla ($CuSiO_3.2H_2O$), chalcanthite ($CuSO_4.5H_2O$) and tetrahedrite ($4Cu_2S.Sb_2S_3$). It is obtained from the ores by smelting, leaching or electrolysis. The most important compounds are the oxide (CuO) and the sulfate (blue vitriol, $CuSO_4.5H_2O$). The discovery of copper dates from prehistoric times. The price of copper in in 1925 was about 15¢ a pound.

Dysprosium [Gr. hard to speak with], Dy; at. wt. 162.52; at. no. 66; m.p. ......; b.p. ......; sp. gr. ......; valence 3. Dysprosium is a member of the erbium family of rare earths and occurs in the minerals xenotime, fergusonite, gadolinite, euxonite, polycrase and blomstrandine. The free element has never been isolated; it forms highly colored salts. The element was discovered in 1886 by Lecoq de Boisbaudran.

Erbium [*Ytterby*, a town in Sweden], Er; at. wt. 167.7; at. no. 68; m.p. ......; b.p. ......; sp. gr. ......; valence 3. Erbium is a member of the family of rare earths which includes thulium, erbium, holmium and dysprosium in the order of increasing basicity. It forms highly colored salts and an oxide Er_2O_3. The free element has not been isolated. It occurs in the minerals xenotime, fergusonite, gadolinite, euxonite, polycrase and blomstrandine.

Europium [*Europe*], Eu; at. wt. 152.0; at. no. 63; m.p. ......; b.p. ......; sp. gr. ......; valence 3. *See Terbium.* Europium is the most sparsely distributed of the terbium family of rare earths which includes europium, gadolinium and terbium in the order of decreasing basicity. The free element has never been isolated; salts of the type EuX_3 and EuX_2, where X is a univalent atom or radical are known. The general characters of this family resemble those of the cerium family.

Fluorine [L. *fluor*, flow], F; at. wt. 19.00; at. no. 9; m.p. -223° C.; b.p. -187° C.; sp. gr. gas 1.31A of liquid 1.14(-200°); valence 1. Fluorine, a member of the halogen group of elements, is obtained by electrolyzing a solution of potassium hydrogen fluoride in anhydrous hydrogen fluoride; it is a pale yellow gas, uniting directly with silicon, carbon, hydrogen and nearly all other elements in the dark, decomposes almost all compounds to form fluorides except in the case of oxygen with which it forms no compounds; it occurs chiefly in fluor spar (CaF_2) and cryolite (Na_3AlF_6); the most important compounds are hydrogen fluoride, which is used in etching glass, and calcium fluoride. It was discovered by Scheele in 1771.

Gadolinium [*Gadolin*, a Russian], Gd; at. wt. 157.26; at. no. 64; m.p. ....; b.p. ....; sp. gr. ....; valence 3. Gadolinium is a member of the terbium family of rare earths which includes terbium and europium. The general characters of this family resemble those of the cerium family; the free element has never been isolated; the element forms oxides of the type R_2O_3 and its salts are usually more soluble than the corresponding terbium salts. Gadolinium is the most plentiful of the three terbium family elements. These elements decrease in basicity in the order Eu, Gd and Tb.

Gallium [L. *Gallia*, France], Ga; at. wt. 69.72; at. no. 31; m.p. 30.1° C.; b.p. ....; sp. gr. 5.94 (23°); valence 2 or 3. Gallium is a rare metal belonging to the aluminum group and is the only metallic element besides mercury which can be a liquid at near room temperatures; it is a hard, grayish-white subtance and was discovered spectroscopically by Lecoq de Boisbaudran in 1875 in the zinc blende of Pierrefitte, Hautes-Pyrenees altho its occurence was predicted before that time by Mendeleeff who named it eka-aluminum. It forms two sets of chlorides, bromides, iodides, nitrates, sulfates and oxides in which it appears divalent and trivalent.

Germanium [L. *Germania*, Germany], Ge; at. wt. 72.60; at. no. 32; m.p. 958° C.; b.p. volatilizes at 1350° C.; sp. gr. 5.47 (20°); valence 4. Germanium is a metallic element of the silicon group lying between silicon and tin in chemical properties; it is a gray-white, crystalline, brittle metal that retains its luster in air at room temperatures; it is prepared by reducing the oxide obtained from a silver ore (argyrodite) with carbon or with hydrogen. The most important compounds are the oxide (GeO_2) and the halides ($GeCl_4$) the latter being volatile. It was discovered by Winkler in 1886 altho it was predicted before that time by Mendeleeff who named it eka-silicon.

Gold [Anglo-Saxon *gold*], Au (aurum); at. wt. 197.2; at. no. 79; m.p. 1063° C.; b.p. 2500° C.; sp. gr. 19.32 (17.5°); valence 1 or 3. Gold is a metallic element which occurs free, is very widely distributed in nature, occuring principally in rock deposits or in alluvial deposits; it has a yellow color when in mass but when finely divided it may be black, ruby or purple; it is the most malleable and ductile, and also one of the softest of the metals; it is a good conductor of heat and electricity and is not affected by air and most reagents. Its chief use is in coinage and jewelry; the commonest compounds are the auric chloride ($AuCl_3$) and the chlorauric acid ($HAuCl_4$) the latter used in photography for toning the silver image.

Hafnium [*Hafnium*, Copenhagen], Hf; at. wt. 180.8; at. no. 72; m.p. ....; b.p. ....; sp. gr. ....; valence 4. Shortly after Bohr's theory was applied to explaining the periodic system of the elements, G. Urbain announced the identity of missing element number 72 with Celtium which he had discovered in 1911. This identification was based upon the Röntgen spectroscopic observations of A. Dauvilliers. This identity of celtium and element number 72 did not fit the Bohr theory as it should have been closely related to the tetravalent zirconium. With confidence in the Bohr theory, D. Coster and G. von Hevesy in 1922 made a search for element number 72 in zirconium minerals by means of Röntgen spectroscopic analysis and the first mineral investigated, a zircon from Norway, showed the presence of element number 72 which they named hafnium.

On treatment of the mineral with potassium bifluoride and separation of K_2ZrF_6, the mother liquors became richer in the amount of the new element. All of the zirconium minerals investigated except *polymignite* (Zr-Ti) contained from 1–20% Hf, most of them having it present to the extent of 5% of the zirconium content. The mineral *alvite* was found to be particularly rich in hafnium. In the range of 2500–3500 A° the following lines were found to be most pronounced: 2761.65, 2866.35, 2916.50 and 2940.80. Coster believes that Urbain's celtium is nothing other than a concentrated cassiopeium (lutecium) preparation. In chemical properties, hafnium resembles zirconium. When sodium phosphate is added to a zirconium solution strongly acidified with hydrochloric or nitric acid, a zirconium phosphate is precipitated. All other phosphates are soluble in concentrated acid (columbium phosphate is only very slightly soluble) except hafnium which is even less soluble than zirconium. Its relative occurence in the earth's crust is estimated at $> 2 \times 10^{-5}$

Helium [Gr. *helios*, the sun] He; at. wt. 4.00; at. no. 2; m.p. .....; b.p. −268.8° C.; sp. gr. 0.137A; valence 0. It has never been solidified, altho H. K. Onnes has cooled the element to the lowest temperature ever obtained, −272.18° C.; he has expressed the opinion that helium may remain a liquid even at absolute zero. Helium is a gas, inert chemically, obtained by compression and fractionation of the gas from certain wells and from the minerals uraninite, cleveite, fergusonite, monazite, thorianite and many radio-active minerals. It is the best gas for inflating balloons because of its lightness, being next to hydrogen in this respect, and its non-inflammability. Evidence of the existence of helium was first obtained by Sir Norman Lockyer during the eclipse of 1868 when he detected a new line in the solar spectrum; in 1895 Ramsey isolated helium from uraninite.

Holmium [L. *Holmia*, for Stockholm], Ho; at. wt. 163.4; at. no. 67; m.p. ....; b.p. ....; sp. gr. ....; valence 3. Holmium in a member of the erbium family of rare earths which includes thulium, erbium, holmium and dysprosium in the order of increasing basicity. It is obtained from xenotime, fergusonite, gadolinite, euxenite, polycrase and blomstrandine. The element forms highly colored salts; the free element has never been isolated.

Indium [From its indigo spectrum], In; at. wt. 114.8; at. no. 49; m.p. 155° C.; b.p. red heat; sp. gr. 7.28; valence 3. Indium a rare metallic element occuring in some zinc ores; it belongs to the aluminum group in properties, being a very soft, silvery metal, not acted on by water or air, burning to the sesquioxide (In_2O_3) with a blue-violet flame. It was discovered in 1863 by Reich and Richter.

Hydrogen [Gr. *hydro*, water, and *genes*, forming], H; at. wt. 1.008; at. no. 1; m.p. −259° C.; b.p. −252.8° C.; sp. gr. gas 0.0695A, liquid 0.070(−252° C.); valence 1. Hydrogen is a colorless gaseous element occuring chiefly in combination with oxygen as water; it is the lightest of all gases, insoluble in water, uniting with many elements to form compounds; it is used as a reducing agent, as a means of obtaining high temperature flames and for inflating balloons; it is a constituent of all acids, hydroxides and alcohols; it is prepared by the electrolysis of water or by displacement from acids with metals. It was first recognized as a distinct substance in 1766 by Cavendish.

Iodine [Gr. *iodes*, violet], I; at. wt. 126.932; at. no. 53; m.p. 113.5° C.; b.p. above 200° C; sp. gr. gas 8.72 A, solid 4.94 (20°) valence 1, 3, 5 or 7. Iodine, a member of the halogen group of elements, occurs sparingly in the form of iodides in sea water from which it is assimilated by seaweeds, in Chile saltpeter, and in caliche (as sodium iodate); from iodides it is obtained on distillation with sulfuric acid and some oxidizing agent (MnO_2) and from the iodates by heating with sodium bisulfite. It is a grayish-black, lustrous solid, volatilizing at ordinary temperatures into a blue-violet gas with an irritating odor; it forms compounds with many elements but is less active than the other halogens which displace it from iodides; it combines only partly with hydrogen when heated and very little or no action on hydrocarbons; it forms brown solutions with water (slightly soluble), and with alcohol or aqueous potassium iodide; with carbon disulfide, chloroform or carbon tetrachloride purple solutions are obtained. The most important compounds are the iodides of sodium and potassium (KI) and the iodates (KIO_3). It was discovered by Courtois in 1811. The price in 1925 was $4.50 –5.00 a pound.

Iridium [L. *iris*, rainbow], Ir; at. wt. 193.1; at. no. 77; m.p. 2360° C.; b.p. . . . .; sp. gr. 22.42 (17°); valence 3 or 4. Iridium, a metallic element belonging to the platinum family is a very hard, brittle, white metal, occuring in alluvial deposits along with platinum; it is used in apparatus for high temperatures; alloyed with platinum, it is used for standard weights and measures; alloys with osmium are used in tipping pens and compass bearings; iridium black, prepared by exposing alcoholic solutions of the sulfate to light, is used as a catalytic agent; the most important salt is the chloride ($IrCl_4$). It was discovered in 1803 by Tennant. The price in 1925 was about $260 an ounce.

Iron [Anglo-Saxon, *iron*], Fe (ferrum); at. wt. 55.84; at. no. 26; m.p. 1530° C.; b.p. 2450° C.; sp. gr. 7.85–7.88; valence 2 or 3. Iron is the most abundant of metals and has been known and used from very early times; the pure metal, which is practically unknown in the Arts (altho some grades of soft steel are almost chemically pure), is silver-white, very ductile and magnetic; the pure metal may be prepared by electric deposition of ferrous sulfate or by reduction of pure oxide with hydrogen or aluminum; pig iron is hard, brittle and fairly fusible, containing about 3 % carbon and varying amounts of sulfur, silicon, manganese and phosphorus; wrought iron is tough, grayish-white, and malleable, having usually a fibrous structure, very infusible, with only a few tenths percent or less of carbon; steel is a solid solution of iron carbide in iron with a carbon content usually below 2 %. Iron is obtained from the oxide ores by reduction with carbon.

Krypton [Gr. *Kryptos*, hidden], Kr; at. wt. 82.9; at. no. 36; m.p. −169° C.; b.p. −151.7° C.; sp. gr. gas 2.8184; valence 0. Krypton is an inert, rare, gaseous element, occuring in small amounts in the atmosphere, and is characterized by a brilliant green and yellow line in its spectrum. It was discovered in 1895 by Ramsay and Travers.

Lanthanum [Gr. *lanthano*, to conceal], La; at. wt. 138.90; at. no. 57; m.p. 810° C.; b.p. ...... ; sp. gr. 6.155; valence 3. Lanthanum is a metallic element of the rare earths, resembling iron in its physical properties, burning brilliantly in air to form the oxide (La_2O_3); it occurs in the ores cerite, orthite, and monazite; it is prepared from the chloride by treatment with sodium. It was discovered by Mosander in 1837.

Lead [Anglo-Saxon, *lead*], Pb (plumbum); at. wt. 207.20; at. no. 82; m.p. 327° C.; b.p. 1525° C.; sp. gr. 11.35; valence 2 or 4. Lead is a metallic element of bluish-white color and bright luster, very soft, highly malleable, slight tenacity, ductile and a poor conductor of electricity; it is obtained chiefly from galena (PbS) by a roasting process. Important lead salts are the nitrate ($Pb(NO_3)_2$), sulfate ($PbSO_4$), acetate ($Pb(C_2H_3O_2)_2$), carbonate ($PbCO_3$), the basic carbonate or *White Lead* ($2PbCO_3 \cdot Pb(OH)_2$). Lead is used in making pipe and containers for corrosive liquids and is a constituent of many useful alloys including solder, type metal and various antifriction metals. Lead salts are used in medicine for washes and lotions because of the astringent properties of the solutions. The price of lead in 1925 was about 9–10c a pound.

Lithium [Gr. *lithos*, stone], Li; at. wt. 6.940; at. no. 3; m.p. 186° C.; b.p. 1400° C.; sp. gr. 0.534; valence 1. Lithium is a soft, white metal, belonging to the alkali-metal group; it is the lightest metal known; it is widely distributed in combination with other elements occuring in the soil, waters and the minerals lepidolite and spodumene (silicates occuring in California and South Dakota respectively), amblygonite (phosphate). When burned in air it forms the oxide lithia (Li_2O); it also forms a number of salts analogous to the salts of sodium or potassium. The carbonate and citrate are used in medicine to remove uric acid from the body, lithium urate being a soluble salt. It was discovered by Arfvedson in 1817.

Lutecium [*Lutetia*, ancient name of Paris], Lu; at. wt. 175.0; at. no. 71; m.p. ...... ; b.p. ...... ; sp. gr. ...... ; valence 3. It occurs in samarskite and gadolinite; it was discovered in 1907 by Urbain and Welsbach. Lutecium belongs to the ytterbium family of earths which includes ytterbium and lutecium. In 1907 Urbain and in 1908 von Welsbach described a process by which Marignac's ytterbium (1879) could be separated into the two elements ytterbium (neo-ytterbium) and lutecium. Both elements occur in very small amounts in nearly all minerals containing yttrium. The best sources are probably gadolinite, xenotime, polycrase and blomstrandine. The oxide, chloride and sulfate have been prepared.

Magnesium [*Magnesia*, district in Thessaly], Mg; at. wt.

24.32; at. no. 12; m.p. 651° C.; b.p. 1120° C.; sp. gr. 1.74 (5°); valence 2. Magnesium is a light, white, hard and fairly tough metal, occuring very widely distributed in combination as magnesite ($MgCO_3$), dolomite (Mg and Ca carbonate), Epsom salts ($MgSO_4.7H_2O$), carnallite (K and Mg chlorides), kieserite ($MgSO_4.H_2O$) and kanite ($KCl.MgSO_4.3H_2O$). It is obtained by electrolysis of the fused chloride. It tarnishes slightly in air and when in the form of ribbon, wire or powder it ignites on heating, burning with a dazzling white heat. It is useful in flash-light photography, and for pyrotechnic purposes. It is often alloyed with nickel and aluminum; the most important compounds are the oxide (MgO), the sulfate ($MgSO_4$), the chloride ($MgCl_2$) and the citrate ($Mg_3(C_6H_5O_7)_2$). It was discovered in 1829 by Bussy. The price of magnesium in 1925 was $1.25-1.30 a pound.

Manganese [L. *magnes*, magnet], Mn; at. wt. 54.93; at. no. 25; m.p. 1230° C.; b.p. 1900° C.; sp. gr. 7.42; valence 2, 4, 6 or 7. Manganese is a gray-white metal resembling iron, but harder and very brittle; it is obtained from pyrolusite (MnO_2) and psilomelane ($RO.4MnO_2$, where R is Ba, Li, K or Mn); other ores found in smaller amounts are braunite ($3Mn_2O_3.MnSiO_3$) and manganite ($Mn_2O_3.H_2O$). The metal is obtained by reduction of the oxide with sodium, magnesium, aluminum or by electrolysis. It is used in the production of alloys with iron (spiegeleisen), copper, brass and nickel. The most important compounds are the chloride ($MnCl_2$), sulfate ($MnSO_4$), oxide (MnO), dioxide (MnO_2), and potassium permanganate ($KMnO_4$). It was discovered in 1774 by Gahn.

Masurium [Masurian province formerly belonging to Germany], Ma; at. wt. ......; at. no. 43; m.p. ......; b.p. ....; sp. gr. ....; valence .... Masurium is one of the eka-manganeses discovered by Noddack, Tacke and Berg in 1924 and occurs in the minerals columbite, sperrylite, gadolinite and fergusonite. The element was detected with the aid of the Röntgen spectrum and the relative occurence in the earth's crust is estimated at 10^{-13}.

Mercury [Planet *Mercury*], Hg (hydrargyrum); at. wt. 200.61; at. no. 80; m.p. −38.85° C.; b.p. 357.25° C.; sp. gr. 13.595 (4°); valence 1 or 2. Mercury or quicksilver is a heavy, silver-white, shining liquid, a fair conductor of heat and electricity and has a regular coefficient of expansion; it tarnishes but slightly in air except when heated to near the boiling point where it is slowly converted to the oxide (HgO) from which oxygen is again set free at higher temperatures. It occurs free in nature to a limited extent but the chief source is the sulfide (cinnabar, HgS) from which it is obtained by heating in a current of air. The most important salts are mercuric chloride (corrosive sublimate, $HgCl_2$), mercurous chloride (calomel, $HgCl$) and mercuric sulfide (vermilion, HgS). Mercury dissolves many metals forming *amalgams* with them. The price of mercury in 1925 was about $1.20 a pound.

Molybdenum [Gr. *molybdos*, lead], Mo; at. wt. 96.0; at. no. 42; m.p. 2535° C.; b.p. 3620° C.; sp. gr. 9.01; valence 3, 4 or 6.

Molybdenum is a very hard, silver-white metal which does not occur native being obtained from molybdenite (MoS_2) and from wulfenite ($PbMoO_4$). It is used chiefly in the manufacture of certain grades of tool steel, boiler plate, rifle barrels, and large cranks. It was discovered in 1782 by Hjelm.

Neodymium [Gr. *neos*, new and *didymos*, twin], Nd; at. wt. 144.27; at. no. 60; m.p. 840° C.; b.p. . . . . . . ; sp. gr. 6.95; valence 3. Neodymium is a metallic element, belonging to the rare earths forming a series of pink salts with a characteristic absorption spectrum. It is one of the components of didymium, occuring in cerite and similar rare minerals. It was discovered in 1885 by Welsbach.

Neon [Gr. *neos*, new], Ne; at. wt. 20.2; at. no. 10; m.p. −253° C.; b.p. −239° C.; sp. gr. 0.674A; valence 0. Neon is a gaseous element present in the atmosphere to the extent of one or two parts per 100,000. It is obtained by liquifaction of air and separated from the other elements by fractional distillation. It is an inert element forming no compounds. Neon glows red-orange in a vacuum tube and is marked by pronounced red and green lines in its spectrum. It was discovered by Ramsey and Travers in 1895.

Nickel [Sw. abbr. of *kupparnickel*], Ni; at. wt. 58.69; at. no. 28; m.p. 1452° C.; b.p. . . . . . . ; sp. gr. 8.90; valence 2 or 3. Nickel is a hard, malleable, ductile and tenacious metal, of a white color, somewhat magnetic, a fair conductor of electricity and belonging to the iron-cobalt group of elements. It is obtained chiefly from the nickeliferous pyrrhotite of Ontario and the garnierite (hydrated silicate of nickel, iron and magnesia found in New Caledonia) by roasting to the oxide which is then reduced by carbon or carbon monoxide. It is chiefly valuable for the alloys which it forms with other metals — nickel steel, German silver (brass and 15-20% Ni), coinage with 75% copper and Monel metal (2½ parts copper and 1 part Ni); electrodeposition of nickel plate is used as a protective coating for metals. The most important compounds are the sulfate ($NiSO_4$), and the oxides (NiO and Ni_2O_3). Nickel was discovered by Cronstedt in 1751. The price of the metal in 1925 was about 32¢ a pound.

Nitrogen [L., niter forming], N; at. wt. 14.008; at. no. 7; m.p. −210.5° C.; b.p. −195° C.; sp. gr. 0.967 A and liquid 0.854 (−205° C.) solid 1.026 (-252° C.); valence 3 or 5. Nitrogen is a gaseous element which occurs free in the atmosphere of which it forms about four-fifths and from which it can be obtained by liquifaction and fractional distillation. It is easily obtained by heating a water solution of ammonium nitrite (mixture of ammonium chloride and sodium nitrite). It is a colorless, odorless and relatively inert element combining directly with magnesium, lithium and calcium when heated with them. When mixed with oxygen and subjected to electric sparks it forms nitrogen peroxide. It occurs in all living things as an essential ingredient and also occurs in the deposits of salt peter (sodium and potassium nitrate). The chief compounds are the nitrates of many metals, the five oxides (N_2O, NO, N_2O_3, NO_2 and N_2O_5) and ammonia

(NH_3). It was first obtained in a pure state by Rutherford, a professor of botany in the University of Edinburgh in 1772 and was first recognized as a distinct element by Lavoisier.

Osmium [Gr. *osme*, odor], Os; at. wt. 190.8; at. no. 76; m.p. 2700° C.; b.p. ......; sp. gr. 22.48; valence 2, 3, 4 or 8. Osmium is a bluish-white, hard, crystalline metal belonging to the platinum family of elements. It occurs in iridosmine and platinum bearing river sands of the Urals, North America and South America. It is the heaviest known form of matter, is very infusible, oxidizing when heated in the air to the oxide (OsO_4) with a pungent, irritating and poisonous vapor and which is easily reduced by organic matter. Osmium is used in making lamp filaments and with iridium it forms the alloy osmiridium which is used because of its hardness in tipping gold pens and for fine machine bearings. It was discovered in 1803 by Tennant.

Oxygen [Gr. acid former]. O; at. wt. 16.000; at. no. 8; m.p. −218° C.; b.p. −182.7° C.; sp. gr. gas 1.1053A, liquid 1.13; valence 2. Oxygen is a gaseous element which occurs free in the atmosphere of which it forms about one-fifth and from which it can be obtained by liquifaction and fractional distillation; it is also obtained by heating barium peroxide (BaO_2), heating potassium chlorate ($KClO_3$), by electrolysis of water containing a small amount of sulfuric acid and by adding sodium peroxide (Na_2O_2) to water. The critical temperature and pressure are −118° C. ,and 50 atmospheres. Gaseous oxygen is colorless, odorless and tasteless; the liquid and solid forms are a pale blue color and are magnetic but much less so than iron. Oxygen is very reactive, capable of combining with all elements except the inert elements of the atmosphere and bromine and fluorine. Under suitable conditions it may be converted into an allotropic form known as ozone (O_3). It is used in combination with combustible gases in the oxygen blow pipes and flames; in medicine it is used to aid respiration. It was discovered in 1774 by Priestley.

Palladium [Planet *Pallas*], Pd; at. wt. 106.7; at. no. 46; m.p. 1549° C.; b.p. 2540° C.; sp. gr. 12.16; valence 2 or 4. Palladium is a steel-white metal, belonging to the platinum family of elements; it is obtained in working up platinum with which it occurs native. It does not tarnish in air and has the property of absorbing large volumes of hydrogen to form the hydride (Pd_2H). It is used in the construction of non-magnetic watches and parts of delicate balances. The most important compound is the chloride ($PdCl_2$). It was discovered in 1804 by Wollaston. The price of the metal in 1925 was about $80 an ounce.

Phosphorus [Gr. *light bearing*]. P; at. wt. 31.027; at. no. 15; m.p. 44.2° C.; b.p. 288° C.; sp. gr. yellow 1.83, red 2.20; valence 3 or 5. Phosphorus occurs in three allotropic forms — *viz.* yellow, red and black. Though never found free in nature, it is widely distributed in combination in minerals, the most important being the apatites ($3Ca_3(PO_4)_2CaF_2$ and $3Ca_3(PO_4)_2CaCl_2$) which are the chief ingredients of commercial phosphates derived from South Carolina, Canada and Spain; it is an essential ingredient of all cell protoplasm, nervous tissue and bones. It is obtained from phosphates by treatment with dilute sulfuric acid to form o-phosphoric acid, the concentrated solution of which is mixed with crushed charcoal or coke and dried; on heating this mixture in retorts, the phosphorus distils and is condensed. It is also prepared by heating crude phosphate with coke in the electric furnace when the phosphorus distils off. Ordinary phosphorus is a waxy solid which is colorless when very pure, insoluble in water and soluble in carbon disulfide; it takes fire spontaneously in air burning to the pentoxide; it is very poisonous; when heated in its own vapor to 250° it is converted into the red variety which does not glow in air and which does not ignite spontaneously and is not poisonous. The most important compounds are the pentoxide or phosphoric anhydride (P_2O_5), the chlorides (PCl_3 and PCl_5) and the phosphates of the alkali metals. It was discovered in 1669 by Brandt. The price of the yellow and red varieties in 1925 were about 35¢ and $1.00 a pound respectively.

Platinum [Sp. *platina*], Pt; at. wt. 195.23; at. no. 78; m.p. 1755° C.; b.p. 3910° C.; sp. gr. 21.37; valence 2 or 4. Platinum is a tin-white metal of metallic luster, tenacious, malleable and ductile, occuring native in alluvial deposits or in rock forming minerals found principally in the Ural mountains, in Colombia, in California, Oregon, Arizona and Alaska. It is welded at a red heat, has a coefficient of linear expansion approximately equal to that of glass; does not oxidize in air at any temperature but is corroded by halogens, cyanide, sulfur and caustic alkalies; it forms alloys with lead; it has a catalytic effect of bringing about combination of hydrogen with water and sulfur dioxide and oxygen. The most important compound is chloroplatinic acid (H_2PtCl_6). It was discovered in 1741 by Wood. The price of platinum in 1925 was around $120.00 an ounce.

Potassium [Eng. *potash*], K (kalium); at. wt. 39.096; at. no. 19; m.p. 62.3° C.; b.p. 712° C.; sp. gr. 0.87; valence 1. Potassium is a soft, bright silvery metal belonging to the alkali group; it is never found free but is obtained by electrolysis of the hydroxide (KOH). On exposure to moist air it becomes coated with a film of the oxide (K_2O) and is preserved by immersing in kerosene or naphtha. The principal sources of potassium are: the mines of Strassfurt in Prussian Saxony from the minerals *kainite* ($MgSO_4.KCl.3H_2O$), *sylvin* (KCl) and *carnallite* ($KCl.MgCl_2.6H_2O$); crude potassium carbonate or potash obtained by extraction of wood ashes; potassium salts from natural brines, from cement mill and blast furnace dust, from kelp, from alkali lakes in Nebraska and Searles Lake, California. The chief compounds of potassium are the hydroxide, the carbonate (K_2CO_3), nitrate (KNO_3), chloride (KCl), chlorate ($KClO_3$), bromide (KBr), iodide (KI), cyanide (KCN), sulfate (K_2SO_4), dichromate ($K_2Cr_2O_7$), chromate (K_2CrO_4) and silicate (K_2SiO_3). It was discovered in 1807 by Davy and was the first metal to be isolated from an earth by the electric current.

Praseodymium [Gr. *praseos*, green, and *didymos*, twin], Pr;

at. wt. 140.92; at. no. 59; m.p. 940° C.; b.p. . . . . ; sp. gr. . . . . ; valence 2. Praseodymium is a metallic element belonging to the group of rare earths; it is a one of the constituents of didymium and is found in cerite. It forms green salts with a characteristic absorption spectrum. It was discovered in 1885 by Welsbach.

Radium [L. *radius*, ray] Ra; at. wt. 225.95; at. no. 88; m.p. 700° C.; b.p. . . . . ; sp. gr. . . . . ; valence 2. Radium is a brilliant white metal obtained in 1911 by Mme. Curie and Debierne by the electrolysis of a pure solution of radium chloride, employing a mercury cathode; the amalgam on distillation in an atmosphere of hydrogen yielded the pure element. The metal alters very rapidly in contact with air, decomposes water and is somewhat more volatile than barium. In the form of a salt it was first isolated by M. and Mme. Curie in 1898 from the pitchblende in North Bohemia in which it occurs in about one part in three million. The carnotite sands of Colorado yield about 2% uranium nitrate, the amount of radium in uranium is one part in 3,200,000. Radium is obtained commercially as the bromide or the chloride. The primary uses of radium are in producing self-luminous paints and in the treatment of cancer and certain types of skin affections. One gram of radium produces about 100 cubic millimeters of emanation per day; this is pumped from the radium, and sealed in minute tubes, which are then applied to the diseased parts. Radium loses about 1% of its activity in 25 years being transformed into elements of lower atomic weight.

Rhenium [Rhine province formerly belonging to Germany], Re; at. wt. . . . . ; at. no. 75; m.p. . . . . ; b.p. . . . . ; sp. gr. . . . . ; valence . . . . Rhenium or dwimanganese is one of the eka-manganeses discovered in 1924 by Noddack, Tacke and Berg in the minerals columbite, tantalite and wolframite. The element was detected with the aid of the Röntgen spectrum and the relative occurence in the earth's crust is estimated at 10^{-12}.

Rhodium [Gr. *rhodon*, rose], Rh; at. wt. 102.91; at. no. 45; m.p. 1950° C.; b.p. 2500° C.(?); sp. gr. 12.44; valence 3. Rhodium is a silver-white metallic element belonging to the platinum family, occuring native with other members of this group in river sands in the Urals and in North and South America. The salts form red solutions. An alloy with platinum is used in connection with pure platinum, to make the thermojunctions in some forms of pyrometers. It was discovered in 1804 by Wollaston.

Rubidium [L. *rubidus*, red], Rb; at. wt. 85.44; at. no. 37; m.p. 38.5° C.; b.p. 696° C.; sp. gr. 1.52; valence 1. Rubidium is a soft, white, rare metallic element of the potassium group occuring in small quantities in the mineral waters of Dürkheim in Rhenish Palatinate, in lepidolite and in the rare minerals castor and pollux found in Elba. It is prepared by the electrolysis of the cyanide, forms salts similar to potassium and colors the flame red when held in a burner. It was discovered in 1860 by Bunsen.

Ruthenium [*Ruthenia*, Russia], Ru; at. wt. 101.7; at. no. 44; m.p. 2450° C.; b.p. . . . .; sp. gr. 12.06; valence 3, 4, 6, or 8. Ruthenium is a hard, brittle, gray metal belonging to the platinum group, occuring native with the other metals of this group; it forms red or brown salts; ruthenious chloride ($RuCl_3$) gives a characteristic fine black precipitate with water. It was discovered in 1845 by Claus.

Samarium [*Samarski*, a Russian], Sm; at. wt. 150.43; at. no. 62; m.p. 1300–1400° C.; b.p. . . . . . .; sp. gr. 7.7–7.8; valence 3. Samarium is a metallic element belonging to the rare earth group occuring in very minute quantities in samarskite, cerite and certain Scandinavian minerals. It was discovered by Boisbaudran in 1879.

Scandium [*Scandinavia*], Sc; at. wt. 45.10; at. no. 21; m.p. 1200° C.(?); b.p. . . . .; sp. gr. . . . .; valence 3. Scandium is a metal belonging to the rare group which has not been isolated in the elementary form; it forms colorless salts derived from the oxide Sc_2O_3. It was discovered by Nilson in 1879.

Selenium [Gr. *selene*, moon], Se; at. wt. 79.2; at. no. 34; m.p. 217° C.; b.p. 690° C.; sp. gr. 4.47–4.80; valence 2, 4, or 6. Selenium is a gray, crystalline, semi-metallic appearing element of the sulfur group. The principal source is the flue dust obtained in burning pyrites in the manufacture of sulfuric acid. It is prepared in a red, amorphous form by reduction of selenic acid and this on melting and keeping somwhat below the melting point becomes crystalline. Its conductivity for electricity increases with the brightness of the light with which it is illuminated. The compounds of selenium resemble those of sulfur very closely. It was discovered in 1817 by Berzelius.

Silicon [L. *silex*, flint], Si; at. wt. 28.06; at. no. 14; m.p. 1420° C.; b.p. 3500° C. (?); sp. gr. 2.42; valence 4. Silicon is a non-metallic element resembling graphite in appearance; it is not found free but in combination is probably more widely distributed in the solid matter of the earth than any other element except oxygen. It occurs chiefly as the oxide, silica (SiO_2) (quartz, rock crystal, amethyst, agate, flint, jasper, opal, etc.) both free and in combination with the metallic oxides as silicates (granite, hornblende, asbestos, feldspar, clay, mica, etc.). It is obtained as an amorphous, brown powder on fusion of potassium fluosilicate with sodium or potassium; the crystalline form is obtained by passing silicon tetrachloride over melted aluminum in an atmosphere of hydrogen or by heating potassium fluosilicate with zinc and sodium at a temperature just blow the boiling point of zinc. Silicon is not attacked by acids with the exception of a mixture of nitric and hydrofluoric acids; it is soluble in hot caustic potash or soda, evolving hydrogen and forming the corresponding silicate (K_2SiO_3 or Na_2SiO_3). It was first prepared by Berzelius in 1823.

Silver [Anglo-Saxon, *soelfor*], Ag (argentum); at. wt. 107.880; at. no. 47; m.p. 960.5° C.; b.p. 1955° C.; sp. gr. 10.50; valence 1. Silver is a pure white metal having a brilliant luster, a little harder than gold and is excelled only by that metal in malleability and ductility; it excells all other metals as a conductor of heat and electricity; silver undergoes no change in water or pure air, but absorbs about 22 times its volume of oxygen when melted which is again expelled on cooling; it tarnishes in the vapors of sulfur compounds forming the sulfide (Ag_2S). It occurs native and in many ores, the chief ones being argentite (Ag_2S), stephanite (Ag_5SbS), pyragyrite (Ag_3SbS) and horn silver ($AgCl$); lead and copper ores yield considerable silver. Silver is obtained from the ores by smelting with lead or copper or by amalgamation with mercury. The most important compounds of silver are the nitrate ($AgNO_3$ or lunar caustic), the oxide (Ag_2O), and the halides ($AgCl$, $AgBr$) which darken on exposure to light an action of which is made use of in photography. The price of the metal in 1925 was about 68¢ an ounce.

Sodium [English, *soda*], Na (natrium); at. wt. 22.997; at. no. 11; m.p. 97.5° C.; b.p. 750° C.; sp. gr. 0.971; valence 1. Sodium is a soft, bright silvery metal belonging to the alkali group; it is never found free but is obtained by electrolysis of the hydroxide. On exposure to moist air it becomes coated with a film of the oxide and is preserved by immersing in kerosene or naphtha. It is very widely distributed in combination chiefly as common salt or sodium chloride. It decomposes water with the formation of hydrogen and the hydroxide of sodium; it burns in air with the formation of the peroxide (Na_2O_2); formerly it was used as a reducing agent in the preparation of metals (aluminum and magnesium); it is still used for the reduction of organic compounds, in the preparation of the peroxide and cyanide, and for keeping the mercury clean and active in gold extraction. The chief compounds are the chloride ($NaCl$), bromide ($NaBr$), iodide (NaI), carbonate (Na_2CO_3), bicarbonate ($NaHCO_3$), sulfate (Glaubers salt $Na_2SO_4.10H_2O$), nitrate (saltpeter $NaNO_3$), nitrite ($NaNO_2$), sulfite ($Na_2SO_3.7H_2O$), thiosulfate (hypo, $Na_2S_2O_3.5H_2O$), borate (borax $Na_2B_4O_7.10H_2O$) and hydroxide ($NaOH$). It was first isolated in 1807 by Davy.

Strontium [*Strontian*, town in Scotland], Sr; at. wt. 87.63; at. no. 38; m.p. 900° C.; b.p. . . . .; sp. gr. 2.54; valence 2. Strontium is a hard, yellowish metal belonging to the calcium group found chiefly in celestine ($SrSO_4$) and strontianite ($SrCO_3$). It is prepared by electrolysis of the fused chloride and resembles metallic calcium in its properties; the salts are generally soluble in water with the exception of the sulfate, phosphate and carbonate; they impart a brilliant crimson color to the flame and are used in pyrotechny for red fire. The most important salts are the bromide ($SrBr_2$), iodide (SrI_2), and carbonate ($SrCO_3$). The element was first obtained by Davy in 1808.

Sulfur [L. *sulfur*], S; at. wt. 32.064; at. no. 16; m.p. rhombic 112.8° C., monoclinic 119.3° C.; b.p. 444.7° C; sp. gr. rhombic 2.07; monoclinic 1.957; valence 2, 4, or 6. Sulfur occurs widely distributed in nature in the free form in Alabama, California, Colorado, Georgia, Idaho, Kentucky, Louisiana, Nevada, New Mexico, Tennessee, Texas, Utah, Wyoming and Sicily. In combination it occurs mostly as pyrites; sulfides of iron (FeS_2), cupreous and arsenical pyrites; sulfides of lead (galena), zinc (blende), mercury (cinnabar) and antimony (stibnite); it is also widely distributed in the form of the sulfates of calcium (gypsum), strontium (selenite) magnesium (Epsom salt) and barium (heavy spar). It is not practically obtained from the sulfates but is mined as native sulfur or molten underground by superheated steam, pumped up and allowed to solidify. It is purified by precipitation or sublimation. Sulfur is a pale yellow, odorless, brittle solid, which is insoluble in water and soluble in carbon disulfide. It occurs in two crystalline forms and an allotropic form known as plastic sulfur which is insoluble in carbon disulfide and which reverts to the crystalline form on standing; a finely divided form known as flowers of sulfur is obtained by sublimation. It readily forms compounds known as sulfides with many elements. Sulfur is chiefly employed for the preparation of sulfur dioxide, for fumigation, for the preparation of sulfuric acid, as a component of gunpowder and as a parasiticide. It is easily ignited in air burning to form the dioxide; it is a good electrical insulating material. The price of sulfur in 1925 was from 2¢ to 15¢ a pound depending upon the quality.

Tantalum [Gr. *tantalus*, myth], Ta; at. wt. 181.5; at. no. 73; m.p. 2910° C.; b.p. ....; sp. gr. 16.6; valence 5. Tantalum was discovered in 1802 by Ekeberg and occurs principally in the mineral Tantalite ($FeTa_2O_6$) and is prepared by reduction of potassium fluorotantalate (K_2TaF_7) with hydrogen followed by fusion in a vacuum. It can be drawn into a wire with a very high point of fusion and great tenacity which has been used in the construction of filaments for incandescent electric lamps. It is also used to alloy with other metals. It is soluble in fused alkalis, insoluble in acids and forms the oxide Ta_2O_5.

Tellurium [L. *tellus*, earth]. Te; at. wt. 127.5; at. no. 52; m.p. 451° C.; b.p. 1390° C.; sp. gr. 6.25; valence 4 or 6. Tellurium was discovered by Reichenstein in 1782 and occurs as gold telluride and with some copper ores. It is obtained by reduction of telluric oxide and forms a powder of grayish white metallic appearance. It is a semi-metallic element of the sulfur group and forms tellurides with hydrogen and metals similar to the sulfides; the compounds H_2TeO_3 and H_2TeO_4 are only slightly acid. The inhalation of the vapors of tellurium compounds produces the very offensive "tellurium breath". Tellurium is used in ceramics.

Terbium [*Ytterby*, town in Sweden], Tb; at. wt. 159.2; at. no. 65; m.p. ....; b.p. ....; sp. gr. ....; valence 3. Terbium was discovered by Mosander in 1843. It occurs in gadolinite and in the majority of ceria and yttria minerals. The terbium family of rare earths includes europium, gadolinium and terbium. None of the metals of the terbium family have been isolated. The general characters of this family resemble those of the cerium family. Among the rare earths the decrease in basicity is in the order Sa, Eu, Gd, Tb, Dy. The elements are all trivalent and yield colorless oxides of the type R_2O_3, altho terbium alone furnishes the higher oxide Tb_4O_7. The salts of terbium are generally less soluble than those of gadolinium. These salts are of the type RX_3 where X is a univalent atom or radical. Europium also forms salts of the type EuX_2. Europium is most sparsely distributed and gadolinium the most plentiful of these elements.

Thallium [Gr. *thallos*, budding twig], Tl; at. wt. 204.39; at. no. 81; m.p. 301.7° C.; b.p. 1280° C.; sp. gr. 11.85; valence 1 or 3. Thallium, a mtaellic element, discovered by Crookes in 1862 occurs in pyrites and is prepared from the flue dust of sulfuric acid works. The metal is obtained by heating thallium iodide with metallic sodium; it resembles lead having a hardness of 1.2 compared with 1.5 for lead; the malleability is high and the tenacity is low; it exists in two allotropic forms with a transition temperature of 226° C.; it is a poor conductor of electricity, tarnishes in air forming the oxide Tl_2O or the hydroxide TlOH in the presence of water; the element is displaced from solutions of its salts by zinc. Thallium salts are poisonous and have no commercial application.

Thorium [God *Thor*], Th; at. wt. 232.15; at. no. 90; m.p. above 1700° C.; b.p. . . . . ; sp. gr. 11.2; valence 4. Thorium was discovered by Berzelius in 1828 and occurs chiefly in thorite and other rare minerals. In the U. S. it is obtained chiefly from monazite which contains from 3 to 9 per cent of the oxide. The free element has been obtained by heating the double chloride or fluoride of thorium and potassium with metallic sodium or potassium. The element belongs to the tin group of metals. Thorium burns brightly in oxygen to form the oxide ThO_2 which is also obtained on heating the nitrate, a reaction which is made use of in the preparation of incandescent gas mantles. Thorium emits radiations similar but not identical with those of radium.

Thulium [*Thule*, Northland], Tm; at. wt. 169.4; at. no. 69; m.p. . . . . ; b.p . . . . ; sp. gr. . . . . ; valence 3. Thulium discovered in 1879 by Cleve belongs to the erbium family of the rare earths which includes dysprosium, holmium, erbium and thulium. They are characterized by their absorption spectra and the formation of highly colored salts; they form basic oxides of the type M_2O_3 with the following order of increasing basicity: thulium, erbium, holmium and dysprosium. They are obtained from xenotime, fergusonite, gadolinite, euxonite, polycrase and blomstrandine. The free elements have not been isolated.

Tin. [Anglo-Saxon, *tin*], Sn (stannum); at. wt. 118.70; at. no. 50; m.p. 231.9° C.; b.p. 2270° C.; sp. gr. gray, 5.85 at 15°; rhombic, 6.55; tetragonal, 7. 298 at 15°; valence 2 or 4. Tin is found chiefly in the mineral cassiterite (SnO_2) and is obtained by roasting to remove sulfur and arsenic, and smelting with powdered anthracite in a reverbatory furnace. It is a silver white, malleable and somewhat ductile metal with a low tenacity and highly crystalline structure; it takes a high polish and is used to coat other metals to prevent corrosion as it does not corrode easily in air. When heated in air it forms the dioxide (SnO_2) which is feebly basic forming stannate salts with basic oxides. The most important compound is the chloride ($SnCl_2.2H_2O$) which is used as a reducing agent and as a mordant in calico-printing. Tin is obtained chiefly from the Malay states, Bolivia, Banka, Billiton, Cornwall and Australia. The price of the metal was from 65¢ to 75¢ per pound in 1925.

Titanium [L. *Titanes*, sons of the earth], Ti; at. wt. 48.1; at. no. 22; m.p. 1800–1850° C.; b.p. . . . . ; sp. gr. 4.5; valence 3 or 4. Titanium was discovered by Gregor in 1789; it is a metallic element of the tin group which occurs naturally as the oxide (TiO_2) as rutile, brookite and anastase; it occurs also in various titanates, and with many iron ores. The free element is prepared by heating the oxide with aluminum or by electrolysis of the solution of the oxide in calcium chloride. It is a lustrous white metal which burns in air and is the only element which burns in nitrogen. The most important compounds are the oxide (TiO_2) which is feebly acidic and from which the titanates are derived; the halides (TiX_4) are volatile liquids, the nitrides (Ti_2N_2, Ti_3N_4) are metallic in appearance. It is used with steel to increase the tensile strength; most of the metallurgical titanium of the U. S. comes from the rutile of Virginia. The price of titanium oxide in 1925 was about 13¢ a pound.

Tungsten [Sw. heavy stone], W (wolframium); at. wt. 184.0; at. no. 74; m.p. 3400° C.; b.p. . . . . ; sp. gr. 18.7; valence 6. Tungsten, a metallic element, discovered by d'Elhujar in 1781, occurs in the form of the oxide (WO_3) in wolframite, hubnerite, scheelite. The free element is obtained by fusion of tungsten disulfide and calcium oxide in a graphite crucible by means of the electric arc. It is hard, brittle, nonmagnetic and forms the oxide when heated in air. The only solvent for tungsten is a mixture of nitric and hydrofluoric acids. It forms alloys with iron and manganese and imparts hardness to steel. It is used to make filaments for incandescent electric lamps.

Uranium [Planet *Uranus*], U; at. wt. 238.17; at. no. 92; m.p. near Mo at a bright red heat; b.p. . . . . ; sp. gr. 18.68; valence 4 or 6. Uranium was discovered by Klaproth in 1789; it occurs in pitchblende (as uranous uranate $U(UO_4)_2$). The free element is prepared by reduction of uranous chloride (UCl_4) with sodium and is a hard white metal; uranium is used chiefly in the form of the compounds which give a canary-yellow fluorescent glass, a black pigment for china painting and in photography. Uranium compounds emit rays although this property may be due to radium which contaminates the uranium.

Vanadium [Goddess *Vanadis*], V; at. wt. 50.96; at. no. 23; m.p. 1720–1780° C.; b.p. . . . . ; sp. gr. 5.69; valence 3 or 5. Vanadium is a rare metallic element discovered by Sefström in 1830 and occurs in mettramite (a lead-copper vanadate) and vanadinite (a lead vanadate); the free element is obtained by reduction of the chloride in hydrogen forming a gray and very infusible metal. When alloyed with steel it increases the hardness. The vanadates are employed in the preparation of aniline black and for coloring glass.

Xenon [Gr. *xenos*, strange], Xe; at. wt. 130.2; at. no. 54; m.p. −140° C.; b.p. −109.1° C.; sp. gr. 4.422 (A); sp. gr. liquid, 3.52 valence 0. Xenon was discovered by Ramsay and Travers in 1895 in the residue left on evaporating liquid air. It is the rarest and heaviest of the gases of the argon family and is present in the atmosphere to the extent of about one part in twenty million. It is inert and forms no compounds with other elements.

Ytterbium [*Ytterby*, town in Sweden], Yb; at. wt. 173.6; at. no 70; m.p. . . . .; b.p. . . . .; sp. gr. . . . .; valence 3. The ytterbium family of earths includes ytterbium and lutecium of which very little is known, both of which have been obtained from the ytterbium separated by Marignac in 1878. In 1907 Urbain and in 1908 von Welsbach described a process by whch this ytterbium could be resolved into two elements, —neo-ytterbium, or simply ytterbium, and lutecium. These elements occur in nearly all the minerals which contain yttrium but in very small amounts. The best sources are probably gadolinite, xenotime. polycrase and blomstrandine. The oxides, chlorides and sulfates of these elements have been prepared.

Yttrium [*Ytterby*, town in Sweden], Y; at. wt. 88.9; at. no. 39; m.p. 1490° C.; b.p. 2500° C.; sp. gr. 3.8; valence 3. Yttrium is a metallic element belonging to the rare earths. Yttria was discovered by Gadolin in 1794 and in 1842 Mosander showed that yttria could be resolved into three others, the name yttria being reserved for the most basic one, the others were named erbia and terbia. Wöhler obtained the free element by reduction of the chloride with potassium; it has also been obtained by electrolysis of a mixture of the chloride and sodium chloride. The metal forms small scales with a metallic luster and an iron-grey color; it is readily oxidized in air and is converted to the hyroxide by boiling water. Yttrium occurs in nearly all the rare earths but mostly in gadolinite, xenotime, euxonite, polycrase and samarskite.

Zirconium [Per. *argun*. gold color], Zr; at. wt. 91.00; at. no. 40; m.p. 2350° C.; b.p. . . . .; sp. gr. 6.25; valence 4. Zirconium was discovered by Berzelius in 1824 and occurs as the silicate in zircon and hyacinth. It is prepared from the fluorine-potassium compound by displacement with aluminum or sodium and forms silvery grey scales or an amorphous black powder. The oxide has been used in the preparation of incandescent gas mantles, in paints and lacquers, in insulators, as an abrasive and colored varieties of the naturally occuring silicates are used as gems. The price of the pure oxide in 1925 was about 45¢ to 50¢ per pound.

Zinc [G. *Zink*], Zn; at. wt. 65.38; at. no. 30; m.p. 419.4° C.; b.p. 930° C.; sp. gr. 7.00–7.19; valence 2. Zinc is a metallic element occuring in nature only in combination with other elements. The principle ores are the sulfide (sphalerite, or blende), the carbonate (smithsonite), the oxide (zincite), the silicates (willemite and calamine). It is a bluish-white metal which is brittle at ordinary temperatures but becomes malleable at 100° C., a fair conductor of electricity and burns in air at a high red heat with evolution of white clouds of the oxide. It is used to alloy with other metals — e. g., with copper it forms brass.

Galvanizing consists in coating other metals with zinc to prevent corrosion. It is used as the negative electrode in various types of electric batteries. The most important compounds are the oxide, the sulfate and the chloride. The price of the metal in 1925 was about 8c to 10c per pound.

PHYSICAL CONSTANTS OF

The following table gives data for over two thousand compounds. It is intended to include all inorganic compounds concerning which definite information is available.

The molecular weights are computed to the nearest hundredth from the atomic weights of 1925.

Specific gravities are given for definite temperatures where possible, the temperature in degrees Centigrade being indicated by the small figures appearing in the position of an exponent. Unless otherwise indicated the values are referred to water at 4° C. The figures $5.63^{20°}_{15°}$ indicate a specific gravity of 5.63 at 20° C. referred to water at 15° C.

In all cases where temperatures are not stated ordinary room temperatures may be understood (15–25° C.).

Boiling points are given at atmospheric pressure unless otherwise indicated.

Solubilities have been given in definite figures and the temperatures stated, where possible, in the same form as for specific gravity.

The following abbreviations are employed: —

a. ....acid
acet. ....acetone
acet. a. ....acetic acid
al. ....alcohol
alk. ....alkali
amor. ....amorphous
appr. ....approximately
aq. ....aqua, water
aq. reg. ....aqua regia
asym. ....asymmetrical
atm. ....atmospheres
bl. ....blue
blk. ....black
br. ....brown

	Name	Formula	Mol. wt.	Crystalline form and color
1	Acetic acid	$HC_2H_3O_2$	60.03	liq., colorl.
2	Aluminum	Al	26.97	octahdr., silvery
3	acetate, normal	$Al(C_2H_3O_2)_3$	204.04	wh. powd.
4	acetate, basic	$Al(C_2H_3O_2)_2OH$	162.03	amor., wh.
5	arsenate	$AlAsO_4$	165.93	
6	bromate	$Al(BrO_3)_3.9H_2O$	572.86	cryst.
7	bromide	$AlBr_3$	266.72	
8	bromide	$AlBr_3.6H_2O$	374.81	colorl. cryst.
9	carbide	Al_4C_3	143.88	yel., hex.
10	chlorate	$Al(ClO_3)_3.6H_2O$	385.44	rhbdr.
11	chloride	$AlCl_3$	133.34	wh. powd.
12	chloride	$AlCl_3.6H_2O$	241.44	
13	fluoride	AlF_3	83.97	
14	fluoride	$Al_2F_6.7H_2O$	294.05	wh. cryst. powd.
15	hydroxide	$Al(OH)_3$	77.99	wh., amor.
16	iodide	AlI_3	407.77	brown* cryst.
17	iodide	$AlI_3.6H_2O$	515.86	white
18	nitride	Al_2N_2	81.96	yel. cryst.
19	nitrate	$Al(NO_3)_3.9H_2O$	375.14	rhombic
20	oxide	Al_2O_3	101.94	hex., amor., white
21	oxide	$Al_2O_3.H_2O$	119.16	trimetric
22	oxide	$Al_2O_3.2H_2O$	137.97	amor.
23	phosphate	$AlPO_4$	122.00	hex., amor., white
24	potassium tartrate	$KAl(C_4H_4O_6)_2$	362.13	

* Due to free iodine.

INORGANIC COMPOUNDS

chl.	chloroform	monocl.	monoclinic
colorl.	colorless	need.	needles
conc.	concentrated	octahdr.	octahedral
cryst.	crystalline	or	orange
d.	decomposes	pa.	pale
dec.	decomposes	pl.	plates
deliq.	deliquescent	powd.	powder
dil.	dilute	pr.	prisms
dk.	dark	reg.	regular
eth.	ether	rhomb.	rhombic
ex.	excess	rhbdr.	rhombohedral
gel.	gelatinous	s.	soluble
glyc.	glycerine	sl.	slightly
gr.	gray	subl.	sublimes
grn.	green	tabl.	tablets
h.	hot	tetrag.	tetragonal
hex.	hexagonal	tricl.	triclinic
hyg.	hygroscopic	trim.	trimetric
i.	insoluble	volt.	volatilizes
ind.	indigo	v.	very
lt.	light	wh.	white
liq.	liquid	yel.	yellow
met.	metallic	∞	soluble in all proportions
meth.	methyl		
min.	mineral		

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	$1.0607^{15°}_{4}$	16.7	118.1	∞	∞	s. al.
2	2.71	658.7	1800	i.	i.	s. alk.; s. HCl, H_2SO_4
3	....	d.	....	s.	dec.	
4	....	d.	....	i.	....	s. a.; i. NH_4 salts
5	....	....	....	i.	i.	sl. s. a.
6	....	62.3	d. 100	hyg.		
7	2.54	93	263.3^{747mm}	s.	....	s. CS_2, al.
8	....	....	....	deliq.	s.	s. CS_2, al.
9	2.36	....	....	dec. to CH_4	....	s. a.
10	....	d.	....	v. s.	v. s.	
11	....	190, 2½ atm.	$182.7^{752mm.}$	$69.87^{15°}$	s.	s. chl., CCl_4, eth., CS_2
12	....	....	....	40	v. s.	s. eth.; 50 al
13	3.10	....	....	s.	s.	
14	....	$-4H_2O$, 120	$-6H_2O$, 250	i.	sl. s.	
15	2.42	$-2H_2O$, 300	....	i.	i.	s. a.; s. alk.
16	2.63	185	360	s.		
17	....	....	....	v. s.	v. s.	s. al., CS_2
18	....	2150	....	dec. slowly	....	s. alk.
19	....	73	d. 134	v. s.	v. s., dec.	s. al., CS_2
20	3.75–4.00	2050	....	i.	i.	s. alk., H_2SO_4, HCl
21	3.43	....	....	i.	i.	i. a., alk.
22	....	....	....	i.	i.	i. a., alk.
23	2.54–.59	....	....	i.	i.	s. a., alk.; i. acet. a.
24	....	....	....	s.	s.	

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Aluminum sodium chloride	$AlCl_3.NaCl$	191.80	
2	sodium fluoride	$AlF_3.3NaF$	209.96	
3	sulfate	$Al_2(SO_4)_3$	342.13	cryst., wh.
4	sulfate	$Al_2(SO_4)_3.18H_2O$	666.42	monocl. colorl.
5	sulfide	Al_2S_3	150.13	hex. need. yel.
6	Alum, ammonium	$Al_2(SO_4)_3.(NH_4)_2SO_4.24H_2O$	906.66	Colorl. cryst.
7	ammonium, chrome	$Cr_2(SO_4)_3.(NH_4)_2SO_4.24H_2O$	956.74	octahdr. grn. or violet
8	ammonium, iron	$Fe_2(SO_4)_3.(NH_4)_2SO_4.24H_2O$	964.40	reg. violet
9	caesium	$Al_2(SO_4)_3.Cs_2SO_4.24H_2O$	1136.20	
10	potassium	$Al_2(SO_4)_3.K_2SO_4.24H_2O$	948.77	regular
11	potassium, chrome	$Cr_2(SO_4)_3.K_2SO_4.24H_2O$	998.85	reg., green
12	potassium, iron	$Fe_2(SO_4)_3.K_2SO_4.24H_2O$	910.45	reg., violet
13	potassium, manganese	$Mn_2(SO_4)_3.K_2SO_4.24H_2O$	909.63	reg., violet
14	rubidium	$Al_2(SO_4)_3.Rb_2SO_4.24H_2O$	1041.46	
15	sodium	$Al_2(SO_4)_3.Na_2SO_4.24H_2O$	916.57	regular
16	thallium	$Al_2(SO_4)_3.Tl_2SO_4.24H_2O$	1279.36	
17	Ammonia	NH_3	17.03	colorl. gas
18	Ammonium acetate	$NH_4C_2H_3O_2$	77.06	wh. hyg. cryst.
19	antimonate	$NH_4SbO_3.2H_2O$	223.84	cryst.
20	auricyanide	$Au(CN)_3.NH_4CN.H_2O$	337.29	plates
21	aurocyanide	$AuCN.NH_4CN$	267.26	
22	arsenate	$(NH_4)_3AsO_4.3H_2O$	247.13	
23	arsenite	NH_4AsO_2	125.00	prisms
24	benzoate	$NH_4C_7H_5O_2$	139.08	colorl. cryst.
25	borofluoride	NH_4BF_4	104.86	hex. prisms
26	bromide	NH_4Br	97.96	reg., colorl.
27	bromoplatinate	$(NH_4)_2PtBr_6$	710.81	red reg.
28	carbonate	$(NH_4)_2CO_3.H_2O$	114.10	pl., colorl
29	carbonate, acid	NH_4HCO_3	79.05	rhomb. or monocl.
30	carbonate, carbamate	$NH_4HCO_3.NH_4CO_2NH_2$	157.11	wh. cryst.
31	carbonate, sesqui	$(NH_4)_2CO_3.2NH_4HCO_3.H_2O$	272.20	
32	chloraurate	$(NH_4AuCl_4)_4.5H_2O$	1518.35	yel. monocl.
33	chlorate	NH_4ClO_3	101.50	monocl.
34	chloride	NH_4Cl	53.50	tetrag.
35	chloroiridate	$(NH_4)_2IrCl_6$	441.92	reddish br.
36	chloropalladate	$(NH_4)_2PdCl_6$	355.52	br. red
37	chloropalladite	$(NH_4)_2PdCl_4$	284.61	olive grn. need
38	chloroplatinate	$(NH_4)_2PtCl_6$	444.05	yel. reg.
39	chloroplatinite	$(NH_4)_2PtCl_4$	373.14	tetrag.
40	chlorostannate	$(NH_4)_2SnCl_6$	367.52	
41	chromate	$(NH_4)_2CrO_4$	152.09	monocl. yel.
42	citrate	$(NH_4)3C_6H_5O_7$	243.16	wh. powd.
43	cyanate	NH_4CNO	60.05	
44	cyanide	NH_4CN	44.05	regular

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	....	185	....	s.	s.	
2	2.9–3.08	....	....	sl. s.	....	i. HCl
3	$2.672^{22.5°}$	d. 770	....	30.1[illegible]	80.1[illegible]	
4	1.62	d.	....	85.85[illegible]	113[illegible]	i. al.
5	2.02[illegible]	1100	....	dec.	....	s. a.
6	1.645[illegible]	94.5	$-20H_2O$, 120; $-24H_2O$, 200	3.9[illegible]	357[illegible]	i. al.
7	1.719	....	....	$3.95^{0°}$, 151[illegible]	....	s. al.
8	1.712	....	....	40[illegible]	4[illegible]	i. al.
9	$2.021^{0°}$	117	....	0.4211[illegible]	$31.3^{100°}$	
10	1.757[illegible]	92	$-18H_2O$, 64.5	5.2[illegible]	422[illegible]	
11	$1.8128^{0°}$	89	....	20	50	i. al.
12	1.806	....	....	$20^{12.5°}$	v.	i. al.
13	....	....	....	dec.		
14	1.87	99	....	$1.3^{0°}$	43.25[illegible]	
15	$1.675^{20°}_{4}$	61–5	....	$103.1^{10°}$	146.3[illegible]	i. al.
16	2.32	....	....	$4.84^{0°}$	65.1[illegible]	
17	(A) 0.5971 Liq. 0.6234[illegible]	−77.34	−38.5	$89.9^{0°}$ g 104,960 c.c.	7.4[illegible] g 58,594[illegible] c.c.	14.8[illegible] al.; s. eth.
18	....	89	....	148[illegible]		
19	....	d.	....	i.		
20	....	d. 290	....	s.	v. s.	i. al.
21	....	d. 150–200	....	s.	....	s. alk.
22	....	....	....	s.		
23	....	....	....	v. s.	....	s. alk.
24	....	d. 193	....	$19.6^{14.5°}$	$83.3^{100°}$	3.57[illegible], $13.2^{78°}$ al.
25	$1.851^{17°}$	....	....	s.		
26	$2.327^{15°}_{4}$	subl.	....	$68^{10°}$	$145.6^{100°}$	s. al., eth.
27	1.265[illegible]	d	....	$0.59^{20°}$		
28	....	d. 85	....	$100^{15°}$	....	i. al.
29	1.586	d. 36–60	....	$11.9^{0°}$	$27^{30°}$	i. al.
30	....	subl.	....	$25^{15°}$	$67^{65°}$	
31	....	d	....	$25^{13°}$	$50^{49°}$	
32	....	$-5H_2O$, 100	....	s.	....	s. al.
33	....	expl. 102	....	s.	....	s. al.
34	$1.52^{17°}$	d. 350	....	$29.4^{0°}$	$77.3^{100°}$	sl. s. al. NH_3, meth. al.
35	2.856	....	....	$0.7^{14°}$	$2.8^{69°}$	
36	2.418	d.	....	s.		
37	....	d.	....	v. s.	....	i. al.
38	3.034[illegible]	d.	....	$0.67^{20°}$	$1.25^{100°}$	0.005 al.
39	....	d.	....	s.	v. s.	
40	2.511	....	....	$33.33^{15°}$		
41	$1.866^{11°}$	d. 180	....	$40^{30°}$	dec.	
42	....	....	....	s., deliq.		
43	....	d.	....	s.	dec.	sl. s. al.
44	....	d. 36	....	s.	v. s.	s. al.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Ammonium dichromate	$(NH_4)_2Cr_2O_7$	252.10	monocl. orange
2	dithionate	$(NH_4)_2S_2O_6$	196.21	monocl.
3	ferric oxalate	$(NH_4)_3Fe(C_2O_4)_3.4H_2O$	446.02	lt. grn. cryst.
4	ferrocyanide	$(NH_4)_4Fe(CN)_6.6H_2O$	392.14	monocl.
5	fluoride	NH_4F	37.04	hex.
6	fluoride acid	$NH_4F.HF$	57.05	rhombic
7	fluosilicate	$(NH_4)_2SiF_4$	140.14	
8	formate	NH_4CHO_2	63.05	monocl.
9	gallate	$NH_4C_7H_5O_5.H_2O$	205.10	
10	hypophosphite	$NH_4H_2PO_2$	83.08	rhombic tabl.
11	iodate	NH_4IO_3	192.97	rhombic
12	iodide	NH_4I	144.97	regular
13	magnesium arsenate	$MgNH_4AsO_4.6H_2O$	289.42	tetrag.
14	magnesium phosphate	$MgNH_4PO_4.6H_2O$	245.48	tetrag.
15	metavanadate	NH_4VO_3	117.00	cryst.
16	molybdate	$(NH_4)_2MoO_4$	196.08	monocl.
17	molybdate, hepta-	$(NH_4)_6Mo_7O_{24}.4H_2O$	1236.30	monocl. colorl.
18	nitrate	NH_4NO_3	80.05	rhomb. or tetrag., colorl.
19	nitrite	NH_4NO_2	64.05	yel. liq.
20	oxalate	$(NH_4)_2C_2O_4.H_2O$	142.10	trimet. pr.
21	oxalate, acid	$NH_4HC_2O_4.H_2O$	125.06	trimet. pr.
22	perchlorate	NH_4ClO_4	117.50	rhombic
23	perchromate	$(NH_4)_3CrO_8$	234.13	red, octahdr.
24	permanganate	NH_4MnO_4	136.97	rhombic
25	persulfate	$(NH_4)_2S_2O_8$	228.21	monocl.
26	phosphate, di-	$(NH_4)_2HPO_4$	132.12	monocl., colorl.
27	phosphate, meta-	$(NH_4)_4P_4O_{12}$	388.27	tetrag.
28	phosphate, mono-	$NH_4H_2PO_4$	115.08	tetrag.
29	phosphite	$NH_4H_2PO_3$	99.08	colorl. deliq.
30	phosphomolybdate	$(NH_4)_3PO_4.12MoO_3.3H_2O$	1931.20	yellow
31	salicylate	$NH_4C_7H_5O_3$	155.08	monocl.
32	selenate	$(NH_4)_2SeO_4$	179.28	rhombic or monocl.
33	stannic chloride	$(NH_4)_2SnCl_6$	367.52	reg.
34	sulfate	$(NH_4)_2SO_4$	132.14	rhomb., colorl.
35	sulfate, acid	NH_4HSO_4	115.11	rhombic
36	sulfide	$(NH_4)_2S$	68.14	
37	sulfide, penta-	$(NH_4)_2S_5$	196.40	or.-red pr.
38	sulfite	$(NH_4)_2SO_3.H_2O$	134.16	monocl. colorl.
39	sulfite, acid	NH_4HSO_3	99.11	rhombic
40	sulfhydrate	NH_4HS	51.11	rhombic, colorl.
41	sulfocyanate	NH_4CNS	76.11	monocl. colorl.
42	tartrate	$(NH_4)_2C_4H_4O_6$	184.11	colorl. monocl.
43	tartrate, acid	$NH_4HC_4H_4O_6$	167.08	colorl.
44	thiocarbonate	$(NH_4)_2CS_3$	144.27	yellow
45	thiosulfate	$(NH_4)_2S_2O_3$	148.21	rhombic
46	tungstate, meta-	$(NH_4)_2W_4O_{13}.8H_2O$	1124.21	octahdr.
47	tungstate, para-	$(NH_4)_6W_7O_{24}.6H_2O$	1888.34	rhombic
48	Antimonic acid, meta-	$HSbO_3$	170.78	
49	Antimonic acid, ortho-	H_3SbO_4	188.79	

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water	Hot water	Alcohol, acids, etc.
1	2.367	d.	....	$47.1^{30°}$	v. s.	
2	1.704	....	....	v. s.	....	i. al.
3	$1.775^{17°}$	$-3H_2O$, 100	d. 165	$42.8^{0°}$	$345^{100°}$	
4	....	....	....	s.	....	i. al.
5	....	....	....	v. s.	dec.	sl. s. al.
6	$1.211^{12°}_{2}$	....	....	v. s.		
7	....	....	....	$18.5^{17.5°}$		
8	1.266	d.	....	$102^{0°}$	$531^{80°}$	
9	....	....	....	s.		
10	....	100	....	s.	s.	v. s. al.
11	3.31-.34	d. 150	....	$2.6^{15°}$	$14.5^{100°}$	
12	2.515	subl.	d.	v. s.	v. s.	v. s. al.
13	....	....	....	$0.038^{20°}$	s.	i. al.; s. a.
14	1.65	....	....	0.0132	....	i. al.; s. a.
15	....	d.	....	sl. s.	v. s.	i. NH_4Cl
16	2.38-.05	d.	....	dec.	dec.	i. al.
17	....	....	....	s.		
18	$1.725^{15°}$	153-66	d. 210	$118^{0°}$	$871^{100°}$	$3.8^{20°}$ al.
19	1.69	d.	....	s.	dec.	s. al.
20	1.502	....	....	$4.2^{15°}$	41.34	
21	1.556	....	....	s.		
22	1.95	d.	....	s.	v. s.	
23	....	d. 50	....	sl. s.	....	sl. s. NH_3; i. al., eth.
24	2.208	d.	....	$8^{15°}$		
25	....	d.	....	$58.2^{0°}$		
26	1.619	....	....	25	....	i.
27	....	....	....	s.		
28	$1.803^{18°}_{4}$	....	....	$171^{0°}$	$260^{30°}$	
29	....	123	d. 150	s.		
30	....	....	....	$0.03^{15°}$	i.	i. al., HNO_3; s. alk.
31	....	....	....	$111^{25°}$	s.	$43.5^{20°}$, $100^{79°}$ al.
32	$2.197^{18°}$	d.	....	$117^{7°}$	$197^{100°}$	
33	2.511	....	....	33		
34	$1.769^{20°}_{4}$	*600	d. 140	$71^{0°}$	$103^{100°}$	i. al.
35	1.787	....	....	100		
36	....	dec.	....	v. s.		
37	....	....	....	s.		
38	....	d.	....	$100^{12°}$	....	i. al.
39	....	d.	....	s.		
40	....	d.	....	v. s.	....	s. al.
41	$1.3057^{13°}$	159	d. 170	$122^{0°}$	$162^{20°}$	s. al.
42	1.601	....	....	s.	s.	
43	1.689	....	....	sl. s.	....	i. al.; s. a., alk.
44	....	subl.	....	v. s.	....	i. al., eth.
45	....	....	....	s.		
46	....	$-7H_2O$, 100	....	120		i. al., eth.
47	....	$-4H_2O$, 100	....	$2.8^{15°}$	$4.5^{22°}$	
48	6.6	d.	....	sl. s.	sl. s.	s. a., KOH
49	6.6	d.	....	sl. s.	sl. s.	

* Under pressure.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Antimonic acid, pyro-	$H_4Sb_2O_7$	358.57	
2	Antimonous acid	H_3SbO_3	172.79	
3	Antimony	Sb	121.77	hex. rhomb. white
4	bromide (butter of Sb)	$SbBr_3$	361.52	rhombic
5	chloride, tri-	$SbCl_3$	228.14	rhombic
6	chloride, penta-	$SbCl_5$	299.06	liq.
7	fluoride, tri-	SbF_3	178.77	octahdr.
8	fluoride, penta-	SbF_5	216.77	oily, liq.
9	hydride (stibene)	SbH_3	124.79	gas
10	iodide, tri-	SbI_3	502.57	hex., rhomb., monocl., red-yel.
11	oxide, tri-	Sb_2O_3	291.54	rhombic or regular
12	oxide, tetra-	Sb_2O_4	307.54	white
13	oxide, penta-	Sb_2O_5	323.54	yellow
14	oxychloride (ous)	SbOCl	173.23	monocl., white
15	oxychloride (ic)	$SbOCl_3$	244.14	yellow
16	sulfate	$Sb_2(SO_4)_3$	531.73	wh. powd
17	sulfide, tri-	Sb_2S_3	339.73	hex. black
18	sulfide, penta-	Sb_2S_5	403.86	orange
19	Antimonyl potassium tartrate	$K(SbO)C_4H_4O_6.\frac{1}{2}H_2O$	333.91	octahdr.
20	sulfate, basic	$(SbO)_2SO_4.Sb_2(OH)_4$	683.18	
21	sulfate, normal	$(SbO)_2SO_4$	371.60	
22	Arsenic cryst	As_4	299.84	gray rhbdr.
23	Arsenic amorphous	As_4	299.84	black
24	acid, meta-	$HAsO_3$	123.97	
25	acid, ortho-	$H_3AsO_4.\frac{1}{2}H_2O$	150.99	
26	acid, pyro-	$H_4As_2O_7$	265.95	
27	fluoride	AsF_5	169.96	gas
28	iodide, di-	AsI_2	328.82	
29	pentoxide	As_2O_5	229.92	amor.
30	sulfide, di- (realgar)	As_2S_2	213.05	monocl. red
31	sulfide, penta-	As_2S_5	309.24	yellow
32	Arsenous bromide	$AsBr_3$	314.71	prisms
33	chloride	$AsCl_3$	181.33	need., oily liq.
34	fluoride	AsF_3	131.96	oily liq.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	....	$-H_2O$, 200	....	sl. s.	sl. s.	s. KOH
2	....	d.	....	i.	i.	i. al.
3	[illegible]	30	1440	i.	i.	s. h. conc. H_2SO_4, aq. rg.
4	[illegible]	[illegible]4.2	280	dec.	dec.	s. HCl, HBr, CS_2, al.
5	3.064[illegible]	73.2	223.5	601.6$^{0°}$	4531[illegible]	s. al., HCl, $H_2C_4H_4O_6$
6	2.346[illegible]	−6	102[illegible] mm	dec.	dec.	s. HCl
7	4.379[illegible]	[illegible]	subl.	21.3$^{0°}$	31.3[illegible]	
8	2.990[illegible]	....	155	s.	....	s. KF
9	(A) 4.344[illegible]	−91.5	−18, d. 150	20 cc.	4 c.c.	[illegible] c.c. al., 2500 c.c. CS_2
10	4.848$^{26°}$	170.8	401	dec.	dec.	s. al., HI, HCl, KI, CS_2
11	3.70–.72, 5.2–.6	....	1550	0.00182$^{15°}$	0.01	s. HCl, KOH, $H_2C_4H_4O_6$
12	3.8–4.0	O, 1060	....	i.	i.	s. HCl, KOH, HI; sl. s. a.
13	3.78	O, 450	2O 1060	i.	i.	s. HCl, KOH, HI
14	....	....	....	i.	dec.	i. al.; s. HCl, CS_2
15	....	d.	....	i.	dec.	s. al.
16	4.80	d.	....	dec.	dec.	s. H_2SO_4
17	4.62	555	....	0.000175	dec.	s. alk., NH_4HS, K_2S, HCl
18	4.120[illegible]	....	....	i.	i.	s. alk., NH_4HS, HCl
19	2.6	$-\frac{1}{2}H_2O$ 100	....	5.26$^{8.7°}$	35.7$^{100°}$	i. al.; s. glyc.
20	....	....	....	i.	dec.	5.15[illegible] glyc.
21	4.89	....	....	dec.	dec.	
22	5.727$^{14°}$	subl.*	....	i.	i.	s. HNO_3
23	4.716$^{14°}$	....	....	i.	i.	s. HNO_3, Cl_2 H_2O, aq. reg., hot alk.
24	....	d.	....	Forms orth	o arsenic ac	id
25	2.00–.50	35.5	$-H_2O$, 160	16.7	50	s. alk.
26	....	d. 206	....	Forms orth	o arsenic ac	id
27	(D) 5.964	−80	−53	s.	....	s. alk., al., eth.
28	....	d.	....	....	....	s. al., eth., CS_2, chl.
29	4.086	....	d.	150	v. s.	s. alk.
30	3.55	307	565	i.	i.	s. K_2S, $NaHCO_3$
31	....	....	subl.	i.	i.	s. alk., HNO_3
32	3.66$^{15°}_{15°}$	31	221	dec.	dec.	s. HBr, HCl
33	2.205$^{0°}_{4}$	−18	130.2	dec.	dec.	s. HBr, HCl
34	2.73	−8.5	63	dec.	dec.	s. al., eth.

* Melts at 500° under pressure, sublimes without melting 446–457.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Arsenous hydride (arsine)	AsH_3	77.98	gas
2	iodide	AsI_3	455.76	red, hex.
3	oxide	As_2O_3	197.92	reg., amor. white
4	oxychloride	$AsOCl$	126.42	
5	phosphide	AsP	105.99	brown
6	selenide	As_2Se_3	387.52	
7	sulfide (orpiment)	As_2S_3	246.11	monocl. yel. or red
8	Auric. *see gold*			
9	Barium	Ba	137.37	yellowish metal
10	acetate	$Ba(C_2H_3O_2)_2.H_2O$	273.43	prisms
11	arsenate	$Ba_3(AsO_4)_2$	690.83	black
12	arsenate, acid	$BaHAsO_4.H_2O$	295.35	white cryst.
13	boride	BaB_6	202.29	black reg.
14	bromate	$Ba(BrO_3)_2.H_2O$	411.22	monocl.
15	bromide	$BaBr_2$	297.20	
16	bromide	$BaBr_2.2H_2O$	333.23	monocl.
17	butyrate	$Ba(C_4H_7O_2)_2.2H_2O$	341.51	
18	carbide	BaC_2	161.37	gray crystals
19	carbonate	$BaCO_3$	197.37	rhombic, white
20	chlorate	$Ba(ClO_3)_2.H_2O$	322.30	monocl.
21	chloride	$BaCl_2$	208.28	
22	chloride	$BaCl_2.2H_2O$	244.32	rhombic
23	chloroplatinate	$BaPtCl_6.4H_2O$	617.41	monocl. red
24	chloroplatinite	$BaPtCl_4.3H_2O$	528.48	
25	chromate	$BaCrO_4$	253.38	rhombic yel. pl.
26	citrate	$Ba_3(C_6H_5O_7)_2.7H_2O$	916.30	
27	cyanide	$Ba(CN)_2$	189.39	
28	dichromate	$BaCr_2O_7$	353.39	red monocl. pr.
29	dichromate	$BaCr_2O_7.2H_2O$	389.42	yel. need.
30	dithionate	$BaS_2O_6.2H_2O$	333.53	rhombic
31	ferrocyanide	$Ba_2Fe(CN)_6.6H_2O$	594.72	yel. monocl.
32	fluoride	BaF_2	175.37	wh. powd.
33	fluosilicate	$BaSiF_6$	279.43	
34	fluobromide	$BaBr_2.BaF_2$	472.57	plates
35	fluochloride	$BaCl_2.BaF_2$	383.65	plates
36	fluoiodide	$BaI_2.BaF_2$	566.60	plates
37	formate	$Ba(CHO_2)_2$	227.39	monocl.
38	hexanitride	$BaN_6.H_2O$	239.43	cryst.
39	hydride	BaH_2	139.39	cryst.
40	hydroxide	$Ba(OH)_2.8H_2O$	315.51	tetrag. wh.
41	hypophosphate	$BaPO_3$	216.40	need.
42	hypophosphite	$Ba(H_2PO_2)_2.H_2O$	285.47	monocl.
43	iodate	$Ba(IO_3)_2.H_2O$	505.25	monocl.
44	iodide	$BaI_2.2H_2O$	427.27	rhombic
45	malate	$BaC_4H_4O_5$	269.40	

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of: Cold water	Hot water	Alcohol, acids, etc.
1	(A) 2.6[illegible]5	−113.5	−54.8, d. 230	5.1 vol.	sl. s.	sl. s. alk.
2	4.39[illegible]°	14[illegible].7	3[illegible]4–411	....	$30^{100°}$	s. al., eth.
3	3.65–4.15	218 subl.	....	$1.2006^{20°}$	$2.038^{25°}$	s. alk., alk carb., HCl, al.
4	....	....	....	dec.	dec.	
5	....	....	....	dec.	dec.	s. CS_2; i. al., eth.
6	4.75	360	....	i.	dec.	s. alk.
7	3.46	310	>700	0.00005	sl. s.	s. alk., alk. carb.
8						
9	3.78	850	950	dec.	dec.	s. al., a.
10	2.02	d.	....	$6.9^{30°}$	$80.5^{99°}$	i. al.
11	....	....	....	0.055	....	s. a., NH_4Cl
12	....	$-H_2O$, 150	$-1\frac{1}{2}H_2O$, 225			
13	$1.36^{15°}$	....	....	i.	i.	s. HNO_3
14	3.82	d.	....	$0.3^{0°}$	$5.67^{100°}$	
15	$3.852^{24°}_{4}$	$-2H_2O$, 100	d.	$125^{0°}$	$181.7^{100°}$	v. s. meth. al.
16	$4.781^{24°}_{4}$	880	d.	$98^{0°}$	$149^{100°}$	
17	....	....	....	$37.4^{20°}$	$42.1^{280°}$	
18	3.75	....	....	d. to C_2H_2	....	d. a.
19	4.275	d. $-CO_2$	....	$0.0022^{20°}$	$0.0065^{100°}$	i. al.; s. a., NH_4Cl
20	3.179	414	....	$19.2^{3°}$	$111.2^{100°}$	sl. s. al.
21	$3.856^{24°}_{4}$	[illegible]55	....	$30.9^{0°}$	$62.7^{100°}$	i. al.; sl. s.
22	$3.097^{24°}_{4}$	$-2H_2O$, 100	....	$36.2^{0°}$	$73.5^{100°}$	HCl, HNO_3
23	2.86	....	....	s.	....	d. a.
24	2.868	....	....	s.	....	v. s. 93% al.
25	$4.498^{15°}$	....	....	$0.00035^{18°}$	0.0043	s. HCl, HNO_3
26	....	....	....	$0.0406^{18°}$	....	sl. s. al.
27	....	....	....	$80^{14°}$	....	$18^{14°}$ al.
28	....	....	....	sl. s.	....	s. h. conc. H_2SO_4
29	....	....	....	dec.		
30	5.6	....	....	$24.75^{18°}$	$90.9^{100°}$	
31	....	....	....	$0.1^{15°}$	$1^{75°}$	
32	4.828	1280	....	$0.163^{18°}$	sl. s.	s. a., NH_4Cl
33	$4.28^{15°}$	....	....	$0.026^{17°}$	$0.09^{100°}$	i. al.; sl. s. HCl, NH_4Cl
34	4.96	....	....	dec.	dec.	
35	$4.51^{18°}$	....	....	dec.	dec.	i. al.; s. conc. HCl, HNO_3
36	5.21	....	....	dec.	dec.	
37	3.212	....	....	$27.76^{0°}$	$39.71^{80°}$	i. al., eth.
38	....	expl.	....	v. s.	v. s.	
39	$4.21^{0°}$	....	1400	dec.	dec.	
40	1.656	80; $-7H_2O$, 95°	108; $-8H_2O$, 780	$5.56^{15°}$	$182.7^{80°}$	s. al.; i. eth.
41	....	....	....	sl. s.	....	s. al.
42	2.875	....	....	29	33	i. al.
43	5.23	$-H_2O$, 130	....	$0.008^{0°}$	$0.21^{100°}$	i. al.; s. HCl, HNO_3
44	$5.150^{25°}_{4}$	$-2H_2O$, 539; 740	....	$170^{0°}$	$272^{100°}$	v. s. al.
45	....	....	....	$0.883^{20°}$	$1.044^{80°}$	

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Barium malonate	$BaC_3H_2O_4.H_2O$	257.40	
2	manganate	$BaMnO_4$	256.30	green, hex.
3	metatungstate	$BaW_4O_{13}.9H_2O$	1243.51	tetrag.
4	nitrate	$Ba(NO_3)_2$	261.39	reg.
5	nitrite	$Ba(NO_2)_2.H_2O$	247.40	hex. need.
6	oxalate	$BaC_2O_4.H_2O$	243.39	
7	oxide	BaO	153.37	amor.
8	oxide	BaO	153.37	regular
9	perchlorate	$Ba(ClO_4)_2$	336.28	hex.
10	permanganate	$Ba(MnO_4)_2$	375.23	
11	peroxide	BaO_2	169.37	gray
12	peroxide	$BaO_2.8H_2O$	313.50	grayish white
13	persulfate	$BaS_2O_8.4H_2O$	401.56	prisms
14	phosphate, di-	$BaHPO_4$	233.41	rhombic need.
15	phosphate, mono-	$BaH_4(PO_4)_2$	331.46	tricl.
16	phosphate, pyro-	$Ba_2P_2O_7$	448.79	rombic, wh.
17	phosphate, tri-	$Ba_3(PO_4)_2$	602.16	
18	platinocyanide	$BaPt(CN)_4.4H_2O$	508.70	gray to yel. monocl.
19	propionate	$Ba(C_3H_5O_2)_2.H_2O$	301.47	
20	selenate	$BaSeO_4$	280.57	
21	silicate	$BaSiO_3$	213.43	rhombic
22	silicate	$BaSiO_3.6H_2O$	321.53	
23	succinate	$BaC_4H_4O_4$	253.40	
24	sulfate	$BaSO_4$	233.43	rhombic
25	sulfate, acid	$Ba(HSO_4)_2$	331.51	
26	sulfhydrate	$Ba(SH)_2.4H_2O$	275.58	rhombic
27	sulfide, mono-	BaS	169.43	rhombic yel.-grn.
28	sulfide, tetra-	$BaS_4.H_2O$	283.64	red, rhombic
29	sulfide, tri-	BaS_3	233.56	yel.-grn.
30	sulfite	$BaSO_3$	217.43	hex.
31	sulfocyanate	$Ba(CNS)_2.2H_2O$	289.55	needles
32	Beryllium (Glucinum)	Be, (Gl)	9.02	hex. gray
33	bromide	$BeBr_2$	168.85	need.
34	carbide	Be_2C	30.04	yel. hex.
35	carbonate	$BeCO_3.4H_2O$	141.08	
36	carbonate, basic	$(BeO)_5.CO_2.5H_2O$	259.18	
37	chloride	$BeCl_2$	79.93	need.
38	chloride	$BeCl_2.4H_2O$	152.00	cryst.
39	fluoride	BeF_2	47.02	
40	hydroxide	$Be(OH)_2$	43.04	white
41	iodide	BeI_2	262.88	need.
42	nitrate	$Be(NO_3)_2.3H_2O$	187.08	cryst.
43	oxide	BeO	25.02	hex.
44	oxychloride	Be_2OCl_2	104.95	
45	potassium fluoride	$BeF_2.2KF$	163.21	
46	sodium fluoride	$BeF_2.2NaF$	131.01	
47	sulfate	$BeSO_4.4H_2O$	177.15	tetrag.
48	sulfate	$BeSO_4.7H_2O$	231.20	

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point Deg. C.	Solubility in 100 parts of Cold water	Hot water	Alcohol, acids, etc.
1	....	....	....	$0.143^{0°}$	0.326[illegible]	
2	4.85	....	....	i.	....	d. a.
3	4.298	....	....	dec.		
4	$3.244^{23°}$	575	d.	$5.2^{0°}$	32.2[illegible]	i. al.; sl. s. a.
5	$3.173^{29°}$	d. 115	....	58[illegible]	97[illegible]	1.6 94% al.
6	2.6578	....	....	0.0093[illegible]	0.0228[illegible]	i. al.; s. a., NH_4Cl
7	4.73-5.46	BaO_2, 450	....	$1.5^{0°}$	90.8[illegible]	s. HCl, HNO_3
8	5.32-.74					
9	....	505	....	v. s.	v. s.	v. s. al.
10	....	....	....	$62.5^{11°}$	72.4[illegible]	
11	4.958	−O, 450	....	i.	dec.	s. dil. a.
12	....	....	....	i.	dec.	s. dil. a.
13	....	....	....	$52.2^{0°}$	....	s. al.
14	4.165[illegible]	....	....	0.01-.02	....	s. a., NH_4 salts
15	2.9[illegible]	....	....	dec.	dec.	s. a.
16	3.9[illegible]	....	....	0.01	....	s. a., NH_4 salts
17	4.1[illegible]	....	....	i.	....	s. a.
18	3.054	....	....	3[illegible]		
19	....	....	....	47.98[illegible]	67.85[illegible]	
20	4.75	....	....	0.0118	0.0158	i. HNO_3; s. HCl
21	$4.44^{18°}$	1470	....	s.	dec.	s. HCl
22						
23	....	....	....	0.421[illegible]	0.237[illegible]	sl. s. al.
24	4.25-.50	1580, d.	....	0.000173[illegible]	0.00031[illegible]	0.006, 3% HCl; s. conc. H_2SO_4
25						
26	....	....	....	s.	....	i. al.
27	4.25[illegible]	....	....	dec.	dec.	i. al.
28	2.98	d. 300	....	$41^{15°}$	v. s.	i. al., CS_2
29	....	....	....	s.		
30	....	....	....	0.0197[illegible]	0.00177[illegible]	v. s. HCl
31	....	....	....	s.	s.	s. al.
32	$1.85^{20°}$	1280	>1900	i.	sl. s., d.	s. dil. a., alk.
33	....	601	subl. 450	deliq.	v. s.	
34	$1.9^{15°}$	....	....	dec.	dec.	s. a.
35	....	....	....	$0.36^{0°}$		
36	....	....	....	i.	dec.	s. a., alk.
37	....	400	500	deliq.	v. s.	v. s. al.
38	....	....	....	deliq.	v. s.	s. al.
39	$2.1^{15°}$	800	....	v. s.	v. s.	s. al., H_2SO_4
40	....	d.	....	i.	....	s. a., alk., $(NH_4)_2CO_3$
41	4.20[illegible]	510	585-95	dec.	dec.	s. al., eth., CS_2
42	....	90	d. 100	deliq.	v. s.	v. s. al.
43	3.01[illegible]	....	....	i.	....	s. a., alk.
44	....	....	....	i.		
45	....	....	....	$2^{20°}$	$5.26^{100°}$	
46	....	....	....	1.471[illegible]	$2.94^{100°}$	
47	$1.7125^{10.5°}$	$-2H_2O$,	100 d.	$100^{14°}$	v. s.	i. al.
48						

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Bismuth	Bi	209.00	rhbdr. pinkish
2	bromide	$BiBr_3$	448.75	yel. cryst
3	carbonate, sub-	$Bi_2O_3.CO_2.H_2O$	544.02	
4	chloride, di-	$BiCl_2$	279.91	black need
5	chloride, tri-	$BiCl_3$	315.37	wh. cryst
6	citrate	$BiC_6H_5O_7$	398.04	cryst
7	dichromate, basic	$(BiO)_2Cr_2O_7$	766.02	orange red
8	hydroxide	$Bi(OH)_3$	260.02	white
9	iodide	BiI_3	589.80	black hex
10	iodate	$Bi(IO_3)_3$	733.80	white
11	nitrate	$Bi(NO_3)_3.5H_2O$	485.10	tricl
12	nitrate, sub-	$BiONO_3.H_2O$	305.02	hex. pl
13	oxalate	$Bi_2(C_2O_4)_3$	682.00	
14	oxide, tri-	Bi_2O_3	466.00	yel. tetrag
15	oxide, tetra-	$Bi_2O_4.2H_2O$	518.03	brown-yel
16	oxide, penta-	Bi_2O_5	498.00	brown
17	oxide, penta-	$Bi_2O_5.H_2O$	516.02	red
18	oxybromide	$BiOBr$	304.92	
19	oxychloride	$BiOCl$	260.46	white
20	oxyfluoride	$BiOF$	244.00	cryst
21	oxyiodide	$BiOI$	351.93	red cryst
22	phosphate	$BiPO_4$	304.03	
23	selenide	Bi_2Se_3	655.60	black
24	sulfate	$Bi_2(SO_4)_3$	706.19	wh. need
25	sulfide	Bi_2S_3	514.19	br. rhomb
26	Boric acid	H_3BO_3	61.84	tricl. wh
27	Boron	B	10.82	grn. amor., monocl.
28	bromide	BBr_3	250.57	
29	carbide	B_6C	76.92	black cryst
30	chloride	BCl_3	117.19	
31	fluoride	BF_3	67.82	gas
32	iodide	BI_3	391.62	cryst. plates
33	hydride	BH_3	13.84	gas
34	oxide	B_2O_3	69.64	
35	phosphide	BP	41.85	
36	sulfide, tri-	B_2S_3	117.83	white cryst
37	sulfide, penta-	B_2S_5	181.96	cryst
38	Borofluohydric acid	HBF_4	87.83	
39	Bromic acid	$HBrO_3$	128.92	colorl
40	Bromine	Br_2	159.83	red brown liq
41	chloride	$BrCl.10H_2O$	295.53	yellow
42	fluoride	BrF_3	136.92	prisms
43	hydrate	$Br_2.10H_2O$	339.99	red octahdr
44	iodide	BrI	206.85	

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	$9.78^{20°}$	269.2	1436	i.	i.	s. HNO_3, aq rg., conc. H_2SO_4
2	5.604	219	453	dec.	dec.	s. eth., HBr
3	6.86	d.	....	i.	i.	s. a.
4	4.86	163	d. 300	dec.		
5	$4.56^{11°}$	232	447	dec.	dec.	s. al., a., acet.
6	....	d.	....	i.	....	i. al.; s. NH_4OH
7	....	....	....	i.	i.	s. a.; i. alk.
8	....	$-H_2O$, 100	$-1\frac{1}{2}H_2O$, 150	i.	....	s. a.; i. alk.
9	$5.65^{20°}$	408	....	i.	dec.	$35^{20°}$ al.; s. HI, KI
10	....	....	....	i.	....	sl. s. HNO_3
11	2.78	74	d. 75–80	dec.	dec.	s. a.; 40[illegible]° acet.
12	4.928[illegible]°	d. 260	....	i.	i.	s. a.
13	....	....	....	i.	i.	s. a.
14	8.868	820–60	....	i.	i.	s. a.
15	5.6	$-O$, 305	....	i.	....	s. a.
16	....	$-O$, 150	$-2O$, 357	i.	i.	s. a., KOH
17	5.917	$-H_2O$, 120	$-2O$, 357	i.	....	s. a; KOH
18	$8.082^{15°}$	....	....	i.	....	s. a.
19	$7.717^{15°}$	....	....	i.	i.	s. a.; i. $H_2C_4H_4O_6$
20	7.55[illegible]°	....	....	i.	....	s. a.
21	$7.922^{15°}$	....	....	i.	....	s. a; i. KI
22	....	....	....	i.	i.	s. HCl; i. dil. HNO_3
23	6.82	d.	....	i.	....	i. alk.
24	....	....	....	dec.	dec.	s. a.
25	7.39	d.	....	0.000018	....	s. HNO_3
26	$1.4347^{15°}$	185	$-1\frac{1}{2}H_2O$, 300	$4.9^{21°}$	$28.7^{100°}$	0.24[illegible]° eth.; s. al.; 28[illegible], $72^{100°}$ glyc.
27	2.45–.55	2000–2500	subl. 3500	i.	i.	i. al.; s. HNO_3, H_2SO_4
28	$2.65^{0°}_{4}$	-46	90.5	dec.	....	d. al.
29	2.51	....	....	i.	i.	i. a.
30	$1.434^{0°}_{4}$	-107	18.23	dec.	dec.	d. al.
31	2.3 (A)	-127	-101	$105.7^{0°}$ c.c.	....	d. al.
32	$3.3^{50°}$	43	210	dec.	....	v. s. CS_2, CCl_4
33	....	-140	-87	sl. s.	dec.	s. NH_4OH
34	1.75–.83	577	....	$1.1^{0°}$	$16.4^{102°}$	s. al., a.
35	....	ign. 200	....	i.	i.	i. all solv.
36	1.55	310	....	dec.	....	sl. s. PCl_3, SCl_2
37	1.85	390	....	dec.		
38	....	....	130	s.		
39	....	d. 100	....	v. s.	dec.	
40	$3.1883^{0°}$	-7.3	58.7	$4.17^{0°}$	$3.49^{50°}$	s. alk., CS_2, eth., al.
41	....	7	d. 10	s.	....	s. CS_2, eth.
42	....	5	130–40	dec.	....	d. alk.
43	....	d. 15	....	s.		
44	....	36	....	....	....	s. CS_2, $CHCl_3$

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Bromplatinic *see platinic*			
2	Cadmium	Cd	112.41	hex.
3	acetate	$Cd(C_2H_3O_2)_2.3H_2O$	284.51	monocl. colorl.
4	borotungstate	$Cd_2B_2W_9O_{32}.18H_2O$	2738.75	yel. cryst
5	bromate	$Cd(BrO_3)_2.H_2O$	386.26	tricl.
6	bromide	$CdBr_2$	272.24	yel'sh. cryst.
7	carbonate	$CdCO_3$	172.41	
8	chlorate	$Cd(ClO_3)_2.2H_2O$	315.36	
9	chloride	$CdCl_2$	183.32	hex.
10	chloride	$CdCl_2.2H_2O$	219.36	monocl.
11	cyanide	$Cd(CN)_2$	164.43	
12	ferrocyanide	$Cd_2Fe(CN)_6$	436.71	
13	fluoride	CdF_2	150.41	cryst.
14	formate	$Cd(CHO_2)_2.H_2O$	220.44	monocl.
15	hydroxide	$Cd(OH)_2$	146.43	hex. wh.
16	iodate	$Cd(IO_3)_2$	462.27	cryst.
17	iodide	CdI_2	366.27	brownish
18	lactate	$Cd(C_3H_5O_3)_2$	290.49	need.
19	nitrate	$Cd(NO_3)_2.4H_2O$	308.49	prism. need.
20	oxalate	$CdC_2O_4.3H_2O$	254.46	
21	oxide	CdO	128.41	brown amor.
22	oxide	CdO	128.41	reg.
23	oxide, sub-	Cd_4O	465.64	grn. amor
24	permanganate	$Cd(MnO_4)_2.6H_2O$	458.40	
25	phosphate	$Cd_3(PO_4)_2$	527.28	amor.
26	potassium iodide	$CdI_2.2KI.2H_2O$	734.36	
27	selenate	$CdSeO_4.2H_2O$	291.64	rhombic
28	sulfate	$CdSO_4$	208.47	
29	sulfate	$CdSO_4.4H_2O$	280.54	
30	sulfate	$3CdSO_4.8H_2O$	769.55	monocl. or amor.
31	sulfide (Greenockite)	CdS	144.47	yel. hex.
32	sulfite	$CdSO_3$	192.47	cryst.
33	tungstate	$CdWO_4$	360.41	yel. cryst
34	Caesium	Cs	132.81	silvery yel.
35	bromide	CsBr	212.73	
36	bromoiodide	$CsBrI_2$	466.59	
37	carbonate	Cs_2CO_3	325.62	
38	carbonate, acid	$CsHCO_3$	193.82	rhomb. prisms
39	chloraurate	$CsAuCl_4$	471.84	
40	chloride	CsCl	168.27	reg. colorl.
41	chloroplatinate	Cs_2PtCl_6	673.59	yel. reg.
42	chromate	$CsCrO_4$	248.82	
43	cyanide	CsCN	158.82	
44	fluosilicate	Cs_2SiF_6	407.68	reg.
45	hydride	CsH	133.82	cryst.
46	hydroxide	CsOH	149.82	gray

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1						
2	8.65	320.9	778	i.	i.	s. a., NH_4NO_3
3	2.01	...	...	v. s.		
4	...	...	...	125		
5	3.758	d.	...	$125^{11°}$		
6	$5.1[illegible]2^{25°}_{4}$	558	8[illegible]6–12	61.1	$1[illegible]1^{100°}$	26.[illegible] al.; 0.4 eth.
7	$4.258^{4°}$	d	...	i.	i	s. a., NH_4 salts
8	...	80	...	33	54	s. a
9	$4.05^{25°}_{4}$	558	861–954	140	150	1.52 al.
10	3.32	...	...	168	18[illegible]	2.05 meth. al.
11	...	d. 200	...	1.7	...	s. KCN, NH_4OH, a.
12	...	...	...	i.	...	s. HCl
13	6.64	520	1000	4.36	...	i. al.; s. a.
14	2.45	d	...	v. s.		
15	$4.79^{15°}$	$-H_2O$, 300	...	0.00026	...	i. alk.; s. a., NH_4 salts
16	5.64–.[illegible]8	d.	...	sl. s.	sl. s.	s. HNO_3, NH_4OH
17	5.644	385 (404)	708–19	$80.1^{0°}$	$128^{100°}$	s. a., eth., NH_4OH
18	...	...	...	10	12.5	i. al
19	2.455	59.5	132	$103.4^{0°}$	...	s. al.; i. HNO_3
20	Anh. 3.32	d.	...	0.00337	0.0[illegible]	s. a., NH_4OH
21	6.95	...	d. 900–1000	i.	i.	s. a., NH_4 salts; i. alk.
22	8.11	...	...	i.	i.	
23	$8.18–.21^{19°}$	d.	...	...	...	d. alk., a.
24	...	d.	...	v. s.		
25	...	...	...	i.	...	s. a., NH_4 salts
26	3.359	...	...	$137^{15°}$	...	71 al.; 42 eth.
27	3.632	...	...	v. s.		
28	4.72	1000	...	$76.5^{0°}$	60.8	
29	3.05	...	...	$140^{0°}$	$135.5^{100°}$	i. al.
30	3.087	...	...	$114.2^{0°}$	87	
31	4.8	...	...	0.00013	colloidal	v. s. NH_4OH; s. a.
32	...	d.	...	sl. s.	...	i. al.; s. a., NH_4OH
33	...	...	...	0.05	...	s. NH_4OH
34	1.87	26.4	[illegible]70	dec.	dec.	s. a., al.
35	4.455	...	...	s.	...	d. al.
36	...	...	...	dec.	...	s. al.
37	...	...	d. 610	382.3	v. s.	11.1, 20.1 al.
38	...	$-\frac{1}{2}CO_2$, 175	...	210.2	v. s.	s. al.
39	...	...	...	$[illegible].5^{10°}$	38	s. al.
40	3.972	645	subl.	161.4	270.5	s. al.
41	...	...	...	0.024	$0.377^{100°}$	
42	4.237	...	...	71.35	$88.66^{30°}$	
43	...	...	...	...	...	i. al.
44	3.37[illegible]	...	...	$60^{17°}$	v. s.	s. al.
45	2.7	d	...	dec.	dec.	d. a.
46	4.018	<272.3	...	$301.3^{30°}$	s.	s. al.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Caesium iodide	CsI	259.74	
2	mercuric bromide	$CsBr.2HgBr_2$	933.61	
3	mercuric chloride	$CsCl.HgCl_2$	439.79	
4	nitrate	$CsNO_3$	194.82	tetrag.
5	nitrite	$CsNO_2$	178.82	yel. cryst.
6	oxide, mono-	Cs_2O	281.62	or. cryst.
7	oxide, di-	Cs_2O_2	297.62	yel. need.
8	oxide, tri-	Cs_2O_3	313.62	choc. br.
9	oxide, tetra- (per)	Cs_2O_4	329.62	yel. cryst.
10	perchlorate	$CsClO_4$	232.27	
11	periodate	$CsIO_4$	323.74	rhombic pl.
12	permanganate	$CsMnO_4$	251.74	
13	silicotungstate	$Cs_8SiW_{12}O_{42}$	3970.54	
14	sulfate	Cs_2SO_4	361.68	need.
15	sulfide	$Cs_2S.4H_2O$	369.75	cryst.
16	sulfide, di-	Cs_2S_2	329.75	dk. red, amor.
17	sulfide, di-	$Cs_2S_2.H_2O$	347.76	cryst.
18	sulfide, tri-	Cs_2S_3	361.81	orange
19	sulfide, penta-	Cs_2S_5	425.94	
20	tartrate acid	$CsHC_4H_4O_6$	281.85	
21	Calcium	Ca	40.07	silv. hex. or rhbdr.
22	acetate	$Ca(C_2H_3O_2)_2.H_2O$	176.13	need.
23	aluminate	$CaAl_2O_4$	158.01	prism. need.
24	ammonium arsenate	$NH_4CaAsO_4.6H_2O$	305.17	monocl. pl.
25	ammonium phosphate	$NH_4CaPO_4.7H_2O$	279.25	monocl.
26	arsenate	$Ca_3(AsO_4)_2$	398.13	
27	arsenide	Ca_3As_2	270.13	red cryst.
28	borate	$Ca(BO_2)_2.2H_2O$	161.74	
29	boride	CaB_6	104.99	black reg.
30	bromide	$CaBr_2$	199.90	need.
31	bromide	$CaBr_2.6H_2O$	308.00	cryst.
32	carbide	CaC_2	64.07	cryst. gray
33	carbonate	$CaCO_3$	100.07	hex. rhomb. or rhbdr.
34	chlorate	$Ca(ClO_3)_2$	206.98	rhomb.
35	chloride	$CaCl_2$	110.98	
36	chloride	$CaCl_2.H_2O$	129.00	
37	chloride	$CaCl_2.6H_2O$	219.08	hex.
38	chromate	$CaCrO_4.2H_2O$	192.11	yel. prisms
39	citrate	$Ca_3(C_6H_6O_7)_2.4H_2O$	570.35	need.
40	cyanide	$Ca(CN)_2$	92.09	reg.
41	cyanamide	$CaCN_2$	66.08	
42	ferrocyanide	$Ca_2Fe(CN)_6.12H_2O$	508.22	tricl.
43	fluoride	CaF_2	78.07	reg.
44	fluosilicate	$CaSiF_6$	182.13	
45	formate	$Ca(CHO_2)_2$	130.09	rhombic
46	hydride	CaH_2	42.09	cryst.
47	hydroxide	$Ca(OH)_2$	74.09	hex.
48	hypochlorite	$Ca(ClO_2)_2.4H_2O$	247.05	
49	hypophosphate	$Ca_2P_2O_6.2H_2O$	274.23	
50	hypophosphite	$Ca(H_2PO_2)_2$	170.16	monocl.
51	iodate	$Ca(IO_3)_2$	389.93	rhombic

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	$4.51_{4}^{25°}$	621	....	27.7[illegible]	51.5[illegible]	
2	....	....	....	$0.807^{1[illegible]°}$	....	sl. s. al.
3	....	....	....	$1.40[illegible]^{17°}$	....	i. al.
4	$3.687_{4}^{20°}$	414	d.	$9.33^{0°}$	1[illegible]7[illegible]	sl. s. al.
5	....	....	....	v. s.	v. s.	
6	4.78[illegible]	Cs_2O_4, 150	....	v. s.	....	s. abs. al.
7	$4.47^{1[illegible]°}$	400–50	–O, 650	s.		
8	$4.25^{0°}$	400	....	dec.		
9	$3.77^{19°}$	515	d.	dec.		
10	....	d.	....	i.	....	i. abs. al.
11	$4.259_{4}^{[illegible]°}$	....	....	2.15[illegible]		
12	$3.5974^{10.3°}$	d.	....	$0.0[illegible]7^{1°}$	1.25[illegible]	
13	....	....	....	$0.005^{20°}$	0.52[illegible]	i. al., HCl
14	$4.2434_{4}^{20°}$	....	....	167[illegible]	$220.3^{100°}$	i. al.
15	....	....	....	v. s.	v. s.	
16	....	460	>800	hyg.		
17	....	....	....	s.		
18	....	217	>800			
19	$2.806^{16°}$	202.5	....	....	....	s. al.
20	....	....	....	$9.7^{25°}$	$98^{100°}$	
21	$1.5446^{29°}$	810	....	dec.	dec.	sl. s. al.; s. a.
22	....	d.	....	$43.6^{0°}$	$34.3^{100°}$	sl. s. al.
23	$3.671^{20°}$	1587	....	dec.	....	s. HCl
24	$1.905^{15°}$	d.	....	0.02	s.	i. NH_4OH; s. NH_4Cl
25	1.561	d.	....	i.	i.	s. a.
26	....	....	....	i.	i.	
27	$2.5^{1[illegible]°}$	d.	....	dec.	dec.	s. a.
28	....	....	....	$0.40^{30°}$	$0.40^{90°}$	s. a., NH_4 sal's
29	$2.33^{1[illegible]°}$	....	....	i.	i.	s. HNO_3
30	$3.353_{4}^{25°}$	680–760	806–12	$125^{0°}$	$312^{105°}$	v. s. al.
31	....	35–8	149–50	$50^{0°}$		
32	$2.22^{13°}$	....	....	dec. to C_2H_2		
33	2.70–.95	d. 825	....	$0.0065^{20°}$	$0.002^{100°}$	s. a., NH_4Cl
34	....	>100	....	$177.7^{8°}$	....	s. al.
35	$2.152_{4}^{20°}$	774	....	$59.5^{0°}$, $74.5^{20°}$	$159^{100°}$ ..	s. al.
36	....	....	....	$60.1^{0°}$	205[illegible]	s. al.
37	1.654	30.2	129–30	$165.7^{0°}$	$7141^{40°}$	s. al.
38	....	$-2H_2O$, 200	....	$22.2^{0°}$	$4.3^{100°}$	s. al., a.
39	....	$-2H_2O$, 130	$-4H_2O$, 185	$0.085^{16°}$	$0.096^{25°}$	$0.0065^{15°}$ al
40	....	....	....	s.	s.	
41	....	....	....	....	s. dec.	
42	....	....	....	....	$50^{90°}$	
43	3.18	1378	....	$0.0037^{15.5°}$	$0.0016^{18°}$	sl. s. a.
44	$2.662^{17.5°}$	....	....	sl. s.	....	s. HF, HCl
45	2.021	d.	....	$16^{0°}$	$18.4^{100°}$	i. al.
46	1.7	....	....	dec.	dec.	d. a.; i. bz.
47	2.078	$-H_2O$, 580	....	$0.17^{0°}$	$0.08^{100°}$	s. NH_4Cl
48	....	d.	....	deliq.	dec.	d. a.
49	....	....	....	i.	....	s. $H_4P_2O_6$, HCl
50	....	d.	....	17	s.	i. al.
51	....	d.	....	$0.4^{15°}$	$1.33^{100°}$	s. HNO_3

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Calcium iodide.	CaI_2	293.93	plates. . . . .
2	iodide.	$CaI_2.6H_2O$	402.03	. . . .
3	lactate.	$Ca(C_3H_5O_3)_2.5H_2O$	308.23	. . . .
4	nitrate.	$Ca(NO_3)_2$	164.09	prisms. . . . .
5	nitrate.	$Ca(NO_3)_2.4H_2O$	236.15	monocl. . . . .
6	nitride.	Ca_3N_2	148.23	br. cryst. . . . .
7	nitrite.	$Ca(NO_2)_2.H_2O$	150.10	prisms. . . . .
8	oxalate.	$CaC_2O_4.H_2O$	146.09	colorl. octah. . . . . .
9	oxide.	CaO	56.07	amor. or reg. . . . . .
10	permanganate.	$Ca(MnO_4)_2.4H_2O$	349.99	purp. prisms. . . . . .
11	peroxide.	$CaO_2.8H_2O$	216.20	tetrag. . . . .
12	phosphate, mono-. .	$CaH_4(PO_4)_2.H_2O$	252.17	rhombic. . . . .
13	phosphate, di-.	$CaHPO_4.2H_2O$	172.14	monocl. plates. . . .
14	phosphate, tri-.	$Ca_3(PO_4)_2$	310.26	amor. . . . .
15	phosphate, pyro-. . .	$Ca_2P_2O_7.4H_2O$	326.26	cryst. . . . .
16	phosphate, meta-. . .	$Ca(PO_3)_2$	198.12	white. . . . .
17	phosphide.	Ca_3P_2	182.26	red cryst. . . . .
18	phosphite.	$2CaHPO_3.3H_2O$	294.26	. . . .
19	plumbate.	Ca_2PbO_4	351.34	brown cryst. . . . . .
20	plumbite.	$CaPbO_2$	279.27	cryst. . . . .
21	potassium sulfate. .	$CaK_2(SO_4)_2.H_2O$	328.41	monocl. . . . .
22	phosphate, pyro-. .	$Ca_2P_2O_7$	254.19	white. . . . .
23	salicylate.	$Ca(C_7H_5O_3)_2.2H_2O$	350.18	octahdr. . . . .
24	silicate.	$CaSiO_3$	116.13	monocl. or hex. . . .
25	silicide.	$CaSi_2$	96.19	. . . .
26	sodium sulfate. . . .	$CaSO_4.2Na_2SO_4.2H_2O$	456.28	. . . .
27	sulfate.	$CaSO_4$	136.13	rhombic. . . . .
28	sulfate (gypsum). .	$CaSO_4.2H_2O$	172.17	monocl. . . . .
29	sulfhydrate.	$Ca(SH)_2.6H_2O$	214.31	prismatic. . . . .
30	sulfide.	CaS	72.13	reg. wh. . . . .
31	sulfite.	$CaSO_3.2H_2O$	156.17	cryst. . . . .
32	sulfocyanate.	$Ca(CNS)_2.3H_2O$	210.26	cryst. . . . .
33	tartrate.	$CaC_4H_4O_6.4H_2O$	260.17	trimet. prisms. . . .
34	thiocarbonate.	$CaCS_3$	148.26	yellow. . . . .
35	thiosulfate.	$CaS_2O_3.6H_2O$	260.29	tricl. . . . .
36	tungstate.	$CaWO_4$	288.07	tetrag. . . . .
37	Carbon, amorphous. .	C	12.00	amor., blk. . . . . . .
38	Carbon, graphite. . . .	C	12.00	hex. blk. . . . .
39	Carbon, diamond. . . .	C	12.00	reg. . . . .
40	bromide, di-.	C_2Br_4	343.66	. . . .
41	bromide, tri-.	C_2Br_6	503.50	. . . .
42	bromide, tetra-. . . .	CBr_4	331.66	tablets. . . . .
43	chloride, di-.	C_2Cl_4	165.83	. . . .
44	chloride, tri-.	C_2Cl_6	236.74	rhomb. tricl. or reg. .
45	chloride, tetra-. . . .	CCl_4	153.83	colorl. liq. . . . .
46	dioxide.	CO_2	44.00	colorl. gas. . . . .

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	3.956[illegible]°	831	708-19	192[illegible]	$435^{92°}$	s. a., al.
2	....	42	150	907[illegible]	v. s.	
3	....	$-3H_2O$, 100	....	10.5	....	i. eth.; s. al.
4	2.36	561	....	93.1[illegible]	351.2[illegible]	14[illegible] al.; s. amyl al.
5	1.9[illegible]°	42.3	132	134[illegible]	506[illegible]°	s. al.
6	$2.63^{17°}$	1200	....	dec.	dec.	s. dil. a.; i. abs. al.
7	2.231[illegible]°	....	....	deliq.	v. s.	i. al.
8	2.2[illegible]° anh.	d.	....	0.0006[illegible]°	0.0014[illegible]	s. a.; i. acet. a.
9	2.306[illegible]°	2570	....	0.131[illegible]°	0.067[illegible]	s. a.
10	....	d.	....	331[illegible]°	388[illegible]°	
11	....	$-8H_2O$, 130	....	sl. s.	dec.	s. a.
12	2.220[illegible]	$-H_2O$, 100	d. 200	....	dec.	
13	2.306[illegible]	d.	....	0.02[illegible]	0.075[illegible]	
14	3.18	1550	....	0.0023-31	dec.	s. a.
15	....	....	....	sl. s.	....	s. a.; i. NH_4Cl
16	....	....	....	i.	i.	i. a.
17	$2.51^{15°}$	....	....	dec.	....	i. al., eth.; s. dil. a.
18	....	....	....	sl. s.	dec.	s. NH_4Cl
19	....	....	....	i.	....	s. a.
20	....	....	....	sl. s.		
21	2.6[illegible]°	....	....	0.25	dec.	s. a.
22	....	....	....	i.	....	s. a.
23	....	....	....	v. s.	....	s. al.
24	2.919[illegible]	1512	....	$0.0095^{17°}$	....	s. HCl
25	2.5	....	....	i.		
26	....	$-2H_2O$, 80	....	....	dec.	
27	2.96	1360	....	0.179[illegible]°	0.178[illegible]	s. a., $Na_2S_2O_3$, NH_4 salts, HCl, NaCl, glyc.
28	2.32	$-2H_2O$, 300	....	$0.241^{0°}$	0.222[illegible]	
29	....	d. 15-18	....	v. s.	....	s. al.
30	$2.8^{15°}$	....	....	dec.	dec.	s. a.
31	....	$-2H_2O$, 100	....	0.125	....	s. H_2SO_3
32	....	....	....	deliq.	v. s.	v. s. al.
33	....	d.	....	$0.016^{15°}$	0.3[illegible]	sl. s. al.
34	....	....	....	s.	....	s. al.
35	1.872	....	....	$0.3^{10°}$	dec.	i.
36	6.062	....	....	0.2	....	i. a.; s. NH_4Cl
37	1.75-2.10	>3500	subl. 3500			
38	2.3	....		i.	i.	i. a., alk.
39	3.51	....				
40	....	53				
41	....	....	....	....	....	s. CS_2; i. al., eth.
42	$3.42^{14°}$	42	189.5	i.	....	s. al., eth., chl.
43	$1.62^{20°}$	....	121			
44	1.6298; 8.15 (A)	182	187	i.	....	s. al., eth.
45	1.5817[illegible]°	−23.77	76.74	i.	i.	s. al.
46	1.53 (A); 22. (D)	−57	subl. −80	179.67[illegible]° c.c.	90.14[illegible]° c.c.	s. a., alk.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Carbon disulfide	CS_2	76.13	colorl. liq.
2	iodide, tetra	CI_4	519.73	octahdr.
3	monoxide	CO	28.00	colorl. odorless, poisonous gas
4	monosulfide	CS	44.06	red powd.
5	oxybromide	$COBr_2$	187.83	. . . .
6	oxychloride (phosgene)	$COCl_2$	98.91	gas, poisonous
7	oxysulfide	COS	60.06	gas
8	selenosulfide	$CSSe$	123.26	liq.
9	silicide	CSi_2	68.12	gr. cryst.
10	suboxide	C_3O_2	68.00	gas
11	telluro-sulfide	$CSTe$	171.56	yel.-red
12	thionyl chloride	$CSCl_2$	114.98	golden red
13	thionyl perchloride	$CSCl_4$	185.89	golden yel.
14	Ceric carbide	CeC_2	164.25	red hex.
15	fluoride	$CeF_4.H_2O$	234.27	amor.
16	hydroxide	$2CeO_2.3H_2O$	398.55	. . . .
17	nitrate	$Ce(NO_3)_4$	388.28	red-yel.
18	oxide	CeO_2	172.25	pale yel. powd.
19	peroxide	CeO_3	188.25	red
20	silicide	$CeSi_2$	196.37	. . . .
21	sulfate	$Ce(SO_4)_2.4H_2O$	404.44	yel. need.
22	Cerium	Ce	140.25	steel gray
23	Cerous acetate	$Ce_2(C_2H_3O_2)_6.3H_2O$	688.69	need.
24	bromide	$CeBr_3.H_2O$	398.01	need.
25	carbonate	$Ce_2(CO_3)_3.5H_2O$	550.58	wh. powd.
26	chloride	$CeCl_3$	246.62	cryst.
27	fluoride	$CeF_3.\frac{1}{2}H_2O$	206.26	. . . .
28	hydroxide	$Ce_2O_3.6H_2O$	436.60	. . . .
29	iodide	$CeI_3.9H_2O$	683.19	cryst.
30	nitrate	$Ce(NO_3)_3.6H_2O$	434.37	red. cryst.
31	oxalate	$Ce_2(C_2O_4)_3.9H_2O$	706.64	. . . .
32	oxide	Ce_2O_3	328.50	gr. powd.
33	oxychloride	$Ce_2O_3.2CeCl_3$	821.74	purple
34	phosphate	$CePO_4$	235.28	monocl. pr. or rhombic
35	sulfate	$Ce_2(SO_4)_3$	568.69	monocl. or rhombic
36	sulfate	$Ce_2(SO_4)_3.8H_2O$	712.82	monocl., tricl.
37	sulfide	Ce_2S_3	376.69	red cryst.
38	Chloric acid	$HClO_3.7H_2O$	210.58	. . . .
39	Chlorine	Cl_2	70.91	greenish yel. gas
40	hydrate	$Cl.5H_2O$	125.54	octahdr.
41	oxide, mono	Cl_2O	86.91	yel. red.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	$1.292^{20°}_{4}$ 2.63 (A)	−110	46.2	$0.2^{0°}$	$0.014^{50°}$	s. al., eth.
2	$4.32^{20°}$	d.	....	....	dec.	s. al., CS_2, eth.
3	0.9670 (A)	−205.7	−192	$3.5^{0°}$ c.c. $0.0044^{0°}$	$0.0018^{50°}$ $2.312^{20°}$ c.c.	s. al., Cu_2Cl_2
4	1.66	d.	....	i.	....	i. al.; s. CS_2, eth.
5	$2.48^{0°}$	....	63–6			
6	$1.432^{0°}$	....	8.2	dec.	....	s. acet. a.; d. a.
7	2.10 (A) 30.4 (D)	d.	−47	$133^{0°}$	$40.3^{30°}$	v. s. al., alk.
8	....	−85	84	i.	i.	s. CS_2; sl. s. al.
9	2.5	....	....	dec.	dec.	i. al., eth.; s. HNO_3, H_2SO_4
10	....	−107	−7	dec.		
11	....	−54	d.	....	....	s. CS_2, bz.
12	$1.5085^{15°}$	....	170			
13	$1.712^{13°}$	....	146–7	....	dec.	
14	5.23	....	....	dec.	dec.	s. a.
15	....	d.	....	i.		
16	....	....	....	....	....	s. a.; i. alk.; sl. s. alk. carb.
17	....	....	....	deliq.	dec.	s. al.
18	7.65	....	....	i.	i.	s. H_2SO_4
19						
20	$5.67^{17°}$	....	....	i.		
21	....	....	....	s.		
22	$6.92^{25°}$	640	....	i.	i.	i. al., HNO_3, HCl
23	....	$-3H_2O$, 115	d.	$26.45^{15°}$	$16.2^{76°}$	
24	....	d.	....	deliq.	....	s. al.
25	....	....	....	i.	....	s. $(NH_4)_2CO_3$
26	$3.88^{16°}_{6}$	848	....	100	dec.	30 al.
27	....	....	....	i.		
28	....	....	....	....	....	s. a., $(NH_4)_2CO_3$, i. alk.
29	....	....	....	s.	....	s. al.
30	....	$-3H_2O$, 150	d. 200	deliq.	v. s.	50 al.
31	....	d.	....	$0.053^{25°}$	....	i. $H_2C_2O_4$
32	6.9–7.0	....	....	i.	....	s. H_2SO_4
33	....	....	....	i.	....	s. dil. a.
34	3.8	....	....	i.	i.	s. a.
35	[illegible].912	....	....	$16.56^{0°}$	$2.25^{100°}$	
36	3.220	$-8H_2O$, 630	....	$23.8^{0°}$	$6^{50°}$	
37	$5.020^{110°}$	d.	....	i.	dec.	s. dil. a.
38	$1.282^{14°}$	<-20	d. 40	v. s.		
39	$2.49^{0°}$ (A)	−101.5	−33.6	$150^{0°}$ c.c. $300^{10°}$ c.c.	$180^{30°}$ $136^{40°}$	s. alk.
40	1.23	−50	d. 35	s.		
41	2.977 (A)	−20	−5	$200^{0°}$ c.c.	....	s. alk., H_2SO_4

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt	Crystalline form and color
1	Chlorine oxide, di- or per-	ClO_2	67.46	yellowish gas
2	oxide, hept-	Cl_2O_7	182.91	oil, colorl.
3	oxide, tetr-	ClO_4	99.46	
4	Chlorosulfonic acid	$ClSO_2.OH$	116.53	
5	Chromic arsenide	CrAs	126.97	gray
6	boride	CrB	62.83	silvery cryst.
7	bromide	$CrBr_3$	291.76	olive grn. hex.
8	bromide	$CrBr_3.6H_2O$	399.85	green hex. pl.
9	carbide	Cr_3C_2	180.06	gray cryst.
10	chloride	$CrCl_3$	158.38	pink cryst.
11	chloride	$CrCl_3.6H_2O$	266.48	violet or grn. hex. pl.
12	fluoride	CrF_3	109.01	grn. octahdr.
13	fluoride	$CrF_3.9H_2O$	271.15	
14	hydroxide	$Cr(OH)_3$	103.03	grn. or blue gel
15	hydroxide	$Cr(OH)_3.2H_2O$	139.07	green
16	nitrate	$Cr(NO_3)_3.9H_2O$	400.18	purp. prisms
17	nitrate	$Cr_2(NO_3)_6.15H_2O$	746.31	purp. monocl. pr.
18	nitride	CrN	66.02	amor.
19	oxide	Cr_2O_3	152.02	hex. dk. grn.
20	phosphate	$Cr_2(PO_4)_2.6H_2O$	402.17	bl. grn.
21	phosphate	$Cr_2(PO_4)_2.12H_2O$	510.27	violet, tricl.
22	phosphide	CrP	83.04	gr.-blk. cryst.
23	silicide	Cr_3Si_2	212.15	tetrag. pr.
24	sulfate	$Cr_2(SO_4)_3$	392.21	
25	sulfate	$Cr_2(SO_4)_3.5H_2O$	482.29	green
26	sulfate	$Cr_2(SO_4)_3.15H_2O$	662.45	violet cryst.
27	sulfate	$Cr_2(SO_4)_3.18H_2O$	716.50	reg. violet
28	sulfide	Cr_2S_3	200.21	br.-blk. powd.
29	Chromium	Cr	52.01	gray cryst.
30	dioxide	CrO_2	88.01	gray
31	tetrasulfide	Cr_3S_4	232.28	gr.-blk. powd.
32	trioxide	CrO_3	100.01	red, tricl.
33	Chromous acetate	$Cr_2(C_2H_3O_2)_6.2H_2O$	494.20	green
34	carbonate	$CrCO_3$	112.01	amor.
35	chloride	$CrCl_2$	122.92	cryst.
36	fluoride	CrF_2	90.01	grn. cryst.
37	hydroxide	$Cr(OH)_2$	86.03	yel. brn.
38	iodide	CrI_2	305.87	
39	oxide	CrO	68.01	black
40	sulfate	$CrSO_4.7H_2O$	274.19	blue
41	sulfide	CrS	84.07	black powd.
42	Chromyl chloride	CrO_2Cl_2	154.92	dk. red liq.
43	Cobalt	Co	58.94	silvery
44	carbonyl	$Co(CO)_4$	170.94	
45	phosphide	Co_2P	148.91	sm. need.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	1.5 2.315 (A)	−70	9.9	$2000^{4°}$ c.c.	dec.	s. H_2SO_4, alk.
2	....	expl.	....	s.	....	s. bz.
3						
4	1.734	82	155.3	dec.	....	i. CS_2; d. al.
5	6.35	....	....	i.	i.	i. a.
6	....	....	....	i.		
7	....	....	....	200	....	v. s. al.
8	5.4	....	....	i.	i.	s. fused Na_2O_2
9	5.62	....	....	i.	i.	s. dil. HCl
10	2.757	....	1200-1500	i.	sl. s.	s. a.
11	....	subl. 83	....	v. s.	....	s. al.
12	3.78	d.	....	i.	....	i. al.; sl. s. a.
13	....	....	....	v. s.	....	i. al.; s. a.
14	....	....	....	i.	....	s. a., alk.; al. s. NH_4OH
15	....	....	....	i.	i.	s. a., alk.
16	....	36.5	125.5	s.	s.	s. a., alk.
17	....	100	....	s.	s.	
18	....	d. 1500	....	i.	....	i. a., alk.
19	5.04	1990	....	i.	i.	sl. s. a.
20	....	....	....	sl. s.	....	s. a., alk.; i. acet. a.
21	2.121	$-7H_2O$, 100	....	sl. s.	....	s. a., alk.; i. acet. a.
22	$5.71^{15°}$	....	....	i.	....	i. a.; s. HNO_3, HF
23	5.6	....	....	i.	i.	s. HCl, HF; i HNO_3, H_2SO_4
24	3.012	....	....	i.	....	i. a.
25	....	....	....	....	....	v. s. al.
26	$1.867^{17°}$	100	$-10H_2O$, 100	....	d. 67°	i. al.
27	$1.7^{20°}$	$-12H_2O$, 100	....	120		
28	$3.77^{19°}$	....	....	i.	dec.	s. HNO_3
29	$6.92^{20°}$	1615	2200	i.	i.	s. HCl, dil. H_2SO_4; i. HNO_3
30	....	190	−O, 300	i.		
31	....	....	....	i.	....	sl. s. a.
32	2.74	196	d.	$163.4^{0°}$	$206.7^{100°}$	s. al., eth., H_2SO_4
33	....	....	....	s.	....	i. al.
34	....	....	....	i.	....	i. eth.
35	2.751	....	....	v. s.	v. s.	
36	4.11	1100	....	sl. s.	....	i. al.; s. h. HCl
37	....	....	....	dec.	....	s. a.
38	....	....	....	v. s.		
39	....	....	....	i.	i.	i. dil. HNO_3
40	....	....	....	12.35	....	sl. s. al.
41	4.08	....	....	i.	....	v. s. a.
42	$1.9501^{0°}_{4}$	−96.5	116.7	dec.		
43	8.72	1480	....	i.	i.	s. a.
44	$1.827^{10°}$	42-6	d. 135	i.	i.	s. CS_2, eth., al.
45	$6.4^{1°}$	....	....	i.	i.	s. HNO_3

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Cobaltic boride	CoB	69.76	prisms
2	chloride	$CoCl_3$	165.31	
3	chloride dichro	$Co(NH_3)_3Cl_3.H_2O$	234.42	
4	chloride praseo	$Co(NH_3)_4Cl_3.H_2O$	251.46	green cryst.
5	chloride purpureo	$Co(NH_3)_5Cl_3$	250.47	
6	chloride luteo	$Co(NH_3)_6Cl_3$	267.50	
7	chloride roseo	$Co(NH_3)_5Cl_3.H_2O$	268.49	brick red
8	chromate	$2CoO.CrO_3.2H_2O$	285.92	
9	hydroxide	$Co(OH)_3$	109.96	black
10	oxide	Co_2O_3	165.88	black
11	potassium nitrite	$2Co(NO_2)_3.6KNO_2.3H_2O$	958.60	yel. pr.
12	sulfate	$Co_2(SO_4)_3$	406.07	blue cryst.
13	sulfide	Co_2S_3	214.07	blk. cryst.
14	sulfide di-	CoS_2	123.07	black
15	Cobalto cobaltic oxide	Co_3O_4	240.82	reg. blk.
16	Cobaltous acetate	$Co(C_2H_3O_2)_2.4H_2O$	249.05	red-violet cryst.
17	ammonium chloride	$CoCl_2.NH_4Cl.6H_2O$	291.45	red
18	ammonium sulfate	$CoSO_4.(NH_4)_2SO_4.6H_2O$	395.24	
19	arsenate	$Co_3(AsO_4)_2.8H_2O$	598.87	red monocl.
20	arsenite	$Co_3H_6(AsO_3)_4.H_2O$	692.72	rose red
21	bromate	$Co(BrO_3)_2.6H_2O$	422.87	octahdr.
22	bromide	$CoBr_2$	218.77	green
23	bromide	$CoBr_2.6H_2O$	326.88	red prisms
24	carbonate	$CoCO_3$	118.94	rhbdr., red
25	carbonate basic	$2CoCO_3.3Co(OH)_2$	516.75	red
26	chlorate	$Co(ClO_3)_2.6H_2O$	333.95	regular
27	chloride	$CoCl_2$	129.85	blue cryst.
28	chloride	$CoCl_2.6H_2O$	237.95	red monocl.
29	chromate	$CoCrO_4$	174.95	yel.-brown
30	cyanide	$Co(CN)_2.2H_2O$	146.99	buff
31	ferricyanide	$Co_3[Fe(CN)_6]_2$	600.60	red
32	ferrocyanide	$Co_2Fe(CN)_6.7H_2O$	455.88	gray-grn.
33	fluoride	$CoF_2.2H_2O$	132.97	rose red, cryst.
34	fluoride	$CoF_2.5HF.6H_2O$	305.08	trimet. prisms
35	hydroxide	$Co(OH)_2$	92.96	rose red, rhombic
36	iodate	$Co(IO_3)_2$	408.80	
37	iodide	CoI_2	312.80	
38	iodide	$CoI_2.2H_2O$	348.84	green
39	iodide	$CoI_2.6H_2O$	420.90	red
40	nitrate	$Co(NO_3)_2.6H_2O$	291.05	red monocl.
41	oxalate	$CoC_2O_4.2H_2O$	182.97	reddish wh.
42	oxide	CoO	74.94	brown
43	perchlorate	$Co(ClO_4)_2$	257.85	red need.
44	phosphate	$Co_3(PO_4)_2$	366.87	reddish
45	phosphate	$Co_3(PO_4)_2.8H_2O$	511.00	
46	phosphite	$CoHPO_3.2H_2O$	175.01	reddish

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water	Hot water	Alcohol acids, etc.
1	$7.25^{15°}$	....	....	dec.	dec.	s. HNO_3
2	2.94	subl.	....	s.	s.	
3	....	....	....	s.	....	s. a., al.
4	....	....	....	v. s.	....	s. a.; i. al.
5	$1.802^{15°}$	....	....	$0.232^{0°}$	$1.031^{46.6°}$	i. al.
6	$1.7016^{20°}$	....	....	4.26[illegible]°	$12.74^{46.5°}$	i. al., NH_4OH
7	....	....	....	$16.12^{0°}$	$24.87^{16°}$	sl. s. HCl
8	....	....	....	dec.		
9	....	....	....	i.	i.	i. al.; s. a.
10	5.18	....	....	i.	i.	s. a.
11	....	....	....	sl. s.	....	i. al., eth.
12	....	....	....	dec.	....	s. H_2SO_4
13	4.8	....	....	i.	....	d. a.
14	4.269	....	....	i.	....	s. HNO_3, aq. rg.
15	5.8–6.3	....	....	i.	i.	s. a.
16	$1.7043^{13.7°}$	....	....	s.	s.	s. a.
17	....	....	....	deliq.	v. s.	
18	$1.902^{18°}$	....	....	$20.5^{20°}$	$45.4^{80°}$	i. al.
19	2.948	....	....	i.	i.	s. a., NH_4OH
20	....	....	....	i.	....	s. a.
21	....	....	....	$45.5^{17°}$	....	s. NH_4OH
22	$4.909^{25°}_{4}$	d.	....	$66.7^{59°}$	$68.1^{97°}$	s. a., eth.
23	....	100	....	deliq.	$153.2^{97°}$	s. a., eth.
24	4.13	d.	....	i.	i.	s. a.
25	....	....	....	i.	dec.	s. $(NH_4)_2CO_3$
26	....	50	d. 100	$558.3^{0°}$	s.	s. al.
27	$3.348^{25°}_{4}$	subl.	....	$45^{7°}$	$105^{96°}$	31 al., 8.6 acet.
28	1.84	86.75	$-6H_2O$, 110	$76.7^{0°}$	$190.7^{100°}$	v. s. eth.
29	....	d.	....	i.	....	s. a., NH_4OH, dil. HNO_3
30	....	$-2H_2O$, 280	....	i.	....	s. KCN, HCl, NH_4OH
31	....	....	....	i.	....	i. HCl; s. NH_4OH
32	....	....	....	i.	....	i. HCl; s. KCN
33	anh. 4.43	....	....	s.	dec.	s. HF
34	2.086					
35	$3.597^{15°}$	....	....	i.	i.	i. alk.; s. NH_4 salts
36	$5.008^{18°}$	....	....	$0.4^{15°}$	$1.33^{100°}$	s. HCl, HNO_3
37	....	....	....	$159^{9°}$	$420^{100°}$	v. s. al.
38	....	....	....	deliq.		
39						
40	$1.83^{14°}$	56	d.	$133.8^{0°}$	....	$100^{12.5°}$ al.
41	anh. $2.325^{19°}$	....	....	i.	....	s. a., NH_4OH
42	5.68	−O, 2860	....	i.	i.	s. a., NH_4OH; i. al.
43	3.327	....	....	$100^{0°}$	$115^{45°}$	s. al., acet.
44	....	....	....	i.	i.	s. H_3PO_4, NH_4OH
45	....	....	....	i.	i.	s. H_3PO_4
46						

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Cobaltous potassium carbonate	$CoCO_3.KHCO_3.4H_2O$	291.11	rose cryst.
2	selenide	$CoSe$	138.14	yel. cryst.
3	silicate	Co_2SiO_4	209.94	violet
4	sulfate	$CoSO_4$	155.00	red powd.
5	sulfate	$CoSO_4.7H_2O$	281.12	red rhomb. or monocl.
6	sulfide	CoS	91.00	brown need.
7	sulfite	$CoSO_3.5H_2O$	229.08	red
8	Columbic acid	$3Cb_2O_5.7H_2O$	924.71	
9	Columbium (Niobium)	Cb	93.10	steel gray
10	bromide	$CbBr_5$	492.68	purp. red
11	chloride penta-	$CbCl_5$	270.39	yel. need.
12	hydride	CbH	94.11	gray powd.
13	nitride	CbN	107.11	black
14	oxalate	$Cb(HC_2O_4)_5$	538.14	monocl.
15	oxide mono-	CbO	109.10	reg.
16	oxide di-	CbO_2	125.10	black
17	oxide penta-	Cb_2O_5	266.20	cryst.
18	oxybromide	$CbOBr_3$	348.85	yel. cryst.
19	oxychloride	$CbOCl_3$	215.47	need.
20	oxysulfide	Cb_2OS_3	298.39	black
21	Copper	Cu	63.57	red cryst.
22	boride	Cu_3B_2	212.35	yellow
23	hydride	Cu_2H_2	129.16	red-brown
24	nitride	Cu_3N	204.72	
25	peroxide	$CuO_2.H_2O$	113.59	olive grn.
26	suboxide	Cu_4O	270.28	olive grn.
27	Cupric acetate	$Cu(C_2H_3O_2)_2.H_2O$	199.63	dk. grn.
28	aceto-arsenite	$(CuOAs_2O_3)_3.Cu(C_2H_3O_2)_2$	1014.09	green
29	ammonium chloride	$CuCl.2NH_4Cl.2H_2O$	242.05	lt. blue rhbdr. or monocl.
30	ammonium sulfate	$CuSO_4.4NH_3.H_2O$	245.78	rhombic blue
31	arsenate	$Cu_3(AsO_4)_2.4H_2O$	540.69	bluish grn.
32	arsenate, acid	$Cu_5H_2(AsO_4)_4.2H_2O$	911.74	blue
33	arsenide	Cu_5As_2	467.77	bluish octahdr.
34	arsenite (Paris green)	$CuHAsO_3$	187.54	green
35	bromate	$Cu(BrO_3)_2.5H_2O$	409.48	blue-grn. cryst.
36	bromide	$CuBr_2$	223.40	black

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	....	....	....	dec.		
2	7.65					
3	4.63	....	....	i.	....	d. HCl
4	$3.472^{[illegible]°}$	98.9	d. 880	$26.2^{3°}$	$82.6^{100°}$	$1.04^{[illegible]}$ meth. al.
5	$1.918^{15°}$	96.8	$-7H_2O$, 420	$60.4^{[illegible]°}$	s.	$2.5^{[illegible]°}$ al.
6	$5.45^{18°}$	>1100	....	0.00038	....	s. a., aq. rg., al.
7	....	....	....	i.	....	s. H_2SO_3
8	....	....	....	i.	....	s. KOH, HF, H_2SO_4
9	$7.06^{18°}_{18}$	1950, ign.	....	i.	i.	sl. s. HCl, HNO_3, aq. rg.; s. hot H_2SO_4
10						
11	$2.75^{20°}$	194	240.5	dec.	....	s. CCl_4, al., HCl
12	6.0–.6	d.	....	....	....	s. HF; i. a.
13	....	....	....	....	....	i. HNO_3; s. $HF+HNO_3$
14	....	....	....	dec.	dec.	d. al.; s. $H_2C_2O_4$
15	6.3–.7					
16	....	....	....	i.	....	i. HNO_3; s. H_2SO_4
17	4.4–.5	....	....	i.	....	s. H_2SO_4, HF
18	....	subl.	....	dec.	....	s. a.
19	....	subl. 400	....	dec.	....	s. H_2SO_4, al.
20	....	....	....	i.	....	s. H_2SO_4
21	8.91–.96	1083	2310	i.	i.	s. HNO_3, h. H_2SO_4
22	8.116					
23	....	d. 60	....	....	....	s. HCl
24	....	d. 300	....	....	....	d. a.
25	....	....	....	i.	....	s. a.
26	....	....	....	i.	....	d. a.
27	1.9	d. 240	....	7.2	20	7.143 al.; s. eth.
28	....	....	....	i.	....	s. a., NH_4OH
29	1.96–.97	$-2H_2O$, 120	....	$33.8^{0°}$	$99.3^{80°}$	s. a.
30	....	d. 150	....	$18.5^{21.5°}$	dec.	i. al.
31	....	....	....	i.	i.	s. a., NH_4OH
32	....	....	....	i.	....	s. a., NH_4OH
33	7.56	d.	....	i.	i.	s. HNO_3, aq. rg.
34	....	d.	....	i.	i.	s. a., NH_4OH
35	2.583	$-5H_2O$, 200	....	v. s.		
36	....	d.	....	v. s.	....	i. bz.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Cupric carbonate ba- (malachite)	$CuCO_3.Cu(OH)_2$	221.16	dk. grn. monocl.
2	carbonate (azurite)	$2CuCO_3.Cu(OH)_2$	344.73	blue monocl.
3	chlorate	$Cu(ClO_3)_26H_2O$	338.58	grn. octahdr.
4	chloride	$CuCl_2$	134.48	br. yellow
5	chloride	$CuCl_2.2H_2O$	170.52	blue rhombic
6	chromate, basic	$CuCrO_4.2CuO.2H_2O$	374.75	yellow-br.
7	cyanide	$Cu(CN)_2$	115.59	yellow grn.
8	dichromate	$CuCr_2O_7.2H_2O$	315.62	blk. cryst.
9	ferricyanide	$Cu_3[Fe(CN)_6]_2$	614.49	yel.-grn.
10	ferrocyanide	$Cu_2Fe(CN)_6.7H_2O$	465.14	red br.
11	fluoride	$CuF_2.2H_2O$	137.60	pale bl. monocl.
12	fluosilicate	$CuSiF_6.6H_2O$	313.73	blue
13	formate	$Cu(CHO_2)_2$	153.59	blue monocl.
14	hydroxide	$Cu(OH)_2$	97.59	blue cryst.
15	iodate	$Cu(IO_3)_2$	413.43	grn. monocl.
16	iodate	$Cu(IO_3)_2.H_2O$	431.45	blue tricl.
17	iodate	$Cu(IO_3)_2.2H_2O$	449.47	grn.-blue
18	iodate, basic	$CuOHIO_3$	255.51	grn. orthorhombic
19	lactate	$Cu(C_3H_5O_3)_2.2H_2O$	277.68	dk. blue monocl.
20	nitro prusside	$CuFe(CN)_5NO.2H_2O$	315.49	greenish
21	nitrate	$Cu(NO_3)_2.3H_2O$	241.63	blue prism.
22	nitrate	$Cu(NO_3)_2.6H_2O$	295.68	blue cryst.
23	oxalate	$CuC_2O_4.\frac{1}{2}H_2O$	160.58	bl. white
24	oxide	CuO	79.57	reg. monocl., blk.
25	oxychloride	$CuCl_2.2CuO.4H_2O$	365.69	bl.-grn.
26	periodate	Cu_2HIO_6	351.08	grn. powd.
27	phosphate	$Cu_3(PO_4)_2.3H_2O$	434.81	rhombic blue
28	phosphide	Cu_3P_2	252.76	black
29	phosphite	$CuHPO_3.2H_2O$	179.64	
30	salicylate	$Cu(C_7H_5O_3)_2.4H_2O$	409.71	bl.-grn. need.
31	sulfate	$CuSO_4$	159.61	grn.-white powd.
32	sulfate (blue vitriol)	$CuSO_4.5H_2O$	249.69	tricl. blue
33	sulfide	CuS	95.63	blk. hex.
34	tartrate	$CuC_4H_4O_6.3H_2O$	265.65	lt. grn.
35	Cuprous ammonium iodide	$CuI.NH_4I.H_2O$	353.49	rhombic plates
36	bromide	Cu_2Br_2	286.97	brown
37	carbonate	Cu_2CO_3	187.14	yellow
38	chloride	Cu_2Cl_2	198.05	wh. tetrahdr.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water	Hot water	Alcohol, acids, etc.
1	3.7–4.0	d.	....	i.	dec.	0.026 CO_2 water; s. KCN
2	3.88	d.	....	i.	dec.	s. NH_4OH, h. $NaHCO_3$ aq.
3	....	65	d. 100	$207^{0°}$	v. s.	s. al.
4	3.054	498	d.	$70.6^{0°}$	$107.9^{100°}$	53[illegible] al.; $68^{.5°}$ meth. al.
5	2.47–.54	−2H_2O, 100	d.	$110.4^{0°}$	$192.4^{100°}$	s. al., eth., NH_4Cl
6	....	−2H_2O, 260	....	i.	....	s. HNO_3, NH_4OH
7	....	d.	....	i.	....	s. KCN
8	$2.286^{18°}$	....	....	deliq.	dec.	s. a., NH_4OH
9	....	....	....	i.	....	i. HCl; s. NH_4OH
10	....	....	....	i.	i.	s. NH_4OH
11	....	....	....	sl. s.	dec.	s. al., HCl, HNO_3, HF
12	2.182	....	....	$2.32^{17°}$	....	$0.16^{20°}$ al.
13	1.831	....	....	12.5	dec.	0.25 al.
14	3.368	d.	....	i.	dec.	s. a., al., NH_4OH, KCN
15	$5.241^{15°}$	d.	....	$0.1364^{25°}$	i.	s. dil. H_2SO_4,
16	$4.876^{15°}$	d. 290	....	$0.1424^{25°}$	i.	i. dil. HNO_3
17	....	d.	....	$0.33^{15°}$	$0.65^{100°}$	s. HCl, NH_4OH
18	$4.878^{15°}$	d. 290	....	i.	i.	s. dil. H_2SO_4
19	....	....	....	16.7	$45^{100°}$	0.9 c., 4 h., al.
20	....	....	....	i.	....	d. alk.
21	2.174	114.5	d. 170	$137.8^{0°}$	$1270^{100°}$	$100^{12.5°}$ al.
22	2.074	26.4	d	$243.7^{0°}$	∞	s. al.
23	....	....	....	i.	....	i. acet. a.
24	6.3–.4	1064	−O, 1040	i.	i.	s. a., NH_4Cl, KCN
25	....	−3H_2O, 140	....	i.	....	s. a.
26	....	d., 110	....	i.	i.	s. dil. HNO_3
27	....	....	....	sl. s.	....	s. a., NH_4OH
28	6.67	....	....	i.	....	i. HCl; s. HNO_3
29	....	d.	....	i.	i.	
30	....	....	....	v. s.	....	v. s. al.
31	$3.516^{30°}$	d. 621	....	$20^{0°}$	$194^{100°}$	i. al.
32	$2.284^{15°}$	−4H_2O, 110	−5H_2O, 230	$31.61^{0°}$	$203.3^{100°}$	i. al.
33	3.98	d. 220	....	0.000033	....	s. HNO_3, KCN
34	....	d.	....	$0.02^{15°}$	$0.14^{85°}$	
35	....	....	....	dec.	dec.	s. NH_4I
36	4.72	484	861–954	i.	i.	s. HBr, HCl, NH_4OH
37	....	d.	....	i.	i.	s. a., NH_4OH
38	3.53	422	954–1032	sl. s.	....	s. HCl, NH_4OH

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Cuprous cyanide	$Cu_2(CN)_2$	179.16	wh. monocl.
2	fluoride	Cu_2F_2	165.14	red cryst.
3	ferricyanide	$Cu_3Fe(CN)_6$	402.60	br.-red
4	ferrocyanide	$Cu_4Fe(CN)_6$	466.17	br.-red
5	hydroxide	$CuOH$	80.58	yellow
6	iodide	Cu_2I_2	381.00	
7	oxide	Cu_2O	143.14	reg. red
8	phosphide	Cu_6P_2	443.47	gray blk.
9	sulfide	Cu_2S	159.20	rhombic blk.
10	sulfite	$Cu_2SO_3.H_2O$	225.22	red
11	sulfocyanate	$CuCNS$	121.64	white
12	Cyanogen	C_2N_2	52.02	gas
13	Cyanogen compounds	*see organic tables*		
14	Dysprosium	Dy	162.52	
15	acetate	$Dy(C_2H_3O_2)_3.4H_2O$	411.66	yel. need.
16	bromate	$Dy(BrO_3)_3.9H_2O$	708.41	yel. hex. need.
17	carbonate	$Dy_2(CO_3)_3.4H_2O$	577.10	
18	chloride	$DyCl_3$	268.89	yel. plates
19	chromate	$Dy_2(CrO_4)_3.10H_2O$	853.23	yel. cryst.
20	oxalate	$Dy_2(C_2O_4)_3.10H_2O$	769.20	prisms
21	phosphate	$DyPO_4.5H_2O$	347.63	yellow
22	selenate	$Dy_2(SeO_4)_3.8H_2O$	898.77	yel. need.
23	Erbium	Er	167.70	
24	chloride	$ErCl_3.6H_2O$	382.17	
25	nitrate	$Er(NO_3)_3.6H_2O$	461.82	cryst.
26	oxide	Er_2O_3	383.40	
27	sulfate	$Er_2(SO_4)_3$	623.59	
28	sulfate	$Er_2(SO_4)_3.8H_2O$	767.72	
29	Ferric acetate, basic	$FeOH(C_2H_3O_2)_2$	190.90	amor.
30	arsenate	$FeAsO_4.2H_2O$	230.83	rhombic, wh.
31	arsenite, basic	$2FeAsO_3.Fe_2O_3.5H_2O$	607.36	br.-yel.
32	bromide	$FeBr_3$	295.59	dk. red cryst.
33	chloride	$FeCl_3$	162.21	hex., blk.-br.
34	chloride	$FeCl_3.6H_2O$	270.31	red-yel.
35	ferrocyanide (Prussian blue)	$Fe_4[Fe(CN)_6]_3$	859.02	dk. bl. cryst.
36	fluoride	FeF_3	112.84	grn., rhombic
37	fluoride	$FeF_3.4\frac{1}{2}H_2O$	193.91	yel. cryst.
38	formate	$Fe(CHO_2)_3.H_2O$	208.88	yel. cryst.
39	hydroxide	$Fe(OH)_3$	106.86	red-br.
40	hypophosphite	$Fe(H_2PO_2)_3$	250.97	
41	lactate	$Fe(C_3H_5O_3)_3$	322.96	brn. amor.
42	nitrate	$Fe(NO_3)_3.9H_2O$	404.01	rhombic
43	oxalate	$Fe_2(C_2O_4)_3$	375.68	amor.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	....	....	....	i.	i.	s. HCl, NH_4OH, KCN
2	....	908	....	i.	....	s. HNO_3, HCl; i. al.
3	....	....	....	i.	....	s. NH_4OH; i. HCl
4	....	....	....	i.	....	s. NH_4OH; i NH_4Cl
5	....	$-\frac{1}{2}H_2O$, 360	....	i.	i.	s. a., NH_4OH
6	$5.65^{15°}$	606	759–72	$0.0008^{20°}$	....	i. a., al.; s. KI
7	5.88	1210	−O, 1800	i.	i.	s. NH_4OH, NH_4Cl, HCl
8	6.35–.75	....	....	i.	....	s. HNO_3; i. HCl
9	5.58	1100	....	0.00005	....	s. HNO_3
10	3.83–4.46	....	....	sl s.	....	s. NH_4OH, HCl; i. al., eth.
11	....	1084	....	$0.023^{15°}$	....	s. NH_4OH
12	1.8064 (A)	−39	−22	25 c.c.	....	4.4 c.c. al.; s. eth.
13						
14						
15	....	d. 120	....	s.	....	v. sl. s. al.
16	....	78	$-6H_2O$, 110	v. s.	....	sl. s. al.
17	....	$-3H_2O$, 150	....	i.		
18	3.67_4	680				
19	....	$-3\frac{1}{2}H_2O$, 150	d.	$1.002^{25°}$		
20	....	....	....	i.	....	s. dil. a.
21	....	$-5H_2O$, 200	....	i.	....	s. dil. a., acet. a.
22	....	$-8H_2O$, 200	....	v. s.	....	i. al.
23	4.77					
24	....	....	....	deliq.	s.	s. al.
25	....	....	....	s.	....	s. al.
26	5.64	....	....	i.	....	s. h. a.
27	3.678	d. 950	....	43		
28	3.180	....	....	30	$100^{100°}$	
29	....	....	....	i.	....	s. al., a.
30	3.18	d.	....	i.	i.	s. HCl
31	....	d.	....	sl. s.	....	s. a., alk.
32	....	subl. d.	....	s.	s.	s. al., eth.
33	$2.804^{11°}$ (A) $11.2^{320°}$	298	....	$74.3^{0°}$	$536.6^{100°}$	v. s. al., eth. + HCl
34	....	37	280–5	$246^{0°}$	∞	s. al.
35	....	d.	....	i.	i.	s. HCl, H_2SO_4
36	3.18	....	....	sl. s.	s.	i. al., eth.; s. a.
37	....	$-3H_2O$, 100	....	sl. s.	s.	i. al.
38	....	....	....	s.	dec.	
39	3.4–.9	$-1\frac{1}{2}H_2O$, 500	....	i.	i.	i. al.; s. a.
40	....	d.	....	$0.043^{25°}$	$0.083^{100°}$	s. alk. citrate
41	....	....	....	deliq.	v. s.	i. eth.
42	$1.6835^{20°}$	47.2	d.	v. s.	v. s.	s. al.
43	....	d. 100	....	v. s.	v. s.	i. al.; s. a.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol wt.	Crystalline form and color
1	Ferric oxide (hematite)	Fe_2O_3	159.68	red, hex., rhbdr. or reg.
2	phosphate	$FePO_4.4H_2O$	222.93	yel. rhomb. or monocl.
3	pyrophosphate	$Fe_4(P_2O_7)_3.9H_2O$	907.67	yel.
4	sulfate	$Fe_2(SO_4)_3$	399.87	amor.
5	sulfate	$Fe_2(SO_4)_3.9H_2O$	562.02	yel. rhomb.
6	*(See also under alum)*			
7	sulfide	Fe_2S_3	207.87	yel.-grn.
8	sulfocyanate	$Fe(CNS)_3.3H_2O$	284.10	dk. red, reg.
9	Ferroso-ferric	$FeCl_2.2FeCl_3.18H_2O$	775.46	yel.
10	chloride			
11	ferricyanide (Prus-	$Fe'''_4Fe''_3[Fe(CN)_6]_6$	1662.21	grn.
12	sian green)			
13	hydrate	$Fe_3O_4.4H_2O$	303.58	blk.
14	oxide (magnetic	Fe_3O_4	231.52	blk., octahdr.
15	oxide)			
16	sulfide	Fe_3S_4	295.78	hex.
17	Ferrous acetate	$Fe(C_2H_3O_2)_2.4H_2O$	245.95	need.
18	ammonium sulfate	$FeSO_4(NH_4)_2SO_4.6H_2O$	392.14	monocl., bl.-grn.
19	arsenate	$Fe_3(AsO_4)_2.6H_2O$	552.54	grn. amor.
20	arsenite	$Fe_2As_2O_5$	341.60	grn.-wh.
21	bromide	$FeBr_2$	215.67	
22	bromide	$FeBr_2.6H_2O$	323.77	rhomb., red
23	carbonate	$FeCO_3$	115.84	rhbdr. gray
24	carbonate	$FeCO_3.H_2O$	133.86	amor.
25	chloride	$FeCl_2$	126.75	
26	chloride	$FeCl_2.4H_2O$	198.82	monocl. bl.-grn.
27	chloroplatinate	$FePtCl_6.H_2O$	481.83	yel. hex.
28	ferricyanide (Turnbull's blue)	$Fe_3[Fe(CN)_6]_2$	591.30	deep bl.
29	ferrocyanide	$Fe_2Fe(CN)_6$	323.57	amor. bl.-wh.
30	fluoride	$FeF_2.8H_2O$	237.97	grn.
31	formate	$Fe(CHO_2)_2.2H_2O$	181.89	
32	hydroxide	$Fe(OH)_2$	89.86	pa. grn. cryst.
33	iodide	$FeI_2.4H_2O$	381.77	grn. cryst.
34	lactate	$Fe(C_3H_5O_3)_2.3H_2O$	287.97	grn. cryst.
35	nitrate	$Fe(NO_3)_2.6H_2O$	287.95	cryst.
36	oxalate	$FeC_2O_4.2H_2O$	179.86	pa. yel. cryst.
37	oxide	FeO	71.84	black
38	perchlorate	$Fe(ClO_4)_2.6H_2O$	362.85	grn.
39	phosphate	$Fe_3(PO_4)_2.8H_2O$	501.70	monocl. bl.
40	potassium oxalate	$K_2Fe(C_2O_4)_2.2H_2O$	346.06	gold., need.
41	sulfate	$FeSO_4.7H_2O$	278.02	monocl. or rhombic, bl.-grn.
42	sulfide	FeS	87.90	blk. hex.
43	sulfite	$FeSO_3.2\frac{1}{2}H_2O$	180.94	
44	sulfocyanate	$Fe(CNS)_2.3H_2O$	226.03	grn. rhomb.
45	tartrate	$FeC_4H_4O_6$	203.87	cryst.
46	thiosulfate	$FeS_2O_3.5H_2O$	258.05	grn. cryst.
47	*See also under iron*			
48	Fluorine	F_2	38.00	grn.-yel.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of: Cold water	Hot water	Alcohol, acids, etc.
1	5.12–.30	1541	....	i.	....	s. HCl.
2	2.87	....	....	i.	0.067	i. acet. a.; s. min. a
3	....	....	....	i.	....	s. a.
4	3.097[illegible]	d. 480	....	sl. s.	dec.	i. H_2SO_4
5	2.0–.1	....	....	v. s.	dec.	s. abs. al.
6						
7	4.25–.41	d.	....	dec.	dec.	d. a.
8	....	d.	....	v. s.	v. s.	v. s. al., eth.
9	....	d. 50	....	deliq.		
10						
11	....	d. 180	....	i.	....	s. h. HCl
12						
13	....	d.	....	i.	i.	s. a.
14	4.96–5.40	1538	....	i.	i.	i. al.
15						
16	4.51–.64	....	....	i.	....	s. a.
17	....	d.	....	v. s.		
18	1.865	d.	....	$18^{0°}$	$78.2^{75°}$	i. al.
19	....	d.	....	i.	i.	sl. s. NH_4OH; s. dil. HCl
20	....	....	....	i.	....	s. NH_4OH
21	$4.636^{25°}$	....	....	$102^{0°}$	$177.8^{100°}$	s. al.
22	....	27	....	$313.2^{0°}$	∞	s. al.
23	3.7–.9	d.	....	i.	i.	s. CO_2 aq.
24	....	d.	....	sl. s.	....	s. a., CO_2 aq.
25	$2.988^{16°}$	....	....	$64.4^{10°}$	$105.7^{100°}$	100 al.
26	1.926	....	....	$160.1^{10°}$	$415.5^{100°}$	s. al.
27	2.714	....	....	v. s.	v. s.	
28	....	d.	....	i.	....	i. al., dil. a.
29	....	....	....	i.		
30	4.09 anh.	$-8H_2O$, 100	....	sl. s.	....	s. HF; i. al., eth.; s. a.
31	....	d.	....	sl. s.		
32	....	....	....	0.00067	....	s. a., NH_4Cl
33	2.873	177 anh.	....	v. s.	dec.	s. al.
34	....	d.	....	$2.1^{10°}$	$8.5^{100°}$	i. al.
35	....	60.5	....	$200^{0°}$	$300^{25°}$	
36	....	d. 160	....	0.022	0.026	s. a.
37	....	1419	....	i.	i.	s. a.; i. alk.
38	....	d. <100	....	s.	....	s. al.
39	2.58–.68	....	....	i.	i.	s. a.; i. acet. a.
40	....	d.	....	s.	s.	
41	$1.8987^{14.8°}$	64, $-6H_2O$, 100	$-7H_2O$, 300	$32.8^{0°}$	$196.4^{76°}$	i. al.
42	4.84	1197	d.	0.00089	....	s. a.
43	....	d. 250	....	sl. s.	....	s. SO_2 aq.
44	....	d.	....	v. s.	....	v. s. al., eth.
45	....	....	....	$0.877^{16°}$		
46	....	....	....	v. s.	dec.	v. s. al.
47						
48	(A) $1.31^{15°}$	−223	−187	dec.	dec.	

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Fluosilicic acid	H_2SiF_6	144.08	
2	Formic acid	$HCOOH$	46.02	colorl. liq.
3	Gadolinium	Gd	157.26	
4	acetate	$Gd(C_2H_3O_2)_3.4H_2O$	406.40	tricl.
5	bromide	$GdBr_3.6H_2O$	505.10	rhomb. pl.
6	chloride	$GdCl_3$	263.63	pr. need.
7	chloride	$GdCl_3.6H_2O$	371.73	quad. pyram.
8	nitrate	$Gd(NO_3)_3.6\frac{1}{2}H_2O$	460.39	asym.
9	oxalate	$Gd_2(C_2O_4)_3.10H_2O$	758.68	monocl.
10	potassium sulfate	$Gd_2(SO_4)_3.K_2SO_4.2H_2O$	813.00	cryst.
11	selenate	$Gd_2(SeO_4)_3.8H_2O$	888.25	pearly monocl.
12	sulfate	$Gd_2(SO_4)_3$	602.71	
13	sulfate	$Gd_2(SO_4)_3.8H_2O$	746.84	monocl.
14	Gallium	Ga	69.72	gray, octahdr.
15	bromide	$GaBr_3$	309.47	cryst.
16	chloride di-	$GaCl_2$	140.63	wh. cryst.
17	chloride tri-	$GaCl_3$	176.09	wh. need.
18	hydroxide	$Ga(OH)_3$	120.74	
19	iodide	GaI_3	450.52	
20	nitrate	$Ga(NO_3)_3$	255.74	
21	oxide mono-	GaO	85.72	gray-bl.
22	oxide sesqui-	Ga_2O_3	187.44	
23	sulfate	$Ga_2(SO_4)_3$	427.63	wh.
24	sulfide	Ga_2S_3	235.63	wh.
25	Germanium	Ge	72.60	gray,-cubic.
26	bromide	$GeBr_4$	392.26	gray, reg., octhdr.
27	chloride di-	$GeCl_2$	143.51	
28	chloride tetra-	$GeCl_4$	214.43	liq.
29	chloroform	$GeHCl_3$	179.98	colorl. liq.
30	ethide	$Ge(C_2H_5)_4$	188.76	
31	fluoride	$GeF_4.3H_2O$	202.65	cryst.
32	iodide	GeI_4	580.33	yel.
33	oxide mono-	GeO	88.60	gray-blk.
34	oxide di-	GeO_2	104.60	rhombic, wh.
35	oxychloride	$GeOCl_2$	159.51	
36	sulfide mono-	GeS	104.66	rhombic or monocl.
37	sulfide di-	GeS_2	136.73	wh. powd.
38	Glucinum *see beryllium*			
39	Gold	Au	197.20	reg. yel.
40	colloidal	Au	197.20	bl.-violet.
41	bromide (ic)	$AuBr_3$	436.95	dk.-br.
42	bromide (ous)	AuBr	277.12	yel.-grn.
43	chloride (ic)	$AuCl_3$	303.57	yel.-red cryst.
44	chloride (ic)	$AuCl_3.2H_2O$	339.60	orange.
45	chloride (ous)	AuCl	232.66	yel. cryst.
46	cyanide (ic)	$Au(CN)_3.6H_2O$	383.32	
47	cyanide (ous)	AuCN	223.21	yel. cryst.
48	hydrogen nitrate (ic)	$Au(NO_3)_3.HNO_3.3H_2O$	500.29	yel. tricl. octhdr.
49	hydroxide (ic)	$Au(OH)_3$	248.22	yel. br.
50	hydroxide (ous)	AuOH	214.21	red. br.
51	iodide (ic)	AuI_3	578.00	dk. grn.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point Deg. C.	Boiling-point Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	....	....	....	s.	s.	
2	$1.218^{20°}$	8.6	100.8	∞	∞	
3	1.31					
4	1.611	....	....	sl. s.		
5	2.844	....	....	s.	s.	
6	$4.52^{0°}$	628	....	s.	s.	
7	....	....	....	s.	s.	
8	2.332	....	....	v. s.	v. s.	
9	....	$-6H_2O$, 110	....	0.11	....	s. HNO_3
10	$1.503^{16°}$	....	....	s.	s.	s. K_2SO_4
11	3.309	$-8H_2O$, 130	....	s.	s.	
12	$4.139^{14.6°}$	....	....	$3.98^{0°}$	$2.26^{34.4°}$	
13	3.010	....	....	s.	s.	
14	$5.95^{24°}$	30.15	....	i.	i.	s. a., alk.
15	....	....	....	deliq.	s.	
16	....	164	535	deliq.	dec.	
17	$2.36^{80°}_{80}$	75.5	220	deliq.	dec.	
18	....	....	....	i.	....	s. a., alk.
19	....	....	....	deliq.	s.	
20	....	d. 110	Ga_2O_3, 200	deliq.	v. s.	
21	....	....	....	i.	....	s. a.
22	....	....	....	i.	....	s. a.
23	....	....	....	v. s.	v. s.	s. al.; i. eth.
24						
25	$5.469^{20°}_{20}$	958	>1350	i.	i.	s. h. H_2SO_4, aq. reg.
26	....	O ±	....	dec.		
27	....	....	....	dec.		
28	$1.887^{18°}$	....	86	dec.	....	i. h. H_2SO_4
29	....	....	72	i.	i.	
30	....	....	160	i.	....	s. HCl
31	....	d.	....	deliq.	s.	
32	(A) $20.5^{440°}$	144	350–400	deliq.	s.	
33	....	....	....	s.	....	s. HCl
34	$4.703^{18°}$	....	....	$0.4^{20°}$	1.05[illegible]	s. a., alk.
35	....	....	>100	i.	....	s. a.
36	(A) $3.54^{1100°}$	....	....	0.25	sl. s.	s. HCl, KOH
37	....	....	....	0.45	sl. s.	i. a.; s. alk.
38						
39	$19.32^{17.5°}$	1063.0	2500	i.	i	i. a.; s. KCN, aq. reg.
40	....	....	....	s.	....	i. a.; s. alk., aq. reg.
41	....	....	....	s.	....	s. eth.
42	....	d. 115	....	i.	i.	d. a.
43	3.9	d. 180	....	68	v. s.	s. al., eth.
44	....	d.	....	s.	s.	s. al.
45	....	d.	....	dec.	dec.	
46	....	....	....	v. s.	v. s.	s. al.
47	....	d.	....	i.	i.	i. a.; s. KCN
48	2.58	d.	....	d.	....	s. HNO_3
49	....	$-1\frac{1}{2}H_2O$, 100	d. 250	i.	i.	s. HNO_3
50	....	d. 250	....	s.		
51	....	....	....	i.	dec.	s. iodides

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Gold iodide (ous)	AuI	324.13	yel.
2	oxide (ic)	Au_2O_3	442.40	blk.
3	oxide (ous)	Au_2O	410.40	violet
4	phosphide	Au_2P_3	487.48	gray
5	sulfate (ic)	$Au_2O_3.2SO_3.H_2O$	620.54	
6	sulfide (ic)	Au_2S_3	490.59	br.
7	sulfide (ous)	Au_2S	426.46	blk.
8	Helium	He	4.00	
9	Hydrazine	$NH_2.NH_2$	32.05	cryst. wh. or liq.
10	azoimid	$N_2H_4.HN_3$	75.08	
11	dihydrochloride	$N_2H_4.2HCl$	104.98	reg.
12	formate	$N_2H_4.2HCOOH$	124.08	reg.
13	hydroxide	$N_2H_4.H_2O$	50.06	
14	sulfate	$N_2H_4.H_2SO_4$	130.13	tablets
15	nitrate	$N_2H_4.HNO_3$	95.06	
16	Hydrazoic acid	HN_3	43.03	liq.
17	Hydrobromic acid (hydrogen bromide)	HBr	80.92	colorl. gas
18	Hydrobromic acid	$HBr.H_2O$	98.94	colorl. liq.
19	Hydrobromic acid	$HBr.H_2O$(47.8%)	98.94	colorl. liq.
20	Hydrochloric acid (hydrogen chloride)	HCl	36.47	colorl. gas
21	Hydrochloric acid	$HCl.H_2O$(45.2%)	54.48	colorl. liq.
22	Hydrochloric acid	$HCl.8H_2O$(20.18%)	180.59	colorl. liq.
23	Hydrocyanic acid	HCN	27.02	colorl. liq. or gas
24	Hydroferricyanic acid	$H_3Fe(CN)_6$	214.91	grn. br. need.
25	Hydrofluoric acid (hydrogen fluoride)	HF	20.01	colorl. liq. or gas
26	Hydrofluoric acid	$HF.H_2O$(35.35%)	38.02	colorl. liq.
27	Hydriodic acid (hydrogen iodide)	HI	127.94	colorl.gas
28	Hydriodic acid	$HI.H_2O$(57%)	145.96	colorl. liq.
29	Hydrogen	H_2	2.016	colorl. gas
30	peroxide	H_2O_2	34.02	colorl. liq.
31	persulfide	H_2S_2	66 14	yel. oil
32	selenide	H_2Se	81.22	
33	sulfide	H_2S	34.08	colorl. gas
34	telluride	H_2Te	129.52	gas
35	Hydroxylamine	NH_2OH	33.03	cryst.
36	hydrochloride	$NH_2OH.HCl$	69.50	monocl.
37	nitrate	$NH_2OH.HNO_3$	96.05	
38	sulfate	$(NH_2OH)_2.H_2SO_4$	164.14	monocl.
39	Indium	In	114.80	reg. octhdr.
40	bromide	$InBr_3$	354.55	cryst.
41	chloride mono-	InCl	150.26	dk. red cryst.
42	chloride di-	$InCl_2$	185.71	cryst.
43	chloride tri-	$InCl_3$	221.17	
44	cyanide	$In(CN)_3$	192.82	

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	....	d. 120	....	i.	sl. s.	s. exc. KI
2	....	−O, 160; −3O, 250	....	i.	i.	s. HCl
3	....	d. 250	....	i.	i.	s. HI, HCl, alk.
4	6.67	d.	....	....	....	i. HCl
5	....	....	....	deliq.	dec.	s. HCl, H_2SO_4
6	....	....	....	i.	....	s. Na_2S, K_2S; i. a.
7	....	....	....	i.	....	i. a.
8	(A) 0.1368 (D) 1.98	<−271	−267	1.487 c.c.$^{0.5°}$	1.371 c.c.[illegible]	absorb. Pt
9	$1.013^{15°}$	1.4	113	v. s.	....	s. al.
10	....	65	....	deliq.	v. s.	v. s. al.
11	....	198	....	s.	v. s.	s. al.
12	....	128	....	s.		
13	$1.0305^{21°}$	<−40	119	∞	∞	[illegible] al.; i. eth.
14	....	254	....	sl. s.	v. s.	i. al.
15	....	69				
16	....	−80	37	∞	....	s. al.
17	(A) $2.71^{0°}$	−86.13	−68.7	221.2 c.c.$^{0°}$	130 c.c.$^{100°}$	s. al.
18	1.78					
19	1.49	−11	126	∞	∞	s. al.
20	(A) $1.269^{0°}$	−112.5	−83.1	82.5 c.c.$^{10°}$	56.1 c.c.$^{60°}$	s. al., eth.
21	1.2257	....	....	∞	....	s. al.
22	1.101	....	110	∞	....	s. al.
23	(A) $0.697^{18°}$	−15	26.1	∞	∞	∞ al., eth.
24	....	d.	....	deliq.	s.	s. al.
25	(A) $0.7126^{0°}$	−92.3	19.44	264 c.c.	v. s.	
26	1.15	....	120	v. s.	v. s.	
27	(A) $4.38^{0°}$	−51.3	−35.7	42,500 c.c.$^{10°}$	v. s.	s. al.
28	1.67	....	127	∞	∞	∞ al.
29	(A) 0.06948	−259	−252.6	1.93 c.c.$^{0°}$	....	s. Pd, Pt, Fe
30	$1.458^{0°}$	−2	80.2	∞	....	s. al., eth.
31	1.734	−75	....	d.	....	s. CS_2, bz.; i. al.
32	....	−64	−42	331 c.c.$^{13°}$	....	s. CS_2
33	(A) 1.1895	−83.8	−60.2	437 c.c.$^{0°}$	186 c.c.$^{40°}$	9.54 c.c.$^{20°}$ al.
34	(D) 65.1	−57	0	s.		
35	$1.227^{14°}$	33.05	70^{50mm}	s.	dec.	s. al., a.
36	....	151	d.	v. s.	....	s. al.; i. eth.
37	....	−10	d. >100	v. s.	dec.	v. s. al.
38	....	170	....	v. s.	s.	sl. s. al.
39	$7.12^{13°}$	155	700	i.	i.	s. a.
40	....	....	....	deliq.	v. s.	
41	....	....	....	deliq.	dec.	
42	....	....	....	deliq.	dec.	
43	....	....	440	deliq.	v. s.	sl. s. al., eth.
44	....	....	....	i.	....	s. HCN

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Indium fluoride	$In_2F_6.18H_2O$	667.89	need
2	hydroxide	$In(OH)_3$	165.82	
3	iodide	InI_3	494.60	yel. cryst
4	iodate	$In(IO_3)_3$	638.60	cryst
5	nitrate	$In(NO_3)_3.4\frac{1}{2}H_2O$	381.90	need
6	oxide mono-	InO	130.80	black
7	oxide sesqui-	In_2O_3	277.60	yel. amor. or rhombic
8	perchlorate	$In(ClO_4)_3.8H_2O$	557.30	cryst.
9	sulfate	$In_2(SO_4)_3$	517.79	
10	sulfide	In_2S_3	325.79	yel.
11	sulfite	$2In_2O_3.3SO_2.8H_2O$	891.52	cryst
12	Iodic acid	HIO_3	175.94	rhombic
13	Iodine	I_2	253.86	rhombic, blk.
14	chloride mono-α	ICl	162.39	rhombic, red need.
15	chloride mono-β	ICl	162.39	red br., rhombic plates
16	chloride, tri-	ICl_3	233.30	yel. cryst
17	fluoride	IF_5	221.93	liq.
18	monobromide	IBr	206.85	dk. gray cryst
19	oxide di-	IO_2	158.93	yel. cryst
20	oxide penta-	I_2O_5	333.86	trim.
21	Iodoplatin. acid, *see platinic*			
22	Iridium	Ir	193.10	white spongy
23	Iridium	Ir	193.10	reg. or hex. rhombic
24	bromide tri-	$IrBr_3.4H_2O$	504.91	olive grn. cryst
25	bromide tetra-	$IrBr_4$	512.76	blue cryst
26	chloride di-	$IrCl_2$	264.01	blk.-grn. cryst
27	chloride tri-	$IrCl_3$	299.47	olive grn
28	chloride tetra-	$IrCl_4$	334.93	dk. red cryst
29	hydroxide di-	$IrO_2.2H_2O$	261.13	ind. bl.
30	hydroxide sesqui-	$Ir_2O_3.3H_2O$	488.25	blk.
31	iodide tri-	IrI_3	573.90	blk. cryst
32	iodide tetra-	IrI_4	700.83	blk.
33	oxide di-	IrO_2	225.10	blk.
34	oxide sesqui-	Ir_2O_3	434.20	bl.-blk
35	sulfide mono-	IrS	225.16	bl. blk.
36	sulfide di-	IrS_2	257.23	blk.
37	sulfide sesqui-	Ir_2S_3	482.39	br. blk.
38	Iron cast	Fe	55.84	gray
39	pure	Fe	55.84	cubic. or octhdr. silvery
40	steel	Fe	55.84	gray
41	white pig	Fe	55.84	gray
42	wrought	Fe	55.84	
43	arsenide	FeAs	130.80	
44	arsenide di-	$FeAs_2$	205.76	silver gray

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water	Hot water	Alcohol, acids, etc.
1	....	d.	....	sl. s.	dec.	s. HCl, HNO_3; i. al., eth.
2	....	subl.	....	i.	....	s. a., alk.
3	....	200	....	deliq.		
4	....	....	d.	$0.067^{20°}$	....	s. dil. H_2SO_4, HNO_3
5	....	$-4\frac{1}{2}H_2O$, 10	d.	deliq.	s.	s. al.
6	....	....	....	i.	....	s. a.
7	7.179	....	volt. 850	i.	....	s. a.
8	....	80	d. 200	s.	dec.	s. abs. al., eth
9	3.438	....	....	deliq.	v. s.	
10	....	....	....	....	....	d. a.; s. $(NH_4)_2S$
11	....	$-3H_2O$, 100	$-8H_2O$, 260	i.	....	s. a.
12	$4.629^{0°}$	d. 170	....	28[illegible]°	471[illegible]	v. s. al., HNO_3
13	$1.[illegible]48^{17°}$	112.5	184.35	$0.0182^{11°}$	0.092[illegible]°	s. al., KI, eth.
14	$3.1822^{0°}_{4}$	24.7	101.3	dec.	....	s. al., eth., CS_2, acet. a
15	....	13.9	101.3	dec.	....	
16	3.1107	33	....	s.	dec.	s. al., eth., HCl
17	3.5	8	97	dec.	dec.	dec. a.
18	....	36	....	sl. s.	....	s. al., eth., CS_2
19	$4.2^{18°}_{10}$	d. 130	....	i.	dec.	i. al., eth.; s. H_2SO_4
20	$4.799^{25°}_{4}$	d. 300	....	$187.4^{13°}$	....	i. al., eth., CS_2
21						
22	15.86	2300?	....	i.	i.	s. aq. reg., $Cl_2.H_2O$
23	22.42	....	....	i.	i.	s. aq. reg., $Cl_2.H_2O$
24	....	$-3H_2O$, 100	....	s.	....	i. al. eth.
25	....	d.	....	s.	....	s. al.
26	....	d.	....	s.	....	s. al.
27	....	....	....	s.	....	i. a., alk.
28	....	d.	....	s.	dec.	s. al., dil. HCl
29	....	....	....	i.	....	s. HCl, alk.
30	....	....	....	i.	....	i. a.
31	....	....	....	sl. s.	s.	i. al.
32	....	d. 360	....	i.	i.	s. KI, NaI
33	....	....	....	i.	....	i. a., alk.
34	....	−O, 400	....	i.	....	i. a., alk.
35	....	d.	....	i.	....	i. a.; s. K_2S
36	....	d.	....	i.	....	i. a.; s. K_2S
37	....	d.	....	sl. s.	....	s. HNO_3, K_2S
38	7.03	1275	....	i.	i.	s. a.
39	7.85–.88	1530	2450	i.	i.	s. a.; i. alk.
40	7.60–.80	1375	....	i.	i.	s. a.; i. alk.
41	7.58–.73	1075	....	i.	i.	s. a.; i. alk.
42	7.86	1505	....	i.	i.	s. a.; i. alk.
43	7.83	1020				
44	7.38	980–1040	....	i.	....	i. HCl.; sl. s. HNO_3

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Iron boride	FeB	66.66	gray cryst.
2	carbide	Fe_3C	179.52	reg. gray
3	carbide	FeC_4	103.84	gray cryst.
4	carbonyl	$Fe(CO)_5$	195.84	liq.
5	disulfide	FeS_2	119.97	reg. or rhombic yel.
6	nitride	Fe_2N	125.69	
7	phosphide	Fe_2P	142.71	gray cryst.
8	Krypton	Kr	82.90	colorl. gas
9	Lanthanum	La	138.90	lead gray
10	bromate	$La_2(BrO_3)_6.18H_2O$	1369.58	hex. prisms
11	bromide	$LaBr_3.7H_2O$	504.76	
12	carbide	LaC_2	162.90	yel. cryst.
13	carbonate	$La_2(CO_3)_3.8H_2O$	601.93	trimet.
14	chloride	$LaCl_3$	245.27	wh. cryst.
15	chloride	$LaCl_3.7H_2O$	371.38	tricl.
16	nitrate	$La(NO_3)_3.6H_2O$	433.02	prisms., colorl.
17	oxalate	$La_2(C_2O_4)_3.9H_2O$	703.94	
18	oxide sesqui-	La_2O_3	325.80	amor. or rhombic, wh.
19	sulfate	$La_2(SO_4)_3$	565.99	
20	sulfate	$La_2(SO_4)_3.9H_2O$	728.14	hex. colorl.
21	sulfide	La_2S_3	373.99	red yel. cryst.
22	Lead	Pb	207.20	reg. or monocl. gray
23	acetate (sugar of lead)	$Pb(C_2H_3O_2)_2.3H_2O$	379.30	monocl. wh.
24	acetate basic	$Pb_2(C_2H_3O_2)_3OH$	608.48	
25	acetate basic	$Pb(C_2H_3O_2)_2.Pb(OH)_2.H_2O$	584.48	need.
26	acetate basic	$Pb(C_2H_3O_2)_2.2Pb(OH)_2$	807.68	need.
27	arsenate mono-	$PbH_4(AsO_4)_2$	489.15	rhombic pl.
28	arsenate di-	$PbHAsO_4$	347.17	monocl. leaf.
29	arsenate meta-	$Pb(AsO_3)_2$	453.12	hex. tabl.
30	arsenate pyro-	$Pb_2As_2O_7$	676.32	ortho-rhombic cryst.
31	azoimide	PbN_6	291.25	cryst.
32	borate	$Pb(BO_2)_2.H_2O$	310.86	cryst.
33	bromate	$Pb(BrO_3)_2.H_2O$	481.05	monocl.
34	bromide	$PbBr_2$	367.03	rhombic colorl.
35	carbonate	$PbCO_3$	267.20	rhombic
36	carbonate basic (white lead).	$2PbCO_3.Pb(OH)_2$	775.62	amor. white
37	chlorate	$Pb(ClO_3)_2H_2O$	392.13	monocl.
38	chloride	$PbCl_2$	278.11	rhombic
39	chloride tetra-	$PbCl_4$	349.03	liq.
40	chlorite	$Pb(ClO_2)_2$	342.11	monocl. yel.
41	chromate	$PbCrO_4$	323.21	monocl. yel.
42	chromate, basic	$PbCrO_4.PbO$	546.41	red cryst.
43	(chrome red)			

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	7.15[illegible]	....	....	i.	....	s. HNO_3, h. H_2SO_4
2	$7.07^{16°}$	....	....	i.	i.	s. a.
3	....	....	....	i.	i.	sl. s. HCl
4	1.47	−21	103	....	....	s. H_2SO_4, al., alk.
5	4.8[illegible]–5.18	1171	d.	0.0004[illegible]	....	i. dil. a.
6	6.35	d. 200	....	dec.	....	s. HCl, H_2SO_4
7	$6.57^{15°}$	12[illegible]0	....	i.	i.	i. a.; s. HNO_3 + HF
8	(A) 2.818 (D) 40.78	−169	−151.7			
9	6.155	810?	....	dec.	dec.	s. a.
10	....	37.5	$-14H_2O$, 100	416[illegible]	....	i. al.
11	....	....	....	v. s.	....	v. s. al.; i. eth.
12	$5.02^{20°}$	....	....	dec.	dec.	s. a.
13	....	....	....	i.	....	sl. s. CO_2 aq.
14	$3.947^{15°}$	890	....	v. s.	dec.	v. s. al.
15	....	....	....	v. s.	v. s.	v. s. al.
16	....	40	126	deliq.	v. s.	v. s. al.
17	....	....	....	$0.00008^{25°}$		
18	$6.41^{15°}$	....	....	sl. s. $La(OH)_3$	....	s. al., a., NH_4Cl
19	3.60	d. 1150	....	$3.0^{0°}$	0.87[illegible]	sl. s. al.
20	2.821	d.	....	$3.8^{0°}$	1.06[illegible]	sl. s. HCl
21	$4.911^{11°}$	>1000	....	i.	dec.	s. dil. a.
22	$11.337^{20°}_{20}$	327	1525	i.	i.	s. HNO_3
23	2.50	$-3H_2O$, 75	280	45.64[illegible]	$200^{100°}$	i. al.
24	....	....	....	v. s.	....	sl. s. al.
25	....	....	....	v. s.	....	v. s. al.
26	....	....	....	5.55	18.2	s. al.
27	$4.46^{15°}$	d. 140	....	dec.	....	s. HNO_3
28	6.05[illegible]	$-H_2O$, 280	....	i.	sl. s.	s. HNO_3
29	$6.42^{15°}$	....	....	dec.	dec.	s. HNO_3
30	$6.85^{15°}$	....	....	i.	dec.	
31	....	....	expl.	0.05	sl. s.	v. s. acet. a.
32	5.598 anh.	....	$-H_2O$, 160	i.	i.	i. alk.; s. a.
33	....	d. 180	....	$1.38^{20°}$		
34	$6.572^{19.2°}$	380	861	$0.455^{0°}$	$4.75^{100°}$	s. a., KBr; i. al.
35	6.47	d.	....	0.00198	dec.	i. al.; s. alk., a.
36	....	d.	....	i.	i.	sl. s. CO_2 aq.
37	4.037	d. 230	....	171[illegible]	s.	
38	5.80	500	900	$0.673^{0°}$	$3.34^{100°}$	i. al., sl. s. dil. HCl
39	$3.18^{0°}$	−15	d. 105	dec.	dec.	
40	....	....	....	sl. s.	s.	
41	$6.123^{15°}$	d. 600	....	$0.00002^{18°}$	i.	s. a., alk.; i. acet. a.
42	....	....	....	i.	i.	s. a., alk.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Lead cyanate	$Pb(CNO)_2$	291.22	cryst.
2	cyanide	$Pb(CN)_2$	259.22	
3	dichromate	$PbCr_2O_7$	423.22	red cryst.
4	dithionate	$PbS_2O_6.4H_2O$	439.39	cryst.
5	ferricyanide	$Pb_3[Fe(CN)_6]_2.6H_2O$	1153.47	red cryst.
6	ferrocyanide	$Pb_2Fe(CN)_6.3H_2O$	680.31	
7	fluoride	PbF_2	245.20	
8	formate	$Pb(CHO_2)_2$	297.21	rhombic
9	hydroxide	$Pb(OH)_2$	241.22	white
10	hydroxide	$3PbO.H_2O$	687.62	reg.
11	iodate	$Pb(IO_3)_2$	557.06	white
12	iodide	PbI_2	461.06	hex. yel.
13	nitrate	$Pb(NO_3)_2$	331.22	wh. octhdr.
14	oxalate	PbC_2O_4	295.20	white
15	oxide mono-	PbO	223.20	yel. rhombic
16	oxide mono-	PbO	223.20	red hex.
17	oxide mono-	PbO	223.20	amor.
18	oxide di-	PbO_2	239.20	hex. br.
19	oxide red (minium)	Pb_3O_4	685.60	scarlet, amor.
20	oxide sesqui-	Pb_2O_3	462.40	amor. red yel.
21	oxide sub-	Pb_2O	430.40	amor. blk.
22	oxychloride	$PbCl_2.PbO$	501.31	tetrag. wh.
23	oxychloride	$PbCl_2.2PbO$	724.51	yel. trim.
24	oxychloride	$PbCl_2.3PbO$	947.71	yel.
25	oxychloride (cóssel yellow)	$PbCl_2.7PbO$	1840.51	yel. cryst.
26	perchlorate	$Pb(ClO_4)_2.3H_2O$	460.16	
27	periodate	$PbHIO_6$	415.14	cryst.
28	periodate	$PbHIO_6.H_2O$	433.16	amor.
29	persulfate	$PbS_2O_8.3H_2O$	453.38	
30	phosphate	$Pb_3(PO_4)_2$	811.65	wh.
31	phosphite	$PbHPO_3$	287.24	wh.
32	pyrophosphate	$Pb_2P_2O_7.H_2O$	606.47	rhombic
33	selenide	$PbSe$	286.40	reg.
34	sulfate	$PbSO_4$	303.26	rhombic wh.
35	sulfate, acid	$Pb(HSO_4)_2.H_2O$	419.36	cryst.
36	sulfate, basic	$PbSO_4.PbO$	526.46	
37	sulfide	PbS	239.26	blk. reg.
38	sulfite	$PbSO_3$	287.26	wh.
39	sulfochloride	$3PbS.PbCl_2$	995.91	red
40	sulfocyanate	$Pb(CNS)_2$	323.34	monocl. yel.
41	thiosulfate	PbS_2O_3	319.33	
42	tungstate	$PbWO_4$	455.20	reg.
43	Lithium	Li	6.94	silv. gray
44	acetate	$LiC_2H_3O_2.2H_2O$	102.00	rhombic wh.
45	amide	$LiNH_2$	22.96	reg.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of: Cold water	Hot water	Alcohol, acids, etc.
1	....	d.	....	i.	sl. s.	
2	....	....	....	sl. s.	s.	i. KCN
3	....	....	....	dec.	....	s. a., alk.
4	3.245	d.	....	s.		
5	....	d.	....	sl. s.	s.	s. alk., HNO_3
6	....	d.	....	i.	....	sl. s. H_2SO_4
7	8.24	....	....	$0.064^{15°}$	....	s. HNO_3
8	4.571	d. 190	....	$1.6^{16°}$	$18^{100°}$	i. al.
9	....	d. 145	....	sl. s.	sl. s.	s. a., alk.
10	7.592	$-H_2O$, 130	....	0.014	....	s. alk., a.
11	....	....	....	$0.0012^{20°}$	....	sl. s. HNO_3
12	6.12	358	861–954	$0.044^{0°}$	$0.436^{100°}$	i. al.; s. KI
13	$4.531^{24°}$	d. 223	....	$39^{0°}$	$139^{100°}$	$3.77^{25°}$ al.
14	5.025	d. 300	....	$0.00016^{18°}$	....	i. al.; s. HNO_3
15	9.375	888	....	$0.017^{20°}$	....	s. alk., lead acet., NH_4Cl, $CaCl_2$, $SrCl_2$
16	$8.74^{15°}$	....	....	$0.0013^{22°}$	i.	
17	9.2–.5	....	....	i.	i.	
18	8.91	d. 290	....	i.	i.	i. al.; s. acet. a.
19	9.07	d. 500	....	i.	i.	s. acet. a.
20	....	d. 370	....	i.	dec.	s. a., alk.
21	8.342	....	....	i.	i.	s. a., alk.
22	7.21	....	....	i.	i.	s. alk.
23	7.0–.1	....	....	i.	....	s. alk.
24	....	....	....	$0.0056^{18°}$	$0.07^{74°}$	
25	....	....	....	i.		
26	....	....	....	s.	....	s. al.
27	....	d. 130	....	i.	i.	s. dil. HNO_3
28	....	$-H_2O$, 110	....	i.	i.	sl. s. dil. HNO_3
29	....	....	....	v. s.		
30	6.9–7.3	....	....	$0.000014^{20°}$	i.	s. HNO_3; i. acet. a.
31	....	d.	....	i.	i.	s. HNO_3
32	....	806 anh.	....	i.	dec.	s. HNO_3, KOH $Na_4P_2O_7$
33	$8.10^{15°}$	1065	....	i.	....	s. HNO_3
34	6.23	>1100	....	$0.0042^{20°}$	sl. s.	s. conc. a., NH_4 salts; i. al.
35	....	....	....	sl. s.	....	sl. s. H_2SO_4
36	....	....	....	$0.0044^{0°}$	sl. s.	sl. s. H_2SO_4
37	7.48	1112	....	0.0001	i.	s. a.; i. KOH
38	....	....	....	i.	i.	s. HNO_3
39	....	....	....	i.	dec.	i. dil. a.
40	3.82	....	....	$0.5^{20°}$	dec.	s. KCNS, HNO_3
41	....	d.	....	0.03	....	s. $Na_2S_2O_3$
42	8.235	....	....	i.		
43	$0.534^{20°}$	186	1400	dec.	dec.	s. a.
44	....	70	d.	$300^{15°}$	v. s.	21.5 al.
45	$1.178^{17.5°}$	374	430	dec.	dec.	

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Lithium benzoate	$LiC_7H_5O_2$	127.98	cryst.
2	bicarbonate	$LiHCO_3$	67.95	wh.
3	bichromate	$Li_2Cr_2O_7.2H_2O$	265.93	blk.-br. cryst.
4	borate	$Li_2B_4O_7.5H_2O$	259.24	
5	bromide	$LiBr$	86.86	cryst. wh.
6	carbide	Li_2C_2	37.88	cryst.
7	carbonate	Li_2CO_3	73.88	prisms
8	chlorate	$LiClO_3.\frac{1}{2}H_2O$	99.41	tetrag.
9	chloride	$LiCl$	42.40	octhdr. wh.
10	chloroplatinate	$Li_2PtCl_6.6H_2O$	529.95	orange-red hex.
11	chromate	$Li_2CrO_4.H_2O$	147.91	red. trim.
12	citrate	$Li_3C_6H_5O_7.4H_2O$	281.92	cryst.
13	fluoride	LiF	25.94	tabl.
14	fluosilicate	$Li_2SiF_6.2H_2O$	191.97	monocl.
15	formate	$LiCHO_2.H_2O$	69.96	rhombic
16	hydroxide	$LiOH$	23.95	wh. cryst.
17	iodide	LiI	133.87	cryst.
18	iodide	$LiI.3H_2O$	187.92	
19	nitrate	$LiNO_3$	68.95	rhombic, hex.,
20	nitrate	$LiNO_3.3H_2O$	123.00	rhbdr. or reg.
21	nitrite	$LiNO_2.H_2O$	70.96	flat need.
22	oxalate	$Li_2C_2O_4$	101.88	
23	oxalate, acid	$LiHC_2O_4.H_2O$	113.96	
24	oxide	Li_2O	29.88	cryst.
25	perchlorate	$LiClO_4$	106.40	
26	perchlorate	$LiClO_4.3H_2O$	160.45	rhbdr.
27	phosphate	$Li_3PO_4.H_2O$	133.86	rhbdr.
28	salicylate	$LiC_7H_5O_3$	143.98	
29	silicate	Li_2SiO_3	89.94	hex.
30	silicate	Li_4SiO_4	119.82	
31	silicide	$LiSi_2$	63.06	blue cryst.
32	sulfate	Li_2SO_4	109.94	monocl. reg., rhomb. or hex.
33	sulfate	$Li_2SO_4.H_2O$	127.96	monocl.
34	sulfate, acid	$LiHSO_4$	104.01	prism.
35	sulfide	Li_2S	45.94	
36	sulfite	$Li_2SO_3.6H_2O$	202.04	need.
37	urate	$LiHC_5H_2N_4O_3$	174.00	
38	Magnesium	Mg	24.32	silvery wh.
39	acetate	$Mg(C_2H_3O_2)_2.4H_2O$	214.43	monocl.
40	aluminate	$MgO.Al_2O_3$	142.26	
41	ammonium arsenate	$MgNH_4AsO_4.6H_2O$	289.42	tetrag.
42	ammonium chloride	$MgCl_2.NH_4Cl.6H_2O$	256.83	
43	ammonium chromate	$MgCrO_4.(NH_4)_2.CrO_4.6H_2O$	400.52	yel. monocl.
44	ammonium phosphate	$MgNH_4PO_4.6H_2O$	245.48	tetrag.
45	ammonium sulfate	$MgSO_4.(NH_4)_2SO_4.6H_2O$	360.62	monocl. pr.
46	arsenate	$2MgHAsO_4.13H_2O$	562.78	
47	arsenite	$Mg_3(AsO_3)_2$	318.88	

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	....	....	....	$33^{25°}$	$40^{100°}$	7.7[illegible], 10[illegible] al.
2	....	....	....	5.5[illegible]		
3	....	....	....	$168.3^{30°}$		
4	....	....	....	v. s.	....	i. al.
5	$3.446^{25°}_{4}$	547	....	$143^{0°}$	$270^{100°}$	s. al.
6	$1.65^{15°}$	....	....	dec.	dec.	s. a.
7	2.111	695–710	d. 600	$1.539^{0°}$	$0.728^{100°}$	i. al.
8	....	50	$-1\frac{1}{2}H_2O$, 90	$301^{13°}$	∞	v. s. al
9	2.068	600	1360	$63.7^{0°}$	$129^{96°}$	2.475[illegible] al.; s. eth
10	....	$-6H_2O$, 180	....	s.	s.	s. al., eth.
11	....	....	....	$132^{30°}$		
12	....	d.	....	$50^{25°}$	66.7[illegible]	sl. s. al., eth.
13	2.601	801	....	0.27[illegible]	....	s. HF
14	2.33	$-2H_2O$, 100	d.	52.6	....	s. al.; i. eth
15	1.43–.47	d.	....	$61.67^{0°}$	$346.6^{104°}$	
16	....	462	....	$12.7^{0°}$	$17.5^{90°}$	sl. s. al.
17	$4.063^{25°}_{4}$	330–446	....	$151^{0°}$	$470^{99°}$	
18	....	72				
19	2.334–.442	253–64	....	$48.3^{0°}$	$227.3^{100°}$	s. al.
20	....	29.8	....	$138.4^{0°}$	∞	
21	$1.671^{21°}$	<100	d.	s.	v. s.	v. s. abs. al.
22	$2.121^{17.5°}$	d.	....	$8^{19.5°}$		
23	....	d.	....	$8^{17°}$		
24	$2.102^{15°}$	subl. 1000	....	$5.22^{0°}$		
25	1.841	300	d. 400	s.	....	s. al.
26	....	95	$-2H_2O$, 100 $-3H_2O$, 150	s.	....	s. al.
27	$2.41^{15°}$	857	$-H_2O$, 100	0.04	....	s. a., NH_4Cl
28	....	d.	....	v. s.	....	v. s. al
29	$2.529^{15°}$	1201	....	i.	s. d.	s. dil. HCl
30	2.39	1256	....	i.	d.	
31	1.12	d.	....	d.	d.	d. a.; i. turp.
32	$2.21^{15°}$	843–74	....	$35.34^{0°}$	$29.24^{100°}$	i. 80% al.
33	$2.052^{20°}_{4}$	$-H_2O$, 130	....	$43.52^{0°}$	$35.75^{100°}$	i. 80% al.
34	2.123	120	....	dec.		
35	1.66	....	....	v. s.	v. s.	v. s. al
36	....	....	....	s.	....	sl. s. al
37	....	....	....	$0.27^{20°}$	$2.5^{100°}$	
38	$1.74^{5°}$	651	1120	i.	sl. s., d.	s. a., NH_4 salts
39	1.45	....	....	deliq.	v. s.	v. s. al.
40	$3.57^{15°}$					
41	....	dec.	....	$0.038^{20°}$	s.	i. al; s. a.
42	1.456	....	....	16.7		
43	$1.829^{17°}$	....	....	v. s.	v. s.	
44	$1.71^{15°}$	d.	....	0.01322	s.	s. a.; i. al.
45	$1.723^{20°}_{4}$	....	....	$17.68^{0°}$	$130.58^{100°}$	
46	$3.155^{15°}$	....	....	i.	0.15	s. HNO_3; i. NH_4Cl
47	....	....	....	i.	....	i. NH_4OH; s. NH_4Cl

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Magnesium benzoate	$Mg(C_7H_5O_2)_2.3H_2O$	320.45	wh. powd.
2	borate	$Mg(BO_2)_2.8H_2O$	254.09	
3	bromate	$Mg(BrO_3)_2.6H_2O$	388.25	reg.
4	bromide	$MgBr_2$	184.15	
5	bromide	$MgBr_2.6H_2O$	292.25	colorl. hex.
6	carbonate	$MgCO_3$	84.32	hex. rhbdr. or rhombic.
7	carbonate	$MgCO_3.3H_2O$	138.37	hex.
8	carbonate, basic	$3MgCO_3.Mg(OH)_2.3H_2O$	365.34	monocl.
9	chlorate	$Mg(ClO_3)_2.6H_2O$	299.33	
10	chloride	$MgCl_2$	95.23	hex.
11	chloride	$MgCl_2.6H_2O$	203.33	monocl.
12	chromate	$MgCrO_4.7H_2O$	266.44	yel.
13	ferrocyanide	$Mg_2Fe(CN)_6.12H_2O$	476.72	pa. yel. cryst.
14	fluoride	MgF_2	62.32	tetrag.
15	formate	$Mg(CHO_2)_2.2H_2O$	150.37	rhombic.
16	hydroxide (brucite)	$Mg(OH)_2$	58.34	rhbdr.
17	iodate	$Mg(IO_3)_2.4H_2O$	446.25	monocl.
18	iodide	MgI_2	278.18	
19	nitrate	$Mg(NO_3)_2.6H_2O$	256.43	monocl. or tricl.
20	nitride	Mg_3N_2	100.98	gr. yel. cryst.
21	oxalate	$MgC_2O_4.2H_2O$	148.35	wh.
22	oxide	MgO	40.32	reg. or hex.
23	permanganate	$Mg(MnO_4)_2.6H_2O$	370.28	purp. need.
24	phosphate	$Mg_3(PO_4)_2.4H_2O$	335.08	monocl.
25	phosphate,	$Mg_3(PO_4)_2.8H_2O$	407.14	monocl. pl.
26	phosphate, acid	$MgHPO_4.3H_2O$	174.40	plates.
27	phosphate, acid	$MgHPO_4.7H_2O$	246.47	hex.
28	phosphate, pyro-	MgP_2O_7	222.69	wh.
29	phosphate, pyro-	$Mg_2P_2O_7.3H_2O$	276.74	wh. amor.
30	phosphite	$MgHPO_3.3H_2O$	158.40	
31	potassium chloride	$MgCl_2.KCl.6H_2O$	277.88	hex.
32	potassium sulfate	$MgSO_4.K_2SO_4.6H_2O$	402.74	monocl. pr.
33	selenate	$MgSeO_4.6H_2O$	275.62	monocl.
34	silicide	Mg_6Si_3	205.78	
35	sodium chloride	$MgCl_2.NaCl.H_2O$	171.70	
36	sulfate	$MgSO_4$	120.38	
37	sulfate (epsom salt)	$MgSO_4.7H_2O$	246.50	tetrag. or monocl.
38	sulfide	MgS	56.38	cubic. br.
39	sulfite	$MgSO_3.6H_2O$	212.48	wh. cryst. powd.
40	tartrate	$MgC_4H_4O_6.4H_2O$	244.42	monocl.
41	thiosulfate	$MgS_2O_3.6H_2O$	244.54	prism.
42	Manganese	Mn	54.93	gr. pink.
43	acetate	$Mn(C_2H_3O_2)_2.4H_2O$	245.04	monocl. pa. red
44	ammonium phosphate	$MnNH_4PO_4.H_2O$	186.01	wh. cryst.
45	ammonium sulfate	$MnSO_4.(NH_4)_2SO_4.6H_2O$	391.23	
46	arsenite	$Mn_3H_6(AsO_3)_4.2H_2O$	698.71	rose red.
47	benzoate	$Mn(C_7H_5O_2)_2.3H_2O$	351.06	flat prisms
48	boride	MnB_2	76.57	gr. violet cryst.
49	bromide	$MnBr_2$	214.76	rose red.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	....	d.	....	$4.5^{25°}$	s.	
2	2.27	....	....	i.	i.	s. a.
3	2.29	$-6H_2O$, 200	d.	$71.5^{7°}$	v. s.	
4	....	695	....	$91.9^{0°}$	$120.2^{100°}$	
5	....	165d.	....	$316^{0°}$	v. s.	s. al
6	3.04	d. 350	....	0.0106	....	s. a., CO_2 aq
7	$1.808^{18°}_{18}$	....	....	$0.1518^{19°}$	dec.	s. a., CO_2 aq
8	2.18	....	....	0.04	0.011	s. a., NH_4 salts
9	....	40	....	deliq.	v. s.	s. al
10	2.177	708	....	$52.2^{0°}$	$65.87^{30°}$	50 al.
11	$1.569^{17°}$	$-2H_2O$, 100	d.	167	367	50 al.
12	1.761	....	....	$211.5^{15°}$	v. s.	
13	....	....	....	33		
14	2.472	1396	....	$0.0087^{18°}$	i.	s. HNO_3; i. al
15	....	....	....	7.7	....	i. al., eth
16	$2.36^{15°}$	d.	....	0.0009	....	s. NH_4 salts
17	3.28	$-4H_2O$, 210	d.	$10^{15°}$	$33^{100°}$	
18	....	d.	....	$100^{0°}$	$164.9^{110°}$	s. al., eth.
19	1.464	90	$-5H_2O$, 330	200	∞	s. al.
20	....	d.	....	i.	dec.	s. a.; i. al
21	....	d.	....	$0.07^{16°}$	$0.08^{100°}$	s. alk. oxal. a.
22	3.43	2800	....	0.00062	....	s. a., NH_4 salts
23	....	d.	....	v. s.	dec.	s. acet. a., meth. al
24	$1.64^{15°}$	....	....	0.0205	....	s. a.; i. NH_4 salts
25	$2.195^{15°}$					
26	$2.123^{15°}$					
27	....	....	....	0.3	0.2	s. a.; i. al
28	2.40	....	....	i.	i.	s. a.; i. al
29	2.56	....	....	i.	i.	i. al.
30	....	....	....	0.25	....	s. a.
31						
32	$2.0277^{20°}_{4}$	....	....	$19.26^{0°}$	$81.70^{75°}$	
33	1.928	....	....	v. s.		
34	....	....	....	i.	dec.	d. a., NH_4Cl
35	....	....	....	s.		
36	2.66	d.	....	$26.9^{0°}$	$73.8^{100°}$	s. al.
37	$1.678^{16°}$	d.	....	$76.9^{0°}$	$671.2^{100°}$	s. al
38	$2.82^{15°}$	d.	....	dec.	....	s. a.
39	....	$-6H_2O$, 200	d.	1.25	0.83	i. al.
40	1.67	d.	....	$0.8^{16°}$		
41	$1.818^{24°}$	$-3H_2O$, 170	d.	v. s.	v. s.	s. al.
42	7.42	1230	1900	dec.	dec.	s. dil. a.
43	1.6	....	....	3	....	s. al.
44	....	....	....	0.0031	0.05	i. al., NH_4 salts
45	$1.837^{18°}_{4}$	....	....	$51.3^{25°}$	v. s.	
46	....	....	....	i.	....	s. a.
47	....	....	....	$6.55^{15°}$		
48	$6.04^{19°}$	....	....	i.	dec.	s. a.
49	....	d.	....	$127.3^{0°}$	$228^{100°}$	

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Manganese bromide	$MnBr_2.4H_2O$	286.83	red monocl.
2	carbide	Mn_3C	176.79	tetrahdr.
3	carbonate	$MnCO_3$	114.93	rhbdr. rose
4	chloride	$MnCl_2$	125.84	
5	chloride	$MnCl_2.4H_2O$	197.91	rose. monocl.
6	chloride, per	$MnCl_4$	196.76	green
7	ferrocyanide	$Mn_2Fe(CN)_6.7H_2O$	447.86	
8	fluoride di-	MnF_2	92.93	red quad. pr.
9	fluoride sesqui-	$Mn_2F_6.6H_2O$	331.96	cryst.
10	fluosilicate	$MnSiF_6.6H_2O$	305.09	hex.
11	formate	$Mn(CHO_2)_2.2H_2O$	180.98	monocl.
12	hydroxide (ous)	$Mn(OH)_2$	88.95	hex. wh.
13	hydroxide (ic)	$Mn_2O_3.H_2O$	175.88	tetrag. br.
14	hypophosphite	$Mn(H_2PO_2)_2.H_2O$	203.03	rose red cryst.
15	iodide	$MnI_2.4H_2O$	380.86	rose red monocl.
16	lactate	$Mn(C_3H_5O_3)_2.3H_2O$	287.06	pa. red monocl.
17	nitrate	$Mn(NO_3)_2.6H_2O$	287.04	rose. monocl.
18	oxalate	$MnC_2O_4.2\frac{1}{2}H_2O$	187.97	wh. cryst.
19	oxide (ous)	MnO	70.93	reg. gray grn.
20	oxide (ic)	Mn_2O_3	157.86	reg. blk.
21	oxide, di-	MnO_2	86.93	tetrag. or rhomb. blk.
22	oxide, tri-	MnO_3	102.93	reddish
23	oxide, hept-	Mn_2O_7	221.86	dk. red oil.
24	oxide, ous, ic	Mn_3O_4	227.79	tetrag. blk.
25	phosphate (ous)	$Mn_3(PO_4)_2.7H_2O$	480.96	amor. reddish
26	phosphate (ous) acid	$MnHPO_4.3H_2O$	205.01	cryst.
27	phosphide	MnP	85.96	dk. gray
28	phosphite	$MnHPO_3.H_2O$	152.98	reddish
29	pyrophosphate	$Mn_2P_2O_7$	283.91	
30	pyrophosphate	$Mn_2P_2O_7.3H_2O$	337.96	amor. wh. powd.
31	silicate	$MnSiO_3$	130.99	rose need.
32	silicide	$MnSi$	82.99	tetrahdr.
33	silicide, di-	$MnSi_2$	111.05	gray octahdr.
34	silicide (ous)	Mn_2Si	137.92	quad. pr.
35	sulfate (ic)	$Mn_2(SO_4)_3$	398.05	grn. cryst.
36	sulfate (ous)	$MnSO_4$	150.99	reddish
37	sulfate (ous)	$MnSO_4.H_2O$	169.01	
38	sulfate (ous)	$MnSO_4.2H_2O$	187.03	
39	sulfate (ous)	$MnSO_4.3H_2O$	205.04	
40	sulfate (ous) (common form)	$MnSO_4.4H_2O$	223.06	monocl. or rhombic rose
41	sulfate (ous)	$MnSO_4.5H_2O$	241.07	

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C	Boiling-point, Deg. C	Solubility in 100 parts of: Cold water	Hot water	Alcohol, acids, etc.
1	....	110	d.	2[illegible]6.7$^{[illegible]}$		
2	6.8$^{17°}$	....	....	dec.	dec.	s. a.
3	3.125–.66	d.	....	0.013	....	s. dil. a., CO_2 aq.
4	2.977$^{24°}_{4}$	850	....	62.16$^{0°}$	123.8$^{[illegible]}$	s. al.; i. eth.
5	1.913	87.5	106	151$^{[illegible]}$	∞	s. al.; i. eth.
6	....	....	....	s.	s.	s. eth.
7	....	....	....	i.	....	s. HCl; i. NH_4 salts
8	3.98	856	....	i.	dec.	i. al., eth.; s. a.
9	3.54	d.	....	v. s.	dec.	s. a.
10	1.904$^{17.5°}$	d.	....	140	v. s.	s. al.
11	1.953	d.	....	s.	s.	
12	3.258	d.	....	i.	i.	s. a.; NH_4 salts; i. alk.
13	4.335	d.	....	i.	i.	s. h. H_2SO_4
14						
15	....	d.	....	deliq	v. s.	
16	....	d.	....	s.	v. s.	
17	1.82	25.8	12[illegible].4	426.4$^{0°}$	∞	v. s. al.
18	2.453$^{20°}$	d. 150	....	0.05	0.08$^{100°}$	s. dil. a.
19	5.09–.18	....	....	i.	i.	s. a., NH_4Cl
20	4.325–.820	–O, 1[illegible]	....	i.	i.	s. a.
21	5.026	–O, 535	....	i.	i.	s. HCl
22	....	d.	....	s.	dec.	s. H_2SO_4
23	>1.84	<–20	expl.	v. s.	dec.	s. H_2SO_4
24	4.61	....	....	i.	i.	s. HCl
25	....	....	....	sl. s.	....	s. a.; i. al
26	....	....	....	sl. s.	dec.	s. a.; i. al
27	5.39$^{21°}_{4}$	....	....	i.	i.	sl. s. HNO_3
28	....	–H_2O, 200	....	sl. s.	....	s. $MnCl_2$, $MnSO_4$
29	3.5847$^{20°}$	....	....	i.	....	s. a.
30	....	....	....	i.		
31	3.35	1218	....	i.	i.	
32	5.90$^{15°}$	....	....	i.	i.	i. a.
33	524$^{13°}$	....	....	i.	i.	i. HNO_3, H_2SO_4; s. HF, alk.
34	6.20$^{15°}$	....	....	i.	i.	s. HCl, NaOH; i. HNO_3
35	....	d. 160	....	deliq.	dec.	s. HCl, dil. H_2SO_4
36	2.954	700	d. 850	53.2$^{0°}$	67$^{75°}$	s. al.; i. eth.
37	2.845$^{15°}$	stable 57–117	....	98.47$^{18°}$	79.77$^{100°}$	
38	2.526$^{15°}$	stable 40–57	....	85.27$^{35°}$	106.8$^{[illegible]}$	
39	2.356$^{15°}$	stable 30–40	....	74.22$^{5°}$	99.31$^{[illegible]}$	
40	2.107	stable 18–30	....	105.3$^{0°}$	111.2$^{54°}$	i. al.
41	2.1006$^{14.5°}$	54	stable 8–18°	124.4$^{0°}$	142.1$^{54°}$	

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt	Crystalline form and color
1	Manganese sulfate (ous)	$MnSO_4.6H_2O$	259.09	
2	sulfate (ous)	$MnSO_4.7H_2O$	277.11	pa. red monocl. or rhombic.
3	sulfide (ic)	MnS_2	119.06	blk. reg.
4	sulfide (ous)	MnS	86.99	green cryst. or pinkish
5	sulfide (ous)	$3MnS.H_2O$	279.00	gray-pink
6	sulfocyanate	$Mn(CNS)_2.3H_2O$	225.12	
7	Manganocyanhydric acid	$H_4Mn(CN)_6$	215.01	
8	Mercuric acetate	$Hg(C_2H_3O_2)_2$	318.66	wh. scales
9	arsenate	$Hg_3(AsO_4)_2$	879.75	yel.
10	bromate	$Hg(BrO_3)_2.2H_2O$	492.47	cryst.
11	bromide	$HgBr_2$	360.44	wh. rhombic
12	carbonate, basic	$2HgO.HgCO_3$	693.83	br.-red
13	chlorate	$Hg(ClO_3)_2$	367.52	need.
14	chloride (corrosive sublimate)	$HgCl_2$	271.52	wh. rhombic
15	chromate	$HgCrO_4$	316.62	dk. red trim.
16	cyanide	$Hg(CN)_2$	252.63	wh. tetrag.
17	fluoride	HgF_2	238.61	cryst.
18	fluosilicate	$HgSiF_6.HgO.3H_2O$	613.33	yel. need.
19	fulminate	$HgC_2N_2O_2$	284.63	octahdr.
20	hydroxide	$Hg(OH)_2$	234.63	
21	iodate	$Hg(IO_3)_2$	550.47	
22	iodide, red	HgI_2	454.47	tetrag. red
23	iodide, yellow	HgI_2	454.47	rhombic yel.
24	iodo bromide	$HgIBr$	407.46	rhombic yel.
25	iodo chloride	$HgICl$	363.00	rhombic yel. or tetrag. red
26	nitrate	$Hg(NO_3)_2$	324.63	wh. cryst.
27	nitride	Hg_3N_2	629.85	br. powd.
28	oxalate	HgC_2O_4	288.61	
29	oxide	HgO	216.61	yel. tetrag. pl. or red monocl. pr.
30	oxybromide	$HgBr_2.3HgO$	1010.27	yel. cryst.
31	oxychloride	$HgCl_2.3HgO$	921.35	yel. pr.
32	oxycyanide	$Hg(CN)_2.HgO$	469.24	need.
33	oxyfluoride	$HgF_2.HgO.H_2O$	473.24	yel. cryst.
34	oxyiodide	$HgI_2.3HgO$	1104.30	yel. br.
35	phosphate	$Hg_3(PO_4)_2$	791.88	wh. to yel.
36	potassium iodide	$2HgI_2.2KI.3H_2O$	1295.05	
37	selenide	$HgSe$	279.81	gr. plates
38	sulfate	$HgSO_4$	296.72	wh. cryst. powd.
39	sulfate, basic	$HgSO_4.2HgO$	729.94	yel.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of: Cold water	Hot water	Alcohol, acids, etc.
1	....	stable −5–+8	....	$147.4^{0°}$	$134.5^{35°}$	
2	2.092	$-7H_2O$, 280	stable −10 to −5	$172^{0°}$	$118^{15°}$	
3	....	d.	....	i.	i.	d. HCl
4	3.55–.63	d.	....	0.00047–.0006	i.	i. $(NH_4)_2S$; s. dil. a.
5	....	d.	....	0.0006	i.	i. $(NH_4)_2S$; s. dil. a.
6	....	$-3H_2O$, 160–170	....	deliq.	v. s.	v. s. al.
7	....	d.	....	i.	....	i. eth.; v. s. al.
8	$3.2544^{22°}$	....	....	$25^{10°}$	$100^{100°}$	s. al
9	....	....	....	sl. s.	....	s. HCl, HNO_3
10	....	d. 130–40	....	0.17	1.6	s. HNO_3, HCl, $Hg(NO_3)_2$
11	5.738	235–44	subl. 319–25	$1.06^{9°}$	$20–25^{100°}$	s. al., eth.
12	....	....	....	i.		
13	4.998	d.	....	25		
14	5.424	282	303–7 subl.	$5.73^{0°}$	$53.96^{100°}$	43.5 al., 33 eth.
15	....	d.	....	sl. s.	dec.	dec. a.
16	4.018	d.	....	$12.5^{15°}$	$53^{100°}$	5 al.
17	....	....	....	dec.		
18	....	....	....	dec.	....	s. a.
19	4.42	expl.	....	sl. s.	s.	s. al., NH_4OH
20	....	$-H_2O$, 175	....	i.	i.	s. a.
21	....	....	....	i.	....	s. NH_4Cl, HCl; i. HNO_3
22	6.257	253	349	$0.004^{17.5°}$	....	$1.186^{18°}$ al.; s. $Na_2S_2O_3$, alk. salts
23	6.0	241	349	i.	....	
24	....	229	360	....	....	s. eth.
25	....	153	315	i.	sl. s.	s. al.
26	....	d.	....	v. s.	dec.	s. HNO_3; i. al.
27	....	expl.	....	dec.	....	dec. a.
28	....	d.	....	i.	i.	s. HCl; sl. s. HNO_3
29	11.14	d.	....	$0.00515^{25°}$	$0.0395^{100°}$	s. a.; i. al.
30	....	....	....	i.	sl. s.	v. s. al.
31	8.67	....	....	i.	dec.	
32	$4.437^{19°}$	expl.	....	sl. s.		
33	....	d. 100	....	dec.	....	s. HNO_3
34	....	....	....	dec.	....	s. HI
35	....	....	....	i.	sl. s.	s. a., NH_4Cl; i. al.
36	$4.289^{23.5°}$	....	....	dec.	....	s. al., eth., KI
37	7.1–8.9	subl.	....	i.	....	s. aq. reg.
38	6.466	....	....	dec.	....	s. a.; i. al.
39	6.44	....	....	0.002	....	s. a.; i. al.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Mercuric sulfide	HgS	232.67	blk. amor
2	sulfide	HgS	232.67	red rhbdr. or hex.
3	sulfocyanate	$Hg(CNS)_2$	316.75	
4	Mercurous acetate	$HgC_2H_3O_2$	259.63	micaceous scales
5	arsenate	Hg_3AsO_4	740.79	dk. red
6	arsenate, acid	Hg_2HAsO_4	541.19	yel.-red
7	bromate	$HgBrO_3$	328.53	cryst
8	bromide	$HgBr$	280.53	tetrag. yel
9	carbonate	Hg_2CO_3	461.22	yel.-br
10	chlorate	$HgClO_3$	284.07	cryst
11	chloride (calomel)	$HgCl$	236.07	rhombic or tetrag. wh.
12	chromate	Hg_2CrO_4	517.23	red cryst
13	fluoride	HgF	219.61	yel. monocl
14	fluosilicate	$Hg_2SiF_6.2H_2O$	579.31	prism
15	formate	$HgCHO_2$	245.62	glist. scales
16	iodate	$HgIO_3$	375.54	yellowish
17	iodide	HgI	327.54	yel. tetrag
18	nitrate	$HgNO_3.2H_2O$	298.65	wh. monocl
19	oxalate	$Hg_2C_2O_4$	489.22	
20	oxide	Hg_2O	417.22	black
21	phosphate	Hg_3PO_4	696.86	
22	sulfate	Hg_2SO_4	497.28	wh. monocl
23	sulfide	Hg_2S	433.28	blk
24	sulfocyanate	$HgCNS$	258.68	
25	trinitride	HgN_3	242.63	cryst
26	Mercury	Hg	200.61	silvery liq
27	Mercury-ammonium compounds:			
28	Dimercuri-diammonium chloride (infusible white ppt.)	$NHg_2Cl.NH_4Cl$	504.18	cryst
29	Dimercuri-tetra-ammonium chloride (fusible white ppt.)	$NHg_2Cl.3NH_4Cl$	611.18	crystals, red
30	Molybdenum	Mo	96.00	gray
31	bromhydroxide	$Mo_3Br_4(OH)_2$	641.68	red powd
32	bromide, di-	$MoBr_2$	255.83	yel
33	bromide, tri-	$MoBr_3$	335.75	dk. grn. need
34	bromide, tetra-	$MoBr_4$	415.66	blk. need

INORGANIC COMPOUNDS (Continued)

—	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point. Deg. C.	Boiling-point. Deg. C.	Solubility in 100 parts of Cold water	Hot water	Alcohol, acids, etc.
1	7.67	subl. 446	....	0.0025	i.	s. Na_2S, K_2S; i. HNO_3; s. aq. reg.
2	8.09	subl. 446	....	i.	i.	
3	....	d.	....	sl. s.	s.	s. al. NH_4 salts
4	....	d.	....	$0.75^{13°}$	....	s. H_2SO_4, HNO_3
5	....	d.	....	i.	....	s. HNO_3; i. acet. a.
6	....	d.	....	i.	....	s. HNO_3
7	....	d.	....	dec.	....	s. HNO_3, HCl, $HgNO_3$
8	7.307	subl. 405	....	i.	i.	i. al.; s. a.
9	....	d. 130	....	i.	dec.	s. NH_4Cl
10	6.409	d.	....	s.	dec.	s. al., acet. a.
11	6.482–7.18	subl. 500	382.5	0.00031	0.01	i. al., eth.; s. $Hg(NO_3)_2$, aq. reg.; sl. s. h. HNO_3, HCl
12	....	d.	....	sl. s.	s.	s. HNO_3, KCN
13	....	d. 200	....	dec.		
14	....	....	....	sl. s.		
15	....	....	....	$0.4^{17°}$	dec.	i. al.
16	....	....	....	i.	i.	s. dil. HCl
17	7.7	290	310	0.0417	....	s. KI; i. al.
18	4.78	d.	....	v. s.	dec.	
19	....	....	....	i.	i.	sl. s. HNO_3
20	9.8	d.	....	i.	i.	s. acet. a.; i. alk.
21	....	....	....	i.	dec.	s. HNO_3
22	7.56	....	dec.	$0.055^{16.5°}$	$0.092^{100°}$	s. H_2SO_4, HNO_3
23	....	d. 0°	....	i.	....	i. a., $(NH_4)_2S$
24	....	d.	....	i.	....	s. HCl, KCNS
25	....	expl.	....	i.		
26	$13.595^{0°}_{4}$	−38.87	357.25	i.	i.	s. HNO_3, i. HCl
27						
28	5.70	....	....	0.14	dec.	s. a.; i. al.
29	....	300	....	i.	dec.	s. a., KI
30	9.01	2535	3620	i.	i.	s. HNO_3, H_2SO_4, HCl, aq. reg.
31	....	....	....	....	....	s. KOH
32	....	....	....	i.	i.	s. alk.; i. a.
33	....	d.	....	i.	i.	i. a.; d. alk.
34	....	d.	volt.	v. s.		

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Molybdenum carbide	MoC	108.00	gray pr.
2	chloride, di-	$MoCl_2$	166.91	yel. amor.
3	chloride, tri-	$MoCl_3$	202.37	red need.
4	chloride, tetra-	$MoCl_4$	237.83	br. cryst.
5	chloride, penta-	$MoCl_5$	273.29	blk. cryst.
6	chlorohydroxide	$Mo_3Cl_4(OH)_2.2H_2O$	499.88	yel. amor.
7	hexafluoride	MoF_6	210.00	cryst.
8	oxide, di-	MoO_2	128.00	red pr.
9	oxide, sesqui-	Mo_2O_3	240.00	yel.-blk.
10	oxide, tri-	MoO_3	144.00	rhombic
11	oxybromide	MoO_2Br_2	287.83	yel. cryst.
12	oxychloride	$MoOCl_4$	253.83	green
13	oxychloride	MoO_2Cl_2	198.91	yel. wh.
14	oxychloride	$MoOCl_3$	218.37	green
15	oxychloride	$Mo_2O_3Cl_5$	417.29	dk. br. cryst.
16	phosphide	Mo_3P_2	350.05	gr. cryst.
17	sulfide, di-	MoS_2	160.13	blk. powd.
18	sulfide, tri-	MoS_3	192.19	red.-br.
19	sulfide, tetra-	MoS_4	224.26	brown powd.
20	Molybdic acid	H_2MoO_4	162.02	need. wh.-yel.
21	Molybdic acid	$H_2MoO_4.H_2O$	180.03	monocl. yel.
22	Neodymium	Nd	144.27	yellowish
23	bromate	$Nd_2(BrO_3)_6.18H_2O$	1380.34	red hex. pr.
24	carbide	NdC_2	168.27	yel. hex.
25	chloride	$NdCl_3$	250.64	violet pr.
26	chloride	$NdCl_3.6H_2O$	358.74	red rhombic
27	oxide	Nd_2O_3	336.54	reddish
28	sulfide	Nd_2S_3	384.73	olive grn.
29	Neon	Ne	20.20	colorl. gas.
30	Nickel	Ni	58.69	silvery metal
31	acetate	$Ni(C_2H_3O_2)_2$	176.74	prism. green
32	ammonium chloride	$NiCl_2.NH_4Cl.6H_2O$	291.20	grn. rhombic
33	ammonium sulfate	$NiSO_4.(NH_4)_2SO_4.6H_2O$	394.99	grn. cryst.
34	arsenide	NiAs	133.65	
35	arsenite	$Ni_3H_6(AsO_3)_4.H_2O$	691.97	grn.-wh.
36	boride	NiB	69.51	prisms.
37	bromate	$Ni(BrO_3)_2.6H_2O$	422.62	monocl.
38	bromide	$NiBr_2$	218.52	yel. scales.
39	bromide	$NiBr_2.3H_2O$	272.57	grn. need.
40	bromide ammonia	$NiBr_2.6NH_3$	320.71	violet powd.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	$8.4^{20°}$	d.	....	i.	i.	s. HNO_3, HF, h. H_2SO_4
2	....	d.	....	i.	i.	s. a., al., eth.
3	....	d.	....	i.	dec.	s. HNO_3, H_2SO_4, al.
4	....	....	....	deliq.	dec.	s. HNO_3, H_2SO_4, al.
5	9.5	194	268	deliq.	dec.	s. HNO_3, H_2SO_4, al.
6	....	....	....	i.	....	s. a.; i. al.
7	....	17	35	sl. s.		
8	$6.44^{10°}$	....	....	i.	i.	sl. s. H_2SO_4; i. alk.
9	....	....	....	i.	i.	i. a., alk.
10	$4.39^{21°}$	791	subl.	$0.107^{18°}$	$1.705^{70°}$	s. a., NH_4OH
11	....	subl.	....	s.		
12	....	<100	subl. <100	s.	dec.	
13	....	subl.	....	s.	....	s. al.
14	....	subl.	....	deliq.		
15	....	subl.	....	deliq.	s.	
16	6.17	d.	....	i.	....	s. h. HNO_3
17	$4.80^{14°}$	d.	....	i.	i.	s. H_2SO_4, aq. reg.
18	....	d.	....	sl. s.	s.	s. alk., sulfides
19	....	d.	....	i.	i.	s. alk., sulfides
20	....	....	....	sl. s.	....	s. NH_4OH
21	$3.124^{15°}$	$-H_2O$, 70	....	$0.133^{13°}$	$2.13^{70°}$	s. a., NH_4OH, NH_4 salts
22	6.9563	840	....	dec.		
23	....	66.7	$-18H_2O$, 150	$146^{25°}$		
24	5.515	d.	....	dec.	dec.	s. dil. a., H_2SO_4
25	$4.134^{24°}_{4}$	124	....	$99^{13°}$	$141.2^{100°}$	s. al.; i. eth., chl.
26	$2.282^{16.5°}_{4}$	124	$-5H_2O$, 105 $-6H_2O$, 160	$246^{13°}$	$511.6^{100°}$	s. al.
27	....	....	....	i.	....	s. HCl
28	$5.179^{11°}$	d.	....	i.	dec.	s. dil. a.
29	(A) 0.695 (D) 9.96	−253	−239			
30	8.60–.93	1452	....	i.	i.	s. dil. HNO_3; sl. s. HCl, H_2SO_4
31	1.799	dec.	....	16.6	....	i. al.
32	1.645	....	....	v. s.	v. s.	
33	$1.929^{20°}_{4}$	....	....	$2.5^{3.5°}$	$39.2^{85°}$	sl. s. $(NH_4)_2SO_4$
34	7.663	....	....	i.	i.	s. aq. reg.
35	....	d.	....	i.	....	s. alk., a.
36	$7.39^{18°}$	....	....	dec.	....	s. HNO_3
37	2.575	d.	....	28		
38	$4.64^{29°}_{29}$	d.	....	$112.8^{0°}$	$155.1^{100°}$	s. al., eth.
39	....	$-3H_2O$, 200	....	$199^{0°}$	$315.7^{100°}$	s. al., eth. NH_4OH
40	1.837	....	....	v. s.	dec.	

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Nickel carbonate	$NiCO_3$	118.69	rhombic lt. grn.
2	carbonate, basic	$2NiCO_3.3Ni(OH)_2.4H_2O$	587.56	lt. grn.
3	carbonyl	$Ni(CO)_4$	170.69	need. or liq.
4	chloride	$NiCl_2$	129.60	yel. scales
5	chloride	$NiCl_2.6H_2O$	237.70	hex. grn.
6	chloride ammonia	$NiCl_2.6NH_3$	231.80	
7	cyanide	$Ni(CN)_2.4H_2O$	182.77	grn. pl.
8	dimethylglyoxime	$NiC_{14}H_{14}N_4O_4$	360.83	scarlet red cryst.
9	ferrocyanide	$Ni_2Fe(CN)_6.11H_2O$	527.44	grn. wh.
10	fluoride	NiF_2	96.69	grn. quad.
11	fluoride, acid	$NiF_2.5HF.6H_2O$	304.83	trim. prisms
12	fluosilicate	$NiSiF_6.6H_2O$	308.85	grn. rhbdr.
13	formate	$Ni(CHO_2)_2.2H_2O$	184.74	grn. cryst.
14	hydroxide (ic)	$Ni(OH)_3$	109.71	blk.
15	hydroxide (ous)	$4Ni(OH)_2.H_2O$	388.84	lt. grn.
16	iodide	NiI_2	312.55	blk. scales
17	iodide ammonia	$NiI_2.6NH_3$	414.75	
18	nitrate	$Ni(NO_3)_2.6H_2O$	290.80	grn. monocl.
19	nitrate ammonia	$Ni(NO_3)_2.4NH_3.2H_2O$	286.87	
20	oxide, mon-	NiO	74.69	reg. grn.
21	oxide, sesqui-	Ni_2O_3	165.38	blk.
22	oxide (ous) (ic)	Ni_3O_4	240.07	gray
23	oxyiodide	$NiI_2.9NiO.15H_2O$	1255.00	
24	perchlorate	$Ni(ClO_4)_2.5H_2O$	347.68	grn. hex.
25	phosphate	$Ni_3(PO_4)_2.7H_2O$	492.14	grn.
26	phosphide	Ni_3P_2	138.12	dk. grn.
27	phosphide	Ni_2P	148.41	gray cryst.
28	pyrophosphate	$Ni_2P_2O_7.6H_2O$	399.53	grn.
29	potassium cyanide	$Ni(CN)_2.2KCN.H_2O$	258.93	red yel. monocl.
30	selenide	$NiSe$	137.89	cryst.
31	sulfate	$NiSO_4$	154.75	yel. reg.
32	sulfate	$NiSO_4.6H_2O$	262.85	bl. tetrag. or grn. monocl.
33	sulfate	$NiSO_4.7H_2O$	280.87	grn. rhombic or monocl.
34	sulfide, mono-	NiS	90.75	blk. hex.
35	sulfide, sub-	Ni_2S	149.44	yel. cryst.
36	sulfide, (ous) (ic)	Ni_3S_4	304.33	gr.-blk. rhbdr.
37	sulfite	$NiSO_3.6H_2O$	246.85	grn. tetrahdr.
38	Niobium *see columbium*			
39	Nitric acid	HNO_3	63.02	colorl. liq.
40	Nitrogen	N_2	28.02	colorl. gas

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	....	d.	....	i.	i.	s. a.
2	....	d.	....	i.	dec.	s. a., NH_4 salts
3	$1.3185^{17°}$	−25	43	$0.018^{9.8°}$	i.	s. al., chl., HNO_3
4	2.56	subl.	....	$53.8^{0°}$	$87.6^{100°}$	s. al., NH_4OH
5	....	....	....	$179.3^{0°}$	$599^{100°}$	v. s. al.
6	....	....	....	s.	dec.	i. al.; s. NH_4OH
7	....	$-4H_2O$, 200	d.	i.	i.	s. KCN; i. dil. KCl
8	....	subl. 250	....	i	i.	s. abs. al., a.; i. acet. a., NH_4OH
9	....	....	....	i.	....	i. HCl; s. NH_4OH
10	$2.855^{14°}$	....	....	0.02	....	i. a., al., eth
11	2.132					
12	2.109	d.	....	v. s.		
13	2.1547	d.	....	s.		
14	....	d.	....	i.	i.	s. a., NH_4OH
15	4.36	d.	....	i.	i.	s. a., NH_4OH
16	....	subl.	....	$124.2^{0°}$	$188.2^{100°}$	s. al.
17	2.101	d.	....	dec.	....	s. NH_4OH
18	$2.065^{14°}$	56.7	136.7	$238.5^{0°}$	∞	s. al., NH_4OH
19	....	....	....	v. s.	....	i. al.
20	6.69	to Ni_2O_3, 400	....	i.	i.	s. a., NH_4OH
21	$4.84^{16°}$	to NiO, 600	....	i.	i.	s. HCl, NH^4OH
22	....	....	....	i.	i.	s. a.
23	....	....	....	i.	....	s. HNO_3; i. NH_4OH
24	....	149	....	$222.5^{0°}$	$273.7^{45°}$	s. al.; i. chl.
25	....	....	....	i.	i.	s. a., NH_4 salts
26	5.99	....	....	i.	i.	i. HCl
27	$6.3^{15°}$	....	....	i.	....	i. a.; s. HNO_3 + HF
28	anh. $3.9303^{25°}$	....	....	i.	....	s. a., NH_4OH
29	$1.875^{11°}$	$-H_2O$, 100	....	s	....	d. a
30	8.46	....	....	i.	....	s. HNO_3, aq. reg.
31	$3.418^{15°}$	$-SO_3$, 840	....	$29.3^{0°}$	$83.7^{100°}$	i. al., eth.
32	2.031	$-6H_2O$, 280	....	$62.52^{0°}$	$340.7^{100°}$	v. s. al., NH_4OH
33	1.98	98–100	$-6H_2O$, 103	$75.6^{15.5°}$	$475.8^{100°}$	s. al.
34	4.60	797	....	0.00036	dec.	s. HNO_3, aq. reg.
35	5.52	....	....	i.	....	s. HNO_3
36	....	....	....	i.	....	s. HNO_3
37	....	....	....	i.	....	s. HCl, H_2SO_3
38						
39	$1.53^{15°}_{0}$	−41.3	86	∞	∞	
40	(A) 0.96737	−211	−195	2.348 c.c.$^{0°}$	1.542 c.c.$^{20°}$	sl. s. al.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Nitrogen bromophosphide	$NPBr_2$	204.87	
2	chloride	NCl_3	120.38	yel. oil
3	chlorophosphide	$N_3P_3Cl_6$	347.85	trim.
4	iodide	NI_3	394.80	blk.
5	iodoazoimide	NH_3NI_3	411.84	red ortho rhomb.
6	oxide, mon- (ous)	N_2O	44.02	colorl. gas
7	oxide, di- (ic)	NO or (N_2O_2)	30.01 (60.02)	colorl. gas
8	oxide, tri-	N_2O_3	76.02	bl. solid or liq., red br. gas.
9	oxide, tetra-	NO_2 or $(N_2O_4.)$	46.01 (92.02)	colorl. solid, yel. liq., red br. gas
10	oxide, pent-	N_2O_5	108.02	rhombic wh.
11	oxybromide (nitrosyl bromide)	$NOBr$	109.92	dk. br. liq.
12	oxychloride (nitrosyl chloride)	$NOCl$	65.47	yel.-red cryst., liq. or gas
13	selenide	NSe	93.21	orange yel.
14	sulfide	N_4S_4	184.29	orange red monocl.
15	sulfide, penta-	N_2S_5	188.34	red
16	sulfochloride	NS_3Cl	145.66	yel.
17	Nitroxyl fluoride	NO_2F	65.01	gas
18	Osmium	Os	190.80	bl. amor.
19	ammonium tri-chloride	$2(OsCl_3.2NH_4Cl).3H_2O$	862.38	red br. cryst.
20	chloride, di-	$OsCl_2$	261.71	grn. need.
21	chloride, tri-	$OsCl_3$	297.17	reg. br.
22	chloride, tri-	$OsCl_3.3H_2O$	351.22	
23	chloride, tetra-	$OsCl_4$	332.63	red-yel. need.
24	oxide, mon-	OsO	206.80	blk.
25	oxide, di-	OsO_2	222.80	copper red
26	oxide, sesqui-	Os_2O_3	429.60	blk.
27	oxide, tetra-	OsO_4	254.80	colorl. monocl.
28	potassium tri-chloride	$2(OsCl_3.3KCl).6H_2O$	1149.76	dk. red cryst.
29	potassium tetra-chloride	$OsCl_4.2KCl$	481.73	octahdr. red
30	sulfide, di-	OsS_2	254.93	br. yel.
31	sulfide, tetra-	OsS_4	319.06	br. blk.
32	sulfite	$OsSO_3$	270.86	bl. blk.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water	Hot water	Alcohol, acids, etc.
1	....	....	....	i.	....	s. eth., chl., CS_2
2	1.653	expl. 95	....	s.	dec.	s. chl., CS_2, PCl_3
3	1.98	114	255	dec.	....	s. al., eth., chl.
4	....	expl.	....	sl. s. d.		
5	3.5	expl.	....	dec.	expl.	s. HCl, KCN, $Na_2S_2O_3$; i. abs. al.
6	(A) 1.530	−102.3	−89.4	130.52 c.c.$^{0°}$	60.82 c.c.$^{24°}$	s. al., H_2SO_4
7	(A) 1.0366	−160.6	−153	7.3 c.c.$^{0°}$	0.0$^{100°}$	3.5 c.c. H_2SO_4, 26.6 c.c. al.; s. $FeSO_4$
8	1.447$^{-2°}$	−111	3.5	s.	....	s. a., eth.
9	1.4903$^{0°}_{4}$	−9.6	21.6	s.	....	s. CS_2, chl., HNO_3, H_2SO_4
10	1.642$^{18°}$	29.5	45–50	s.		
11	>1.0	−2	....	dec.	dec.	
12	(A) 2.31 1.4165$^{-12°}$	−60	−5.6	dec.		
13	....	expl.	....	i.	....	s. HNO_3, CS_2
14	2.22$^{15°}$	188	subl. 135	i.	dec.	s. al., eth., CS_2
15	1.901$^{18°}_{4}$	10–11	d.	i.	....	sl. s. al., CS_2
16	....	d.	....	s.	dec.	s. CS_2
17	(A) 2.24	−139	−63.5	dec.		
18	22.48	2700 (?)	....	i.	i.	sl. s. HNO_3, aq. reg.
19	....	....	....	v. s.	dec.	v. s. al.; i. eth.
20	....	....	....	i.	....	s. al., eth., NaCl
21	....	d. 560–600	....	sl. s.	....	s. alk., al., HCl; sl. s. eth.
22	....	....	....	sl. s.	....	s. alk., HCl
23	....	....	....	sl. s.	....	s. HCl, al.
24	....	....	....	i.	i.	i. a.
25	....	....	....	i.	i.	i. a.
26	....	....	....	i.	i.	i. a.
27	8.89	20	100	v. s.	v. s.	s. al. eth. NH_4OH
28	....	$-6H_2O$, 150–180	....	v. s.	....	v. s. al.; i. eth.
29	....	d.	....	sl. s.	....	i. al., HCl
30	....	....	....	sl. s.	....	i. alk.
31	....	d.	....	i.	....	s. HNO_3; i. alk.
32	....	....	....	i.	....	s. HCl

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Oxalic acid	$H_2C_2O_4.2H_2O$	126.05	colorl. cryst
2	Oxygen	O_2	32.00	colorl. gas
3	Ozone	O_3	48.00	colorl. gas
4	Palladium	Pd	106.70	reg. hex. silvery
5	bromide	$PdBr_2$	266.53	br.
6	chloride	$PdCl_2$	177.61	octahdr. reg.
7	chloride	$PdCl_2.2H_2O$	213.65	br. prism
8	cyanide	$Pd(CN)_2$	158.72	yel.
9	fluoride	PdF_2	144.70	br.
10	hydride	Pd_2H	214.41	
11	hydroxide	$Pd(OH)_2$	140.72	br.
12	iodide	PdI_2	360.56	blk.
13	nitrate	$Pd(NO_3)_2$	230.72	yel.-br. rhombic
14	oxide, sub-	Pd_2O	229.40	blk.
15	oxide, mon-	PdO	122.70	blk.
16	oxide, di-	PdO_2	138.70	blk.
17	sulfate	$PdSO_4.2H_2O$	238.80	br. cryst
18	sulfide, sub-	Pd_2S	245.46	gray
19	sulfide, mono-	PdS	138.76	blk.
20	sulfide, di-	PdS_2	170.83	dk. br.
21	Palladous diammonium chloride	$PdCl_2.2NH_3$	211.68	red or yel. cryst.
22	diammonium hydroxide	$Pd(OH)_2.2NH_3$	174.78	cryst.
23	Perchloric acid	$HClO_4$	100.48	colorl. oily liq.
24	Perchloric acid	$HClO_4.H_2O$	118.50	need.
25	Perchloric acid	$HClO_4.2H_2O$	136.51	cryst. or liq.
26	Periodic acid	$HIO_4.2H_2O$	227.97	monocl.
27	Permanganic acid	$HMnO_4$	119.94	
28	Permolybdic acid	$HMoO_4.2H_2O$	197.04	wh. cryst.
29	Phosgene *see carbon oxychloride*			
30	Phosphamic acid	$PONH_2.(OH)_2$	97.07	
31	Phosphine	PH_3	34.05	gas
32	Phosphine liquid	P_2H_4	66.09	liq.
33	Phosphine solid	$(P_4H_2)_3$	378.37	yel.
34	Phosphomolybdic acid	$H_3PO_4.12MoO_3.12H_2O$	2042.24	monocl. yel.
35	Phosphonium bromide	PH_4Br	114.98	reg. colorl. or gas.
36	chloride	PH_4Cl	70.52	reg.
37	iodide	PH_4I	161.99	tetrag. prisms
38	sulfate	$(PH_4)_2SO_4$	166.18	cryst.
39	Phosphoric acid, hypo-	$H_4P_2O_6$	162.09	cryst.
41	Phosphoric acid, meta-	HPO_3	80.04	vitreous

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	$1.653^{18.5°}$	98	....	$4.9^{0°}$	$120^{70°}$	s. al.
2	(A) 1.1053	−227	−182.7	4.89 c.c.$^{0°}$	2.61 c.c.$^{20°}$ 1.7 c.c.$^{100°}$	sl. s. al.; s. fus. Ag
3	(A) 1.658	d. 270	−119	0.88	....	s. oil turp., oil cinn.
4	12.16	1550	....	i.	i.	s. aq. reg.
5	....	....	....	i.	i.	s. HBr
6	....	501	....	s.	s.	s. HCl
7	....	....	....	s.	s.	s. HCl
8	....	d.	....	i.	i.	s. KCN, NH_4OH
9	....	....	....	sl. s.	....	s. HF
10	11.06	d.				
11	....	....	....	i.	i.	s. a., alk.
12	....	100	360	i.	i.	s. ex. KI; i. al., eth.
13	....	d.	....	s.	dec.	s. HNO_3
14	....	d.	....	i.	....	i. a.
15	....	−O, 875	....	i.	i.	sl. s. a.
16	....	−O, 200	....	i.	i.	sl. s. a.
17	....	....	....	v. s.	dec.	
18	$7.303^{15°}$	....	....	i.	....	i. a.; s. aq. reg.
19	....	d.	....	i.	i.	s. HCl; i. $(NH_4)_2S$
20	....	d.	....	i.	i.	s. aq. reg.
21	....	....	....	sl. s.	....	s. a., NH_4OH
22	....	d. <100	....	s.	dec.	
23	$1.764^{23°}_{4}$	....	39	s.		
24	$1.7756^{20°}_{4}$	50	d.	s.		
25	1.65	−20.6	200	v. s.	....	s. al.
26	....	130	734	v. s.	v. s.	s. al., eth.
27	....	....	....	v. s.	dec.	
28	....	....	....	v. s.	v. s.	
29						
30	....	d.	....	v. s.		
31	(A) 1.185	−133.5	−85	sl. s.	i.	s. al., eth., Cu_2Cl_2
32	1.007–.016	<−10	57–8	i.		s. al., turp.
33	1.83	ign. 200	....	i.	i.	i. al.; s. P, P_2H_4
34	....	$-H_2O$, 104	....	s.		
35	(A) 1.906	....	30 d.	dec.	dec.	
36	....	26	subl.	dec.		
37	2.86	....	80	dec.	....	d. al.
38	....	....	....	dec.		
39	....	55	d. 70	s.		
40	2.2–.5	subl.	....	s.	s.	

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Phosphoric acid, ortho-	H_3PO_4	98.05	rhombic
2	Phosphoric acid, pyro-	$H_4P_2O_7$	178.09	need
3	Phosphorous acid, hypo-	H_3PO_2	66.05	tabl.
4	Phosphorous acid, ortho-	H_3PO_3	82.05	yel. cryst.
5	Phosphorous acid, pyro-	$H_4P_2O_5$	146.09	need.
6	Phosphorous, red	P_4	124.11	red amor.
7	Phosphorous, yellow	P_4	124.11	reg. yel.
8	Phosphorous, black	P_4	124.11	rhbdr.
9	Phosphorous arsenide	PAs	105.99	
10	Phosphorous bromide, tri-	PBr_3	270.78	colorl. fum. liq.
11	bromide, penta-	PBr_5	430.61	yel. cryst.
12	bromofluoride	PBr_2F_3	247.86	pa. yel.
13	bromonitride	PBr_2N	204.87	
14	bromotrichloride, di-	PBr_2Cl_3	297.23	orange cryst.
15	bromotrichloride, octa-	PBr_8Cl_3	776.73	br. need.
16	bromotrichloride, tetra-	PBr_4Cl_3	457.06	dk. red cryst.
17	chloride, tri-	PCl_3	137.40	colorl. liq.
18	chloride, penta-	PCl_5	208.31	yel. rhombic.
19	chlorofluoride	PCl_2F_3	158.94	
20	fluoride, tri-	PF_3	88.03	gas.
21	fluoride, penta-	PF_5	126.03	gas.
22	heptabromide dichloride	PBr_7Cl_2	661.35	prisms.
23	hydride *see phosphine*			
24	iodide, di-	P_2I_4	569.78	orange pr.
25	iodide, tri-	PI_3	411.82	red prisms.
26	iodochloride	PI_2Cl_3	391.26	red hex.
27	monobromotetrachloride	$PBrCl_4$	252.77	yel. cryst.
28	nitride	P_3N_5	163.12	amor.
29	oxide, tri-	P_2O_3	110.05	liq. or monocl.
30	oxide, tetra-	P_2O_4	126.05	ortho rhomb.
31	oxide, penta-	P_2O_5	142.05	amor. wh.
32	oxybromide	$POBr_3$	286.78	plates.
33	oxybromdichloride	$POBrCl_2$	197.86	tabl.
34	oxychloride	$POCl_3$	153.40	tabl. or liq.
35	oxyfluoride	POF_3	104.03	gas.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	$1.884^{18°}$	38.6	$-\frac{1}{2}H_2O$, 213	v. s.	v. s.	s. al.
2	....	61	....	v. s.	dec.	v. s. al., eth.
3	$1.493^{18.8°}$	26.5	d.	∞	∞	
4	$1.651^{21.2°}$	70.1	d. 200	∞	∞	
5	....	38	d. 130	dec.		
6	2.20	725, ign. in air	....	i.	i.	i. eth., CS_2; s. alk.
7	$1.83^{18°}$	44.2	290	0.00033	sl. s.	1000 CS_2; 0.4 al.; $1.5^{0°}$, $10^{?1°}$ bz.
8	2.34	....	....	i.	i.	i. CS_2
9	....	....	subl. d.	dec.	....	i. al., eth; s. CS_2
10	2.8847	−41.5	175.3	dec.		s. CS_2, eth., chl.
11	....	<100	106 d.	dec.		
12	....	−20	....	dec.		
13	....	188–90	....	....	....	s. eth., CS_2 chl.
14	....	35				
15	....	25				
16	....	....	....	dec.		
17	$1.6128^{0°}_{4}$	−111.8	75.95	dec.	dec.	s. CS_2, eth., chl.
18	(D) $3.60^{296°}$	148, under press.	subl. 160	dec.	....	s. CS_2, C_6H_5COCl
19	....	−8	d. 250	dec.	....	s. al.
20	....	−160	−95	dec.	....	s. al., alk.
21	(D) 4.30	−83	−75	dec.		
22	....	....	....	dec.	....	s. PCl_3
23						
24	....	110	....	dec.	....	s. CS_2
25	....	61	d.	dec.	dec.	s. CS_2
26	....	....	....	dec.	....	s. CS_2
27	....	....	....	dec.		
28	$2.51^{19°}$	d.	....	i.	s. d.	
29	$2.135^{21°}_{4}$	22.5	173	s.	dec.	s. CS_2 eth., chl.
30	$2.537^{22.6°}_{4}$	>100	180	s.		
31	2.387	800	subl.	v. s.	v. s.	s. H_2SO_4
32	2.822	55.5	189.5	dec.	....	s. eth., CS_2, H_2SO_4
33	$2.049^{0°}_{4}$	13	137.6	dec.		
34	$1.712^{0°}_{4}$	1.25	107.2	dec.	....	d. al.
35	....	−68	−40	dec.	....	d. al.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Phosphorous oxyiodide	$P_3O_8I_6$	982.67	red cryst
2	oxynitride	PON	61.04	amor
3	selenide, sub-	P_4Se	203.31	dk. yel
4	selenide, mono-	P_2Se	141.25	red
5	selenide, tri-	P_2Se_3	299.65	dk. red
6	selenide, penta-	P_2Se_5	458.05	dk. red need
7	sulfide, sesqui-	P_4S_3	220.30	rhombic yel
8	sulfide, di-	P_3S_6	285.47	yel. need
9	sulfide, tri-	P_4S_6	316.49	gray-yel. cryst
10	sulfide, penta-	P_2S_5	222.37	yel. cryst
11	sulfobromchloride	$PSBrCl_2$	213.92	yel. liq
12	sulfobromide	$PSBr_3$	302.84	yel. octahdr
13	sulfobromide	$PSBr_3.H_2O$	320.86	yel. cryst
14	sulfochloride	$PSCl_3$	169.46	liq
15	sulfocyanate	$P(CNS)_3$	205.24	liq
16	sulfofluoride	PSF_3	120.09	gas
17	sulfoxide	$P_4S_4O_6$	348.36	tetrag
18	thioamide	$PS(NH_2)_3$	111.16	amor. yel
19	trioxytetrachloride	$P_2O_3Cl_4$	251.88	
20	trisulfotetrabromide	$P_2S_3Br_4$	477.91	yel. oil
21	Phosphotungstic acid	$P_2O_5.12WO_3.42H_2O$	3682.73	yel.-grn. cryst
22	Platinic acid, brom-	$H_2PtBr_6.9H_2O$	838.89	monocl. red
23	Platinic acid, chlor-	$H_2PtCl_6.6H_2O$	518.08	red.-br. cryst
24	Platinic acid, iodo-	$H_2PtI_6.9H_2O$	1120.98	br. monocl
25	Platino-platinic oxide	Pt_3O_4	649.69	blk
26	Platinum	Pt	195.23	silvery-gray
27	bromide di- (ous)	$PtBr_2$	355.06	br
28	bromide, tetra- (ic)	$PtBr_4$	514.89	dk. br
29	chloride, di- (ous)	$PtCl_2$	266.14	br
30	chloride, tetra- (ic)	$PtCl_4$	337.06	br
31	chloride, tetra- (ic)	$PtCl_4.5H_2O$	427.14	red monocl
32	cyanide	$Pt(CN)_2$	247.25	yel. br
33	fluoride	PtF_4	271.23	lt. br. cryst
34	hydroxide (ous)	$Pt(OH)_2$	229.25	blk
35	hydroxide (ous)	$Pt(OH)_2.2H_2O$	265.28	yel
36	hydroxide (ic)	$Pt(OH)_4$	263.26	red br
37	iodide, di-(ous)	PtI_2	449.09	blk
38	iodide, tetra- (ic)	PtI_4	702.96	amor. br. -blk
39	oxide, mon- (ous)	PtO	211.23	violet-blk
40	oxide, di- (ic)	PtO_2	227.23	blk

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	....	140	d.	s.	....	s. al. eth.
2	....	....	....	i.	....	i. a., alk.
3	....	−12	ign.	dec.	....	s. CS_2, i. al., eth.
4	....	....	....	dec.	....	sl. s. CS_2; i. al., eth.
5	....	....	....	....	dec.	s. KOH; i. CS_2
6	....	....	....	dec.	....	s. CCl_4; i. CS_2
7	2.0$^{11°}$	172	407.8	i.	dec.	s. CS_2, PCl_3
8	....	297	337$^{10.5mm.}$	....	....	sl. s. CS_2
9	....	290	490	dec.	....	s. al., eth., alk.
10	2.09$^{17°}$	275	530	dec.	....	s. CS_2, alk.
11	2.12$^{0°}_{4}$	−30	150	dec.		
12	2.85$^{17°}$	36–8	d.	dec.	....	s. CS_2, eth., PCl_3, PBr_3
13	2.794$^{18°}$	35				
14	1.634$^{22°}$	−35	125	dec.	....	s. CS_2
15	1.625$^{18°}$	<−20	265	dec.	....	s. al., eth., CS_2, chl.
16	....	....	3.8$^{7.6}$ atm.	dec.	....	sl. s. eth.; i. CS_2
17	....	102	295	dec.	....	50 CS_2
18	1.7$^{13°}$	d. 200	....	sl. s.	dec.	
19	1.78$^{7°}$	....	210–15	dec.		
20	2.262$^{17°}$	....	d.			
21	....	....	....	s.	....	s. al., eth.
22	....	d. 100	....	v. s.	v. s.	v. s. al., eth., chl.
23	2.431	d.	....	v. s.	v. s.	s. al., eth.
24	....	....	....	s. d.		
25	....	d.	....	i.	....	i. a.
26	21.37$^{20°}$	1755	3910	i.	i.	s. aq. reg., fus. alk.
27	....	d. 300	....	i.	i.	s. HBr, KBr
28	....	....	....	0.41$^{20°}$	sl. s.	s. al., eth., HBr
29	5.87$^{11°}$	d.	....	i.	i.	s. HCl, NH_4OH
30	....	d.	....	v. s.	v. s.	s. al., eth.
31	2.43	$-4H_2O$, 100	....	v. s.	v. s.	s. al., eth.
32	....	....	....	i.	i.	i. alk.
33	....	d.	....	s. d.		
34	....	d.	....	i.	i.	s. HCl, HBr, alk.
35	....	$-2H_2O$, 100	....	i.	i.	s. a., alk.
36	....	d.	....	i.	i.	v. s. alk., a.
37	....	d. 325	....	i.	i.	i. a., s. Na_2SO_3
38	....	....	....	i.	....	s. alk., HI, KI
39	....	555	....	i.	i.	s. H_2SO_3, HCl
40	....	430	....	i.	i.	i. a.

	Name	Formula	Mol. wt.	Crystalline form and color
1	Platinum oxide, di- (ic)	$PtO_2.H_2O$	245.25	yel.
2	oxide, di- (ic)	$PtO_2.2H_2O$	263.26	br.
3	oxide, di- (ic)	$PtO_2.3H_2O$	281.28	blk.
4	oxide, di- (ic)	$PtO_2.4H_2O$	299.29	yel. need.
5	sulfide, mono- (ous)	PtS	227.29	blk.
6	sulfide, di- (ic)	PtS_2	259.36	need. blk. or gray
7	sulfide, sesqui-	Pt_2S_3	486.65	gray
8	sulfate	$Pt(SO_4)_2.4H_2O$	459.42	yel. pl.
9	Potassium	K	39.10	silvery tetrag.
10	actate	$KC_2H_3O_2$	98.12	wh. powd.
11	acetate, acid	$KH(C_2H_3O_2)_2$	158.14	need. or pl.
12	aluminate	$K_2Al_2O_4.3H_2O$	250.18	cryst.
13	amid	KH_2N	55.12	yel. grn.
14	antimonate	$KSbO_3$	208.87	cryst.
15	antimonyl tartrate	$KSbOC_4H_4O_6.\frac{1}{2}H_2O$	333.91	octahdr.
16	arsenate (tribasic)	K_3AsO_4	256.25	cryst.
17	arsenate (dibasic)	K_2HAsO_4	218.16	cryst.
18	arsenate (monobasic)	KH_2AsO_4	180.07	colorl. cryst.
19	arsenite	$KAsO_2$	146.06	
20	arsenite, acid	$KH(AsO_2)_2.H_2O$	272.04	
21	aurate	$KAuO_2.3H_2O$	322.34	
22	auricyanide	$KAu(CN)_4.1\frac{1}{2}H_2O$	367.35	tabl.
23	aurocyanide	$KAu(CN)_2$	288.31	rhombic octahdr.
24	benzoate	$KC_7H_5O_2.3H_2O$	214.18	wh. cryst powd.
25	borate, meta-	$K_2B_2O_4$	163.83	hex. prisms
26	borate, tetra-	$K_2B_4O_7.5H_2O$	323.55	hex. prisms, wh.
27	borofluoride	KBF_4	125.92	hex.
28	borotartrate	$KC_4H_4BO_7$	213.95	wh. cryst.
29	bromate	$KBrO_3$	167.01	rhbdr.
30	bromide	KBr	119.01	reg. colorl.
31	bromaurate	$KAuBr_4$	555.96	monocl.
32	bromaurate	$KAuBr_4.2H_2O$	591.99	
33	bromoplatinate	K_2PtBr_6	752.92	reg. red.
34	bromoplatinite	K_2PtBr_4	593.09	rhbdr. br.
35	carbonate	K_2CO_3	138.19	wh. powd.
36	carbonate	$K_2CO_3.2H_2O$	174.23	rhombic
37	carbonate	$2K_2CO_3.3H_2O$	330.43	monocl
38	carbonate, acid	$KHCO_3$	100.10	moncl.
39	chlorate	$KClO_3$	122.55	monocl.
40	chloride	KCl	74.55	reg.
41	chloraurate	$KAuCl_4$	378.12	yel. need.
42	chlorochromate	$KOClCrO_2$	174.56	red prisms
43	chloriridate	K_2IrCl_6	484.03	blk. octahdr.
44	chloropalladate	K_2PdCl_6	397.63	red. reg.
45	chloropalladite	K_2PdCl_4	326.72	reg. yel.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	....	$-H_2O$, 100	....	i.	....	s. HCl NaOH; i. acet. a.
2	....	$-H_2O$, 100	....	i.		
3	....	d. 300	....	i.	i.	i. HCl, aq. reg.
4	....	d.	....	i.	i.	s. a.
5	8.897	d.	....	i.	i.	i. a.; s. $(NH_4)_2S$
6	5.27	d.	....	i.	i.	s. $(NH_4)_2S$, aq. reg.
7	5.52	....	....	i.	....	i. a.; s. aq. reg.
8	....	....	....	s.	dec.	s. a., al., eth.
9	$0.870^{20°}$	62.3	712	dec.	dec.	s. a., al., Hg
10	....	292	....	$188^{5°}$	$492^{62°}$	33 al.; i. eth.
11	....	148	d. 200	dec.	....	s. acet. a.
12	....	....	....	v. s.	v. s.	i. al.; s. alk.
13	....	270–2	subl. 400	dec.	....	d. al.
14	....	....	....	i.	sl. s.	s. h. KOH
15	2.6	$-\frac{1}{2}H_2O$, 100	....	$5^{8°}$	$52^{100°}$	i. al.
16	....	....	....	18.87	v. s.	4 al.
17	....	....	....	s.		
18	2.851	288	....	$19^{6°}$	v. s.	i. al.
19	....	....	....	s.	....	sl. s. al.
20	....	....	....	s.	....	sl. s. al.
21	....	....	....	v. s.	dec.	s. al.
22	....	d. 200	....	s.	v. s.	s. al.
23	....	....	....	14.3	200	sl. s. al.; i. eth.
24	....	....	d.	$124.1^{17.5°}$	$161^{5°}$	s. al.
25	....	947	....	$71^{30°}$	v. s.	
26	(anh.) 1.74	d.	....	$26.7^{30°}$	v. s.	
27	$2.498^{20°}$	....	d.	1.42	$6.25^{100°}$	s. alk.; i. al.
28	1.832	....	....	sl. s.		
29	3.24	434	d.	$3.1^{0°}$	$49.75^{100°}$	i.
30	2.75	730	1435	$53.48^{0°}$	$102.04^{100°}$	sl. s. al., eth.
31	....	d.	....	sl. s.	....	s. al.
32	....	....	....	$19.5^{15°}$	$204^{67°}$	s. KBr; d. eth.
33	$4.658^{24°}_{4}$	....	....	$2.07^{10°}$	$10^{100°}$	
34	....	....	....	v. s.	v. s.	
35	$2.33^{17°}$	909	d.	$89.4^{0°}$	$156^{100°}$	i. al.
36	2.043	....	....	$146.9^{0°}$	$331^{100°}$	
37	....	....	....	$129.4^{0°}$	$268.3^{100°}$	
38	2.17	d. 100–200	....	$22.4^{0°}$	$60^{60°}$	i. al.; s. K_2CO_3
39	$2.344^{17°}$	357	d. 400	$3.3^{0°}$	$56^{100°}$	0.83 al.; s. alk.
40	$1.984^{30°}_{4}$	772	1500 subl.	$28.5^{0°}$	$56.6^{100°}$	s. al., alk.
41	....	....	....	$27.7^{10°}$	$80.2^{60°}$	s. al.
42	2.497	....	....	s. d.	....	s. a.
43	3.546	d.	....	$1.25^{19°}$	6.67	i. al., KCl
44	2.7–.8	d.	....	sl. s.	dec.	sl. s. HCl; i. al.
45	2.738	d.	....	s.	v. s.	i. al.; s. KCl, NH_4OH

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Potassium chloroplatinate	K_2PtCl_6	486.16	reg. yel.
2	chloroplatinite	K_2PtCl_4	415.25	tetrag. red
3	chlororhodite	$K_3RhCl_6.3H_2O$	486.99	tricl. red
4	chlorostannate	K_2SnCl_6	409.54	
5	chromate	K_2CrO_4	194.11	rhombic yel.
6	citrate	$K_3C_6H_5O_7.H_2O$	324.34	colorl. cryst.
7	cobalticyanide	$K_3Co(CN)_6$	332.28	rhombic yel.
8	cobaltinitrite	$2Co(NO_2)_3.6KNO_2.3H_2O$	958.60	tetrag yel.
9	cobaltocyanide	$K_4Co(CN)_6$	371.37	violet
10	cobaltosulfate	$K_2SO_4.CoSO_4.6H_2O$	437.36	monocl. pl.
11	cyanate	KCNO	81.10	wh. cryst.
12	cyanide	KCN	65.10	reg. wh.
13	dichromate	$K_2Cr_2O_7$	294.21	tricl. or monocl. red
14	ferricyanide	$K_3Fe(CN)_6$	329.18	monocl. red
15	ferric oxalate	$KFe(C_2O_4)_2.2\frac{1}{2}H_2O$	315.98	olive br. cryst.
16	ferric oxalate	$K_3Fe(C_2O_4)_3.3H_2O$	491.18	
17	ferrocyanide	$K_4Fe(CN)_6.3H_2O$	422.32	monocl. yel.
18	fluoride	KF	58.10	
19	fluoride	$KF.2H_2O$	94.13	monocl. pr.
20	fluoride, acid	KHF_2	78.10	reg.
21	fluogermanate	K_2GeF_6	226.79	
22	fluosilicate	K_2SiF_6	220.25	hex.
23	fluostannate	$K_2SnF_6.H_2O$	328.91	octahdr.
24	fluotitanate	$K_2TiF_6.H_2O$	258.31	
25	fluozirconate	K_2ZrF_6	283.19	rhombic
26	formate	$KCHO_2$	84.10	rhombic
27	hydride	KH	40.10	cryst.
28	hydrosulfide	KHS	72.17	yel. rhbdr.
29	hydroxide	KOH	56.10	rhbdr. wh.
30	hypochlorite	KClO	90.55	need.
31	hypophosphite	KH_2PO_2	104.14	hex.
32	iodate	KIO_3	214.03	reg.
33	iodate, acid	$KH(IO_3)_2$	389.97	rhombic or monocl.
34	iodide	KI	166.03	reg. wh.
35	iodide, tri-	KI_3	419.89	dk. bl. need.
36	iodobromide	KBr.IBr	325.86	
37	iodochloride	$KCl.ICl_3$	307.86	yel. rhomb.
38	iodoiridite	K_3IrI_6	1071.98	grn. cryst.
39	magnesium chloride (carnallite)	$MgCl_2.KCl.6H_2O$	277.88	hex.
40	manganate	K_2MnO_4	197.12	grn. rhombic
41	manganicyanide	$K_3Mn(CN)_6$	328.27	red
42	manganocyanide	$K_4Mn(CN)_6.6H_2O$	475.46	quad. bl.
43	molybdate	K_2MoO_4	138.19	wh. powd.
44	nickel sulfate	$K_2SO_4.NiSO_4.6H_2O$	437.11	monocl. bl.
45	nitrate (saltpeter)	KNO_3	101.10	rhbdr. or prism.
46	nitride	K_3N	131.30	dk. gray
47	nitrite	KNO_2	85.10	prism.
48	nitroprusside	$K_2Fe(CN)_5.NO.2H_2O$	330.11	red. monocl.
49	osmate	$K_2OsO_4.2H_2O$	369.02	octahdr. violet
50	osmocyanide	$K_4Os(CN)_6.3H_2O$	557.28	yel.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	$3.291^{21°}$	d.	....	$0.7^{0°}$	$5.22^{100°}$	i. al., eth.
2	$3.291^{21°}$	....	....	16.6	v. s.	i. al.
3	....	d.	....	sl. s.	d.	i. al.
4	2.687	....	....	s.		
5	$2.732^{18°}$	971	....	$58.9^{0°}$	$79.1^{100°}$	i. al.
6	1.98	d. 230	....	$167^{15°}$	$199.7^{31°}$	sl. s. al.
7	1.906	....	....	v. s.	....	i. al.
8	....	d. 200	....	$0.09^{0°}$	sl. s.	i. al., eth.
9	....	....	....	s.	....	i. al., eth.
10	$2.212^{20°}_{4}$	....	....	$25.4^{0°}$	108.4^{19}	
11	2.048	....	....	s.	s.	v. sl. s. al.
12	$1.52^{15°}$	....	....	s.	$122.2^{103.[illegible]°}$	s. glyc., al.
13	$2.692^{4°}$	396	d.	$4.9^{0°}$	102[illegible]	i. al.
14	$1.871^{17°}$	d.	....	$33^{1.5°}$	$77.5^{100°}$	sl. s. al.
15	....	d.	....	$92^{21°}$	dec.	
16	....	$-3H_2O$, 100	d. 230	$4.7^{0°}$	$117.7^{100°}$	i. al.
17	$1.853^{17°}$	$-3H_2O$, 70	....	$27.8^{12.2°}$	$90.6^{96.[illegible]°}$	i. al.
18	2.48	859.9	....	$92.3^{18°}$	v. s.	i. al.; s. HF
19	2.454	41	....	$349.3^{18°}$	v. s.	i. al., s. HF
20	....	d.	....	$41^{21°}$	....	i. al.; s. $KC_2H_3O_2$
21	....	....	....	$6.45^{18°}$	$43.5^{100°}$	
22	$2.665^{17.5°}_{4}$	d.	....	$0.12^{17.5°}$	$0.955^{100°}$	i. al.; s. HCl
23	3.053	....	....	$3.7^{18°}$	$33.3^{100°}$	
24	....	....	....	$0.556^{0°}$	$1.28^{20°}$	s. HCl
25	3.582	....	....	$0.78^{2°}$	$25^{100°}$	
26	1.908	150	d.	$331^{18°}$	$657^{90°}$	
27	0.8	d.	....	dec.	dec.	i. bz., eth., CS_2
28	2.0	d.	....	s.	s.	v. s. al.
29	2.044	360.4	subl.	$97^{0°}$, $107^{15°}$	$178^{100°}$	v. s. al., eth.
30	....	d.	....	v. s.	v. s.	
31	....	ign.	....	v. s.	....	s. al.; i. eth.
32	$3.975^{18°}$	560	....	$4.74^{0°}$	$32.3^{[illegible]°}$	i. al.; s. KI
33	....	....	....	$1.33^{15°}$		
34	$3.115^{23°}_{4}$	680	1420	$127.9^{0°}$	$209^{100°}$	14.28 al.; s. eth.
35	$3.498^{15°}$	45	....	v. s.	....	s. al., KI
36	....	d.				
37	$1.176^{45°}$	d.	....	dec.	....	d. eth.
38	....	....	....	v. s.	....	i. al.
39	1.618	....	....	$64.5^{18.75°}$	dec.	d. al.
40	....	d. 190	....	dec.	....	s. KOH
41	....	....	....	s.		
42	....	....	....	s.		
43	....	....	....	v. s.	v. s.	i. al.
44	2.124	....	....	$7^{0°}$	$60.8^{75°}$	
45	$2.109^{16°}$	337	d. 400	$13.3^{0°}$	$247^{100°}$	i. al., eth.
46	....	....	....	dec.		
47	$1.195^{25°}$	297.5	d. 350	v. s.	....	s. al.
48	....	....	....	$100^{16°}$	....	s. al.
49	....	....	....	sl. s.	s.	i. al., eth.
50	....	....	....	sl. s.	s.	i. al., eth.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Potassium oxalate	$K_2C_2O_4.H_2O$	184.21	monocl. wh.
2	oxalate, acid	$KHC_2O_4.\frac{1}{2}H_2O$	137.11	trim.
3	oxalate, tetra-	$KH_3(C_2O_4)_2.2H_2O$	254.15	tricl.
4	oxide	K_2O	94.19	octhdr.
5	oxide, per-	K_2O_2	110.19	yel. amor.
6	perchlorate	$KClO_4$	138.55	rhombic
7	perchromate	K_3CrO_8	297.30	br. octahdr.
8	periodate	KIO_4	230.03	rhombic
9	permanganate	$KMnO_4$	158.03	dk. purp. rhombic
10	persulfate	$K_2S_2O_8$	270.32	prism
11	perruthenate	$KRuO_4$	204.80	quad. blk.
12	peruranate	$K_2UO_5.3H_2O$	450.41	red cryst.
13	phosphate, ortho-	K_3PO_4	212.32	rhombic
14	phosphate, hydrogen	K_2HPO_4	174.23	amor. wh. powd.
15	phosphate, dihydrogen	KH_2PO_4	136.14	tetrag. colorl.
16	phosphate, meta-	$K_4P_4O_{12}.2H_2O$	508.52	amor.
17	phosphate, pyro-	$K_4P_2O_7.3H_2O$	384.49	
18	phosphite	K_2HPO_3	158.23	wh. powd.
19	phosphite, hypo-	KH_2PO_2	134.14	hex. wh.
20	platinate	$K_2PtO_3.3H_2O$	375.47	yel. rhbdr.
21	platinocyanide	$K_2Pt(CN)_4.3H_2O$	431.50	yel. rhombic
22	platinonitrite	$K_2Pt(NO_2)_4$	457.45	monocl. pr.
23	plumbate	$K_2PbO_3.3H_2O$	387.44	rhbdr.
24	ruthenate	$K_2RuO_4.H_2O$	261.91	rhombic blk.
25	selenate	K_2SeO_4	221.39	
26	selenocyanide	$KCN.Se$	144.30	need.
27	silicate	K_2SiO_3	154.25	
28	silicate, tetra-	$K_2Si_4O_9$	334.43	amor.
29	silvercyanide	$KAg(CN)_2$	198.99	reg.
30	sodium carbonate	$KNaCO_3.6H_2O$	230.19	monocl.
31	sodium cobaltinitrite	$K_2NaCo(NO_2)_6.H_2O$	454.19	yel.
32	stannate	$K_2SnO_3.3H_2O$	298.94	rhbdr.
33	sulfate	K_2SO_4	174.26	rhombic or hex.
34	sulfate, acid	$KHSO_4$	136.17	monocl. or rhombic.
35	sulfate, pyro-	$K_2S_2O_7$	254.32	
36	sulfide, mono-	K_2S	110.26	br. cryst.
37	sulfide, mono-	$K_2S.5H_2O$	200.34	ortho rhombic
38	sulfide, di-	K_2S_2	142.32	yel. red
39	sulfide, tri-	K_2S_3	174.38	yel.-br. cryst.
40	sulfide, tetra-	K_2S_4	206.45	red br. cryst.
41	sulfide, penta-	K_2S_5	238.51	orange cryst.
42	sulfite	$K_2SO_3.2H_2O$	194.29	monocl. wh.
43	sulfite, acid	$KHSO_3$	120.17	need.
44	sulfite, pyro-	$K_2S_2O_5$	222.32	monocl. pl.
45	sulfocyanate	$KCNS$	97.17	prisms
46	tartrate	$K_2C_4H_4O_6.\frac{1}{2}H_2O$	235.23	monocl.
47	tartrate, acid	$KHC_4H_4O_6$	188.14	rhombic

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of: Cold water	Hot water	Alcohol, acids, etc.
1	2.08	d.	....	$33^{6°}$		
2	anh 2 088	d.	....	$2.2^{0°}$	$51.5^{100°}$	
3	1.836	d.	....	$1.8^{13°}$		
4	$2.32^{0°}_{0}$	....	....	v. s.	v. s.	s. al., eth.
5	....	....	d	dec.	....	d al.
6	$2.524^{10.8°}_{4}$	610	d. 411	$0.7^{0°}$	$19.8^{100°}$	i. al., eth.
7	....	d. 170	....	sl. s.	....	i. al., eth.
8	$3.618^{15°}_{4}$	582	−O, 300	$0.66^{13°}$	s.	sl. s. KOH
9	$2.703^{9.8°}_{4}$	d. 240	....	$283^{0°}$	$32.35^{75°}$	d. al.; s. H_2SO_4
10	....	d. <100	....	$1.77^{0°}$	$4.08^{40°}$	i. al.
11	....	d. 440	....	sl. s.		
12	....	d. 100	....	dec.	dec.	d. HCl
13	....	1340	....	sl. s.	s.	i. al.
14	....	d.	....	v. s.	v. s.	v. s. al.
15	$2.338^{20°}_{4}$	96	$-H_2O$, 400	$25^{7°}$	s.	i. al.
16	$2.264^{14.5°}$	$-2H_2O$, 100	....	sl. s.	....	s. a.
17	2.33	$-3H_2O$, 300	....	s.	v. s.	i. al.
18	....	d.	....	v. s.	v. s.	i. al.
19	....	d.	....	v. s.		
20	....	....	....	s.	....	i. al.
21	$2.455^{16°}$	....	....	sl. s.	v. s.	s. al., eth.
22	....	....	....	$3.8^{15°}$		
23	....	....	....	dec.	dec.	s. KOH
24	....	$-H_2O$, 200	....	v. s.		
25	$3.066^{20°}_{4}$	....	....	$110.5^{0°}$	$122.2^{100°}$	
26	....	d. 100	....	s.	s.	d. a.
27	....	....	....	s.	s.	i. al.
28	....	....	....	s.	s.	i. al.
29	....	....	....	$25^{20°}$	100	4 al.
30	1.61	$-6H_2O$, 100	....	$13^{12°}$	$20^{15°}$	
31	$1.633^{25°}_{4}$	d. 135	....	$0.07^{25°}$	....	i. al.
32	3.197	....	....	$106.6^{10°}$	$110.5^{20°}$	i. al.; sl. s. KOH
33	$2.663^{20°}_{4}$	1076	....	$8.5^{0°}$	$26.2^{100°}$	i. al.
34	2.24 or 2.61	200	d.	36.3	$121.6^{100°}$	d. al.
35	2.27	>300	....	s.	dec.	
36	2.13	....	....	s.	v. s.	s. al., glyc.; i. eth.
37	....	$-3H_2O$, 150	....	s.	....	s. al., glyc.; i. eth.
38	....	....	....	s.	dec.	s. al.
39	....	....	....	s.	dec.	s. al.
40	....	d. 850	....	s.	....	s. al.
41	....	220	....	v. s.	v. s.	v. s. al.
42	....	d.	....	100	v. s.	sl. s. al.
43	....	d.	....	s.	s.	i. al.
44	....	d.	....	s.	....	sl. s. al.
45	1.906	172.3	d. 500	$177.2^{20°}$	$217^{20°}$	s. al., acet.
46	1.975	....	....	$50^{0°}$, $12.5^{17.5°}$	$278^{100°}$	sl. s. al.
47	1.956	....	....	$0.37^{0°}$	$6.1^{100°}$	i. al., acet. a.; s. a., alk.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Potassium tellurate	$K_2TeO_4.5H_2O$	359.77	rhombic pr
2	tellurite	K_2TeO_3	253.60	
3	thioantimonate	$2K_3SbS_4.9H_2O$	896.77	yel. cryst
4	thioarsenate	K_3AsS_4	320.50	cryst
5	thioarsenite	K_3AsS_3	288.44	
6	thiocarbonate	K_2CS_3	186.38	red br. cryst
7	thionate, di-	$K_2S_2O_6$	238.32	hex.
8	thionate, tri-	$K_2S_3O_6$	270.38	rhombic need.
9	thionate, tetra-	$K_2S_4O_6$	302.45	hex. pr.
10	thionate, penta-	$2K_2S_5O_6.3H_2O$	723.07	rhombic pl.
11	thioplatinate	$K_2Pt_4S_6$	1051.50	bl. gray. cryst
12	thiostannate	$K_2SnS_3.10H_2O$	473.24	dk. br. oil
13	thiosulfate	$3K_2S_2O_3.H_2O$	588.98	monocl
14	tungstate, ortho-	$K_2WO_4.2H_2O$	362.22	tricl.
15	tungstate, meta-	$K_2W_4O_{13}.8H_2O$	1166.32	octahdr
16	tungstate, para-	$K_6W_7O_{24}.6H_2O$	2014.67	rhombic
17	uranate	K_2UO_4	380.36	orange yel. rhombic
18	xanthogenate	$KS_2COC_2H_5$	160.26	prisms.
19	Praseodymium	Pr	140.92	yel.
20	ammonium sulfate	$Pr_2(SO_4)_3.(NH_4)_2SO_4.8H_2O$	846.30	cryst
21	bromate	$Pr_2(BrO_3)_6.18H_2O$	1373.62	grn. hex.
22	carbide	PrC_2	164.92	yel. cryst
23	carbonate	$Pr_2(CO_3)_3.8H_2O$	605.97	cryst
24	chloride	$PrCl_3$	247.29	grn. need.
25	chloride	$PrCl_3.7H_2O$	373.40	grn. cryst
26	oxalate	$Pr_2(C_2O_4)_3.10H_2O$	726.00	cryst
27	oxide, tri-	Pr_2O_3	329.84	yel. grn.
28	oxide, tetra-	PrO_4	204.92	blk.
29	oxide, per-	Pr_2O_5	361.84	
30	potassium sulfate	$Pr_2(SO_4)_3.3K_2SO_4.H_2O$	1110.82	cryst
31	sulfate	$Pr_2(SO_4)_3$	570.03	
32	sulfate	$Pr_2(SO_4)_3.8H_2O$	714.16	cryst
33	sulfide	Pr_2S_3	378.03	br.
34	Radium	Ra	225.95	
35	bromide	$RaBr_2$	385.78	
36	chloride	$RaCl_2$	296.86	reg. yel.
37	Rhodium	Rh	102.91	gray wh.
38	chloride	$RhCl_3$	209.28	red
39	chloride	$RhCl_3.4H_2O$	281.35	dk. red
40	hydrosulfide	$Rh(SH)_3$	202.13	br.-bl.
41	hydroxide, tri-	$Rh(OH)_3$	153.93	blk. gel.
42	hydroxide, tetra-	$Rh(OH)_4$	170.94	grn.
43	nitrate	$Rh(NO_3)_3.2H_2O$	324.97	red.
44	oxide, mono-	RhO	118.91	gray
45	oxide, di-	RhO_2	134.91	br.
46	oxide sesqui-	Rh_2O_3	253.82	gray cryst
47	sulfate	$Rh_2(SO_4)_3.12H_2O$	710.20	cryst. lt. yel.
48	sulfide, mono-	RhS	134.97	bluish
49	sulfide, sesqui-	Rh_2S_3	302.01	blk. tabl.
50	sulfite	$Rh_2(SO_3)_3.6H_2O$	554.11	yel. cryst.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	....	....	....	sl. s.	s.	i. al.; sl. s. KOH
2	....	....	....	sl. s.	s.	
3	....	....	....	s.	....	i. al.
4	....	d.	....	v. s.	....	i. al.
5	....	d.	....	s.	....	i. al.
6	....	....	....	v. s.	....	sl. s. al.
7	$2.278^{20°}_{4}$	d.	....	6	$66^{100°}$	i. al.
8	$2.304^{20°}_{4}$	....	....	v. s.	dec.	i. al.
9	$2.295^{20°}_{4}$	....	....	v. s.	....	i. al.
10	$2.112^{20°}_{4}$	d.	....	50	dec.	i. al.
11	$6.44^{15°}$	ign.	....	i.	....	d. HCl
12	....	$-10H_2O, 100$	....	s.	....	i. al.
13	(anh.) 2.590	$-H_2O$, 180	d.	$96.1^{0°}$	$312^{90°}$	i. al.
14	....	....	....	51.5	151.5	i. al.
15	....	....	....	s.	v. s.	
16	....	d.	....	2.15	6.6	i. al.
17	....	....	....	i.	i.	v. s. a.
18	$1.558^{21.5°}$	d. >200	200	v. s.	....	20 al.; i. eth.
19	6.4754	940	....	dec.		
20	$2.531^{16.5°}$	$-8H_2O$, 170	....	sl. s.		
21	....	56.5	$-14H_2O, 100$	$190^{20°}$		
22	5.10	d.	....	dec.	dec.	s. dil. a., H_2SO_4
23	....	$-6H_2O$, 100	....	i.	....	s. a.
24	$4.017^{18°}_{4}$	818	....	$69.5^{13°}$	v. s.	s. al.; i. chl.
25	$2.251^{16.2°}$	....	....	176.5	v. s.	s. HCl
26	....	....	....	$0.098^{25°}$	....	s. a.
27	$7.068^{20°}_{4}$					
28	$5.978^{20°}_{4}$					
29						
30	$3.275^{15°}$	....	....	sl. s.	....	s. HNO_3, HCl
31	$3.72^{16°}$	....	....	$23.64^{0°}$	$1.01^{100°}$	
32	$2.82^{13.2°}$					
33	$5.042^{11°}$	d.	....	i.	dec.	s. dil. a.
34	....	700				
35	....	subl. 900	....	s.	s.	s. al.
36	....	1650				
37	12.44	1950	....	i.	i.	sl. s. a., aq. reg.
38	....	d. 450–500	....	i.	i.	i. a.
39	....	....	....	v. s.	....	s. al., HCl, i. eth.
40	....	....	....	i.	dec.	i. a., Na_2S; s. aq. reg.
41	....	d.	....	i.	....	s. a., KOH
42	....	....	....	i.	....	s. HCl
43	....	....	....	s.	s.	i. al.
44	....	....	....	i.	i.	i. a.
45	....	....	....	i.	i.	i. a., KOH
46	....	....	....	i.	i.	i. a., KOH
47	....	....	....	v. s.	dec.	i. al.
48	....	d.	....	i.	i.	i. a., aq. reg.
49	....	....	....	i.	i.	i. a.
50	....	....	....	s.	....	i. al.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Rubidium	Rb	85.44	silvery wh.
2	bromide	RbBr	165.36	reg.
3	carbonate	Rb_2CO_3	230.88	wh. cryst. powd.
4	carbonate, bi-	$RbHCO_3$	146.45	rhombic pr.
5	chlorate	$RbClO_3$	168.90	trim.
6	chloride	RbCl	120.90	reg.
7	chloroplatinate	Rb_2PtCl_6	578.87	yel. reg.
8	chromate	Rb_2CrO_4	286.89	yel. rhombic.
9	dichromate	$Rb_2Cr_2O_7$	386.90	tricl. or monocl.
10	fluoride	RbF	104.44	
11	fluosilicate	Rb_2SiF_6	312.94	reg.
12	hydride	RbH	86.45	prism. need
13	hydroxide	RbOH	102.45	gray
14	iodide	RbI	212.37	reg. octahdr.
15	iodate	$RbIO_3$	260.37	cryst.
16	nitrate	$RbNO_3$	147.45	hex. or reg.
17	oxide, mon-	Rb_2O	186.88	yel. octahdr.
18	oxide, di- (per)	Rb_2O_2	202.88	yel. need.
19	oxide, tri-	Rb_2O_3	218.88	blk.
20	oxide, tetra-	Rb_2O_4	234.88	yel.
21	perchlorate	$RbClO_4$	184.90	rhombic
22	periodate	$RbIO_4$	276.37	tetrag.
23	permanganate	$RbMnO_4$	204.37	cryst.
24	sulfate	Rb_2SO_4	266.94	hex.
25	sulfide	Rb_2S	202.94	
26	sulfide	$Rb_2S.4H_2O$	275.01	cryst.
27	sulfide, penta-	Rb_2S_5	331.20	red rhombic
28	tartrate, acid	$RbHC_4H_4O_6$	234.48	trim. pr.
29	Ruthenium	Ru	101.70	blk. porous
30	Ruthenium	Ru	101.70	gr. cryst.
31	chloride, di-	$RuCl_2$	172.61	blk. cryst.
32	chloride, tri-	$RuCl_3$	208.07	br. cryst.
33	chloride, tetra-	$RuCl_4$	243.53	
34	hydroxide	$Ru(OH)_3$	152.72	blk. powd.
35	oxide, sesqui-	Ru_2O_3	251.40	bl.-blk.
36	oxide, di-	RuO_2	133.70	reg. violet
37	oxide, tetra-	RuO_4	165.70	rhombic yel.
38	oxide, penta-	Ru_2O_5	283.40	blk. cryst.
39	oxide, non-	Ru_4O_9	550.80	blk. cryst.
40	silicide	RuSi	129.76	met. pr.
41	Samarium	Sa	150.43	
42	bromate	$Sa_2(BrO_3)_6.18H_2O$	1392.64	yel. hex.
43	bromide	$SaBr_3.6H_2O$	498.27	
44	carbide	SaC_2	174.43	yel. hex.
45	chloride	$SaCl_3$	256.80	grn. yel. cryst.
46	chloride	$SaCl_3.3H_2O$	310.85	grn.
47	fluoride	$SaF_3.\frac{1}{2}H_2O$	216.44	
48	hydroxide	$Sa(OH)_3$	201.45	
49	nitrate	$Sa(NO_3)_3.6H_2O$	444.55	pa. yel. pr.
50	oxide	Sa_2O_3	348.86	
51	peroxide	Sa_4O_9	745.72	

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	$1.532^{20°}$	38.5	696	dec.	dec.	s. a., al.
2	$3.21^{23°}$	683	....	$98^{5°}$	$205.2^{113.5°}$	
3	....	837	d. 740	$450^{20°}$	s.	s. al.
4	....	d. 175	....	116.1	....	s. al.
5	....	....	....	$2.8^{1.7°}$	$5.1^{19°}$	
6	$2.706^{22.9°}$	726	....	$76.38^{1°}$	$138.9^{100°}$	s. al.
7	$3.94^{17.5°}$	....	....	$0.184^{0°}$	$0.634^{100°}$	i. al.
8	3.518	....	....	$62^{0°}$	$95.7^{60°}$	
9	....	....	....	$5.72^{18°}$	$38.9^{65°}$	
10	$3.202^{16.5°}$	753	....	$22.7^{13°}$	....	i. al., eth.
11	$3.338^{20°}$	....	....	$0.16^{20°}$	$1.35^{100°}$	i. al.; s. a.
12	2.0	d.	....	dec.	dec.	d. a.
13	$3.203^{11°}$	301	....	$198^{30°}$	v. s.	s. al.
14	$3.55^{24°}_{4}$	642	....	$137.5^{6.9°}$	$152^{17.4°}$	
15	$4.559^{14°}_{4}$	....	....	$2.1^{23°}$		
16	$3.131^{15°}$	....	....	$20.1^{0°}$	$452^{100°}$	v. s. HNO_3
17	$3.720^{0°}_{0}$	....	....	s.	s.	
18	$3.65^{0°}$	600				
19	$3.53^{0°}$	<500	....	dec.		
20	....	600–50				
21	3.014	....	d.	$1.09^{21.3°}$	....	i. al.
22	$3.918^{16°}_{4}$	....	....	$0.65^{13°}$		
23	$3.235^{10.4°}$	....	....	$0.46^{0°}$	$4.68^{60°}$	
24	$3.611^{20°}_{4}$	1051	....	36.4	$81.8^{100°}$	
25	2.912	....	....	v. s.	v. s.	
26	....	....	....	v. s.	v. s.	
27	$2.618^{15°}$	223–4	....	dec.	....	s. al.
28	2.399	d.	....	$1.18^{25°}$	$11.7^{100°}$	
29	8.6	>1950	....	i.	i.	sl. s. a., aq. reg.
30	$12.26^{0°}_{0}$	2450 (?)	....	i.	i.	
31	....	....	....	i.	....	i. a., alk.
32	....	....	....	s.	dec.	sl. s. al.; i. a., CS_2
33	....	....	....	s.	....	s. al.
34	....	....	....	....	....	s. a.
35	....	....	....	i.	i.	i. a.
36	7.2	....	....	i.	i.	i. a.; s. fus. KOH
37	5.7	50	100.8, d. 106	sl. s.	....	s. alk
38	....	$-\frac{1}{2}O$, 360	....	....	....	s. HCl
39	....	$-O$, 440				
40	$5.40^{4°}$	....	....	i.	i.	s. HNO_3 + HF
41	7.7–.8	1350				
42	....	75	$-14H_2O$, 100 $-18H_2O$, 150	$114^{25°}$		
43	$2.97^{22°}$	....	....	deliq.		
44	5.86	....	....	dec.	dec.	s. a.
45	$4.465^{18°}_{4}$	686	....	....	....	s. abs. al.
46	2.392	....	....	deliq.		
47	....	....	....	i.	....	i. a.
48	....	....	....	i	....	s. a.; i. alk.
49	2.375	....	....	v. s.		
50	8.347	....	....	....	....	v. s. a.
51	....	....	....	i.		

PHYSICAL CONSTANTS OF

	Name	Formula	Mol wt.	Crystalline form and color
1	Samarium sulfate	$Sa_2(SO_4)_3.8H_2O$	733.18	
2	Scandium	Sc	45.10	
3	chloride	$ScCl_3$	151.47	pl.
4	oxide	Sc_2O_3	138.20	wh. powd.
5	sulfate	$Sc_2(SO_4)_3$	378.39	
6	Selenium	Se_8	633.60	red. powd.
7	Selenium	Se_8	633.60	red monocl.
8	Selenium	Se_8	630.60	steel gr. hex.
9	bromide, mono-	Se_2Br_2	318.23	br. red liq.
10	bromide, tetra-	$SeBr_4$	398.86	orange cryst.
11	bromochloride, tri-	$SeBr_3Cl$	354.41	orange cryst.
12	bromtrichloride	$SeBrCl_3$	265.49	yel. br. cryst.
13	chloride, mono-	Se_2Cl_2	229.31	red liq.
14	chloride, tetra-	$SeCl_4$	221.03	yel. cryst.
15	iodide, mono-	Se_2I_2	412.26	steel gr. cryst.
16	iodide, tetra-	SeI_4	586.93	dk. gr. cryst.
17	oxide, di-	SeO_2	111.20	tetrag. need.
18	oxychloride	$SeOCl_2$	166.11	yel. liq.
19	oxybromide	$SeOBr_2$	255.03	yel. cryst.
20	nitride	Se_2N_2	186.42	orange yel.
21	sulfide	SeS	111.26	orange yel. tabl.
22	sulfoxide	$SeSO_3$	159.26	grn. pr.
23	sulfoxytetrachloride	$SeSO_3Cl_4$	301.09	wh. need.
24	Selenic acid	H_2SeO_4	145.22	hex. pr.
25	Selenic acid	$H_2SeO_4.H_2O$	163.23	need.
26	Selenious acid	H_2SeO_3	129.22	cryst.
27	Silicic acid, meta-	H_2SiO_3	78.08	amor.
28	Silicic acid, ortho-	H_4SiO_4	96.09	amor.
29	Silicobromoform	$SiHBr_3$	268.82	liq., colorl.
30	Silicochloroform	$SiHCl_3$	135.44	liq., colorl.
31	Silicofluoform	$SiHF_3$	86.07	gas.
32	Silicoiodoform	$SiHI_3$	409.86	red liq.
33	Silico-oxalic acid	$Si_2O_2(OH)_2$	122.14	amor. wh.
34	Silicon, cryst.	Si	28.06	gr. octahdr.
35	Silicon, graphitic	Si	28.06	cryst.
36	Silicon, amorphous	Si	28.06	br. amor.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.930	$-8H_2O$, 450	$-3SO_3$, 1050	sl. s.		
2	....	1350				
3	....	subl. 800–50	....	v. s.	v. s.	i. abs. al.
4	3.864	....	....	i.	i.	s. h. a.
5	2.579	....	....	$10.32^{25°}$		
6	$4.26-.28^{25°}$	50	690	i.	i.	s. CS_2, H_2SO_4
7	$4.47^{25°}$	170–80	690	i.	i.	s. CS_2, H_2SO_4
8	$4.8^{25°}$	217	690	i.	i.	i. CS_2, s. H_2SO_4
9	$3.604^{15°}$	....	225–30	i.	dec.	s. CS_2, C_2H_5Br, chl
10	....	d. 75	....	s.	dec.	s. CS_2, C_2H_5Br, chl.
11	....	d.	....	....	....	sl. s. CS_2
12	....	190	....	....	....	i. CS_2
13	$2.906^{17.5°}$	....	145	dec.	....	v. s. CS_2, CCl_4, chl.
14	....	subl.	....	dec.	....	sl. s. CS_2; s. $POCl_3$
15	....	68–70	d. 100	dec.	dec.	
16	....	75–80	−4I, 100	dec.	dec.	
17	$3.952^{15.3°}_{15.3}$	390	subl. 250–80	$38.4^{14°}$	v. s.	v. s. al., acet. a; acet.
18	2.44	10	179.5	dec.		
19	....	30–40	....	i.	i.	s. CS_2, CCl_4, H_2SO_4
20	....	expl. 200	....	i.	i.	i. al.; sl. s. CS_2
21	$3.056^{0°}$	d.	....	i.	i.	s. CS_2; i. eth.
22	....	d. 40	....	dec.	....	s. H_2SO_4
23	....	165	183	dec.		
24	$2.951^{15°}$	58	260	v. s.	v. s.	s. H_2SO_4; d. al.
25	$2.627^{15°}$	25	....	v. s.		
26	$3.007^{15.7°}$	d.	....	v. s.	v. s.	v. s. al.
27	$1.813^{17°}$	....	....	i.	i.	s. alk.; i. NH_4Cl
28	$1.576^{17°}$	....	....	sl. s.	sl. s.	s. alk.; i. NH_4Cl
29	2.7	>−60	110	dec.		
30	1.3–.6	−1.3	34	dec.	....	s. CS_2, CCl_4, chl.
31	(D) $2.98^{0°}$	−110	−80.2	dec.	....	d. alk., al., eth.; s. tol.
32	$3.314^{20°}$	....	220	dec.	....	s. CS_2
33	....	d.	....	i.		
34	$2.49^{10°}$	1420	3500	i.	i.	i. HF; s. HNO_3 + HF
35	2.00–.50	....	3500	i.	i.	i. HF; s. HNO_3 + HF, fus. KOH
36	2.00	....	3500	i.	i.	s. HF, KOH

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Silicon boride, tri-	SiB_3	60.52	blk. rhombic
2	boride, hexa-	SiB_6	92.98	blk. cryst.
3	bromide, tri-	$SiBr_3$	267.81	rhombic
4	bromide, tetra-	$SiBr_4$	347.72	
5	bromotrichloride	$SiBrCl_3$	214.35	
6	dibromidichloride	$SiBr_2Cl_2$	258.81	liq.
7	tribromchloride	$SiBr_3Cl$	303.27	liq.
8	carbide	SiC	40.06	rhombic pl.
9	chloride, tri-	$SiCl_3$	134.43	leaf. or liq.
10	chloride, tetra-	$SiCl_4$	169.89	yel. liq.
11	chlorohydrosulfide	$SiCl_3SH$	167.50	
12	fluoride	SiF_4	104.06	gas
13	hydride	SiH_4	32.09	gas
14	hydride	Si_2H_6	62.17	gas
15	hydride (trisilane)	Si_3H_8	92.24	
16	hydride (tetrasilane)	Si_4H_{10}	122.32	
17	iodide, di-	SiI_2	281.92	
18	iodide, hexa-	Si_2I_6	817.71	hex. pl.
19	iodide, tetra-	SiI_4	535.79	reg. octahdr., colorl.
20	iodoform	$SiHI_3$	409.86	
21	iodotrichloride	$SiICl_3$	261.36	
22	oxide, di- (amorphous)	SiO_2	60.06	colorl. amor.
23	oxide, di- (cryst.)	SiO_2	60.06	colorl. cryst.
24	oxychloride	Si_2OCl_6	284.86	
25	sulfide	SiS_2	92.19	need.
26	sulfobromide	$SiSBr_2$	219.96	pl.
27	sulfochloride	$SiSCl_2$	131.04	pr.
28	Silver	Ag	107.88	reg. wh.
29	acetate	$AgC_2H_3O_2$	166.90	plates
30	arsenate	Ag_3AsO_4	462.60	dk. red
31	arsenite	Ag_3AsO_3	446.60	yel.
32	bromate	$AgBrO_3$	235.80	tetrag.
33	bromide	$AgBr$	187.80	reg. pa. yel.
34	carbonate	Ag_2CO_3	275.76	yel. powd.
35	chlorate	$AgClO_3$	191.34	tetrag. or reg.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	2.52	....	....	i.	....	sl. s. h. H_2SO_4, HNO_3
2	2.47	....	....	i.	....	sl. s. h. H_2SO_4, HNO_3
3	....	95	265	dec.	....	d. KOH
4	$2.813^{20°}_{0}$	5	153	dec.	dec.	d. H_2SO_4
5	....	....	80	dec.		
6	....	>−60	103–5	dec.		
7	2.432	>−39	126–8	dec.		
8	$3.12^{15°}$	....	....	i.	i.	i. a.
9	1.58	−1	144–8	dec.	dec.	d. alk.
10	$1.524^{20°}_{4}$	−89	57.5	dec.	....	d. al.
11	1.45	....	96	dec.	....	d. al.
12	(A) 3.57	−77	....	dec.	....	s. al., eth., HNO_3
13	....	−185	−112	dec.	....	d. KOH
14	$0.686^{-25°}$	−132.5	−15	dec.	....	s. al., CS_2, bz.
15	$0.725^{0°}$	−117	ign.	dec.		
16	$0.79^{0°}$	−93.5	ign.	dec.		
17	....	....	....	dec.	....	i. CS_2, chl., bz.
18	....	250 (vac.)	d.	dec.	dec.	19CS_2
19	....	120.5	290	dec.	....	$2.2^{27°}CS_2$
20	$3.286^{23°}$	8	d. 150	....	....	∞ CS_2, bz.
21	....	....	113–4	dec.		
22	$2.20^{15.6°}$	1600–1750	subl. 1750	i.	....	s. h. alk., HF
23	2.318–.654	1600–1750	....	i.	....	i. alk., s. HF
24	(D) 10.05	....	136–9	dec.	....	s. CS_2, CCl_4, chl., eth.
25	....	....	....	dec.	....	s. dil. alk.; d. al.
26	....	93	150	dec.	dec.	s. CS_2
27	....	75	$92^{22.5mm.}$	dec.	dec.	s. CS_2
28	10.5	960.5	1955	i.	i.	s. HNO_3, h. H_2SO_4; i. alk.
29	3.259	d.	....	$1.02^{14°}$	$2.52^{30°}$	
30	$6.66^{25°}_{4}$	....	....	$0.00085^{20°}$	....	s. acet. a., NH_4OH, NH_4 salts
31	....	d.	....	$0.00115^{20°}$	i.	s. acet. a., NH_4OH, NH_4 salts
32	5.206	d.	....	$0.158^{20°}$	....	s. NH_4OH; sl. s. HNO_3
33	$6.473^{25°}_{4}$	427	d. 700	$0.000026^{25°}$	$0.00014^{100°}$	$0.051^{100°}$ NH_4OH; s. KCN
34	$6.0^{17.5°}$	d. 200	....	$0.0031^{15°}$	$0.05^{100°}$	s. NH_4OH, $Na_2S_2O_3$; i. al.
35	$4.401^{23°}$	230	d. 270	$10^{15°}$	$50^{30°}$	i. al.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Silver chloride	$AgCl$	143.34	reg. wh
2	chromate	Ag_2CrO_4	331.77	dk. red cryst
3	citrate	$AgC_6H_5O_7$	296.92	need.
4	cyanate	$AgCNO$	149.89	
5	cyanide	$AgCN$	133.89	curd. wh.
6	dichromate	$Ag_2Cr_2O_7$	431.78	tricl. red
7	ferricyanide	$Ag_3Fe(CN)_6$	553.54	orange
8	ferrocyanide	$Ag_4Fe(CN)_6.H_2O$	661.42	yel.
9	fluoride	AgF	126.88	tetrag. yel.
10	fluosilicate	$Ag_2SiF_6.2H_2O$	393.85	cryst
11	iodate	$AgIO_3$	282.81	monocl.
12	iodide	AgI	234.81	hex. or reg. yel
13	nitrate	$AgNO_3$	169.89	hex. or rhombic colorl.
14	nitride	AgN_3	149.90	wh. prisms
15	nitrite	$AgNO_2$	153.89	wh. cryst
16	nitroprusside	$Ag_2Fe(CN)_5NO$	431.65	lt. pink
17	oxalate	$Ag_2C_2O_4$	391.76	wh.
18	oxide	Ag_2O	231.76	br. powd
19	oxide, per-	Ag_2O_2	247.76	blk. octahdr.
20	perchlorate	$AgClO_4$	207.24	wh.
21	permanganate	$AgMnO_4$	226.81	dk. violet, monocl.
22	phosphate, ortho-	Ag_3PO_4	418.67	yel.
23	phosphate, pyro-	$Ag_4P_2O_7$	605.57	
24	potassium cyanide	$KAg(CN)_2$	198.99	reg. octahdr.
25	selenide	Ag_2Se	294.96	gray
26	sulfate	Ag_2SO_4	311.82	rhombic wh.
27	sulfide	Ag_2S	247.82	gr.-blk. reg. or tricl.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water	Hot water	Alcohol, acids, etc.
1	5.553	455	....	$0.000152^{20°}$	$0.0022^{100°}$	s. NH_4OH, KCN; sl. s. HCl
2	5.523	....	....	$0.0028^{15°}$	$0.0284^{100°}$	s. NH_4OH, KCN, a.
3	....	d.	....	$0.028^{18°}$	....	s. NH_4OH, KCN
4	4.0	d.	....	sl. s.	s.	s. HNO_3, NH_4OH, KCN
5	3.95	d.	....	$0.000021^{25°}$	....	s. HNO_3, NH_4OH, KCN
6	....	d.	....	$0.0083^{15°}$	dec.	v. s. HNO_3, NH_4OH, KCN
7	....	....	....	$0.000066^{20°}$	....	s. NH_4OH, h. $(NH_4)_2CO_3$,
8	....	....	....	i.	i.	s. NH_4OH, KCN; i. a.
9	$5.852^{15.5°}$	435	....	$182^{15.5°}$		
10	....	<100	d.	v. s.		
11	5.40–.65	d.	....	$0.00385^{18°}$	sl. s.	s. NH_4OH, HNO_3, KI
12	$5.675^{25°}_{4}$	526–56	....	$0.000035^{21°}$	....	s. KCN, $Na_2S_2O_3$; NaCl
13	$4.352^{19°}$	218	d.	$121.9^{0°}$	$940^{100°}$	66 al.; s. eth., glyc.
14	....	250	expl.	i.	$0.01^{100°}$	s. dil. HNO_3
15	$4.453^{25°}$	....	....	0.33	s.	i. al.
16	....	....	....	i.	....	i. al., HNO_3; s. NH_4OH
17	$5.029^{4°}$	d.	....	$0.00339^{18°}$	....	s. NH_4OH, KCN
18	7.521	−O, 300–40	....	$0.00215^{20°}$	....	s. NH_4OH, KCN
19	5.474	d. >100	....	i.	....	s. H_2SO_4, HNO_3, NH_4OH
20	....	486	....	s.	s.	
21	....	d.	....	$0.55^{0°}$	$1.69^{28.5°}$	
22	7.32	849	....	$0.00193^{20°}$	....	s. a., NH_4OH, KCN
23	$5.306^{7.5°}$	585	....	i.	i.	s. NH_4OH, KCN, HNO_3, H_2SO_4
24	....	....	....	$25^{20°}$	v. s.	4 al.; i. a.
25	8.0	897	....	i.	....	s. h. HNO_3, NH_4OH
26	5.40	655	d.	$0.73^{14.5°}$	$1.393^{100°}$	s. NH_4OH, HNO_3, H_2SO_4; i. al.
27	7.08	842	d.	0.00002	....	s. H_2SO_4, HNO_3

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Silver sulfite	Ag_2SO_3	295.82	cryst. wh.
2	sulfocyanate	$AgCNS$	165.95	curd. wh.
3	tartrate	$Ag_2C_4H_4O_6$	363.79	scales
4	telluride	Ag_2Te	343.26	gr. octahdr.
5	thiosulfate	$Ag_2S_2O_3$	325.89	wh.
6	tungstate	Ag_2WO_4	463.76	pa. yel. cryst.
7	Sodium	Na	23.00	tetrag, silvery
8	acetate	$NaC_2H_3O_2.3H_2O$	136.07	monocl. pr.
9	aluminate	$Na_2Al_2O_4$	163.93	amor.
10	amide	$NaNH_2$	39.02	olive grn.
11	ammonium phosphate	$NaNH_4HPO_4.4H_2O$	209.14	monocl.
12	antimonate	$2NaSbO_3.7H_2O$	511.65	octahdr.
13	antimonate, pyro-	$Na_2H_2Sb_2O_7.H_2O$	421.57	
14	arsenate	$Na_3AsO_4.12H_2O$	424.14	
15	arsenate, acid	$Na_2HAsO_4.7H_2O$	312.07	monocl. colorl.
16	arsenate, acid	$Na_2HAsO_4.12H_2O$	402.15	monocl. or rhombic
17	arsenite	Na_2HAsO_3	169.96	
18	aurosulfide	$NaAuS.4H_2O$	324.33	monocl.
19	benzoate	$NaC_7H_5O_2$	144.04	colorl. cryst
20	borate, meta-	$NaBO_2$	65.82	hex. pr.
21	borate, meta-	$Na_2B_2O_4.4H_2O$	203.70	monocl.
22	borate, tetra-	$Na_2B_4O_7$	201.27	
23	borate, tetra-	$Na_2B_4O_7.5H_2O$	291.35	octahdr.
24	borate, tetra- (borax)	$Na_2B_4O_7.10H_2O$	381.43	monocl. wh.
25	bromate	$NaBrO_3$	150.91	reg. colorl.
26	bromide	$NaBr$	102.91	reg.
27	bromide	$NaBr.2H_2O$	138.95	monocl.
28	bromplatinate	$Na_2PtBr_6.6H_2O$	828.82	dk. red tricl.
29	carbide	Na_2C_2	69.99	powd.
30	carbonate	Na_2CO_3	105.99	wh. powd.
31	carbonate	$Na_2CO_3.H_2O$	124.01	wh. cryst.
32	carbonate (washing soda)	$Na_2CO_3.10H_2O$	286.15	moncl.
33	carbonate, acid (baking soda)	$NaHCO_3$	84.01	monocl.
34	carbonate, sesqui-	$Na_4H_2(CO_3)_3.3H_2O$	328.05	monocl.
35	chlorate	$NaClO_3$	106.45	reg. tetrag.
36	chloraurate	$NaAuCl_4.2H_2O$	398.06	
37	chloride (common salt)	$NaCl$	58.45	reg.
38	chlororhodate	Na_3RhCl_6	384.64	
39	chloriridate	$Na_2IrCl_6.6H_2O$	559.93	red tricl.
40	chloroplatinate	$Na_2PtCl_6.6H_2O$	562.06	red tricl.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	....	d. 100	....	sl. s.	....	s. NH_4OH; i. HNO_3
2	....	....	....	$0.000021^{25°}$	....	i. dil. a.; s. NH_4OH
3	3.432	d.	....	$0.2^{18°}$	$0.203^{25°}$	s. NH_4OH, KCN
4	8.318	955	....	i.	....	s. HNO_3, KCN
5	....	d.	....	sl. s.	....	s. NH_4OH, $Na_2S_2O_3$
6	....	....	....	$0.05^{15°}$	....	s. HNO_3, NH_4OH. KCN
7	$0.971^{20°}$	97.6	750	dec.	dec.	i. bz
8	1.45	58, anh. 319	....	$26^{6°}$	200	$2.1^{18°}$ al.
9	....	1800	....	s.	v. s.	i. al.
10	....	155	400	dec.	dec.	
11	1.554	d.	....	16.7	100	i. al.
12	....	....	....	$0.31^{12.3°}$	....	sl. s. al., NH_4 salts
13	....	....	....	sl. s.	sl. s.	sl. s. al.
14	1.759	85.5	....	$26.7^{17°}$		
15	....	57	$-7H_2O$, 100	$61^{15°}$	v. s.	sl. s. al.
16	1.67-.76	28	$-12H_2O$, 100	$17.2^{0°}$	$140.7^{30°}$	sl. s. al.
17	1.87	....	....	v. s.	sl. s.	
18	....	....	....	s.	....	s. al.
19	....	....	....	$62.5^{25°}$	$76.9^{100°}$	$2.3^{25°}$, $8.3^{78°}$ al.
20	....	966	....	s.	v. s.	
21	....	57	....	s.	v. s.	
22	2.367	741	....	$1.3^{5°}$	$52.5^{100°}$	i. al.
23	1.815	....	....	$1.9^{5°}$	$99.1^{100°}$	
24	$1.694^{17°}$	....	....	$2.83^{0°}$	$201.4^{100°}$	i. a.; s. glyc.
25	$3.339^{17.5°}$	381	....	$27.54^{0°}$	$90.9^{100°}$	i. al.
26	3.014	768	1455	$79.5^{0°}$	$115^{100°}$	sl. s. al.
27	2.176	....	....	$172.5^{0°}$	259.5^{100}	sl. s. al.
28	3.323	d.	....	v. s.	....	v. s. al.
29	$1.575^{15°}$	....	....	dec.	dec.	s. a.; d. al.
30	2.476	852	d.	$7.1^{0°}$	$45.4^{100°}$	i. al.
31	....	$-H_2O$, 100	....	s.	s.	i. al., eth.; s. glyc.
32	1.458	$-5H_2O$, 12.5, 34	106	$21.52^{0°}$	$420.68^{104°}$	i. al.
33	2.206	$-CO_2$, 270	....	$6.90^{0°}$	$16.4^{60°}$	i. al.
34	2.112	d.	....	$12.63^{0°}$	$41.59^{100°}$	
35	$2.490^{15°}$	255	d.	$81.9^{0°}$	$333^{120°}$	s. al.
36	....	....	....	$150^{10°}$	$990^{60°}$	v. s. abs. al.
37	2.17	805	1490	$35.7^{0°}$	$39.8^{100°}$	sl. s. al.; i. HCl
38	....	....	....	v. s.	v. s.	s. al.
39	2.499	$-6H_2O$, 100	....	v. s.	v. s.	s. al., Cl_2 aq.; i. eth.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Sodium chromate	$Na_2CrO_4.10H_2O$	342.16	yel. tricl.
2	citrate	$2Na_3C_6H_5O_7.11H_2O$	714.24	wh. cryst.
3	cyanide	$NaCN$	49.01	wh. cryst.
4	dichromate	$Na_2Cr_2O_7.2H_2O$	298.05	red tricl.
5	dithionate	$Na_2S_2O_6.2H_2O$	242.15	rhombic
6	ferricyanide	$Na_3Fe(CN)_6.H_2O$	298.90	red
7	ferric oxalate	$Na_3Fe(C_2O_4)_3.5\frac{1}{2}H_2O$	487.92	grn. cryst.
8	ferrite	$Na_2Fe_2O_4$	221.67	
9	ferrocyanide	$Na_4Fe(CN)_6.12H_2O$	520.07	yel. monocl.
10	fluoride	NaF	42.00	reg.
11	fluosilicate	Na_2SiF_6	188.05	gelat. or hex.
12	formate	$NaCHO_2$	68.01	rhombic
13	hydride	NaH	24.01	silvery need.
14	hydrosulfide	$NaSH.2H_2O$	92.10	need.
15	hydrosulfite	$Na_2S_2O_4.2H_2O$	210.15	colorl. cryst.
16	hydroxide	$NaOH$	40.01	wh.
17	hypochlorite	$NaOCl$	74.45	need.
18	hypophosphate	$Na_4P_2O_6.10H_2O$	430.20	
19	hypophosphate, acid	$Na_2H_2P_2O_6.6H_2O$	314.16	
20	hypophosphite	$NaH_2PO_2.H_2O$	106.06	monocl. pr. colorl.
21	hyposulfite	$NaHSO_2$	88.07	
22	iodate	$NaIO_3$	197.93	
23	iodide	NaI	149.93	reg.
24	iodide	$NaI.2H_2O$	185.96	monocl.
25	lactate	$NaC_3H_5O_3$	112.04	amor.
26	manganate	$Na_2MnO_4.10H_2O$	345.08	monocl. gr.
27	molybdate	$Na_2MoO_4.2H_2O$	242.03	tabl.
28	molybdate, di-	$Na_2Mo_2O_7$	349.99	need.
29	molybdate, tri-	$Na_2Mo_3O_{10}.7H_2O$	620.11	need.
30	molybdate, tetra-	$Na_2Mo_4O_{13}.6H_2O$	746.09	
31	molybdate, octo-	$Na_2Mo_8O_{25}.4H_2O$	1286.06	powd.
32	molybdate, deka-	$Na_2Mo_{10}O_{31}.12H_2O$	1718.19	cryst.
33	nitrate	$NaNO_3$	81.01	rhbdr.
34	nitride	Na_3N	83.00	dk. gray
35	nitrite	$NaNO_2$	69.01	cryst.
36	nitroprusside	$Na_2Fe(CN)_5NO.2H_2O$	297.91	tricl. red
37	oxalate	$Na_2C_2O_4$	133.99	wh. cryst. powd.
38	oxalate, acid	$NaHC_2O_4.H_2O$	130.02	monocl.
39	oxide	Na_2O	61.99	gray
40	paratungstate	$Na_6W_7O_{24}.16H_2O$	2098.24	tricl.
41	perborate	$NaBO_3.H_2O$	99.83	
42	perborate	$NaBO_3.4H_2O$	153.88	cryst.
43	perchlorate	$NaClO_4$	122.45	rhbdr.
44	perchromate	Na_3CrO_8	249.00	orange pl.
45	permanganate	$NaMnO_4.3H_2O$	195.98	purp. cryst.
46	peroxide	Na_2O_2	77.99	yel. powd.
47	perruthenate	$NaRuO_4.H_2O$	206.71	blk. cryst.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water	Hot water	Alcohol, acids, etc.
1	2.71$^{[illegible]°}$	19.92	....	v. s.	∞	sl. s. al.
2	....	$-11H_2O$, 150	d.	91$^{[illegible]°}$	250$^{[illegible]°}$	sl. s. al.
3	....	....	....	s.	v. s.	sl. s. al.
4	2.52$^{[illegible]°}$	$-2H_2O$, 100; anh. 320	d. 400	23$^{[illegible]°}$; anh. 163$^{0°}$	122$^{[illegible]}$; anh. 433$^{[illegible]}$	
5	2.175$^{11°}$	....	....	47.6$^{[illegible]°}$	90.9$^{[illegible]}$	i. al., HCl
6	....	....	....	18.9$^{0°}$	80$^{[illegible]}$	i. al.
7	1.973$^{17.5°}$	$-4H_2O$, 100	$-5\frac{1}{2}H_2O$ 200	32.5$^{0°}$	182$^{[illegible]}$	
8	....	....	....	dec.	....	v. s. dil. HCl
9	1.458	....	....	22$^{15.5°}$	....	i. al.
10	2.766	992	....	4$^{[illegible]°}$	....	sl. s. al.
11	2.755$^{17.5°}$	d.	....	0.65$^{17.5°}$	2.46$^{[illegible]}$	i. al.
12	1.919	d.	....	44$^{0°}$	160$^{100°}$	sl. s. al.; i. eth.
13	0.92	d.	....	dec.	dec.	i. CS_2, CCl_4, bz.
14	....	d.	....	s.	s.	s. al.
15	....	d.	....	v. s.	dec.	i. al.
16	2.13	318	....	42$^{0°}$, 109$^{20°}$	365$^{110°}$	v. s. al., eth., glyc.
17	....	d.	....	s.	dec.	
18	1.832	....	....	33	v. s.	
19	1.840	d.	....	2.2	20	i. al.
20	....	....	....	s.	s.	v. s. al.
21	....	....	....	v. s.	....	s. al.
22	4.277	d.	....	2.52$^{0°}$	33.9$^{100°}$	i. al.; s. acet. a.
23	3.665$^{24°}_{4}$	664	1350	150$^{0°}$	312$^{100°}$	v. s. al.
24	2.448	....	....	317.9$^{0°}$	1550$^{100°}$	
25	....	d.	....	v. s.	....	s. al.; i. eth.
26	....	17	....	s.	d.	
27	....	....	....	56.2$^{0°}$	115.5$^{100°}$	
28	....	612	....	sl. s.	sl. s.	
29	....	....	....	3.878$^{20°}$	13.7$^{100°}$	
30	....	....	....	sl. s.	v. s.	
31	....	....	....	i.	i.	
32	....	....	....	sl. s.	sl. s.	
33	2.265$^{15°}$	316	d. 380	72.9$^{0°}$	180$^{100°}$	sl. s. al., glyc.
34						
35	2.157$^{25°}$	213	d. 320	83.3$^{20°}$	v. s.	0.31$^{19.5°}$ eth., 4.43$^{19.5°}$ meth. al.; sl. s. al.
36	1.680$^{17°}$	....	....	40$^{15°}$		
37	....	....	....	3.22$^{15.5°}$	6.33$^{100°}$	
38	....	....	....	1.7$^{15°}$		
39	2.27	....	subl.	dec.	dec.	d. al.
40	....	$-16H_2O$,300	....	8	dec.	
41	....	d. 40	....	2.55$^{15°}$	3.78$^{32°}$	s. glyc.
42	....	....	....	sl. s.	dec.	s. a.
43	....	482	d.	s.	v. s.	s. al.
44	....	d. 115	....	sl. s.	....	i. al., eth.
45	....	d.	....	v. s.	v. s.	
46	2.805	d.	....	s.	dec.	s. dil. a.
47	....	....	....	sl. s.		

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Sodium peruranate	$Na_2UO_5.5H_2O$	454.24	red cryst
2	phosphate, tribasic	$Na_3PO_4.12H_2O$	380.21	hex.
3	phosphate, dibasic	$Na_2HPO_4.12H_2O$	358.22	rhombic
4	phosphate, monobasic	$NaH_2PO_4.H_2O$	138.06	rhombic
5	phosphate, meta-	$Na_4P_4O_{12}$	408.10	
6	phosphate, pyro-	$Na_4P_2O_7.10H_2O$	446.20	monocl.
7	phosphate, pyro-disodium	$Na_2H_2P_2O_7.6H_2O$	330.16	
8	phosphite	$Na_2HPO_3.5H_2O$	216.11	rhbdr.
9	phosphite, acid	$2NaH_2PO_3.5H_2O$	298.16	
10	platinate	$Na_2PtO_3.3H_2O$	343.27	yel.
11	potassium carbonate	$NaKCO_3.6H_2O$	230.19	monocl.
12	potassium tartrate (Rochelle salt)	$NaKC_4H_4O_6.4H_2O$	282.19	trim. prisms
13	salicylate	$NaC_7H_5O_3$	160.04	wh. scales
14	selenate	Na_2SeO_4	189.19	
15	selenide	Na_2Se	125.19	cryst
16	silicate	Na_2SiO_3	122.05	monocl.
17	silicate (water glass)	$Na_2Si_4O_9$	302.23	amor.
18	silicate	$Na_2SiO_3.9H_2O$	284.20	
19	stannate	$Na_2SnO_3.3H_2O$	266.74	hex. plates
20	sulfate	Na_2SO_4	142.06	rhomb., monocl., or hex.
21	sulfate	$Na_2SO_4.7H_2O$	268.17	rhomb. or tetrag.
22	sulfate	$Na_2SO_4.10H_2O$	322.22	monocl.
23	sulfate, acid	$NaHSO_4$	120.07	tricl.
24	sulfide, mono-	Na_2S	78.06	amor. pink
25	sulfide, penta-	Na_2S_5	206.31	
26	sufite	Na_2SO_3	126.06	hex. pr.
27	sulfite	$Na_2SO_3.7H_2O$	252.17	monocl. pr.
28	sulfite, acid	$NaHSO_3$	104.07	monocl.
29	sulfocyanate	$NaCNS$	81.07	rhomb. pl.
30	tartrate	$Na_2C_4H_4O_6.2H_2O$	230.06	trim. pr.
31	thioantimonate (Schlippe's salt)	$Na_3SbS_4.9H_2O$	481.16	yel. reg.
32	thioarsenate	$2Na_3AsS_4.15H_2O$	814.65	yel. monocl.
33	thiocarbonate	$Na_2CS_3.H_2O$	172.20	yel.
34	thioplatinate	$Na_4Pt_3S_6$	870.06	red rhombic. need.
35	thiosulfate (hypo)	$Na_2S_2O_3.5H_2O$	248.20	monocl pr.
36	tungstate	$Na_2WO_4.2H_2O$	330.03	rhombic tabl.
37	uranate	Na_2UO_4	348.16	yel.
38	vanadate	$Na_3VO_4.16H_2O$	472.21	cryst
39	Stannous and stannic *see under tin*			
40	Strontium	Sr	87.63	silvery cryst.
41	arsenate	$SrHAsO_4.H_2O$	245.61	rhombic need.
42	arsenite	$Sr_3(AsO_3)_2.4H_2O$	580.87	cryst.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point Deg. C.	Solubility in 100 parts of: Cold water	Hot water	Alcohol acids, etc.
1	....	d. 100	....	dec.	dec.	d. HCl
2	1.645	77	$-11H_2O$, 100	28.3^{15°	∞	
3	1.524^{16°	35	$-12H_2O$, 100	6.3^{0°	∞	i. al.
4	2.040	$-2H_2O$, 200	....	v. s.	v. s.	i. al.
5	2.476	617	....	sl. s.	sl. s.	s. a., alk.
6	1.83	anh. 988	....	5.4^{0°	93^{100°	i. al.
7	1.848					
8	....	53	....	s.	v. s.	i. al.
9	....	42	$-5H_2O$, 100	56^{0°	193^{42°	
10	....	$-3H_2O$, 150–70	....	s.	....	i. al.
11	1.633	$-6H_2O$, 100	....	185^{15°		
12	1.77	70–80	$-4H_2O$, 215	26^{0°	66^{28°	
13	....	....	....	111^{15°	125^{25°	17^{15° al.
14	$2.309^{17.2^\circ}$	....	....	13.3^{0°	72.8^{100°	
15	....	>875	....	dec.		
16	....	1056	....	s.	s.	i. al., Na and K salts
17	....	....	....	s.	s.	i. al., Na and K salts
18	....	48	$-6H_2O$, 100	v. s.	v. s.	$20.3^{17.5^\circ}$ n/2 NaOH
19	....	....	....	67.4^{0°	61.3^{20°	i. al.
20	2.673^{15°	84	....	5.02^{0°	42.5^{100°	i. al.
21	....	....	....	19.5^{0°, 37^{15°	53^{25°	
22	1.492^{20°	32.38	....	5^{0°, 19.4^{20°	50.65^{32°	i. al.
23	2.435^{13°	300	....	50^{0°	100^{100°	d. al.
24	2.471	....	....	15.4^{10°	59.2^{90°	sl. s. al.; i. eth.
25	....	....	....	s.	s.	sl. s. al.
26	$2.633^{15^\circ}_{4}$	150	d.	28.04^{37°	28.26^{84°	i. al.
27	$1.594^{15^\circ}_{4}$	$-7H_2O$, 150	d.	32.83^{0°	196^{40°	i. al.
28	1.48	d.	....	sl. s.	s.	i. al.
29	....	287	....	v. s.	v. s.	v. s. al.
30	1.794	....	....	29^{6°	66^{43°	i. al.
31	1.864	....	....	33	....	i. al.
32	....	....	....	v. s.	....	i. al.
33	....	d.	....	s.	dec.	
34	....	....	....	i.	dec.	
35	1.729^{17°	48	d. 220	74.7^{0°	301.5^{60°	i. al.
36	$3.259^{17.5^\circ}$	$-2H_2O$, 100; anh. 698	....	41^{0°	123.5^{100°	i. al., a.
37	....	....	....	i.	i.	s. dil. a.
38	....	866 anh.	....	v. s.	....	i. al.
39						
40	2.54	900	ign.	dec.	dec.	s. a., al.
41	3.606^{15°	$-H_2O$, 125	$-1\frac{1}{2}H_2O$, 225	$0.281^{15.5^\circ}$	dec.	s. a.
42	....	....	....	sl. s.	....	sl. s. al.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Strontium borate	$SrB_4O_7.4H_2O$	314.97	
2	boride	SrB_6	152.55	blk. cryst
3	bromate	$Sr(BrO_3)_2.H_2O$	361.48	monocl. pr.
4	bromide	$SrBr_2$	247.46	wh. need.
5	bromide	$SrBr_2.6H_2O$	355.56	colorl. cryst
6	carbide	SrC_2	111.63	blk. cryst
7	carbonate	$SrCO_3$	147.63	rhombic, wh.
8	chlorate	$Sr(ClO_3)_2$	254.54	rhombic wh.
9	chlorate	$Sr(ClO_3)_2.8H_2O$	398.67	need. wh.
10	chloride	$SrCl_2$	158.54	wh.
11	chloride	$SrCl_2.6H_2O$	266.64	hex. need., wh.
12	chromate	$SrCrO_4$	203.64	monocl. pr. yel.
13	cyanide	$Sr(CN)_2.4H_2O$	211.71	cryst.
14	dithionate	$SrS_2O_6.4H_2O$	319.82	hex. pl.
15	ferrocyanide	$Sr_2Fe(CN)_6.15H_2O$	657.39	yel. monocl.
16	fluoride	SrF_2	125.63	reg. octahdr. wh.
17	fluosilicate	$SrSiF_6.2H_2O$	265.72	tetrag. pr
18	formate	$Sr(CHO_2)_2.2H_2O$	213.68	rhombic
19	hydrosulfide	$Sr(SH)_2$	153.77	cryst.
20	hydroxide	$Sr(OH)_2$	121.65	wh.
21	hydroxide	$Sr(OH)_2.8H_2O$	265.77	tetrag. colorl.
22	iodide	SrI_2	341.49	plates
23	iodide	$SrI_2.6H_2O$	449.59	colorl. cryst.
24	molybdate	$SrMoO_4$	247.63	
25	nitrate	$Sr(NO_3)_2$	211.65	reg. octahdr.
26	nitrate	$Sr(NO_3)_2.4H_2O$	283.71	tricl. wh.
27	nitrite	$Sr(NO_2)_2.H_2O$	197.66	hex.
28	oxalate	$SrC_2O_4.H_2O$	193.65	colorl.
29	oxide	SrO	103.63	rhomb. gr. wh.
30	oxide, per-	SrO_2	119.63	
31	oxide, per-	$SrO_2.8H_2O$	263.76	cryst. wh.
32	permanganate	$Sr(MnO_4)_2.3H_2O$	379.54	purp. reg.
33	phosphate, acid	$SrHPO_4$	183.67	rhombic pl.
34	salicylate	$Sr(C_7H_5O_3)_2.2H_2O$	397.74	cryst. colorl.
35	selenate	$SrSeO_4$	230.83	rhombic
36	silicate	$SrSiO_3$	163.69	prisms
37	sulfate	$SrSO_4$	183.69	rhombic wh.
38	sulfate, acid	$Sr(HSO_4)_2$	281.77	
39	sulfide, mono-	SrS	119.69	reg. lt. gr.
40	sulfide, tetra-	$SrS_4.6H_2O$	323.98	reddish cryst.
41	sulfite	$SrSO_3$	167.69	cryst.
42	sulfocyanate	$Sr(CNS)_2.3H_2O$	257.82	
43	tartrate	$SrC_4H_4O_6.4H_2O$	307.73	monocl. prisms wh.
44	thiosulfate	$SrS_2O_3.5H_2O$	289.84	monocl.
45	Sulfur, amorphous	S_8	256.51	pa. yel.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	....	....	....	....	$77^{100°}$	s. HNO_3, NH_4 salts
2	$3.28^{15°}$	....	....	i.	i.	s. HNO_3
3	3.773	$-H_2O$, 120	d. 240	$33^{16°}$		
4	$4.216^{24°}_{4}$	498–630	d.	$87.7^{0°}$	$250^{110°}$	s. al., amyl. al.
5	2.358	....	....	$204.2^{0°}$	∞	
6	3.19	....	....	dec.	dec.	d. a.
7	3.62	d. 1155	....	$0.0011^{18°}$	....	0.12 CO_2 aq.; s. a., NH_4 salts
8	3.152	d. 290	....	$174.9^{18°}$	v. s.	s. al.
9	....	....	....	s.	v. s.	s. al.
10	3.054	872	....	$44.2^{0°}$	$101.9^{100°}$	s. abs. al.
11	$1.964^{16.7°}$	$-4H_2O$, 60; 112	$-6H_2O$, 100	$106.2^{0°}$	$205.8^{40°}$	
12	$3.895^{15°}$	....	....	$0.12^{15°}$	....	s. acet. a., NH_4 salts
13	....	d.	....	v. s.		
14	2.373	$-4H_2O$, 78	....	$22^{16°}$	$67^{100°}$	i. al.
15	....	....	....	50	100	
16	4.21	902	d. 1000	$0.012^{18°}$	sl. s.	i. HF; s. HCl
17	2.999	d.	....	$3.2^{15°}$	....	$0.06^{15°}$ 50% al.; s. HCl
18	2.25	d.	....	s.	s.	
19	....	d.	....	s.	d.	
20	3.625	375	....	$0.41^{0°}$	$21.83^{100°}$	s. NH_4Cl
21	$1.396^{16°}$	....	....	$0.90^{0°}$	$47.71^{100°}$	s. NH_4Cl
22	$4.549^{25°}_{4}$	507	d.	$164^{0°}$	$370^{100°}$	
23	4.415	....	....	$448.9^{0°}$	∞	
24	4.145	....	....	$0.0104^{17°}$		
25	$2.98^{16.8°}$	645	....	$39.5^{0°}$	$101.1^{100°}$	0.012 abs. al.
26	$2.249^{15.5°}$	....	....	$60.43^{0°}$	$206.5^{100°}$	i. HNO_3
27	$2.645^{27°}$	$-H_2O$, 44	....	$62.83^{19.5°}$		
28	....	d.	....	$0.0051^{18°}$	$5^{100°}$	s. HCl, HNO_3
29	4.34	3000	....	d. $Sr(OH)_2$	....	sl. s. al.; i. eth.
30	....	d.	....	$0.008^{20°}$	dec.	v. s. al., NH_4Cl
31	....	$-8H_2O$, 100	d.	$0.018^{20°}$	dec.	i. NH_4OH
32	....	dec.	....	$270^{0°}$	$291^{18°}$	
33	$3.544^{15°}$	....	....	i.	i.	s. a., NH_4 salts
34	....	....	....	$5.6^{25°}$	$28.6^{100°}$	$1.5^{25°}$, $9.5^{78°}$ al.
35	4.23	....	....	i.	....	i. HNO_3; s. h. HCl
36	$3.652^{25°}_{4}$	1578	....	i.		
37	3.71–.97	1605	d.	$0.0114^{18°}$	$0.0104^{100°}$	i. dil. H_2SO_4, al.; sl. s. a.
38	....	d.	....	dec.	....	$14^{70°}$ H_2SO_4
39	$3.72^{15°}$	....	....	s. dec.	....	s. al.
40	....	....	....	s.	....	s. al.
41	....	d.	....	0.0033	....	v. s. H_2SO_3
42	....	$-3H_2O$, 100	d. 160–70	v. s.	....	v. s. al.
43	$1.966^{20°}_{4}$	....	....	$0.112^{0°}$	$0.755^{85°}$	
44	$2.178^{17°}$	$-4H_2O^{100°}$	....	$25^{13°}$	$57^{100°}$	i. al.
45	2.046	120	444.7	i.	i.	sl. s. CS_2

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Sulfur, monoclinic	S_8	256.51	pa. yel.
2	Sulfur, rhombic	S_8	256.51	yel.
3	Sulfur chloride, mono-	S_2Cl_2	135.04	yel. red liq.
4	chloride, di-	SCl_2	102.98	dk. red liq.
5	chloride, tetra-	SCl_4	173.89	yel. br. liq.
6	bromide, mono-	S_2Br_2	223.96	red liq.
7	chloriodide	SCl_7I	407.20	red yel. pr.
8	iodide	SI_6	793.66	gray-blk. cryst.
9	hexafluoride	SF_6	146.06	gas.
10	monoxytetra-chloride	S_2OCl_4	221.96	deep red liq.
11	oxide, di-	SO_2	64.06	colorl. gas.
12	oxide, sesqui-	S_2O_3	112.13	bl. grn. cryst.
13	oxide, α-tri-	SO_3	80.06	prism. cryst. or liq.
14	oxide, β-tri-	$(SO_3)_2$	160.13	silky need.
15	oxide, hepta-	S_2O_7	176.13	need. or liq.
16	pentoxydichloride	$S_2O_5Cl_2$	215.04	liq.
17	trioxytetrachloride	$S_2O_3Cl_4$	253.96	cryst.
18	Sulfuric acid	H_2SO_4	98.08	colorl. liq.
19	Sulfuric acid	$H_2SO_4.H_2O$	116.10	prisms or liq.
20	Sulfuric acid	$H_2SO_4.2H_2O$	134.11	colorl. liq.
21	Sulfuric acid, pyro-	$H_2S_2O_7$	178.14	cryst.
22	Sulfuric oxychloride	SO_2Cl_2	134.98	liq.
23	oxyfluoride	SO_2F_2	102.06	gas.
24	Sulfurous oxybromide	$SOBr_2$	207.90	orange yel.
25	oxychloride	$SOCl_2$	118.98	liq.
26	oxyfluoride	SOF_2	86.06	gas.
27	Tantalum	Ta	181.50	blk-gr. cryst.
28	bromide	$TaBr_5$	581.08	yel. cryst.
29	chloride	$TaCl_5$	358.79	lt. yel. pr.
30	fluoride	TaF_5	276.50	tetrag.
31	nitride	Ta_3N_5	614.54	yel. amor.
32	oxide, di-	TaO_2	213.50	br. powd.
33	oxide, tetra-	Ta_2O_4	427.00	dk. gr.
34	oxide, penta-	Ta_2O_5	443.00	rhombic pr., wh.
35	sulfide	Ta_2S_4	491.26	
36	Tartaric acid	$H_2C_4H_4O_6$	150.05	monocl. pr. wh.
37	Telluric acid	H_2TeO_4	193.52	
38	Telluric acid	$H_2TeO_4.2H_2O$	229.55	reg. octahdr. or monocl. pr.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	1.957	119.3	444.7	i.	i.	s. CS_2, al.
2	2.07	114.5	444.7	i.	i.	$24^{0°}$, $181.3^{55°}$ CS_2
3	$1.709^{0°}_{4}$	−80	138	dec.	dec.	s. CS_2, bz., al. eth.
4	$1.622^{15°}_{15}$	−78	59	dec.		
5	....	−30	d. 20	dec.	dec.	
6	$2.636^{20°}$	−46	$54^{0.18\ mm.}$	dec.	dec.	
7	....	d.	....	dec.		
8	....	....	....	....	dec.	s. CS_2
9	....	−55	−62	sl. s.	....	sl. s. al.; s. KOH
10	(D) $386^{100°}$ $1.656^{0°}$	d.	....	dec.	dec.	
11	(A) 2.264, liq. $1.434^{0°}$	−76.1	−10	7979 $c.c.^{0°}$	1560 $c.c.^{60°}$	s. al., H_2SO_4, acet. a.
12	....	d.	....	dec.	....	d. al., eth.
13	(A) 2.75 liq. $1.982^{15°}_{4}$	16.8	44.9	dec.	dec.	s. H_2SO_4
14	1.040	50	....	dec.	dec.	
15	....	0	d.	dec.	dec.	s. H_2SO_4
16	$1.819^{1°}$	−39	150	dec.	dec.	
17	....	57	subl.	dec.	dec.	
18	$1.834^{18°}_{4}$	10.46	d. 40°	∞	∞	d. al.
19	$1.788^{17°}$	8.53	210–338	∞	∞	d. al.
20	$1.665^{0°}$	−38.9	170–90	∞	∞	d. al.
21	1.89	35	d.	dec.	dec.	d. al.
22	$1.667^{20°}_{4}$	....	69.15	dec.	....	s. acet. a.
23	....	−120	−52	....	10 $c.c.^{90°}$	s. alk.
24	....	....	$68^{40\ mm.}$	dec.		
25	$1.677^{0°}_{4}$	....	78	dec.		
26	....	−110	−30	dec.	dec.	s. eth.
27	16.6	2900	....	i.	i.	i. HCl, HNO_3, H_2SO_4; s. HF, fus. alk.
28	....	240	320	dec.	....	s. abs. al., eth.
29	$3.68^{27°}$	211.3	241.6	dec.	....	s. H_2SO_4, abs. al.
30	$4.981^{15°}$	94	226	....	....	s. HF
31	....	ign.	....	i.	....	i. a.; s. HNO_3 + HF
32	....	oxidizes	....	i.	....	i. a.
33	....	oxidizes	....	i.	....	i. a.
34	7.53	....	....	i.	i.	i. a.; s. HF, fus. $KHSO_4$
35	....	oxidizes				
36	1.755	168–70	....	$115^{0°}$	$343^{100°}$	$25.6^{15°}$ al.; sl. s. eth.
37	$3.425^{19°}$	d. 160	....	i.	sl. s.	i. c. a., alk.
38	3.053–.071	$-2H_2O$, 130	....	$19.7^{0°}$	$258.5^{100°}$	s. a., alk.; i. al.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Tellurium	Te	127.50	amor. or rhombic
2	bromide, di-	$TeBr_2$	287.33	steel. gr. need
3	bromide, tetra-	$TeBr_4$	447.16	orange
4	chloride, di-	$TeCl_2$	198.41	blk. cryst
5	chloride, tetra-	$TeCl_4$	269.33	yel. cryst
6	hydride	TeH_2	129.52	gas
7	iodide, di-	TeI_2	381.36	blk. cryst
8	iodide, tetra-	TeI_4	635.23	gr. cryst
9	nitrate	$4TeO_2.N_2O_5.1\frac{1}{2}H_2O$	773.04	ortho rhombic
10	oxide, mon-	TeO	143.50	blk. amor
11	oxidide, di-	TeO_2	159.50	octahdr. yel
12	oxide, tri-	TeO_3	175.50	orange cryst
13	sulfite	$(TeO_2)_2SO_3$	399.06	
14	Tellurous acid	H_2TeO_3	177.52	octahdr. or monocl. pr.
15	Terbium	Tb	159.20	
16	chloride	$TbCl_3$	265.57	need
17	oxide	Tb_2O_3	366.40	amor. orange
18	Thallium	Tl	204.39	bl. wh
19	acetate	$TlC_2H_3O_2$	263.41	silky need
20	bromide, mono-	TlBr	284.31	reg
21	bromide, di-	$TlBr_2$	364.22	yel. need
22	bromide, tri-	$TlBr_3$	444.14	yel. need
23	carbonate	Tl_2CO_3	468.78	monocl
24	chlorate	$TlClO_3$	287.85	
25	chloride, mono-	TlCl	239.85	reg. wh
26	chloride, sesqui-	Tl_2Cl_3	515.15	yel. hex
27	chloride, tri-	$TlCl_3$	310.76	hex. pl
28	chloride, tri-	$TlCl_3.4H_2O$	382.83	need
29	chloroplatinate	Tl_2PtCl_6	816.75	pa. orange
30	chromate	Tl_2CrO_4	524.79	yel
31	cyanide	TlCN	230.40	tabl
32	dichromate	$Tl_2Cr_2O_7$	624.80	red cryst
33	ferrocyanide	$Tl_4Fe(CN)_6.2H_2O$	1065.48	yel. tricl
34	fluoride, mono-	TlF	223.39	reg. octahdr
35	fluoride, tri-	TlF_3	261.39	olive grn
36	fluosilicate	$Tl_2SiF_6.2H_2O$	586.87	reg. octahdr
37	hydroxide (ous)	Tl(OH)	221.40	pr. pa. yel
38	hydroxide (ic)	TlO.OH	237.40	yel. cryst
39	hydroxide (ic)	$Tl(OH)_3$	255.41	br. hex
40	iodide, mono-	TlI	331.32	reg. yel
41	iodide, sesqui-	Tl_2I_3	789.58	blk. need
42	iodide, tri-	TlI_3	585.19	br. need
43	nitrate (ous)	$TlNO_3$	266.40	rhombic <72.8°; rh-bdr. 72.8-142.5°, >142.5° reg.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	6.015, 6.25	451	1390	i.	i.	s. H_2SO_4, KCN, HNO_3, aq. reg., KOH; i. CS_2
2	....	250	339	dec.		
3	$4.31^{13.5^\circ}_{4}$	380	420	v. s.		
4	(D) 6.89	175	324	dec.	....	d. HCl
5	(D) 9.2	214	414	dec.	s.	s. dil. HCl
6	(D) 4.39	−48	0	s.	....	s. alk.
7	....	....	....	i.	i.	
8	....	....	....	sl. s.	dec.	s. HI
9	....	....	....	dec.	....	s. HNO_3
10	....	oxidizes	....	i.	i.	s. HCl, H_2SO_4
11	5.89^{0°	....	>700	0.00067	....	s. a., alk.
12	$5.070^{14.5^\circ}$	d.	....	i.	i.	i. a.; s. h. KOH
13						
14	3.035–.071	d. 40	....	sl. s.	dec.	s. a., alk.
15						
16	$4.35^{0^\circ}_{4}$	588				
17	....	....	....	....	....	s. a.
18	11.85	301.7	1280	i.	i.	s. HNO_3, H_2SO_4
19	....	....	....	v. s.	....	v. s. al.
20	7.54^{22°	450	....	0.0466^{20°	0.869^{69°	
21	....	....	....	dec.	dec.	
22	....	d.	....	s.	v. s.	v. s. al.
23	7.06–.16	272	....	$4.02^{15.5^\circ}$	27.21^{100°	i. a., eth.
24	5.047^{9°	....	....	2.8^{0°	57.3^{100°	
25	7.02	426	708–19	0.2^{0°	1.6^{100°	sl. s. HCl; i. a., NH_4OH
26	5.9	400–500	d.	0.26^{15°	1.9^{100°	
27	....	25°	d.	v. s.		
28	....	36–7	....	86.2^{17°	dec.	
29	5.76^{17°	....	....	0.0064^{15°	0.05^{100°	
30	....	....	....	0.03 [illegible]	0.2^{100°	i. acet. a.; sl. s. a., alk.
31	....	d.	....	$16.8^{28.5^\circ}$		
32	....	....	....	i.	....	d. a.
33	4.641	....	....	0.37^{18°	3.93 [illegible]	
34	....	....	....	80^{15°	v. s.	sl. s. al.
35	....	....	....	i.	....	i. c. HCl
36	....	....	....	v. s.		
37	....	d. 100	....	v. s.	v. s.	s. al.
38	....	$-H_2O$, 115	....	i.	....	s. a. NH_4 salts; i. alk.
39	....	....	....	i.	....	v. s. dil. a.
40	$7.072^{15.5^\circ}$	422	806	0.0064^{20°	0.125^{100°	i. a., KI; s. aq. reg.
41	....	....	....	i.	....	sl. s. al.
42	....	....	....	....	....	s. eth.
43	$5.556^{21.4^\circ}$	205	....	3.9^{0°, 10.6^{15°	588^{107°, 414^{100°	i. al.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Thallium nitrate (ic)	$Tl(NO_3)_3$	390.41	cryst.
2	oxide (ous)	Tl_2O	424.78	yel.
3	oxide (ic)	Tl_2O_3	456.78	hex. blk.
4	perchlorate	$TlClO_4$	303.85	
5	phosphate	Tl_3PO_4	708.20	need.
6	selenate	Tl_2SeO_4	551.98	pr. need.
7	selenide	Tl_2Se	487.98	leaf.
8	sulfate (ous)	Tl_2SO_4	504.84	rhombic pr.
9	sulfate (ic)	$Tl_2(SO_4)_3.7H_2O$	823.08	leaf.
10	sulfate, acid	$TlHSO_4$	301.46	
11	sulfide (ous)	Tl_2S	440.84	bl. blk. tetrag.
12	sulfide (ic)	Tl_2S_3	504.97	blk. amor.
13	sulfite (ous)	Tl_2SO_3	488.84	cryst.
14	sulfocyanate	$TlCNS$	262.46	need.
15	Thio-, *see sulfur*			
16	Thorium	Th	232.15	amor. or cryst.
17	boride	ThB_4	275.43	prisms.
18	boride	ThB_6	297.07	amor. violet
19	bromide	$ThBr_4$	551.81	cryst.
20	carbide	ThC_2	256.15	
21	carbonate	$Th(CO_3)_2$	352.15	
22	chloride	$ThCl_4$	373.98	need.
23	fluoride	$ThF_4.4H_2O$	380.21	cryst.
24	hydroxide	$Th(OH)_4$	300.18	gelat.
25	iodide	ThI_4	539.88	
26	nitrate	$Th(NO_3)_4.12H_2O$	696.37	pl.
27	oxalate	$Th(C_2O_4)_2$	408.15	
28	oxide, di-	ThO_2	264.15	reg.
29	oxide, per-	Th_2O_7	576.30	
30	platinocyanide	$Th[Pt(CN)_4]_2.16H_2O$	1118.93	yel. grn. ortho rhomb.
31	sulfate	$Th(SO_4)_2$	424.28	
32	sulfate	$Th(SO_4)_2.9H_2O$	586.42	monocl.
33	sulfide	ThS_2	296.28	
34	Thulium	Tm	169.40	
35	Tin	Sn	118.70	rhombic
36	Tin	Sn	118.70	wh. tetrag.
37	Tin	Sn	118.70	gray.
38	Stannic acid	H_2SnO_3	168.72	amor.
39	Stannic acid, meta-	$H_{10}Sn_5O_{15}$	843.58	
40	Stannic acid, thio-	H_2SnS_3	216.91	gray.
41	Stannic ammonium chloride	$SnCl_4.(NH_4Cl)_2$	367.52	
42	bromide	$SnBr_4$	438.36	

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water	Hot water	Alcohol, acids, etc.
1	....	....	....	s.		
2	....	>870	−O, 1865	v. s.	s.	s. al.
3	5.56^{0°	759	−2O, 875	i.	i.	s. a.; i. alk.
4	4.89	501	d.	10^{15°	166^{100°	
5	6.89^{10°	....	....	0.5^{15°	0.67^{100°	i. al.; s. NH_4 salts
6	7.019^{16°	>400	....	2.8^{20°	8.5^{80°	i. al., eth.
7	....	340	....	i.	....	i. a.
8	6.77	632	d.	2.7^{0°, 5.4^{25°	16.5^{90°, 18.5^{100°	
9	....	$-6H_2O$, 200	d.	dec.	....	s. dil. H_2SO_4
10	....	115–20				
11	8.0	448	d.	0.0379^{20°	sl. s.	s. a.; i. alk.
12	....	12	d.	i.	i.	s. H_2SO_4
13	6.427^{20°	....	....	3.34^{15°	v. s.	i. al.
14	....	....	....	0.315^{20°	0.732^{40°	i. al.
15						
16	11.00–.23	>1700	....	i.	i.	s. HCl, H_2SO_4, sl. s. HNO_3, i. alk.
17	7.5^{15°	....	....	i.	i.	s. HNO_3, HCl
18	6.4^{15°	....	....	i.	i.	s. HNO_3, HCl
19	5.62	....	725 in vac.	s.		
20	8.96^{15°	ign.	....	dec.		
21	....	....	....	i.	dec.	i. CO_2 aq.; s. conc. Na_2CO_3
22	4.59	820	....	v. s.	v. s.	s. KCl, al., eth.
23	....	$-H_2O$, 100	$-2H_2O$, 140–200	i.	....	i. HF
24	....	dec.	....	i.	i.	s. a.; i. alk.
25	....	....	....	s.		
26	....	....	....	v. s.	....	v. s. al.
27	4.637^{16°	d.	....	i.	....	s. h. $(NH_4)_2C_2O_4$ aq.
28	9.876^{15°	....	....	i.	....	s. h. H_2SO_4
29	....	....	....	i.		
30	2.460	....	....	sl. s.	s.	
31	4.225^{17°	....	....	0.74^{0°	6.76^{55°	
32	2.766^{16°	$-9H_2O$, 400	....	0.97^{0°	9.41^{55°	
33	6.8	....	....	i.	i.	sl. s. a.; s. h. aq. reg.
34	....	....	....	i.	i.	
35	6.53–.56	stable >170	2270	i.	i.	s. HCl, H_2SO_4, dil. HNO_3, aq. reg., h. KOH
36	7.298^{15°	232	2270	i.	i.	
37	5.847^{15°	stable <20°	2270	i.	i.	
38	....	....	....	i.	i.	i. a.; s. KOH
39	....	....	....	i.	i.	i. a.; s. KOH
40	....	....	....	i.		
41	....	....	....	s.		
42	3.349^{35°	29.9	203.3	s.	dec.	

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Stannic chloride	$SnCl_4$	260.53	liq.
2	fluoride	SnF_4	194.70	cryst.
3	iodide	SnI_4	626.43	or.-red octahdr.
4	oxide	SnO_2	150.70	amor., hex., tetrag. or rhombic
5	oxychloride	$SnOCl_2$	205.61	
6	phosphate	$2SnO_2.P_2O_5.10H_2O$	623.61	
7	phosphide	SnP	149.73	
8	selenide	$SnSe_2$	277.10	cryst.
9	sulfate	$Sn(SO_4)_2.2H_2O$	346.86	rhombic
10	sulfide	SnS_2	182.83	hex. yel.
11	Stannous bromide	$SnBr_2$	278.53	yel. cryst.
12	chloride	$SnCl_2$	189.61	wh.
13	chloride (tin salt)	$SnCl_2.2H_2O$	225.65	tricl. wh.
14	ferricyanide	$Sn_3[Fe(CN)_6]_2$	779.88	
15	ferrocyanide	$Sn_2Fe(CN)_6$	449.29	
16	fluoride	SnF_2	156.70	prisms.
17	hydroxide	$Sn(OH)_2$	152.72	amor. yel.
18	iodide	SnI_2	372.56	red cryst.
19	oxide	SnO	134.70	blk. reg.
20	oxychloride	$SnO.SnCl_2.6H_2O$	432.41	
21	selenide	$SnSe$	197.90	steel. gr. pr.
22	sulfate	$SnSO_4$	214.76	cryst.
23	sulfide	SnS	150.76	br.
24	telluride	$SnTe$	246.20	gr. cryst.
25	Titanic acid	H_2TiO_3	98.12	
26	Titanium	Ti	48.10	amor. dk. gr.
27	bromide, tetra-	$TiBr_4$	367.76	orange cryst.
28	chloride, di-	$TiCl_2$	119.01	blk.
29	chloride, tri-	$TiCl_3$	154.47	dk. violet
30	chloride, tetra-	$TiCl_4$	189.93	
31	cyanide	$Ti_5(CN)_4$	344.53	red. octahdr.
32	fluoride, tri-	TiF_3	105.10	purp. red
33	fluoride, tetra-	TiF_4	124.10	
34	iodide, tetra-	TiI_4	555.83	octahdr. red.
35	nitrate	$5TiO_2.N_2O_5.6H_2O$	616.61	pl.
36	oxalate	$Ti_2(C_2O_4)_3.10H_2O$	540.36	yel. pr.
37	oxide, sesqui-	Ti_2O_3	144.20	blk. amor.
38	oxide, di-	TiO_2	80.10	tetrag. wh. to blk.
39	oxide, per-	TiO_3	96.10	yel.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	$2.279^{0°}_{4}$	−33	114	s.	dec.	s. al., CS_2, oil turp.
2	$4.780^{19°}_{4}$	....	705	v. s. hyg.	d. to SnO_2	
3	$4.696^{11°}$	144	295	v. s.	dec.	145[illegible]° CS_2; s. al., eth.
4	6.60–.85	1127	....	i.	i.	s. H_2SO_4
5	....	....	....	s.		
6	anh. 3.98	....	....	i.	i.	i. HNO_3
7	6.56	....	....	i.	....	s. HCl; i. HNO_3
8	4.85	....	....	i.	....	i. dil. a.; s. alk., h. H_2SO_4
9	....	....	....	v. s.	dec.	s. dil H_2SO_4, HCl
10	4.42–.60	d.	....	0.00002	i.	s. HCl, alk. sulfides
11	$5.117^{17°}$	215	617–34	s.	dec.	
12	....	247.2	603–28	$33.9^{0°}$	$269.8^{15°}$	s. alk., al., tart. a.
13	$2.71^{15.5°}$	37.7	d.	$118.7^{0°}$	∞	
14	....	....	....	i.	....	s. HCl
15	....	....	....	i.	....	s. h. HCl
16	....	....	....	v. s.		
17	....	....	....	i.	dec.	s. dil. a., alk.; i. NH_4OH
18	....	316	720	$0.98^{20°}$	$4.03^{100°}$	s. dil. HCl, KOH
19	6.3	d.	....	i.	i.	s. a., NH_4Cl; i. alk.
20	....	....	....	i.	i.	s. dil. a., al.
21	$6.179^{0°}$	....	....	i.	....	s. alk. sulfides
22	....	$-SO_2$, 360	....	$18.9^{13°}$	$18.2^{100°}$	s. H_2SO_4
23	$5.27^{15°}$	882	1230	0.000002	....	s. HCl, $(NH_4)_2S_x$
24	$6.478^{0°}$	....	....	....	....	i. HCl
25	....	....	....	i.	i.	i. al.; s. a., alk.
26	$4.50^{17.5}$	1795	....	i.	dec.	s. a.
27	2.6	39	230	dec.	....	....
28	....	....	....	dec.	....	i. CS_2, eth., chl.
29	....	d. 440	....	s.	s.	v. s. al.; i. eth.
30	$1.76^{0°}_{4}$	−25	136.4	dec.	....	s. dil. HCl
31	5.28	....	....	i.	i.	i. a.; s. HNO_3 + HF
32	....	....	....	s.		
33	$2.798^{20.5°}$	284–87	>400	dec.	....	i. eth.; s. H_2SO_4
34	....	150	>360	v. s.	v. s.	
35	....	....	....	s.		
36	....	....	....	s.	s.	i. al., eth.
37	....	oxidizes	....	i.	i.	s. H_2SO_4, HF
38	3.75–4.25	1560	....	i.	i.	s. H_2SO_4, alk.
39	....	....	....	....	....	s. a.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Titanium sulfate	$Ti_2(SO_4)_3$	384.39	grn. cryst
2	Tungsten	W	184.00	gr. to blk.
3	bromide, di-	WBr_2	343.83	bl. blk.
4	bromide, penta-	WBr_5	583.58	violet- br. need
5	carbide	W_2C	380.00	
6	chloride, di-	WCl_2	254.91	gray, amor
7	chloride, tetra-	WCl_4	325.83	gray cryst
8	chloride, penta-	WCl_5	361.29	blk. need
9	chloride, hexa-	WCl_6	396.74	dk. bl. reg
10	dioxydibromide	WO_2Br_2	375.83	red pr.
11	dioxydichloride	WO_2Cl_2	286.91	yel. tabl.
12	iodide	WI_2	437.86	grn.
13	oxide, di-	WO_2	216.00	rhombic br.
14	oxide, tri-	WO_3	232.00	rhombic yel.
15	oxytetrabromide	$WOBr_4$	519.66	blk. need
16	oxytetrachloride	$WOCl_4$	341.83	red need
17	phosphide	W_2P	399.03	dk. gr. prisms
18	phosphide	WP	215.03	gr. prisms
19	phosphide	WP_2	246.05	blk. cryst
20	sulfide, di-	WS_2	248.13	dk. gr. cryst
21	sulfide, tri-	WS_3	280.19	blk. powd
22	Tungstic acid	H_2WO_4	150.02	yel
23	Tungstic acid, meta-	$H_2W_4O_{13}$	946.02	yel. octahdr
24	Uranic acid	H_2UO_4	304.19	yel. powd
25	Uranium	U	238.17	wh. cryst
26	bromide, tri-	UBr_3	477.92	dk. br. need
27	bromide, tetra-	UBr_4	557.83	blk. leaf
28	carbide	U_2C_3	512.34	cryst.
29	chloride, tri-	UCl_3	344.54	br.-red
30	chloride, tetra-	UCl_4	380.00	dk. grn. reg
31	chloride, penta-	UCl_5	415.46	dk. need
32	fluoride, tetra-	UF_4	314.17	grn. powd
33	fluoride, hexa-	UF_6	352.17	yel. monocl
34	iodide, tetra-	UI_4	745.90	need
35	oxide, di-	UO_2	270.17	blk. octahdr
36	oxide (ous, ic)	U_3O_8	842.51	olive grn

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water	Hot water	Alcohol, acids, etc.
1	....	....	....	i.	i.	s. dil. a.; i. al., eth.
2	18.7	3400	5830	i.	i.	s. HNO_3, aq. reg., conc. h. KOH
3	....	d. 400	....	dec.		
4	....	276	333	dec.	....	s. alk.
5	$16.08^{18°}$	....	....	i.	....	sl. s. HCl, H_2SO_4; s. HNO_3
6	....	....	....	dec.		
7	....	d.	....	dec.		
8	....	248	275.6	dec.	....	sl. s. CS_2
9	(D) $13.3^{350°}$	275	346.7	....	d. 60°	v. s. CS_2, $POCl_3$
10	....	....	d.			
11	....	266	....	s.	dec.	s. alk., NH_4OH
12	$6.9^{18°}$					
13	12.11	....	....	i.	i.	s. a., KOH
14	7.16	....	....	i.	i.	i. a.; s. alk.
15	....	277	327	dec.		
16	....	208–10	227.5	....	....	s. CS_2
17	5.207	....	....	....	....	i. a.; s. fus. $Na_2CO_3 + NaNO_3$
18	8.5	....	....	i.	....	i. alk., HCl; s. $HNO_3 + HF$
19	5.8	d.	....	i.	i.	i. al.; eth.; s. $HNO_3 + HF$
20	$7.5^{10°}$	....	....	....	....	oxidized by HNO_3
21	....	....	....	sl. s.	s.	s. alk. sulf., alk.
22	....	$-\frac{1}{2}H_2O$, 100	....	i.	sl. s.	s. alk.
23	....	....	....	s.		
24	$5.93^{15°}$	$-H_2O$, 250–300	....	i.	i.	s. a., alk. carb.; i. alk.
25	$18.685^{13°}_{4}$	<1850	ign.	i.	i.	s. a.; i. alk.
26	....	....	v. volt.	s.		
27	$4.838^{21°}_{4}$	....	volt.	s.	s.	
28	$11.28^{18°}$	....	....	dec.	dec.	s. a.
29	....	....	....	v. s.		
30	....	....	....	v. s.	dec.	s. NH_4Cl
31	....	d. 120	....	dec.		
32	....	1000	....	i.	....	i. dil. a.; s. conc. a.
33	$4.68^{20.7°}$	69.5^{2} atm.	....	s.	....	s. CCl_4, chl.; i. CS_2
34	$5.6^{15°}$	500	....	s.	s.	
35	10.95	2176	....	i.	i.	s. HNO_3, H_2SO_4
36	7.31	d.	....	i.	i.	s. HNO_3, H_2SO_4

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Uranium oxide, tri-	UO_3	286.17	yel. powd
2	oxide, per-	$UO_4.2H_2O$	338.20	yel. cryst
3	sulfate, (ous)	$U(SO_4)_2.4H_2O$	502.36	grn. monocl
4	sulfide, di-	US_2	302.30	gr.
5	sulfide, sesqui-	U_2S_3	572.53	gr. blk.
6	Uranyl acetate	$UO_2(C_2H_3O_2)_2.2H_2O$	424.25	yel. monocl
7	ammonium carbonate	$UO_2CO_3.2(NH_4)_2CO_3$	522.33	yel. cryst
8	chloride	UO_2Cl_2	341.08	yel. cryst
9	iodate	$UO_2(IO_3)_2.H_2O$	638.05	
10	nitrate	$UO_2(NO_3)_2.6H_2O$	502.28	rhombic yel
11	phosphate	$UO_2(HPO_4)_2.4H_2O$	534.30	rhombic yel
12	potassium carbonate	$UO_2CO_3.2K_2CO_3$	606.55	yel. cryst
13	sodium carbonate	$UO_2CO_3.2Na_2CO_3$	542.16	yel. cryst
14	sulfate	$UO_2SO_4.3H_2O$	420.28	yel. cryst
15	sulfide	UO_2S	302.23	br.
16	Vanadic acid, meta-	HVO_3	99.97	yel. scales
17	Vanadic acid, pyro-	$H_4V_2O_7$	217.95	amor. br.
18	Vanadium	V	50.96	lt. gr. cryst
19	bromide, tri-	VBr_3	290.71	gr. blk. amor
20	carbide	VC	62.96	
21	chloride, di-	VCl_2	121.87	grn. hex.
22	chloride, tri-	VCl_3	157.33	pink
23	chloride, tetra-	VCl_4	192.79	red liq.
24	fluoride, tri-	VF_3	107.96	grn.
25	fluoride, tri-	$VF_3.3H_2O$	162.01	rhbdr.
26	fluoride, tetra-	VF_4	126.96	yel.
27	fluoride, penta-	VF_5	145.96	
28	oxide, di-	V_2O_2	133.92	lt. gr. cryst
29	oxide, tri-	V_2O_3	149.92	blk. cryst
30	oxide, tetra-	V_2O_4	165.92	bl. cryst
31	oxide, penta-	V_2O_5	181.92	yel.-red rhombic
32	oxydibromide	$VOBr_2$	226.79	br.
33	oxytribromide	$VOBr_3$	306.71	red. liq.
34	oxymonochloride	VOCl	102.42	br. powd.
35	dioxymonochloride	V_2O_2Cl	169.38	yel. cryst.
36	oxydichloride	$VOCl_2$	137.84	grn. tabl.
37	oxytrichloride	$VOCl_3$	173.33	yel. liq.
38	silicide	VSi_2	107.08	met. prisms
39	silicide	V_2Si	129.98	silv. prisms
40	sulfide, di-	V_2S_2	166.05	blk. pl.
41	sulfide, tri-	V_2S_3	198.11	dk. pl.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	5.02–.26	d.	....	i.		
2	....	....	....	hyg.	....	d. HCl
3	....	$-4H_2O$, 300	....	dec.	....	s. dil. a.
4	....	>1100	oxidizes	dec.		s. HCl
5	....	ign.	....	....	....	sl. s. HCl; s. HNO_3
6	....	$-2H_2O$, 275	....	s.	dec.	s. al.
7	....	d.	....	5[illegible]	dec.	s. $(NH_4)_2CO_3$, SO_2 aq.
8	....	....	d	320[illegible]	s.	s. al., eth.
9	5.052$^{18°}$	....	....	0.1214$^{18°}$		
10	2.807	60	118	200	v. s.	v. s. al., eth., acet. a.
11	....	....	....	i.	i.	i. acet. a.
12	....	$-CO_2$, 300	....	7.4$^{16°}$	dec.	i. al.
13	....	....	....	s.	....	i. al.
14	3.280$^{16.5°}$	....	....	16.6$^{13°}$	22.2$^{100°}$	i. al.; s. H_2SO_4
15	....	d. 40–50	....	sl. s.	....	s. al., HCl
16	....	....	....	sl. s.	s.	i. al.; s. alk., NH_4OH
17	....	....	....	sl. s.	s.	i. al.; s. NH_4OH
18	6.025$^{15°}_{15}$	1720	....	i.	i.	s. HNO_3, HF, H_2SO_4
19	....	oxidizes	....	s.		
20	5.36	....	....	....	....	s. HNO_3
21	3.23$^{18°}$	....	....	s.	s.	s. al., eth.
22	3.00$^{18°}$	....	....	s.	s.	s. abs. al., eth.
23	1.865$^{0°}_{4}$	<−18	154	s.	s.	s. abs. al., eth.
24	3.363$^{19°}$	>800	subl.	i.	....	i. al., chl., CS_2
25	....	$-3H_2O$, 130	....	s.	v. s.	i. abs. al.
26	2.975$^{23°}$	d. 325	....	s.	....	s. acet.; sl. s. a., chl.
27	2.177$^{19°}$	....	111.2	s.	....	s. al., chl.; i. CS_2
28	3.64	ign.	....	i.	i.	s. a.
29	4.87$^{18°}_{4}$	....	....	sl. s.	s.	s. HF, HCl, h. H_2SO_4
30	....	....	....	i.	i.	s. a., alk.
31	3.357$^{18°}_{4}$	658	....	0.8$^{20°}$	....	s. a., alk.
32	....	d. 180	....	s.		
33	2.933$^{14.5°}$	130–6	d. 180	s.		
34	....	....	....	i.	....	v. s. HNO_3
35	....	....	....	i.	....	s. HNO_3
36	2.88$^{13°}$	....	....	d.	....	s. dil. HNO_3
37	1.836$^{17.5°}$	<−15	127.19	v. s.	....	s. al.
38	4.42	....	....	i.	i.	} i. al., eth., bz., a.; s. HF
39	....	....	....	i.	i.	}
40	4.2–.4	oxidizes	....	....	....	s. h. H_2SO_4, HNO_3
41	3.7–4.0	oxidizes	....	....	....	s. alk. sulf., alk.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Vanadium sulfide, penta-	V_2S_5	262.24	blk
2	Vanadyl sulfate	$(VO)_2(SO_4)_3$	422.11	blue
3	Water	H_2O	18.02	colorl. liq
4	Xenon	Xe	130.20	colorl. gas
5	Ytterbium	Yb	173.60	
6	acetate	$Yb(C_2H_3O_2)_3.2H_2O$	386.70	hex. pl
7	chloride	$YbCl_3.6H_2O$	388.07	rhombic grn
8	oxalate	$Yb_2(C_2O_4)_3.10H_2O$	791.36	cryst
9	oxide	Yb_2O_3	395.20	
10	oxide	$Yb_2O_3.6H_2O$	503.30	gelat
11	selenate	$Yb_2(SeO_4)_3.8H_2O$	920.93	hex. pl
12	selenite	$Yb_2(SeO_3)_3$	728.80	
13	sulfate	$Yb_2(SO_4)_3$	635.39	
14	sulfate	$Yb_2(SO_4)_3.8H_2O$	779.52	prisms
15	Yttrium	Y	88.90	hex. gr. blk
16	bromate	$Y(BrO_3)_3.9H_2O$	634.79	hex. pr
17	bromide	YBr_3	328.65	
18	bromide	$YBr_3.9H_2O$	490.79	tabl
19	carbonate	$Y_2(CO_3)_3.3H_2O$	411.85	
20	chloride	YCl_3	195.27	pl
21	chloride	$YCl_3.6H_2O$	303.37	rhombic prisms
22	fluoride	$YF_3.\frac{1}{2}H_2O$	154.91	gelat
23	hydroxide	$Y(OH)_3$	139.92	gelat
24	iodide	YI_3	469.70	
25	nitrate	$Y(NO_3)_3.4H_2O$	346.99	prisms
26	nitrate	$Y(NO_3)_3.6H_2O$	383.02	cryst
27	oxalate	$Y_2(C_2O_4)_3.9H_2O$	603.94	
28	oxide	Y_2O_3	225.80	cryst
29	sulfate	$Y_2(SO_4)_3$	465.99	
30	sulfate	$Y_2(SO_4)_3.8H_2O$	610.12	monocl
31	Zinc	Zn	65.38	cryst. silvery
32	acetate	$Zn(C_2H_3O_2)_2$	183.43	monocl.-lvs
33	acetate	$Zn(C_2H_3O_2)_2.3H_2O$	237.48	wh. monocl. pl
34	amide	$Zn(NH_2)_2$	97.43	amor
35	ammonium sulfate	$ZnSO_4.(NH_4)_2SO_4.6H_2O$	401.68	
36	arsenate	$Zn_3(AsO_4)_2.8H_2O$	618.19	monocl. need
37	bromate	$Zn(BrO_3)_2.6H_2O$	429.31	reg
38	bromide	$ZnBr_2$	225.21	need
39	carbonate	$ZnCO_3$	125.38	rhbdr
40	chlorate	$Zn(ClO_3)_2.6H_2O$	340.39	

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of Cold water	Hot water	Alcohol, acids, etc.
1	3.0	oxidizes	....	....	....	s. alk. sulf., alk.
2	....	....	....	v. s.	dec.	s. al.
3	$1.00^{4°}$	0	100	....	....	∞ al.
4	(D) 63.5 (A) 4.422	−140	−109.1	28.4 c.c.$^{17°}$		
5	....	1800				
6	2.09	$-4H_2O$, 100	....	v. s.	v. s.	
7	2.575	150-5	$-6H_2O$, 180	v. s.	v. s.	s. abs. al.
8	2.644	....	....	0.000583	....	sl. s. dil. a.
9	9.175	....	....	i.	i.	s. h. dil. a.
10	....	....	....	i.	....	v. s. a., KOH; i. NH_4OH
11	3.49	....	....	s.		
12	....	....	....	i.		
13	3.62	d. 900	....	$44.2^{0°}$	$4.67^{100°}$	
14	$3.286^{20.6°}$	....	....	s.		
15	$3.80^{15°}$	1490	....	sl. dec.	dec.	v. s. dil. a., h. KOH
16	....	780	$-6H_2O$, 100	158		
17	....	....	....	v. s.	....	s. al.; i. eth.
18	....	....	....	v. s.		s. al.; i. eth.
19	....	....	....	i.	....	sl. s. CO_2 aq.; s. $(NH_4)_2CO_3$ aq.
20	$2.8^{19°}$	160	....	v. s.		
21	$2.18^{18°}$	d. 100	....	v. s.	v. s.	s. al.; i. eth.
22	....	....	....	i.	....	sl. s. a.
23	....	d.	....	i.	i.	i. alk.; s. a., NH_4Cl
24	....	....	....	v. s.	....	s. al.; sl. s. eth.
25	2.682	....	....	s.	....	s. HNO_3
26	....	d.	....	v. s.	....	v. s. al., eth.
27	....	d.	....	0.000137	....	sl. s. HCl
28	$5.35^{18°}$	....	....	i.	i.	s. a.; i. alk.
29	2.612	d. 1000	....	1.52	sl. s.	s. sat. K_2SO_4 aq.
30	2.558	$-8H_2O$, 450	....	9.3	$4.8^{100°}$	s. sl. s. H_2SO_4; i. al.
31	$7.142^{16°}$	419.4	930	i.	i.	s. a., alk., acet. a.
32	1.84	242	subl. in vac.	$30^{25°}$	$44.6^{100°}$	$2.8^{25°}$, $166^{79°}$ al.
33	1.72	235-57	$-3H_2O$, 100	$40^{25°}$	$66.6^{100°}$	
34	....	d.	....	dec.	....	d. al.; i. eth.
35	....	....	....	$7^{0°}$	$42^{80°}$	
36	$3.309^{15°}$	....	....	i.	....	s. HNO_3, H_3AsO_4, alk.
37	2.566	100	$-6H_2O$, 200	100	v. s.	
38	$4.219^{20°}$	394	650	$390^{0°}$	$670^{100°}$	v. s. al., eth., NH_4OH
39	4.42-.45	$-CO_2$, 300	....	$0.001^{15°}$	....	s. a., alk., NH_4 salts
40	....	60	d.	$652^{0°}$	∞	v. s. al.

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Zinc chloride	$ZnCl_2$	136.29	octahdr. or pr. wh.
2	cyanide	$Zn(CN)_2$	117.40	ortho-rhombic pr.
3	ferrocyanide	$Zn_2Fe(CN)_6.3H_2O$	396.70	wh. powd.
4	fluoride	ZnF_2	103.38	monocl. need.
5	fluoride	$ZnF_2.4H_2O$	175.44	
6	hydroxide	$Zn(OH)_2$	99.40	rhombic pr.
7	iodate	$Zn(IO_3)_2.2H_2O$	451.28	
8	iodide	ZnI_2	319.24	octahdr.
9	nitrate	$Zn(NO_3)_2.6H_2O$	297.49	tetrag.
10	nitride	Zn_3N_2	224.16	gray
11	oxalate	$ZnC_2O_4.2H_2O$	189.41	wh. powd.
12	oxide	ZnO	81.38	wh. hex. or amor.
13	oxide, per-	ZnO_2	97.38	yel.
14	oxysulfide	$ZnO.ZnS$	178.82	yel.
15	permanganate	$Zn(MnO_4)_2.6H_2O$	411.34	dk. bl. cryst.
16	phosphate	$Zn_3(PO_4)_2$	386.19	pr.
17	phosphate	$Zn_3(PO_4)_2.4H_2O$	458.26	pr.
18	phosphate	$Zn_3(PO_4)_2.8H_2O$	530.32	rhombic pl.
19	phosphate, acid	$ZnH_4P_2O_8.2H_2O$	295.50	tricl.
20	phosphate, pyro-	$Zn_2P_2O_7$	304.81	
21	phosphide	Zn_3P_2	258.19	octahdr.
22	salicylate	$Zn(C_7H_5O_3)_2.3H_2O$	393.51	need.
23	silicate	$ZnSiO_3$	141.44	hex. pr.
24	sulfate	$ZnSO_4$	161.44	hex. pr.
25	sulfate	$ZnSO_4.6H_2O$	269.54	monocl. or tetrag.
26	sulfate	$ZnSO_4.7H_2O$	287.56	rhombic or monocl.
27	sulfide	ZnS	97.44	yel. reg. tetrahdr. or hex. rhbdr.
28	sulfide (blende)	ZnS	97.44	gr.
29	sulfite	$ZnSO_3.2\frac{1}{2}H_2O$	190.48	
30	Zirconium	Zr	91.00	{cryst. {amor.
31	bromide	$ZrBr_4$	410.66	cryst. powd.
32	carbide	ZrC_2	115.00	
33	chloride	$ZrCl_4$	232.83	
34	fluoride	ZrF_4	167.00	hex.
35	hydroxide	$Zr(OH)_4$	159.03	gelat.
36	iodide	ZrI_4	598.73	red br. cryst.

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. $H_2O = 1$ (A) air = 1 (D) $H_2 = 1$	Melting-point, Deg. C.	Boiling-point, Deg. C	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	$2.907^{25°}_{4}$	365	730	$209^{0°}$	$616^{100°}$	$100^{12.5°}$ al.; v. s. eth.
2	....	d.	....	i.	i.	i. al.; s. alk., KCN
3	....	....	....	i.	i.	i. HCl; s. NH_4OH
4	$4.612^{12°}$	734	....	sl. s.	s.	i. al.; s. h. a.
5	$2.535^{12°}$	$-4H_2O$, 100	....	$1.6^{18°}$	s.	s. NH_4OH, a., alk.
6	3.053	d.	....	$0.00042^{18°}$	i.	s. a., alk.
7	....	....	....	0.877	1.32	s. HNO_3, NH_4OH, alk.
8	4.696	446	624	$430^{0°}$	$510^{100°}$	s. a., $(NH_4)_2CO_3$ aq.
9	$2.065^{13°}$	36.4	$-6H_2O$, 105 131	$324.5^{0°}$	∞	v. s. al.
10	....	....	....	dec.		
11	anh....... $2.582^{17.5°}$	....	....	$0.00079^{18°}$	....	s. a., alk.
12	5.42–.78	....	....	0.001	....	s. a., alk. NH_4Cl
13	....	....	....	i.	....	d. a.
14	....	....	....	....	....	s. HCl
15	....	$-5H_2O$, 100	....	v. s.	v. s.	d. al., a.
16	$3.998^{15°}$	....	....	i.	i.	s. a.
17	2.76–.85	....	....	i.	....	v. s. a., NH_4OH, NH_4 salts
18	$3.109^{15°}$	....	....	i.	....	s. alk.
19	....	....	....	dec.		
20	....	....	....	i.	i.	s. a., alk., NH_4OH
21	$4.55^{13°}$	....	....	i.	....	s. dil. a.
22	....	....	....	$5^{20°}$	....	s. al.
23	$3.52^{25°}_{4}$	1437	....	i.		
24	$3.624^{15°}$	d. 720	....	$43.02^{0°}$	$95.03^{100°}$	sl. s. al.
25	2.07	....	....	s.		
26	$1.966^{16.5°}$	$-7H_2O$, 280	....	$115.2^{0°}$	$633.59^{100°}$	sl. s. al.
27	3.98	1049	subl. 1180	0.00065	i.	v. s. a.; i. acet. a.
28	4.03–.07	1049	subl. 1180	0.00065	i.	v. s. a.; i. acet. a.
29	....	....	....	0.16	dec.	i. al.; s. H_2SO_3, NH_4OH
30	$6.40^{18°}$ 4.15	2350 1500	....	i.	i.	s. HF; sl. s. a.
31	....	....	....	dec.		
32	....	....	....	....	....	s. dil. HF
33	....	....	400	s.	dec.	s. al.
34	$4.433^{16°}$	....	....	1.388	dec.	s. HF
35	3.25	$-2H_2O$, 550	....	0.02	i.	s. a.; i. alk., al.
36	....	....	....	s.	s.	s. a., eth.; sl. s. CS_2

PHYSICAL CONSTANTS OF

	Name	Formula	Mol. wt.	Crystalline form and color
1	Zirconium citrate	$Zr(NO_3)_4.5H_2O$	429.11	
2	oxalate	$Zr(C_2O_4)_2.2Zr(OH)_4$	585.06	
3	oxide, di-	ZrO_2	123.00	amor. or hex
4	oxide, per-	ZrO_3	139.00	
5	oxybromide	$ZrOBr_2.3H_2O$	320.88	need
6	oxychloride	$ZrOCl_2.8H_2O$	322.04	need
7	oxyiodide	$ZrI(OH)_3.3H_2O$	323.00	amor
8	oxyiodide	$ZrI_2O.8H_2O$	504.99	need
9	sulfate	$Zr(SO_4)_2.4H_2O$	355.19	cryst

INORGANIC COMPOUNDS (Continued)

	Sp. Gr. H_2O = 1 (A) air = 1 (D) H_2 = 1	Melting-point, Deg. C.	Boiling-point, Deg. C.	Solubility in 100 parts of		
				Cold water	Hot water	Alcohol, acids, etc.
1	....	d. 100	....	s.	dec.	
2	....	d.	....	i.	....	s. $(NH_4)_2C_2O_4$
3	$5.482_{4}^{14.5°}$	2500	....	i.	i.	s. H_2SO_4, HF
4	....	....	....	....		i. c. dil. H_2SO_4
5	....	....	....	s.		
6	....	....	....	s.	dec.	s. al.
7	....	....	....	v. s.		
8	....	d.	....	v. s.	v. s.	v. s. eth.
9	....	....	....	s.	$146^{39.5°}$	s. H_2SO_4; i. al

PHYSICAL CONSTANTS OF

The following table contains data for over three thousand compounds. The information has been collected from a large number of sources including not only the standard reference works but many modern texts on organic chemistry and on special branches of the subject.

Specific gravities are given at 15° C. where no other temperature is indicated, or at the definite temperature shown by the small figures at the right.

Boiling-points are given at normal atmospheric pressure unless otherwise indicated. Decomposition, occurring near or below the melting or boiling point is indicated by the letter d., preceding the temperature when decomposition occurs before the change of state and following the temperature when decomposition occurs with the change of state: d. 178 indicates that decomposition occurs at 178° C.; 178, d. indicates that the substance changes state with decomposition at 178° C.

Solubilities are indicated by figures giving the mass in grams soluble in 100 c.c. of the solvents. Unless otherwise indicated solubilities under alcohol are for 95% ethyl alcohol.

No.	Name	Synonyms	Formula	Mol. wt.
1	Abietic acid.....	....	$C_{20}H_{30}O_2$..........	302.24
2	Acenaphthene....	....	$C_{10}H_6(CH_2)_2$.......	154.08
3	Acetal..........	....	$CH_3\cdot CH(OC_2H_5)_2$..	118.11
4	Acetaldehyde....	aldehyde........	CH_3CHO..........	44.03
5	Acetaldehyde-semicarbazone	....	$CH_3CH:N\cdot NH\cdot CO\cdot NH_2$	101.08
6	Acetaldoxime....	aldoxime........	$CH_3\cdot CH:NOH$....	59.05
7	Acetamide.......	....	$CH_3\cdot CO\cdot NH_2$......	59.05
8	Acetamidine.....	....	$CH_3\cdot C(NH)NH_2$...	58.06
9	Acetamino-naphthol (1, 2)	....	$CH_3CO\cdot NH\cdot C_{10}H_6\cdot OH$	201.10
10	Acetamino-naphthol (4, 1)	naphthacetol.....	$CH_3CO\cdot NH\cdot C_{10}H_6\cdot OH$	201.10
11	Acetamino-phenol " " (2, 1)	....	$CH_3CO\cdot NH\cdot C_6H_4\cdot OH$	151.08
12	" " (3, 1)	....	$CH_3CO\cdot NH\cdot C_6H_4\cdot OH$	151.08
13	" " (4, 1)	....	$CH_3CO\cdot NH\cdot C_6H_4\cdot OH$	151.08
14	Acetanilide......	antifebrin.......	$C_6H_5\cdot NH\cdot CO\cdot CH_3$	135.08
15	Acetaniside (o.)..	....	$CH_3O\cdot C_6H_4\cdot NH\cdot COCH_3$	165.10
16	Acetbromamide..	....	$C_2H_3O\cdot NHBr$......	137.96
17	Acetcinnamone...	....	$C_6H_5\cdot C_2H_2\cdot CO\cdot CH_3$	146.08
18	Acetic acid......	....	$CH_3\cdot COOH$.......	60.03
19	anhydride......	....	$(CH_3CO)_2O$........	102.05
20	Acetnaphthalide(1)	acetalphanaphthyl-amine	$C_{10}H_7\cdot NH\cdot COCH_3$.	185.10
21	" (2)	acet-betanaphthyl-amine	$C_{10}H_7\cdot NH\cdot COCH_3$.	185.10
22	Acetoacetanilide..	....	$CH_3\cdot CO\cdot CH_2\cdot CO\cdot NH\cdot C_6H_5$	177.10
23	Acetoethylnitrate..	....	$C_2H_4O(C_2H_5\cdot NO_3)_2$..	226.13

ORGANIC COMPOUNDS

The following abbreviations are used: — a., acid; abs., absolute; abt., about; acet., acetone; acet. a., acetic acid; al., alcohol; alk., alkali; amor., amorphous; anh., anhydrous; br., brown; bz., benzene; c., cold; chl., chloroform; colorl., colorless; cryst., crystals; d., under melting-points, boiling-points or solubilities, decomposes; d., in connection with the names of compounds, dextrorotary; dec., decomposes; dil., dilute; dk., dark; deliq., deliquescent; eth., ether; exp., explodes; f., from; feath., feathery; fluores., fluorescent; glac., glacial; glit., glittering; grn., green; h., hot; hex., hexagonal; i., insoluble; ign., ignites; l., laevo-rotary; leaf, leaflets; liq., liquid; lgr., ligroin; lng., long; lust., lustrous; m., meta-; meth., methyl; mic., microscopic; min., mineral; monocl., monoclinic; m.p., melting-point; n., normal; need., needles; o., ortho-; octahdr., octahedral; p., para-; ps., pale; pl., plates; powd., powder; pr., prisms; purp., purple; pyr., pyridine; rac., racemic; rhomb., rhombic; rhbdr., rhombohedral; s., soluble; sc., scales; sl., slightly; sm., small; subl., sublimes; sym., symmetrical; tab., tablets; tetr., tetragonal; tricl., triclinic; trim., trimetric; uns., unsymmetrical; v., very; visc., viscous; w., water; wh., white; yel., yellow; >, above; <, below; ∞, soluble in all proportions.

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	leaf.	....	182	......	i.	v. s.	v. s.
2	need.	1.0687	95	277.5	......	s. h.	....
3	liq.	$0.8314^{20°}$	......	104	5 5 c.	∞	∞
4	liq.	$0.806^{0°}$	−120.7	20.8	∞	∞	∞
5	cryst.	$1.0300^{0°}$	162	......	......	......	....
6	liq. or need.	$0.965^{20°}$	13 or 47	115	∞	∞	∞
7	need. f. chl.	1.139	82	222	v. s.	v. s.	sl. s.
8	....	....	166–7 d.	......	......	s.	s. s.
9	leaf.	....	235 d.	......	......	s.	....
10	need.	....	187	......	i.	s.	....
11	leaf.	....	201	......	s. h.	s.	....
12	need.	....	148–9	......	v. s.	s.	v. sl. s.
13	monocl.	$1.293^{21°}$	166	......	......	......	....
14	white leaf.	$1.211^{4°}$	114.2	303.8	0.5	40	8.3
15	whte.cryst	....	78–84	303–5	v. s. h.	$55.^{21°}$	....
16	pl.	....	70–80 (108)	....	d. 100°	......	v. s.
17	pl.	1.008	42	261	i.	v. s.	s.; s. H_2SO_4
18	liq.	$1.051^{18°}_{18}$	16.7	118.1	∞	∞	∞
19	liq.	$1.080^{15°}$	......	137	dec.	∞	∞
20	colorl. cryst.	....	159	......	s. h.	v. s.	....
21	leaf.	....	132	......	s. h.	s.	....
22	....	....	85	......	sl. s.	s.	s.
23	liq.	$1.045^{19°}$	......	89 expl.	i.	s.	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Acetoglyceral. . .	. . . .	$C_3H_5(OH)O_2C_2H_4$. . .	118.08
2	Aceto-acetic ether.	See *ethyl acetoacetate*		
3	Acetohydroxy-benzoic acid	. . . .	$C_2H_3O \cdot OC_6H_4 \cdot COOH$	180.06
4	Acetol.	acetyl carbinol. . .	$CH_3 \cdot CO \cdot CH_2OH$. . .	74.05
5	Acetone.	dimethyl ketone. .	$CH_3 \cdot CO \cdot CH_3$.	58.05
6	Acetone acid. . . .	hydroxyiso-butyric acid	$(CH_3)_2\ C \cdot (OH) \cdot COOH$	104.06
7	Acetonechloride. .	. . . .	$CH_3 \cdot CCl_2 \cdot CH_3$.	112.96
8	Acetonecyan-hydrine	. . . .	$(CH_3)_2C(OH) \cdot CN$ . .	85.06
9	Acetonediacetic acid	. . . .	$CO(C_2H_4 \cdot COOH)_2$. .	174.08
10	Acetonedicar-boxylic acid	. . . .	$CO(CH_2 \cdot COOH)_2$. . .	146.05
11	Acetone phenyl-hydrazone	. . . .	$(CH_3)_2C : N_2H \cdot C_6H_5$	148.11
12	Acetonitrile.	See *methyl cyanide*		
13	Acetonylurea. . . .	. . . .	$C_5H_8N_2O_3$.	144.08
14	Acetophenine. . . .	. . . .	$C_{23}H_{17}N$.	307.14
15	Acetophenone. . . .	phenyl methyl ketone, hypnone	$CH_3 \cdot CO \cdot C_6H_5$.	120.06
16	Acetophenone-acetone	. . . .	$C_6H_5 \cdot CO \cdot C_2H_4 \cdot CO \cdot CH_3$	176.10
17	Acetophenone-alcohol	hydroxy-aceto-phenone	$C_6H_5CO \cdot CH_2OH$ . . .	136.06
18	Acetopropionic acid (β)	. . . .	$CH_3 \cdot CO \cdot C_2H_4 \cdot COOH$	116.06
19	Acetothioamide. . .	. . . .	$CH_3 \cdot CS \cdot NH_2$.	75.11
20	Acetoxime.	. . . .	$(CH_3)_2C : NOH$.	73.06
21	Acetphenetidide (p.)	phenacetin, oxy-ethyl acetanilide	$CH_3CO \cdot NH \cdot C_6H_4 \cdot OC_2H_5$	179.11
22	Acet-toluide (o.)	. . . .	$CH_3 \cdot C_6H_4 \cdot NH \cdot COCH_3$	149.10
23	" (m.)	. . . .	$CH_3 \cdot C_6H_4 \cdot NH \cdot COCH_3$	149.10
24	" (p.)	. . . .	$CH_3 \cdot C_6H_4 \cdot NH \cdot COCH_3$	149.10
25	Aceturic acid. . . .	. . . .	$(C_2H_3O)NH \cdot CH_2 \cdot COOH$	117.06
26	Acetyl-acetone. . .	. . . .	$CH_3CO \cdot CH_2COCH_3$	100.06
27	Acetylamino-benzoic acid (o.)	. . . .	$CH_3CO \cdot NH \cdot C_6H_4 \cdot COOH$	179.08
28	Acetylamino-benzoic acid (m.)	. . . .	$CH_3CO \cdot NH \cdot C_6H_4 \cdot COOH$	179.08
29	Acetylamino-benzoic acid (p.)	. . . .	$CH_3CO \cdot NH \cdot C_6H_4 \cdot COOH$	179.08
30	Acetylbenzoic acid (o.)	. . . .	$CH_3 \cdot CO \cdot C_6H_4 \cdot COOH$	164.06
31	Acetylbenzoic acid (p.)	. . . .	$CH_3 \cdot CO \cdot C_6H_4 \cdot COOH$	164.06
32	Acetyl-biuret. . . .	. . . .	$CH_3 \cdot CO \cdot NH \cdot CO \cdot NH \cdot CO \cdot NH_2$	145.08
33	bromide.	. . . .	$CH_3 \cdot CO \cdot Br$.	122.94

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in grams per 100 c.c. of		
					Water	Alcohol	Ether
1	liq.	$1.081^{0°}$	......	184–8	sl. s.	s.	....
2							
3	cryst.	....	127	......	s. h.	s.	s.
4	liq.	....	......	145–50	∞	∞	∞
5	liq.	$0.792^{20°}$	−94.6	56.5	∞	∞	∞
6	pr.	....	79; subl. 50	212	v. s.	v. s.	v. s.
7	liq.	$1.827^{16°}$	......	69.7	......	......	....
8	liq.	....	......	120	......	......	....
9	leaf.	....	143	......	......	s.	sl. s.
10	....	....	135	dec.	v. s.	s.	v. sl. s.; i. bz.; i. chl.
11	....	....	16 $1H_2O$; 42 anh.	165	s.	s.	s.; s. dil. min. a.
12							
13	pr.	$0.8018^{4°}$	−41	82	s.	s.	s.
14	need.	....	135	......	......	s.	....
15	pl.	$1.033^{15°}_{15}$	20.5	202	i.	s.	s.
16	....	....	......	dec.	sl. s. c.	......	....
17	hex. pl.	....	86	......	v. s. h.	s.	s.
18	leaf.	$1.1367^{25°}$	......	250–3	......	......	....
19	monocl. pr.	....	108	......	v. s.	s.	....
20	prisms	$0.887^{7.5°}_{4}$	59–60	135	v. s.	v. s.	v. s.
21	leaf.	....	134–5	......	0.11	6	1.3
22	colorl. cryst.	$1.168^{15°}$	107–110	296	0.86	s.	s.
23	cryst.	....	65.5	303	$0.44^{13°}$	......	....
24	need.	....	151–3	307	0.09	10.8	....
25	need.	....	206	......	$2.7^{15°}$	v. s.	i.
26	liq.	$0.987^{15°}$	......	139.6	12.5	∞	∞
27	need.	....	185	......	sl.s.; s.h.	s. h.	s.
28	....	....	248 d.	......	sl. s. h.	sl. s. h.	sl. s.
29	need.	....	250 d.	......	sl. s.	s.	sl. s.
30	cryst.	....	114	......	s. h.	......	....
31	need.	....	200	subl.	sl. s.	sl. s.	sl. s.
32	need.	....	193	......	v. s.	......	v. sl. s.
33	liq.	....	......	81	d.	d.	s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Acetyl-			
1	carbazole (9) ...	....	$C_{12}H_8N \cdot C_2H_3O$....	209.10
2	chloride........	....	$CH_3 \cdot CO \cdot Cl$.......	78.48
3	cyanide........	....	$CH_3 \cdot CO \cdot CN$......	69.03
4	diphenylamine..	....	$(C_6H_5)_2N \cdot C_2H_3O$...	211.11
5	disulfide........	....	$(CH_3 \cdot CO)_2S_2$......	150.18
6	ethylmalonate..	....	$(CH_3 \cdot CO) \cdot CH(CO_2 \cdot C_2H_5)_2$	202.11
7	ethyloxamate...	....	$NH(C_2H_3O) \cdot C_2O_2 \cdot OC_2H_5$	159.08
8	ethylsuccinate..	....	$CH_3 \cdot CO \cdot CH(CH_2 \cdot CO_2C_2H_5)(CO_2C_2H_5)$	216.13
9	glycine........	....	$CH_2(NH \cdot C_2H_3O) \cdot CO_2H$	117.06
10	indol (1).......	....	$C_8H_6(C_2H_3O)N$.....	159.08
11	iodide.........	....	C_2H_3OI...........	169.96
12	isatin..........	....	$C_6H_4 \cdot CO_2 \cdot N(C_2H_3O)$	177.06
13	malic acid.....	....	$C_2H_3(O \cdot C_2H_3O)(COOH)_2$	176.06
14	naphthol.......	....	$C_{10}H_7O \cdot C_2H_3O$.....	186.08
15	peroxide.......	....	$(CH_3CO)_2O_2$.......	118.05
16	phenol.........	....	$C_6H_5O \cdot C_2H_3O$......	136.06
17	phenylene-diamine (p.)	amino-acetanilide	$NH_2 \cdot C_6H_4 \cdot NH \cdot COCH_3$	150.10
18	phenylhydrazine (α)	hydracetin.......	$C_6H_5 \cdot NH \cdot NH \cdot COCH_3$	150.10
19	pyrrol (1)......	....	$C_4H_4N \cdot C_2H_3O$.....	109.06
20	salicylic acid...	aspirin..........	$C_6H_4 < {O \cdot COCH_3 \atop COOH}$	180.06
21	thiourea.......	....	$CS \cdot NH(C_2H_3O)NH_2$	118.13
22	urea..........	....	$NH_2 \cdot CO \cdot NH \cdot COCH_3$	102.06
23	Acetylene.......	....	$HC \vdots CH$.........	26.02
24	dicarboxylic acid	....	$C_2(COOH)_2$........	114.02
25	dichloride......	....	$CHCl : CHCl$......	96.91
26	tetrabromide...	....	$CHBr_2 \cdot CHBr_2$.....	345.68
27	tetrachloride....	tetrachlorethane..	$CHCl_2 \cdot CHCl_2$......	167.84
28	urea...........	....	$C_2H_2(CO \cdot N_2H_2)_2$...	142.08
29	Achroodextrin....	....	$C_{36}H_{62}O_{31}$?	990.50
30	Aconic acid......	....	$CH_2 \cdot CO \cdot O \cdot CH : C \cdot COOH$ (ring)	128.03
31	Aconine.........	....	$C_{25}H_{41}NO_9$.........	499.34
32	Aconitic acid....	equisetic acid....	$C_3H_3(COOH)_3$......	174.05
33	Aconitine........	acetylbenzoyl-aconine	$C_{34}H_{47}O_{11}N(?)$......	645.38
34	hydrobromide...	....	$C_{34}H_{47}O_{11}N \cdot HBr + 2\frac{1}{2}H_2O$	771.35
35	Acridine.........	....	$C_6H_4 < {CH \atop N} > C_6H_4$...	179.08
36	Acrolein.........	acrylic aldehyde..	$CH_2 : CH \cdot CHO$....	56.03

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	need. f. w	....	69	>360 d.	sl. s.	s	s.
2	liq.	$1.105^{20°}$	......	55 (50.9)	d.	d.	s.
3	....	....	......	93	......	......	....
4	lng. need.	....	99.5	......	......	......	s.
5	cryst.	....	20°	d.	i.	s.	s. CS_2
6	liq.	$1.080^{23°}$	......	240	s. N_2CO_3	......	....
7	need.	....	54	......	i.	s.	s.
8	liq.	$1.079\frac{21}{3}^{\circ}$	......	254–6 133–4 8mm.	i.	s	....
9	cryst.	....	d. 130	......	s.	s.	....
10	liq.	....	......	152–3 14mm.	......	......	....
11	br. liq.	$1.98^{17°}$	......	108	d.	......	....
12	yel. pr.	....	141	......	sl. s.	s.	s. bz.
13	cryst.	....	132	d.	......	......	....
14	....	$1.1336^{0°}$	......	296	......	s.	s.
15	leaf.	....	30	63 21mm.	sl. s.	......	∞
16	liq. yel.	1.074	......	193	......	......	....
17	need.	....	159.5	......	sl. s.	v. s.	v. s.
18	colorl. cryst.	....	128–30	......	sl. s.; s. h.	s.	sl. s.
19	liq.	....	......	181–2	v. sl. s.	......	....
20	colorl. cryst.	....	135	......	sl. s.	s.	s.
21	prisms	....	165	......	s. h.	s.	sl. s.
22	....	....	218–9	......	v. s. h.	$1^{20°}$	....
23	gas	0.906(A)	–81	–85	v. sl. s.	s.	25 in 1
24	long pr.	....	175	......	v. s.	v. s.	v. s.
25	liq.	....	......	55	......	......	....
26	yel. liq.	2.97	......	136–7 36mm. d.239–42	i.	s.	∞
27	liq.	$1.58^{25°}$	......	147	i.	∞	∞
28	need.f.w.	....	......	......	$1.333^{15°}$	s.	a.
29	amor. wh.	....	......	......	s.	i.	colorl. w. I
30	rh'b'd. f. w.	....	164	......	$18^{15°}$	......	....
31	....	....	175	......	v. s.	v. s.	i.
32	leaf.	....	191 d.	......	18	$50^{12°}$	sl. s.
33	prisms	....	abt. 190	......	.03	4.5	2.25
34	hex. tab.	....	160–3	......	s.	s.	....
35	leaf.	....	107	abt. 360	v. sl. s.	v. s.	v. s.
36	liq.	0.84	......	52.4	40	s.	s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Acrylic acid	ethylenecarboxylic acid	$CH_2:CH \cdot COOH$	72.03
2	Adenine		$C_5H_5N_5$	135.08
3	Adipic acid		$COOH(CH_2)_4COOH$	146.08
4	Aesculin	esculin	$C_{15}H_{16}O_9$	340.13
5	Aesculetin		$C_9H_6O_4 + H_2O$	196.06
6	Aldehyde.	See *acetaldehyde*		
7	ammonia		$CH_3 \cdot CH(OH)NH_2$	61.06
8	benzoic acid (o.)		$COOH \cdot C_6H_4 \cdot CHO$	150.05
9	" " (m.)		$COOH \cdot C_6H_4 \cdot CHO$	150.05
10	" " (p.)		$COOH \cdot C_6H_4 \cdot CHO$	150.05
11	Aldehydin		$(CH_3)(C_2H_5)C_5H_2N$	120.09
12	Aldehydohydroxybenzoic acid (3, 1, 4)		$C_6H_3(OH)(COOH)(CHO \cdot)$	166.05
13	Aldehydohydroxybenzoic acid (4, 1, 3)		$C_6H_3(OH)(COOH)(CHO)$	166.05
14	Aldehydohydroxybenzoic acid (3, 1, 2)		$C_6H_3(OH)(COOH)(CHO)$	166.05
15	Aldehydohydroxybenzoic acid (2, 1, 5)		$C_6H_3(OH)(COOH)(CHO)$	166.05
16	Alizarine	dihydroxyanthraquinone (α, β)	$C_6H_4(CO)_2C_6H_2(OH)_2$	240.06
17	amide (o.)		$C_6H_4(CO)_2C_6H_2(OH)(NH_2)$	239.08
18	carboxylic acid		$(COOH)C_6H_3(CO)_2C_6H_2(OH)_2$	284.06
19	Alkanin		$C_{15}H_{14}O_4$	258.11
20	Allantoin		$C_4H_6N_4O_3$	158.08
21	Allanturic acid		$NH_2 \cdot CO \cdot NHCO \cdot CHO$	'116.05
22	Allocinnamic acid		$C_9H_8O_2$	148.06
23	Alloxan	mesoxalylurea	$C_4H_2N_2O_4 + 1$ or $4\ H_2O$	160.05 or 214.10
24	Alloxanic acid		$NH_2 \cdot CO \cdot NH \cdot C_3O_3(OH)$	160.05
25	Alloxantine		$C_8H_4O_7N_4$	268.06
26	Allyl-acetate		$CH_3 \cdot COO \cdot C_3H_5$	100.06
27	acetic acid		$C_3H_5 \cdot CH_2 \cdot COOH$	100.06
28	acetone		$CH_3 \cdot CO \cdot CH_2 \cdot C_3H_5$	98.08
29	acetonitrile		$C_3H_5 \cdot CH_2CN$	81.06
30	alcohol		$CH_2:CH \cdot CH_2OH$	58.05
31	amine		$CH_2:CH \cdot CH_2 \cdot NH_2$	57.06
32	aniline		$C_6H_5 \cdot NH \cdot C_3H_5$	133.06
33	benzene		$C_6H_5 \cdot CH:CH \cdot CH_3$	118.08

ORGANIC COMPOUNDS (Continued)

No	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	liq.	$1.062^{16°}$	7–8	140	∞	......	....
2	need. f. c. H_2O	....	360 d.	......	.09 cold	sl. s.	i.
3	need.	....	153	$265^{100mm.}$	$1.5^{15°}$	v. s.	sl. s.
4	wh. need	....	160	......	0.16 c., 8 h.	sl. s.	sl. s.
5	need.	....	270 d.	......	sl. s. c.	s.	v. sl. s. s. alk.
6							
7	rhomb.	....	70–80	100	v. s.	v. s.	sl. s.
8	leaf.	1.404	97.2	......	v. s.	v. s.	v. s.
7	need.	....	164–6	......	......	......	....
10	wh. need	....	246,(285)	......	s. h.	v. s.	sl. s.
11	....	$.9184^{20°}$	......	173–4	i.	s.	s.
12	need.	....	234	......	sl. s.h.	s.	s.
13	pr.	....	243–4	subl.	s. h.	s.	s.
14	need.	....	179	......	$1.15^{100°}$	s.	....
15	need.	....	248–9	......	$1.150^{100°}$	s.	s.
16	or. need.	....	289–90	430	i. c.	v. s.	v. s.
17	br. need.	....	150	subl.	i.	s.	s.
18	r. need.	....	305	subl.	v. sl. s.	s.	sl. s.
19	r. amor.	....	d. <100	......	i.	sl. s.	s. glac. acet. a.; s. alk.
20	wh. cryst.	....	227–31d.	......	0.6 c.; v. s. h.	v. sl. s.	i.
21	gum.	....	......	......	deliq.	i.	....
22	monocl.	....	68	......	......	......	....
23	pr.	....	d. abt. 170	......	v. s.	s.	....
24	cryst.	....	d.	......	v. s.	1 : 5	sl. s.
25	....	....	......	......	sl. s.	v. sl. s.	v. sl. s.
26	liq.	$0.938^{0°}$	......	$103–4^{734mm.}$	sl. s.	∞	∞
27	liq.	$0.984^{18°}$	......	186–8	sl. s.	v. s.	v. s.
28	liq.	$0.834_{17.5}^{27}°$	......	128–30	i.	......	....
29	liq.	$1.18^{13°}$	......	140	i.	......	....
30	liq.	$0.854^{20°}$	......	96.6	∞	∞	∞
31	liq.	0.769	......	56.0–56.5	v. s.	s.	∞
32	yel. oil	$0.982^{25°}$	......	208–9	sl. s.	s.	....
33	liq.	0.914	......	176–7	......	s.	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Allyl-			
1	benzoate	....	$C_6H_5 \cdot CO_2 \cdot C_3H_5$ ...	162.08
2	bromide	monobromopropylene (γ)	$CH_2 : CH \cdot CH_2Br$...	120.96
3	chloride	monochloropropylene (γ)	$CH_2 : CH \cdot CH_2Cl$...	76.50
4	cinnamate	....	$C_6H_5CH : CH \cdot COO \cdot C_3H_5$	188.10
5	cyanide	....	$CH_2 : CH \cdot CH_2CN$..	67.05
6	ether	....	$(CH_2 : CH \cdot CH_2)_2O$..	98.08
7	formate	....	$HCOO \cdot C_3H_5$.......	86.05
8	iodide	....	$CH_2 : CH \cdot CH_2I$....	167.97
9	isoamyl ether	....	$C_3H_5 \cdot O \cdot C_5H_{11}$......	128.13
10	isocyanide	....	$CH_2 : CHCH_2NC$...	67.05
11	malonic acid	....	$CH(C_3H_5)(COOH)_2$.	144.06
12	mercaptan	....	$CH_2 : CH \cdot CH_2SH$..	74.11
13	mustard oil	allyl isosulfocyanicester, allyl isothiocyanate	$CH_2 : CH \cdot CH_2NCS$	99.11
14	oxalate	....	$C_2O_4(C_3H_5)_2$........	170.08
15	phenyl ether	....	$C_6H_5 \cdot OC_3H_5$.......	134.08
16	phenylurea	....	$NH(C_3H_5)CONH(C_6H_5)$	176.11
17	pyridine (1)	....	$C_3H_5 \cdot C_5H_4 \cdot N$......	119.08
18	sulfide	thioallyl ether...	$(CH_2 : CH \cdot CH_2)_2S$..	114.14
19	sulfocarbamide..	thiosinamine.....	$C_3H_5 \cdot NH \cdot CS \cdot NH_2$.	116.11
20	thiocyanate	....	$C_3H_5 \cdot SCN$.........	99.11
21	trisulfide	....	$(C_3H_5)_2S_3$..........	178.27
22	Allylene	methyl acetylene, propine	$CH_3 \cdot C : CH$.......	40.03
23	dichloride	....	$C_3H_4Cl_2$...........	110.95
24	oxide	....	$CH_3 \cdot (C : CH)O$....	56.03
25	Aloïn	....	$C_{17}H_{18}O_7 + \frac{1}{2}H_2O$...	343.15
26	Alstonine	....	$C_{21}H_{20}N_2O_4 + 3\frac{1}{2}\ H_2O$	427.22
27	Aluminum-ethyl..	....	$Al(C_2H_5)_3$..........	114.09
28	methyl	....	$Al(CH_3)_3$..........	72.04
29	Amalinic acid	tetramethyl alloxantin	$C_8(CH_3)_4N_4O_7$......	324.13
30				
31	Amarin	triphenyl dihydroglyoxalin	(C_6H_5) $CH \cdot (C_6H_5) \cdot CH$ | | $NH(C_6H_5)C : N$	298.16
32	Amidol.	See *diaminophenol hydrochloride*		
33	Amino-acetanilid (p.)	....	$NH_2 \cdot C_6H_4 \cdot NH \cdot COCH_3$	150.10
34	acetic acid	glycin, glycocoll..	$NH_2 \cdot CH_2 \cdot COOH$...	75.05
35	acetophenone (p.)	....	$NH_2 \cdot C_6H_4COCH_3$	135.08
36	anthraquinone(1)	....	$NH_2 \cdot C_6H_3 : (CO)_2 : C_6H_4$	223.08
37	" (2)	....	$NH_2 \cdot C_6H_3 : (CO)_2 : C_6H_4$	223.08
38	azo-benzene (p.)	aniline yellow....	$NH_2 \cdot C_6H_4 \cdot N_2 \cdot C_6H_5$	197.11
39	azo-naphthalene (4, α, α)	....	$C_{10}H_7 \cdot N_2 \cdot C_{10}H_6 \cdot NH_2$	297.14
40	azophenylene	azimido benzene	$C_6H_4 \cdot NH \cdot N : N$....	119.06

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. $H_2O = 1$ (A)Air = 1	Melting-point °C	Boiling point °C	Solubility in gms per 100 c.c. of Water	Alcohol	Ether
1	....	1.059	......	228	......	......	....
2	liq.	1.436	......	70–71	i.	∞	∞
3	liq.	$0.937^{20°}$	......	44.6–46	i.	s.	∞
4	wh. cryst	$1.052^{25°}_{25}$	......	284–6 d	i.	v. s.	∞
5	....	0.835	......	119	......	s.	....
6	....	$0.805^{18°}$	......	94.3	sl. s.	∞	∞
7	liq.	0.932	......	82–3	......	s.	....
8	yel liq.	$1.89^{18°}$	......	101–2	i.	s.	....
9	liq.	....	......	120	v. sl. s.	∞	∞
10	liq.	$0.794^{17°}$	......	96–106	sl. s.	s.	∞
11	pr.	....	103	d.	s.	s.	s.; s. bz.
12	....	....	......	90	......	∞	∞
13	liq.	$1.017^{10°}$	......	150.7	v. sl. s.	v. s.	v. s.
14	....	1.055	......	217	i.	s.	....
15	....	0.986	......	191.7	i.	......	....
16	need.	....	96–7	......	......	......	....
17	liq.	$0.959^{0°}$	......	189–90	......	......	....
18	....	$0.888^{27°}$	......	140	sl. s.	∞	∞
19	....	....	74	......	v. s.	v. s.	v. s.
20	....	1.056	......	161	i.	......	....
21	liq.	....	......	140	s.	......	....
22	gas	....	−110	−23.5	......	......	3000 c.c.
23	liq.	....	......	75 (84–6)	......	......	....
24	....	....	......	62–3	sl. s.	......	....
25	yel. need.	....	d. 100	......	sl. s. c.	sl. s. c.	s. KOH
26	br. amor.	....	<100; 195 anh.	......	......	s.	v. sl. s.; s. chl.
27	liq.	....	......	194	d.	......	....
28	liq.	....	0	130	......	......	....
29	cryst.	....	......	......	sl. s. h.	v. sl. s.	s. KOH
30							
31	....	....	100; anh. 130	......	i.	s.	s.
32							
33	need.	....	159.5	......	sl. s.	v. s.	v. s.
34	monocl.	1.161	233 d.	......	23	i.	i.
35	yel. pr.	....	105–6	......	v. sl. s.	s.	s.
36	red need.	....	242	......	i.	s.	s.
37	red need.	....	302	subl.	i.	s.	s.; s. 62
38	yel. need.	....	125–6	abt. 360	sl. s. h.	s. h.	s.
39	red need.	....	173–5	......	......	sl. s.	sl. s.
40	need.	....	98.5	......	......	s.	s. bz.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Amino- azotoluene.... $CH_3:N:N:CH_3:NH_2$ 1 2 5 1 2	....	$C_6H_4\cdot CH_3\cdot N_2\cdot C_6H_4\cdot CH_3\cdot NH_2$	226.15
2	1 3 5 1 2	....	$C_6H_4\cdot CH_3\cdot N_2\cdot C_6H_4\cdot CH_3\cdot NH_2$	226.15
3	1 4 5 1 2	....	$C_6H_4\cdot CH_3\cdot N_2\cdot C_6H_4\cdot CH_3NH_2$	226.15
4	1 4 6 1 3	....	$C_6H_4\cdot CH_3\cdot N_2\cdot C_6H_4\cdot CH_3NH_2$	226.15
5	benzaldehyde (o.)	....	$NH_2\cdot C_6H_4\cdot CHO$ ...	121.06
6	" (m.)	....	$NH_2\cdot C_6H_4\cdot CHO$ ...	121.06
7	" (p.)	....	$NH_2\cdot C_6H_4\cdot CHO$ ...	121.06
8	benzamide (o.)..	....	$NH_2\cdot C_6H_4\cdot CONH_2$..	136.08
9	" (m.).	....	$NH_2\cdot C_6H_4\cdot CONH_2$..	136.08
10	" (p.)..	....	$NH_2\cdot C_6H_4\cdot CONH_2$..	136.08
11	benzene.	See *aniline*		
12	benzene-sulfonic acid (o.)	....	$NH_2\cdot C_6H_4\cdot SO_3H + \frac{1}{2}H_2O$	182.14
13	benzene-sulfonic acid (m.)	metanilic acid....	$NH_2\cdot C_6H_4\cdot SO_3H + 1\frac{1}{2}H_2O$	200.15
14	benzene-sulfonic acid (p.)	See *sulphanilic acid*		
15	benzidine (2)...	....	$(NH_2)_2C_6H_3\cdot C_6H_4 NH_2$	199.13
16	benzoic acid (o.)	anthranilic acid...	$NH_2 : C_6H_4\cdot COOH$	137.06
17	" " (m.)	....	$NH_2\cdot C_6H_4\cdot COOH$..	137.06
18	" " (p.)	....	$NH_2\cdot C_6H_4\cdot COOH$..	137.06
19	benzophenone (o.)	....	$C_6H_5\cdot CO\cdot C_6H_4NH_2$	197.10
20	" (m.)	....	$C_6H_5\cdot CO\cdot C_6H_4NH_2$	197.10
21	" (p.)	....	$C_6H_5\cdot CO\cdot C_6H_4NH_2$	197.10
22	benzonitrile (m.)	....	$NH_2\cdot C_6H_4\cdot CN$.....	118.06
23	" (p.)	....	$NH_2\cdot C_6H_4\cdot CN$.....	118.06
24	butyric acid (α)	....	$C_2H_5\cdot CH(NH_2) COOH$	103.08
25	" " (β)	....	$CH_3CH(NH_2)\cdot CH_2\cdot COOH$	103.08
26	camphor	....	$C_{10}H_{15}(NH_2)O$......	167.14
27	cinnamic acid (o.)	....	$NH_2\cdot C_6H_4\cdot CH : CH\cdot COOH$	163.08
28	" " (m.)	....	$NH_2\cdot C_6H_4\cdot CH : CH\cdot COOH$	163.08
29	" " (p.)	....	$NH_2\cdot C_6H_4\cdot CH : CH\cdot COOH$	163.08
30	4 cresol (2).....	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	123.08
31	5 " (2).....	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	123.08
32	6 " (2).....	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	123.08
33	6 " (3).....	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	123.08
34	2 " (4).....	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	123.08
35	3 " (4).....	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	123.08
36	dimethyl aniline (o.)	....	$NH_2\cdot C_6H_4\cdot N(CH_3)_2$	136.11
37	" " (m.)	....	$NH_2\cdot C_6H_4\cdot N(CH_3)_2$	136.11
38	" " (p.)	....	$NH_2\cdot C_6H_4\cdot N(CH_3)_2$	136.11
39	diphenyl (o.)...	....	$NH_2\cdot C_6H_4\cdot C_6H_5$....	169.10
40	" (m.)...	....	$NH_2\cdot C_6H_4\cdot C_6H_5$....	169.10
41	" (p.)...	xenylamine......	$NH_2\cdot C_6H_4\cdot C_6H_5$....	169.10

ORGANIC COMPOUNDS (Continued)

No	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	yel. pl.	....	100	......	......	s.	....
2	yel. need.	....	80	......	sl. s.	s.	....
3	yel. pl.	....	127–8	......	i.	sl. s.	....
4	yel. lvs.	....	127	......	i.	s.	....
5	leaf.	....	39	decomp.	sl. s.	v. s.	v. s.
6	yel. amor.	....	......	......	......	......	....
7	flat plates	....	70	......	s.	......	....
8	leaf.	....	108	......	s. h.	v. s.	sl. s.
9	yellow	....	79	abt. 300	sl. s.	s.	s.
10	yellow	....	178–9	......	sl. s.	......	....
11			(182.9)				
12	prisms	....	......	......	$1.5^{15°}$	sl. s.	sl. s.
13	need. or pr.	....	......	......	s.	sl. s.	sl. s.
14							
15	need.	....	134	......	......	......	....
16	yel. lf.	....	144–5	......	$0.35^{113.8°}$	$10.7^{9.6°}$	$16.05^{6.9}$
17	yel. cryst.	....	174	......	$0.56^{10°}$	$2.2^{10°}$	$1.7^{10°}$
18	yel. cryst.	....	186–7	......	$0.33^{10°}$	$11.3^{10°}$	$6.11^{10°}$
19	yel. leaf.	....	106	......	......	s.	s.
20	need.	....	87	......	i.	s.	s.
21	leaf.	....	124	......	sl. s.	s.	s.
22	need.	....	53–4	288–90	sl. s.	v. sl. s.	v. sl. s.
23	colorl.	....	86	......	v. s. h.	v. s.	v. s.
24	leaf.	....	d.	......	1 : 3.5	1 : 550 h.	....
25	need.	....	184	......	deliq.	i. abs.	i.
26	waxy	....	226–8	246.4	......	......	s. a.
27	need.	....	158–9 d.	......	sl. s. c.; s. h.	s. h.	s.
28	yel. need.	....	180–1	......	sl. s. c.; v. s. h.	v. s.	v. s.
29	yel. need.	....	175–6 d.	......	sl. s. c.; v. s. h.	v. s.	v. s.
30	colorl. leaf. or need.	....	159–61	......	s. c.; v. s. h.	v. s.	v. s.
31	leaf. f. bz.	....	abt. 174	......	s.	v. s.	v. s.
32	need.	....	124–8	......	sl. s.	......	sl. s.
33	warts f. bz.	....	174 d.	......	......	......	....
34	colorl.	....	144.5	......	......	......	....
35	sc. f. eth.	....	135	......	v. sl. s.	v. s.	v. s.
36	....	....	......	218	......	......	....
37	....	....	......	268–70	......	......	....
38	....	....	41	262	......	......	....
39	colorl. leaf.	....	45.5	299	i.	s.	....
40	....	....	30	254	......	......	....
41	colorl. leaf.	....	53	302	sl. s. h.	v. s.	v. s.

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
1	Amino- diphenylamine (o.)	....	$NH_2\cdot C_6H_4\cdot NH\cdot C_6H_5$	184.11
2	ethanol........	....	$NH_2\cdot CH_2\cdot CH_2\cdot OH$	61.06
3	ethyl benzene (o.)	....	$NH_2\cdot C_6H_4\cdot C_2H_5$....	121.10
4	" " (m.)	....	$NH_2\cdot C_6H_4\cdot C_2H_5$....	121.10
5	" " (p.)	....	$NH_2\cdot C_6H_4\cdot C_2H_5$....	121.10
6	guanidine......	....	$(NH)C<^{NHNH_2}_{NH_2}$	74.08
7	hexahydro- benzene	....	$C_6H_5(NH_2)H_6$.....	99.11
8	isocaproic (α) acid	....	$(CH_3)_2CH\cdot CH_2\cdot CH(NH_2)COOH$	131.11
9	isopropylbenzene	....	$C_6H_4(C_3H_2)NH_2$....	130.07
10	isovaleric acid (α)	....	$(CH_3)_2CHCH(NH_2)COOH$	117.10
11	" " (β)	....	$(CH_3)_2C(NH_2)CH_2\cdot COOH$	117.10
12	malonic acid...	....	$NH_2\cdot CH(COOH)_2$..	119.05
13	naphthol (7, 2)..	....	$C_{10}H_6(NH_2)OH$.....	159.08
14	" (1, 2)..	....	$C_{10}H_6(NH_2)OH$.....	159.08
15	" (4, 1)..	....	$C_{10}H_6(NH_2)OH$.....	159.08
16	phenol (o.).....	....	$NH_2\cdot C_6H_4\cdot OH$.....	109.06
17	" (m.).....	....	$NH_2\cdot C_6H_4\cdot OH$.....	109.06
18	" (p.).....	para-amidophenol, rodinol	$NH_2\cdot C_6H_4\cdot OH$.....	109.06
19	propionic acid (α, d.)	d-alanine........	$CH_3\cdot CH(NH_2)COOH$	89.06
20	propionic acid (α, l.)	l-alanine.........	$CH_3\cdot CH(NH_2)COOH$	89.06
21	propionic acid (α, rac.)	d, l-alanine......	$CH_3\cdot CH(NH_2)COOH$	89.06
22	propionic acid (β)	β-alanine........	$CH_2(NH_2)CH_2COOH$	89.06
23	pyridine (2)....	....	$NH_2\cdot C_5H_4N$.......	94.06
24	" (3)....	....	$NH_2\cdot C_5H_4N$.......	94.06
25	" (4)....	....	$NH_2\cdot C_6H_4N$.......	94.06
26	quinoline (2)....	....	$C_9H_6N\cdot NH_2$.......	144.08
27	" (4)....	....	$C_9H_6N\cdot NH_2$.......	144.08
28	salicylic acid (3)	....	$NH_2\cdot C_6H_3(OH)(COOH)$	153.06
29	" " (5)	....	$NH_2\cdot C_6H_3(OH)(COOH)$	153.06
30	thiazol.........	....	$C_3H_2NS\cdot NH_2$......	100.11
31	thiophene......	....	$NH_2C_4H_3S$.........	99.11
32	thiophenol (o.)..	....	$C_6H_4(NH_2)SH$.....	125.13
33	triphenyl- methane	....	$(C_6H_5)_2CH\cdot C_6H_4NH_2$	259.14
34	valeric acid (α)	....	$CH_3CH_2CH_2CH(NH_2)COOH$	117.10
35	" " (γ)	....	$CH_3CH(NH_2)CH_2CH_2COOH$	117.10

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	need. f. w.	....	79–80	......	s.	......	s. a.; i. lgr.; s. bz.
2	colorl. liq.	$1.022^{20°}$	......	171	∞	∞	1
3	liq.	$0.983^{22°}$	......	215–6	......	......	......
4	colorl. liq.	$0.990^{0°}$	......	214–15	......	......	......
5	leaf.	$0.975^{22°}$	5	216–65	......	......	......
6	cryst.	....	d.	......	s.	s.	i.
7	colorl. liq.	$0.8678^{20°}_{4}$	......	134	......	......	......
8	leaf.	....	......	......	1 : 117.5	sl. s.	......
9	....	....	41	257	s.	s.	s. bz.
10	leaf.	....	291.5 d.	......	s.	sl. s.	i.
11	pr.	....	217	......	v. s.	i.	i.
12	colorl.	....	109. d.	......	sl. s.	sl. s.	......
13	need.	....	200 d.	......	s. HCl.	s.	s.
14	leaf.	....	......	......	s. h.	......	s. fluor.
15	....	....	......	......	s. w. d.	w. Fe Cl_3 naphtho	gives quinone
16	rhomb.	....	170	subl.	$1.7^{0°}$	$4.4^{0°}$	v. s.
17	colorl.	....	123	......	2.6	v. s.	v. s.
18	leaf.	....	184 d.	......	$1.1^{0°}$	$4.5^{0°}$	sl. s.
19	colorl.	....	293	......	20	v. sl. s.	......
20	prisms	....	297 d.	......	......	......	......
21	colorl.	....	195	......	v. s.	$0.37^{25°}$	......
22	prisms f. al.	....	196	......	v. s.	v. sl. s. abs.	i.
23	leaf. f. lgr.	....	56	204	......	v. s.	......
24	leaf. f. bz.	....	64	250–2	v. s.	v. s.	v. s.
25	need. f. bz.	....	154.8	......	v. s.	v. s.	s.
26	leaf.	....	129	......	v. sl. s.; s. h.	v. s.	v. s.
27	need. f. w.	....	154 (+H_2O 69–70)	......	s.	s.	v. s. chl.
28	....	....	235 d.	......	......	v. sl. s.	......
29	need.	....	280 d.	......	i.	i.	......
30	yel. pl.	....	90	d.	sl. s.	sl. s.	sl. s.
31	yel. oil	....	......	......	v. s.	v. s.	i.
32	need.	....	26	d.	......	......	......
33	pr. f. etl.	....	84	......	......	......	s.; s. bz., lgr.
34	leaf.	....	$291.^{5}$ d.	......	s.	s.	i.
35	....	....	193	d.	v. s.	sl. s.	i.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Amino-valeric acid (δ)	....	$NH_2 \cdot CH_2CH_2 \cdot CH_2 \cdot CH_2COOH$	117.10
2	Ammelid........	....	$(CN)_3(NH_2)(OH)_2$..	128.06
3	Ammelin........	....	$(CN)_3(NH_2)_2OH$....	127.08
4	Amygdalin......	....	$C_{20}H_{27}NO_{11} + 3H_2O$	511.27
5	Amygdalinic acid	....	$(OH)_7 \cdot C_{12}H_{14}O_4 \cdot C_7H_6 \cdot COOH$	476.22
6	Amyl acetate....	amylacetic ester..	$CH_3COO \cdot C_5H_{11}$....	130.11
7	Amyl alcohol (n.)	....	$CH_3(CH_2)_3CH_2OH$..	88.10
8	" " (act.)	....	$CH_3(C_2H_5)CH \cdot CH_2OH$	88.10
9	" " (sec. α)	methyl-n-propyl carbinol	$CH_3 \cdot CH_2 \cdot CH_2 \cdot CH(OH) \cdot CH_3$	88.10
10	" " (tert.)	dimethyl ethyl carbinol	$(CH_3)_2 \cdot C(OH) \cdot C_2H_5$	88.10
11	aldehyde.......	....	$C_4H_9 \cdot CHO$........	86.08
12	amine..........	....	$CH_3 \cdot (CH_2)_4NH_2$....	87.11
13	benzene (n.)....	phenyl pentane...	$C_6H_5 \cdot C_5H_{11}$........	148.13
14	bromide (n.)....	α-bromopentane..	$CH_3 \cdot (CH_2)_4Br$.....	151.00
15	butyrate.......	....	$C_3H_7 \cdot COOC_5H_{11}$....	158.14
16	carbylamine....	....	$C_5H_{11}NC$..........	97.10
17	cyanide........	caproic nitrile....	$C_5H_{11}CN$..........	97.10
18	dimethylbenzene	....	$C_6H_3(CH_3)_2C_5H_{11}$...	176.16
19	chloride (n.)....	α-chloropentane..	$CH_3(CH_2)_4Cl$.....	106.55
20	ether (n.)......	....	$(C_5H_{11})_2O$..........	158.18
21	formate (n.)....	....	$HCOO \cdot C_5H_{11}$......	116.10
22	glycol (2, 4)....	isoamylene alcohol	$C_5H_{10}(OH)_2$........	104.10
23	" (1, 4)....	....	$C_5H_{10}(OH)_2$........	104.10
24	iodide..........	....	$CH_3(CH_2)_4I$........	198.02
25	isobutyrate.....	....	$C_3H_7COOC_5H_{11}$.....	158.14
26	isothiocyanate..	....	$C_5H_{11}NCS$.........	129.16
27	mercaptan.....	....	$C_5H_{11}SH$..........	104.16
28	methylbenzene..	....	$C_5H_{11}(CH_3)C_6H_4$....	162.14
29	methylether....	....	$C_5H_{11}OCH_3$........	102.11
30	nitrate.........	....	$C_5H_{11}ONO_2$........	133.10
31	nitrite (n.).....	....	$C_5H_{11}NO_2$.........	117.10
32	propionate.....	....	$C_2H_5COOC_5H_{11}$.....	144.13
33	salicylate......	....	$HO \cdot C_6H_4 \cdot COOC_5H_{11}$	208.13
34	valeriate.......	apple oil.........	$C_4H_9COOC_5H_{11}$.....	172.16
35	Amylene (n.)....	propyl ethylene...	$CH_3 \cdot (CH_2)_2 \cdot CH : CH_2$	70.08
36	"	ethyl-methyl-ethylene	$C_2H_5CH : CH \cdot CH_3$	70.08
37	"	trimethyl-ethylene	$(CH_3)_2C : CH \cdot CH_3$	70.08
38	Amyloid........	....	$(C_6H_{10}O_5)x$........	(162.08)x
39	Anaesthesine.....	ethyl para-amino-benzoate	$NH_2 \cdot C_6H_4 \cdot COOC_2H_5$	165.10
40	Anacardic acid...	....	$C_{22}H_{32}O_3$..........	344.26
41	Analgen.........	o-ethoyx-α-benzoyl-aminoquinoline	$C_7H_5O \cdot NH \cdot C_6H_2(OC_2H_5) : C_3H_3N$	292.14

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	leaf.	....	158	d.	v. s.	sl. s.	i.
2	wh.	....	......	......	i.	......	s.
3	mic. need.	....	d.	......	$.0214^{20°}$; $.080^{100°}$	i.	i.; s. KOH
4	rhomb. f. w.	....	214–16	......	$8.3^{10°}$	$0.11^{10°}$	i.
5	cryst.	....	......	......	d.	i.	i
6	liquid	$0.866^{20°}$	......	148	$0.18^{20°}$	∞	∞
7	colorl. liq.	$0.817^{20°}$	......	137.8	$2.7^{22°}$	∞	∞
8	colorl. liq.	$0.817^{18°}$	......	128.7	sl. s.	∞	∞
9	colorl. liq.	$0.824^{0°}$	......	119	16.7	∞	∞
10	colorl. liq.	0.814	−12	102.5	sl. s.	s.	s.
11	liq.	$0.8185^{11°}$	......	102	sl. s.	s.	......
12	colorl. liq.	$0.760^{19°}$	......	104	s.	s.	∞
13	colorl. liq.	$0.860^{22°}$	......	201	......	s.	......
14	colorl. liq.	$1.223^{20°}$	......	128.7 $_{740mm.}$	......	s.	......
15	liq.	....	......	176	sl. s.	v. s.	v. s.
16	liq.	<H_2O	......	137	i.	s.	......
17	liq.	$0.866^{20°}$	......	146	sl. s.	s.	s.
18	liq.	$0.8951^{9°}$	......	232	......	s.	......
19	colorl. liq.	$0.883^{30°}$	......	106.6 $_{740mm.}$	......	s.	......
20	yel. liq.	$0.775^{25°}$	......	169	i.	∞	∞
21	colorl. liq.	$0.902^{0°}$	......	130.4	sl. s.	∞	∞
22	liq.	$0.987^{0°}$	......	177	∞	∞	∞
23	oil	$1.0003^{0°}$	......	219–20	s.	s.	i. lgr.
24	....	$1.517^{20°}$	......	155.4 $_{739mm.}$	......	s.	......
25	....	0.859	......	153–5	sl. s.	......	......
26	liq.	$0.9575^{0°}$	......	183–4	......	......	......
27	liq.	0.8406	......	120	......	......	......
28	liq.	....	......	213	......	......	......
29	liq.	....	......	......	......	......	......
30	liq.	....	......	148	......	......	......
31	pa. yel. liq.	....	......	96	......	......	......
32	liq.	<H_2O	......	100	......	......	......
33	colorl. liq.	1.052	......	276–7	......	33(90%)	......
34	liq.	....	......	196	sl. s.	∞	∞
35	liq.	....	......	39–40	i.	∞	∞
36	colorl. liq.	....	......	36.5	i.	∞	∞
37	colorl. liq.	0.666	......	37.1	v. sl. s.	s.	∞
38	....	....	......	......	s. ammoniacal copper.		
39	rhomb. f. eth.	....	90–91	......	v. sl. s.	s.	14.3
40	cryst.	....	26	......	i.	v. s.	v. s.
41	yel. cryst.	....	206	......	i.	v. sl. s.	s. a.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Anethol (p.)	....	$CH_3 \cdot CH : CH \cdot C_6H_4 \cdot OCH_3$	148.10
2	Angelic acid	....	$C_4H_7 \cdot COOH$	100.06
3	Anhydroformaldehyde-aniline	....	$C_6H_5N : CH_2$	105.06
4	Aniline	amino-benzene, phenyl-amine	$C_6H_5 \cdot NH_2$	93.06
5	Anis alcohol (p.)	anisyl alcohol	$CH_3O \cdot C_6H_4 \cdot CH_2 \cdot OH$	138.08
6	Anisaldehyde (p.)	....	$CH_3O \cdot C_6H_4 \cdot CHO$	136.06
7	Anisic acid (p.)	....	$CH_3O \cdot C_6H_4 \cdot COOH$	152.06
8	Anisidine (o.)	....	$CH_3O \cdot C_6H_4 \cdot NH_2$	123.08
9	" (p.)	....	$CH_3O \cdot C_6H_4 \cdot NH_2$	123.08
10	Anisol	methyl phenyl ether	$C_6H_5 \cdot O \cdot CH_3$	108.06
11	Anthracene	....	$C_6H_4 : (CH)_2 : C_6H_4$	178.08
12	Anthracenecarboxylic acid (α)	....	$C_6H_4C_2H(COOH)C_6H_4$	222.08
13	Anthracenecarboxylic acid (β)	....	$C_6H_4 \cdot C_2H_2 \cdot C_6H_3 \cdot COOH$	222.08
14	Anthracenecarboxylic acid (γ)	....	$C_6H_4 \cdot C_2H_2 \cdot C_6H_3 \cdot COOH$	222.08
15	Anthrachryson	....	$C_{14}H_4(OH)_4O_2$	272.06
16	Anthraflavic acid (2, 6)	....	$C_6H_3(OH)(CO)_2C_6H_3(OH)$	240.06
17	Anthragallol (1, 2, 3)	trihydroxy-anthraquinone	$C_{14}H_5O_2(OH)_3$	256.06
18	Anthramine (β)	β-amino-anthracene	$C_6H_4 : (CH)_2 : C_6H_3 \cdot NH_2$	193.10
19	Anthranil	....	$C_6H_4 : NH \cdot CO$	119.05
20	Anthranilic acid.	See *o.-amino-benzoic acid*		
21	Anthranol	γ-hydroxy-anthracene	$C_{14}H_{10}O$	194.08
22	Anthrapurpurin	trihydroxy anthraquinone (1, 2, 7)	$C_{14}H_5O_2(OH)_3$	256.06
23	Anthraquinoline	....	$C_{17}H_{11}N$	229.10
24	Anthraquinone	....	$C_6H_4 : (CO)_2 : C_6H_4$	208.06
25	Anthrarufin (1, 5)	....	$C_6H_3(OH)(CO)_2C_6H_3(OH)$	240.06
26	Anthrol (m.)	....	$C_6H_4 : (CH)_2 : C_6H_3 \cdot OH$	194.08
27	Antimonytriethyl	....	$Sb(C_2H_5)_3$	208.89
28	Antifebrin.	See *acetanilid*		
29	Antimony pentamethyl	....	$Sb(CH_3)_5$	196.89
30	trimethyl	....	$Sb(CH_3)_3$	166.84
31	Antipyrene	analgesine	$C_{11}H_{12}N_2O$	188.11
32	Apomorphine	....	$C_{17}H_{17}NO_2$	267.14

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O = 1$ (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	lvs.	0.994	21.6	233	v. sl. s.	∞	∞
2	monocl.	$0.954^{76°}$	45.5	185	sl. s.	v. s. h	v. s.
3	mic.	....	d.	......	......	sl. s.	......
4	liquid	$1.022^{20°}$	−6	184.4	$3.1^{16°}$	∞	∞
5	need.	1.113	45	258.8	i.	v. s.	v. s.
6	colorl. liq.	1.126	0	248	sl. s.	∞	∞
7	monocl.	$1.364^{4°}$	184.2	275–80	v. sl. s.; s. h.	v. s.	s.
8	colorl. liq	1.098	5.2	224	sl. s	......	......
9	need. f. h w.	....	57.7	239.5	......	......	......
10	colorl. liq.	$0.988^{21°}$	−37.8	155	i.	s.	s.
11	colorl. leaf.	1.147	216.5	351	i.	$0.59^{15°}$	$1.17^{15°}$
12	yel. need.	....	206 d.	......	sl. s. h.	s.	......
13	yel. need.	....	260	subl.	i.	s.	sl. s.
14	yel. leaf.	....	abt. 280	subl.	......	sl. s.	s. glac. acet. a.
15	need. f. al.; yel. leaf. subl.	....	>360	......	i.	s.	v. sl. s.
16	yel. need.	....	>330	subl. d.	i.	sl. s.	i.
17	or. red need.	....	310	......	s. alk., green	s.	s.
18	yel. need.	....	238	......	v. sl. s	sl. s.	sl. s.
19	colorl.	1.189	18	210–5 d.	s. h. dil. NaOH	v. s.	......
20							
21	pale yel. need.	....	160–70 d.	......	......	......	v. s. h. bz.; s. alk.
22	or. need. f. al.	....	abt. 330	......	sl. s. h.	v. s.	sl. s.
23	leaf.	....	170	446	i.	v. s.	v. s.; s. bz.
24	pale yel. need.	....	284.5	380	i	$0.05^{10°}$ $2.3^{70°}$	v. sl. s.
25	yel. lvs.	....	280	......	s.	sl. s.	s. bz.
26	need.	....	d. 200	......	s. acet.	v. s.	v. s.
27	liq.	$1.324^{16°}$	......	158	i.	s.	s.
28							
29	....	....	......	96–100	i.	......	......
30	....	1.523	......	80.6	sl. s.	i.	s.
31	leaf.	$1.19^{20°}$	111–13	......	100+	100	3.3
32	wh. amor.	....	......	......	sl. s.	s.	s.; sl. s. HCl.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Apoquinine		$C_{19}H_{22}N_2O_2 + 2H_2O$	346.22
2	Arabinic acid		$(C_6H_{10}O_5)_2 \cdot H_2O$	342.18
3	Arabinose (d. or l.)		$C_5H_{10}O_5$	150.08
4	Arabitol	arabite	$C_5H_{12}O_5$	152.10
5	Arabonic acid		$HO \cdot CH_2(CHOH)_3 COOH$	166.08
6	Arachidic acid	arachic acid	$C_{20}H_{40}O_2$	312.32
7	Arbutin		$C_{12}H_{16}O_7 + \frac{1}{2}H_2O$*	281.14
8	Arsenic diethyl		$As(C_2H_5)_2$	133.04
9	Arsenic triethyl		$As(C_2H_6)_3$	162.08
10	Arsenic trimethyl		$As(CH_3)_3$	120.03
11	Asparagine (l.)		$C_2H_3(NH_2)(COOH) \cdot CO \cdot NH_2$	132.08
12	Aspartic acid		$CH(NH_2) \cdot COOH \; CH_2 \cdot COOH$	133.06
13	Aspirin	acetyl-salicylic acid	$C_6H_4<^{O \cdot COCH_3}_{COOH}$	180.06
14	Atrolactic acid		$CH_3 \cdot C(C_6H_5)(OH) COOH + \frac{1}{2}H_2O$	175.09
15	Atropic acid		$CH_2 : C(C_6H_5) \cdot COOH$	148.06
16	Atropine	dauterine, inactive tropine	$C_{17}H_{23}O_3N$	289.19
17	Atropine sulfate		$(C_{17}H_{23}O_3N)_2H_2SO_4$	676.45
18	Auramine		$HN : C[C_6H_4 \cdot N(CH_3)_2]_2$	267.19
19	Aurine	coralline	$C_{19}H_{14} \cdot O_3$	290.11
20	Azelaic acid		$COOH \cdot (CH_2)_7 \cdot COOH$	188.13
21	Azobenzene		$C_6H_5 \cdot N_2 \cdot C_6H_5$	182.10
22	Azobenzoic acid (o.)		$COOH \cdot C_6H_4 \cdot N_2 \cdot C_6H_4 \cdot COOH$	270.10
23	Azobenzoic acid (m.)		$C_{14}H_{10}N_2O_4 + \frac{1}{2}H_2O$	279.10
24	Azobenzoic acid (p.)		$C_{14}H_{10}N_2O_4 + \frac{1}{2}H_2O$	279.10
25	Azodicarbonamide		$NH_2 \cdot CON_2CO \cdot NH_2$	116.06
26	Azodinaphthylamine (α)		$C_{10}H_7 \cdot N_2 \cdot C_{10}H_6 \cdot NH_2$	297.14
27	Azonaphthalene (α, α)		$C_{10}H_7 \cdot N_2 \cdot C_{10}H_7$	282.13
28	Azophenetol (o.)		$(C_6H_4OC_2H_5)_2N_2$	270.16
29	" (p.)		$(C_6H_4OC_2H_5)_2N_2$	270.16
30	Azophenol (o.)	dihydroxy-azobenzene (2, 2′)	$HO \cdot C_6H_4 \cdot N_2 \cdot C_6H_4 \cdot OH$	214.10
31	" (m.)	dihydroxy-azobenzene (3, 3′)	$HO \cdot C_6H_4 \cdot N_2 \cdot C_6H_4 \cdot OH$	214.10
32	" (p.)	dihydroxy-azobenzene (4, 4′)	$HO \cdot C_6H_4 \cdot N_2 \cdot C_6H_4 \cdot OH$	214.10
33	Azotoluene (o.)	dimethyl-azobenzene (2, 2′)	$CH_3 \cdot C_6H_4 \cdot N_2 \cdot C_6H_4 \cdot CH_3$	210.13
34	" (m.)	dimethyl-azobenzene (3, 3′)	$CH_3 \cdot C_6H_4 \cdot N_2 \cdot C_6H_4 \cdot CH_3$	210.13

* Other authorities give $C_{25}H_{34}O_{14}$ and m.p. 144–166° C.

ORGANIC COMPOUNDS (Continued)

No	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	need. f. eth.	....	210	......	s. h.	s.	v. s.; s. chl.; s. bz.; s. CS_2
2	....	....	......	......	v. s.	sl. s.	......
3	rhomb.	....	abt. 160	......	$59^{10°}$	v. sl. s.	i.
4	colorl. warts.	....	102	......	v. s.	v. s. h.	......
5	micr. need.	....	89	......	s.	......	......
6	lvs.	....	77	......	i.	0.45[illegible]°	v. s.
7	need.	....	165–70	......	v. s. h.	v. s.	i.
8	liq.	$>H_2O$	......	185–90	i.	s.	s.
9	liq.	$1.15^{18°}$	......	140	i.	......	......
10	liq.	....	......	<100	......	......	......
11	rhomb.	1.543	230–5 d.	......	$1.8^{10°}$ $53^{100°}$	i.	i.
12	leaf.	....	290.4 d.	......	$0.39^{10°}$ $5.41^{100°}$	i. abs.	......
13	colorl. cryst.	....	135	......	sl. s.	s.	s.
14	rhomb.	....	90; anh. 93	......	s.	......	......
15	monocl. tab.	....	106–6	267 d.	$0.14^{19°}$	s.	s. CS_2
16	need.	....	115–115.5	......	$0.22^{25°}$	68.5	6
17	wh. powd.	....	188	......	260	27	0.05
18	yel. leaf. f. al.	....	136	......	i.	s.	......
19	red need.	....	abt. 220	......	i.; s. alk.	s.	s.
20	leaf.	....	106	abt. 360 d.	0.24[illegible]° v. s. h.	v. s.	2.7
21	or. leaf.	1.203	68	295–7	i.	$8.5^{16°}$	s.
22	dk. yel. need.	....	237 d.	......	v. sl. s.	s.	v. s.
23	wh. amor.	....	......	d.	sl. s.	sl. s.	sl. s.
24	red amor.	....	......	d.	sl. s.	sl. s.	sl. s.
25	red cryst.	....	180 d.	......	sl. s.	i.	......
26	red need.	....	......	(135) 174	i.	sl. s.	s. H_2SO_4
27	red need.	....	186–90	subl.	i.	sl. s.	s. bz.
28	red pr.	....	131	240 d.	i.	s.	s.; s. HCl
29	yel. leaf.	....	160	d.	i.	s. h.	v. s.
30	yel. leaf.	....	171	subl.	i.; s. alk	0.33	v. s.
31	br. leaf.	....	205	......	v. sl. s.	s.	sl. s.
32	br. triclin.	....	204 d.	......	sl. s.	v. s.	v. s.; s. bz.
33	red pr.	....	55	......	i.	$6^{14.5°}$	$147.7^{16.5°}$
34	or. red rhomb.	....	54–5	......	i.	v. s.	v. s.

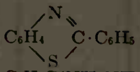
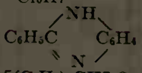
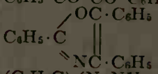
PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Azotoluene (p.)	dimethyl-azobenzene (4, 4′)	$CH_3 \cdot C_6H_4 \cdot N_2 \cdot C_6H_4 \cdot CH_3$	210.13
2	Azoxybenzene		$(C_6H_5)_2 : N_2O$	198.10
3	Azoxybenzoic acid (o.)		$(COOH \cdot C_6H_4)_2N_2O$	286.10
4	Azoxybenzoic acid (m.)		$(COOH \cdot C_6H_4)_2N_2O$	286.10
5	Azoxybenzoic acid (p.)		$(COOH \cdot C_6H_4)_2N_2O$	286.10
6	Azoxynaphthalene (α)		$(C_{10}H_7)_2N_2O$	298.13
7	Baphiīn		$C_{12}H_{10}O_4$	218.08
8	Barbituric acid	malonyl urea	$CO : (NH \cdot CO)_2 : CH_2 + 2H_2O$	164.08
9	Basilicum camphor		$C_{10}H_{16} + 3H_2O$	190.18
10	Bassorine		$C_{16}H_{10}O_5$	282.08
11	Bebeerine		$C_{18}H_{21}NO_3$	299.18
12	Behenic acid		$C_{22}H_{44}O_2$	340.35
13	Behenolic acid		$C_{22}H_{40}O_2$	336.32
14	Benzalacetone	benzylidene-acetone	$C_6H_5C_2H_2COCH_3$	146.08
15	Benzal-acetophenone	chalkon	$C_6H_5C_2H_2 \cdot CO \cdot C_6H_5$	208.10
16	azine		$C_6H_5CH : N \cdot N : CH \cdot C_6H_5$	208.11
17	chloride	benzylidene chloride	$C_6H_5 \cdot CHCl_2$	160.96
18	cyanhydrine	mandelic nitrile	$C_6H_5 \cdot CH(OH) \cdot CN$	133.06
19	Benzaldehyde	art. almond oil	$C_6H_5 \cdot CHO$	106.05
20	phenylhydrazone		$C_6H_5 \cdot CH : N \cdot NH \cdot C_6H_5$	196.11
21	sulfonic acid (α)		$C_6H_4(CHO) \cdot SO_3H$	187.12
22	Benzaldoxime (α) (anti.)		$C_6H_5 \cdot CH : NOH$	121.06
23	Benzaldoxime (β) (syn.)		$C_6H_5 \cdot CH : NOH$	121.06
24	Benzaldoxime carboxylic anhydride (o.)	benzoxazinone	$C_6H_4 \cdot CH : NO \cdot CO$	147.05
25	Benzalhydrazine	benzylidenehydrazine	$C_6H_5 \cdot CH : N \cdot NH_2$	120.08
26	Benzalmalonic acid		$C_6H_5 \cdot CH : C(COOH)_2$	192.06
27	Benzamaron		$C_6H_5 \cdot CH[CH \cdot (C_6H_5)COC_6H_5]_2$	480.22
28	Benzamide		$C_6H_5 \cdot CONH_2$	121.06
29	Benzaurine		$C_6H_5 \cdot C(: C_6H_4O) \cdot C_6H_4OH$	274.11
30	Benzamidine	benzenylamidine	$C_6H_5C(NH)NH_2$	120.08
31	Benzanilide	phenyl benzamide	$C_6H_5 \cdot CO \cdot NH \cdot C_6H_5$	197.10
32	Benzazide	benzoylazide	$C_6H_5 \cdot CON_3$	147.06

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	or. yel. need.	....	144	......	i.; s. lgr.	s.	v. s.
2	yel. need f. h. al.	$1.248^{30°}_{20}$	36.2	d.	i.	$17.5^{16°}$	v. s.
3	pa. yel. leaf.	....	248	dec.	v. sl. s. h.	sl. s.	sl. s.
4	pa. yel. need.	....	320 d.	......	i.	sl. s.	sl. s.
5	yel. amor	....	dec.	......	i.	i.	s. pyr.
6	red rhomb.	....	126.5–7.0	......	s. conc. H_2SO_4	s.	......
7	leaf.	....	......	......	i.	s.	s.
8	rhombs.	....	d.	......	sl. s.	......	......
9	pr.	....	......	......	s. h.	s.	1 : 6
10	amor.	....	......	......	sl. s.	......	......
11	powd.	....	214	......	sl. s	s.	s.
12	colorl. need.	....	84	......	i.	$0.10^{17°}$	$1.92^{16°}$
13	need.	....	56.5	......	i.	v. s. abs.	......
14	tetr. pl.	1.008	42	262	i.	s.	s.
15	rhomb. pl.	....	58	347	i.	......	s. petr. eth.
16	yel. pr.	....	93	d.	i.	v. s. h.	v. s.
17	colorl. liq.	$1.295^{16°}$	−16	213	i.	∞	∞
18	liq.	1.124	−10	d 170	i.	s.	s.
19	colorl. liq.	1.05	−13.5	179.5	0.33	∞	∞
20	colorl.-pink	....	154.5–155.5	......	......	......	......
21	....	....	114	......	s.	......	......
22	colorl. leaf.	$1.11^{29°}$	33–5	118–9 10mm.	sl. s.	v. s.	v. s.
23	colorl. tab. or need.	....	128–30	......	sl. s. bz.	......	v. s.
24	....	....	145 d. to	C_6H_4(C	N)COO	H	......
25	....	....	16	140	......	s.	......
26	pr. f. w.	d. to cinna	mic acid	......	s. h.	s.	sl. s.
27	....	....	219; iso-180	......	1 : 157 h.	sl. s.	......
28	colorl. monocl.	$1.341^{4°}$	128	290	sl. s. h.	$27^{25°}$	v. s.
29	red cryst.	....	100	......	sl. s.	s.	s.
30	cryst.	....	75–80	......	s.	v. s.	sl. s.
31	colorl. leaf.	$1.32^{4°}$	160–1	......	i.	1.7 c.; 14.3 h.	sl. s.
32	pr.	....	29–30	......	i.	v. s.	v. s

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Benzene.	. . . .	C_6H_6.	78.05
2	azo-α-naphthyl-amine	. . . .	$C_6H_5 \cdot N_2 \cdot C_{10}H_6 \cdot NH_2$	247.13
3	hexabromide (α)	. . . .	$C_6H_6Br_6$.	557.54
4	hexachloride (α)	. . . .	$C_6H_6Cl_6$.	290.79
5	" (β)	. . . .	$C_6H_6Cl_6$.	290.79
6	indone.	aposafranone.	$C_{18}H_{12}N_2O$.	272.11
7	pentacarboxylic acid	. . . .	$C_6H(COOH)_5$.	298.05
8	sulfide.	. . . .	$(C_6H_5)_2S$.	186.14
9	sulfinic acid. . . .	. . . .	$C_6H_5 \cdot SO_2H$.	142.11
10	sulfonic acid. . . .	. . . .	$C_6H_5 \cdot SO_3H + 1\frac{1}{2}H_2O$	185.14
11	sulfonic amide. .	. . . .	$C_6H_5 \cdot SO_2NH_2$.	157.13
12	sulfonic chloride	. . . .	$C_6H_5 \cdot SO_2Cl$.	176.56
13	sulfoxide.	. . . .	$(C_6H_5)_2SO_2$.	218.14
14	trisulfonic acid. .	. . . .	$C_6H_3(SO_3H)_3$.	318.24
15	Benzenylami-noxime	. . . .	$C_6H_5C(NOH)NH_2$. .	136.08
16	Benzenylamino-thiophenol	μ-phenylbenzo-thiazole		211.14
17	Benzenylnaphth-ylamidine	. . . .	$C_6H_5C(NH)NH \cdot C_{10}H_7$	246.13
18	Benzenylphenyle-neamidine	. . . .		194.10
19	Benzhydrolether. .	. . . .	$[(C_6H_5)_2CH]_2O$.	350.18
20	Benzhydroxamic acid	. . . .	$C_6H_5C(NOH)OH$. . .	137.06
21	Benzhydrylamine	. . . .	$(C_6H_5)_2CH \cdot NH_2$. . . .	183.11
22	Benzhydrylbenzoic acid (p.)	. . . .	$C_6H_5CH(OH) \cdot C_6H_4COOH$	228.10
23	Benzidine (p.). . . .	4, 4′-diamino-diphenyl (p.)	$NH_2 \cdot C_6H_4 \cdot C_6H_4 \cdot NH_2$	184.11
24	disulfonic acid (o.)	. . . .	$(NH_2)_2C_{12}H_6(SO_3H)_2$	344.24
25	sulfone.	. . . .	$C_{12}H_6(NH_2)_2SO_2$. . . .	246.16
26	Benzil.	dibenzoyl	$C_6H_5 \cdot CO \cdot CO \cdot C_6H_5$	210.08
27	Benzilam.	triphenyloxazole		297.13
28	Benzilosazone. . . .	. . . .	$(C_6H_5C)_2(N \cdot NH \cdot C_6H_5)_2$	390.21
29	Benzildioxime (α)	. . . .	$C_6H_5 \cdot C_2(NOH)_2C_6H_5$	240.11
30	" (β)	. . . .	$C_6H_5 \cdot C_2(NOH)_2C_6H_5$	240.11
31	" (γ)	. . . .	$C_6H_5 \cdot C_2(NOH)_2C_6H_5$	240.11
32	Benziloxime (α). .	. . . .	$C_6H_5CO \cdot C(NOH)C_6H_5$	225.10
33	" (γ). .	. . . .	$C_6H_5CO \cdot C(NOH)C_6H_5$	225.10

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in grms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. rhomb. prisms	$0.879^{20°}$	5.4	80.36	$0.07^{22°}$	∞	∞
2	red need.	....	123	......	s. bz.	s.	s.
3	colorl. monocl.	....	212	......	......	sl. s.	sl. s.
4	colorl. monocl.	$1.87^{20°}$	157	218 345mm.	4.35^1[illegible]° chl.	$6.5^{18°}$ bz.	v. s. aniline
5	colorl.	....	310	subl.	(Less s.	than α in	chl.)
6	red cryst.	....	242	......	sl. s.	s.	s. bz.
7	....	....	......	d.	v. s.	......	......
8	liq.	1.12	......	292	i.	s.	s.
9	prisms	....	83–4	d. 100	s. h.	v. s.	v. s.
10	colorl. leaf.	....	65–6	......	v. s.	v. s.	i.
11	lust. pl.	....	150	......	sl. s.	v. s.	v. s.
12	oil	1.384	14.5	251.5	i.	v. s.	s.
13	....	....	128	subl.	i.	s.	s.
14	cryst + $3H_2O$	....	......	......	deliq	......	......
15	pr.	....	79	......	s. h.	s.	s.
16	need. f. al.	....	115	360	i.	s.	s.
17	pl.	....	141	......	i.	s.	......
18	rhomb. pl.	....	280	......	sl. s.	s.	s. glac. acet. a.
19	monocl. f. bz.	....	109–11	315	......	sl. s.	sl. s.; s. bz.
20	rhomb. lvs. or pl	....	124–5	......	$1 : 44.5^{6°}$	s.	sl. s.
21	hex. pl.	....	......	295	......	......	......
22	need.	....	164–5	d.	s. h.	s.	s.
23	lust. scales f. h. w.	....	128.2–30.7	400–1 740mm.	$0.94^{100°}$	s.	2.2
24	leaf.	....	......	......	sl. s.	sl. s.	sl. s.
25	yel. amor.	....	300 d.	......	i.	i.	i.
26	yel. need.	....	95	346–8 d.	i.	v. s.	v. s.
27	rhomb. pr.	....	115	......	......	sl. s.	sl. s.
28	need.	....	225	......	i.	sl. s.	sl. s.
29	leaf.	....	237	......	i.	sl. s.	i.
30	need.	....	206	......	sl. s. h.	sl. s.	s.
31	need.	....	165	......	......	s.	......
32	leaf.	....	137	......	sl. s.	v. s.	v. s.
33	need.	....	114	......	......	s.	s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Benzilic acid.	. . . .	$(C_6H_5)_2C(OH)\cdot COOH$	228.10
2	Benzimidazole (o.)	. . . .	$C_6H_4\cdot N:CH\cdot NH$ . .	118.06
3	Benzimidazolone (o.)	phenylene urea. . .	$C_6H_4\cdot NH\cdot CO\cdot NH$	134.06
4	Benzoic acid.	. . . .	$C_6H_5\cdot COOH$.	122.05
5	anhydride.	. . . .	$(C_6H_5\cdot CO)_2O$	226.08
6	Benzoin.	. . . .	$C_6H_5\cdot CH(OH)\cdot CO\cdot C_6H_5$	212.10
7	Benzoin ethyl ether	. . . .	$C_6H_5\cdot CH(OC_2H_5)\cdot CO\cdot C_6H_5$	240.13
8	Benzonitrile.	phenyl cyanide. . .	$C_6H_5\cdot CN$.	103.05
9	Benzophenone. . . .	diphenyl ketone. .	$C_6H_5\cdot CO\cdot C_6H_5$.	182.08
10	dicarboxylic acid	. . . .	$CO:(C_6H_4\cdot COOH)_2$	270.08
11	oxime.	. . . .	$(C_6H_5)_2C:NOH$. . . .	197.10
12	Benzophosphinic acid (p.)	. . . .	$COOH\cdot C_6H_4\cdot PO(OH)_2$	202.08
13	Benzopinacone. . .	. . . .	$(C_6H_5)_2\cdot C(OH)\cdot C(OH)(C_6H_5)_2$	366.19
14	Benzoquinone.	See *quinone*		
15	Benzothiophene.	See *thio naphthene*		
16	Benzotichlroride. .	toluene trichloride	$C_6H_5\cdot CCl_3$.	195.41
17	Benzoyl-acetic acid	. . . .	$C_6H_5\cdot CO\cdot CH_2\cdot COOH$	164.06
18	acetone.	. . . .	$C_6H_5\cdot CO\cdot CH_2\cdot CO\cdot CH_3$	162.08
19	acetonitrile. . . .	. . . .	$C_6H_5\cdot CO\cdot CH_2\cdot CN$.	145.06
20	aminobenzoic acid (o.)	. . . .	$NH\cdot(C_7H_5O)\cdot C_6H_4COOH$	241.10
21	aminobenzoic acid (m.)	. . . .	$NH\cdot(C_7H_5O)\cdot C_6H_4COOH$	241.10
22	aminobenzoic acid (p.)	. . . .	$NH\cdot(C_7H_5O)\cdot C_6H_4COOH$	241.10
23	benzoic acid (o.)	. . . .	$C_6H_5\cdot CO\cdot C_6H_4COOH + H_2O$	244.10
24	" " (m.)	. . . .	$C_6H_5\cdot CO\cdot C_6H_4COOH$	226.08
25	" " (p.)	. . . .	$C_6H_5\cdot CO\cdot C_6H_4COOH$	226.08
26	bromide.	. . . .	$C_6H_5\cdot COBr$.	184.96
27	chloride.	. . . .	$C_6H_5\cdot COCl$.	140.50
28	cyanide.	. . . .	$C_6H_5\cdot COCN$.	131.05
29	disulfide.	. . . .	$(C_6H_5\cdot CO)_2S_2$.	274.21
30	fluoride.	. . . .	$C_6H_5\cdot COF$.	124.04
31	formic acid. . . .	. . . .	$C_6H_5\cdot CO\cdot COOH$. . .	150.05
32	glycolic acid	. . . .	$C_7H_5O\cdot OCH_2\cdot COOH$	180.06
33	hydrazine	. . . .	$C_6H_5\cdot CO\cdot NH\cdot NH_2$	136.08
34	hydrogenperoxide	. . . .	$C_6H_5\cdot CO\cdot O_2H$.	138.05
35	iodide.	. . . .	$C_6H_5\cdot COI$.	231.97
36	lactic acid.	. . . .	$CH_3\cdot CH(OC_7H_5O)\cdot COOH$	194.08

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	monocl.	....	150	......	v. s. h.	v. s.	v. s.
2	need.	....	170	......	s.	s.	s.
3	leaf.	....	305	......	sl. s.	s.	......
4	colorl. leaf or need.	1.266	121.2	249.2	$0.29^{20°}$ $5.9^{100°}$	$47^{15°}$ abs.	31.4
5	colorl. rhomb.	1.199	42	360	......	s.	s.
6	hex. f. al.	....	133–7	343–4	i. c.; sl. s. h.	s. h.	......
7	pr.	....	95	184–6	......	s.	s.
8	liq.	$1.000^{25°}$	–13.1	191	$1^{100°}$	∞	∞
9	colorl. rhomb.	$1.098^{50°}_{50}$	(27) 48.0–.5	306	i.	$13.5^{18°}$	$17.5^{13°}$
10	gelat.	....	>300	......	i.	s.	......
11	need.	....	140	......	i.	s.	s. alk.
12	need.	....	>300	......	s.	s.	......
13	pr.	....	168	......	......	s. h. 1 : 39	s.
14							
15							
16	colorl. oil	1.38	–21.2	213–4	dec.	......	......
17	colorl. need.	....	103–4, d.	......	sl. s.	v. s.	v. s.
18	colorl.	....	60–1	......	v. sl. s.	v. s.	v. s.
19	need.	....	80.5	......	......	s.	s.
20	l. need. f. al.	....	182	......	i.	s.	s.
21	red cryst.	$1.5105^{4°}$	174	subl.	sl. s. c.; s. h.	s.	s.
22	sm. need. f. al.	....	278	......	sl. s.	s.	s.
23	tricl. need.	....	85–7	......	s. h.	......	......
24	l. need.	....	161–2	......	sl. s.	s.	s.
25	monocl. lvs. f. w.	....	......	subl.	sl. s.	s.	s.
26	colorl. liq.	1.570	abt. 0	218	d.	s. w. d.	∞
27	colorl. liq.	1.219	–1	198	d.	d.	∞
28	colorl. tab.	....	32–3	206.8	i.	......	......
29	pr.	....	128	d.	i.	sl. s.	sl. s.; s. CS_2
30	liq.	>H_2O	......	161.5	......	......	......
31	cryst.	....	65–6	......	s.	s.	s.
32	lg. pr.	....	......	......	sl. s. c.; s. h.	s.	s.
33	pl.	....	112.5	267	v. s.	v. s.	sl. s.
34	cryst.	....	42	expl.	sl. s.	......	......
35	lvs.	....	d.	......	d.	s.	......
36	pl.	....	112	......	1 : 400 c.; s. h.	s.	s.

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
	Benzoyl-			
1	peroxide		$(C_6H_5 \cdot CO)_2O_2$	242.08
2	phenylhydrazine (α)		$C_6H_5 \cdot CO \cdot NH \cdot NH \cdot C_6H_5$	212.11
3	phthalic acid (1, 2, 3)		$C_6H_5 \cdot CO \cdot C_6H_3 (COOH)_2$	270.08
4	propionic acid (β)		$C_6H_5 \cdot CO \cdot CH_2 \cdot CH_2 \cdot COOH$	178.08
5	terephthalic acid		$C_6H_5 \cdot CO \cdot C_6H_3 (COOH)_2$	270.08
6	tetramethylene		$C_6H_5 \cdot CO \cdot CH(CH_2)_3$	160.10
7	thiourea		$NH_2CSNH(C_7H_5O)$	180.14
8	toluide (o.)		$C_7H_5O \cdot NH \cdot C_6H_4 \cdot CH_3$	211.11
9	" (p.)		$C_7H_5O \cdot NH \cdot C_6H_4 \cdot CH_3$	211.11
10	Benzpinacone		$(C_6H_5)_2C(OH) \cdot C(OH)(C_6H_5)_2$	366.18
11	Benzyl-acetamide		$C_7H_7 \cdot NH(C_2H_3O)$	149.10
12	acetate		$CH_3 \cdot COO \cdot CH_2 \cdot C_6H_5$	150.08
13	aniline		$C_7H_7 \cdot NH \cdot C_6H_5$	183.11
14	azide		$C_6H_5 \cdot CH_2N_3$	133.08
15	aceto-acetic ether		$C_2H_3O \cdot CH(C_7H_7) COOC_2H_5$	220.13
16	alcohol	phenyl carbinol	$C_6H_5 \cdot CH_2OH$	108.06
17	amine		$C_6H_5 \cdot CH_2 \cdot NH_2$	107.08
18	benzoic acid (o.)		$C_6H_5 \cdot CH_2 \cdot C_6H_4 COOH$	212.10
19	" " (p.)		$C_6H_5 \cdot CH_2 \cdot C_6H_4 COOH$	212.10
20	benzoate		$C_6H_5 \cdot COOCH_2 \cdot C_6H_5$	212.10
21	bromide		$C_6H_5 \cdot CH_2 \cdot Br$	170.97
22	carbamate		$NH_2 \cdot COOC_7H_7$	151.08
23	carbinol.	See *phenyl ethyl alcohol*		
24	chloride		$C_6H_5 \cdot CH_2Cl$	126.51
25	cinnamate	cinnamein	$C_9H_7O_2C_7H_7$	238.11
26	cyanamide		C_7H_7NHCN	132.08
27	cyanide		$C_6H_5 \cdot CH_2CN$	117.06
28	cyanurate		$(C_7H_7NCO)_3$	399.19
29	diphenyl (o.)		$C_6H_5 \cdot CH_2 \cdot C_6H_4 \cdot C_6H_5$	244.13
30	" (p.)		$C_6H_5 \cdot CH_2 \cdot C_6H_4 \cdot C_6H_5$	244.13
31	diphenylamine		$C_7H_7 \cdot N(C_6H_5)_2$	259.14
32	disulfide		$(C_6H_5 \cdot CH_2)_2S_2$	246.24
33	ether		$(C_6H_5 \cdot CH_2)_2O$	198.11
34	hydrazine		$C_6H_5 \cdot CH_2 \cdot NH \cdot NH_2$	122.10
35	hydroxylamine (α)		$C_6H_5 \cdot CH_2 \cdot NHOH$	123.08
36	hydroxylamine (β)		$C_6H_5 \cdot CH_2 \cdot NHOH$	123.08
37	iodide		$C_6H_5 \cdot CH_2I$	217.99
38	mercaptan		$C_6H_5 \cdot CH_2 \cdot SH$	124.13

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. rhomb.	....	103.5	......	i.; s. bz.	s.	v. s.
2	colorl.	....	168	......	v. sl. s. h.	s. h.	v. sl. s
3	pl.	....	155	......	s. h.	s.	......
4	need.	....	116	......	s. h.	s.	......
5	....	....	250	......	i.	s.	......
6	....	....	......	258	......	......	......
7	sm. pr.	....	169–70	......	sl. s.	s.	i.
8	need.	....	142–3	......	sl. s. h.	s.	......
9	l. need.	....	155	......	......	s.	s.
10	pr.	....	185	......	......	......	......
11	leaf.	....	(30) 57	300	i.	s.	s.
12	colorl. liq.	$1.057^{16°}$	......	206	v. sl. s.	∞	∞
13	pr. fr. al.	....	32	$200^{50mm.}$	......	s.	......
14	....	....	......	$74^{11mm.}$	......	......	......
15	colorl. liq.	$1.061\frac{25}{25}°$	......	284–90	i.	∞	∞
16	colorl. liq.	$1.043^{20°}$	......	204.7	$4^{17°}$	∞	∞
17	colorl. liq.	$0.980^{20°}$	......	184	∞	∞	∞
18	need.	....	114	subl.	sl. s.	s.	s.
19	need. f. w.	....	154–5	subl.	sl. s.	v. s.	v. s.
20	colorl. liq. or leaf.	$1.114^{19°}$	18.3	323–4	i.	s.	∞
21	liq.	$1.438^{22°}$	–3.9	198.5	i.	∞	∞
22	leaf.	....	86	d.	sl. s.	s.	s.
23							
24	colorl. liq.	$1.103^{18°}$	–41.2	176–9	i.	∞	∞
25	pr.	....	39	dist. in vac.	......	......	......
26	leaf.	....	33	......	i.	s.	s.
27	liq.	$1.021\frac{15}{15}°$	–24.6	233.5	i.	∞	∞
28	need.	....	157	>320	i.	s.	sl. s.
29	monocl. need.	....	54	283–87	......	s.	s.
30	leaf.	....	85	285–6	......	s.	s.
31	....	....	87	......	......	sl. s. c.	......
32	leaf.	....	71	......	......	sl. s. c.; v. s. h.	sl. s.
33	colorl. oil	$1.036^{16°}$	......	295–8	......	v. s. h.	s
34	....	....	......	$103^{41mm.}$	......	......	......
35	....	....	......	$123^{50mm.}$	......	......	......
36	....	....	57	......	......	......	......
37	....	$1.734^{25°}$	24	d.	s. CS_2	sl. s.	s.
38	liq.	$1.058^{20°}$	......	194.5	......	......	......

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Benzyl-			
1	mustard oil.	benzyl-isothiocyanate	$C_6H_5 \cdot CH_2 \cdot NCS$. . . .	149.13
2	naphthalene (α)	. . . .	$C_6H_5 \cdot CH_2 \cdot C_{10}H_7$. . .	218.11
3	" (β)	. . . .	$C_6H_5 \cdot CH_2 \cdot C_{10}H_7$. . .	218.11
4	naphthylketone.	. . . .	$C_6H_5 \cdot CH_2 \cdot CO \cdot C_{10}H_7$	246.11
5	phenanthracene	. . . .	$C_7H_7 \cdot C_6H_3 \cdot C_2H_2 \cdot C_6H_4$	268.13
6	phenol (p.).	. . . .	$C_6H_5 \cdot CH_2 \cdot C_6H_4OH$	184.10
7	pyridine (α). . . .	. . . .	$C_6H_5 \cdot CH_2 \cdot C_5H_4N$. .	169.10
8	" (β). . . .	. . . .	$C_6H_5 \cdot CH_2 \cdot C_5H_4N$. .	169.10
9	sulfide.	. . . .	$(C_7H_7)_2S$.	214.18
10	sulfone.	. . . .	$(C_7H_7)_2SO_2$.	
11	sulfoxide.	. . . .	$(C_7H_7)_2SO$.	246.18
12	tartronic acid. . .	. . . .	$C_7H_7 \cdot C(OH)(COOH)_2$	230.18 210.08
13	thiourea.	. . . .	$NH_2CSNH(C_7H_7)$. .	
14	toluene (m.). . . .	. . . .	$C_7H_7 \cdot C_6H_4 \cdot CH_3$. . . .	166.16
15	" (p.). . . .	. . . .	$C_7H_7 \cdot C_6H_4 \cdot CH_3$. . . .	182.11
16	urea.	benzyl carbamide	$C_6H_5 \cdot CH_2 \cdot NH \cdot CO \cdot NH_2$	182.11 150.10
17	Benzylideneaniline	benzalaniline.	$C_6H_5 \cdot CH : N \cdot C_6H_5$	
18	Benzylidene bromide	benzalbromide. . .	$C_6H_5 \cdot CHBr_2$.	181.10 249.88
19	Benzylidenephenylhydrazine	. . . .	$C_6H_5 \cdot CH : N \cdot NH \cdot C_6H_5$	196.11
20	Benzylidenephthalide	. . . .	$C_6H_5 \cdot CHC \cdot C_6H_4 \cdot CO \cdot O$	222.08
21	Berberine.	. . . .	$C_{20}H_{17}O_4N + 6H_2O$	443.24
22	Berberonic acid. . .	pyridine tricarboxylic acid (2, 4, 5)	$C_5H_5N(COOH)_3$ (2, 4, 5) $+ 2H_2O$	250.10
23	Betaine.	trimethylglycine	$CO \cdot CH_2 \cdot N(CH_3)_3 \cdot O$	117.10
24	Betol.	naphthosalol.	$C_{10}H_7O \cdot CO \cdot C_6H_4(OH)$	264.10
25	Betulin.	. . . .	$C_{36}H_{60}O_3$.	540.48
26	Betulinic acid. . . .	. . . .	$C_{36}H_{54}O_6$.	582.43
27	Bilifuscin.	. . . .	$C_{16}H_{10}N_2O_4$.	294.10
28	Bilirubin.	. . . .	$C_{34}H_{36}N_4O_7$.	612.32
29	Biliverdin.	. . . .	$C_{32}H_{36}N_4O_8$.	604.32
30	Bismuthtriethyl. .	. . . .	$Bi(C_2H_5)_3$.	296.12
31	Biuret.	. . . .	$NH_2 \cdot CO \cdot NH \cdot CO \cdot NH_2 \cdot + H_2O$	121.08
32	Borneol (i.).	. . . .	$C_{10}H_{17}OH$.	154.14
33	" (d.).	Borneo camphor. .	$C_{10}H_{17}OH$.	154.14
34	" acetate (d.)	. . . .	$CH_3 \cdot COOC_{10}H_{17}$. . . .	196.16
35	Bornylamine.	. . . .	$C_{10}H_{17}NH_2$.	153.16

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	....	....	......	243	i.	......	s.
2	monocl. pr. f. al.	$1.166^{17°}$	58.6	330–40	......	1 : 30 h.	1 : 2
3	monocl.	1.176	55	345	......	1 : 44	s. bz.
4	pl. f. al.	....	57	......	......	s.	s.
5	need. f. bz.	....	155–6	......	......	sl. s.	sl bz.
6	need.	....	84	325	......	s.	......
7	....	....	......	276	......	......	......
8	....	....	34	287	......	......	......
9	rhomb. pl. f. eth.	....	49	......	i.	s.	s.
10	need.	....	150	......	......	sl. s. c.	s. bz.
11	leaf.	....	130–3	......	i. c.; s. h.	s.	s.
12	pr.	....	143	d.	s.	s.	......
13	....	....	101	......	s.	......	......
14	liq.	$0.997^{17.5°}$	......	268–9.5	......	s.	s.
15	liq.	$0.995^{17.5°}$	......	279–80	......	s.	s.
16	need.	....	147	......	sl. s.	v. s.	sl. s.
17	yel. need.	....	45	......	i.	s.	s.
18	....	....	......	$130^{20mm.}$	......	......	......
19	monocl. pr.	....	152.5	......	......	s. h.	sl. s.
20	....	....	99; iso. 91	......	......	......	......
21	yel. or or. need.	....	145 d.	......	$22^{21°}$	1 c.; v. s. h	v. sl. s.
22	colorl. tricl.	....	235 d.	......	sl. s. c.; v. s. h.	v. sl. s. h.	i.
23	colorl. monocl.	....	270–6 d.	......	v. s.	s.	......
24	wh. powd.	....	95	......	......	s.	......
25	need.	....	251–2	subl.	......	1 : 118 c.; 1 : 23.4 h.	1 : 250.5 c.; 1 : 32.5 h.
26	wh. powd.	....	195	......	sl. s.	v. s.	......
27	br. powd.	....	......	......	sl. s.	......	sl. s.
28	dk. red rhombs.	....	192–2.5	......	v. sl. s.; s. alk.	sl. s.	v. sl. s.
29	blk. powd.	....	......	......	i.	s.	sl. s.
30	liq.	....	......	......	i.	s.	s.
31	colorl. need.	....	190 d.	......	$1.54^{15°}$ $45.5^{106°}$	v. s.	v. sl. s.
32	colorl. hex. leaf.	1.011	210.5	subl.	v. sl. s.	v. s.	v. s.
33	colorl. hex. leaf.	1.011	203.4	212–2	v. sl. s.	v. s.	v. s.
34	colorl.	....	29	223	v. sl. s.	v. s.	s.
35	....	....	158–60	200	sl. s.	v. s.	v. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Bornylchloride . . .	. . . .	$C_{10}H_{17}Cl$	172.59
2	Borontriethyl	. . . .	$B(C_2H_5)_3$	97.94
3	Brassidic acid	. . . .	$C_{22}H_{42}O_2$	338.34
4	Brazileïn	. . . .	$C_{16}H_{12}O_5$	284.10
5	Brazilin	. . . .	$C_{16}H_{14}O_5 + 1\frac{1}{2}H_2O$ . .	313.14
6	Brom-acetic acid	. . . .	$CH_2BrCOOH$	138.94
7	acetone	. . . .	$CH_2Br \cdot CO \cdot CH_3$	136.96
8	acetylene	. . . .	C_2HBr	104.92
9	allyl alcohol . . .	. . . .	$CH_2 : CBr \cdot CH_2OH$	136.96
10	aniline (o.)	. . . .	$Br \cdot C_6H_4NH_2$	171.97
11	" (m.)	. . . .	$Br \cdot C_6H_4NH_2$	171.97
12	" (p.)	. . . .	$Br \cdot C_6H_4NH_2$	171.97
13	anthraquinone (o.)	. . . .	$C_6H_4(CO)_2C_6H_3Br$ . . .	286.97
14	anthraquinone (m.)	. . . .	$C_6H_4(CO)_2C_6H_3Br$ . . .	286.97
15	benzene.	phenyl bromide	C_6H_5Br	
16	benzoic acid (o.)	. . . .	$BrC_6H_4 \cdot COOH$	200.96
17	" " (m.)	. . . .	$BrC_6H_4 \cdot COOH$	200.96
18	" " (p.)	. . . .	$BrC_6H_4 \cdot COOH$	200.96
19	camphor	. . . .	$C_{10}H_{15}BrO$	231.04
20	cinnamic acid (α)	. . . .	$C_6H_5 \cdot CH : CBr \cdot COOH$	226.97
21	" " (β)	. . . .	$C_6H_5 \cdot CBr : CH \cdot COOH$	226.97
22	ethylene	. . . .	$CH_2 : CHBr$	106.94
23	hexahydro-	. . . .	$C_6H_5BrH_6$	163.00
24	benzene			
25	naphthalene (α)	. . . .	$C_{10}H_7Br$	206.97
26	" (β)	. . . .	$C_{10}H_7Br$	206.97
27	nitrobenzene (o.)	. . . .	$BrC_6H_4NO_2$	201.96
28	" (m.)	. . . .	$BrC_6H_4NO_2$	201.96
29	" (p.)	. . . .	$BrC_6H_4NO_2$	201.96
30	phenol (o.)	. . . .	BrC_6H_4OH	172.96
31	" (m.)	. . . .	BrC_6H_4OH	172.96
32	" (p.)	. . . .	BrC_6H_4OH	172.96
33	phthalic acid (v.)	. . . .	$C_6H_3Br(COOH)_2$	244.96
34	styrene (α)	. . . .	$C_6H_5 \cdot CH : CHBr$ . . .	182.97
35	" (β)	. . . .	$C_6H_5 \cdot CBr : CH_2$	182.97
36	toluene (o.)	. . . .	$BrC_6H_4CH_3$	170.97
37	" (m.)	. . . .	$BrC_6H_4CH_3$	170.97
38	" (p.)	. . . .	$BrC_6H_4CH_3$	170.97
39	Bromal	tribromaldehyde . .	$CBr_3 \cdot CHO$	280.76
40	Bromoform	. . . .	$CHBr_3$	252.76
41	Brucine	. . . .	$C_{23}H_{26}O_4N_2 + 4H_2O$	466.29
42	hydrochloride . . .	. . . .	$C_{23}H_{26}O_4N_2 \cdot HCl$	430.69
43	nitrate	. . . .	$C_{23}H_{26}O_4N_2 \cdot HNO_3 + 2H_2O$	493.27

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	....	....	148	......	d. 40°	v. s.	v. s.
2	liq.	$0.691^{23°}$	......	95	......	s.	s.
3	colorl. lvs.	$0.859^{57°}$	60	......	$0.74^{24°}$	v. sl. s. c.	s.
4	rhomb. leaf.	....	......	......	......	s.	s. alk.
5	colorl. need.	....	abt. 250	......	sl. s.	s.	s.
6	colorl. hex.	....	50	208	∞	∞	∞
7	....	....	......	$136.5_{725mm.}$	......	......	......
8	gas	....	......	−2	v. s.	s.	......
9	....	$1.6^{15°}$	......	155	......	......	......
10	....	....	31–1.5	250–1	......	s.	......
11	....	$1.582^{21°}$	18–18.5	251	......	s.	......
12	rhombs.	....	66.4	d.	i.	v. s.	v. s.
13	yel. need. f. bz.	....	188	subl.	......	s.	......
14	yel. need.	....	187	subl.	s. h. bz.	sl. s.	......
15	....	$1.4991\frac{15}{5}°$	−30.5	156.6	......	s.	s.
16	colorl. need.	....	150	subl.	$0.18^{25°}$	v. s.	v. s.
17	colorl. need.	....	155	......	$0.04^{25°}$	v. s.	v. s.
18	colorl. monocl.	....	251	......	v. sl. s. c	s.	v. s.
19	monocl. pr. f. al.	1.437	76	274	s. bz.	sl. s.	s. CS_2
20	need. f. w.	....	130–1	......	......	∞	∞
21	hex. cryst.	....	120	......	s. h.	v. s.	v. s. CS_2
22	....	$1.517^{14°}$	......	$16^{750mm.}$	i.	∞	∞
23	....	....	......	162	......	......	......
24							
25	pr.	$1.487\frac{20}{15}°$	5	279	α bz.	α abs.	∞
36	rhomb. lvs.	$1.605^{0°}$	59	282	s. bz.	6	v. s.
27	....	....	38.5	264.4	i.	v. s.	s.
28	....	....	52.6	257.5	i.	s.	s.
29	monocl.	$1.934^{22°}$	125	259.2	i.	s.	......
30	oil	....	5.6	195	s. alk.	......	......
31	leaf.	....	32–3	236	s. alk.	......	......
32	tetr.	1.840	63–4	238	s. chl.	v. s.	v. s.
33	powd.	....	138–40	......	v. s.	v. s.	v. s.
34	....	....	......	d.	......	......	......
35	....	....	7	219–21	......	......	......
36	liq.	$1.431\frac{15}{5}°$	−26	181	i.	s.	......
37	liq.	$1.410^{20°}$	−40	183	i.	s.	......
38	rhomb.	$1.354^{64°}$	28.5	184–5	i.	s.	s.
39	yel. liq.	2.65	......	174	dec.	......	......
40	colorl. liq.	$2.884^{25°}$	9	151.2	sl. s.	∞	∞
41	monocl.	....	105	......	0.31 c.; $0.67^{100°}$	v. s.	v. sl. s.
42	need.	....	......	......	v. s.	......	......
43	prisms	....	230 d.	......	s.	s.	......

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
1	Brucine sulfate	....	$(C_{23}H_{26}O_4N_2)_2H_2SO_4 + 7H_2O$	1012.64
2	Butane (n.)......	....	$CH_3 \cdot CH_2 \cdot CH_2 \cdot CH_3$	58.08
3	Butyl acetate....	....	$CH_3 \cdot COO \cdot C_4H_9$...	116.10
4	alcohol (n.).....	....	$CH_3 \cdot (CH_2)_2 \cdot CH_2OH$	74.08
5	" (sec.)...	methyl ethyl carbinol	$CH_3 \cdot CH_2 \cdot CHOH \cdot CH_3$	74.08
6	" (iso)....	....	$(CH_3)_2 \cdot CH \cdot CH_2OH$	74.08
7	" (tert.)...	trimethyl carbinol	$(CH_3)_3 \cdot COH$.......	74.08
8	amine (n.)......	....	$CH_3 \cdot (CH_2)_2 \cdot CH_2NH_2$	73.10
9	" (sec.)....	....	$CH_3 \cdot CH(NH_2) \cdot CH_2 \cdot CH_3$	73.10
10	benzene (n.)....	....	$C_6H_5 \cdot C_4H_9$.........	134.11
11	" (iso.)...	....	$C_6H_5 \cdot C_4H_9$.........	134.11
12	" (sec.)...	....	$C_6H_5 \cdot C_4H_9$.........	134.11
13	benzoate (n.)...	....	$C_6H_5 \cdot COO \cdot C_4H_9$...	178.11
14	bromide (n.)....	....	$CH_3 \cdot (CH_2)_2 \cdot CH_2Br$	136.99
15	butyrate (n.)...	....	$C_3H_7 \cdot COO \cdot C_4H_9$...	144.13
16	carbinol........	....	$(CH_3)_3 \cdot C \cdot CH_2OH$..	88.10
17	chloral.........	....	$C_4H_5Cl_3O$..........	175.51
18	" hydrate	....	$C_4H_5Cl_3O + H_2O$...	193.53
19	chloride (n.)....	....	$CH_3 \cdot (CH_2)_2CH_2Cl$..	92.53
20	" (tert.)..	....	$(CH_3)_3C \cdot Cl$........	92.53
21	cyanide (n.)....	valeronitrile.....	$CH_3 \cdot (CH_2)_2CH_2CN$	83.08
22	" (tert.)..	....	$(CH_3)_3C \cdot CN$.......	83.08
23	ether (n.)......	....	$(C_4H_9)_2O$..........	130.14
24	formate........	....	$HCOO \cdot C_4H_9$.......	102.08
25	iodide (n.)......	....	$CH_3(CH_2)_2CH_2I$ ...	184.00
26	" (sec.)....	....	$CH_3 \cdot CH_2 \cdot CHI \cdot CH_3$	184.00
27	" (tert.)....	....	$(CH_3)_3C \cdot I$.........	184.00
28	mustard oil (n.)	....	$CH_3 \cdot (CH_2)_2CH_2NCS$	115.14
29	" " (sec.)	....	$CH_3 \cdot CH_2 \cdot CH(NCS)CH_3$	115.14
30	" " (tert.)	....	$(CH_3)_3C \cdot NCS$......	115.14
31	phenyl ketone...	....	$C_4H_9 \cdot CO \cdot C_6H_5$.....	162.11
32	sulfide (n.).....	....	$[CH_3 \cdot (CH_2)_2CH_2]_2 : S$	146.21
33	" (sec.)....	....	$(CH_3 \cdot CH_2 \cdot CH \cdot CH_3)_2S$	146.21
34	Butylene (n.)....	ethyl ethylene....	$C_2H_5 \cdot CH : CH_2$....	56.06
35	glycol (α)......	....	$CH_3 \cdot CH_2 \cdot CH(OH) \cdot CH_2OH$	90.08
36	" (β)......	....	$CH_3 \cdot CH(OH) \cdot CH_2 \cdot CH_2OH$	90.08
37	" (pseudo)	....	$CH_3 \cdot CH(OH) \cdot CH(OH)CH_3$	90.08
38	Butyramide (n.)..	....	$CH_3 \cdot CH_2 \cdot CH_2 \cdot CONH_2$	87.08
39	Butyric acid (n.)..	....	$CH_3 \cdot (CH_2)_2 \cdot COOH$	88.06
40	aldehyde (n.)...	....	$CH_3 \cdot (CH_2)_2 \cdot CHO$..	72.06
41	anhydride......	....	$[CH_3 \cdot (CH_2)_2CO]_2 \cdot O$	158.11
42	Butyryl chloride (n.)	....	$CH^3 \cdot CH_2 \cdot CH_2 \cdot COCl$	106.51
43	Butyryl chloride (iso.)	....	$(CH_3)_2 \cdot CH \cdot COCl$..	106.51

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O = 1$ (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	long need.	....	......	......	s.	s.	....
2	gas	$0.60^{0°}$ 2.046 (A)	......	1	i.	5.6 c.	....
3	colorl. liq.	$0.882^{20°}$	......	125	sl. s.	∞	∞
4	colorl. liq.	$0.810^{20°}$	......	117	8.3	∞	∞
5	colorl. liq.	$0.819^{22°}$	......	99.8	$29^{20°}$	......	....
6	colorl. liq	$0.806^{15°}$	−108	106.5	$9.5^{18°}$	∞	∞
7	colorl. liq. or rhomb.	$0.781^{25°}$	25	82.9	∞	s.	∞
8	colorl. liq.	$0.740^{20°}$	......	78	v. s.	s.	s.
9	liq.	$0.7557^{15°}$	......	65.5	∞	......	....
10	....	$0.875^{0°}$	......	180	......	......	....
11	....	$0.89^{15°}$	......	167.5	......	......	....
12	....	$0.8726^{16°}$	......	170–2	......	......	....
13	oil	$1.000^{20°}$	......	247.3–9.0	i.	∞	∞
14	liq.	$1.279^{20°}$	......	101	i.	∞	∞
15	colorl. liq.	$0.888^{0°}$	......	165	sl. s.	∞	∞
16	....	$0.812^{20°}$	52–3	113–4	sl. s.	v. s.	v. s.
17	liq.	$1.395^{20°}$	......	164	d.	......	....
18	leaf. f. w.	1.693	78	d.	......	......	....
19	colorl. liq.	$0.887^{20°}$	......	77.5–8.0	i.	∞	∞
20	liq.	$0.8658^{0°}$	......	50–1	......	......	....
21	liq.	$1.000^{20°}$	......	141	i.	s.	s.
22	cryst.	....	15–6	105–6	......	......	....
23	colorl. liq.	$0.769^{40°}$	......	141	s.	......	....
24	colorl. liq.	$0.911^{0°}$	......	106.9	sl. s.	∞	∞
25	liq.	$1.617^{20°}$	......	129.6	i.	∞	∞
26	liq.	1.62	......	117–18	......	......	....
27	liq.	$1.571^{0°}$	......	98–9 d.	......	......	....
28	liq.	....	......	167	i.	v. s.	v. s.
29	liq.	$0.944^{12°}$	......	159.5	......	......	....
30	....	$0.9487^{10°}$	10.5	140	......	......	....
31	liq.	....	......	237.5–8.5	i.	v. s.	v. s.
32	liq.	$0.8523^{0°}$	......	182	i.	......	....
33	liq.	$0.8317^{23°}$	......	165	......	......	....
34	gas	....	1.5–2.5	......	i.	v. s.	v. s.
35	liq.	$1.019^{0°}$	......	191–2	sl. s.	∞	....
36	liq.	1.0259	......	203.5–4.0	sl. s.	s.	i.
37	liq.	$1.048^{0°}$	......	183–4	∞	s.	s.
38	wh. tab.	....	115–6	216	s.	s.	sl. s.
39	colorl. liq.	$0.960^{19°}$	−7.9	162.5	∞	∞	∞
40	colorl. liq.	$0.817^{20°}$	......	73–4	3.7	∞	∞
41	colorl. liq.	0.978	......	191–3	dec.	dec.	∞
42	liq.	$1.0277^{20°}$	......	100–1.5	......	......	....
43	liq.	....	......	92	......	......	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Butyrine	tributyrine	$(C_3H_7 \cdot COO)_3C_3H_5$	302.21
2	Cacodyl		$(CH_3)_2As \cdot As(CH_3)_2$	210.02
3	chloride		$(CH_3)_2AsCl$	140.46
4	oxide		$((CH_3)_2As)_2 \cdot O$	226.02
5	sulfide		$[(CH_3)_2As]_2S$	242.08
6	trichloride		$(CH_3)_2AsCl_3$	211.38
7	Cacodylic acid		$(CH_3)_2AsO \cdot OH$	138.02
8	Caffeic acid		$C_9H_8O_4 + \frac{1}{2}H_2O$	189.07
9	Caffeine	theine, 1, 3, 7-tri-methyl-xanthine	$C_8H_{10}O_2N_4 + H_2O$	212.13
10	Camphane		$C_{10}H_{18}$	138.14
11	Camphene (i.)		$C_{10}H_{16}$	136.13
12	" (d. or l.)		$C_{10}H_{16}$	136.13
13	Campholic acid		$C_{10}H_{18}O_2$	170.14
14	Camphor (d.)		$C_{10}H_{16}O$	152.13
15	Camphoric acid (i.)		$C_8H_{14}(COOH)_2$	200.13
16	" " (d.)		$C_8H_{14}(COOH)_2$	200.13
17	" anhydride		$C_{10}H_{14}O_3$	182.11
18	Camphoronic acid		$C_6H_{11}(COOH)_3$	218.11
19	Camphylamine		$C_9H_{15}(CH_2 \cdot NH_2)$	153.16
20	Cane sugar.	See *sucrose*		
21	Cantharidine		$C_{10}H_{12}O_4$	196.10
22	Capric acid		$CH_3 \cdot (CH_2)_8 \cdot COOH$	172.16
23	Caproic acid (n.)		$CH_3 \cdot (CH_2)_4 \cdot COOH$	116.10
24	Caprylic acid		$CH_3 \cdot (CH_2)_6 \cdot COOH$	144.13
25	Carbamide chloride		$CO \cdot (NH_2) \cdot Cl$	79.48
26	Carbanil	phenyl isocyanate	$C_6H_5 \cdot NCO$	119.05
27	Carbanilid	diphenyl urea	$C_6H_5 \cdot NH \cdot CO \cdot NH \cdot C_6H_5$	212.11
28	Carbazide	carbohydrazide	$CO(NH \cdot NH_2)_2$	90.08
29	Carbazole		$C_6H_4 \cdot NH \cdot C_6H_4$	167.08
30	Carbodiphenylimide		$C(NC_6H_5)_2$	194.10
31	Carbolic acid.	See *phenol*		
32	Carbon dioxide		CO_2	44.00
33	disulfide		CS_2	76.13
34	hexachloride		C_2Cl_6	236.74
35	monoxide		CO	28.00
36	oxysulfide		COS	60.06
37	suboxide		C_3O_2	68.00
38	tetrabromide		CBr_4	331.66
39	tetrachloride	tetrachlormethane	CCl_4	153.83
40	tetraiodide		CI_4	519.73
41	Carbonyl chloride	phosgene	$COCl_2$	98.91
42	disulfethyl		$CO(SC_2H_5)_2$	150.21
43	sulfide	carbon oxysulfide	COS	60.06
44	Carbo-styril	2-hydroxy-quinoline	$HO \cdot C_9H_6N(Py2)$	145.06
45	thialdine		$NH_2CS \cdot S \cdot N(C_2H_4)_2$	162.22

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O = 1$ (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	....	1.052	......	285	i.	v. s.	v. s.
2	colorl. liq.	....	−6	170	sl. s.	s.	s.
3	....	....	......	100	i.	......	....
4	....	1.462	−25	120	i.	......	....
5	....	....	40 d.	>100	s.	s.	....
6	....	....	......	......	d.	......	....
7	rhomb.	....	200 d.	......	v. s.	v. s.	v. sl. s.
8	yel. pr.	....	195	d.	s.	v. s.	....
9	wh. need.	1.23^{19°	229.5–30.5	......	1.35^{16°; 45.5^{60°	2.3^{16° (85%)	0.044^{16°
10	cryst.	....	154	160	......	......	....
11	feath. need.	....	47	157	i.	v. s.	v. s.
12	feath. need. f. al.	....	51–2	159	i.	v. s.	v. s.
13	tricl. pr.	....	95 (106)	250	sl. s. c.	s.	s.
14	colorl. hex.	0.992^{10°	176.4	205.3	v. sl. s.	120^{12°	v. s.
15	....	1.228	208	......	0.76^{25°; 10^{100°	s.	v. s.
16	colorl. monocl.	1.186	187	......	0.62^{12°; 8.3^{100°	112	....
17	rhomb. f. al.	....	220–1	abt. 270 d.	v. sl. s.	v. s.	v. s.
18	sm. need.	....	136–7	......	6	v. s.	v. s.
19	leaf.	0.93^{37°	......	194–6	......	......	....
20							
21	rhomb. pl.	....	218	......	i.	0.03^{18°	0.11
22	colorl. need.	0.930^{37°	31.3	268.4	v. sl. s.	s.	s.
23	colorl. liq.	0.929^{20°	−5.2	205.7	v. sl. s.	s.	s.
24	colorl. lvs.	0.910^{20°	16.5	237.5	0.25^{100°	∞	∞
25	need.	....	50	61	i.	i.	....
26	liq.	1.092^{15°	......	163	d.	interacts	....
27	need. fr. al.	....	236–7	......	v. sl. s.	v. s.	v. s.
28	....	....	152	......	......	......	....
29	colorl. lvs.	....	238.5	354.7	i.	$0.92^{1.4^\circ}$	sl. s.
30	amor.	....	......	330	......	d. h.	d. HCl.
31							
32	gas	1.53 (A)	−65	−80	179.7^{0°; 107.5^{15° c.c.	319.9^{15° c.c.	....
33	colorl. liq.	1.256^{22°	−112.8	46.2	0.22^{22°	∞	∞
34	rhombic.	1.99^{20°	182	187	i.	s.	v. s.
35	gas	0.967(A)	−205.7–7.0	−190	2.5^{15° c.c.	20^{20° c.c.	....
36	gas	2.104(A)	......	−47.5	100c.c.	......	....
37	gas	1.11^{0°	−107	7	dec.	......	s.
38	tab.	3.42	92	189	i.	s.	s.
39	colorl. liq.	1.584^{25°	−19.5	76	0.08^{20°	∞	∞
40	red	4.32^{20°	......	dec.	i.	s.	s.
41	gas	....	<−75	8.2	dec.	dec.	....
42	....	1.085^{19°	......	196.7	......	......	....
43	gas	....	......	......	s.	......	....
44	pr. fr. al.	....	199–200	subl.	v. sl. s.; s. h.	v. s.	v. s.
45	....	....	......	......	i.	sl. s.	i.; s. a.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Carbyl-oxime.	See *fulminic acid*		
2	sulfate.	. . . .	$CH_2O \cdot SO_2 \cdot O \cdot SO_2 \cdot CH_2$	188.16
3	Carmine red	. . . .	$C_{11}H_{12}O_7$.	256.10
4	Carminic acid. . . .	. . . .	$C_{22}H_{22}O_{13}$	494.18
5	Carnine	. . . .	$C_7H_8N_4O + H_2O$ . . .	182.11
6	Carvacrol.	isopropylhydroxy-toluene	$(CH_3)_2CH \cdot C_6H_3 \cdot (CH_3) \cdot OH(4, 1, 2)$	150.11
7	Carvenone.	carveol.	$C_{10}H_{16}O$	152.13
8	Carvomenthene. .	. . . .	$C_{10}H_{18}$.	138.14
9	Carvomenthol. . . .	. . . .	$C_{10}H_{19}OH$	156.16
10	Carvon.	anise oil.	$C_{10}H_{14}O$	150.11
11	Caryophylin	. . . .	$C_{20}H_{32}O_2$.	304.26
12	Catechin	. . . .	$C_{19}H_{18}O_6$.	342.14
13	Catechol.	pyrocatechin.	$C_6H_4(OH)_2$(o.).	110.05
14	Cedrene.	. . . .	$C_{15}H_{24}$.	204.19
15	Cedriret	cörulignon.	$C_{16}H_{16}O_6$.	304.13
16	Cellulose	. . . .	$(C_6H_{10}O_5)x$.	(162.08)x
17	acetate penta-. .	. . . .	$C_6H_5(COOCH_3)_5$. . . .	372.16
18	" tetra-. . .	. . . .	$C_6H_6O(COOCH_3)_4$. .	330.14
19	" tri-.	. . . .	$C_6H_7O_2(COOCH_3)_3$..	288.13
20	nitrate hexa-. . . .	principal constituent of gun cotton	$C_{12}H_{14}O_4(NO_3)_6$.	594.16
21	" penta-. . .	. . . .	$C_{12}H_{15}O_5(NO_3)_5$.	549.16
22	" tetra-. .	constituents of collodion	$C_{12}H_{16}O_6(NO_3)_4$.	504.16
23	" tri-. . . .		$C_{12}H_{17}O_7(NO_3)_3$.	459.16
24	Cerotic acid	. . . .	$C_{26}H_{52}O_2$.	396.42
25	Ceryl alcohol.	. . . .	$C_{26}H_{54}O$ *	382.43
26	Cetyl alcohol.	ethal.	$C_{16}H_{33}OH$.	242.27
27	Cetylene	. . . .	$C_{16}H_{30}$.	222.24
28	Chlor-acetanilide (o.)	. . . .	$Cl \cdot C_6H_4 \cdot NH \cdot C_2H_3O$	169.53
29	Chlor-acetanilide (m.)	. . . .	$Cl \cdot C_6H_4 \cdot NH \cdot C_2H_3O$	169.53
30	Chlor-acetanilide (p.)	. . . .	$Cl \cdot C_6H_4 \cdot NH \cdot C_2H_3O$	169.53
31	acetic acid.	. . . .	$CH_2Cl \cdot COOH$	94.48
32	acetone	. . . .	$CH_2Cl \cdot CO \cdot CH_3$. . . .	92.50
33	acetyl chloride. .	. . . .	$CH_2Cl \cdot COCl$.	112.93

* Also given as $C_{27}H_{56}O$

ORGANIC COMPOUNDS (Continued)

No	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1							
2	cryst.	....	80	......	deliq. d.	......	....
3	red or.	....	......	......	s.	s.	i
4	monocl. pr.	....	136 d.	......	v. s.	s.	v. sl. s.
5	sm. cryst.	....	......	......	s. h.	i.	i.
6	oil	$0.978^{20°}_{20}$	......	236–8	s. al.	......	s.
7	....	0.927	......	232	......	......	....
8	....	....	......	175	......	......	....
9	....	$0.904^{20°}$	......	221–2	......	......	....
10	....	$0.9608^{20°}_{4}$	......	230; $104^{11mm.}$	v. sl. s.	∞	∞
11	cryst.	....	......	280 subl.	i.	sl. s.	v. s.
12	....	....	217	d.	i.	s.	s.
13	colorl. lvs. f. bz.	1.344	104	240–45	v. s.	v. s.	v.
14	liq.	....	......	237	......	......	....
15	blue need.	....	d.	......	s. h.	i.	s. H_2SO_4
16	amor.	abt. 1.5	......	......	i.*	i.	i.
17	amor.	....	......	......	i.	s.	....
18	amor.	....	soft. abt 150	......	i.; i. acet.	i.; i. meth.	i.; i. amyl.‡ acet.
19	amor.	....	......	......	i.	i.; i. acet	i.‡
20	wh. amor.	abt. 1.66	ign. 160–70	......	i.; i. bz.	i.; v. v. sl. s. eth.-al.	i.; s.† nitro-bz.
21	wh. amor.	abt. 1.66	......	......	i.; i. bz.	i.; s. eth.-al.	i
22	wh. amor.	abt. 1.66	......	......	i.; i. bz.	i.; s. eth.-al.	i.; s. meth. al.
23	wh. amor.	abt. 1.66	......	......	i.; i. bz.	s. abs.; s. meth.	s. glac. acet. a.h.
24	need. f. al.	$0.836^{79°}$	78–82.5	dec.	i.; s. acet.	v. sl. s.c.; s. h.	$20^{30°}$ s. bz.
25	colorl. cryst.	....	79	......	i.	s.	s.
26	leaf. f. al.	$0.818^{50°}$	50	344	i.	s.	s.
27	....	....	–25	280–5	......	......	....
28	need.	....	87–8	......	......	s.	s. bz.
29	need.	....	72.5	......	......	s.	s. bz.
30	need.	....	172.5	......	......	s.	s.
31	colorl. rhomb.	$1.398^{34°}$	62–3	186	v. s.	s.	s.
32	colorl. liq.	$1.162^{16°}$	......	119	sl.	∞	∞
33	colorl. liq.	$1.495^{0°}$	......	105–6	d.	d.	....

* Soluble in conc. H_2SO_4 and ammoniacal CuO.
† All nitro celluloses are soluble in acetone, ethyl acetate, amylacetate.
‡ Soluble in chil., glac. acet. a. and nitrobenzene.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Chlor-			
1	acetylene	....	C_2HCl	60.46
2	acrylic acid (α)	....	$CH_2:CCl\cdot COOH$	106.48
3	" " (β)	....	$CHCl:CH\cdot COOH$	106.48
4	aniline (o.)	....	$ClC_6H_4\cdot NH_2$	127.51
5	" (m.)	....	$ClC_6H_4\cdot NH_2$	127.51
6	" (p.)	....	$ClC_6H_4\cdot NH_2$	127.51
7	benzamide (o.)	....	$ClC_6H_4\cdot CONH_2$	155.51
8	" (m.)	....	$ClC_6H_4\cdot CONH_2$	155.51
9	" (p.)	....	$ClC_6H_4\cdot CONH_2$	155.51
10	benzene	phenylchloride	C_6H_5Cl	112.50
11	benzoic acid (o.)	....	ClC_6H_4COOH	156.50
12	" " (m.)	....	ClC_6H_4COOH	156.50
13	" " (p.)	....	ClC_6H_4COOH	156.50
14	benzyl chloride (p.)	....	$Cl\cdot C_6H_4\cdot CH_2Cl$	160.96
15	camphor	....	$C_{10}H_{16}Cl_2$	207.04
16	crotonic acid (α)	....	$CH_3\cdot CH:CCl\cdot COOH$	120.50
17	diphenyl (o.)	....	$Cl\cdot C_6H_4\cdot C_6H_5$	188.53
18	" (m.)	....	$Cl\cdot C_6H_4\cdot C_6H_5$	188.53
19	" (p.)	....	$Cl\cdot C_6H_4\cdot C_6H_5$	188.53
20	ethyl alcohol (2)	....	$CH_2Cl\cdot CH_2OH$	80.50
21	malonic acid	....	$CHCl\cdot(COOH)_2$	138.48
22	naphthalene (α)	....	$C_{10}H_7Cl$	162.51
23	" (β)	....	$C_{10}H_7Cl$	162.51
24	nitro-benzene (o.)	....	$ClC_6H_4\cdot NO_2$	157.50
25	" " (m.)	....	$ClC_6H_4\cdot NO_2$	157.50
26	" " (p.)	....	$ClC_6H_4\cdot NO_2$	157.50
27	nitronaphthalene (α₁, α₂)	....	$C_{10}H_6Cl(NO_2)$	207.51
28	nitronaphthalene (β₁, α₄)	....	$C_{10}H_6Cl(NO_2)$	207.51
29	phenol (o.)	....	$Cl\cdot C_6H_4\cdot OH$	128.50
30	" (m.)	....	$Cl\cdot C_6H_4\cdot OH$	128.50
31	" (p.)	....	$Cl\cdot C_6H_4\cdot OH$	128.50
32	phthalic acid (1, 2, 4)	....	$Cl\cdot C_6H_3(COOH)_2$	200.50
33	picrin	nitro-chloroform, nitrotrichlormethane	CCl_3NO_2	164.38
34	propionic acid (α)	....	$CH_3\cdot CHCl\cdot COOH$	108.50
35	" " β	....	$CH_2Cl\cdot CH_2\cdot COOH$	108.50
36	pyridine (2)	....	ClC_5H_4N	113.50
37	" (3)	....	ClC_5H_4N	113.50
38	" (4)	....	ClC_5H_4N	113.50
39	quinoline (2)	....	ClC_9H_6N	163.51
40	" (3)	....	ClC_9H_6N	163.51
41	" (4)	....	ClC_9H_6N	163.51
42	toluene (o.)	....	$ClC_6H_4\cdot CH_3$	126.51
43	" (m.)	....	$ClC_6H_4\cdot CH_3$	126.51
44	" (p.)	....	$ClC_6H_4\cdot CH_3$	126.51

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	gas	....	spon.	infl.	......	......	......
2	......	....	......	176–81 d.	∞	∞	∞
3	lvs.	....	84–5	......	......	......	......
4	liq.	$1.213^{20°}$	......	207	s. a.	......	s.
5	liq.	$1.216^{20°}$	......	230	s. a.	......	......
6	rhomb.	$1.340^{18°}$	70	230–2	s. h.; s. a.	s.	s.
7	long need.	....	142.4	......	sl. s.	v. s.	v. s.
8	need.	....	134.5	......	sl. s.	v. s.	......
9	need.	....	178.3	......	v. sl. s.	v. s.	v. s.
10	colorl. liq.	$1.106^{20°}$	–45	132	i.	∞	∞
11	colorl. rhomb.	1.540	137, (142)	......	$0.21^{20°}$	v. s.	v. s.
12	colorl. prisms	....	153, (158)	subl.	$0.04^{0°}$	s.	s.
13	colorl. monocl.	$1.541^{24°}$	236 (240–3)	......	v. sl. s.	v. s.	v. s.
14	......	....	29	213–4	......	s. c.; v. s. h.	v. s.
15	need. f. al.	....	155–5.5	......	......	s.	v. s.
16	long. need.	....	97.5	212	......	......	......
17	monocl.	....	34	267–8	......	s. lgr.	......
18	......	....	89	......	......	......	......
19	pr. or sm. need.	....	148	315	......	......	......
20	colorl. liq.	$1.201^{19°}$	......	132	∞	∞	∞
21	prisms	....	133	......	v. s.	v. s.	v. s.
22	colorl.	$1.194^{20°}$	......	263	i.	s.	s.
23	colorl. leaf.	$1.266^{16°}$	56	265	i.	s.	s.
24	need.	$1.368^{22°}$	32.5	246	i.	s.	s.
25	rhomb.	1.534	44.2	235.6	s. bz.	v. s. h.	s.
26	monocl	$1.520^{18°}$	83	239–42	i.	s.	......
27	yel. need.	....	85	......	i.	s.	s.
28	yel. need.	....	116	......	i.	s.	......
29	colorl. liq.	$1.241\frac{18°}{15}$	8.8	175–6	......	s.	......
30	colorl. liq.	$1.245^{16°}$	32.8	214	......	s.	......
31	colorl. liq.	$1.306^{20°}$	42.9	217	v. sl. s.	v. s.	v. s.
32	......	....	......	......	s.	s.	......
33	liq.	$1.692^{0°}$	–69.2	112	i.	∞	∞
34	colorl. liq.	$1.28^{0°}$	......	186	∞	∞	∞
35	colorl. leaf.	....	41.5	203–5	v. s.	v. s.	∞
36	liq.	1.205	......	166^{714mm}	v. sl. s.	......	......
37	liq.	....	......	148^{743mm}	......	......	......
38	liq.	....	......	147–8	s.	......	......
39	need.	$1.275^{17°}$	37–8	275	v. sl. s.	v. s.	v. s.
40	......	....	......	255^{743mm}	......	......	......
41	......	$1.377^{17°}$	34	260–1 $_{744mm}$	......	v. s.	v. s.
42	colorl. liq.	$1.085^{18°}$	–34	157	sl. s.	s.	∞
43	colorl. liq.	$1.072^{20°}$	–47.8	162 (150)	sl. s.	s.	∞
44	colorl. liq.	$1.071^{18°}$	6.5–7.5	162	sl. s.	s.	∞

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Chloral	trichloracetic aldehyde	$CCl_3 \cdot CHO$	147.35
2	alcoholate		$CCl_3 \cdot CH(OH) \cdot O \cdot C_2H_5$	193.43
3	hydrate		$CCl_3 \cdot CH(OH)_2$	165.40
4	Chloranil		$C_6Cl_4O_2$	245.83
5	Chlorhydrine (α)		$CH_2Cl \cdot CHOH \cdot CH_2OH$	110.51
6	Chloroform	trichlormethane	$CHCl_3$	119.38
7	Cholesterol	cholesterin	$C_{26}H_{43}OH + H_2O$	390.37
8	benzoate		$C_{26}H_{43}OC_7H_5O$	476.38
9	Cholic acid		$C_{24}H_{40}O_5 + H_2O$	426.34
10	Choline	bilineurine	$HO \cdot CH_2 \cdot CH_2 \cdot N(CH_3)_3OH$	121.13
11	Chromone	benzo-γ-pyrone	$C_6H_4 \cdot CO \cdot CH : CHO$	146.05
12	Chrysammic acid		$C_{14}H_2(NO_2)_4(OH)_2O_2$	420.06
13	Chrysaniline		$C_{19}H_{15}N_3 + 2H_2O$	321.18
14	Chrysarobine	dyhydroxy-methyl-anthranol	$C_{15}H_{12}O_2$	224.10
15	Chrysazine		$C_6H_3(CO)_2C_6H_3OH$	224.10
16	Chrysene		$C_{18}H_{12}$	228.10
17	Chrysine		$C_{15}H_{10}O_4$	254.08
18	Chrysoïdine		$C_6H_5 \cdot N_2 \cdot C_6H_3(NH_2)_2$	212.13
19	Chrysophanic acid		$C_{14}H_5(OH)_2 \cdot CH_3O_2$	254.08
20	Chrysoquinone		$C_{18}H_{10}O_2$	258.08
21	Cincholepidine		$C_{10}H_9N$	143.08
22	Cinchomeronic acid		$C_5H_3N(COOH)_2$	167.05
23	Cinchonidine		$C_{19}H_{22}N_2O$	294.19
24	Cinchonine		$C_{19}H_{22}ON_2$	294.19
25	bisulfate		$C_{19}H_{22}ON_2 \cdot H_2SO_4 + 4H_2O$	464.34
26	hydrochloride		$C_{19}H_{22}ON_2 \cdot HCl + 2H_2O$	366.69
27	sulfate		$(C_{19}H_{22}ON_2)_2H_2SO_4 + 2H_2O$	722.49
28	Cineolic acid		$C_{10}H_{16}O_5$	216.13
29	Cinnamene	styrene	$C_6H_5 \cdot CH : CH_2$	104.06
30	Cinnamic acid	phenylacrylic acid (β)	$C_6H_5 \cdot CH : CH \cdot COOH$	148.06
31	Cinnamic anhydride		$(C_9H_7O)_2O$	278.11
32	Cinnamic aldehyde		$C_6H_5 \cdot CH : CH \cdot CHO$	132.08
33	Cinnamic carboxylic acid (o.)		$COOH \cdot C_6H_4 \cdot CH : CH \cdot COOH$	192.06

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	colorl. liq	$1.512^{20°}$	−57.5	98	v. s.	∞	∞
2	colorl. cryst.	$1.143^{40°}$	56	115	v. s.	s.	s.
3	colorl. tab.	1.901	57	97–97.5, d.	66	v. s.	s.
4	yel. monocl. pr. f. bz	....	......	subl.	i.	s. h.	....
5	liq.	$1.326^{18°}_{18}$	......	128*	s.	s.	s.
6	colorl. liq.	$1.499^{15°}$	−70	61.2	$0.62^{22°}$	∞	∞
7	monocl. tab.	1.067	148.5	......	i.	20 h.	18
8	pl.	....	150	......	......	i.	s.
9	rhomb. pl.	....	......	......	v. sl. s.	s.	....
10	visc. liq.	....	......	......	s.	s.	....
11	wh. need	....	59	......	i.	s.	s.
12	monocl. yel. pr.	....	expl.	......	i.	s.	s.
13	yel. need.	....	267–70	......	v. sl. s.	sl. s.	....
14	yel. leaf.	....	178 ?	......	i.	s.	s. chl.
15	red need. f. acet. a.	....	191	......	......	s.	s.
16	scl. red fluor.	....	250	448	v. sl. s.	v. s.. s	v. sl. s.
17	yel. leaf.	....	275	subl.	i.	1 : 180 c	sl. s.; s. alk.
18	yel. cryst	....	110	......	sl. s.	s.	s.
19	yel. need.	....	172	subl.	i.	1 : 224 h.	s.
20	or. need.	....	235	subl.	i.	s. b.	sl. s.; s H_2SO_4
21	liq.	....	......	258.8	v. sl. s.	v. s.	v. s.
22	pr. f. HCl.	....	258 d.	......	sl. s.	sl. s.	v. sl. s. c
23	pr.	....	202.5	......	v. sl. s.	$1 : 16.3_{13°}$	$1 : 188^{14}$
24	colorl. need.	....	240–50, d.	......	0.027^{20}	1	0.27
25	octahed.	....	......	......	$217^{14°}$	$111^{14°}$	....
26	colorl. monocl.	....	......	......	4.5 c.	100	0.18
27	rhombic	....	198.5	......	$1.55^{13°}$	$17^{11°}$	....
28	....	0.92	−1	176	d.	......	....
29	colorl. liq	$0.925^{0°}$	......	146	i.	∞	∞
30	colorl. monocl.	$1.248^{4°}$	133	300	$0.1^{20°}$	$23^{20°}$	v. s.
31	cryst.	....	127	......	i.	sl. s.	....
32	colorl. liq	$1.050^{24°}$	−7.5	$128–30^{20mm}$	v. sl. s	∞	∞
33	need. f. w.	....	173–5	......	sl. s.	v. s.	....

*Constant boiling mixture, 42.5% H_2O — boiling point 95.8°.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Cinnamone	....	$(C_6H_5\cdot CH:CH)_2CO$	234.11
2	Cinnamyl alcohol	....	$C_6H_5\cdot CH:CH\cdot CH_2OH$	134.08
3	Cinnamyl chloride	....	$C_9H_7O\cdot Cl$	166.51
4	Cinnamylmethyl-ketone	....	$C_6H_5\cdot C_2H_2COCH_3$	146.08
5	Citraconic acid	....	$C_3H_4(COOH)_2$	130.05
6	Citral	geraniol	$C_9H_{15}\cdot CHO$	152.13
7	Citramalic acid	....	$C_2H_4(COOH)CHOH\cdot COOH$	148.06
8	Citrene	....	$C_{10}H_{16}$	136.13
9	Citric acid	....	$COOH\cdot CH_2\cdot C(OH)(COOH)\cdot CH_2\cdot COOH$	192.06
10	Citronellal	....	$C_9H_{17}\cdot CHO$	154.14
11	Citronellol (d.)	....	$C_{10}H_{20}O$	156.16
12	Cocaine	....	$C_{17}H_{21}O_4N$	303.18
13	hydrochloride	....	$C_{17}H_{21}O_4N\cdot HCl$	339.64
14	Codeine	morphine methyl ether	$C_{18}H_{21}O_3N + H_2O$	317.19
15	hydrochloride	....	$C_{18}H_{21}O_3N\cdot HCl + 2H_2O$	371.67
16	phosphate	....	$C_{18}H_{21}O_3N\cdot H_3PO_4 + 2H_2O$	433.26
17	sulfate	....	$(C_{18}H_{21}O_3N)_2\cdot H_2SO_4 + 5H_2O$	786.51
18	Collidine (α)	2-methyl-4-ethyl pyridine	$CH_3\cdot C_5H_3N\cdot C_2H_5$	121.10
19	" (β)	4-methyl-3-ethyl pyridine	$CH_3\cdot C_5H_3N\cdot C_2H_5$	121.10
20	" (γ)	2, 4, 6-trimethyl pyridine	$(CH_3)_3\cdot C_5H_2N$	121.10
21	Coniferine	....	$C_{16}H_{22}O_8 + 2H_2O$	378.21
22	Coniferyl alcohol	....	$C_{10}H_{12}O_3$	180.10
23	Coniine (d.)	2-propyl piperidine	2, $C_5H_{10}N\cdot C_3H_7$	127.14
24	hydrochloride	....	$C_8H_{17}N\cdot HCl$	163.61
25	Conylene	....	C_8H_{14}	110.11
26	Cotarnine	....	$C_{12}H_{15}NO_4$	237.13
27	Coumalic acid	....	$C_5H_3O_2(COOH)$	140.03
28	Coumaric acid (o.)	hydroxycinnamic acid (o.)	$HO\cdot C_6H_4\cdot CH:CH\cdot COOH$	164.06
29	" " (m.)	hydroxycinnamic acid (m.)	$HO\cdot C_6H_4\cdot CH:CH\cdot COOH$	164.06
30	" " (p.)	hydroxycinnamic acid (p.)	$HO\cdot C_6H_4\cdot CH:CH\cdot COOH$	164.06
31	Coumarilic acid	hydroxyphenyl-propiolic acid	$HO\cdot C_6H_4\cdot C:C\cdot COOH$	162.05
32	Coumarin	cumarin	$C_9H_6O_2$	146.05
33	Coumaron	....	C_8H_6O	118.05
34	Creatine	methylglycocy-amine	$NH:C(NH_2)N(CH_3)\cdot CH_2\cdot COOH + H_2O$	149.11
35	Creatinine	methylglycocyami-dine	$C_4H_7ON_3$	113.08

ORGANIC COMPOUNDS (Continued)

No	Crystal-line form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	yel. leaf.	....	112	......	s. acet	sl. s.	sl. s.
2	need.	$1.040\frac{13°}{8}$	33	254	sl. s.	v. s.	v. s.
3	cryst.	....	35–6	170[illegible] mm	......	......	....
4	pl.	1.008	41	260–2	......	s.	s.
5	monocl.	1.616	80	......	v. s.	......	....
6	colorl. liq.	0.897	......	228–9	i.	∞	∞
7	cryst.	....	119	130 d.	s.	......	....
8	liq.	$0.85^{15°}$	......	173–4	......	s.	....
9	colorl. rhomb.	$1.542^{18°}$	153	dec.	133 c.*	$116^{25°}$	2.26 c.
10	colorl. liq.	$0.854^{17.5°}$	......	205–8	v. sl. s.	∞	∞
11	colorl. liq.	$0.856^{8°}$	......	118^{17mm}	v. sl. s.	∞	∞
12	colorl. monocl.	....	98	......	$0.16^{25°}$ $0.38^{80°}$	$20^{25°}$	26.3
13	colorl. prisms	....	186†	......	$250^{25°}$	38.4^{25}	i.
14	colorl. orthorh.	....	155 anh.	......	$0.83^{25°}$; $1.7^{80°}$	$62.5^{25°}$	$8^{25°}$
15	colorl. need.	....	264 anh.	......	$3.84^{15°}$	......	....
16	colorl. need.	....	235	......	$44.5^{25°}$	$0.38^{25°}$	0.07
17	colorl. rhomb.	....	278, d.	......	$3.3^{25°}$	0.1^{25}	i.
18	colorl. liq	$0.927^{16°}$	......	179	s.	v. s.	v. s.
19	colorl. liq.	$0.966^{0°}$	......	abt. 195	i.	s.	....
20	colorl. liq.	0.917	......	171–2	v. sl. s.	......	....
21	need.	....	185	d.	s. h.	s.	i.
22	pr.	....	73–4	......	sl. s. h.	s.	s.
23	colorl. liq.	$0.844^{20°}$	–2	166–7	1.1 c.	∞	v. s.
24	colorl. rhomb.	....	208–12	......	50	s.	i.
25	....	0.76^{15}	......	125	......	......	....
26	need.	....	125	......	sl. s.	s.	s.
27	pr.	....	205–7	subl.	sl. s. c.	s.	sl. s.
28	colorl. need.	....	208	dec.	sl. s.	v. s.	v. sl. s.
29	colorl. prisms	....	191	......	v. s. h.	......	v. s.
30	colorl. need.	....	206	......	sl. s. c.; v. s. h.	v. s.	v. s.
31	need. f. w.	....	192–3	d.	s. h.	s.	....
32	colorl. rhomb.	....	67	290–0.5	v. sl. s.; s. h.	v. s.	v. s.
33	liq.	$1.078\frac{15°}{15}$	< –18	169–74	i.	s.	s.
34	colorl. monocl.	....	d. 295–300	......	$1.35^{1°}$	$0.008^{70°}$	i.
35	colorl. prisms f.w.	....	d. abt. 270	......	$8.7^{16°}$	0.16 c. abs.	....

* Crystallizes from water with $1H_2O$. † Crystallized from alcohol.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Creosole	...	$CH_3 \cdot O \cdot C_6H_3 \cdot (CH_3) \cdot OH$, (1, 4, 2)	138.08
2	Cresol (o.)	...	$CH_3 \cdot C_6H_4 \cdot OH$	108.06
3	" (m.)	...	$CH_3 \cdot C_6H_4 \cdot OH$	108.06
4	" (p.)	...	$CH_3 \cdot C_6H_4 \cdot OH$	108.06
5	Cresotinic acid, 1, 4, 3	...	$C_6H_3(CH_3)(OH)COOH$	152.06
6	Cresotinic acid, 1, 3, 2	...	$C_6H_3(CH_3)(OH)COOH$	152.06
7	Cresotinic acid, 1, 3, 4	...	$C_6H_3(CH_3)(OH)COOH$	152.06
8	Croconic acid	...	$C_5O_3(OH)_2 + 3H_2O$	196.06
9	Crotonic acid (α)	...	$C_3H_5 \cdot COOH$	86.05
10	" " (β)	...	$C_3H_5 \cdot COOH$	86.05
11	" aldehyde (α)	...	$C_3H_5 \cdot CHO$	70.05
12	Crotonyl alcohol	...	$CH_2 \cdot CH : CH \cdot CH_2OH$	72.06
13	Crotonylene	dimethylacetylene	$CH_3 \cdot C \vdots C \cdot CH_3$	54.05
14	Cubebine	...	$C_{10}H_{10}O_3$	178.08
15	Cumene	isopropylbenzene	$C_6H_5 \cdot CH(CH_3)_2$	120.10
16	Cumidic acid	...	$C_6H_2(CH_3)_2(COOH)_2$	194.08
17	Cumidine	p-isopropylamino-benzene	$(CH_3)_2CH \cdot C_6H_4 \cdot NH_2$	135.11
18	Cumidine, 1, 2, 4, 5	amino-isopropyl-benzene	$C_6H_4(C_3H_2)NH_2$	130.07
19	Cuminic acid (p.)	...	$(CH_3)_2CH \cdot C_6H_4 \cdot COOH$	164.10
20	Cumin alcohol (p.)	...	$C_6H_4 \cdot (C_3H_7) \cdot CH_2OH$	150.10
21	Cuminic aldehyde (p.)	p-isopropyl-benzaldehyde	$(CH_3)_2CH \cdot C_6H_4 \cdot CHO$	148.10
22	Curcumin	...	$C_{14}H_{14}O_4$	246.11
23	Cyamelide	...	$(CNOH)_n$	(43.02)n
24	Cyan-acetic acid	nitrilomalonic acid	$CH_2 \cdot (CN) \cdot COOH$	85.03
25	Cyanamide	...	$CN \cdot NH_2$	42.03
26	Cyananilide	...	$CN \cdot NH \cdot C_6H_5$	118.06
27	Cyanethyl carbonate	...	$CN \cdot COOC_2H_5$	99.05
28	Cyanpropionic acid (α)	...	$CH_3 \cdot CH(CN) \cdot COOH$	99.05
29	Cyansulfide	...	$(CN)_2S$	84.08
30	Cyanogen	...	$N \vdots C \cdot C \vdots N$	52.02
31	bromide	...	$CNBr$	105.92
32	chloride	...	$CNCl$	61.47

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of: Water	Alcohol	Ether
1	oil	$1.096^{\frac{15}{15}°}$	......	220–2	sl. s.	∞	∞, ∞ bz.
2	colorl.	$1.051^{\frac{15}{15}°}$	30	190.8	$3.1^{35°}$	∞ abv. 30°	∞ abv. 30°
3	colorl. liq.	$1.039^{\frac{15}{15}°}$	4	202.8	$2.41^{25°}$	∞	∞
4	colorl. prisms	$1.039^{\frac{15}{15}°}$	36	201.8	$2.36^{40°}$	∞ abv. 36	∞ abv. 36
5	need. f. w.	....	151	vol. in steam	s.	s.	s.
6	need. f. h. w.	....	163–4	......	s.	s.	s.
7	need. f. w.; monocl. f. al.	....	177	236–7	s.	s.	s.
8	yel. leaf.	....	100 anh.	......	v. s.	s.	....
9	colorl. monocl.	$0.973^{72°}$	72	185	8.3	......	....
10	colorl. need.	1.031	15.5	169.72, d.	40	s.	....
11	colorl. liq.	$0.859^{14°}$	......	104–5	s.	......	....
12	colorl. liq.	$0.873^{0°}$	......	117	16.6	......	....
13	liq.	....	......	27	i.	......	....
14	need.	....	125	not. volat.	v. sl. s.	$1.31^{12°}$	3.75
15	colorl. liq.	$0.862^{20°}$	......	152.5–3.0	i.	s.	s.
16	long pr. f. bz. + al.	....	subl.	......	sl. s.	s. h.	....
17	colorl. liq.	0.953	< −20	225	s. a.	......	....
18	....	....	41	257	s.	s.	s. bz.
19	colorl. tricl.	$1.163^{4°}$	116.5	subl.	v. sl. s. c.	s.	v. s.
20	liq.	....	......	243	sl. s	s.	....
21	colorl. liq.	$0.976^{\frac{25}{25}°}$	......	235	i.	s.	s.
22	yel. pr.	....	177–8	......	s. alk.	s.	s.
23	wh. powd.	$1.127^{15°}$	......	d.	i.	∞	∞
24	colorl.	....	69–70	d.	s.	s.	s.
25	colorl. need.	....	46(41–2)	......	v. s.	v. s.	s.
26	need. f. eth.	....	36–7	......	sl. s.	s.	s.
27	liq.	> H_2O	......	115–6	i.	s.	s.
28	yel. amor.	....	140 d.	......	s.	s.	....
29	rhombs.	....	60	d.	s.	s.	s.
30	gas	1.806(A)	−34	−21	400 c.c.	v. s.	s.
31	colorl. need.	....	52	61.5	s.	s.	s.
32	gas	....	−5	15.5	2500 c.c.	10,000 c.c.	5,000 c.c.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Cyanuramide....	melamin.........	$C_3N_3(NH_2)_3$.........	126.10
2	Cyanuric acid....	....	$H_3O_3N_3C_3 + 2H_2O$..	165.08
3	Cyclo-hexane....	hexanaphthene...	C_6H_{12}.............	84.10
4	hexanol........	hexahydrophenol	$(CH_2)_5 : CHOH$.....	100.10
5	hexanone.......	....	$(CH_2)_5 : CO$.........	98.08
6	Cymene (1, 4)....	p.-isopropyl toluene	$CH_3 \cdot C_6H_4 \cdot CH(CH_3)_2$	134.11
7	" (1, 2)....	o.-isopropyl toluene	$CH_3 \cdot C_6H_4 \cdot CH(CH_3)_2$	134.11
8	" (1, 3)....	m.-isopropyl toluene	$CH_3 \cdot C_6H_4 \cdot CH(CH_3)_2$	134.11
9	Dambose........	....	$C_6H_6(OH)_6$.........	180.10
10	Daphnetin.......	....	$C_9H_6O_4$............	178.05
11	Deca-hydro-naphthalene	....	$C_{10}H_{18}$.............	138.14
12	Deca-hydro-quinoline	....	$C_9H_7NH_{10}$.........	139.14
13	Decane (n.)......	....	$CH_3 \cdot (CH_2)_8 \cdot CH_3$...	142.18
14	Decyl alcohol (n.)	....	$CH_3 \cdot (CH_2)_8CH_2OH$	158.18
15	Decylene (n.)....	....	$CH_3 \cdot (CH_2)_7 \cdot CH : CH_2$	140.16
16	Dehydracetic acid	6-methyl-3-aceto-pyronone	$CH_3 \cdot CO \cdot CHCOCH : C(CH_3)OCO$	168.06
17	Desoxalic acid....	....	$C_2H(OH)_2(COOH)_3$	194.05
18	Desoxybenzoïn...	....	$C_6H_5 \cdot CO \cdot CH_2 \cdot C_6H_5$	196.10
19	Dextrin.........	....	$(C_6H_{10}O_5)x$.........	(162.08)x
20	Dextrose........	glucose, grape sugar	$C_6H_{12}O_6 + H_2O$.....	198.11
21	Diacetamide.....	....	$(CH_3 \cdot CO)_2NH$.....	101.06
22	Diacetanilide.....	....	$C_6H_5 \cdot N(COCH_3)_2$...	177.10
23	Diacetin.........	glyceryl diacetate	$C_3H_5(OH)(OOC \cdot CH_3)_2$	176.10
24	Diacetoethylacetate	....	$(C_2H_3O)_2CH \cdot COOC_2H_5$	172.10
25	Diacetyl.........	....	$CH_3 \cdot CO \cdot CO \cdot CH_3$..	86.05
26	Diacetylbenzaldehyde	benzylidene-diacetate	$C_6H_5 \cdot CH(C_2H_3O_2)_2$	208.10
27	Diacetylglucose...	....	$C_5H_6(OC_2H_3O)_2(OH)_3C(OH)$	264.13
28	Diacetylhydro-quinone	....	$C_6H_4(C_2H_3O_2)_2$......	194.08
29	Diacetylene......	....	$CH : C \cdot C : CH$.....	50.02
30	Di-allyl.........	....	$(C_3H_5)_2$...........	82.08
31	Dialuric acid.....	tartronylurea....	$C_4H_4N_2O_4$.........	144.05
32	Diaminoanthra-quinone (α)	....	$C_{14}H_6(NH_2)_2O_2$.....	238.10
33	Diaminoanthra-quinone (β)	....	$C_{14}H_6(NH_2)_2O_2$.....	238.10
34	Diaminoanthra-quinone (γ)	....	$C_{14}H_6(NH_2)_2O_2$.....	238.10

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	monocl. pr.	....	subl. d.	......	sl. s.	i.	i.
2	colorl. monocl.	$1.768^{0°}$	......	......	$0.25^{17°}$	0.33 c	v. sl. s.
3	colorl. liq	$0.779^{20°}$ (0.790^{20})	6.4 (4.7)	80.8	i.	∞	∞
4	colorl.	$0.962^{20°}$	16 (24)	160–1	3.6	s.	s.
5	colorl. liq	$0.947^{20°}$	......	155–7	v. s.	s.	s.
6	colorl. liq.	$0.860^{16°}$	−73.5	175–6.5	i.	v. s.	s.
7	....	0.858	......	157	i.	s.	....
8	....	0.865	......	175	i.	s.	....
9	hex. pr.	....	212	......	v. s.	i. abs.	....
10	yel. pr.	....	253–6 d.	......	v. s. h.	s. h.	v. sl. s.
11	colorl. liq	$0.877^{20°}$	......	189–91; (173–80)	i.	s.	s.
12	wh. pr.	....	48	204	......	......	....
13	colorl. liq.	$0.730^{20°}$	−30–2	173	i.	∞	∞
14	colorl. visc. liq	$0.830^{20°}$	7	231	......	s.	....
15	colorl. liq	$0.763^{0°}$	......	172	i.	∞	∞
16	rhomb. pl.	....	108	269	s.	s. h.	....
17	liq.	....	......	d.	v. s.	s.	....
18	pl.	....	60	314	sl. s.	s.	s.
19	wh. amor	1.038	......	......	v. s. h.	i.	i.
20	need. f. al.	$1.562^{18°}$	146 anh.	......	$83^{17.5°}$	sl. s.	i.
21	need. f. eth.	....	78	223	s.	......	....
22	colorl. lvs	....	37–8	142^{11mm}	......	......	....
23	....	$1.179^{15°}_{15}$	40	259–60	∞	v. s.	s.
24	liq.	$1.064^{15°}$	......	200–5 d.	sl. s.	......	....
25	yel. liq.	$0.973^{22°}$	......	87.5–8.0	$25^{15°}$	......	....
26	....	....	44	220	......	s.	....
27	....	....	<100	......	s.	s.	s.
28	....	....	123–4	......	sl. s. h.	sl. s.	v. s.
29	gas	....	......	......	......	......	....
30	liq.	$0.6872^{17°}$	......	59	i.	......	....
31	tetr.	....	......	......	sl. s.	......	....
32	red need.	....	236	subl.	v. sl. s.	i.	v. s. bz.
33	br. red need.	....	subl. abv. 300	......	sl. s.	s.	s.
34	....	....	d. 130	......	i.	s.	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt
1	Diamino-azo-benzene (2, 4)	....	$(NH_2)_2 \cdot C_6H_3 \cdot N_2 \cdot C_6H_5$	212.13
2	-azo-benzene hydrochloride	chrysoidine orange	$C_6H_5 \cdot N_2 \cdot C_6H_3 \cdot (NH_2)_2HCl$	248.59
3	benzene (o.)	....	$C_6H_4 \cdot (NH_2)_2$	108.08
4	" (m.) ...	....	$C_6H_4 \cdot (NH_2)_2$	108.08
5	" (p.)	....	$C_6H_4 \cdot (NH_2)_2$	108.08
6	Diaminobenzoic acid, COOH, NH₂, NH₂, 1, 2, 3	....	$C_6H_3(NH_2)_2COOH$ ..	152.08
7	Diaminobenzoic acid, COOH, NH₂, NH₂, 1, 3, 4	....	$C_6H_3(NH_2)_2COOH$ ..	152.08
8	Diaminobenzoic acid, COOH, NH₂, NH₂, 1, 3, 5	....	$C_6H_3(NH_2)_2COOH$ ..	152.08
9	Diaminobenzoic acid, COOH, NH₂, NH₂, 1, 3, 6	....	$C_6H_3(NH_2)_2COOH$ ..	152.08
10	Diaminobenzophenone (4, 4′)	Mischler's ketone	$(C_6H_4NH_2)_2CO$	212.11
11	Diaminobenzophenone (3, 3′)	....	$(C_6H_4NH_2)_2CO$	212.11
12	Diamino-diphenylamine (p.)	....	$NH(C_6H_4NH_2)_2$	199.13
13	Diamino-diphenyl methane (4, 4′)	....	$CH_2(C_6H_4 \cdot NH_2)_2$	198.13
14	Diamino-naphthalene (1, 2)	naphthylene diamine	$C_{10}H_6 \cdot (NH_2)_2$	158.10
15	Diamino-naphthalene (1, 5)	naphthylene diamine	$C_{10}H_6 \cdot (NH_2)_2$	158.10
16	Diamino-naphthalene (1, 8)	naphthylene diamine	$C_{10}H_6 \cdot (NH_2)_2$	158.10
17	Diaminophenol (2, 4)	....	$(NH_2)_2 \cdot C_6H_3(OH)$	124.08
18	hydrochloride...	amidol..........	$HO \cdot C_6H_3 \cdot (NH_2)_2 \cdot 2HCl$	197.01
19	Diamino-stilbene	....	$C_2H_2(C_6H_4NH_2)_2$ ...	210.13
20	Diamino-triphenyl methane (4, 4′)	....	$C_6H_5 \cdot CH(C_6H_4NH_2)_2$	274.16
21	Dianisidine......	....	$C_{12}H_6(OCH_3)_2(NH_2)_2$	244.14
22	Diazo-amino-benzene	....	$C_6H_5 \cdot N_2 \cdot NHC_6H_5$ ..	197.11
23	aminonaphthalene	....	$C_{10}H_7N_2NHC_{10}H_7$ ...	297.14
24	benzene chloride	....	$C_6H_5 \cdot N_2Cl$	140.51
25	benzene cyanide	....	$C_6H_5 \cdot N_2CN + HCN$	158.08
26	benzeneimide...	....	$C_6H_5 \cdot N_3$	119.06
27	benzene nitrate	....	$C_6H_6 \cdot N_2NO_3$	167.06
28	" sulfonic acid (o.)	....	$C_6H_4 : N_2SO_3$	184.11

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	yel. need.	....	117.5	......	sl. s.	s.	s.
2	red brown	....	......	......	v. s.	s.	....
3	tab. f. chl.	....	101.2	256–8	sl. s. c.; s. h.	v. s.	v. s.
4	rhombic	....	63	283–4	s.	s.	s.
5	colorl. sc. f. bz.	....	140	267	s.	s.	s.
6	lng. need.	....	......	d.	sl. s.	......	....
7	lvs.	....	......	210–1 d.	sl. s. c.; s. h.	......	....
8	l. need.	....	abt. 240	d.	s. h.	v. s.	v. s.
9	sm. pr.	....	......	d.	v. sl. s.	v. sl. s.	v. sl. s.
10	yel. need.	....	239	......	s. h.	s.	s.
11	need.	....	172	......	......	s.	s.
12	leaf.	....	158	d.	......	......	....
13	colorl. leaf.	....	88	......	......	v. s.	s. bz.
14	colorl. rhomp. f. w.	....	95–6	......	s. h.	v. s.	v. s.
15	colorl. prisms f. cth.	....	189.5	subl.	v. sl. s. c	v. s. chl	v. s.
16	colorl. f. al.	....	66.5	......	sl. s.	v. s.	v. s.
17	colorl.	....	78–80 d.	......	s. alk.	......	....
18	gray-wh. cryst.	....	......	......	s.	sl. s.	....
19	leaf.	....	170	subl. d.	sl. s.	s.	sl. s.
20	colorl. warts	....	139	......	v. sl. s.	v. s.	v. s.
21	need.	....	168–72	......	sl. s. h.	......	sl. s.
22	yel. leaf. f. al.	....	96	......	i.	s. h.	v. s.
23	yel. lvs.	....	expl.	......	......	......	....
24	colorl. need.	....	d.	......	v. s.	s.	i.
25	yel. pr.	....	69	......	sl. s.	......	....
26	yel. oil	....	......	expl. 59^{12mm}	i.	sl. s.	sl. s.
27	colorl. need.	....	expl.	......	v. s.	s.	i.
28	cryst.	....	......	......	$0.0715^{25°}$	......	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Diazo-			
1	benzene sulfonic acid (m.)	....	$C_6H_4:N_2SO_3$.......	184.11
2	benzene sulfonic acid (p.)	....	$C_6H_4:N_2SO_3$.......	184.11
3	ethylacetate .. .	....	$CO_2C_2H_5CHN_2$.....	114.06
4	methane.......	....	CH_2N_2............	42.03
5	Dibenzyl........	....	$C_6H_5 \cdot CH_2 \cdot CH_2 \cdot C_6H_5$	182.11
6	amine..........	....	$(C_6H_5 \cdot CH_2)_2NH$....	197.13
7	ketone.........	....	$(C_7H_7)_2CO$.........	210.11
8	Dibrom-acetic acid	....	$CHBr_2 \cdot COOH$.....	217.85
9	anthracene	....	$C_{14}H_8Br_2$..........	335.90
10	anthraquinone (α)	....	$C_{14}H_6Br_2O_2$.........	365.88
11	" (β)	....	$C_6H_4(CO)_2C_6H_2Br_2$..	365.88
12	benzene (o.)....	....	$C_6H_4Br_2$..........	235.86
13	" (m.)....	....	$C_6H_4Br_2$..........	235.86
14	" (p.)....	....	$C_6H_4Br_2$..........	235.86
15	succinic acid....	....	$C_2H_2Br_2(COOH)_2$...	275.86
16	Dichlor-acetal....	....	$CHCl_2 \cdot CH(OC_2H_6)_2$	187.01
17	acetamide......	....	$CHCl_2 \cdot CONH_2$.....	127.95
18	acetic acid......	....	$CHCl_2 \cdot COOH$.....	128.93
19	acetone (α).....	....	$CHCl_2 \cdot CO \cdot CH_3$....	126.95
20	" (β).....	....	$CH_2Cl \cdot CO \cdot CH_2Cl$..	126.95
21	acetyl chloride..	....	$CHCl_2 \cdot COCl$......	147.38
22	aldehyde.......	....	$CHCl_2 \cdot CHO$.......	112.93
23	anthracene (9, 10)	....	$C_{14}H_8Cl_2$..........	246.98
24	aniline (2, 4)....	....	$NH_2 \cdot C_6H_3Cl_2$......	161.96
25	" (2, 5)....	....	$NH_2 \cdot C_6H_3Cl_2$......	161.96
26	" (3, 4)....	....	$NH_6 \cdot C_6H_3Cl_2$......	161.96
27	" (3, 5)....	....	$NH_6 \cdot C_6H_3Cl_2$......	161.96
28	benzene (o.)....	....	$C_6H_4Cl_2$..........	146.95
29	" (m.)...	....	$C_6H_4Cl_2$..........	146.95
30	" (p.)....	....	$C_6H_4Cl_2$..........	146.95
31	benzoic acid (2, 5)	....	$Cl_2C_6H_3 \cdot COOH$....	190.95
32	" " (2, 6)	....	$Cl_2C_6H_3 \cdot COOH$....	190.95
33	" " (3, 4)	....	$Cl_2C_6H_3 \cdot COOH$....	190.95
34	diphenyl (p.)...	....	$(C_6H_4Cl)_2$..........	222.98
35	ether..........	....	$CH_2Cl \cdot CHCl \cdot OC_2H_5$	142.98
36	ethylene (asym.)	....	$CH_2:CCl_2$.........	96.93
37	" (sym.)	....	$CHCl:CHCl$......	96.93
38	hydrine (1, 3) (α)	....	$CH_2Cl \cdot CHOH \cdot CH_2Cl$	128.96
39	" (2, 3) (β)	....	$CH_2Cl \cdot CHCl \cdot CH_2OH$	128.96
40	methylarsine....	methylarsenic-dichloride	$AsCl_2CH_3$..........	160.90
41	methyl ether....	....	$CH_2Cl \cdot O \cdot CH_2Cl$...	114.95
42	naphthalene (1, 4)	....	$C_{10}H_6Cl_2$..........	196.96
43	" (1, 5)	....	$C_{10}H_6Cl_2$..........	196.96

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 cc. of		
					Water	Alcohol	Ether
1	red yel. pr. f. w.	....	expl.	......	v. s.	......	....
2	sm. need. f. w.	....	......	......	v. s.$^{60°}$	i.	....
3	....	$1.073^{22°}$	......	141	sl. s.	∞	∞
4	yel.	....	......	0; expl. 200	d.	s.	s.
5	colorl. monocl.	0.995	52	284	i.	s.	v. s.
6	liq.	$1.033^{14°}$	......	d.	i.	v. s.	....
7	....	....	30	230–1	......	......	....
8	....	....	48	232	v. s.	v. s.	v. s.
9	yel. need.	....	221	subl.	s. bz. h.	sl. s.	sl. s.
10	yel. need.	....	236(145)	subl.	......	sl. s.	s. bz.
11	yel. need.	....	174	subl.	......	v. sl. s.	s. bz.
12	colorl.	$1.977^{18°}$	–1	224	i.	s.	....
12	colorl.	$1.955^{19°}$	1–2	219.5	i.	s.	s.
14	colorl. monocl.	2.220	89.3	219	i.	$14^{30°}$	....
15	cryst.	....	230 d.	......	sl. s.	......	....
16	liq.	....	......	180–4	......	......	....
17	monocl.	....	98	233–4$^{755mm.}$	v. s. h.	v. s.	v. s.
18	colorl. liq.	$1.572^{13°}$	–4	190–1	s.	s	s.
19	colorl. liq	$1.236^{21°}$	......	120	s.	s.	∞
20	....	....	45	172–4	......	......	....
21	colorl. liq.	....	......	107–8	dec.	dec.	∞
22	colorl. liq.	....	......	88–90	i.	......	....
23	yel. need.	....	209	......	s. bz.	sl. s.	sl. s.
24	need....	....	63	245	......	s.	....
25	need....	....	50	251	......	s.	....
26	need....	....	71.5	272	......	s.	....
27	need....	....	505	259–60	i.	s.	....
28	colorl. liq.	$1.325^{0°}$	......	179	i.	s.	....
29	colorl. liq.	$1.307^{0°}$	–18	172	i.	s.	s.
30	leaf. f. al.	$1.268^{15°}_{8}$	53	172–4	......	s.	v. s.
31	colorl. need.	....	156	301	sl. s.; s. alk.	s.	....
32	colorl. need.	....	126.5	......	s. alk.	......	....
33	colorl. need.	....	203	......	sl. s.; s. alk.	v. sl. s.	....
34	pr.	....	148	315	......	......	....
35	....	$1.174^{23°}$	......	140–7	......	......	....
36	....	$1.250^{15°}$	......	37	......	......	....
37	....	....	......	55	......	......	....
38	colorl. liq.	$1.367^{19°}$	......	174 (182)	$1.1^{19°}$	∞	∞
39	colorl. liq.	$1.355^{17.5°}$	......	182–3	......	......	....
40	liq.	....	......	133	......	......	....
41	....	1.315	......	105	......	......	....
42	need. f. al.	....	67–8	287	i.	s.	s.
43	sc. f. al.	....	107	subl.	i.	s.	s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Dichlor-			
1	nitro-hydrine...	....	$CH_2Cl\cdot CH(NO_3)\cdot CH_2Cl$	173.96
2	quinoline (o.)...	....	$C_9H_5Cl_2N$..........	197.96
3	" (m.)	....	$C_9H_5Cl_2N$..........	197.96
4	N, Cl, Cl, 1, 1′, 3′ quinoline (p.)	....	$C_9H_5Cl_2N$..........	197.96
5	N, Cl, Cl, 1, 1′, 4′ quinone......	....	$C_6H_2Cl_2O_2$.........	176.93
6	Dicyandiamide...	param, cyanguanidine	$(CN)_2(NH_2)_2$ or $C(NH)NH_2NHCN$	84.06
7	Dicyandiamidine	guanylurea......	$HN:C(NH_2)NHCONH_2$	102.08
8	Diethyl-acetic acid	....	$(C_2H_5)_2:CH\cdot COOH$	116.10
9	amine..........	....	$(C_2H_6)_2:NH$.......	73.10
10	aniline.........	....	$C_6H_5\cdot N(C_2H_5)_2$.....	149.13
11	benzene (o.)....	....	$C_6H_4(C_2H_5)_2$........	134.11
12	" (m.) ..	....	$C_6H_4(C_2H_5)_2$........	134.11
13	" (p.)....	....	$C_6H_4(C_2H_5)_2$........	134.11
14	carbinol........	....	$(C_2H_5)_2CHOH$......	88.10
15	cyanamide.....	....	$CN\cdot N(C_2H_5)_2$......	98.10
16	ketone.........	....	$C_2H_5\cdot CO\cdot C_2H_5$.....	86.08
17	methylcarbinol..	....	$(C_2H_5)_2C(OH)CH_3$..	102.11
18	oxamide (s.)....	....	$(CO\cdot NHC_2H_5)_2$.....	144.11
19	phosphine......	....	$(C_2H_5)_2PH$.........	90.12
20	phosphoric acid	....	$PO(OC_2H_5)_2OH$....	154.12
21	propylcarbinol..	....	$(C_2H_5)_2C(OH)C_3H_7$	130.14
22	toluene (1, 3, 5)	....	$(C_2H_5)_2:C_6H_3\cdot CH_3$	148.13
23	urea (s.).......	....	$C_2H_5NH\cdot CO\cdot NHC_2H_6$	116.11
24	" (uns.).....	....	$NH_2\cdot CO\cdot N(C_2H_5)_2$	116.11
25	Diethylenediamine	piperazine.......	$NH(C_2H_4)NHC_2H_4$	86.10
26	Diethyleneglycol	....	$(CH_2OH\cdot CH_2)_2O$...	106.08
27	Digallic acid.....	....	$(HO)_3C_6H_2CO_2C_6H_2(OH)_2\cdot COOH$	322.08
28	Diglycerol.......	....	$C_6H_{14}O_5$...........	166.11
29	Diglycolic acid...	....	$O(CH_2\cdot COOH)_2$....	134.05
30	Dihydracrylic acid	....	$C_6H_6O_3$	126.05
31	Dihydro-anthracene	....	$C_6H_4:(CH_2)_2:C_6H_4$	180.10
32	benzene (1, 2)...	....	C_6H_8.............	80.06
33	" (1, 4)...	....	C_6H_8.............	80.06
34	carveol........	....	$C_{10}H_{18}O$..........	154.14
35	carvone........	....	$C_{10}H_{16}O$..........	152.13
36	cymene........	....	$C_{10}H_{14}H_2$.........	136.13
37	ethylanthracene	....	$C_6H_4C_2H_3(C_2H_5)\cdot C_6H_4$	208.13
38	naphthalene (1, 4)	....	$C_{10}H_{10}$............	130.08
39	quinoline.......	....	C_9H_9N...........	131.08
40	resorcinol......	....	$C_6H_6O_2H_2$.........	112.06
41	toluene (1, 3)...	....	$CH_3\cdot C_6H_7$.........	94.08
42	xylene.........	....	C_8H_{12}............	108.10
43	Dihydroxy-anthracene (α)	chrysazol........	$C_{14}H_8(OH)_2$.......	210.08

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. $H_2O = 1$ (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl.	1.459	......	......	i.	s.	s.
2	cryst.	....	104–5	......	i.	s.	s.
3	l. need.	....	103–4	......	......	s.	....
4	sh. need.	....	92–3	......	......	s.	s.
5	yel. rhomb.	....	120	......	......	......	....
6	....	....	205	d.	s.	s.	sl. s.
7	cryst.	....	......	......	s.	s.	s. a.
8	colorl. liq.	$0.920^{18°}$	......	190	sl. s.	......	....
9	colorl. liq.	$0.712^{15°}$	−40	55.5–6.0	v. s.	s.	s.
10	colorl. liq.	0.936	−38–9	216	v. sl. s.	s.	s.
11	colorl. liq.	$0.866^{18°}$	......	185	i.	s.	s.
12	colorl. liq.	$0.860^{20°}$	......	181–2	i.	s.	s.
13	colorl. liq.	$0.862^{18°}$	......	182–3	i.	s.	s.
14	colorl. liq.	$0.832^{0°}$	......	116.5	sl. s.	s.	s.
15	liq.	....	......	186	i.	s.	s.
16	colorl. liq.	$0.814^{20°}$	......	102–7	s.	∞	∞
17	....	....	......	120	......	s.	....
18	colorl. need.	....	175	......	sl. s.	s.	v. sl. s.
19	....	<H_2O	......	85	......	......	....
20	liq.	$0.6872^{17°}$	......	59	i.	......	....
21	....	....	......	145–50	......	......	....
22	colorl. liq.	$0.879^{20°}$	......	199–200	i.	∞	∞
23	colorl. prisms	1.042	112	263	v. s.	v. s.	v. s.
24	colorl. prisms	....	70–4	......	v. s.	v. s.	s.
25	cryst.	....	104	146	s.	......	....
26	....	$1.132^{0°}$	......	250	s.	s.	s.
27	amor.	....	......	......	s.	i.	i.
28	....	....	......	220–30	s. h.	......	i.
29	rhomb. pr.	....	150	d.	s.	s.	s.
30	....	....	d.	......	s.	s.	s.
31	colorl. tricl.	....	108.5	313	i.	v. s.	v. s.
32	colorl. liq.	$0.848^{20°}$	......	82–5	i.	s.	v. s.
33	colorl. liq	$0.847^{20°}$	......	85–6	i.	∞	∞
34	liq.	$0.927^{20°}$	......	225	......	......	....
35	liq.	$0.928^{19°}$	......	222	......	......	....
36	....	....	......	174	......	......	....
37	oil	$1.049^{16°}$	......	320	i.	s.	s.
38	colorl. liq.	....	15–5.5	212	i.	v. s.	v. s.
39	yel. cryst.	....	220–6	......	......	......	....
40	pr.	....	105	......	......	......	....
41	liq.	....	......	105–8	......	......	....
42	liq.	....	......	135	......	......	....
43	yel. lvs. or need.	....	220 d.	......	......	s.	s. alk.

No	Name	Synonyms	Formula	Mol. wt.
	Dihydroxy-			
1	anthracene (β)	rufol.	$C_{14}H_8(OH)_2$.	210.08
2	benzene (o.)	See *catechol*		
3	" (m.)	See *resorcinol*		
4	" (p.)	See *quinol*		
5	benzoic acid (2, 3)	. . . .	$(HO)_2 : C_6H_3 \cdot COOH + 2H_2O$	190.08
6	" " (2, 4)	. . . .	$(HO)_2 : C_6H_3 \cdot COOH + 3H_2O$	208.10
7	" " (2, 5)	. . . .	$(HO)_2 : C_6H_3 \cdot COOH$	154.05
8	" " (3, 5)	. . . .	$(HO)_2 : C_6H_3 \cdot COOH + 1\frac{1}{2}H_2O$	181.07
9	" " (2, 6)	γ-resorcylic acid. .	$(HO)_2 : C_6H_3 \cdot COOH$	154.05
10	benzophenone (2, 4)	. . . .	$C_6H_3(OH)_2 \cdot CO \cdot C_6H_5$	214.08
11	benzophenone (3, 3′)	. . . .	$[C_6H_4(OH)]_2CO$. . . .	214.08
12	benzophenone (4, 4′)	. . . .	$[C_6H_4(OH)]_2CO$. . . .	214.08
13	cinnamic acid. . .	. . . .	$(HO)_2C_6H_3 \cdot C_2H_2 \cdot COOH + \frac{1}{2}H_2O$	189.07
14	diphenylmethane (p.)	. . . .	$CH_2(C_6H_4OH)_2$.	200.10
15	naphthalene (1, 6)	. . . .	$C_{10}H_6(OH)_2$.	160.06
16	" (1, 7)	. . . .	$C_{10}H_6(OH)_2$.	160.06
17	" (1, 8)	. . . .	$C_{10}H_6(OH)_2$.	160.06
18	" (2, 3)	. . . .	$C_{10}H_6(OH)_2$.	160.06
19	" (1, 4)	. . . .	$C_{10}H_6(OH)_2$.	160.06
20	" (1, 2)	. . . .	$C_{10}H_6(OH)_2$.	160.06
21	" (1, 5)	. . . .	$C_{10}H_6(OH)_2$.	160.06
22	" (2, 6)	. . . .	$C_{10}H_6(OH)_2$.	160.06
23	" (2, 7)	. . . .	$C_{10}H_6(OH)_2$.	160.06
24	pyridine (2, 4). .	. . . .	$(HO)_2C_5H_3N$.	111.05
25	" (2, 6). .	. . . .	$(HO)_2C_5H_3N + \frac{1}{2}H_2O$	120.06
26	quinone (2, 5). . .	. . . .	$C_6H_2O_2(OH)_2$.	140.03
27	stearic acid.	. . . .	$C_{18}H_{34}(OH)_2O_2$.	316.29
28	tartaric acid. . . .	. . . .	$COOH \cdot C(OH)_2C(OH)_2COOH$	182.05
29	terephthalic acid (2, 5)	. . . .	$C_6H_2(OH)_2(COOH)_2 + H_2O$	216.06
30	toluene (2, 4). . .	. . . .	$CH_3C_6H_3(OH)_2$.	124.06
31	" (2, 5). . .	. . . .	$CH_3C_6H_3(OH)_2$.	124.06
32	" (2, 6). . .	. . . .	$CH_3C_6H_3(OH)_2$.	124.06
33	xylene (1, 3, 4, 6)	. . . .	$C_6H_2(CH_3)_2(OH)_2$. . .	138.08
34	" (1, 4, 2, 5)	hydrophloron. . . .	$C_6H_2(CH_3)_2(OH)_2$. . .	138.08
35	" (1, 4, 2, 6)	β-orcin.	$C_6H_2(CH_3)_2(OH)_2$. . .	138.08
36	Diiodo-acetic acid	. . . .	$CHI_2 \cdot COOH$.	311.88
37	benzene (o.). . . .	. . . .	$C_6H_4I_2$.	329.90
38	" (m.). . .	. . . .	$C_6H_4I_2$.	329.90
39	" (p.). . . .	. . . .	$C_6H_4I_2$.	329.90

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	yel. need	......	......	......	......	s.	s. alk.
2							
3							
4							
5	colorl. need.	....	204	dec.	s.	......	....
6	colorl. need.	....	204–6 d. (213)	dec.	$0.26^{17°}$	v. s.	v. s.
7	colorl. need.	....	199–200	dec.	v. s.	v. s.	v. s.
8	colorl. prisms	....	232	......	s.	v. s.	v. s.
9	colorl.	....	148–67 d.	......	s. alk.	......	.....
10	pyram. f. bz.	....	143–4	......	s. h.	s. alk.	v. s.; s. bz.
11	sm. need.	....	162–3	......	s.	s.	s. alk.
12	yel. need. f. lgr.	....	210	......	v. s. h.	v. s.	v. s.; s. acet
13	yel. monocl. pr. or lvs.	....	124 d.	......	v. s.	v. s.	v. s.
14	lvs. or need.	....	158	subl.	......	s.	s.
15	colorl. pr.	....	134–5	......	......	v. sl. s.	v. s.
16	colorl. need.	....	178	......	s.	v. s.	v. s.
17	need.	....	140	......	sl. s. h.	v. s. bz	v. s.
18	rhomb. f. w.	....	159	......	s. h.	v. s.	v. s.
19	lng. need.	....	176	......	s. h.	s.	s.
20	....	....	60	......	s.	......	yel. in alk. sol.
21	sm. pr.	....	259	......	s. h.	s.	s.
22	leaf.	....	215	subl.	sl. s.	s.	....
23	need. or leaf.	....	186	subl.	s.	s.	s. bz.
24	rhomb.	....	260–5	......	sl. s.	sl. s.	i.
25	yel. need.	....	195	......	sl. s.	sl. s.	v. sl. s.
26	yel. need.	....	215–20	......	i.	v. s.	v. sl. s.
27	rhomb.	....	126	......	......	s. h.	s.
28	wh. cryst.	....	98	......	......	......	....
29	yel. need. or pr.	....	d.	......	s. h.	s.	s.
30	colorl.	....	103–4	267–70	v. s.	v. s.	v. s.
31	colorl. leaf.	....	124	subl.	v. s.	v. s.	v. s.
32	colorl. need.	....	63–6	......	v. s.	v. s.	....
33	cryst.	....	125	279	s.	v. s.	v. s.
34	leaf.	....	212	subl.	sl. s.	s.	s.
35	tetrag.	....	163	279	s.	s.	....
36	yellow	....	110	......	sl. s.	......	....
37	prisms	....	27	286.5	i.	s.	....
38	rhomb.	....	40.4	284.7	i.	s.	....
39	leaf.	....	129.4	285	i.	s.	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Diiso-amylamine	....	$[(CH_3)_2CH \cdot CH_2 \cdot CH_2]_2NH$	157.19
2	amyl ketone....	....	$(C_6H_{11})_2CO$........	170.18
3	butyl..........	....	$(CH_3)_2CH(CH_2)_2CH(CH_3)_2$	114.14
4	butylamine.....	....	$[(CH_3)_2CH \cdot CH_2]_2NH$	129.16
5	butylketone....	valerone........:	$(C_4H_9)_2CO$.........	142.14
6	butyloxalate....	....	$C_2O_4(C_4H_9)_2$........	202.14
7	butylene.......	....	$(CH_3)_2C : CH \cdot C(CH_3)_3$	112.13
8	propyl carbinol	....	$(C_3H_7)_2CHOH$.....	116.13
9	propylethylene	....	$(CH_3)_2CH \cdot CH : CH \cdot CH(CH_3)_2$	112.13
10	propyl ketone...	....	$(C_3H_7)_2CO$.........	114.11
11	Dimethyl acetic acid	See *isobutyric acid*		
12	aldehyde.......	ethylidene-dimethyl-ether	$CH_3 \cdot CH(OCH_3)_2$...	90.08
13	amine..........	....	$(CH_3)_2NH$.........	45.06
14	anilin..........	....	$C_6H_5N(CH_3)_2$......	121.10
15	anthracene (2, 3)	....	$C_{14}H_8(CH_3)_2$.......	206.11
16	" (2, 4)	....	$C_{14}H_8(CH_3)_2$.......	206.11
17	arsine.........	....	$(CH_3)_2AsH$........	106.02
18	benzene	See *xlyenes*		
19	benzoic acid (2, 3)	....	$(CH_3)_2C_6H_3 \cdot COOH$	150.08
20	" " (2, 4)	xylic acid........	$(CH_3)_2C_6H_3 \cdot COOH$	150.08
21	" " (2, 5)	....	$(CH_3)_2C_6H_3 \cdot COOH$	150.08
22	" " (2, 6)	....	$(CH_3)_2C_6H_3 \cdot COOH$	150.08
23	" " (3, 4)	....	$(CH_3)_2C_6H_3 \cdot COOH$	150.08
24	" " (3, 5)	mesitylinic acid (1, 3, 5)	$(CH_3)_2C_6H_3 \cdot COOH$	150.08
25	diethylmethane	....	$(CH_3)_2C(C_2H_5)_2$.....	100.13
26	ether..........	methyl ether.....	$CH_3 \cdot O \cdot CH_3$.......	46.05
27	ethyl acetic acid	....	$(CH_3)_2(C_2H_5) \cdot C \cdot COOH$	116.10
28	" benzene (2, 3, 5)	....	$C_2H_5 \cdot C_6H_3 \cdot (CH_3)_2$	134.11
29	" benzene...	....	$C_2H_5 \cdot C_6H_3 \cdot (CH_3)_2$ (1, 3, 4)	134.11
30	ethylene.......	....	$CH_3 \cdot CH : CH \cdot CH_3$	56.06
31	glyoxime.......	diacetyldioxime...	$(CH_3)_2C_2(NOH)_2$...	116.08
32	hydroquinone...	....	$C_6H_4(OCH_3)_2$.......	138.08
33	isobutylcarbinol	....	$(CH_3)_2C(OH)CH_2 \cdot CH(CH_3)_2$	116.13
34	isophthalate (1, 3)	....	$C_6H_4(COOCH_3)_2$....	194.08
35	isopropylcarbinol	....	$(CH_3)_2(C_3H_7)COH$	102.11
36	naphthalene (α) (1, 4)	....	$C_{10}H_6(CH_3)_2$.......	156.10
37	" (β)	....	$C_{10}H_6(CH_3)_2$.......	156.10
38	naphthylamine(α)	....	$C_{10}H_7 \cdot N(CH_3)_2$.....	171.11
39	" (β)	....	$C_{10}H_7 \cdot N(CH_3)_2$.....	171.11
40	nitros amine....	....	$(CH_3)_2N \cdot NO$.......	74.06

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl.	0.778	......	190	sl. s.	s.	∞
2	yel. liq.	....	......	226	i.	s.	s.
3	liq.	$0.7135^{0°}$	......	108.5	......	......	....
4	colorl. liq.	$0.749^{4°}$	......	139–40	v. sl. s.	s.	s.
5	liq.	$0.833^{20°}$	......	181–2	i.	......	....
6	colorl. liq.	$1.002^{14°}$	......	229	i.	s.	s.
7	....	$0.734^{0°}$	......	102.53	......	......	....
8	colorl. liq	$0.829^{20°}$	......	140	v. sl. s.	s.	s.
9	....	....	......	116–20	......	......	....
10	colorl.	$0.806^{20°}$	......	123.7	......	s. bz.	....
11							
12	....	$0.8787^{0°}$	......	64.4	......	......	....
13	gas	$0.687^{-5.8°}$	......	7.2	v. s.	s.	s.
14	yel. liq.	$0.958^{20°}$	2.5	194	v. sl. s	s.	s.
15	colorl. leaf.	....	246	......	......	......	v. s. bz.
16	need. f. al.	....	71	......	......	s.	v. s. bz.
17	colorl. liq.	$1.213^{29°}$	......	36	∞ chl.	∞	∞
18							
19	colorl. prisms	....	144	......	v. sl. s. h.	s.	....
20	colorl. monocl.	....	126	268	v. sl. s. h.	v. s. h.	s.
21	colorl. need.	....	132	268	v. sl. s h.	v. s.	....
22	need. f. al.	....	97–9 (116)	274.5	sl. s.	......	v. s.
23	colorl. prisms	....	163	......	v. sl. s. h.	v. sl. s.	....
24	monocl. f. al.	....	166	sub.	v. sl. s.	v. s.	....
25	liq.	$0.711^{0°}$	......	86.7	......	s.	s.
26	gas	1.617 (A)	–138.5	–24	3700 c.c	s.	s.
27	colorl. liq	....	–14	187	v. sl. s.	s.	s.
28	colorl. liq.	$0.861^{20°}$	......	185	i.	......	....
29	colorl. liq.	$0.878^{20°}$	......	183.4	i.	......	....
30	....	$0.635^{13°}$	......	+1	i. H_2SO_4	......	....
31	colorl.	....	234.5	......	i.	v. s.	v. s.
32	....	....	55–6	205	i.	......	s. bz.
33	liq.	....	......	129–31	sl. s.	s.	s.
34	colorl.	....	64.5	......	i.	......	....
36	colorl. liq.	$0.823^{19°}$	–14	117.6	s.	s.	....
36	....	$1.0176^{20°}$	......	263	......	......	....
37	....	....	......	266	......	......	....
38	colorl.	$1.045\frac{15}{15}°$	......	276	i.	s.	s.
39	colorl.	$1.046\frac{4}{40}°$	46	305	i.	......	....
40	yel. liq.	....	......	153	i.	......	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Dimethyl			
1	oxalate		$(COOCH_3)_2$	118.05
2	oxamide (s.)		$(CO \cdot NHCH_3)_2$	116.08
3	" (uns.)		$(CH_3)_2N \cdot CO \cdot CO \cdot NH_2$	116.08
4	phosphine		$(CH_3)_2PH$	62.08
5	phosphinic acid		$(CH_3)_2(OH)PO$	94.08
6	phthalate (o.)		$C_6H_4(COOCH_3)_2$	194.08
7	propyl carbinol		$(CH_3)_2(C_3H_7)COH$	102.10
8	pyridine.	See *lutidine*		
9	pyrrol		$(CH_3)C:CH \cdot CH:(CH_3)NH$	83.08
10	quinone (2, 3)		$(CH_3)_2C_6H_2O_2$	136.06
11	" (2, 5)		$(CH_3)_2C_6H_2O_2$	136.06
12	" (2, 6)		$(CH_3)_2C_6H_2O_2$	136.06
13	racemate		$C_4H_4O_6(CH_3)_2$	178.08
14	resorcinol		$C_6H_4(OCH_3)_2$	138.08
15	succinate		$C_2H_4 \cdot (COO \cdot CH_3)_2$	146.08
16	sulfate		$(CH_3)_2SO_4$	126.11
17	tartrate (d. and l.)		$C_4H_4O_6(CH_3)_2$	178.08
18	terephthalate (p.)		$C_6H_4(COOCH_3)_2$	194.08
19	thetin		$(CH_3)_2S \cdot CH_2 \cdot CO \cdot O$	120.13
20	thiophene (2, 4)		$(CH_3)_2C_4H_2S$	112.13
21	" (2, 5)		$(CH_3)_2C_4H_2S$	112.13
22	urea (sym.)		$CH_3NH \cdot CO \cdot NHCH_3$	88.08
23	" (uns.)		$NH_2 \cdot CO \cdot N(CH_3)_2 \cdot$	88.08
24	Dinaphthol (α)		$HO \cdot C_{10}H_6 \cdot C_{10}H_6 OH$	286.11
25	" (β)		$HO \cdot C_{10}H_6 \cdot C_{10}H_6 \cdot OH$	286.11
26	Dinaphthyl (α α)		$C_{10}H_7 \cdot C_{10}H_7$	254.11
27	" (β β)		$C_{10}H_7 \cdot C_{10}H_7$	254.11
28	Dinaphthylamine (β β)		$NH(C_{10}H_7)_2$	269.13
29	Dinaphthylketone (α)		$(C_{10}H_7)_2CO$	282.11
30	" (β)		$(C_{10}H_7)_2CO$	282.11
31	" (γ)		$(C_{10}H_7)_2CO$	282.11
32	Dinaphthyl-methane (α)		$(C_{10}H_7)_2CH_2$	268.13
33	Dinaphthyl-methane (β)		$(C_{10}H_7)_2CH_2$	268.13
34	Dinicotinic acid N, $(COOH)_2$ (1, 3, 5)	pyridine dicarboxylic acid	$C_5H_3N(COOH)_2$	167.05
35	Dinitraniline (2, 4)		$(NO_2)_2C_6H_3NH_2$	183.07
36	" (2, 6)		$(NO_2)_2C_6H_3NH_2$	183.07

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O = 1$ [A] Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. monocl.	....	54	166.3	......	......	....
2	colorl. need.	....	209–10	......	sl. s.	sl. s.	v. sl. s.
3	colorl. tab.	....	104	......	v. s.	v. s.	v. sl. s.
4	....	....	......	25	i.	......	....
5	cryst.	....	76	......	s.	s.	s.
6	colorl. liq.	....	......	282	i.	......	....
7	colorl. liq.	....	......	123	v. sl. s.	s.	....
8							
9	oil	....	......	165	v. sl. s.	s.	s.
10	yel. need.	....	55	subl.	v. sl. s.	s.	s.
11	prisms	....	125	subl.	sl. s. h.	sl. s.	v. s.
12	yel. need.	....	72–3	......	......	......	....
13	monocl. f. al.	....	85	282	......	s.	....
14	liq.	$1.075^{0°}$	-17	214	v. sl. s.	s.	s.
15	colorl.	1.126	18.5	195.2	i.	......	....
16	....	....	......	188.5	......	......	....
17	colorl.	1.340	48	280	s.	v. s.	s. chl.
18	need.	....	140	......	0.33	......	....
19	cryst.	....	d.	......	deliq.	s.	....
20	....	$0.996^{20°}$	......	138	i.	s.	s.
21	....	0.986	......	135	i.	s.	s.
22	colorl. prisms	....	100	268–73	v. s.	s.	i.
23	colorl. prisms	....	180	......	v. s.	v. sl. s.	v. sl. s.
24	rhombic	....	300	......	i.	s.	v. s.
25	need.	....	218	subl.	i.	s.	v. s.
26	colorl. tab.	....	154 (160.5)	abt. 360	v. s. bz.	s.	s.
27	colorl.	....	187	......	......	sl. s.	....
28	leaf.	....	171	471	i.	sl. s.	s. bz.
29	need. f. al.	....	135	......	......	s.	s.
30	need.	....	125.5	......	......	1 : 267	....
31	leaf.	....	164.5	......	......	1 : 1250	....
32	sm. pr. f. al.	....	109	>360	s. chl.; s. bz.	1 : 15 h.	s.
33	sm. need.	....	92	......	......	v. s.	s. bz.
34	....	....	323	......	v. sl. s.	......	....
35	yel. monocl.	1.615	187.5–8.0	......	i.	$0.7^{21°}$	....
36	yel., lng. need.	....	183	......	......	sl. s. h.	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Dinitro benzene (o.)		$C_6H_4(NO_2)_2$	168.05
2	" " (m.)		$C_6H_4(NO_2)_2$	168.05
3	" " (p.)		$C_6H_4(NO_2)_2$	168.05
4	benzoic acid (2, 4)		$(NO_2)_2 \cdot C_6H_3 \cdot COOH$	212.05
5	" " (2, 5)		$(NO_2)_2 \cdot C_6H_3 \cdot COOH$	212.05
6	" " (2, 6)		$(NO_2)_2 \cdot C_6H_3 \cdot COOH$	212.05
7	" " (3, 4)		$(NO_2)_2 \cdot C_6H_3 \cdot COOH$	212.05
8	" " (3, 5)		$(NO_2)_2 \cdot C_6H_3 \cdot COOH$	212.05
9	chlorbenzene (γ)		$C_6H_3Cl(NO_2)_2$	202.50
10	" (β) (1, 2, 4)		$C_6H_3Cl(NO_2)_2$	202.50
11	" (α) (1, 2, 4)		$C_6H_3Cl(NO_2)_2$	202.50
12	" (1, 3, 2)		$C_6H_3Cl(NO_2)_2$	202.50
13	" (1, 3, 4)		$C_6H_3Cl(NO_2)_2$	202.50
14	" (1, 3, 5)		$C_6H_3Cl(NO_2)_2$	202.50
15	cresol (p.)		$C_6H_2(NO_2)_2(CH_3)OH$	198.06
16	diphenyl (p.p.)		$NO_2C_6H_4 \cdot C_6H_4NO_2$	244.08
17	" (o.p.)		$NO_2C_6H_4 \cdot C_6H_4NO_2$	244.08
18	diphenylamine (o.p.)		$(C_6H_4NO_2)_2NH$	259.10
19	" (p.p.)		$(C_6H_4NO_2)_2NH$	259.10
20	methane		$CH_2(NO_2)_2$	106.03
21	naphthalene (α) (1, 5)		$C_{10}H_6(NO_2)_2$	218.06
22	" (β) (1, 8)		$C_{10}H_6(NO_2)_2$	218.06
23	" (γ) (1, 3)		$C_{10}H_6(NO_2)_2$	218.06
24	naphthol (α) (1, 2, 4)		$C_{10}H_5(NO_2)_2OH$	234.06
25	" (β)		$C_{10}H_5(NO_2)_2OH$	234.06
26	phenol (2, 3)		$(NO_2)_2 \cdot C_6H_3 \cdot OH$	184.05
27	" (2, 4)		$(NO_2)_2 \cdot C_6H_3 \cdot OH$	184.05
28	" (2, 6)		$(NO_2)_2 \cdot C_6H_3 \cdot OH$	184.05
29	" (3, 4)		$(NO_2)_2 \cdot C_6H_3 \cdot OH$	184.05
30	" (3, 5)		$(NO_2)_2 \cdot C_6H_3 \cdot OH$	184.05
31	resorcinol (2, 4, 1, 3)		$C_6H_2(NO_2)_2(OH)_2$	200.05
32	salicylic acid		$C_7H_4(NO_2)_2O_2 + H_2O$	246.06
33	toluene (2, 4)		$(NO_2)_2 \cdot C_6H_3 \cdot CH_3$	182.06
34	" (2, 5)		$(NO_2)_2 \cdot C_6H_3 \cdot CH_3$	182.06
35	" (2, 6)		$(NO_2)_2 \cdot C_6H_3 \cdot CH_3$	182.06
36	" (3, 4)		$(NO_2)_2 \cdot C_6H_3 \cdot CH_3$	182.06
37	" (3, 5)		$(NO_2)_2 \cdot C_6H_3 \cdot CH_3$	182.06
38	xylene (m.)		$C_6H_8(NO_2)_2$	196.08
39	" (p.)		$C_8H_6(NO_2)_2$	196.08
40	" (p. isomer)		$C_8H_6(NO_2)_2$	196.08

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of: Water	Alcohol	Ether
1	tab. f. al.	1.565[illegible]	117	319	0.38[illegible]	3.8[illegible]	v. s. bz.
2	need. f. al	1.546[illegible]	90	297	0.01 c.	3.5[illegible]	v. s. v. s. bz.
3	need.	$1.587^{17°}$	171–2	298.4	0.18[illegible]	0.4[illegible]	s. bz.
4	colorl. pr. f. w.	....	179	......	1.85[illegible]	v. s	0.71[illegible] bz.
5	colorl. need.	....	177	......	sl. s. h.	......	....
6	colorl. need.	....	202	dec.	v. s. h.	......	....
7	colorl.	....	163–4	......	0.67[illegible]	v. s	v. s
8	tab. f. w.	....	233–4	......	1.9[illegible]	v. s.	sl. s.
9	need.	....	38.8	......	......	s.	s.
10	monocl.	....	37.1 to γ	......	......	s	....
11	monocl.	....	36.3 to γ	......	......	s.	....
12	....	$1.687^{16°}$	42	315	......	v. s.	s.
13	....	$1.697^{22°}$	50	315	......	s.	....
14	....	....	59	vol. in steam	......	s.	s.
15	lng. yel. pr.	....	84	......	......	......	....
16	need.	....	233–5	......	......	s. h.	v. s.
17	monocl. need.	....	93.5	......	......	s. h.	....
18	red need.	....	156–7	......	......	......	....
19	yel. pr.	....	214	......	......	s.	....
20	liq.	....	......	expl. 100	s.	......	....
21	hex. need.	....	214	subl.	......	sl. s.	....
22	rhomb. pl	....	170	d.	......	sl. s	sl. s. bz
23	yel. need.	....	144	subl.	......	......	....
24	yel. need.	....	138	......	v. sl. s. h.	sl. s.	s. acet. a.
25	yel. need.	....	195	......	v. sl. s	s.	s.
26	yel. need. f. w.	....	144	......	sl. s.	v. s. h.	v. s.
27	yel. pl. f. w.	$1.683^{24°}$	114	......	v.sl.s.c.; v. s. h	$3.9^{19°}$	v. s.
28	yel. need. f. w.	....	61.8	......	v.sl.s.c.; v. s. h.	v. s. h.	v. s
29	need.	....	134	......	......	......	....
30	leaf.	....	122	......	......	......	....
31	yel. lvs.	....	142	subl.	......	s.	....
32	pl. or need.	....	165 anh.	subl.	v. s. h.	......	....
33	need. f. al.	$1.321^{0°}$	70.7	......	v. s. s. c	sl. s	v. s.
34	need. f. al.	....	52	......	v. s. CS_2	v. s.	v. s. bz.
35	need.	....	66	......	......	s.	....
36	need. f. CS_2	1.32	61	......	i.	s.	2.19 c. CS_2
37	need. f. w.	....	92–3	......	v. sl. s.	s.	v. s.
38	lng. pr.	....	93	......	......	s. h.	....
39	sm. need.	....	123.6	......	......	sl. s.	....
40	rhbdr.	....	9.3	......	......	s.	....

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
1	Dioxindole	....	$C_6H_4CH(OH)CO \cdot NH$	149.06
2	Diphenic acid	....	$(C_6H_4 \cdot COOH)_2$	242.08
3	Diphenol (α) (o. o.)	....	$(HO \cdot C_6H_4)_2$	186.08
4	" (β) (m. m.)	....	$(HO \cdot C_6H_4)_2$	186.08
5	" (γ) (p. p.)	....	$(HO \cdot C_6H_4)_2$	186.08
6	" (δ)	....	$(HO \cdot C_6H_4)_2$	186.08
7	Diphenyl	....	$C_6H_5 \cdot C_6H_5$	154.08
8	acetic acid	....	$(C_6H_5)_2 \cdot CH \cdot COOH$	212.10
9	amine	....	$(C_6H_5)_2 \cdot NH$	169.10
10	benzene (p.)	....	$C_6H_5 \cdot C_6H_4 \cdot C_6H_5$	230.11
11	carbinol	benzhydrol	$(C_6H_5)_2CHOH$	184.10
12	dicarboxylic acid	....	$C_{12}H_8(COOH)_2$	242.08
13	ethane (α)	....	$CH_3 \cdot CH(C_6H_5)_2$	182.11
14	hydrazine (α, α)	....	$(C_6H_5)_2N \cdot NH_2$	184.11
15	ketone.	See *benzophenone*		
16	methane	....	$(C_6H_5)_2CH_2$	168.10
17	mustard oil	....	$C_{12}H_9NCS$	211.14
18	oxide	....	$(C_6H_4)_2O$	168.06
19	thiourea (sym.)	....	$CS(NHC_6H_5)_2$	228.18
20	tolylmethane (m.)	....	$(C_6H_5)_2CH(C_6H_4CH_3)$	258.14
21	Diphenylol	....	$C_6H_5 \cdot C_6H_5OH$	171.09
22	urea (uns.)	carbanilide	$NH_2 \cdot CO \cdot N \cdot (C_6H_5)_2$	212.11
23	Dipicolinic acid (2, 6)	....	$C_6H_3N(COOH)_2 + 1\frac{1}{2}H_2O$	194.07
24	Dipropargyl	....	$CH \vdots C \cdot CH_2 \cdot CH_2 \cdot C \vdots CH$	78.05
25	Dipropyl amine	....	$(C_3H_7)_2NH$	101.13
26	carbinol	....	$(C_3H_7)_2 \cdot CHOH$	116.13
27	ether	propyl ether	$C_3H_7 \cdot O \cdot C_3H_7$	102.11
28	ketone	butyrone	$C_3H_7 \cdot CO \cdot C_3H_7$	114.11
29	Dipyridine	....	$C_{10}H_{10}N_2$	158.10
30	Dipyridyl (p. p.)	....	$C_5H_4N \cdot C_5H_4N + 2H_2O$	192.11
31	Diquinoline	....	$C_9H_7N \cdot C_9H_7N$	258.13
32	Diquinoyl (2, 3′)	....	$(C_9H_6N)_2$	256.11
33	" (6, 6′)	....	$(C_9H_6N)_2$	256.11
34	" (7, 2′)	....	$(C_9H_6N)_2$	256.11
35	Diresorcinol	....	$(HO)_2C_6H_3 \cdot C_6H_3(OH)_2 + 2H_2O$	254.11
36	Dithiocarbamic acid	....	$NH_2 \cdot CS_2H$	93.16
37	Ditolyl (o. o.)	....	$CH_3 \cdot C_6H_4 \cdot C_6H_4 \cdot CH_3$	182.11
38	" (o. m.)	....	$CH_3 \cdot C_6H_4 \cdot C_6H_4 \cdot CH_3$	182.11
39	" (m. m.)	....	$CH_3 \cdot C_6H_4 \cdot C_6H_4 \cdot CH_3$	182.11

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O = 1$ (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms per 100 c.c. of Water	Alcohol	Ether
1	rhomb. pr.	....	180	195 d.	1 : 13; h. 1 : 6	1 : 15	s. alk.
2	need.	....	226	subl.	sl. s.	s.	s.
3	lng. need.	....	123	......	s. h.	s.	s.
4	sm. leaf.	....	190	......	v. sl. s.	s.	s.
5	leaf. f. al.	....	269–70	subl.	sl. s.	s.	s.
6	sm. need.	....	161	342	sl. s. h.	s.	s.
7	colorl. tab.	1.165	70.5	254.6	i.	10 c.	s.
8	colorl. need.	....	148	......	v. s. h.	v. s.	v. s.
9	colorl. scales	1.159	54	302 (310)	v. sl. s.	v. s.	v. s.
10	colorl. leaf.	....	205	383	s. h. bz.	v. sl. s.	sl. s.
11	need.	....	67.5–8.0	297–8	0.05 c.	v. s.	v. s.
12	amor. powd.	....	......	d.	i.	i.	i.
13	oil	....	......	268–71	......	......	......
14	tricl. f. lgr.	1.190	34.5 (44)	220^{40mm}	v. sl. s.	v. s.	v. s.
15							
16	colorl.	$1.001^{26°}$	26–7	261–2	v. sl. s.	v. s.	v. s.
17	need.	....	58	......	......	......	v. s.
18	sm. lvs. f. al.	....	80–1	287–8	i.	......	s.
19	leaf.	1.31	144	......	......	s.	s.
20	....	....	59.0–9.5	>360	s. bz.	sl. s. c.	s.
21	need. or leaf.	....	165	305–8	......	v. s.	v. s.
22	colorl. need.	....	189	......	v. sl. s.	s.	s.
23	colorl. need.	....	226 d.	......	v. sl. s.	v. sl. s.	......
24	liq.	0.805	−6	85	i.	s.	v. s.
25	colorl. liq.	$0.736^{25°}$	......	110	s.	s.	......
26	colorl. liq.	$0.820^{20°}$	......	154	......	s.	s.
27	colorl. liq.	$0.744^{21°}$	......	90.7	s.	∞	∞
28	colorl. liq.	0.821	......	144	i.	∞	∞
29	need. f. h. w.	....	108	subl. need.	sl. s. c.; s. h.	s.	s.
30	need.	....	73; anh. 115	305	v. sl. s.	v. s.	v. s.
31	yel. need.	....	114	......	i.	v. s.	v. s.
32	monocl. tab.	....	176–7	>400	i.	v. s.	sl. s.
33	monocl. tab. f. al.	....	178	dist.	v. sl. s. h.	v. sl. s.	v. sl. s.
34	monocl. tab. f. al.	....	192.5	subl.	i.	v. sl. s.	sl. s.
35	cryst.	....	310	......	s. h.	i. acet.	s.
36	colorl. need.	....	......	......	s.	s.	s.
37	colorl. liq.	....	......	272	i.	......	......
38	colorl. liq.	....	......	288	i.	v. s.	v. s.
39	colorl. liq.	....	......	280–1	i.	......	......

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Ditolyl (p. p.)		$CH_3 \cdot C_6H_4 \cdot C_6H_4 \cdot CH_3$	182.11
2	Ditolyl amine (o.)		$(CH_3C_6H_4)_2NH$	197.13
3	" " (m.)		$(CH_3C_6H_4)_2NH$	197.13
4	" " (p.)		$(CH_3C_6H_4)_2NH$	197.13
5	Diurea	urazine	$CO(NH \cdot NH)_2CO$	116.06
6	Dodecane (n.)		$CH_3(CH_2)_{10} \cdot CH_3$	170.21
7	Dodecylene		$C_{12}H_{24}$	168.19
8	Dulcite		$C_6H_8(OH)_6$	182.11
9	Ecgonine (l.)		$C_9H_{15}O_3N + H_2O$	203.14
10	hydrochloride		$C_9H_{15}O_3N \cdot HCl$	221.59
11	Echitine		$C_{32}H_{52}O_2$	468.42
12	Eicosan		$C_{20}H_{42}$	282.34
13	Elaeomargaric acid		$C_{17}H_{30}O_2$	266.24
14	Elaeostearic acid		$C_{17}H_{30}O_2$	266.24
15	Elaïdic acid		$C_{17}H_{33}COOH$	282.27
16	Elaterin		$C_{20}H_{28}O_5$	348.22
17	Ellagic acid		$COC_6H(OH)_2C_6(OH)_3 \cdot OCO + 2H_2O$	338.08
18	Emetin		$C_{30}H_{40}N_2O_5$	544.34
19	Emodin	trihydroxymethyl-anthraquinone	$C_{14}H(CH_3)(OH)_3O_2$	267.06
20	Eosine	tetrabromfluorescein	$C_{20}H_8O_5Br_4$	647.73
21	Eosine (dye)	alkali salt of above	$C_{20}H_6O_5Br_4Na_2$	691.70
22	Epichlorhydrine (α)	chloropropylene oxide	C_3H_5ClO	92.50
23	Epicyanhydrine		C_3H_5OCN	83.05
24	Epidichlorhydrine (α)		$C_3H_4Cl_2$	110.95
25	Epiiodohydrine		C_3H_5IO	183.97
26	Erucic acid		$C_{21}H_{41}COOH$	338.34
27	Erythrosine	tetraiodofluorescein	$C_{20}H_8O_5I_4$	835.79
28	Erythrosine (dye)	alkali salt of above	$C_{20}H_6O_5I_4Na_2$	879.77
29	Eserin		$C_{15}H_{21}N_3O_2$	275.19
30	Ethane		$CH_3 \cdot CH_3$	30.05
31	Ethenyl-amino-phenol		$C_6H_4N : C(CH_3)O$	133.06
32	aminothiophenol		$C_6H_4N : C(CH_3)S$	149.13
33	diphenylamidine		$CH_3C(:NC_6H_5) \cdot NHC_6H_5$	210.13
34	tricarboxylic acid		$CH_3 \cdot C(COOH)_3$	162.05
35	triethyl ether		$CH_3 \cdot C(OC_2H_5)_3$	162.14
36	Ether	diethyl ether	$C_2H_5 \cdot O \cdot C_2H_5$	74.08
37	Ethoxy-benzoic acid (o.)		$C_2H_5 \cdot O \cdot C_6H_4 \cdot COOH$	166.08
38	Ethoxy-benzoic acid (m.)		$C_2H_5 \cdot O \cdot C_6H_4 \cdot COOH$	166.08
39	Ethoxy-benzoic acid (p.)		$C_2H_5 \cdot O \cdot C_6H_4 \cdot COOH$	166.08

ORGANIC COMPOUNDS (Continued)

No	Crystal-line form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. pr. f. eth.	....	121	......	......	s.	s.
2	liq.	....	......	313–4	v. sl. s	......	......
3	liq.	....	......	319–20	i.	v. s.	v. s.
4	colorl. need.	....	79	330.5	v. sl. s.	......	......
5	pr.	....	270	......	sl. s	sl. s.	......
6	colorl. liq.	0.76[illegible]	−12	214.5	i.	v. s.	v. s.
7	colorl. liq.	0.785^{20}	−31.5	213–5	i.	v. s.	v. s.
8	colorl. pr.	1.466	188.5	......	4 c., v. s. h.	v. sl. s	v. sl. s.
9	colorl. pr.	....	198 d.	......	$21.7^{17°}$	1.5	v. sl. s.
10	tricl. pl.	....	246	......	s.	sl. s.	......
11	leaf.	....	170	......	......	v. s. h.	sl. s.
12	....	$0.777^{37°}$	37	205^{15mm}	......	......	......
13	rhomb. pl.	....	48	......	......	s.	v. s.
14	leaf.	....	71	......	......	s.	v. s.
15	colorl. leaf.	$0.851^{7°}$	51.5	234^{15mm}	i.	s.	s.
16	hex. pl.	....	200	......	i.	s.	sl. s
17	yel. cryst.	$1.667^{1°}$	d.	......	v. sl. s. h.	sl. s.	i.
18	....	....	68	......	0.1	s.	......
19	or. monocl. pr.	....	245–50	......	s.	s. glac. acet. a.	......
20	red need.	....	......	......	i.	s.	s. acet. a.
21	red to br. powd.	....	......	......	s.	s.	......
22	colorl. liq.	$1.203^{0°}$	......	117	i.	∞	∞
23	pr.	....	162	......	s. h.	......	......
24	colorl. liq.	$1.209^{25°}$	......	96	i.	∞	∞
25	....	$2.03^{18°}$	......	160–80	i.	......	......
26	colorl. need.	$0.860^{55°}$	33.4	264^{15mm}	......	v. s.	......
27	yel. cryst.	....	......	......	i.	s.	v. sl. s.
28	red-br. powd.	....	......	......	s.	s.	......
29	....	....	106	......	sl. s.	v. s.	s. bz.
30	gas.....	1.049 (A)	−172	−86	sl. s.	46 c.c.$^{4°}$	......
31	liq.	$1.136^{0°}$	......	201	i.	s.	......
32	liq.	....	......	238	i.	s.	......
33	need.	....	131–2	......	......	sl. s. c.; v. s. h.	v. s.
34	pr.	....	159 d.	......	s.	s.	s.
35	....	$0.942^{22°}$	......	142	d. h.	......	......
36	colorl. liq.	0.719	−116.2	35	$8.3^{17.5}$	∞	......
37	colorl.	....	19.4	......	sl. s.	......	......
38	colorl. need.	....	137	sub.	sl. s. h.	s.	s.
39	colorl. need.	....	195	......	v. sl. s. h.	......	......

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Ethoxyl-amine	...	$CH_2OH \cdot CH_2NH_2$	61.06
2	aniline	...	$C_6H_5NH(C_2H_4OH)$	137.10
3	piperidine	...	$C_5H_{10}N \cdot C_2H_4OH$	129.13
4	Ethyl-acetamide	...	$C_2H_3O \cdot NH \cdot C_2H_5$	87.08
5	acetate	...	$CH_3COOC_2H_5$	88.06
6	acetoacetate	acetoacetic ether	$CH_3 \cdot CO \cdot CH_2 \cdot CO_2 \cdot C_2H_5$	130.08
7	acetylene	...	$C_2H_5 \cdot C:CH$	54.05
8	acrylate	...	$C_3H_3OO \cdot C_2H_5$	100.06
9	alcohol	...	$C_2H_5 \cdot OH$	46.05
10	allophanate	...	$NH_2CONHCOOC_2H_5$	132.08
11	allyl	...	$C_3H_5 \cdot C_2H_5$	70.08
12	allyl ether	...	$C_2H_5O \cdot CH_2 \cdot CH:CH_2$	86.08
13	amine	...	$C_2H_5 \cdot NH_2$	45.06
14	aminobenzoic acid	...	$C_2H_5 \cdot NH \cdot C_6H_4 \cdot COOH$	165.10
15	aminophenol	...	$HO \cdot C_6H_4 \cdot NH \cdot C_2H_5$	137.10
16	amylketone	...	$C_2H_5 \cdot CO \cdot C_5H_{11}$	128.13
17	aniline	...	$C_6H_5 \cdot NH \cdot C_2H_5$	121.10
18	anthracene	...	$C_6H_4C_2H(C_2H_5) \cdot C_6H_4$	206.11
19	benzalacetoacetate	...	$CH_3COC:(CHC_6H_5)COO \cdot C_2H_5$	218.11
20	benzene	phenylethane	$C_6H_5 \cdot C_2H_5$	106.08
21	benzoate	...	$C_6H_5 \cdot COO \cdot C_2H_5$	150.08
22	benzoic acid (o.)	...	$C_2H_5 \cdot C_6H_4 \cdot COOH$	150.08
23	" " (m.)	...	$C_2H_5 \cdot C_6H_4 \cdot COOH$	150.08
24	" " (p.)	...	$C_2H_5 \cdot C_6H_4 \cdot COOH$	150.08
25	benzoyl-acetate	benzoyl acetic ester	$C_6H_5 \cdot CO \cdot CH_2 \cdot COO \cdot C_2H_5$	192.10
26	benzylbenzene	...	$C_6H_5CH_2 \cdot C_6H_4 \cdot C_2H_5$	196.13
27	benzyl ether	...	$C_2H_5 \cdot O \cdot CH_2 \cdot C_6H_5$	136.10
28	" ketone	...	$C_2H_5 \cdot CO \cdot CH_2 \cdot C_6H_5$	148.10
29	brom-acetate	...	$CH_2Br \cdot COO \cdot C_2H_5$	166.97
30	bromide	monobromethane.	C_2H_5Br	108.96
31	butyl ether (n.)	...	$C_2H_5 \cdot O \cdot C_4H_9$	102.11
32	" ketone (n.)	...	$C_2H_5 \cdot CO \cdot C_4H_9$	114.11
33	butyrate	...	$C_3H_7 \cdot COO \cdot C_2H_5$	116.10
34	caprate	...	$C_9H_{19}COOC_2H_5$	200.19
35	caproate	...	$C_5H_{11}COOC_2H_5$	144.13
36	caprylate	...	$C_7H_{15}COOC_2H_5$	172.16
37	carbamate.	See *urethane*		
38	carbazole	...	$C_{12}H_8N \cdot C_2H_5$	195.11
39	carbonate	...	$(C_2H_5)_2CO_3$	118.08
40	carbostyril	...	$C_6H_4 \cdot C_2H_2(C_2H_5)NHCO$	174.10
41	chloracetate	...	$CH_2Cl \cdot COOC_2H_5$	122.51
42	chloracetoacetate	...	$CH_2Cl \cdot CO \cdot CH_2COOC_2H_5$	164.53
43	chlorocarbonate	...	$Cl \cdot COOC_2H_5$	108.50
44	chlorformate	ethyl chlorcarbonate	$ClCOO \cdot C_2H_5$	108.50

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	....	....	100 hyd	rochlori	de	......	......
2	liq.	$1.11^{0°}$	......	280	v. sl. s.	s.	......
3	liq.	....	......	199	s.	s.	......
4	....	$0.942^{4°}$	......	205	......	......	s. a.
5	colorl. liq.	$0.900^{20°}$	-82.4	77	$8.6^{20°}$	∞	∞
6	liq.	$1.030^{15°}$	......	181	sl. s.	s.	s.
7	colorl.	....	-130	18	i.	s.	s.
8	colorl. liq	$0.939^{0°}$	......	98.5	......	......	......
9	colorl. liq.	$0.789^{20°}$	-114	78.4	∞	......	∞
10	need.	....	190	d.	i. c.	......	sl. s.
11	liq.	....	......	37	......	......	......
12	colorl. liq.	$0.799^{25°}$	......	66	i.	∞	∞
13	colorl. liq	0.689	-84	abt. 19	∞	∞	∞
14	pr.	....	112	subl.	v. sl. s.	s.	s.
15	rhomb.	....	167.5	......	i.	s.	sl. s.
16	colorl. liq.	$0.850^{0°}$	......	170	i.	∞	∞
17	liq.	$0.963^{20°}$	-80	205	v. sl. s.	∞	∞
18	leaf.	....	60-1	......	i.	s.	......
19	....	....	59	181^{17mm}	......	s.	s.
20	colorl. liq.	$0.874^{14°}$	-94	136.5	i.	∞	∞
21	colorl. liq.	1.051	......	212	sl. s. h.	s.	∞
22	colorl. need.	....	68	259	v. sl. s.	v. s.	v. s.
23	colorl. need.	....	47	......	v. sl. s.	......	......
24	colorl. leaf.	....	112-3	......	s. h.	v. s.	v. s.
25	colorl. liq	1.121	......	265-70 d.	i.	∞	∞
26	liq.	$0.985^{12°}$	......	294-5	......	s.	s.
27	colorl. liq.	$0.950^{19°}_{15}$	......	185(189)	i.	∞	∞
28	colorl. liq.	$0.998^{17.5°}$	......	223-6 (230)	i.	∞	∞
29	colorl. liq.	$1.507^{25°}_{25}$	......	158-60	i.	∞	∞
30	colorl. liq.	1.450	......	39	$0.09^{20°}$	∞	∞
31	colorl. liq.	$0.752^{20°}$	......	92	i.	∞	∞
32	colorl. liq	....	......	147-8	i.	∞	∞
33	colorl. liq.	0.886	-93.3	119.9	$0.68^{25°}$	s.	s.
34	liq.	0.862	......	243	......	......	......
35	liq.	$0.8888^{0°}$	......	214	i.	s.	s.
36	liq.	0.8738	......	60	d.	......	......
37							
38	leaf.	....	68	......	......	s. h.	s.
39	colorl. liq.	0.978	......	126	i.	s.	......
40	cryst.	....	168	......	......	......	......
41	colorl. liq.	$1.159^{20°}$	......	145.5	i.	......	......
42	colorl. liq.	$1.179^{25°}_{25}$	......	196-200	v. sl. s.	∞	∞
43	liq.	$1.139^{15°}$	......	94	d.	......	......
44	colorl. liq.	1.139	......	93	dec.	∞	∞

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Ethyl-chloride...	....	C_2H_5Cl............	64.50
2	chlorpropionate (α)	....	$CH_3 \cdot CHCl \cdot COO \cdot C_2H_5$	136.53
3	cinnamate...	....	$C_6H_5 \cdot CH : CH \cdot COO \cdot C_2H_5$	176.10
4	crotonic acid...	....	$CH_3 \cdot C_2H(C_2H_5) COOH$	114.08
5	cyanacetate...	....	$CH_2CN \cdot COOC_2H_5$	113.06
6	cyanate.......	....	$NCO(C_2H_5)$........	71.05
7	cyanide.......	propionitrile.....	C_2H_5CN..........	55.05
8	diaceto-acetate..	....	$(CH_3 \cdot CO)_2CH \cdot COO \cdot C_2H_5$	172.10
9	dichloracetate...	....	$CHCl_2 \cdot COO \cdot C_2H_5$..	156.96
10	diethyl-aceto-acetate	....	$CH_3CO \cdot C(C_2H_5)_2 CO_2C_2H_5$	186.14
11	diethyl-malonate	....	$(C_2H_5)_2 \cdot C \cdot (COO \cdot C_2H_5)_2$	216.16
12	dimethyl-malonate	....	$(CH_3)_2 \cdot C \cdot (COO \cdot C_2H_5)_2$	188.13
13	diphenylamine..	....	$(C_6H_5)_2NC_2H_5$......	197.13
14	diphenyl-phosphine	....	$(C_6H_5)_2C_2H_5P$......	214.15
15	disulfide........	....	$(C_2H_5)_2S_2$..........	122.21
16	fluoride........	....	C_2H_5F.............	48.04
17	formamide.....	....	$HCONHC_2H_5$......	73.06
18	formate........	....	$HCOOC_2H_5$........	74.05
19	glycerate......	....	$C_2H_3(OH)_2COOC_2H_5$	134.08
20	glycine.........	....	$CH_2(NHC_2H_5)COOH$	103.08
21	glycol ether.....	....	$CH_2OH \cdot CH_2 \cdot O \cdot C_2H_5$	90.08
22	glycollate......	....	$CH_2OH \cdot COOC_2H_5$	104.06
23	glycollic acid...	....	$CH_2(OC_2H_5) \cdot COOH$	104.05
24	hexyl carbinol...	....	$C_2H_5 \cdot CH(OH) \cdot C_6H_{13}$	144.16
25	hydrazine.....	....	$C_2H_5NH \cdot NH_2$......	60.08
26	hydrocinnamate	....	$C_6H_5 \cdot CH_2 \cdot CH_2 \cdot COOC_2H_5$	178.11
27	hydrogenphthalate	....	$C_6H_4(COOC_2H_5) COOH$	194.08
28	hydrogen sulfate	ethyl sulfuric acid	$C_2H_5 \cdot HSO_4$........	126.11
29	hydrosulphide.	See *ethyl mercaptan*		
30	hydroxylamine(α)	....	$NH_2 \cdot O \cdot C_2H_5$......	61.06
31	" (β)	....	C_2H_5NHOH.......	61.06
32	iodide........	....	C_2H_5I............	155.97
33	isoamyl ether...	....	$C_2H_5 \cdot O \cdot C_5H_{11}$......	116.13
34	isobutyl........	....	$CH_3(CH_2)_2CH(CH_3)_2$	86.11
35	isobutyl ether...	....	$C_2H_5 \cdot O \cdot C_4H_9$......	102.11
36	isobutyl ketone	....	$C_2H_5 \cdot CO \cdot C_4H_9$.....	114.11
37	isobutyrate.....	....	$(CH_3)_2CH \cdot COO \cdot C_2H_5$	116.10
38	isocyanate......	....	C_2H_5NCO.........	71.05
39	isocyanide......	ethyl carbylamine	C_2H_5NC...........	55.05
40	isopropyl-aceto-acetate	....	$C_2H_3O \cdot CH(C_3H_7) \cdot CO_2 \cdot C_2H_5$	172.13
41	isopropyl ether..	....	$C_2H_5 \cdot O \cdot CH(CH_3)_2$	88.10
42	" ketone	....	$C_2H_5 \cdot CO \cdot CH(CH_3)_2$	100.10

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	$0.921^{0°}$ ($0.925^{0°}$)	−141	12.2–.5	2	∞	∞
2	colorl. liq.	1.087	......	146	v. sl. s.	∞	∞
3	colorl. liq.	1.050	12	271	i.	s.	v. s.
4	monocl.	....	39.5 (41.5)	subl.	sl. s.	s.	....
5	colorl. liq.	1.066	......	207	i.	∞	∞
6	liq.	0.089	......	162	i.	......	....
7	colorl. liq.	$0.780^{20°}$	......	97.1	s.	∞	....
8	colorl. liq.	1.101	......	200–5	sl. s.	......	....
9	colorl. liq.	1.283	......	156–8	v. sl. s.	∞	∞
10	colorl. liq.	$0.974^{20°}$	......	218	i.	∞	∞
11	colorl. liq.	0.992	......	223	i.	∞	∞
12	colorl. liq.	1.002	......	196.5	i.	∞	∞
13	liq.	....	......	295	i.	s.	....
14	liq.	....	......	293	......	s.	s. bz.
15	....	$0.993^{20°}$	......	151	v. sl. s.	......	....
16	gas	1.7 A	......	−32	198 c.c.$^{14°}$	v. s.	....
17	....	$0.952^{21°}$	......	199	......	......	....
18	liq.	0.917	−80	54.3	11	s.	s.
19	liq.	1.091	......	230–40	s.	v. s.	v. s.
20	leaf.	....	160 d.	......	s.	s.	....
21	colorl. liq.	$0.926^{13°}$	......	135	s.	∞	∞
22	colorl. liq.	$1.083^{23°}$	......	160	......	v. s.	v. s.
23	liq.	....	......	206–7	......	......	....
24	liq.	$0.839^{0°}$	......	195^{750mm}	......	......	....
25	colorl. liq.	....	......	101	v. s.	v. s.	v. s.
26	colorl. liq.	1.102^{25}_{25}	......	247–9	i.	......	....
27	liq.	....	......	d.	sl. s.	s.	....
28	liq.	1.316	......	dec.	v. s.	s.	s.
29							
30	colorl. liq.	$0.883^{7.5°}$	......	68	∞	∞	∞
31	colorl. leaf.	$0.908^{64°}$	59–60 d.	......	v. s.	v. s.	sl. s.
32	liq.	$1.94^{18°}_{15}$	−112	72.3	$0.4^{20°}$	s.	s.
33	colorl. liq.	0.761	......	112	i.	∞	∞
34	liq.	$0.7011^{0°}$	......	62	......	s.	s.
35	colorl. liq.	0.751	......	78–80	i.	∞	∞
36	colorl. liq.	$0.815^{17°}_{6}$	......	136	i.	∞	∞
37	colorl. liq.	$0.869^{20°}$	......	110.1	sl. s.	∞	∞
38	liq.	0.898	......	60	i.	......	s.
39	colorl. liq.	$0.759^{4°}$	......	78–9	v. s.	......	s.
40	colorl. liq.	$0.947^{22°}_{18}$	......	200.5 d.	v. sl. s.	∞	∞
41	colorl. liq.	$0.745^{0°}$	......	54	s.	∞	∞
42	colorl. liq.	$0.830^{0°}$	......	114.5	v. sl. s.	v. s.	∞

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
	Ethyl-			
1	isosuccinate....	....	$CH_3 \cdot CH(COO \cdot C_2H_5)_2$	174.11
2	isothiocyanate..	ethyl mustard oil	$C_2H_5 \cdot N : CS$	87.11
3	isovaleriate.....	....	$(CH_3)_2CH \cdot CH_2 \cdot COO \cdot C_2H_5$	130.11
4	lactate.........	....	$C_3H_5O_3 \cdot C_2H_5$.......	118.08
5	malate.........	....	$C_2H_3(OH) \cdot (COO \cdot C_2H_5)_2$	190.11
6	malonic acid	....	$C_2H_5 \cdot CH(COOH)_2$	132.06
7	malonate.......	....	$CH_2(COO \cdot C_2H_5)_2$...	160.10
8	mercaptan.....	....	C_2H_5SH...........	62.11
9	monotartrate...	....	$COOH \cdot (CHOH)_2 \cdot COO \cdot C_2H_5$	178.08
10	mustard oil. See	*ethyl isothiocyanate*		
11	naphthalene (α)	....	$C_{10}H_7 \cdot C_2H_5$........	156.10
12	" (β)	....	$C_{10}H_7 \cdot C_2H_5$........	156.10
13	naphthyl ether(α)	....	$C_{10}H_7 \cdot O \cdot C_2H_5$.....	172.10
14	" " (β)	....	$C_{10}H_7 \cdot O \cdot C_2H_5$.....	172.10
15	naphthylamine .	....	$C_{10}H_7NHC_2H_5$.....	171.11
16	nitrate.........	....	$C_2H_5NO_3$..........	91.05
17	nitrite.........	....	$C_2H_5NO_2$..........	75.05
18	nitro-benzoate(o.)	....	$NO_2 \cdot C_6H_4 \cdot COO \cdot C_2H_5$	195.08
19	" " (m.)	....	$NO_2 \cdot C_6H_4 \cdot COO \cdot C_2H_5$	195.08
20	" " (p.)	....	$NO_2 \cdot C_6H_4 \cdot COO \cdot C_2H_5$	195.08
21	nitrocinnamate (o.)	....	$C_9H_6(NO_2)O_2C_2H_5$..	221.10
22	" (p.)	....	$C_9H_6(NO_2)O_2C_2H_5$	221.10
23	nitrolic acid....	....	$CH_3C \cdot (NOH) \cdot NO_2$.	104.05
24	oenanthylate...	....	$CH_3 \cdot (CH_2)_5 COOC_2H_5$	158.14
25	orthoacetate....	....	$CH_3 \cdot C(OC_2H_5)_3$....	162.14
26	orthocarbonate .	....	$C(OC_2H_5)_4$	192.16
27	orthoformate...	....	$CH(OC_2H_5)_3$.......	148.13
28	orthosilicate....	....	$(C_2H_5)_4SiO_4$........	208.22
29	oxalacetate.....	....	$C_2H_5CO_2 \cdot CO \cdot CH_2 \cdot COOC_2H_5$	188.10
30	oxalate........	....	$(\cdot COO \cdot C_2H_5)_2$.....	146.08
31	palmitate......	....	$C_{15}H_{31} \cdot COO \cdot C_2H_5$..	284.29
32	pelargonate.....	....	$C_9H_{18}O_2 \cdot C_2H_5$......	187.18
33	phenate........	See *phenetol*		
34	phenol (o.).....	....	$C_2H_5 \cdot C_6H_4 \cdot OH$....	122.08
35	" (p.).....	....	$C_2H_5 \cdot C_6H_4 \cdot OH$....	122.08
36	phenyl-acetate..	....	$C_6H_5 \cdot CH_2 \cdot COO \cdot C_2H_5$	164.10
37	phenylacetylene.	....	$C_6H_5C : CC_2H_5$	130.08
38	phenylcarbamate	....	$CO(NHC_6H_5)OC_2H_5$	165.10
39	phenylcarbinol..	....	$C_6H_5 \cdot CH(OH) \cdot C_2H_5$	136.10
40	phenylhydrazine (α, α)	....	$C_6H_5N(C_2H_5) \cdot NH_2$	136.11
41	" (α, β)	....	$C_6H_5NH \cdot NHC_2H_5$	136.11

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq	1.021	......	198	v. sl. s.	∞	∞
2	colorl. liq	0.995[illegible]	−5.9	131–2	i.	s.	s.
3	colorl. liq.	0.872	......	134.3	i.	∞	∞
4	colorl. liq.	$1.031^{19°}$	......	154.5	∞	v. s.	v. s.
5	colorl. liq.	1.124[illegible]°	......	248–52 d.	s.	∞	∞
6	rhomb.	....	111.5	160 d.	s.	s.	s.
7	colorl. liq	1.061	−50	198	v. sl. s.	∞	∞
8	liq.	0.838[illegible]	−144	36–7	1.5	s.	s.
9	colorl. rhomb.	....	90	......	s.	......	....
10							
11	colorl. liq.	$1.064^{15°}_{15}$	......	258 sl. d.	i.	∞	∞
12	colorl. liq.	$1.008^{0°}$	−19	251	i.	∞	∞
13	liq.	....	5.5	280	i.	v. s.	v. s.
14	....	....	37	282	i.	sl. s.	s.
15	cryst.	....	193	303	......	......	....
16	colorl. liq.	1.116	−112	87.6	i.	∞	∞
17	liq.	0.900	......	17	v. sl. s.	∞	s.
18	colorl. tricl.	....	30	......	......	......	....
19	prisms	....	47 (54)	......	i.	v. s.	v. s.
20	colorl.	....	57	......	......	......	....
21	rhomb. need.	....	44	......	v. s. bz.	v. s.	v. s.
22	yel. need.	....	140–1	......	i.	sl. s.	sl. s.
23	yel. rhomb.	....	86–8 d.	......	s.	......	s.
24	liq.	....	......	188	......	......	....
25	....	$0.94^{22°}$	......	142	......	......	....
26	liq.	....	......	158–9	......	......	....
27	liq.	....	......	146	......	......	....
28	....	$0.933^{20°}$	......	165	d.	......	....
29	....	....	......	131	......	......	....
30	colorl. liq	1.085	......	186.1	sl. s.	∞	∞
31	colorl.	....	24.2	......	i.	s.	s.
32	liq.	....	......	......	......	s.	....
33							
34	colorl. liq.	1.037[illegible]°	......	206.5–7.5	......	......	....
35	colorl.	....	46	218.5	......	v. s.	v. s.
36	colorl. liq.	1.086	......	229 (226)	i.	∞	∞
37	....	$0.923^{21°}$	......	202	......	......	....
38	lng. need. f. w.	....	52	237–8	......	......	....
39	liq.	$0.99^{15°}$	......	212	......	s.	s.
40	liq.	1.018[illegible]5°	......	237	......	......	....
41	liq.	1.+−	......	100–4 $_{10mm}$	sl. s.	s.	s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Ethyl-			
1	phenyl ketone		$C_2H_5 \cdot CO \cdot C_6H_5$	134.08
2	phenylsulfone		$C_6H_5 \cdot SO_2 \cdot C_2H_5$	170.14
3	phenylurea		$C_2H_5 \cdot NH \cdot CO \cdot NH \cdot C_6H_5$	164.11
4	phosphate		$(C_2H_5)_3PO_4$	182.15
5	phosphine		$C_2H_5 \cdot PH_2$	62.08
6	phthalate (o.)		$C_6H_4 \cdot (COO \cdot C_2H_5)_2$	222.11
7	" (m.)	ethyl isophthalate	$C_6H_4 \cdot (COO \cdot C_2H_5)_2$	222.11
8	" (p.)	ethyl terephthalate	$C_6H_4 \cdot (COO \cdot C_2H_5)_2$	222.11
9	propiolate		$CH \vdots C \cdot COO \cdot C_2H_5$	98.05
10	propionate		$C_2H_5 \cdot COO \cdot C_2H_5$	102.08
11	propyl carbinol (n.)		$C_3H_7 \cdot CHOH \cdot C_2H_5$	102.11
12	" ether		$C_3H_7 \cdot O \cdot C_2H_5$	88.10
13	" ketone		$C_2H_5COC_3H_7$	100.10
14	" malonate		$C_3H_7 \cdot CH \cdot (COO \cdot C_2H_5)_2$	202.14
15	pyridine (2)		$C_2H_5 \cdot C_5H_4N$	107.08
16	" (3)		$C_2H_5 \cdot C_5H_4N$	107.08
17	" (4)		$C_2H_5 \cdot C_5H_4N$	107.08
18	salicylate		$HO \cdot C_6H_4 \cdot COO \cdot C_2H_5$	166.08
19	silicate	See *ethyl orthosilicate*		
20	succinate (n.)		$(\cdot CH_2 \cdot COO \cdot C_2H_5)_2$	174.11
21	succinic acid		$C_2H_3(C_2H_5)(COOH)_2$	146.08
22	sulfate		$(C_2H_5)_2SO_4$	154.14
23	sulfide		$(C_2H_5)_2S$	90.14
24	sulfinic acid		$C_2H_5 \cdot SO_2H$	94.11
25	sulfite		$(C_2H_5)_2SO_3$	138.14
26	sulfocyanate	See *ethyl thiocyanate*		
27	sulfone		$(C_2H_5)_2SO_2$	122.14
28	sulfonic acid		$C_2H_5SO_2 \cdot OH$	110.11
29	sulfonic chloride		$C_2H_5 \cdot SO_2Cl$	128.56
30	sulfoxide		$(C_2H_5)_2SO$	106.14
31	tartrate (d. or l.)		$[\cdot CH(OH) \cdot COO \cdot C_2H_5]_2$	206.11
32	thiocarbamate		$CS(NH_2)SC_2H_5$	121.19
33	thiocyanate		$C_2H_6 \cdot SCN$	87.11
34	toluate (o.)		$CH_3 \cdot C_6H_4 \cdot COO \cdot C_2H_5$	164.10
35	" (m.)		$CH_3 \cdot C_6H_4 \cdot COO \cdot C_2H_5$	164.10
36	" (p.)		$CH_3 \cdot C_6H_4 \cdot COO \cdot C_2H_5$	164.10
37	toluene (o.)	methylethyl benzene (o.)	$C_2H_5 \cdot C_6H_4 \cdot CH_3$	120.10
38	" (m.)	methylethyl benzene (m.)	$C_2H_5 \cdot C_6H_4 \cdot CH_3$	120.10
39	" (p.)	methylethyl benzene (p.)	$C_2H_5 \cdot C_6H_4 \cdot CH_3$	120.10
40	trichloracetate		$CCl_3 \cdot COO \cdot C_2H_5$	191.41
41	urea		$NH_2 \cdot CO \cdot NHC_2H_5$	88.08
42	valeriate		$C_4H_9 \cdot COO \cdot C_2H_5$	130.11

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. $H_2O = 1$ (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	color. leaf	1.015	21	218	i.	s.	s.
2	monocl.	....	42	>300	sl. s. c.	s.	s.
3	nced.	....	9.9	......	......	s.	....
4	....	....	......	215	d.	s.	s.
5	liq.	$<H_2O$	......	25	......	......	....
6	colorl. liq	$1.118^{20°}$	......	295	i.	∞	∞
7	colorl. liq	....	......	285	......	......	....
8	colorl.	....	44	......	......	......	....
9	colorl. liq.	....	......	119	i.	v. s	v. s.
10	colorl. liq.	0.896	......	98.3	$2.4^{20°}$	∞	∞
11	colorl. liq.	$0.819^{20°}$	......	135	......	s.	....
12	colorl. liq.	$0.755^{0°}$	......	63.6	s.	∞	∞
13	colorl. liq.	$0.818^{18°}$	......	122–4	v. sl. s.	∞	∞
14	colorl. liq.	0.993	......	221	......	......	....
15	liq.	$0.937^{17°}$	......	148.6	sl. s.	∞	v. s.
16	colorl. liq	$0.959^{0°}$	......	165	v. sl. s.	......	....
17	colorl. liq	$0.952^{0°}$	......	164–6	s. dil. a.	......	....
18	colorl. liq	1.135	1.3	231	......	∞	∞
19							
20	colorl. liq.	1.044	−20.8	216.5	i.	∞	∞
21	colorl. prisms	....	98	......	v. s.	v. s.	v. s.
22	colorl. liq.	1.184	−24.5	208	i.; sl. dec.	dec. h.	....
23	colorl. liq.	$0.837^{20°}$	−99.5	91–3	i.	s.	s.
24	syrup...	....	......	......	......	......	s. alk.
25	colorl. liq.	$1.106^{0°}$	......	161	s. dec.	s.	....
26							
27	rhombic	$1.357^{20°}$	70	248	$15.6^{16°}$	......	....
28	crystals	....	......	......	s.	s.	s. alk.
29	liq.	....	......	177	dec.	dec.	v. s.
30	liq.	....	......	......	s.	......	....
31	colorl. liq.	1.209	......	280	sl. s.	∞	∞
32	....	....	41–2	......	v. sl. s.	s.	s.
33	colorl. liq.	$1.007^{23°}$	......	146 (142)	i.	∞	∞
34	colorl. liq.	1.039	......	221 (227)	i.	∞	∞
35	colorl. liq.	....	......	226–8	i.	∞	∞
36	colorl. liq.	....	......	228	......	......	....
37	colorl. liq.	0.873	......	158–9	i.	∞	∞
38	colorl. liq.	$0.869^{20°}$	......	158–9	i.	s.	s.
39	colorl. liq.	$0.865^{21°}$	......	162	i.	s.	s.
40	colorl. liq.	1.309	......	164–7	i.	∞	∞
41	colorl. prisms	$1.213^{18°}$	92	......	v. s.	v. s.	i.
42	colorl. liq.	$0.877^{20°}$	......	144.5	i.	∞	∞

No.	Name	Synonyms	Formula	Mol. wt.
	Ethyl-			
1	vanillate.......	....	$C_{10}H_{12}O_4$..........	196.10
2	xylene 1, 3, 5...	....	$C_6H_3(CH_3)_2C_2H_5$..	134.11
3	" 1, 3, 4...	....	$C_6H_3(CH_3)_2C_2H_5$....	134.11
4	Ethylene........	....	$CH_2 : CH_2$.........	28.03
5	acetate........	....	$(CH_3{\cdot}COO)_2C_2H_4$...	146.08
6	alcohol	See *ethylene glycol*		
7	benzoate.......	....	$C_2H_4(C_7H_5O_2)_2$.....	270.11
8	bromide........	glycol dibromide .	$CH_2Br{\cdot}CH_2Br$.....	187.86
9	chlorohydrine...	....	$CH_2Cl{\cdot}CH_2OH$.....	80.50
10	chloride........	glycol dichloride..	$CH_2Cl{\cdot}CH_2Cl$......	98.95
11	cyanhydrine....	glycol cyanhydrine	$HO{\cdot}CH_2{\cdot}CH_2{\cdot}CN{\cdot}$	71.05
12	cyanide...... ..	succinonitrile....	$CN{\cdot}CH_2{\cdot}CH_2{\cdot}CN$.	80.05
13	diamine........	....	$NH_2{\cdot}CH_2{\cdot}CH_2NH_2$.	60.08
14	diphenyldiamine	....	$C_2H_4(C_6H_5{\cdot}NH)_2$...	212.14
15	diphenyl ether..	....	$C_2H_4(OC_6H_5)_2$......	214.11
16	disulfonic acid..	....	$C_2H_4(SO_3H)_2$	190.18
17	ethylidene oxide	....	$CH_3{\cdot}CHO_2C_2H_4$....	88.06
18	glycol..........	glycol...........	$HOCH_2{\cdot}CH_2OH$...	62.05
19	glycol monoacetate	glycol monoacetate	$HOCH_2{\cdot}CH_2OOC{\cdot}CH_3$	104.06
20	iodide.........	glycol diiodide...	$CH_2I{\cdot}CH_2I$........	281.90
21	lactic acid	See *hydracrylic acid*		
22	mercaptan.....	....	$C_2H_4(SH)_2$.........	94.18
23	nitrate.........	glycol dinitrate	$NO_3{\cdot}CH_2{\cdot}CH_2{\cdot}NO_3$	152.05
24	nitrite.........	glycol dinitrite...	$NO_2{\cdot}CH_2{\cdot}CH_2{\cdot}NO_2$	120.05
25	oxide..........	....	C_2H_4O...........	44.03
26	phenylsulfone...	....	$(C_6H_5SO_2)_2C_2H_4$...	310.24
27	thiocyanate....	....	$C_2H_4(SCN)_2$.......	144.18
28	urea..........	....	$CH_2{\cdot}NHCONHCH_2$	86.06
29	Ethylidene acetone	....	$CH_3COCH : CH{\cdot}CH_3$	84.06
30	cyanhydrine....	....	$CH_3CH(OH)CN$...	71.05
31	dibromide......	....	$CH_3{\cdot}CHBr_2$.......	187.86
32	dichloride......	....	$CH_3{\cdot}CHCl_2$........	98.95
33	diiodide........	....	$CH_3{\cdot}CHI_2$.........	281.90
34	urea...........	....	$C_3H_6ON_2$..........	86.06
35	urethane.......	....	$C_2H_4(NHCOOC_2H_5)_2$	204.14
36	Eucalyptol......	cineol...........	$C_{10}H_{18}O$...........	154.14
37	Eugenol (1, 4, 3).	eugenic acid.....	$C_3H_5{\cdot}C_6H_3$......... (OH)(OCH$_3$)	164.10
38	methyl ether... (1, 2, 4)	....	$C_3H_5{\cdot}C_6H_3 : (OCH_3)_2$	178.11
39	Eugetinic acid...	....	$C_6H_2(OH)(OCH_3)C_3H_5COOH$	208.09
40	Eupittonic acid...	....	$C_{19}H_8(OCH_3)_6O_3$....	470.21
41	Euxanthic acid...	... .	$C_{19}H_{16}O_{10} + 3H_2O$	458.18

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl.	....	44	292	i.	v. s.	v. s.
2	liq.	$0.861^{20°}$	......	185	i.	......	s.
3	liq.	$0.8783^{20°}$	......	183–4	......	......	....
4	gas	0.978(A)	–169	–102.7	25.6 c.c.$^{0°}$	360 c.c.	s.
5	colorl. liq.	$1.128^{0°}$	......	186–7	14.3	s.	s.
6							
7	rhomb. pr	....	67	>360	i.	......	s.
8	colorl. liq.	2.189	9–10	131	v. sl. s.	s.	∞
9	liq.	$1.24^{8°}$	......	128	s.	s.	s.
10	colorl. liq.	1.265	......	84	sl. s.	s.	∞
11	colorl. liq.	$1.059^{0°}$	......	221–3	∞	∞	s.
12	colorl.	....	51–2 (54.5)	265–7 d.	v. s.	v. s.	s.
13	colorl.	0.902	10 ($1H_2O$)	117	s.	......	v. sl. s.
14	cryst.	....	59.(63)	......	i.	s.	s.
15	colorl.	....	98.5	......	v. sl. s. c.	sl. s.	v. s.
16	....	....	94	......	deliq.	s.	....
17	....	1.0002	......	82.5	1 : 1.5	......	....
18	colorl. liq.	1.115	......	197–7.5	∞	∞	sl. s.
19	colorl. liq.	1.108	......	182	∞	s.	....
20	yel. pr.	2.07	81.2	......	sl. s.	s.	s.
21							
22	liq.	$1.123^{23°}$	......	146	......	s.	s. NH_3 aq.
23	yel. liq.	$1.483^{8°}$	......	*	i.	s.	....
24	liq.	$1.216^{0°}$	......	96–8	i.	s.	s.
25	colorl. liq.	$0.897^{0°}$	......	14	∞	∞	∞
26	need.	....	180	......	sl. s. h.	sl. s. h.	s. glac. acet. a.; s. bz.
27	rhombic	....	90	d.	s.	s.	....
28	need.	....	131	......	s. chl.	......	....
29	liq.	0.861	......	122	......	......	....
30	....	....	......	182–4	s.	s.	s.
31	liq.	2.100	......	110–12.5	i.	v. s.	v. s.
32	colorl. liq.	1.178	......	58–60	$0.55^{20°}$	v. s.	v. s.
33	liq.	$2.84^{0°}$	......	178	i.	v. s.	v. s.
34	colorl. need.	....	154	d.	v. sl. s.	sl. s.	v. sl. s.
36	need.	....	125–6	d.	sl. s. c.	s.	s.
35	colorl. liq.	$0.927^{20°}$	–1—3	176	i.	∞	∞
37	colorl. liq.	$1.063^{16°}$	......	247.5 (253)	v. sl. s.	∞	∞
38	colorl. liq.	$1.035^{15°}_{15}$	......	250–3 (244)	i.	∞	∞
39	pr.	....	124	......	sl. s. c.	s.	s.
40	or. need.	....	200 d.	......	bl. in alk.	sl. s. h.	s. glac. acet. a.
41	yel. need.	....	160 d.	......	sl. s.	s. h.	v. s.

* Explodes by percussion or on heating to 114–16° C.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Euxanthone	1, 7-dihydroxyxanthone	$HO \cdot C_6H_3CO_2C_6H_3OH$	228.06
2	Evernic acid		$C_{17}H_{16}O_7$	332.13
3	Everninic acid		$C_6H_7(OH)_2COOH$	182.08
4	Fenchene		$C_{10}H_{16}$	136.13
5	Fenchone		$C_{10}H_{16}O$	152.13
6	Ferulic acid		$C_6H_3(OCH_3)OH \cdot C_2H_2COOH$	194.08
7	Fisetin	tetrahydroxyflavone	$HOC_6H_3OC(C_6H_3(OH)_2)C(OH)CO$	286.08
8	Fixilic acid		$C_{14}H_{18}O_6$	266.14
9	Flavaniline		$NH_2 \cdot C_6H_4 \cdot C_9H_5N \cdot CH_3$	234.13
10	Flavone	β-phenylbenzo-γ-pyrone	$C_6H_4OC(C_6H_5):CHCO$	222.08
11	Flavopurpurin	trihydroxy-anthraquinone (1, 2, 6)	$C_{14}H_5O_2 \cdot (OH)_3$	256.06
12	Fluoran		$C_{20}H_{12}O_3$	300.10
13	Fluoranthene		$C_{15}H_{10}$	190.08
14	Fluorene		$(C_6H_4)_2:CH_2$	166.08
15	Fluorene alcohol		$(C_6H_4)_2CHOH$	182.08
16	Fluorenenone	diphenylene ketone	$(C_6H_4)_2CO$	180.06
17	Fluorbenzene		C_6H_5F	96.04
18	Fluorbenzoic acid (o.)		C_6H_4FCOOH	140.04
19	" " (m.)		C_6H_4FCOOH	140.04
20	" " (p.)		C_6H_4FCOOH	140.04
21	Fluorescein		$C_{20}H_{12}O_5$	332.10
22	Fluoroform		CHF_3	70.01
23	Formaldehyde		$HCHO$	30.02
24	Formamide		$HCONH_2$	45.03
25	Formamidoxime	isuretin	$CH(NH_2):NOH$	60.05
26	Formanilid		C_6H_5NHOCH	121.06
27	Formic acid		$HCOOH$	46.02
28	Formoxime		$CH_2:NOH$	45.03
29	Formyldiphenylamine		$CHON(C_6H_5)_2$	197.10
30	Formylhydrazine		$HCONH \cdot NH_2$	60.05
31	Formylsulfaldehyde		$C_3H_6S_3$	138.24
32	Frangulin		$C_{20}H_{20}O_9$	404.16
33	Fraxin		$C_{32}H_{36}O_{20}$	740.29
34	Fructose	laevulose, fruit sugar	$C_6H_{12}O_6$	180.10
35	Fuchsin	See *rosaniline*		
36	Fulminuric acid		$C_3H_3O_3N_3$	129.05
37	Fumaric acid		$HOOC \cdot CH:CH \cdot COOH$	116.03
38	Furfural	furfuraldehyde	$C_4H_3O \cdot CHO$	96.03
39	Furfuramide		$(C_5H_4O)_3N_2$	268.11
40	Furfurane		C_4H_4O	68.03

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O = 1$ (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in grms. per 100 c.c. of: Water	Alcohol	Ether
1	yel. need.	....	240	......	i.	s. h.	sl. s.; s. alk.
2	need.	....	164	......	i. c.	s.	s.
3	cryst.	....	157	......	s.$^{100°}$	s.	s.
4	....	0.864$^{20°}$	......	158–60	......	......	......
5	cryst.	0.9465$^{19°}$	5–6	192–3	......	......	......
6	rhomb. need.	....	168	d.	s. h.	v. s.	sl. s.
7	....	....	......	......	......	s.	......
8	cryst.	....	160	......	i.	i.	sl. s.
9	colorl. pr.	....	97	......	v. sl. s.	v. s.	s. bz.
10	....	....	97	......	......	......	......
11	yel. need.	....	459	......	v. sl. s. h.	s. h.	sl. s.
12	need.	....	180 (175)	......	......	s.	......
13	colorl. monocl.	....	109–10	......	......	sl. s. c.	v. s.
14	colorl. leaf.	....	113–6	295	......	sl. s.	v. s.
15	hex.	....	153	......	......	s.	s.
16	yel. rhomb. pl.	....	84	341	i.	s.	s.
17	....	1.0236$^{20°}$	40	180–3	......	......	......
18	need. f. w.	....	123	......	sl. s.	v. s.	v. s.
19	leaf. f. w.	....	123.6	......	......	......	......
20	monocl. pr.	....	182	......	sl. s.	s.	s.
21	or. powd.	....	d. 290	......	i.; s. alk.	s.	s.
22	gas	....	......	20$^{40 atm.}$	sl. s.	500 c.c.	s. l. s. chl.
23	colorl. gas	....	......	−21	s.	s.	s.
24	colorl. liq.	1.337	......	192–5 d.	∞	∞	sl. s.
25	rhomb.	....	114	d.	s.	v. s.	s.
26	colorl. pr.	1.144	46	......	s.	v. s.	s.
27	colorl. liq.	1.218$^{20°}$	8.6	100.8	∞	∞	......
28	....	....	......	84	d. h.	......	......
29	cryst.	....	73–4	210–20 vac.	......	s.	......
30	....	....	54	......	......	......	......
31	tetr. pr.	....	218	subl.	sl. s. h.	sl. s.	sl. s.
32	yel. cryst.	....	286	......	v. sl. s.	s. h.	s. h.
33	need.	....	190	......	s. h.	s.	......
34	need. f. w.	1.555$^{0°}$	94–5	......	v. s.	20	s.
35							
36	colorl. prisms	....	exp. 145	......	s.	s.	s.
37	colorl. prisms	1.625	284	sub. 200	0.70$^{25°}$ 9.8$^{100°}$	5.75$^{29.7°}$ v. sl. s. CCl_4 or $CHCl_3$	0.72$^{25°}$
38	colorl-yel.	1.159$^{20°}$	−36.5	161	9$^{13°}$	s.	s.
39	need.	....	......	250 d.	i.	s.	s.
40	colorl. need.	0.944	......	31.5	i.	v. s.	v. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Furfuryl alcohol..	....	$C_4H_3O \cdot CH_2OH$.....	98.05
2	Furfuryl amine...	....	$C_4H_3O \cdot CH_2 \cdot NH_2$...	97.06
3	Galactose (d.)....	....	$C_6H_{12}O_6$...........	180.10
4	Galleïn.........	....	$C_{20}H_{10}O_7$..........	362.08
5	Gallic acid (3, 4, 5)	....	$(HO)_3C_6H_2COOH + H_2O$	188.06
6	Gallin...........	....	$C_{20}H_{14}O_7$..........	366.11
7	Gentianin.......	gentisin.........	$C_{14}H_{10}O_5$..........	258.08
8	Geraniol.........	....	$C_9H_{15} \cdot CH_2OH$.....	154.14
9	acetate........	....	$CH_3 \cdot COOC_{10}H_{17}$...	196.16
10	Gluconic acid....	....	$C_5H_6(OH)_5COOH$..	196.10
11	Glucosazone (d.) .	....	$C_6H_{10}O_4(N_2HC_6H_5)_2$	358.21
12	Glucose (d.)	See *dextrose*		
13	pentacetate.....	....	$C_6H_7O_6(COCH_3)_5$..	390.18
14	phenyl hydrazone (α)	....	$C_6H_{12}O_5N_2HC_6H_5$..	270.16
15	phenyl hydrazone (β)	....	$C_6H_{12}O_5N_2HC_6H_5$..	270.16
16	Glucosone.......	....	$C_4H_9O_4CO \cdot CHO$...	178.08
17	Glucosoxime (d.) .	....	$C_6H_{12}O_5 : NOH$.....	195.11
18	Glutamic acid (r.)	glutaminic acid ..	$C_3H_5(NH_2)(COOH)_2$	147.08
19	Glutamine.......	....	$C_3H_5(NH_2)(CONH_2)COOH$	146.10
20	Glutaric acid.....	....	$HOOC \cdot (CH_2)_3 \cdot COOH$	132.06
21	Glyceric acid.....	....	$HOCH_2 \cdot CHOH \cdot COOH$	106.05
22	aldehyde.......	....	$HOCH_2 \cdot CHOH \cdot CHO$	90.05
23	Glycerine........	....	$HOCH_2 \cdot CHOH \cdot CH_2OH$	92.06
24	Glycerolphosphoric acid	....	$C_3H_5(OH)_2OPO_3H$..	171.09
25	Gyceryl			
26	chlorhydrine (α).	See *chlorhydrine α*		
27	diacetate.	See *diacetin*		
28	dichlorhydrine (α, α)	See *dichlorhydrine* (1, 3)		
29	" (α, β)	See *dichlorhydrine* (2, 3)		
30	dinitrate (α) ...	....	$C_3H_5(OH)(NO_3)_2 + \frac{1}{2}H_2O$	188.07
31	ether..........	....	$C_3H_5O_3C_3H_5$.......	130.08
32	monoacetate.	See *monacetin*		
33	mononitrate (α)	....	$CH_2OH \cdot CHOH \cdot CH_2NO_3$	137.06
34	triacetate.	See *triacetin*		
35	tribromhydrine.	See *tribromhydrine*		
36	trichlorhydrine.	See *trichlorhydrine*		
37	trinitrate.	See *nitroglycerine*		
38	trinitrite.......	....	$CH_2NO_2 \cdot CHNO_2 \cdot CH_2NO_2$	179.06
39	Glycid..........	....	$C_2H_3O \cdot CH_2OH$.....	74.05

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	colorl. liq.	$1.136^{20°}$	......	168–70	s.	v. s.	v. s.
2	liq.	<H_2O	......	145–6	s.	......	......
3	hex. tab.	....	168–70	......	v. s.	sl. s.	......
4	red. cryst.	....	d.	......	v. sl. s. h.	s.	sl. s.; s. alk.
5	tricl.	$1.694^{4°}$	222–40	d.	$1.16^{25°}$	$27.2^{25°}$	$2.5^{15°}$
6	need.	....	......	......	s.	s.	s.
7	yel. need.	....	......	250 subl. d.	v. sl. s.	sl. s. h.	sl. s. hs.
8	colorl. liq.	0.881	......	229–30	i.	∞	∞
9	colorl. liq.	0.915	......	242–5 d.	v. sl. s.	v. s	∞
10	syrup	....	......	......	sl. s.	i.	......
11	....	....	145; β 204	......	v. sl. s.	sl. s.	......
12							
13	need.	....	130	subl.	v. sl. s.	$1.32^{15°}$	$2.1^{15°}$
14	....	....	144–5	......	v. s.	v. s. h.	v. sl. s.
15	need.	....	115–6	......	......	s.	......
16	....	....	......	......	s.	......	......
17	....	....	137.5	......	......	......	......
18	colorl.	....	208 d.	......	1	v. sl. s.	......
19	need.	....	......	......	......	1 : 25	i.
20	colorl. monocl.	....	97.5	302–4 d.	$64^{20°}$	v. s.	v. s.
21	syrup	....	......	......	∞	∞	i.; v. s. acet.
22	....	....	abt. 132	......	sl. s.	v. sl. s.	v. sl. s.
23	colorl. liq.	$1.260^{20°}$	17*	290	∞	∞	i.
24	....	....	d.	......	s. h. d.	s.	......
25							
26							
27							
28							
29							
30	....	1.47 anh.	26	......	7.7	v. s.	s.
31	colorl. liq.	1.091	......	171–2	∞	∞	∞
32							
33	....	1.40	5.8	......	$70^{15°}$	v. s.	sl. s.
34							
35							
36							
37							
38	yel. liq.	....	......	150	i.	dec.	s.
39	colorl.	$1.165^{0°}$	......	161–2d.	∞	∞	∞

* Solidifies at a much lower temperature.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Glycin	glycocoll	$CH_2(NH_2)\cdot COOH$	75.05
2	Glycocoholic acid		$C_{24}H_{39}O_4\cdot NH\cdot CH_2\cdot COOH$	465.35
3	Glycogen		$(C_6H_{10}O_5)x$	162.08x
4	Glycol	ethylene glycol	$HOCH_2\cdot CH_2OH$	62.05
5	acetate		$C_2H_4(OH)OC_2H_3O$	104.06
6	aldehyde		$CH_2OH\cdot CHO$	60.03
7	amide		$CH_2(OH)\cdot CONH_2$	75.05
8	bromhydrine	ethylene bromhydrine	$CH_2OH\cdot CH_2Br$	124.96
9	chlorhydrine	ethylene chlorhydrine	$CH_2OH\cdot CH_2Cl$	80.50
10	cyanhydride	ethylene cyanhydride	$CH_2OH\cdot CH_2CN$	71.05
11	diacetate	See *ethylene acetate*		
12	dibromide.	See *ethylene bromide*		
13	dichloride.	See *ethylene chloride*		
14	dicyanide.	See *ethylene cyanide*		
15	diiodide.	See *ethylene iodide*		
16	dinitrate.	See *ethylene nitrate*		
17	dinitrite.	See *ethylene nitrite*		
18	monoacetate.	See *ethylene glycol*	*monoacetate*	
19	urea	hydantoin	$C_3H_4O_2N_2$	100.05
20	Glycolid		$C_4H_4O_4$	116.03
21	Glycollic acid	hydroxyacetic acid	$CH_2(OH)\cdot COOH$	76.03
22	anhydride		$C_4H_6O_5$	134.05
23	Glycocyamine		$C(NH)(NH_2)NHCH_2COOH$	117.08
24	Glycolylthiourea		$C_3H_4N_2SO$	116.11
25	Glyoxal	oxalaldehyde	$CHO\cdot CHO$	58.02
26	Glyoxalic acid	glyoxylic acid	$CHO\cdot COOH + H_2O$	92.03
27	Glyoxalin		$C_3H_4N_2$	68.05
28	Glyoxime		$HON:CH\cdot CH:NOH$	88.05
29	Guaiacol		$HO\cdot C_6H_4\cdot OCH_3(o)$	124.06
30	Guanidine		$NH:C(NH_2)_2$	59.06
31	Guanine		$C_5H_5ON_5$	151.08
32	Gun cotton. See	*cellulose hexanitrate*		
33	Haematein		$C_{16}H_{12}O_6$	300.10
34	Haematin		$C_{32}H_{32}N_4Fe_4$	695.65
35	Haematoxylin		$C_{16}H_{14}O_6 + 3H_2O$	356.16
36	Harmalin		$C_{13}H_{14}N_2O$	214.13
37	Harmin		$C_{13}H_{12}N_2O$	212.11
38	Helenin		$C_{12}H_{16}O_2$	192.13
39	Helicin		$C_{13}H_{16}O_7(\frac{3}{4}H_2O?)$	299.64

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in grms. per 100 c.c. of		
					Water	Alcohol	Ether
1	colorl. monocl.	1.161	231–5 d.	......	23 c.	v. sl. s.	i.
2	colorl. need.	....	132–4 (152)	......	0.33 c.	v. s.	v. sl. s.
3	wh. amor.	....	abt. 240	......	v. s.	i.	i.
4	colorl. liq.	1.115	......	197–7.5	∞	∞	sl. s.
5	liq.	$<H_2O$	......	182	∞	∞	......
6	plates	....	95–7	......	v. s.	v. s. h.	sl. s.
7	colorl.	....	120	......	v. s.	sl. s.	sl. s.
8	liq.	....	......	147	s.	......	....
9	colorl. liq.	1.223^{0°	......	128	∞	......	....
10	colorl. liq.	1.059^{0°	......	221–3	∞	∞	s.
11							
12							
13							
14							
15							
16							
17							
18							
19	colorl. need.	....	215	......	s.; v. s. h.	......	....
20	colorl. leaf.	....	86–7	......	i.; v. s. acet.	sl. s.	sl. s.
21	leaf. f. eth.	....	78–9	dec.	s.	s.	s.
22	powd.	....	128–30	......	i.; c. s. h.	i.	i.
23	leaf.	....	......	......	sh.	i.	i.
24	need. f. h. w.	....	d. 200	......	s. h.	i.	i.
25	....	1.14	15	50.5	v. s.	s.	s.
26	colorl. rhomb.	....	......	......	v. s.	......	....
27	colorl. prisms	....	88–9	255	v. s.	v. s.	s.
28	rhomb. tab. f. w.	....	178	......	v. s. h.	s.	s.
29	colorl. prisms	$1.140^{18^\circ}_{18}$	31–2	205	1.6^{15°	s.	s.
30	cryst.	....	......	......	v. s.	v. s.	....
31	colorl. need.	....	dec. abv. 360	......	i.; s. alk.	v. sl. s.	v. sl. s.
32							
33	brown plates	....	......	......	0.6^{20°	sl. s.	sl. s. sl. s.
34	brown powd.	....	......	......	s. alk.	s. h.	....
35	tetrag.	....	140	......	v. sl. s.	s.	s.
36	rhomb. f. al.	....	......	......	v. sl. s.	sl. s.	sl. s.
37	monocl. f. al.	....	......	256 subl.	v. sl. s.	sl. s.	sl. s.
38	need.	....	109–11	......	sl. s.	s.	....
39	....	....	175	......	v. s. h.	s.	i.

No.	Name	Synonyms	Formula	Mol. wt
1	Hemimelitic acid	benzenetricarboxylic acid (1, 2, 3)	$C_6H_3(COOH)_3$	210.05
2	Hemimellithene	See *trimethylbenzene* (1, 2, 3)	C_9H_{12}	120.10
3	Hemipinic acid (3, 4) (1, 2)		$C_6H_2(OCH_3)_2(COOH)_2$	226.08
4	Heptamethylene		C_7H_{14}	98.11
5	Heptane (n.)		$CH_3\cdot(CH_2)_5CH_3$	100.13
6	Heptoic acid (n.)	oenanthylic acid	$CH_3\cdot(CH_2)_5\cdot COOH$	130.11
7	Heptoic anhydride		$(C_6H_{13}CO)_2O$	242.21
8	Heptyl acetate (n.)		$CH_3\cdot COOC_7H_{15}$	158.14
9	alcohol		$CH_3\cdot(CH_2)_5\cdot CH_2OH$	116.13
10	aldehyde	oenanthal	$CH_3\cdot(CH_2)_5\cdot CHO$	114.11
11	amine		$CH_3\cdot(CH_2)_5\cdot CH_2NH_2$	116.14
12	ether		$(C_7H_{15})_2O$	214.24
13	formate		$HCOO\cdot C_7H_{15}$	144.13
14	Heptylene	heptene	$CH_3\cdot(CH_2)_4\cdot CH:CH_2$	98.11
15	Hesperidine		$C_{22}H_{26}O_{12}$; $(C_{50}H_{60}O_{22})$	482.21
16	Hesperitinic acid		$C_{10}H_{10}O_4$	194.08
17	Hexabrom ethane		$CBr_3\cdot CBr_3$	503.50
18	Hexachlor benzene		C_6Cl_6	284.74
19	ethane		$CCl_3\cdot CCl_3$	236.74
20	Hexadecane		$C_{16}H_{34}$	226.27
21	Hexaethyl benzene		$C_6(C_2H_5)_6$	246.24
22	Hexahydro-anthracene		$C_{14}H_{16}$	184.13
23	benzene		C_6H_{12}	84.10
24	benzoic acid		$C_6H_{11}\cdot COOH$	128.10
25	cumene		$C_6H_{11}\cdot C_3H_7$	126.14
26	cymene (p.)		$CH_3\cdot C_6H_{10}\cdot C_3H_7$	140.16
27	mellitic acid		$C_6H_6(COOH)_6$	348.10
28	mesitylene		$C_6H_9(CH_3)_3$ (1, 3, 5)	126.14
29	naphthalene		$C_{10}H_{14}$	134.11
30	phenol		$C_6H_5OHH_6$	100.10
31	pyridene.	See *piperidine*		
32	salicylic acid		$HO\cdot C_6H_{10}\cdot COOH$	144.10
33	toluene		$C_6H_{11}\cdot CH_3$	98.11
34	xylene (m.)		$C_6H_{10}(CH_3)_2$	112.13
35	" (p.)		$C_6H_{10}(CH_3)_2$	112.13
36	Hexahydroxy benzene		$C_6(OH)_6$	174.05
37	Hexaiodobenzene		C_6I_6	833.59
38	Hexamethyl benzene		$C_6(CH_3)_6$	162.14
39	Hexamethylene-tetramine	urotropine	$C_6H_{12}N_4$	140.13
40	Hexane (n.)		$CH_3(CH_2)_4CH_3$	86.11
41	Hexenyl alcohol		$C_6H_{11}OH$	100.10

ORGANIC COMPOUNDS (Continued)

No	Crystal-line form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	colorl. need.	....	185 d. (195)	......	sl. s.	......	s.
2	....	....	......	175.5	......	......	......
3	cryst.	....	180	subl.	v. s.	sl. s.	......
4	oil......	$0.8094^{20°}$	......	117	i.	v. s.	v. s.
5	colorl. liq.	0.689	......	98.4	i.	100	∞
6	colorl.	0.921	−10	224	0.24^{15}	s.	s.
7	....	$0.9342^{0°}$	......	268.71	i.	s.	s.
8	liq.	0.874	......	190	i.	s.	s.
9	colorl. liq.	0.830	......	175.8	s.	∞	∞
10	colorl. liq.	0.822	......	153–5	sl. s.	s.	∞
11	colorl. liq.	$0.78^{20°}$	......	155–7	v. sl. s.	∞	∞
12	colorl. liq.	$0.815^{0°}$	......	261	i.	s.	s.
13	colorl. liq.	$0.894^{0°}$	......	176–7	i.	......	s.
14	colorl. liq.	$0.703^{19°}$	......	98–9	i.	s.	s.
15	sm. need.	....	251 d.	......	sl. s.	sl. s.	i.
16	need.	....	228	......	v. s. h.	v. s.	v. s.
17	rhombic	....	d. 210	......	i.	sl. s.	sl. s.
18	monocl.	$2.044^{23°}$	229	326	i.	i. c.	v. sl. s.
19	rhomb. tabl.	....	184–7	subl.	i.	v. s.	v. s.
20	colorl. leaf.	$0.775^{18°}$	18	287.5–91.0	i.	∞	∞
21	colorl. monocl.	$0.831^{20°}$	129	298	i.	s.	v. s.
22	colorl. leaf.	....	63	290	i.; v. s. bz.	v. s.	v. s.
23	colorl. liq.	$0.747^{0°}$	......	79	i.	......	......
24	colorl. monocl.	1.048	30	233	sl. s.	v. s.	v. s.
25	colorl. liq.	$0.787^{20°}$	......	147–50	i.	v. s.	v. s.
26	colorl. liq.	0.796	......	171–3	i.	v. s.	v. s.
27	cryst.	....	dec.	......	v. s.	v. s.	v. s.
28	colorl. liq.	....	......	135–8	......	......	......
29	colorl. liq.	$0.934^{20°}_{0}$	......	abt. 205	......	......	......
30	....	....	17	160	......	..	......
31							
32	tab.	....	111	......	v. s.	v. s.	v. s.
33	colorl. liq.	$0.769^{20°}$	......	101–2	i.	∞	∞
34	colorl. liq.	$0.771^{21°}$	......	118–9	i.	∞	∞
35	colorl. liq.	$0.769^{20°}$	......	120.5–1.0	......	......	......
36	need.	....	dec. 200	......	sl. s.	sl. s.	sl. s.
37	red.-br. need.	....	140–50 d.	......	......	......	......
38	colorl. rhomb.	....	164	264	......	sl. s.	......
39	rhomb. f. al.	....	280–1	......	$83^{12°}$	3	v. sl.
40	colorl. liq.	$0.660^{20°}$	−94	69	i.	$50^{33°}$	∞
41	colorl. liq.	$0.891^{10°}$	......	137	v. s.	∞	∞

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
1	Hexoic aldehyde	....	$CH_3(CH_2)_4CHO$	100.10
2	Hexyl acetate (n.)	....	$CH_3 \cdot COOC_6H_{13}$	144.13
3	alcohol	....	$CH_3 \cdot (CH_2)_4 \cdot CH_2OH$	102.11
4	formate	....	$HCOOC_6H_{13}$	130.11
5	Hexylene (n.)	....	$CH_3(CH_2)_3CH : CH_2$	84.10
6	glycol (2, 3)	....	$C_3H_7CHOH \cdot CHOH \cdot CH_3$	118.11
7	iodide	....	$C_6H_{12}I_2$	336.96
8	Hippuric acid	benzoyl glycine	$C_6H_5CO \cdot NH \cdot CH_2 \cdot COOH$	179.05
9	Homophthalic acid	....	$C_6H_3(CH_6)(COOH)_2$	180.06
10	Homopyrocatechin	....	$CH_3 \cdot C_6H_3 \cdot (OH)_2$ (1, 3, 4)	124.06
11	Homotropine	....	$C_{16}H_{21}O_3N$	275.18
12	hydrobromide	....	$C_{16}H_{21}O_3N \cdot HBr$	356.10
13	Hydantoin	glycolylurea	$CO \cdot NH \cdot CH_2 \cdot CO \cdot NH$	100.05
14	Hydantoic acid	....	$NH_2CONHCH_2COOH$	118.06
15	Hydracetamide	....	$(CH_3CH)_3N_2$	112.11
16	Hydracrylic acid	....	$CH_2OH \cdot CH_2 \cdot COOH$	90.05
17	Hydrastin	....	$C_{21}H_{21}O_6N$	383.18
18	hydrochloride	....	$C_{21}H_{21}O_6N \cdot HCl$	419.64
19	Hydratropic acid	....	$C_6H_5CH(CH_3)COOH$	150.08
20	Hydrazo-benzene	diphenylhydrazine (sym.)	$C_6H_5 \cdot NH \cdot NH \cdot C_6H_5$	184.11
21	benzoic acid (o.)	....	$(HOOC \cdot C_6H_4 \cdot NH)_2$	272.11
22	" " (m.)	....	$(HOOC \cdot C_6H_4 \cdot NH)_2$	272.11
23	" " (p.)	....	$(HOOC \cdot C_6H_4 \cdot NH_2)_2$	272.11
24	naphthalene (1, 1′)	....	$C_{10}H_7 \cdot NH \cdot NH \cdot C_{10}H_7$	284.14
25	" (2, 2′)	....	$C_{10}H_7 \cdot NH \cdot NH \cdot C_{10}H_7$	284.14
26	toluene (o.)	....	$(CH_3 \cdot C_6H_4 \cdot NH)_2$	212.14
27	" (m.)	....	$(CH_3 \cdot C_6H_4 \cdot NH)_2$	212.14
28	" (p.)	....	$(CH_3 \cdot C_6H_4 \cdot NH)_2$	212.14
29	Hydrindene (1, 2)	....	$C_6H_4 : C_2H_4 : CH_2$	118.08
30	Hydrindone (α)	....	C_9H_8O	132.06
31	" (β)	....	$C_6H_4 \cdot CH_2 \cdot CO \cdot CH_2$	132.06
32	Hydro-acridine	....	$C_6H_4 \cdot CH_2 \cdot C_6H_4 \cdot NH$	181.10
33	anthracene. See	*dihydro-anthracene*		
34	anthranol	....	$C_6H_4 \cdot CH_2C_6H_4CHOH$	196.10
35	atropic acid	phenyl propionic acid (α)	$CH_3 \cdot CH(C_6H_5) \cdot COOH$	150.08
36	benzamide	tribenzaldiamine	$(C_6H_5 \cdot CH)_3N_2$	298.16
37	benzoin	....	$[C_6H_6 \cdot CH(OH) \cdot]_2$	214.11

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	liq.	$0.834^{20°}$	......	116–8	i.	v. s.	v. s.
2	colorl. liq.	$0.890^{0°}$	......	169.2	i.	v. s.	v. s.
3	colorl. liq.	$0.820^{20°}$	......	157	sl. s.	∞	∞
4	colorl. liq	$0.898^{0°}$	......	153.6	......	∞	∞
5	colorl. liq.	$0.683^{20°}$	–98.5	68–70	i.	∞	∞
6	....	$0.9669^{0°}$	......	207	∞	s.	s.
7	liq.	$2.024^{0°}$	......	d.	......	......	......
8	colorl. rh.	$1.371^{21°}$	187–90	......	33^{20}	sl. s.	sl. s.
9	trim.	....	185	......	s. h.	s.	s.
10	colorl.	....	51	251–2	v. s.	v. s.	v. s.
11	colorl. prisms	....	96.5–7.5	......	sl. s.	s.	s.
12	colorl. prisms	....	213.8	......	17.5^{25}	3.3	i.
13	need.	....	216	......	s. h.	s.	......
14	monocl. pr.	....	......	......	sl. s.	s. h.	v. sl. s.
15	yel. powd.	....	......	......	v. s.	v. s.	......
16	syrup	....	......	d.	......	......	
17	colorl. pr.	....	132	......	$0.025^{80°}$	$0.74^{25°}$	$0.8^{25°}$
18	powd.	....	......	......	s.	......	......
19	liq.	....	......	264–5	......	......	......
20	colorl. tab.	1.158	131 (126)	d.	v. sl. s.	$5^{16°}$	s.
21	colorl. leaf	....	205	......	i.	s.	......
22	yel. cryst.	....	......	......	i.	sl. s. h.	s. alk.
23	sm. need. f. al.	....	......	......	i.	sl. s.	s. KOH
24	colorl. leaf.	....	275	......	i.	v. s.	v. s.
25	colorl. flocks	....	162–4	......	i.	sl. s.	v. s.
26	colorl. leaf	....	165	d.	v. sl. s.	s.	s.
27	....	....	......	......	i.	s.	......
28	colorl. monocl.	0.957	133–4 (128)	d.	i.	v. s.	v. s.
29	colorl. liq.	0.957	......	176	i.	∞	∞
30	rhomb. tab.	$1.101^{45°}$	41	244	v. sl. s.	v. s.	s.
31	....	....	61	220 d.	......	......	......
32	colorl. cryst. f. al.	....	169	subl.	i.	s. h.	s.
33							
34	need.	....	76	......	s. h.	s.	s.
35	colorl. liq.	....	......	264–5	sl. s.	......	......
36	colorl. prisms	....	101	......	i.	v. s.	v. s.
37	leaf. f. al.	....	138	abt. 300	0.25; c. 1.3 h.	v. s.	......

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Hydro-carbostyril.....	....	C_9H_9ON..........	147.08
2	cinnamic acid...	phenyl propionic acid (β)	$C_6H_5 \cdot CH_2 \cdot CH_2 \cdot COOH$	150.08
3	" aldehyde	....	$C_6H_5 \cdot CH_2 \cdot CH_2 \cdot CHO$	134.08
4	coerulignone....	....	$C_{12}(OH)_6(CH_3)_4$....	306.13
5	coumaric acid (o.)	....	$HO \cdot C_6H_4(CH_2)_2 \cdot COOH$	166.08
6	" " (p.)	phenol propionic acid (β)	$HO \cdot C_6H_4(CH_2)_2$ COOH	166.08
7	cyanic acid.....	prussic acid......	HNC..............	27.02
8	naphthoquinone (1, 2)	....	$C_{10}H_6(OH)_2$........	160.06
9	naphthoquinone (1, 4)	....	$C_{10}H_6(OH)_2$........	160.06
10	phenazine......	....	$C_6H_4NHC_6H_4CH$	180.09
11	phthalic acid...	....	$C_6H_6(COOH)_2$.....	168.06
12	terephthalic acid	....	$C_6H_6(COOH)_2$.....	168.06
13	quinone (p.).	See *quinol*		
14	quinone dimethyl ether	....	$C_6H_4(OCH_3)_2$......	138.08
15	quinone ethyl ether	....	$HO \cdot C_6H_4 \cdot OC_2H_5$...	138.08
16	quinonaphthalein	....	$C_{20}H_{12}O_3$..........	300.10
17	Hydroxy-acetic acid. See *glycollic acid*			
18	acrylic acid (β).	....	$CHOH : CH \cdot COOH$	88.03
19	anthraquinone (2)	....	$C_6H_4 : (CO)_2 : C_6H_3 \cdot OH$	224.06
20	azo benzene (o.)	....	$HO \cdot C_6H_4 \cdot N : N \cdot C_6H_5$	198.10
21	" " (p.)	....	$HO \cdot C_6H_4 \cdot N : N \cdot C_6H_5$	198.10
22	benzaldehyde (o.)	salicylaldehyde...	$HO \cdot C_6H_4 \cdot CHO$....	122.05
23	" (m.)	....	$HO \cdot C_6H_4 \cdot CHO$....	122.05
24	" (p.)	....	$HO \cdot C_6H_4 \cdot CHO$....	122.05
25	benzamide (o.)..	....	$HO \cdot C_6H_4 \cdot CONH_2$..	137.06
26	" (m.).	....	$HO \cdot C_6H_4 \cdot CONH_2$..	137.06
27	" (p.)..	....	$HO \cdot C_6H_4 \cdot CONH_2$..	137.06
28	benzoic acid (o.)	salicylic acid (o.).	$HO \cdot C_6H_4 \cdot COOH$ ..	138.05
29	" " (m.)	....	$HO \cdot C_6H_4 \cdot COOH$ ..	138.05
30	" " (p.)	....	$HO \cdot C_6H_4 \cdot COOH$ ..	138.05
31	benzyl alcohol (o.)	saligenin........	$HO \cdot C_6H_4 \cdot CH_2OH$..	124.06
32	" " (m.)	....	$HO \cdot C_6H_4 \cdot CH_2OH$..	124.06
33	" " (p.)	....	$HO \cdot C_6H_4 \cdot CH_2OH$..	124.06

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. prisms f. al.	....	163	......	v. sl. s.	v. s.	v. s.
2	colorl. need.	$1.071^{49°}$	48.7	279.8	$0.59^{20°}$	v. s.	s.
3	colorl. liq.	....	......	208 (223)	i.	17	....
4	monocl. pr. f. al.	....	190	......	sl. s.	s.	sl. s.
5	pr.	....	82.3	......	$1:20^{18°}$	s.	s.
6	colorl. monocl.	....	128–9	......	v. s. h.	v. s.	v. s.
7	colorl. liq.	$0.697^{18°}$	–10–12*	25.2	∞	∞	v.s. (∞)
8	colorl. leaf.	....	60	......	s. alk.	......	....
9	colorl. need.	....	175	......	s. h.	v. s. h.	v. s.
10	leaf.	....	......	......	......	......	....
11	monocl. tab.	....	200 d.	......	1 c.	s.	sl. s.
12	flocks...	....	......	......	i.	......	....
13							
14	colorl. leaf.	....	55–6	216.6	i.	s. bz.	....
15	leaf.	....	66	246–7	sl.	v. s.	v. s.
16	need. f. eth.	....	232–4	d.	......	s.	s.
17							
18	liq.	....	......	......	v. s.	v. s.	v. s.
19	yel leaf.	....	302	subl.	v. sl. s.	s.	s.
20	need.	....	82.5–3.0	......	sl. s.; s. alk.	s.	s.
21	prisms. f. al.	....	152	......	v. sl. h.	v. s.	v. s.
22	liq.	$1.159^{21°}$	–20	196.7	v. sl. s.	∞	∞
23	colorl. need.	....	104	240	s. h.	v. s.	s.
24	colorl. need.	....	115–6	sub.	sl. s.	v. s.	v. s.
25	yel. leaf.	....	140	270 d.	s.	......	....
26	colorl. leaf.	....	167 (170.5)	......	sl. s. c.; s. h.	v. s.	v. s.
27	need.	....	162	......	sl. s.	v. s.	sl. s.
28	need. f. w.	....	158	sub.	$0.18^{20°}$	$50^{15°}$	$23.4^{17°}$
29	colorl. rhomb.	....	200	......	$0.92^{18°}$	......	9.7^{17}
30	colorl. monocl.	$1.404^{22°}$	210 (214)	dec.	$0.79^{15°}$	v. s.	9.4^{17}
31	rhombic	$1.161^{25°}$	86 (82)	sub.	$6.7^{22°}$	v. s.	v. s.
32	need.	....	67	300 d.	v. s. h.	v. s.	v. s.
33	colorl. need.	....	110 (125)	......	s.	v. s.	v. s.

* Solidifies at –15° C.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Hydrooxy			
1	butyric acid (α)	....	$CH_3 \cdot CH_2CH(OH) \cdot COOH$	104.06
2	" " (β)	....	$CH_3 \cdot CHOH \cdot CH_2 \cdot COOH$	104.06
3	" " (γ)	....	$CH_2OH \cdot (CH_2)_2 \cdot COOH$	104.06
4	caproic acid (α).	oxycaproic acid .	$CH_3 \cdot (CH_2)_3 \cdot CHOH \cdot COOH$	132.10
5	caprylic acid (α)	....	$CH_3 \cdot (CH_2)_5 \cdot CHOH \cdot COOH$	160.13
6	cinnamic acid.	See *coumaric acid*		
7	citric acid......	....	$C_3H_3(OH)_2 \cdot (COOH)_3$	208.06
8	diphenyl (p.)...	....	$C_6H_5 \cdot C_6H_4OH$.....	170.08
9	diphenylamine (m.)	....	$C_6H_5 \cdot NH \cdot C_6H_4OH$	185.10
10	" (p.)	....	$C_6H_5 \cdot NH \cdot C_6H_4OH$	185.10
11	ethylamine.....	....	$C_2H_4(OH)NH_2$.....	61.06
12	glutaric acid (α)	....	$(COOH)_2CHOH(CH_2)_2$	148.06
13	" " (β)	....	$HOCH(CH_2COOH)_2$	148.06
14	isobutyric acid(α)	acetonic acid.....	$(CH_3)_2 \cdot C(OH) \cdot COOH$	104.06
15	isocaprylic acid (α)	....	$[(CH_3)_2CH]_2C(OH)COOH$	160.13
16	isophthalic acid (2) (1, 3)	....	$HO \cdot C_6H_3 \cdot (COOH)_2 + H_2O$	200.06
17	isophthalic acid (4) (1, 3)	....	$HO \cdot C_6H_3 \cdot (COOH)_2$	182.05
18	isophthalic acid (5) (1, 3)	....	$HO \cdot C_6H_3 \cdot (COOH)_2 + 2H_2O$	218.08
19	methylbenzoic acid (o.)	....	$C_6H_4(CH_2OH) \cdot COOH$	152.06
20	methyleneacetone	....	$CH(OH) : CH \cdot CO \cdot CH_3$	86.05
21	naphthoic acid OH,COOH 1, 2	....	$C_{10}H_6(OH)COOH$..	188.06
22	naphthoic acid (α) (α, α)	....	$C_{10}H_6(OH)COOH$..	188.06
23	naphthoic acid 1, 8	....	$C_{10}H_6(OH)COOH$..	188.06
24	naphthoic acid (β) (α, β)	....	$C_{10}H_6(OH)COOH$..	188.06
25	naphthoic acid (γ) (α, β)	....	$C_{10}H_6(OH)COOH$..	188.06
26	naphthoic acid (α, β)	....	$C_{10}H_6(OH)COOH$..	188.06
27	naphthoic acid 2, 1	....	$C_{10}H_6(OH)COOH$..	188.06
28	naphthoic acid (β)	....	$C_{10}H_6(OH)COOH$..	188.06
29	naphthoquinone (α)	juglon...........	$C_{10}H_5O_2 \cdot OH$.......	174.05
30	" (β)	....	$C_{10}H_5O_2 \cdot OH$.......	174.05

ORGANIC COMPOUNDS (Continued)

No	Crystal-line form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl.	....	43	255–60 d.	s.	s.	s.
2	syrup	....	......	......	......	......	......
3	liq.	....	−17	......	......	......	......
4	colorl.	....	60–2	subl. 100	......	......	......
5	pl.	....	69.5	......	v. sl. s.	v. s.	v. s.
6							
7	liq.	....	......	......	v. s.	v. s.	v. s.
8	need. or leaf.	....	165	305–8	s. h.	s.	s.
9	leaf.	....	82	340	......	s.	......
10	leaf. f. w.	....	70	330	s. h.	s.	s.
11	....	....	......	171	......	......	......
12	sm. cryst.	....	72–3	......	s.	......	......
13	Exists only as methyl ester.						
14	colorl. pr.	....	79	212	v. s.	v. s.	v. s.
15	need.	....	110–1	......	sl. s.	s.	s.
16	colorl. need.	....	243	......	v. sl. s. c.; s. h.	v. s.	v. s.
17	colorl. need.	....	305	......	sl. s. h.	v. s.	v. s.
18	colorl. need.	....	288	sub.	$18^{100°}$; sl. s. c.	v. s.	v. s.
19	need.	....	120	......	......	v. s.	v. s.
20	....	....	......	......	......	......	......
21	need. f. al. and eth.	....	187	......	sl. s. h.	s.	s.
22	long. need. f. w.	....	234–7	subl.	sl. s. h.	v. s.	......
23	need. f. eth.	....	169	......	s.	v. s.	s.
24	need. f. w.	....	245–7	......	s. h.	s.	......
25	sm. need. f. w.	....	187	......	s. h.	v. s.	......
26	long. need. f. w.	....	210–1	......	s. h.	......	......
27	need. f. dil. al.	....	156–7	......	v. sl. s.	v. s. abs.	......
28	rhomb. lvs. f. w.	....	216	......	s. h.	s.	s.
29	red. br. *or* pr. f. chl.	....	151–4	......	v. s. chl.	s. acet. a. h.	sl. s.
30	yel. need.	....	190 d.	subl.	sl. s. h.	s.	s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Hydro-oxy			
1	nicotinic acid. . .	....	$C_5H_3N(OH)COOH$.	139.05
2	phenylacetic acid (o.)	....	$HO\cdot C_6H_4\cdot CH_2\cdot COOH$	152.06
3	" " (m.)	....	$HO\cdot C_6H_4\cdot CH_2\cdot COOH$	152.06
4	" " (p.)	....	$HO\cdot C_6H_4\cdot CH_2\cdot COOH$	152.06
5	phenylethylamine (p.)	....	$HO\cdot C_6H_4\cdot CH_2\cdot CH_2\cdot NH_2$	137.10
6	phthalic acid (3) (1, 2)	....	$HO\cdot C_6H_3(COOH)_2$	182.05
7	phthalic acid (2)	....	$HO\cdot C_6H_3(COOH)_2$.	182.05
8	phthalic acid (4) (1, 2)	....	$HO\cdot C_6H_3\cdot(COOH)_2$	182.05
9	propionic acid (*a*)	See *lactic acid*		
10	pyridine (2)	*a* pyridone	$HO\cdot C_5H_4N$	95.05
11	" (3)	*β* pyridone	$HO\cdot C_5H_4N$	95.05
12	" (4)	*γ* pyridone	$HO\cdot C_5H_4N + H_2O$.	113.06
13	pyrotartaric acid	....	$CHOH(CH_2COOH)_2$	148.06
14	quinol (1, 2, 4) .	....	$C_6H_3(OH)_3$	126.05
15	quinaldine (o.) . .	....	$C_{10}H_9NO$	159.08
16	" (p.) . .	....	$C_{10}H_9NO$	159.08
17	" (m?) .	....	$C_{10}H_9NO$	159.08
18	" (*γ*) . .	....	$C_{10}H_9NO$	159.08
19	quinoline (2) . . .	carbostyril (pr. 2)	$HO\cdot C_9H_6N$	145.06
20	" (bz. 1) (8)	....	$HO\cdot C_9H_6N$	145.06
21	" (bz. 2) (7)	....	$HO\cdot C_9H_6N$	145.06
22	" (bz. 3) (6)	....	$HO\cdot C_9H_6N$	145.06
23	" (bz. 4) (5)	....	$HO\cdot C_9H_6N$	145.06
24	" (4) . . .	kyanuran	$HO\cdot C_9H_6N + 3H_2O$	199.11
25	stearic acid	....	$C_{18}H_{36}O_3$	300.29
26	succinic acid.	See *malic acid*		
27	terephthalic acid (2) (1, 4)	....	$HO\cdot C_6H_3(COOH)_2$	182.05
28	terephthalic acid (1, 4, 3)	....	$HO\cdot C_6H_3(COOH)_2$	182.05
29	toluic acid (1, 2, 3)	....	$CH_3\cdot C_6H_3\cdot(COOH)(OH)$	152.06
30	" " (1, 2, 4)	....	$CH_3\cdot C_6H_3\cdot(COOH)(OH)$	152.06
31	" " (1, 2, 5)	....	$CH_3\cdot C_6H_3\cdot(COOH)(OH) + \frac{1}{2}H_2O$	161.07
32	" " (1, 2, 6)	....	$CH_3\cdot C_6H_3\cdot(COOH)(OH)$	152.06
33	" " (1, 3, 2)	....	$CH_3\cdot C_6H_3\cdot(COOH)(OH)$	152.06
34	" " (1, 3, 4)	....	$CH_3\cdot C_6H_3\cdot(COOH)(OH)$	152.06

ORGANIC COMPOUNDS (Continued)

No	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in grms. per 100 c.c. of Water	Alcohol	Ether
1	need.	....	303 d.	subl.	sl. s. h.	sl. s.	sl. s.
2	need. f. eth.	....	137	......	s.	......	....
3	need. f. bz and lgr.	....	129	......	v. s.	v. s.	v. s.
4	pr. need. f. w.	....	148	......	v. s. h.	v. s.	v. s.
5	need.	....	160	$180^{8mm.}$	sl. s.	1 : 10 h.	s. bz.
6	colorl. pr.	....	d.	......	$20^{17°}$	s.	s.
7	powd.	....	......	subl.	sl. s.	v. s.	s.
8	colorl. rosettes	....	181 d.	......	$3^{10°}$	v. s.	s.
9							
10	colorl. need. f. bz.	....	106–7	280–1	v. s.	v. s.	s.
11	need.	....	129	......	v. s.	v. s.	....
12	colorl. monocl.	....	148.5 anh.	......	100	v. s.	v. sl. s.
13	need.	....	108	......	s.	s.	s.
14	colorl.	....	140.5	......	v. s.	v. s.	v. s.
15	tricl. pr. f. al.	....	74	266–7 subl.	......	......	....
16	....	....	213	......	v. sl. s.	s.	s.
17	....	....	232–4	......	i.	s. h.	s.
18	pr. f. w.	....	230–1	......	s. h.	s.	i.
19	colorl. pr. f. al.	....	199–200	subl.	v. sl. s. c.; v. s. h.	v. s.	v. s.
20	pr. f. dil. al.	....	75–6	266.6$^{752mm.}$	v. sl. s.	v. s.	sl. s.
21	pr. f. al.	....	235–8	subl.	sl. s.	v. s.	....
22	sm. pr. f. al.	....	193	>360	v. sl. s.	sl. s.	v. sl. s.
23	sm. leaf.	....	224	......	s. alk.	......	sl. s.
24	colorl.	....	201	......	$0.47^{15°}$	s.	sl. s.
25	wh. cryst.	....	......	......	......	......	....
26							
27	powd.	....	subl.	......	sl. s.	v. s.	s.
28	powd.	....	subl.	......	sl. s. h.	s.	s.
29	need. f. w.	....	168	......	$0.14^{25°}$	v. s.	v. s.
30	need. f. w.	....	172 (183)	......	sl. s.	v. s.	v. s.
31	sm. need. f. w.	....	177 anh.	......	sl. s.	v. s.	v. s.
32	glit. need. f. w.	....	145–6 (183)	......	s.	v. s.	v. s.
33	long need. f. w.	....	163–4	......	v. s. h.	s. chl.	v. s.
34	long. need. f. w.	....	151	......	v. sl. s.	v. s.	......

No.	Name	Synonyms	Formula	Mol. wt.
	Hydroxy			
1	toluic acid (1, 3, 5)	....	$CH_3 \cdot C_6H_3 \cdot (COOH)(OH)$	152.06
2	" " (1, 3, 6)	....	$CH_3 \cdot C_6H_3 \cdot (COOH)(OH) + \frac{1}{2}H_2O$	161.07
3	" " (1, 4, 2)	....	$CH_3 \cdot C_6H_3 \cdot (COOH)(OH)$	152.06
4	" " (1, 4, 3)	....	$CH_3 \cdot C_6H_3 \cdot (COOH)(OH)$	152.06
5	" " (1, 5, 2)	....	$CH_3 \cdot C_6H_3(COOH) \cdot OH$	152.06
6	urea	....	$NH_2 \cdot CO \cdot NH(OH)$	76.05
7	valeric acid (*a*) .	....	$CH_3 \cdot (CH_2)_2 \cdot CH(OH) \cdot COOH$	118.08
8	Hyoscine........	scopolamine.....	$C_{17}H_{21}O_4N$.........	303.18
9	hydrobromide ..	....	$C_{17}H_{21}O_4N \cdot HBr + 3H_2O$	438.15
10	Hyoscyamine....	....	$C_{17}H_{23}O_3N$.........	289.19
11	hydrobromide ..	....	$C_{17}H_{23}O_3NHBr$.....	370.12
12	Hypnoacetin.....	....	$C_{16}H_{16}O_3N$.........	269.13
13	Hypnone........	phenacyl bromide	$C_6H_5 \cdot CO \cdot CH_2 \cdot Br$..	198.97
14	Hypogaeic acid...	....	$C_{15}H_{29} \cdot COOH$.....	254.24
			$(OH) \cdot COOH$	
15	Hypoxanthine....	....	$C_6H_4ON_4$.........	136.06
16	Hystazarine.....	....	$C_{14}H_8O_4$...........	240.06
17	Imesatin........	....	$C_6H_4C(NH)CONH$	146.06
18	Imino-acetic acid.	....	$NH \cdot (CH_2COOH)_2$..	133.06
19	aceto-nitrile....	....	$NH \cdot (CH_2 \cdot CN)_2$....	95.06
20	ethyl alcohol ...	....	$NH \cdot (CH \cdot CH_2 \cdot OH)_2$	103.08
21	Imperatorin.....	peucedanin......	$C_{16}H_{16}O_4$..........	272.13
22	Indanthrene.....	dihydroanthraquinonazine	$C_{14}H_6O_2(NH)_2C_{14}H_6O_2$	442.13
23	Indene...	....	$C_6H_4CH : CH \cdot CH_2$	116.06
24	Indican.........	....	$C_{14}H_{17}O_6N + 3H_2O$.	349.19
25	Indigo..	indigotine.......	$C_{16}H_{10}O_2N_2$........	262.10
26	carmine........	soluble indigo....	$C_{16}H_8O_2N_2(SO_3Na)_2$.	466.20
27	dicarboxylic acid	....	$C_{18}H_{10}O_6N_2$........	350.10
28	disulfonic acid..	....	$C_{16}H_8N_2O_2(SO_3H)_2$..	422.22
29	purpurin.......	....	C_8H_5NO...........	131.05
30	sulfonic acid....	....	$C_{16}H_9N_2O_2(SO_3H)$	342.15
31	white..........	....	$C_{16}H_{12}N_2O_2$........	264.11
32	Indirubin........	....	$C_{16}H_{10}N_2O_2$........	262.10
33	Indole..........	benzopyrrol......	C_8H_7N............	117.06
34	Indophenin......	....	$C_{12}H_7NOS$.........	213.13

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O = 1$ (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	tabl. f. w.	....	208 (210)	subl.	s.	.....	....
2	need. f. w.	....	172–3 anh.	......	s. h.	v. s.	v. s.
3	long. need.	....	206–7	subl.	v. sl. s.	v. s.	s.
4	monocl. f. al.	....	177	......	v. sl. s.	s.	....
5	long. need f. w.	....	151	......	s. h.	v. s.	v. s.
6	colorl. need.	....	128–30	......	v. s.	s.	....
7	colorl. need.	....	31	......	v. s.	v. s.	v. s.
8	colorl. prisms	....	56–7	......	$10.5^{15°}$	v. s.	v. s.
9	colorl. rhomb.	....	193–4	......	$66.6^{25°}$	$6.3^{25°}$	i.
10	need.	....	108.5	......	5.	v. s.	s.
11	prisms	....	151.8	......	v. s.	50	0.06
12	colorl. leaf. f. al.	....	160	......	v. sl. s.	$0.28^{20°}$	v. sl. s.
13	pr.	....	50	......	i.	v. s.	v. s.
14	colorl. need.	....	33	......	i.	v. s.	s.
15	need.	....	d. 150	......	$0.07^{19°}$; $1.4^{100°}$	......	....
16	yel. need.	....	260	......	......	sl. s.	sl. s.
17	yel. pr.	....	......	......	i.	s.	sl. s.
18	colorl. rhomb.	....	abt. 225	......	$2.43^{5°}$	i.	i.
19	colorl. lf. f. eth.	....	75	......	s.	s.	sl. s.
20	colorl.	....	28	270	∞	∞	∞
21	rhomb. pr	....	75	......	i.	s. h.	s.
22	blue	....	......	......	i.	i.	....
23	....	$1.04^{15°}$	......	180	......	......	....
24	br. liq.	....	176–7 anh.	dec.	v. s.	v. s.	s.
25	rhomb.	....	390–2 d.	......	i.; s. h. anil.	i.	i.; s. h. chl.
26	blue powd	....	......	......	s.	sl. s.	....
27	blue powd.	....	......	......	i.; s. H_2SO_4	i.	i.
28	blue amor.	....	......	......	s.	s.	....
29	need....	....	......	......	i.	s.	s.
30	purple	....	......	200 d.	s.	s.	....
31	wh. powd.	....	......	......	i.; s. alk.	s.	s.
32	br. need.	....	......	......	......	......	......
33	colorl. leaf.	....	52	253–4	s. h.	v. s.	v. s.
34	bl. need.	....	......	......	i.	sl. s.	sl. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Indoxyl	....	$C_6H_4C(OH):CH\cdot NH$	133.16
2	Indoxylic acid	....	$C_9H_7NO_3$	177.16
3	Inulin	....	$(C_6H_{10}O_5)_6 + H_2O$	990.50
4	Inosite (i.)	....	$C_6H_{12}O_6 + 2H_2O$	216.13
5	Iodeosine.	See *erythrosine*		
6	Iodinecyanide.	See *cyanogen iodide*		
7	Iodo-acetic acid	....	$CH_2I\cdot COOH$	185.96
8	aniline (o.)	....	$IC_6H_4\cdot NH_2$	218.99
9	" (m.)	....	$IC_6H_4\cdot NH_2$	218.99
10	" (p.)	....	$IC_6H_4\cdot NH_2$	218.99
11	benzene	....	C_6H_5I	203.97
12	ethylene	....	$CH_2\cdot:CHI$	153.96
13	propionic acid (α)	....	$CH_3\cdot CHI\cdot COOH$	199.97
14	" " (β)	....	$CH_2I\cdot CH_2\cdot COOH$	199.97
15	toluene (o.)	....	$IC_6H_4\cdot CH_3$	217.99
16	" (m.)	....	$IC_6H_4\cdot CH_3$	217.99
17	" (p.)	....	$IC_6H_4\cdot CH_3$	217.99
18	Iodoform	....	CHI_3	393.80
19	Iodosobenzene	....	C_6H_5IO	219.97
20	Iodoxybenzene	....	$C_6H_5IO_2$	235.97
21	Ionone (α)	....	$C_{13}H_{20}O$	192.16
22	" (β)	....	$C_{13}H_{20}O$	192.16
23	" semicarbazone (α)	....	$C_{13}H_{20}:N\cdot NHCO\cdot NH_2$	249.21
24	" " (β)	....	$C_{13}H_{20}:N\cdot NHCO\cdot NH_2$	249.21
25	Irone	....	$C_{13}H_{20}O$	192.16
26	Isatine	....	$C_8H_5O_2N$	147.05
27	chloride	....	C_8H_4ONCl	165.50
28	Isatinic acid	....	$NH_2\cdot C_6H_4\cdot CO\cdot COOH$	165.06
29	Isatoic acid anhydride	....	$C_6H_4COO\cdot CONH$	163.05
30	Isatoxime	....	$C_8H_6O_2N_2$	162.06
31	Isatropic acid	....	$C_9H_8O_2$	148.06
32	Isoamyl-acetate	....	$CH_3\cdot COOC_5H_{11}$	130.11
33	acetic acid	....	$(CH_3)_2\cdot CH(CH_2)_2\cdot COOH$	130.11
34	alcohol	isobutyl carbinol.	$(CH_3)_2\cdot CH\cdot(CH_2)_2 OH$	88.10
35	" (sec.)	methyl isopropyl carbinol	$(CH_3)_2\cdot CH\cdot CH(OH) CH_3$	88.10
36	aldehyde	....	$(CH_3)_2CH\cdot CH_2\cdot CHO$	86.08
37	amine	....	$(CH_3)_2CH\cdot CH_2\cdot CH_2\cdot NH_2$	87.11
38	aniline	....	$C_5H_{11}NHC_6H_5$	163.14

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O = 1$ (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	oil	....	......	not volatile	......	......	s. alk.
2	cryst.	....	......	122–3 subl. d.	sl. s.	......	....
3	micr. cryst.	1.539 anh.	160 d.	......	$0.001^{15°}$	v. sl. s.	....
4	colorl. monocl.	....	225	......	$17.5^{24°}$	i. abs.	i.
5							
6							
7	yel.	....	82	dec.	i.	s.	v. sl. s.
8	need.	....	57 (60–1)	......	v. sl. s.	v. s.	....
9	leaf.	....	25–7	......	i.	s.	....
10	need. or pr.	....	63 (67–8)	......	i.	s.	....
11	liq.	....	−28.5	188.2	i.	s.	∞
12	"	$2.08^{0°}$	......	56	i.	∞	∞
13	prisms	....	44.5–5.5	......	sl. s	v. s.	v. s.
14	leaf.	....	82	......	$8^{25°}$	v. s.	v. s.
15	liq.	$1.697^{20°}$	......	211 (204)	i.	∞	∞
16	"	$1.698^{20°}$	......	204	i.	∞	∞
17	leaf.	....	35	211.5	i.	v. s.	v. s.
18	yel. hex.	....	119 subl.	......	$0.01^{25°}$	$1.3^{18°}$; $7.8^{78°}$	13.6 [illegible]°
19	amor.	....	expl. abt. 210	......	s.	s.	i.
20	need.	....	expl. 230–8	......	v. sl. s.	v. s. bz.	v. s. chl.
21	colorl. liq	0.934	......	$120 \cdot 6^{12mm}$	v. sl. s.	∞	∞
22	colorl. liq.	0.949	......	$134 \cdot 6^{12mm}$	v. sl. s.	∞	∞
23	....	....	110	......	......	......	....
24	....	....	148	......	......	......	....
25	colorl. liq.	0.939	......	144^{16mm}	v. sl. s.	v. s.	v. s.
26	red. need. f. al.	....	198–9	subl.	v. sl. s. c.; s. h.	s.	sl. s.
27	br. need.	....	180 d.	......	i.	s.	v. s.
28	wh. powd.	....	d.	......	sl.	......	....
29	monocl.	....	240 d.	......	$0.7^{100°}$	$3^{78°}$	sl. s.
30	yel. need.	....	202 d.	......	v. sl. s.	s.	s. alk.
31	cryst.	....	237–7.5	......	v. sl. sh.	sl. s.	....
32	colorl. liq.	0.876	......	139	$0.16^{25°}$	∞	∞
33	colorl. liq.	$0.912^{19°}$	......	209	sl. s. h.	∞	∞
34	colorl. liq.	$0.810^{20°}$	......	130	$3.3^{22°}$	∞	∞
35	colorl. liq.	$0.819^{19°}$	......	112.5	sl. s.	∞	∞
36	liq.	$0.768^{12.6°}$	......	92.5	sl. s.	s.	....
37	colorl. liq.	0.747	......	95	v. sl. s.	∞	∞
38	liq.	$0.928^{15°}_{4}$	......	258	......	......	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Isoamyl-			
1	benzene		$C_6H_5 \cdot C_5H_{11}$	148.13
2	benzoate		$C_6H_5 \cdot COOC_5H_{11}$	192.13
3	bromide		$(CH_3)_2 \cdot CH \cdot (CH_2)_2 Br$	151.00
4	butyrate		$C_3H_7 \cdot COOC_5H_{11}$	158.14
5	chlorcarbonate		$Cl \cdot COOC_5H_{11}$	150.56
6	chloride		$(CH_3)_2 \cdot CH \cdot (CH_2)_2 Cl$	106.54
7	cyanide	capronitrile	$(CH_3)_2 \cdot CH \cdot (CH_2)_2 \cdot CN$	97.10
8	ether		$C_5H_{11} \cdot O \cdot C_5H_{11}$	158.18
9	formate		$H \cdot COOC_5H_{11}$	116.10
10	iodide		$(CH_3)_2 \cdot CH \cdot (CH_2)_2 I$	198.02
11	isobutyrate		$(CH_3)_2 \cdot CH \cdot COOC_5H_{11}$	158.14
12	isocyanide		$(CH_3)_2 \cdot CH \cdot (CH_2)_2 \cdot NC$	97.10
13	isovaleriate		$C_4H_9 \cdot COOC_5H_{11}$	172.16
14	mustard oil		$C_5H_{11} \cdot NCS$	129.16
15	nitrate		$(CH_3)_2 \cdot CH \cdot (CH_2)_2 \cdot NO_3$	133.10
16	nitrite		$(CH_3)_2 \cdot CH \cdot (CH_2)_2 \cdot NO_2$	117.10
17	phenol (p.)		$C_5H_{11} \cdot C_6H_4 \cdot OH$	164.13
18	phenyl ketone		$C_5H_{11} \cdot CO \cdot C_6H_5$	176.13
19	propionate		$CH_3 \cdot CH_2 \cdot COOC_5H_{11}$	144.13
20	salicylate		$HO \cdot C_6H_4 \cdot COOC_5H_{11}$	208.13
21	sulfide		$(C_5H_{11})_2S$	174.24
22	urea		$NH_2 \cdot CO \cdot NH(C_5H_{11})$	130.13
23	urethane		$CO(NH_2)OC_5H_{11}$	131.11
24	Isoamylene		$(CH_3)_2CH \cdot CH : CH_2$	70.08
25	Isoanthraflavic acid		$C_{14}H_8O_4 + H_2O$	258.08
26	Isobutane	trimethyl methane	$(CH_3)_2 \cdot CH \cdot CH_3$	58.08
27	Isobutyl-acetate		$CH_3 \cdot COOC_4H_9$	116.10
28	alcohol	isopropyl carbinol	$(CH_3)_2 \cdot CH \cdot CH_2OH$	74.08
29	aldehyde		$(CH_3)_2 \cdot CH \cdot CHO$	72.06
30	amine		$(CH_3)_2 \cdot CH \cdot CH_2 \cdot NH_2$	73.10
31	benzene		$C_6H_5 \cdot C_4H_9$	134.11
32	benzoate		$C_6H_5 \cdot COOC_4H_9$	178.11
33	bromide		$(CH_3)_2 \cdot CH \cdot CH_2Br$	136.99
34	butyrate		$C_3H_7 \cdot COOC_4H_9$	144.13
35	chlorcarbonate		$Cl \cdot COOC_4H_9$	136.53
36	chloride		$(CH_3)_2 \cdot CH \cdot CH_2Cl$	92.53
37	cyanide	isovaleronitrile	$(CH_3)_2 \cdot CH \cdot CH_2 \cdot CN$	83.08
38	ether		$C_4H_9 \cdot O \cdot C_4H_9$	130.14
39	formate		$H \cdot COOC_4H_9$	102.08
40	formic acid		$(CH_3)_2CH \cdot CH_2 \cdot COOH$	102.08

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. $H_2O = 1$ (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	$0.885^{18°}$	......	193 (201)	i.	∞	∞
2	colorl. liq.	$0.993^{19°}$	......	261	i.	s.	......
3	colorl. liq.	1.219	......	120–0.6	i.	s.	......
4	colorl. liq.	$0.882^{0°}$	......	178.6	v. sl. s.	v. s	v. s.
5	colorl. liq.	$1.024^{25°}_{25}$	......	151–6	dec.	∞	∞
6	colorl. liq.	0.880	......	100–1	i.	s.	∞
7	liq.	0.807	......	155.5	i.	s.	∞
8	colorl. liq.	0.781	......	173	i.	......	∞
9	colorl. liq.	$0.894^{0°}$	......	123.3	v. sl. s.	s.	∞
10	liq.	$1.473^{20°}$	......	148.2	i.	s.	∞
11	colorl. liq.	$0.876^{0°}$	......	168.8	......	s.	s.
12	liq.	....	......	137	i.	s	s.
13	colorl. liq.	$0.858^{17°}$	......	194	v. sl. s.	s.	s.
14	liq.	0.942	......	183–4	v. sl. s.	v. s.	v. s.
15	liq.	$1.000^{7.5°}$	......	147	v. sl. s.	s.	v. s
16	liq.	0.880	......	94–5	v. sl. s.	∞	∞
17	need. f. h. w.	....	92–3	255	v. sl. s. h.	v. s.	v. s.
18	colorl. liq.	....	......	241.5–2.5	i.	v. s	v. s.
19	colorl. liq.	$0.888^{0°}$	......	160.2	$0.09^{25°}$	s.	s.
20	colorl. liq.	$1.045^{25°}_{25}$	......	270	i.	v. s.	∞
21	colorl. liq.	$0.843^{20°}$	......	213–16	i.	v. s.	v. s.
22	colorl.	....	89–91	......	sl. s.	......	......
23	....	....	60	220	s. h.	s.	s.
24	....	....	......	25	......	......	......
25	long. yel. need.	....	330	subl.	s. alk.	s.	v. sl. s.
26	gas	*$0.603^{0°}$	......	−11	i.	s.	s.
27	colorl. liq.	$0.871^{20°}$	......	116.3	$0.63^{25°}$	∞	∞
28	colorl. liq.	0.806	−108	106.5	$9.5^{18°}$	∞	∞
29	colorl. liq.	$0.794^{20°}$	......	63–4	11	∞	∞
30	colorl. liq.	0.735	......	68	∞	∞	∞
31	colorl. liq.	0.873	......	171–1.5	i.	∞	∞
32	colorl. liq.	1.002	......	237 (241.5)	i.	∞	∞
33	liq.	1.260	......	90–1	i.	∞	∞
34	colorl. liq.	0.866	......	156.9	v. sl. s.	∞	∞
35	liq.	$1.040^{25°}_{25}$	......	127–30	dec.	∞	∞
36	colorl. liq.	0.880	......	69	i.	∞	∞
37	liq.	$0.807^{20°}$	......	129–9.5	sl. s.	∞	∞
38	colorl. liq.	....	......	122–2.5	sl. s.	∞	∞
39	colorl. liq.	$0.885^{20°}$	......	98.5	1	∞	∞
40	....	$0.8854^{0°}$	......	97.9	1 : 99	......	......

* Specific gravity of the liquid.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Isobutyl-			
1	iodide		$(CH_3)_2CH \cdot CH_2I$	184.00
2	isoamyl		$(CH_3)_2CH(CH_2)_3 \cdot CH(CH_3)_2$	128.16
3	isocyanide		$(CH_3)_2 \cdot CH \cdot CH_2 \cdot NC$	83.08
4	isovaleirate		$C_4H_9 \cdot COO \cdot C_4H_9$	158.14
5	ketone		$C_4H_9 \cdot CO \cdot C_4H_9$	142.14
6	mustard oil		$C_4H_9 \cdot NCS$	115.14
7	nitrate		$(CH_3)_2 \cdot CH \cdot CH_2 \cdot NO_3$	119.07
8	nitrite		$(CH_3)_2 \cdot CH \cdot CH_2 \cdot NO_2$	103.08
9	phenyl ketone		$C_4H_9 \cdot CO \cdot C_6H_5$	162.11
10	Isobutylene		$(CH_3)_2C : CH_2$	56.06
11	Isobutyric acid		$(CH_3)_2 \cdot CH \cdot COOH$	88.06
12	amide		$(CH_3)_2 \cdot CH \cdot CONH_2$	87.08
13	anhydride		$[(CH_3)_2 \cdot CH \cdot CO]_2O$	158.11
14	Isocarbostyril	1 hydroxy-isoquinoline	C_9H_7ON	145.06
15	Isocholesterol		$C_{26}H_{43}OH$	372.35
16	" benzoate		$C_{26}H_{43}O \cdot C_7H_5O$	476.38
17	Isocinchomeronic acid	1, 4-pyridine dicarboxylic acid	$C_5H_3N \cdot (COOH)_2 + H_2O$	185.06
18	Isocinnamic acid		$C_6H_5 \cdot CH : CH \cdot COOH$	148.06
19	Isocitric acid		$C_6H_8O_7 + H_2O$	210.08
20	Isocrotonic acid		$CH_3 \cdot CH : CH \cdot COOH$	86.05
21	Isocoumarin		$C_6H_4 \cdot CH : CH \cdot OCO$	146.05
22	Isocymene (m.)		$CH_3 \cdot C_6H_4 \cdot CH(CH_3)_2$	134.11
23	Isodulcite		$CH_3(CHOH)_4CHO + H_2O$	182.11
24	Isodurene		$C_6H_2(CH_3)_4$ (1, 2, 3, 5)	134.11
25	Isoeugenol(1, 3, 4)		$C_3H_5 \cdot C_6H_3(OCH_3)OH$	164.10
26	Isoferulic acid		$C_7H_7O_2 \cdot C_2H_2 \cdot COOH$	194.08
27	Isoglucosamine		$C_6H_{11}O_5(NH_2)$	179.11
28	Isoheptoic acid		$C_6H_{13}COOH$	130.11
29	Isohydrobenzoin		$C_{14}H_{12}(OH)_2$	214.11
30	Isomalic acid		$CH_3 \cdot C(OH)(COOH)_2$	134.05
31	Isomannid		$C_6H_{10}O_4$	146.08
32	Isomethylcyanurate		$C_3O_3N_3(CH_3)_3$	171.10
33	Isonaphthazarine	2, 3-α-dihydroxy-naphthoquinone	$C_{10}H_4O_2(OH)_2$	190.05
34	Isonicotinic acid		$C_5H_4N \cdot COOH$ (4)	123.05
35	Isonitrosoacetone		$CH_3COCH : NOH$	87.05
36	Isopentane		$(CH_3)_2CHCH_2CH_3$	72.10

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	1.614	–90.7	120	i.	∞	∞
2	....	$0.7247^{0°}$	......	132	......	......	......
3	colorl. liq.	$0.787^{4°}$	......	114–7	sl. s.	s.	s.
4	colorl. liq.	$0.848^{25°}_{25}$	......	167–70	i.	∞	∞
5	colorl. liq.	$0.833^{20°}$	......	181–2	i.	v. s.	v. s.
6	liq.	$0.943^{20°}$	......	162	i.	v. s.	v. s.
7	colorl. liq.	1.021	......	123	i.	∞	∞
8	liq.	$0.908^{0°}$	......	67	......	s.	......
9	colorl. liq.	0.993	......	225–6	i.	∞	∞
10	....	....	......	–6	s. H_2SO_4	......	......
11	colorl. liq.	$0.945^{25°}$	...	155	$20^{20°}$	∞	∞
12	colorl. leaf.	....	128–9	216–20	v. s.	v. s.	sl. s.
13	colorl. liq.	0.957	......	182.5	dec.	dec.	......
14	colorl.	....	208–9	......	sl. s.	v. s.	sl. s
15	cryst.	....	138	......	......	s.	s.
16	need.	....	195	......	......	s.	v. s.
17	colorl. leaf.	....	236	subl.	v. sl. s.	v. sl. s.	v. sl. s.
18	....	....	57	......	......	......	......
19	pr.	....	......	......	v. sl. s.	v. sl. s.	v. sl. s.
20	need.	1.031	15.5	169–9.3	40	......	...
21	....	....	47	285	i.	s.	s.
22	....	$0.862^{20°}$	<–25	175–6	......	......	......
23	lq. monocl. f. w.	$1.4708^{20°}_{4}$	92–3	......	$5711^{19°}$	s.	54 meth. al.
24	liq.	$0.896^{0°}$	......	195–7	i.	s.	......
25	liq.	$1.091^{15°}_{15}$	......	267.5	sl. s.	s.	s.
26	need.	....	228	......	sl. s. d.; s. h.	s.	s.
27	....	....	......	......	......	i.	i.
28	liq.	....	......	210–13	......	......	......
29	colorl. monocl.	....	119.5	......	$0.21^{15°}$	v. s.	v. s.
30	monocl.	....	dec.	......	v. s.	v. s.	v. s.
31	colorl. monocl.	....	87	274 d.	v. s.	sl. s.	i.
32	pr.	....	175	295	......	......	......
33	red. br. need.	....	subl.	......	sl. s.	s.	s. alk.
34	colorl. need.	....	315	......	sl. s. c.; v. s. h.	v. sl. s.	v. sl. s.
35	leaf.	....	65	subl.	v. s.	......	v. s.
36	colorl. liq.	0.628	......	31	i.	∞	∞

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Isophthalic acid (m.)	....	$C_6H_4(COOH)_2$.....	166.05
2	aldehyde (m.) ..	....	$C_6H_4(CHO)_2$.......	134.05
3	nitrile.........	....	$C_6H_4(CN)_2$........	128.05
4	Isoprene........	....	$CH_2 : CH \cdot C(CH_3) : CH_2$	68.06
5	Isopropyl-acetate.	....	$CH_3 \cdot COO \cdot CH(CH_3)_2$	102.08
6	acetylene.......	....	$(CH_3)_2CH \cdot C : CH$..	68.06
7	alcohol........	....	$CH_3 \cdot CH(OH) \cdot CH_3$.	60.06
8	amine.........	....	$(CH_3)_2CHNH_2$.....	59.08
9	benzene.	See *cumene*		
10	benzoic acid (o.)	....	$(CH_3)_2 \cdot CH \cdot C_6H_4 \cdot COOH$	164.10
11	bromide........	....	$(CH_3)_2CH \cdot Br$......	122.97
12	chloride........	....	$(CH_3)_2CH \cdot Cl$......	78.51
13	cyanide........	....	$(CH_3)_2CH \cdot CN$....	69.06
14	ether..........	....	$(CH_3)_2CH \cdot O$....... $CH(CH_3)_2$	102.11
15	ethylene.......	....	$(CH_3)_2CH \cdot CH : CH_2$	70.08
16	iodide.........	....	$(CH_3)_2CH \cdot I$.......	169.99
17	isocyanide......	....	$(CH_3)_2CH \cdot NC$.....	69.06
18	ketone.........	....	$(CH_3)_2CH \cdot CO \cdot CH(CH_3)_2$	114.11
19	mercaptan.....	....	$(CH_3)_2CH \cdot SH$.....	76.13
20	methyl benzene (p.).	See *cymene* (p.)		
21	phenyl ketone..	....	$(CH_3)_2CH \cdot CO \cdot C_6H_5$	148.10
22	pyridine (1)....	....	$(CH_3)_2CH \cdot C_5H_4N$..	121.10
23	pyridine (3)....	....	$(CH_3)_2CH \cdot C_5H_4N$..	121.10
24	sulfide.........	....	$(CH_3)_2CH \cdot S \cdot CH(CH_3)_2$	118.18
25	Isopurpurin.	See *anthrapurpurin*		
26	Isoquinoline.....	....	C_9H_7N...........	129.06
27	Isosaccharic acid.	....	$[CH(OH) \cdot CH(COOH)]_2O$	192.06
28	Iso-safrol........	....	$CH_2O_2C_6H_3CH$ $CH \cdot CH_3$	162.08
29	Isosuccinic acid..	methyl malonic acid	$CH_3 \cdot CH(COOH)_2$..	118.05
30	Isovaleric acid...	....	$(CH_3)_2CH \cdot CH_2 \cdot COOH$	102.08
31	aldehyde.......	....	$(CH_3)_2CH \cdot CH_2 \cdot CHO$	86.08
32	Isovanillin (1, 3, 4)	....	$C_6H_3(CHO)(OCH_3)OH$	152.06
33	Itaconic acid.....	....	$CH_2 \cdot C(COOH)CH_2 \cdot COOH$	130.05
34	Itamalic acid....	....	$CH_2(OH)CH(COOH)CH_2 \cdot COOH$	148.06
35	Kairoline........	methyltetrahydroquinoline	$C_9H_{10}N \cdot CH_3$.......	147.11
36	Ketazine........	....	$(CH_3)_2C : N_2 : C(CH_3)_2$	112.11
37	Ketene..........	....	$CH_2 : CO$..........	42.02
38	Ketine..........	....	$(CH_3)C : CHN : C(CH_3)CH : N$	108.08
39	Ketobutyric acid	....	$CH_3.CH_2.CO.COOH$	102.05

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	colorl. need.	....	abt. 300	subl.	0.01 [illegible] 0.22 h.	s.	....
2	need	....	80	......	sl. s.	v. s.	....
3	colorl. need.	....	158–9	......	sl. s.	s. h.	....
4	colorl. liq.	0.691[illegible]	......	35.8	i.	∞	∞
5	colorl. liq.	0.917[illegible]	......	90–3	sl. s.	∞	∞
6	colorl. liq.	$0.685^{0°}$	......	28–9	i.	∞	∞
7	colorl. liq.	0.789[illegible]	......	82.8	∞	∞	∞
8	colorl. liq.	$0.690^{15°}$	......	32.2	∞	∞	∞
9							
10	colorl. pr.	....	51	......	s. h.	......	....
11	colorl. liq.	1.310[illegible]	......	59–60	i.	∞	∞
12	colorl. liq.	0.857[illegible]	......	35–6	v. sl. s.	∞	∞
13	colorl. liq.	....	......	107–8	sl. s.	∞	∞
14	colorl. liq.	0.725[illegible]	......	69	sl. s.	∞	∞
15	colorl. liq.	....	......	21.2	i.	∞	∞
16	liq.	1.705[illegible]	......	89.5	i.	∞	∞
17	colorl. liq.	0.760[illegible]	......	87	i.	∞	∞
18	colorl. liq.	$0.806^{20°}$	......	123.7	i.	∞	∞
19	colorl. liq.	>1	......	57–60	sl. s.	∞	∞
20							
21	colorl. liq.	....	......	217	i.	s.	s.
22	liq.	0.934[illegible]	......	158–9	sl. s.	∞	∞
23	liq.	$0.944^{0°}$	......	177–8	......	∞	∞
24	liq.	....	......	120.5	i.	s.	s.
25							
26	colorl.	1.099[illegible]	24.6	240.8	v. sl. s.	......	....
27	rhomb.	....	185	dec.	v. s.	v. s.	v. s.
28	....	....	......	249	i.	s.	....
29	colorl. pr.	1.455	135 d.	......	$44.3^{0°}$	v. s.	v. s.
30	colorl. liq.	0.956[illegible]	......	176	$4.2^{20°}$	∞	∞
31	colorl. liq.	$0.820^{0°}$	......	92.5	sl. s.	s.	s.
32	pr.	....	116	......	s. h.	s.	....
33	rhomb.	1.57	161	d.	1 : 15	......	....
34	long. need.	....	64	d.	deliq.	s.	s.
35	....	....	......	245	......	v. s.	sl. s.
36	....	0.836	......	131	s.	......	....
37	gas	....	......	−56	d.	s.	s.
38	....	....	......	153	......	......	....
39	oil	$1.200^{17°}$	......	$78^{25mm.}$	......	......	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Ketoheptamethylene	....	$(CH_2)_6CO$	112.10
2	Ketopentamethylene	....	$(CH_2)_4CO$	84.06
3	Ketopyrrolidine..	α, γ-butyrolactam	$NH(CH_2)_3CO$	85.06
4	Kynurenic acid ..	γ-hydroxyquinoline-Py-carboxylic acid	$C_9H_6(OH)(COOH)N$	189.06
5	Lactamide.......	....	$CH_3 \cdot CH(OH) \cdot CO \cdot NH_2$	89.06
6	Lactic acid (i.)...	....	$CH_3 \cdot CH(OH) \cdot COOH$	90.05
7	anhydride......	....	$C_6H_{10}O_5$...........	162.08
8	Lactide.........	....	$C_6H_8O_4$............	144.09
9	Lactoic acid.....	....	$CH_2OH(CHOH)_4COOH$	196.10
10	Lactose.........	milk sugar.......	$C_{12}H_{22}O_{11} + H_2O$...	360.19
11	Lactyl urea......	....	$C_4H_6O_2N_2 + H_2O$...	131.07
12	Laevulin........	....	$C_6H_{10}O_5$ at 100°	162.08
13	Laevulinic acid...	....	$CH_3 \cdot CO \cdot (CH_2)_2 \cdot COOH$	116.06
14	aldehyde.......	....	$CH_3 \cdot CO \cdot (CH_2)_2 \cdot CHO$	100.06
15	Laevulose.	See *fructose*		
16	Lauric acid......	....	$C_{11}H_{23} \cdot COOH$......	200.19
17	aldehyde.......	....	$C_{11}H_{23} \cdot CHO$.......	184.19
18	Lead tetraethyl ..	....	$Pb(C_2H_5)_4$.........	323.36
19	tetramethyl	....	$Pb(CH_3)_4$..........	267.30
20	triethyl....	....	$Pb_2(C_2H_5)_6$........	588.64
21	Lecithin.........	protagon........	$C_{42}H_{84}PO_9N$........	777.71
22	Lepidine.......	....	$CH_3 \cdot C_9H_6N$ (py. 4)	143.08
23	Lepamine.......	....	$C_{20}H_{32}N_2$..........	300.27
24	Leucaurine......	....	$CH(C_6H_4OH)_3$.....	292.13
25	Leucinic acid	....	$C_5H_{10}(OH)COOH$..	132.10
26	Leucine (1)......	....	$CH_3 \cdot (CH_2)_3 \cdot CH(NH_2) \cdot COOH$	131.11
27	Leuco-aniline....	....	$(NH_2 \cdot C_6H_4)_2 \cdot CH \cdot C_6H_3 \cdot CH_3(NH_2)$	303.19
28	" " (p.)	....	$CH(C_6H_4 \cdot NH_2)_3$...	289.18
29	Leuco-malachite-green	....	$C_6H_5 \cdot CH \cdot [C_6H_4 \cdot N(CH_3)_2]_2$	330.22
30	Lichenin........	moss starch......	$(C_6H_{10}O_5)x$........	(162.08)
31	Lignoceric acid...	....	$C_{24}H_{48}O_2$..........	368.38
32	Limonene (d. or l.)	....	$C_{10}H_{16}$............	136.13
33	Limonin.........	....	$C_{22}H_{36}O_7$.........	412.29
34	Linalool (d. or l.).	....	$C_{10}H_{18}O$..........	154.14

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	oil	$0.9685^{0°}$	......	178.5–95	sl. s.	v. s.	s.
2	....	$0.9416^{21°}_{4}$	......	130–0.5	......	......	......
3	cryst.	....	95	250	hydrol	......	......
4	need.	....	257	......	v. sl. s.	s. h.	sl. s.
5	colorl.	1.138[illegible]	74	......	v. s.	v. s.	......
6	colorl. syrup.	1.249	......	$119^{12mm.}$	∞	∞	∞
7	amor.	....	250–60 d.	......	v. sl. s.	v. s.	v. s.
8	colorl. monocl.	$0.862^{19°}$	128	255	v. sl. s. c.	v. sl. s.	......
9	cryst.	....	100; lactone	......	s.	......	......
10	colorl. rh.	$1.525^{20°}$	abt. 200 d.	......	17 c.; 40 h.	i.	i.
11	rhombs.	....	anh. 145	......	v. s.	v. s.	v. s.
12	amor.	....	174	......	deliq. ∞	10[illegible], 84 [illegible]	i.
13	colorl. leaf.	$1.137^{25°}$	33	245–6	v. s.	v. s.	v. s.
14	colorl. liq.	1.016	......	186–8 d.	∞	∞	∞
15							
16	colorl. need.	$0.864^{60°}$	43.6 (48)	dec.	i.	s.	s.
17	colorl. leaf.	....	44.5	$184–5^{100mm}$	i.	s.	s.
18	liq.	1.62	......	198–202	i.	......	......
19	liq.	$2.031^{0°}$	......	110	......	......	......
20	liq.	1.471	......	d.	i.	......	......
21	amor. waxy.	....	d.	......	i.	s.	s.
22	colorl. liq.	$1.086^{20°}$	......	266 (261–3)	v. sl. s.	∞	∞
23	liq.	....	......	275	......	......	......
24	need.	....	......	......	sl. s.	s.	......
25	pr. or need.	....	78	subl. 100 +	s.	v. s.	v. s.
26	colorl. leaf.	$1.293^{18°}$	283–5 d.	......	$2.4^{22°}$	$0.07^{17°}$; 0.12 h.	10.9 gl. ac. a.
27	colorl.	....	abt. 100	......	v. sl. s. h.	v. s.	v. sl. s.
28	colorl. leaf.	....	148	......	i.	s.	......
29	colorl.	....	93–4	......	i.	v. s.	v. s.
30	amor.	....	......	......	s. h.	i.	i.
31	need. f. al.	....	80.5..	......	s. bz., CS_2, acet. a.	s.	s.
32	colorl. liq.	$0.853^{10°}$	......	176.5	i.	∞	∞
33	micr. cryst.	....	275	......	v. sl. s.	s.	v. sl. s.
34	colorl. liq.	0.873	......	195–9	v. sl. s.	∞	∞

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Linalyl acetate	....	$CH_3 \cdot COOC_{10}H_{17}$	196.16
2	Linoleic acid	....	$C_{18}H_{32}O_2$	280.27
3	Lithofellic acid	....	$C_{20}H_{36}O_4$	340.29
4	Lophine	....	$C_{21}H_{16}N_2$	296.14
5	Lutidine (α)	dimethyl pyridine	$(CH_3)_2 \cdot C_5H_3N$	107.08
6	" (2, 4)	" "	$(CH_3)_2 \cdot C_5H_3N$	107.08
7	" (2, 6)	" "	$(CH_3)_2 \cdot C_5H_3N$	107.08
8	" (3, 4)	" "	$(CH_3)_2 \cdot C_5H_3N$	107.08
9	Lutidinic acid	....	$C_5H_3N \cdot (COOH)_2 + H_2O$	185.06
10	Maclurin	....	$COC_6H_2(OH)_3C_6H_3(OH)_2$	262.08
11	Malamide	....	$C_2H_3(OH)(CONH_2)_2$	132.09
12	Maleic acid	....	$COOH \cdot CH : CH \cdot COOH$	116.03
13	anhydride	....	$C_4H_2O_3$	98.02
14	Malic acid (d. or l.)	....	$COOH \cdot CH_2 \cdot CH(OH) \cdot COOH$	134.05
15	" " (i.)	....	$COOH \cdot CH_2 \cdot CH(OH)COOH$	134.05
16	Malonic acid	....	$CH_2 \cdot (COOH)_2$	104.03
17	amide	....	$CH_2 \cdot (CO \cdot NH_2)_2$	102.06
18	Malononitrile	....	$CH_2 \cdot (CN)_2$	66.03
19	Maltose	malt sugar	$C_{12}H_{22}O_{11} + H_2O$	360.19
20	Mandelic acid (i.)	....	$(C_6H_5 \cdot CH(OH) \cdot COOH$	152.06
21	Manitol (d.)	mannite	$C_6H_8(OH)_6$	182.11
22	Mannite hexanitrate	....	$C_6H_8(ONO_2)_6$	452.11
23	Mannoheptose (d.)	....	$C_6H_7(OH)_6CHO$	210.11
24	Mannose (d.)	....	$C_6H_{12}O_6$	180.10
25	Margaric acid	....	$C_{16}H_{33} \cdot COOH$	270.27
26	Maconic acid	....	$C_7H_4O_7 + 3H_2O$	254.08
27	Meconine	....	$C_{10}H_{10}O_4$	194.08
28	Melam	....	$C_6H_9N_{11}$	235.16
29	Melamine	cyanuric amide	$(CN \cdot NH_2)_3$	126.10
30	Melene	....	$C_{30}H_{60}$	420.48
31	Melilotic acid	....	$C_6H_4(OH)CH_2 \cdot CH_2 \cdot COOH$	166.08
32	Melissic acid	....	$C_{29}H_{59} \cdot COOH$	452.48
33	Mellitic acid	....	$C_6(COOH)_6$	342.05
34	Mellophanic acid	....	$C_{10}H_6O_8$	254.05
35	Menthene	....	$C_{10}H_{18}$	138.14
36	Menthol (l.)	....	$C_{10}H_{19}OH$	156.16
37	Menthone (l.)	....	$C_{10}H_{18}O$	154.14
38	Mercuric cyanide	....	$Hg(CN)_2$	252.62
39	fulminate	....	$Hg(ONC)_2 + \frac{1}{2}H_2O$	293.65

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	0.91	......	abt. 220d.	v. sl. s.	∞	∞
2	yel. oil.	0.921	<−18	......	i.	∞	∞
3	micr.	....	204	d.	i.	s.	......
4	need.	....	275	......	i.	$0.88^{21°}$	$0.32^{[illegible]}$
5	colorl. liq.	$0.947^{0°}$	......	154–6.5	25	......	......
6	colorl. liq.	0.938	......	157–9	20	......	......
7	colorl. liq.	$0.942^{0°}$	......	142–3	∞ c.	......	......
8	colorl. liq.	....	......	163.5–4.5	......	......	......
9	leaf.	....	235	......	s.	s.	i.
10	yel.	....	......	d.	s. h.	s.	s.
11	pr.	....	......	......	s.	......	......
12	colorl. pr.	1.590	130–0.5	......	$78.8^{25°}$ $392.6^{97.5°}$	$69.9^{39.7°}$	$8^{25°}$
13	colorl. trim.	$0.934^{19°}$	52.6	202	$16.32^{29.7°}$	v. sl. s. CCl_4	
14	colorl. need.	1.595	100	dec.	v. s.	sl. s.	sl. s.
15	colorl.	$1.601^{20°}$	128.5–9	dec.	$144^{26°}$ $411^{79°}$	v. s.	v. s.
16	colorl. tricl.	....	132	dec.	>100	s.	s.
17	colorl. need.	....	170	......	$8.3^{8°}$	i. abs.	......
18	colorl.	....	29–30	218–9	13.3	40	20
19	fine need.	$1.540^{17°}$	......	......	v. s.	v. sl. s. c.	......
20	colorl. rhomb.	$1.361^{4°}$	118	dec.	$16^{20°}$	s.	s.
21	colorl. need.	1.521	166	......	$15.6^{18°}$	v. sl. abs	i.
22	need.	$1.604^{[illegible]}$	112–3	exp. 120	i.	$2.9^{13°}$	$4^{[illegible]}$
23	need.	....	134–5	......	v. s.	sl. s.	......
24	colorl. pr.	....	132.3	......	250	v. sl. s.	i.
25	colorl.	$0.853^{60°}$	59.9	$227^{100mm.}$	i.	sl. s.	v. s.
26	rhomb. ab.	....	......	......	$25^{100°}$	sl. s.	sl. s.
27	colorl. need.	....	102–2.5	......	0.14 c.; 4.5 h.	......	......
28	or. powd.	....	......	......	i.	s. KOH	......
29	monocl.	....	......	......	sl. s.	sl. s.	i.
30	colorl.	0.89	62	370–80	i.	s. h.	......
31	need.	....	82–3	d.	s.	s.	s.
32	colorl. sc.	....	90	......	i.	sl. s. c.; s. h.	v. sl. s.
33	colorl. need.	....	286–8	d.	v. s.	s.	......
34	cryst. f. w.	....	238 anh.	......	s.	......	......
35	....	$0.8073^{20°}$	164.5–5.5	......	......	......	......
36	colorl. trim.	0.890	42	210	sl. s.	v. s.	v. s.
37	colorl. liq.	$0.896^{20°}$	......	207	sl. s.	∞	∞
38	tetr.	4.011	d.	......	s.	sl. s.	......
39	rhombs.	....	exp. 180	......	$0.07^{12°}$	sl. s. h.	......

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Mercury ethyl		$Hg(C_2H_5)_2$	258.69
2	mercaptide		$(C_2H_5S)_2Hg$	322.82
3	methyl		$Hg(CH_3)_2$	230.66
4	naphthyl		$Hg(C_{10}H_7)_2$	454.72
5	phenyl		$Hg(C_6H_5)_2$	354.69
6	Mesaconic acid		$CH_3(COOH)C:CHCOOH$	130.05
7	Mesidine		$(CH_3)_3C_6H_2 \cdot NH_2$	135.11
8	Mesitol (1, 3, 5, 2)		$(CH_3)_3C_6H_2\ OH$	136.10
9	Mesityl oxide		$(CH_3)_2C:CH \cdot CO \cdot CH_3$	98.08
10	Mesitylene (1, 3, 5)		$(CH_3)_3C_6H_3$	120.10
11	Mesitylinic acid		$(CH_3)_2C_6H_3 \cdot COOH$	150.08
12	Mesorcin		$C_6H(CH_3)_3(OH)_2$	152.10
13	Mesotartaric acid		$(HO)_2C_2H_2(COOH)_2 + H_2O$	168.06
14	Mesoxalic acid		$(HO)_2C(COOH)_2$	136.03
15	Metacetone		$C_6H_{10}O$	98.08
16	Metacrolein		$C_9H_{12}O$	136.10
17	Metacrylic acid		$CH_2:C:(CH_3)COOH$	86.05
18	Metaldehyde		$(C_2H_4O)_4$	176.13
19	Metanilic acid (m.)		$C_6H_4NH_2SO_3H$	173.13
20	Matastyrene		$(C_8H_8)x$	104.06
21	Methacetine	p-methoxy-acet-aminophenol	$CH_3O \cdot C_6H_4 \cdot NH \cdot CO \cdot CH_3$	165.10
22	Methane	marsh gas	CH_4	16.03
23	Methenyldiphenyl-amine		$CH(C_6H_5N)C_6H_5NH$	196.11
24	Methoxybenzoic acid (o.)		$CH_3O \cdot C_6H_4 \cdot COOH$	152.06
25	Methoxybenzoic acid (m.)		$CH_3O \cdot C_6H_4 \cdot COOH$	152.06
26	Methoxypyridine (p.)		$C_2H_2 \cdot C(OCH_3)\ CH_2:N$	97.06
27	Methoxyquinoline (p.)	quinanisol	$C_9H_6N(OCH_3)$	159.08
28	Methyl acetanilide		$CH_3CO \cdot N(CH_3) \cdot C_6H_5$	149.10
29	acetate		$CH_3 \cdot COO \cdot CH_3$	74.05
30	aceto-acetate		$CH_3CO \cdot CH_2 \cdot COO \cdot CH_3$	116.06
31	aceto-acetic ethic		$CH_3CO \cdot CH(CH_3) \cdot COO \cdot C_2H_5$	144.10
32	acetylurea		$CH_3NHCONHCOCH_3$	116.08
33	acridine (2)		$CH_3 \cdot C_{13}H_8N$	193.10
34	acrylate		$CH_3O_2 \cdot CH_3$	62.05
35	acrylic acid		$CH_2:C(CH_3) \cdot COOH$	86.05
36	alcohol	wood alcohol	CH_3OH	32.03
37	alizarine		$C_6H_4(CO)_2 \cdot C_6H \cdot CH_3(OH)_2$	254.08

ORGANIC COMPOUNDS (Continued)

No	Crystal-line form and color	Sp. gr. $H_2O = 1$ (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	liq.	2.444	......	159	i.	sl. s.	s.
2	....	....	60	d	......	s.	......
3	liq.	3.069	......	96	i.	......	......
4	....	1.944	243	......	s. CS_2	sl. s. h.	s. chl
5	rhomb.	2.32	120	......	s. CS_2	sl. s. h.	s. chl s. bz
6	colorl. need.	....	202	subl.	2.7^{18}; v. s. h.	39	s.
7	liq.	0.9633	......	229–30	......	......	......
8	cryst.	....	68–9	219.5	i.	v. s.	v. s.
9	....	$0.8568^{18°}$	......	128.3	i.	∞	∞
10	colorl. liq.	$0.863^{20°}$	......	164.5	i.	s.	s.
11	monocl.	....	166	subl.	v. sl. s.	v. s.	......
12	leaf.	....	149–50	275	sl. s. c.	v. s.	v. s.
13	colorl. tab.	1.666	140–3	......	$120^{15°}$	......	......
14	colorl. deliq. need.	119.20	......	......	v. s.	s.	s.
15	....	$>H_2O$	8	......	i.	......	......
16	cryst.	....	50	170	i.	s.	s.
17	pr.	....	16	160.5	s.	......	......
18	colorl. tetrag.	....	subl. 112–6	......	i.	$1.8^{70°}$	0.5[illegible]
19	need.	....	......	......	$1:68^{15°}$	......	......
20	vitreous	$1.054^{13°}$	d.	......	i.	i	v. sl. s.
21	colorl.	....	127	......	$2^{15°}$	$12.7^{21°}$	v. s. chl
22	gas	0.558 (A)	–84	–1.53	$5.45 s.c.^{0°}$	52.2 c.c	s.
23	need. f. al.	....	136	>250	sl. s.	s.	s. bz.
24	monocl. tab.	1.180	98.5	......	$0.5^{30°}$	......	......
25	colorl. need.	....	167	subl.	sl. s.; v. s. h.	v. s.	v. s.
26	liq.	....	......	119.1^{738}	s.	......	......
27	....	$1.665^{0°}$	......	$186^{35 mm.}$	......	s.	......
28	colorl. prisms	....	102	245	s.	s.	......
29	colorl. liq.	0.964	......	57.5 (54)	$31.9^{20°}$	∞	∞
30	colorl. liq.	$1.037^{9°}$	......	170	v. sl. s.	∞	∞
31	colorl. liq.	$1.009^{6°}$	......	186.8	......	s.	s.
32	monocl. pr.	....	180	......	sl. s. h.	sl. s.	sl. s.
33	yel'sh	....	131.5–4.0	......	v. s. bz	v. s.	v. s.
34	colorl. liq.	$0.973^{0°}$	......	80.3	......	s.	s.
35	colorl. prisms	$0.015^{20°}$	14	162–3	s.	∞	∞
36	colorl. liq.	$0.798^{15°}_{15}$	–97.1	66	∞	∞	∞
37	or. need.	....	250–2	subl. 200	s. acet.	s.	s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Methyl allene		$CH_2:C:CH \cdot CH_3$	54.05
2	allyl amine		$CH_3 \cdot NH \cdot C_3H_5$	71.08
3	" carbinol		$CH_2:CH \cdot CH_2 \cdot CH(OH) \cdot CH_3$	86.08
4	" ether		$CH_3 \cdot O \cdot C_3H_5$	72.06
5	amine		CH_3NH_2	31.05
6	amine hydrochloride		$CH_3NH_2 \cdot HCl$	67.51
7	amino-acetate		$NH_2 \cdot CH_2 \cdot COO \cdot CH_3$	89.06
8	" -benzoate (o.)		$NH_2 \cdot C_6H_4 \cdot COO \cdot CH_3$	151.08
9	" " (p.)		$NH_2 \cdot C_6H_4 \cdot COO \cdot CH_3$	151.08
10	" -propionic acid (α)		$CH_3 \cdot CH(NHCH_3) \cdot COOH$	103.08
11	amyl ketone		$CH_3 \cdot CO \cdot C_5H_{11}$	114.11
12	aniline		$C_6H_5 \cdot NHCH_3$	107.07
13	anthracene (α)		$C_{14}H_9 \cdot CH_3$	192.10
14	" (β)		$C_{14}H_9 \cdot CH_3$	192.10
15	anthranilate		$H_2N \cdot C_6H_4 \cdot COO \cdot CH_3$	151.08
16	anthraquinone (2)		$C_{14}H_7O_2 \cdot CH_3$	222.08
17	arsenic acid		$AsOCH_3(OH)_2$	140.00
18	arsenious oxide		$AsOCH_3$	105.98
19	arsenic dichloride	dichlormethyl-arsine	$AsCl_2CH_3$	160.93
20	arsine		$CH_3 \cdot AsH_2$	92.00
21	auramine		$CH_3N \cdot C \cdot [C_6H_4 \cdot N(CH_3)_2]_2$	281.21
22	benzoate		$C_6H_5 \cdot COO \cdot CH_3$	136.06
23	benzoyl-acetate		$C_6H_5CO \cdot CH_2 \cdot COO \cdot CH_3$	178.08
24	benzyl-ketone		$CH_3 \cdot CO \cdot CH_2C_6H_5$	134.08
25	bromide		CH_3Br	94.94
26	butyl amine		$CH_3 \cdot NH \cdot C_4H_9$	87.11
27	" carbinol		$CH_3 \cdot CH(OH) \cdot C_4H_9$	102.11
28	" ether		$CH_3 \cdot O \cdot C_4H_9$	88.10
29	" ketone		$CH_3 \cdot CO \cdot C_4H_9$	100.10
30	butyrate		$C_3H_7 \cdot COO \cdot CH_3$	102.08
31	butyrone		$C_8H_{16}O$	128.13
32	caprate		$C_9H_{19} \cdot COO \cdot CH_3$	186.18
33	caproate		$C_5H_{11} \cdot COO \cdot CH_3$	130.11
34	caprylate		$C_7H_{15} \cdot COO \cdot CH_3$	158.14
35	carbamate		$NH_2 \cdot COO \cdot CH_3$	75.05
36	carbanilide		$CH_3 \cdot C_6H_5N \cdot CO \cdot NH \cdot C_6H_5$	226.13
37	carbostyril (γ)	lepidone	$C_9H_6(CH_3)ON$	159.08
38	chloracetate		$CH_2Cl \cdot COO \cdot CH_3$	108.52
39	chlorcarbonate		$Cl \cdot COO \cdot CH_3$	94.48
40	chloride	chloromethane	CH_3Cl	50.48
41	chloroform		CCl_3CH_3	133.40

ORGANIC COMPOUNDS (Continued)

No	Crystal-line form and color	Sp. gr. $H_2O = 1$ (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	....	......	118–9	i.	∞	∞
2	colorl. liq.	....	......	65	∞	......	......
3	colorl. liq	$0.834^{20°}$	......	115–6	12.5	∞	∞
4	colorl. liq	0.77	......	46	v. sl. s.	∞	∞
5	gas	$0.699^{-10.8}$	......	–6.7	$1150^{12°}$ c.c.	s.	......
6	leaf.	....	226–7	......	v. s.	s.	i.
7	colorl. liq.	....	......	abt. 130 d.	......	......	......
8	colorl.	1.168	24.5	......	s.	v. s.	v. s.
9	colorl. leaf.	....	112(102)	......	......	......	......
10	colorl. rhomb.	....	260 d.	......	s.	v. sl. s. c. abs.	......
11	colorl. liq.	$0.835^{0°}$	......	151	v. sl. s.	s.	s.
12	yellow liq	$0.987^{20°}$	......	195.5	v. sl. s.	s.	∞
13	colorl. leaf.	....	199–200	......	s. bz.	......	......
14	colorl. scales	....	199–200 (207)	......	s. bz.	sl. s.	sl. s.
15	....	1.168	24.5	......	sl. s.	v. s.	v. s.
16	yel'sh need.	....	177	subl.	v. s. bz.	v. sl. s.	s.
17	pl.	....	......	......	s.	s.	......
18	pr.	....	95	d.	......	......	......
19	....	....	......	133	......	......	......
20	gas	....	......	2	......	v. s.	v. s.
21	gr'n'sh yel.	....	130–3	......	v. sl. s.	v. s.	......
22	colorl. liq.	1.094	–12.3	199	v. sl. s.	∞	∞
23	colorl. liq.	....	......	260–5 d.	i.	∞	∞
24	colorl.	$1.019^{0°}$	27	215	i.	v. s.	v. s.
25	gas	$1.732^{0°}$	<–84	4.5	sl. s.	v. s.	v. s.
26	colorl. liq.	0.737	......	91	......	......	......
27	colorl. liq.	$0.833^{0°}$	......	136	v. sl. s.	s.	......
28	colorl. liq.	$0.763^{0°}$	......	70.3	v. sl. s.	∞	∞
29	colorl. liq.	$0.830^{0°}$	......	127	v. sl. s.	∞	∞
30	colorl. liq.	$0.919^{0°}$	......	102.3	s.	∞	∞
31	colorl. liq.	0.827	......	180	i.	v. s.	v. s.
32	colorl. liq.	....	......	223.5	i.	v. s.	v. s.
33	colorl. liq.	$0.904^{0°}$	......	150	i.	v. s.	v. s.
34	colorl. liq.	$0.894^{0°}$	......	193	i.	v. s.	v. s.
35	colorl. tab.	....	52	177	$217^{11°}$	$73^{15°}$	s.
36	colorl. need.	....	104	......	i.	sl. s.	v. s.
37	colorl. need.	....	217.4	......	v. sl. s. c.	v. s. h.	v. sl. s.
38	colorl. liq.	....	......	130–2	v. sl. s.	∞	∞
39	colorl. liq.	....	......	72–5	dec.	∞	∞
40	colorl. gas	0.920	–91.5	–23.7	400 c.c.	3500 c.c.	......
41	....	$1.346^{0°}$	......	74.1	......	......	......

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Methyl			
1	cinnamate.....	....	$C_6H_5 \cdot CH : CH \cdot COOCH_3$	162.08
2	cotonate (α)...	....	$C_3H_5 \cdot COO \cdot CH_3$.....	100.06
3	coumarin......	....	$C_6H_4 \cdot C(CH_3) : CH \cdot COO$	160.06
4	cyan-acetate...	....	$CH_2(CN) \cdot COOCH_3$	99.05
5	cyanide.......	acetonitrile......	$CH_3 \cdot CN$..........	41.03
6	diazoamino-benzene (4)	....	$CH_3 \cdot C_6H_4 \cdot N_2 \cdot NH \cdot C_6H_5$	211.13
7	diethyl amine..	....	$CH_3N(C_2H_5)_2$......	87.11
8	diethyl amino-benzene (o.)	....	$CH_3 \cdot C_6H_4 \cdot N(C_2H_5)_2$	163.14
9	diethyl amino-benzene (p.)	....	$CH_3 \cdot C_6H_4 \cdot N(C_2H_5)_2$	163.14
10	diethyl carbinol	....	$(C_2H_5)_2 \cdot C(OH) \cdot CH_3$	102.11
11	diphenylamine.	....	$(C_6H_5)_2NCH_3$......	183.11
12	ether.........	....	$CH_3 \cdot O \cdot CH_3$........	46.05
13	ethyl acetic acid	....	$CH_3 \cdot CH(C_2H_5) \cdot COOH$	102.08
	" acetone...	....	$CH_3 \cdot CO \cdot CH(C_2H_5) \cdot CH_3$	100.10
15	" aniline...	....	$C_6H_5 \cdot N(CH_3)C_2H_5$..	135.11
16	" benzene (o.)	....	$CH_3 \cdot C_6H_4 \cdot C_2H_5$.....	120.10
17	" " (m.)	....	$CH_3 \cdot C_6H_4 \cdot C_2H_5$.....	120.10
18	" " (p.)	....	$CH_3 \cdot C_6H_4 \cdot C_2H_5$.....	120.10
19	" carbonate.	....	$CH_3 \cdot CO_3 \cdot C_2H_5$.....	104.06
20	" ether.....	....	$CH_3 \cdot O \cdot C_2H_5$.......	60.06
21	" ketone....	....	$CH_3 \cdot CO \cdot C_2H_5$.....	72.06
22	" ketoxime .	....	$CH_3 \cdot C(NOH) \cdot C_2H_5$	87.08
23	" oxalate...	....	$CH_3 \cdot OOC \cdot COO \cdot C_2H_5$	132.06
24	" protocatechuic aldehyde	....	$C_6H_3(CHO)(OCH_3)(OC_2H_5)$	180.10
25	ethyl succinate.	....	$C_7H_{12}O_4$..........	160.10
26	" sulfide...	....	$CH_3 \cdot S \cdot C_2H_5$........	76.13
27	formate.......	....	$H \cdot COO \cdot CH_3$.......	60.03
28	furfurane......	....	$C_4H_3O(CH_3)$.......	82.05
29	furfurol.......	....	$CH_3 \cdot C_4H_2O \cdot CHO$...	110.05
30	glycerate......	....	$CH_2OH \cdot CHOH \cdot COO \cdot CH_3$	120.06
31	glycolate......	....	$CH_2(OH) \cdot COO \cdot CH_3$	90.05
32	glyoxaline.....	....	$C_3H_3N_2CH_3$........	82.06
33	heptenone.....	....	$(CH_3)_2C : CH(CH_2)_2 \cdot COCH_3$	126.11
34	heptyl ether...	....	$CH_3 \cdot O \cdot C_7H_{15}$......	130.14
35	hexyl carbinol..	....	$CH_3(CH_2)_5CHOH \cdot CH_3$	130.14
36	hexyl ketone...	....	$CH_3 \cdot CO \cdot C_6H_{13}$.....	128.13
37	hydantoin (β)..	....	$C_4H_6N_2O_2$.........	114.06
38	hydrazine	....	$NH_2 \cdot NH \cdot CH_3$......	46.06
39	hydrazo-benzene (o.)	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot NH \cdot C_6H_5$	198.13
40	hydrazo-benzene (m.)	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot NH \cdot C_6H_5$	198.13

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl.	$1.042^{36°}$	36	260	i.	v. s.	s.
2	colorl. liq.	$0.981^{4°}$	......	120.7	i.	v. s.	v. s.
3	need.	....	126	......	......	s.	s. bz.
4	colorl. liq.	....	−22.5	204	i.	∞	∞
5	colorl. liq.	0.791	−41	81.5	∞	∞	....
6	yel'sh leaf.	....	90–1	......	......	......	....
7	colorl. liq.	....	......	63–5	v. s.	......	....
8	colorl. liq.	....	......	227–8	......	......	....
9	colorl. liq.	0.924	......	229	......	......	....
10	colorl. liq.	$0.824^{20°}$	......	123	sl. s.	s.	......
11	colorl. liq.	$1.052^{15°}_{15}$	......	296	i.	......	......
12	colorl. gas	....	−138.5	−34	3700 c.c.	v. s.	v. s.
13	colorl. liq.	$0.938^{20°}_{20}$	<−80	177	sl. s.	∞	∞
14	colorl. liq.	0.818	......	118	sl. s.	∞	∞
15	colorl. liq.	....	......	201	......	......	......
16	colorl. liq.	0.873	......	158–9	i.	s.	s.
17	colorl. liq.	$0.869^{20°}$	......	158–9	i.	s.	s.
18	colorl. liq.	0.865	......	162	i.	s.	s.
19	colorl. liq.	$1.002^{27°}$	−14.5	109.2	i.	∞	∞
20	colorl. liq.	$0.725^{0°}$	......	10.8	s.	∞	∞
21	colorl. liq.	$0.805^{20°}$	......	80.6	s.	∞	s.
22	colorl. liq.	$0.919^{24°}$	......	152–3	10	∞	∞
23	colorl. liq.	$1.156^{0°}$	......	173.8	i.	v. s.	v. s.
24	pr.	....	73–4	subl.	sl. s. h.	sl. s.	s.
25	colorl. liq.	$1.093^{0°}$	......	208.2	i.	v. s.	v. s.
26	liq.	....	−105	70	i.	∞	∞
27	colorl. liq.	0.980	......	32.3	$30.4^{20°}$	∞	....
28	....	....	......	63	......	......	....
29	colorl. liq.	1.109	......	187	3.3	v. s.	....
30	liq.	....	......	239–44	∞	∞	v. sl. s.
31	colorl. liq.	$1.168^{18°}$	......	151.2	......	......	....
32	....	$1.036^{10°}$	−6	197–9	∞	......	....
33	colorl. liq.	0.855	......	173–4 (170)	i.	∞	∞
34	colorl. liq.	$0.795^{0°}$	......	149.8	i.	∞	∞
35	....	$0.823^{16°}$	......	179.5	......	......	....
36	colorl. liq.	0.820	−16	172.5	i.	∞	∞
37	pr.	....	157–8	subl.	s.	s.	....
38	colorl. liq.	....	......	87.5	v. s.	∞	∞
39	colorl. leaf.	....	101–2	......	i.	......	....
40	colorl. prisms f. lgr.	....	59–61	......	......	v. s.	....

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
	Methyl-			
1	hydrazo-benzene (p.)	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot NH \cdot C_6H_5$	198.12
2	hydrogen sulfate	methyl sulfuric acid	$CH_3 \cdot HSO_4$.........	112.10
3	hydroxylamine (β)	....	CH_3NHOH........	47.05
4	iodide.........	iodomethane.....	CH_3I.............	141.96
5	isatin (p.)	....	$C_6H_4 \cdot N : C(OCH_3)CO$	161.06
6	isoamyl ketone .	....	$CH_3 \cdot CO \cdot C_5H_{11}$....	114.11
7	" ketoxime	....	$CH_3 \cdot C(NOH) \cdot C_5H_{11}$	129.13
8	isobutyl amine	....	$CH_3 \cdot NH \cdot C_4H_9$....	87.11
9	" ketone.	....	$CH_3 \cdot CO \cdot C_4H_9$....	100.10
10	isobutyrate... .	....	$(CH_3)_2 \cdot CH \cdot COO \cdot CH_3$	102.08
11	isocyanide.	methyl carbylamine	$CH_3 \cdot NC$..........	41.03
12	isopropyl benzene (m.)	....	$CH_3 \cdot C_6H_4CH(CH_3)_2$	134.11
13	" (p.)	See *cymene*		
14	" ketone	....	$CH_3 \cdot CO \cdot CH(CH_3)_2$	86.08
15	" ketoxime	....	$CH_3 \cdot C(NOH) \cdot CH(CH_3)_2$	101.10
16	isosuccinate....	....	$CH_3\ CH \cdot (COO \cdot CH_3)_2$	146.08
17	isovaleriate....	....	$C_4H_9 \cdot COO \cdot CH_3$....	116.10
18	lactate......	....	$CH_3 \cdot CH(OH) \cdot COO \cdot CH_3$	104.06
19	malate........	....	$C_2H_4O \cdot (COO \cdot CH_3)_2$	162.08
20	malonate......	....	$CH_2 \cdot (COO \cdot CH_3)_2$..	132.06
21	mercaptan.....	....	$CH_3 \cdot SH$..........	48.10
22	mustard oil.....	methyl isothiocyanate	$CH_3 \cdot NCS$.......	73.10
23	naphthalene (α)	....	$C_{10}H_7 \cdot CH_3$........	142.08
24	" (β)	....	$C_{10}H_7 \cdot CH_3$........	142.08
25	naphthylamine (α)	....	$C_{10}H_7 \cdot NHCH_3$.....	157.10
26	" (β)	....	$C_{10}H_7 \cdot NHCH_3$.....	157.10
27	naphthyl ether (α)	....	$C_{10}H_7 \cdot O \cdot CH_3$......	158.08
28	" " (β)	nerolin..........	$C_{10}H_7 \cdot O \cdot CH_3$......	158.08
29	nitrate.........	....	$CH_3 \cdot NO_3$..........	77.03
30	nitrite..........	....	$CH_3 \cdot NO_2$..........	61.03
31	nitrobenzoate (o.)	....	$NO_2 \cdot C_6H_4 \cdot COO \cdot CH_3$	181.06
32	" (m.)	....	$NO_2 \cdot C_6H_4 \cdot COO \cdot CH_3$	181.06
33	" (p.)	....	$NO_2 \cdot C_6H_4 \cdot COO \cdot CH_3$	181.06
34	nitrolic acid....	....	$HC(NOH)NO_2$.....	90.03
35	nonyl ketone...	....	$CH_3 \cdot CO \cdot C_9H_{19}$....	170.18

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	colorl. scales	....	86–7	......	......	v. s.	v. s. bz.
2	oil	....	<–30	......	v. s.	s.	s.
3	....	....	42	$62^{15mm.}$	......	......	......
4	colorl.-br. liq.	2.285	......	42.5 (45)	$1.4^{20°}$	∞	∞
5	red. cryst.	....	187	......	sl. s. c.	s. alk.	......
6	colorl. liq.	$0.818^{17°}$	......	144	v. sl. s.	∞	∞
7	colorl. yel.	$0.888^{20°}$	......	195–6 d.	......	......	......
8	colorl. liq.	$0.722^{18°}$	......	76–8	......	......	......
9	colorl. liq.	$0.803^{19°}$	......	116 (119)	i.	∞	∞
10	colorl. liq.	$0.912^{0°}$	......	92.3	sl. s.	∞	∞
11	colorl. liq.	$0.756^{4°}$	......	59.6	$10^{15°}$	s.	∞
12	colorl. liq.	$0.862^{20°}$	......	175–6	......	......	......
13							
14	colorl. liq.	0.805	......	95	v. sl. s.	∞	∞
15	colorl. liq.	....	......	157–8	......	......	......
16	colorl. liq.	1.107	......	179	v. sl. s.	∞	∞
17	colorl. liq.	$0.901^{0°}$	......	116.7	v. sl. s.	∞	∞
18	colorl. liq.	1.094	......	144.8	s., d.	s.	s.
19	colorl. liq.	....	......	242–6	v. s.	∞	∞
20	colorl. liq.	1.160	–62	181.5	v. sl. s.	∞	∞
21	gas	....	–130.5	5.8	i.	v. s.	v. s.
22	....	$1.069^{37°}$	35	119	v. sl. s.	∞	v. s.
23	colorl. liq.	$1.001^{19°}$	–22	240–2	i.	v. s.	v. s.
24	colorl. monocl.	....	32.5	242	i.	v. s.	v. s.
25	red oil	....	......	293	i.	v. s.	v. s.
26	darkens in air	....	......	298	......	......	......
27	colorl. liq.	1.096	......	269	i.	v. s.	v. s.
28	colorl. leaf.	....	72	274	sl. s.	sl. s.	v. s.
29	liq.	$1.182^{20°}$	......	55–6, exp.	sl. s.	s.	s.
30	gas......	0.991	......	–12	......	s.	s.
31	yel. oil	$1.286^{20°}$	–13	275 (286–9)	i.	∞	∞
32	....	....	78.5 (70)	279	......	sl. s. methyl	......
33	yel. leaf.	....	96	......	i.	s.	s.
34	need.	....	64	......	v. s.	......	v.s.
35	colorl.	$0.829^{18°}$	15 *	224 (230)	i.	s.	s.

* Solidifies at 6° C

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt
	Methyl-			
1	orange	Na salt of helianthine	$(CH_3)_2N \cdot C_6H_4 \cdot N_2 \cdot C_6H_4 \cdot SO_3Na$	327.20
2	oxalate		$(CH_3O_2C)_2$	118.05
3	palmitate		$C_{15}H_{31} \cdot COOCH_3$	270.27
4	phenazine		$C_6H_4 : N_2 : C_6H_3(CH_3)$	194.1[illegible]
5	phenyl acetate		$C_6H_5 \cdot CH_2 \cdot COO \cdot CH_3$	150.08
6	" carbinol		$CH_3 \cdot CH(OH) \cdot C_6H_5$	122.08
7	" ether.	See *anisol*		
8	phosphine		$CH_3 \cdot PH_2$	48.07
9	phosphoric acid		$CH_3PO(OH)_2$	96.07
10	phthalate. See	*dimethyl phthalate*		
11	piperidine (α)	pipecolin	$CH_3 \cdot C_5H_9NH$	99.11
12	" (β)		$CH_3 \cdot C_5H_9NH$	99.11
13	" (γ)		$CH_3 \cdot C_5H_9NH$	99.11
14	propargyl ether		$CH_3 \cdot O \cdot C_3H_3$	70.05
15	propionate		$C_2H_5 \cdot COO \cdot CH_3$	88.06
16	propyl acetic acid		$CH_3 \cdot CH(C_3H_7) \cdot COOH$	116.10
17	" amine		$CH_3 \cdot NH \cdot C_3H_7$	73.10
18	" benzene (o.)		$C_6H_4(CH_3)C_3H_7$	134.11
19	" " (m.)		$C_6H_4(CH_3)C_3H_7$	134.11
20	" ether		$CH_3 \cdot O \cdot C_3H_7$	74.08
21	" ketone		$CH_3 \cdot CO \cdot C_3H_7$	86.08
22	" ketoxime		$CH_3 \cdot C(NOH) \cdot C_3H_7$	101.10
23	pseudoisatin		$C_6H_4N(CH_3)CO \cdot CO$	161.06
24	pyridine.	See *picoline*		
25	pyrogallol		$C_6H_2(CH_3)(OH)_3$	140.06
26	pyrrol (1)		$C_4H_4N \cdot CH_3$	81.06
27	" (2)		$C_4H_4N \cdot CH_3$	81.06
28	pyruviate		$C_3H_3O_3 \cdot CH_3$	102.05
29	quinoline (2)	quinaldine	$CH_3 \cdot C_9H_6N$	143.08
30	salicylate	artificial oil of wintergreen	$HO \cdot C_6H_4 \cdot COO \cdot CH_3$	152.06
31	stearate		$C_{17}H_{35} \cdot COO \cdot CH_3$	298.30
32	succinate		$C_2H_4(COOCH_3)_2$	146.08
33	succinic acid		$CH_3 \cdot CH(COOH) \cdot CH_2 \cdot COOH$	132.06
34	sulfate		$(CH_3)_2 \cdot SO_4$	126.11
35	sulfide		$(CH_3)_2 \cdot S$	62.11
36	sulfite		$(CH_3)_2 \cdot SO_3$	110.11
37	sulfocyanate	methyl thiocyanate	$CH_3 \cdot SCN$	73.10
38	sulfonic acid		$CH_3 \cdot HSO_3$	96.10
39	" chloride		CH_3SO_2Cl	114.54
40	tartrate. See	*dimethyl tartrate*		
41	tetramethylene		C_5H_{10}	70.08
42	thiocarbamide	methylthiourea	$CS(NH_2)(NHCH_3)$	90.13
43	trichlor-acetate		$CCl_3 \cdot COO \cdot CH_3$	177.45
44	trimethyl acetate		$(CH_3)_3C \cdot COO \cdot CH_3$	116.10
45	trimethylene		C_4H_8	56.06

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O = 1$ (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	yel. powd.	....	......	....	v. s.	s.	i.
2	monocl. tab.	$1.1479^{54°}$	54	63.3	sl. s.	s.	s. meth. al
3	colorl.	....	28	......	i.	s.	s.
4	need.	....	117	350 d.	sl. s. h.	sl. s.	sl. s.
5	colorl. liq.	1.044	......	220	i.	∞	∞
6	colorl. liq.	....	......	202–4	i.	∞	∞
7							
8	gas	....	......	–14	sl. s.	sl. s.	v. s.
9	....	....	105	......	......	......	......
10							
11	liq.	$0.86^{0°}$	......	118–9	s.	......	....
12	liq.	$0.8684^{0°}$	......	124–6	v. s.	......	....
13	liq.	$0.8674^{0°}$	......	126–9	s.	......	....
14	colorl. liq.	0.83	......	61–2	sl. s.	∞	∞
15	colorl. liq.	$0.915^{20°}$	<–75	79.9	$6.5^{20°}$	∞	∞
16	colorl. liq.	$0.941^{0°}$	......	193	$0.57^{17°}$	s.	s.
17	colorl. liq.	$0.720^{17°}$	......	62–4	s.	......	....
18	liq.	....	......	181–2	i.	s.	....
19	liq.	$0.863^{16°}$	......	176–7	i.	s.	....
20	colorl. liq.	$0.746^{0°}$	......	38.9	s.	∞	∞
21	colorl. liq.	0.812	......	102	v. sl. s.	∞	∞
22	colorl. liq.	$0.907^{20°}$	......	168	s.	∞	∞
23	red. need.	....	134	......	......	......	....
24							
25	cryst.	....	129	......	......	......	....
26	colorl. liq.	0.915	......	114–5	i.	∞	∞
27	....	$0.9446^{15/4°}$	......	147–8 (750 mm)	......	......	....
28	colorl. liq.	$1.154^{0°}$	......	134–7	......	∞	∞
29	colorl. liq.	....	......	246–7	v. sl. s.	......	....
30	colorl. liq.	1.186	–8.3	224	sl. s.	∞	∞
31	colorl.	....	38	......	i.	s.	s.
32	cryst.	$1.1208^{20/4°}$	18.5	195.3	......	......	....
33	sm. need.	1.410	112	d.	1 : 15	s.	s.
34	colorl. liq.	1.352 [illegible]	–10	188.3–.6	v. sl. s.	......	s.
35	colorl. liq.	$0.846^{21°}$	–83	38	i.	s.	s.
36	colorl. liq.	1.046	......	121.5	dec.	s.	s.
37	colorl. liq.	$1.069^{24°}$	–51	133	i.	∞	∞
38	colorl. liq.	....	......	d. 130	v. s.	......	....
39	....	1.51	......	160	i.	s.	s.
40							
41	colorl. liq.	....	......	39–40	i.	∞	∞
42	pr.	....	118	......	s.	s.	sl. s.
43	colorl.	$1.673^{35°}$	34	191–2	dec.	dec.	s.
44	colorl. liq.	$1.044^{0°}$	......	101	......	∞	∞
45	gas	....	......	4–5	sl. s.	v. s.	v. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Methyl- uracyl		$CH_3\cdot$ C: CHCONHCONH	126.06
2	urea		$NH_2\cdot CO\cdot NHCH_3$	74.06
3	uric acid (1)		$C_6H_6O_3N_4$	182.08
4	" " (3)		$C_6H_6O_3N_4 + \frac{1}{2}H_2O$	191.09
5	" " (7)		$C_6H_6O_3N_4 + H_2O$	200.10
6	valeriate		$C_4H_9\cdot COO\cdot CH_3$	116.10
7	Methylal		$CH_2\cdot(OCH_3)_2$	76.06
8	Methylene acetate		$(CH_3\cdot COO)_2CH_2$	132.06
9	bromide	dibrom-methane	CH_2Br_2	173.85
10	chloride	dichlor-methane	CH_2Cl_2	84.95
11	disulfonic acid		$CH_2(SO_3H)_2$	176.16
12	iodide	diiodo methane	CH_2I_2	267.88
13	Michler's ketone.	See *tetramethyldiaminobenzophenone* (4, 4′)		
14	Milk sugar.	See *lactose*		
15	Monacetin (α)	glyceryl monacetate	$CH_2(OH)\cdot CH(OH)\cdot CH_2\cdot OOC\cdot CH_3$	134.08
16	Morin	tetrahydroxy-flavanol	$C_{15}H_{10}O_7 + 2H_2O$	338.11
17	Morphine		$C_{17}H_{19}O_3N + H_2O$	303.18
18	hydrochloride		$C_{17}H_{19}O_3N\cdot HCl + 3H_2O$	375.68
19	sulphate		$(C_{17}H_{19}O_3N)_2H_2SO_4 + 5H_2O$	758.48
20	Mucic acid		$COOH\cdot(CHOH)_4\cdot COOH$	210.08
21	Muconic acid		$C_6H_6O_4$	142.05
22	Murexide	NH_4 salt of purpuric acid	$C_8H_4O_6N_5\cdot NH_4 + H_2O$	302.13
23	Mustard oil acetic acid		$CSN\cdot CH_2\cdot COOH$	117.10
24	Myricyl alcohol		$C_{30}H_{61}\cdot OH$	438.50
25	Myristic acid		$C_{13}H_{27}\cdot COOH$	228.22
26	Myristine	trimyristine	$(C_{14}H_{27}O_2)_3C_3H_5$	722.69
27	Naphthalene		$C_{10}H_8$	128.06
28	dicarboxylic acid (α)		$C_{10}H_6(COOH)_2$	216.06
29	" " (β)		$C_{10}H_6(COOH)_2$	216.06
30	disulfonic acid (2, 6)		$C_{10}H_6(SO_3H)_2$	288.19
31	disulfonic acid (2, 7)		$C_{10}H_6\cdot(SO_3H)_2$	288.19
32	sulfonic acid (α)		$C_{10}H_7\cdot SO_3H + H_2O$	226.14

ORGANIC COMPOUNDS (Continued)

No	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	need.	....	......	......	sl. s.	sl. s.	v. sl. s.
2	colorl. prisms	....	102	dec.	v. s.	v. s.	sl. s.
3	colorl. need.	....	d. 400	......	$0.05^{100°}$	......	....
4	colorl. pr. f. w.	....	d. 360	......	$0.38^{100°}$	v. sl. s.	s. alk.
5	colorl. leaf f. w.	....	1. 370–80	......	$1.25^{100°}$	s. alk.	....
6	colorl. liq.	$0.910^{0°}$	......	127.3	v. sl. s.	∞	∞
7	colorl. liq.	0.872	......	45.5	v. s.	∞	∞
8	colorl. liq.	....	......	170	....	∞	∞
9	liq.	2.498	......	97	$1.15^{20°}$	∞	∞
10	colorl. liq.	1.377	......	42	$2^{20°}$	∞	∞
11	need.	....	......	......	deliq.	......	....
12	yel. liq.	3.333	4	180 d.	i.	∞	s.
13							
14							
15	colorl. liq.	1.221	......	dec.	v. s.	v. s.	sl. s.
16	colorl. need.	....	285	......	1: 4000	s.	s. acet. a.
17	colorl. need.	1.32	230 d.	......	0.03	0.6	0.02
18	need.	....	......	......	5.72	2.38	i.
19	need.	....	d. 250	......	6.66	0.22	i.
20	colorl. cryst. powd.	....	206 d.	......	$0.33^{14°}$	i.	....
21	....	....	100	......	s.	s.	s.
22	purp. powd.	....	......	......	s.	i.	i.
23	rhomb. pl.	....	125–6	subl.	s. h.	......	....
24	colorl. need. f. eth.	....	85	......	i.	s.	s.
25	colorl. leaf.	....	53.8	250.5_{100mm}	i.	v. sl. s.	v. sl. s.
26	glit. need. f. eth.	....	55	......	......	......	s.
27	colorl. monocl.	1.152	80	218	i.	5.3 abs.	v. s.
28	need. f. al.	....	>300	......	......	sl. s. h.	....
29	long. need. f. al.	....	d.	......	......	......	....
30	need.	....	......	......	v. s.	s.	i.
31	leaf.	....	......	......	v. s.	s.	i.
32	....	....	90	......	s.	s.	sl. s.

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
	Naphthalene			
1	sulfonic acid (β)	....	$C_{10}H_7 \cdot SO_3H$	208.15
2	sulfonic chloride (α)	....	$C_{10}H_7 \cdot SO_2 \cdot Cl$	226.57
3	" " (β)	....	$C_{10}H_7 \cdot SO_2 \cdot Cl$	226.57
4	Naphthalic acid (1, 8)	....	$C_{10}H_6 \cdot (COOH)_2$....	216.06
5	Naphthamide (α)	....	$C_{10}H_7 \cdot CO \cdot NH_2$....	171.08
6	" (β)	....	$C_{10}H_7 \cdot CO \cdot NH_2$....	171.08
7	Naphthazarin (7, 8-1, 4)	dihydroxy-α-naphtho-quinone	$C_{10}H_4(OH)_2O_2$......	190.05
8	Naphthionic acid.	α¹, α²-naphthylamine-sulfonic acid	$C_{10}H_6NH_2SO_3H$....	223.14
9	Naphthoic acid (α)	....	$C_{10}H_7 \cdot COOH$......	172.06
10	" " (β)	....	$C_{10}H_7 \cdot COOH$......	172.06
11	aldehyde (α) ...	....	$C_{10}H_7 \cdot CHO$	156.06
12	" (β)....	....	$C_{10}H_7 \cdot CHO$	156.06
13	Naphthol (α)	....	$C_{10}H_7 \cdot OH$.........	144.06
14	" (β)	....	$C_{10}H_7 \cdot OH$.........	144.06
15	" acetate (α)	....	$C_{10}H_7OC_2H_3O$......	186.08
16	" " (β)	....	$C_{10}H_7OC_2H_3O$......	186.08
17	Naphtholethyl ether (α)	....	$C_{10}H_7OC_2H_5$.......	172.10
18	Naphtholethyl ether (β)	neroline.........	$C_{10}H_7OC_2H_5$.......	172.10
19	Naphtholmethyl ether (α)	....	$C_{10}H_7OCH_3$........	158.08
20	Naphtholmethyl ether (β)	....	$C_{10}H_7OCH_3$........	158.08
21	Naphtholnaphthyl ether (β)	....	$(C_{10}H_7)_2O$	270.11
22	Naphthol sulfonic acid (1, 4)	....	$C_{10}H_6(OH)SO_3H$....	224.13
23	Naphthol sulfonic acid (1, 5)	....	$C_{10}H_6(OH)SO_3H$....	224.13
24	Naphthol sulfonic acid (1, 8)	....	$C_{10}H_6(OH)SO_3H + H_2O$	242.14
25	Naphthol sulfonic acid (1, 2), (α)	....	$C_{10}H_6(OH)SO_3H$....	224.13
26	Naphthol sulfonic acid (2, 3)	....	$C_{10}H_6(OH)SO_3H$....	224.13
27	Naphthol sulfonic acid (2, 6), (β)	....	$C_{10}H_6(OH)SO_3H$....	224.13
28	Naphthonitrile (α)	naphthyl cyanide	$C_{10}H_7 \cdot CN$.........	153.06
29	" (β)	" "	$C_{10}H_7 \cdot CN$.........	153.06

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O = 1$ (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	leaf.	....	161	......	s.	......	....
2	tab.	....	67	......	i.	s.	v. s.
3	tab.	....	77	......	i.	s.	v. s.
4	colorl. need. f. al.	....	*	......	v. sl. s.	sl. s.	sl. s.
5	colorl. f. al.	....	202	......	v. sl. s.	v. sl. s.	....
6	colorl. tab.	....	192	......	sl. s.	sl. s.	....
7	red br. need. f. al.	....	subl.	......	sl. s. h.	s.	s. alk.
8	sm. need. f. w.	....	d.	......	1: 4030 $^{15°}$	v. sl. s.	i.
9	colorl. need.	....	160	300	v. sl. s. h.	v. s. h.	s.
10	colorl. need.	....	184	>300	v. sl. s. h.	v. s.	v. s.
11	liq.	....	......	292	i.	s.	s.
12	colorl. leaf. f. w.	....	61	......	s. h.	v. s.	v. s.
13	colorl. monocl.	$1.224^{4°}$...	94	278–80	sl. s. h.; i. c.	v. s.	v. s.
14	colorl. leaf.	$1.217^{4°}$	122	285–6	sl. s. h.	v. s.	v. s.
15	need. or pl. f. al.	....	......	......	d. on boil	s.	v. s.
16	sm. need.	....	70	......	i.	s.	s.
17	liq.	....	......	272	......	......	....
18	cryst.	....	33	274–5	......	......	....
19	liq.	....	......	263	......	......	....
20	sm. leaf. f. eth.	....	70	274	sl. s.	sl. s.	v. s.
21	colorl. leaf.	....	subl.	......	i.	s. h.	v. s.
22	colorl. pl.	....	170 d.	......	v. s.	......	....
23	cryst.	....	110–20	......	s.	......	....
24	cryst.	....	107	180 anh.	v. s.	......	....
25	colorl. tab.	....	>250	......	s.	......	....
26	leaf.	....	125	......	v. s.	s.	....
27	colorl. leaf.	....	122	......	v. s.	v. s.	....
28	colorl. need.	$1.117^{15°}_{15}$	37.5	299	i.	v. s.	v. s.
29	colorl. leaf.	$1.094^{80°}_{80}$	66	304–5	i.	s.	s.

* The anhydride forms at 150° C.; this melts at about 270° C.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Naphthophenazine (α, β)	....	$C_{10}H_6: N_2: C_6H_4$ ...	230.10
2	Naphthoquinaldine (α)	....	$C_{13}H_8NCH_3$........	193.10
3	" (β)	....	$C_{13}H_8NCH_3$	193.10
4	Naphthoquinoline (α)	....	$C_{13}H_9N$	179.08
5	" (β)	....	$C_{13}H_9N$............	179.08
6	Naphthoquinone (α)	....	$C_{10}H_6O_2$...........	158.07
7	" (β)	....	$C_{10}H_6O_2$...........	158.07
8	Naphthosalol ...	betol	$C_{10}H_7OCOC_6H_4(OH)$	264.10
9	Naphthosulfone..	....	$C_{10}H_6OSO_2$........	206.11
10	Naphthyl acetate (α)	....	$CH_3 \cdot COO \cdot C_{10}H_7$...	186.08
11	" " (β)	....	$CH_3 \cdot COO \cdot C_{10}H_7$...	186.08
12	amine (α)......	....	$C_{10}H_7 \cdot NH_2$	143.08
13	" hydrochloride (α)	....	$C_{10}H_7 \cdot NH_2 \cdot HCl$...	179.55
14	" (β)	....	$C_{10}H_7 \cdot NH_2$	143.08
15	" hydrochloride (β)	....	$C_{10}H_7 \cdot NH_2 \cdot HCl$...	179.55
16	" sulfonic acid (1, 4)	naphthionic acid..	$NH_2 \cdot C_{10}H_6 \cdot SO_3H + \frac{1}{2}H_2O$	232.20
17	cyanide.	See *naphtho-nitrile*		
18	ether (α).......	....	$C_{10}H_7 \cdot O \cdot C_{10}H_7$....	270.11
19	" (β).......	....	$C_{10}H_7 \cdot O \cdot C_{10}H_7$ ...	270.11
20	hydrazine (α)...	....	$C_{10}H_7 \cdot NH \cdot NH_2$....	158.10
21	" (β)...	....	$C_{10}H_7 \cdot NH \cdot NH_2$....	158.10
22	ketone (α, β)...	....	$C_{10}H_7 \cdot CO \cdot C_{10}H_7$...	282.11
23	mercaptan......	....	$C_{10}H_7SH$..........	160.13
24	phenylmethane	....	$C_{10}H_7CH_2C_6H_5$.....	218.11
25	Naphthylene diamine	See *diamino-naphthalene*		
26	Narceïne........	....	$C_{23}H_{27}O_8N + 3H_2O$	499.27
27	hydrochloride...	....	$C_{23}H_{27}O_8N \cdot HCl$.... $+ 3H_2O$	535.74
28	Narcotine.......	....	$C_{22}H_{23}O_7N$.........	413.19
29	Nicotine........	....	$C_{10}H_{14}N_2$..........	162.13
30	salicylate.......	....	$C_{10}H_{14}N_2 \cdot C_7H_6O_3$...	300.18
31	Nicotinic acid....	....	$C_5H_4N \cdot COOH$.....	123.05
32	Nitracetanilide (o.)	....	$C_6H_4NO_2C_2H_3ONH$	180.08
33	" (m.)	....	$C_6H_4NO_2C_2H_3ONH$	180.08
34	" (p.)	....	$C_6H_4NO_2C_2H_3ONH$	180.08

ORGANIC COMPOUNDS (Continued)

No	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	yel.	....	142.5	>360	......	v. sl. s.	v. sl. s.
2	liq.	....	......	>300	......	......	....
3	need.	....	82	>300	sl. s.	s.	s.
4	cryst. f. eth.	....	50	251	v. sl. s.	v. s.	v. s.
5	sm. leaf. f. h. w.	....	93.5	349.5–50	s. h.	v. s.	v. s.
6	yel. need.	....	125	......	sl. s.	s.	v. s.
7	red need. f. eth.	....	d. 115–20	......	s.	s.	....
8	wh. cryst.	....	95	......	......	......	....
9	pr.	....	154	360	sl. s.	sl. s.	s. bz.
10	need. f. al.	....	44.8	......	s. h.	s.	v. s.
11	need.	....	68.5	......	i.	v. s.	v. s.
12	colorl. need.	$1.123^{25°}$	50	300	0.17	v. s.	v. s.
13	need.	....	......	......	$3.77^{20°}$	v. s.	s.
14	leaf. f. w.	....	111–2	306	s.	s.	....
15	leaf.	....	......	......	v. s.	v. s.	s.
16	need. f. w.	....	......	......	*$0.02^{15°}$	v. sl. s.	v. sl. s.
17							
18	colorl. leaf.	....	110	>360	i.	s. h.	s.
19	colorl.	....	105	abt. 360	......	s. h.	v. s.
20	colorl. leaf.	....	116	......	v. sl. s. c.	v. s. h.	v. s. chl.
21	colorl. leaf.	....	124–5	......	s. chl.	v. s. h.	s. bz.
22	colorl. need. f. al.	....	135	......	......	$1.3^{14°}$	v. s.
23	liq.	....	......	285	i.	......	....
24	....	....	58.6	330–40	s. bz.; s. CS_2	1 : 30 h.	s.
25							
26	colorl. prisms f. w.	....	170	......	$0.078^{13°}$	0.1	....
27	yel. cryst.	....	190–2 anh.	......	sl. s.	s.	....
28	colorl. need. f. al.	....	176	......	i.	$1^{20°}$	0.8
29	liq.	$1.010^{20°}$	......	247.3	∞	∞	∞
30	plates	....	117.5	......	s.	s.	....
31	colorl. need.	....	228–9	subl.	sl. s. c.; s. h.	s. h.	v. sl. s.
32	yel. leaf.	....	78	......	s. d.	......	v. s.
33	yel. leaf.	....	141–3	......	s. h.	......	i.
34	pr.	....	207	......	......	......	s.

* All other naphthylamine sulphonic acids have similar solubilities.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Nitranilic acid...	dinitrodihydroxyquinone	$C_6(NO_2)_2(OH)_2O_2$...	230.03
2	Nitraniline (o.)...	....	$NO_2 \cdot C_6H_4 \cdot NH_2$....	138.06
3	" (m.)...	....	$NO_2 \cdot C_6H_4 \cdot NH_2$....	138.06
4	" (p.)...	....	$NO_2 \cdot C_6H_4 \cdot NH_2$....	138.06
5	Nitro-alizarine (α)	....	$(HO)_2 \cdot C_{14}H_5O_2 \cdot NO_2$	285.06
6	" " (β)	alizarine orange..	$(HO)_2 \cdot C_{14}H_5O_2 \cdot NO_2$	285.06
7	" aminobenzoic acid (1, 2, 5) (COOH, NH_2, NO_2)	....	$C_6H_3 \cdot COOH \cdot NH_2 \cdot NO_2$	182.06
8	Nitro-aminobenzoic acid (1, 2, 3) (COOH, NH_2, NO_2)	....	$C_6H_3 \cdot COOH \cdot NH_2 \cdot NO_2$	182.06
9	Nitro-aminobenzoic acid (1, 3, 6) (COOH, NH_2, NO_2)	....	$C_6H_3 \cdot COOH \cdot NH_2 \cdot NO_2$	182.06
10	Nitro-aminobenzoic acid (1, 3, 2) (COOH, NH_2, NO_2)	....	$C_6H_3 \cdot COOH \cdot NH_2 \cdot NO_2$	182.06
11	Nitro-aminobenzoic acid (1, 3, 5) (COOH, NH_2, NO_2)	....	$C_6H_3 \cdot COOH \cdot NH_2 \cdot NO_2$	182.06
12	Nitro-aminobenzoic acid (1, 3, 4) (COOH, NH_2, NO_2)	....	$C_6H_3 \cdot COOH \cdot NH_2 \cdot NO_2$	182.06
13	Nitro-aminobenzoic acid (1, 4, 3) (COOH, NH_2, NO_2)	....	$C_6H_3 \cdot COOH \cdot NH_2 \cdot NO_2$	182.06
14	Nitro-aminophenol (6, 1, 2)	....	$C_6H_3 \cdot OH \cdot NO_2 \cdot NH_2$	154.06
15	" (3, 1, 2)	....	$C_6H_3 \cdot OH \cdot NO_2 \cdot NH_2$	154.06
16	" (4, 1, 2)	....	$C_6H_3 \cdot OH \cdot NO_2 \cdot NH_2$	154.06
17	anisol (o.)......	....	$NO_2 \cdot C_6H_4 \cdot OCH_3$...	153.06
18	" (p.)......	....	$NO_2 \cdot C_6H_4 \cdot OCH_3$...	153.06
19	anthracene (9)..	nitrosoanthron...	$C_{14}H_9 \cdot NO_2$........	223.08
20	anthraquinone (α)	....	C_6H_4: $(CO)_2$: $C_6H_3 \cdot NO_2$	253.06
21	" (o.)	....	$C_{14}H_7NO_2O_2$.......	253.06
22	benzaldehyde (o.)	....	$NO_2 \cdot C_6H_4 \cdot CHO$...	151.05
23	" (m.)	....	$NO_2 \cdot C_6H_4 \cdot CHO$...	151.05
24	" (p.)	....	$NO_2 \cdot C_6H_4 \cdot CHO$...	151.05
25	benzamide (o.)..	....	$NO_2 \cdot C_6H_4 \cdot CO \cdot NH_2$	166.06
26	" (m.)	....	$NO_2 \cdot C_6H_4 \cdot CO \cdot NH_2$	166.06
27	" (p.)..	....	$NO_2 \cdot C_6H_4 \cdot CO \cdot NH_2$	166.06
28	benzanilide (m.)	....	$NO_2 \cdot C_6H_4 \cdot CO \cdot NH \cdot C_6H_5$	242.08
29	benzene........	....	$C_6H_5 \cdot NO_2$.........	123.05

ORGANIC COMPOUNDS (Continued)

No	Crystal-line form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	lng. yel. pl.	....	100	170 d.	v. s.	v. s.	i.
2	need. f. al.	1.443	71.4	......	v. sl. s.	s.	s.
3	yel. need. f. al.	$1.398^{18°}$	114 (111.8)	285	sl. s.	s.	s.
4	yel. need. f. al.	1.437	146.	......	$0.08^{19°}$; $2.2^{100°}$	s.	s.
5	yel. need. f. al.	....	289 d.	......	sl. s.	s.	s. alk.
6	or. need. f. bz.	....	244 d	......	sl. s.	s.	s. chl.
7	yel. need.	....	263	......	s. h.	s.	s.
8	yel. need. f. w.	....	204	......	......	v. s.	v. s.
9	yel. need. or pr.	....	......	......	sl. s. h.	s. h.	....
10	yel. need. f. w.	....	156–7	......	v. s. h.	v. s.	v. s.
11	yel. pr. f. w.	....	208	......	......	......	s. acet. a.
12	red leaf. f. al.	....	298	......	sl. s.	s.	s.
13	red yel. need. f. al.	....	284	......	i.	sl. s. h.	....
14	red need. f. al.	....	110–1	......	sl. s. h.	s.	v. s. bz.; chl.
15	yel. need.	....	76	......	......	......	....
16	or. pr.	....	80–90	......	sl. s.	v. s.	v. s.
17	yel. oil	$1.268^{20°}$	9	265	i.	∞	∞
18	colorl. plates	$1.233^{20°}$	54	258–60	v. sl. s. c.	s.	v. s.
19	yel. need. f. al.	....	146	......	v. s. bz.	v. s. CS_2	....
20	yel. need.	....	228–30	subl.	i.	sl. s.	sl. s.
21	pr. need.	....	220	subl.	......	sl. s.	sl. s.
22	yel. need. f. w.	....	44.5	153^{23mm}	v. sl. s.	v. s.	v. s.
23	need.	....	58	164^{23mm}	v. sl. s.	s.	v. s.
24	colorl. prisms	....	106	......	sl. s. h.	v. s.	s.
25	need.	....	174–6	317	s. h.	s.	s.
26	yel. need. f. w.	....	140–2	310–5	s. h.	s.	s.
27	need.	....	197–8 (201.4)	......	v. sl. s.	s.	s.
28	leaf. fr. w.	....	153–4	subl.	v. sl. s. c.	s.	s.
29	yel. liq.	$1.2033^{20°}_{4°}$	5.4	210	v. sl. s.	v. s. c.	v. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Nitro-			
1	benzoic acid (o.)	....	$NO_2 \cdot C_6H_4 \cdot COOH$..	167.05
2	" " (m.)	....	$NO_2 \cdot C_6H_4 \cdot COOH$..	167.05
3	" " (p.)	....	$NO_2 \cdot C_6H_4 \cdot COOH$..	167.05
4	benzonitrile (o.)	....	$NO_2 \cdot C_6H_4 \cdot CN$....	148.05
5	" (m.)	....	$NO_2 \cdot C_6H_4 \cdot CN$.....	148.05
6	" (p.)	....	$NO_2 \cdot C_6H_4 \cdot CN$.....	148.05
7	benzophenone (o.)	....	$NO_2 \cdot C_6H_4 \cdot CO \cdot C_6H_5$	227.08
8	" (m.)	....	$NO_2 \cdot C_6H_4 \cdot CO \cdot C_6H_5$	227.08
9	" (p.)	....	$NO_2 \cdot C_6H_4 \cdot CO \cdot C_6H_5$	227.08
10	benzoquinone...	....	$NO_2 \cdot C_6H_3O_2$.......	153.03
11	benzoylformic acid (o.)	....	$C_6H_4(NO_2)CO \cdot COOH$	195.05
12	benzyl alcohol (o.)	....	$NO_2 \cdot C_6H_4 \cdot CH_2OH$	153.06
13	" " (m.)	....	$NO_2 \cdot C_6H_4 \cdot CH_2OH$	153.06
14	" " (p.)	....	$NO_2 \cdot C_6H_4 \cdot CH_2OH$	153.06
15	" chloride (o.)	....	$C_6H_4(NO_2) \cdot CH_2Cl$	171.51
16	" " (m.)	....	$C_6H_4(NO_2) \cdot CH_2Cl$	171.51
17	" " (p.)	....	$C_6H_4(NO_2) \cdot CH_2Cl$	171.51
18	" cyanide (o.)	....	$C_6H_4(NO_2) \cdot CH_2CN$	162.06
19	" " (p.)	....	$C_6H_4(NO_2) \cdot CH_2CN$	162.06
20	benzylidene chloride (m.)	....	$C_6H_4(NO_2) \cdot CHCl_2$	205.96
21	benzylidene-chloride (p.)	....	$C_6H_4(NO_2) \cdot CHCl_2$	205.96
22	bromoform.....	....	CBr_3NO_2..........	297.76
23	camphor (*a*)....	....	$C_{10}H_{15} \cdot NO_2 \cdot O$.....	197.13
24	chlorbenzene (o.)	....	$C_6H_4ClNO_2$........	157.50
25	" (m.)	....	$C_6H_4ClNO_2$........	157.50
26	" (p.)	....	$C_6H_4ClNO_2$........	157.50
27	chloroform.	See *chlor-picrin*		
28	chlorophenol OH, Cl, NO_2 (1, 2, 5)	....	$C_6H_3 \cdot Cl \cdot NO_2 \cdot OH$	173.50
29	chlorophenol OH, Cl, NO_2 (1, 3, 6)	....	$C_6H_3 \cdot Cl \cdot NO_2 \cdot OH$	173.50
30	chlorophenol OH, Cl, NO_2 (1, 4, 2)	....	$C_6H_3 \cdot Cl \cdot NO_2 \cdot OH$	173.50
31	chlorophenol OH, Cl, NO_2 (1, 2, 4)	....	$C_6H_3 \cdot Cl \cdot NO_2 \cdot OH$	173.50

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in grams per 100 c.c. of Water	Alcohol	Ether
1	need. f. w.	$1.575^{4°}$	148	......	$0.68^{20°}$	$28^{10°}$	$21.0^{11°}$
2	leaf. f. w.	$1.494^{4°}$	140	......	$0.31^{[illegible]}$	$33^{1?°}$	$25.1^{11°}$
3	leaf. f. w.	$1.550^{32°}$	238	......	$0.04^{[illegible]}$	$0.09^{1?°}$	$2.2^{11°}$
4	silky need.	....	109	......	s. h.	s.	s.
5	need.	....	117–8 (115)	......	sl. s.	s.	s.
6	leaf. f. al.	....	147	......	sl. s. c.	sl. s. c.; s. h.	s. chl.
7	colorl.	....	105	......	......	sl. s. abs.	....
8	colorl. need. f. al.	....	94–5	......	......	s.	....
9	colorl. leaf. f. al.	....	138	......	......	s.	....
10	yel.	....	d. abt. 206	......	v. s. h.	s.	sl. s.
11	need.	....	46–7	......	v. s. h.	......	....
12	need.	....	74	......	sl. s. c.	s.	s.
13	rhomb.	....	27	......	......	......	....
14	need. f. w.	....	93	179.3	sl. s. c.; s. h.	v. s.	v. s.
15	cryst.	....	48–9	......	......	s.	....
16	yel. need.	....	45–7	173–83$^{30mm.}$	......	s.	....
17	leaf. or need.	....	71	......	......	s.	....
18	need. f. w.	....	82.5–4.0	......	s. h.	......	....
19	pr. f. al.	....	114–6	......	i.	s.	s.
20	monocl. leaf. or need.	....	65	......	......	s. h.	s. h.
21	pr. f. al.	....	46	......	......	s.	s.
22	....	$2.811^{12°}$	10	127^{118mm}	i.	s.	s.
23	monocl. pr. f. bz.	....	100–1	......	i.	s.	s. chl. s. bz.
24	need.	$1.368^{22°}$	32.5	243	......	s.	....
25	rhomb.	1.534	44.4	235.6	......	s. h.	s.
26	rhomb. leaf.	$1.380^{22°}$	83	242	......	s.	....
27							
28	yel. need.	....	70	......	sl. s.	s. chl.	....
29	yel. pr. f. w.	....	38.9	......	......	......	....
30	yel. need. f. al.	....	86–7	......	v. sl. s.	s.	s.; s. chl.
31	lng. colorl. need. f. al.	....	110–1	......	......	v. s.	v. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Nitro-			
1	cinnamic acid (o)	....	$NO_2 \cdot C_6H_4 \cdot CH:CH \cdot COOH$	193.06
2	" " (m.)	....	$NO_2 \cdot C_6H_4 \cdot CH:CH \cdot COOH$	193.06
3	" " (p.)	....	$NO_2 \cdot C_6H_4 \cdot CH:CH \cdot COOH$	193.06
4	cumene (o. and p.)	....	$NO_2 \cdot C_6H_4CH(CH_3)_2$	165.10
5	diethyl aniline (m.)	....	$NO_2 \cdot C_6H_4 \cdot N(C_2H_5)_2$	194.13
6	" " (p.)	....	$NO_2 \cdot C_6H_4 \cdot N(C_2H_5)_2$	194.1[illegible]
7	dimethyl amine	....	$(CH_3)_2N \cdot NO_2$......	90.06
8	" aniline (m.)	....	$NO_2 \cdot C_6H_4 \cdot N(CH_3)_2$	166.10
9	" " (p.)	....	$NO_2 \cdot C_6H_4 \cdot N(CH_3)_2$	166.10
10	diphenyl (o.)...	....	$C_6H_5 \cdot C_6H_4 \cdot NO_2$...	199.08
11	" (p.)...	....	$C_6H_5 \cdot C_6H_4 \cdot NO_2$...	199.08
12	ethane........	....	$C_2H_5 \cdot NO_2$.........	75.06
13	erythrite.......	....	$C_4H_6(ONO_2)_4$......	302.08
14	glycerine.......	glyceryl trinitrate	$C_3H_5(NO_3)_3$........	227.06
15	glycerol, Di-β...	....	$C_3H_5(OH)(ONO_2)_2$	182.06
16	" Mono-α	....	$C_3H_5(OH)_2(ONO_2)$	137.06
17	" Mono-β	....	$C_3H_5(OH)_2(ONO_2)$	137.06
18	guanidine......	....	$NH_2 \cdot CNH \cdot NHNO_2$	104.06
19	isatine.........	....	$C_6H_3(NO_2) \cdot NHCO \cdot CO$	192.05
20	isoquinoline....	....	$C_6H_3(NO_2):C_3H_3N$	174.06
21	mannite........	....	$C_6H_8(ONO_2)_6$......	452.11
22	mesitylene (CH_3, CH_3, CH_3, NO_2) (1, 3, 5, 6)	....	$C_6H_2NO_2(CH_3)_3$....	165.10
23	methane.......	....	$CH_3 \cdot NO_2$..........	61.03
24	naphthalene (α)	....	$C_{10}H_7 \cdot NO_2$........	173.06
25	" (β)	....	$C_{10}H_7 \cdot NO_2$........	173.06
26	naphthoic acid (8, 1)	....	$C_{10}H_6(NO_2) \cdot COOH$	217.06
27	naphthol (2, 1)..	....	$NO_2 \cdot C_{10}H_6 \cdot OH$....	189.06
28	" (4, 1)...	....	$NO_2 \cdot C_{10}H_6 \cdot OH$....	189.06
29	" (1, 2)...	....	$NO_2 \cdot C_{10}H_6 \cdot OH$....	189.06
30	" (5, 2)...	....	$NO_2 \cdot C_{10}H_6 \cdot OH$....	189.06
31	" (8, 2)...	....	$NO_2 \cdot C_{10}H_6 \cdot OH$....	189.06
32	naphthylamine (2, 1)	....	$NO_2 \cdot C_{10}H_6 \cdot NH_2$...	188.08
33	" (1, 2)	....	$NO_2 \cdot C_{10}H_6 \cdot NH_2$...	188.08
34	" (5, 2)	....	$NO_2 \cdot C_{10}H_6 \cdot NH_2$...	188.08
35	" (8, 2)	....	$NO_2 \cdot C_{10}H_6 \cdot NH_2$...	188.08

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in grams per 100 c.c. of		
					Water	Alcohol	Ether
1	sc. or need. f. al.	....	240	......	i. c.	sl. s. c.	....
2	yel. need.	....	196–7	......	v. sl. s.	......	....
3	pr. f. al.	....	284–6	......	v. sl. s.	sl. s. h.	v. sl. s.
4	....	$1.1025^{20°}_{0°}$	–35	d. 224	......	......	....
5	yel. oil	....	......	288–90	......	......	....
6	need.	....	77–8	......	......	v. s. h.	sl. s. lgr.
7	....	....	57–8	187	s.	s.	s.
8	red pr. f. eth.	$1.313^{17°}$	60–1	280–5 d.	i.	s.	s.
9	need. f. al.	....	163–4	......	i.	s.	s. conc. HCl
10	leaf. f. al.	....	37	320	i.	v. s.	v. s.
11	need. f. al.	....	114	340	i.	sl. s. c.	s.
12	liq.	1.056	......	114–5	sl. s.	∞	∞
13	leaf. f. al.	....	61	expl.	s. h.	......	....
14	colorl.-yel. liq.	1.601	13	expl. 260	0.12	25	∞
15	liq.	....	......	$145^{15mm.}$	......	......	....
16	....	1.40	58	155–6 15mm.	70	......	....
17	....	....	54	155–60 15mm.	......	......	....
18	need.	....	230 (240)	......	v. sl. s. c.; sl. s. h.	sl. s.	i.
19	rosettes f. al.	....	226–30	......	sl. s.	v. s.	s. KOH
20	need.	....	110	......	s. h.	s.	....
21	need.	$1.604^{0°}$	108	120 exp.	i.	s. h.	s.
22	tricl. pr. f. al.	....	41–2	255	......	......	....
23	liq.	1.144	–26	101	sl. s.	s. alk.	s.
24	yel. need.	....	61	304	i.	s.	$2.8^{15°}$
25	rhomb. need.	....	79	......	i.	v. s.	v. s.
26	prisms f. al.	....	215	......	0.04 c.	4.6	sl. s.
27	leaf.	....	128	......	v. sl. s.	sl. s.	....
28	yel. need. f. w.	....	164	......	s. h.	v. s.	....
29	yel.	....	103	......	......	v. sl. s. c.	v. s.
30	yel. need.	....	147	......	......	v. s.	....
31	yel. need. f. w.	....	144–5	......	s.	v. s.	....
32	yel. pr. f. al.	....	144	......	......	s.	....
33	or. yel. need.	....	abt. 125	......	s. h.	v. s.	....
34	red. need. f. al.	....	143.5	......	......	v. s. h.	s. bz.
35	red. need.	....	103.5	......	......	v. s.	....

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
1	Nitro-phenol (o.)	....	$NO_2 \cdot C_6H_4 \cdot OH$.....	139.05
2	" (m.).	....	$NO_2 \cdot C_6H_4 \cdot OH$.....	139.05
3	" (p.).	....	$NO_2 \cdot C_6H_4 \cdot OH$.....	139.05
4	phenylpropiolic acid (o.)	....	$C_6H_4NO_2C : C \cdot COOH$	191.05
5	phenylpropiolic acid (p.)	....	$C_6H_4NO_2C : C \cdot COOH$	191.05
6	phthalic acid (3)	....	$NO_2 \cdot C_6H_3 \cdot (COOH)_2$	211.05
7	" " (4)	....	$NO_2 \cdot C_6H_3 \cdot (COOH)_2 + H_2O$	229.06
8	" (1, 3, 5)	....	$NO_2 \cdot C_6H_3 \cdot (COOH)_2 + 1\frac{1}{2}H_2O$	238.07
9	phthalide (5)...	....	$NO_2 \cdot C_8H_5O$........	163.05
10	propane........	....	$CH_3 \cdot CH_2 \cdot CH_2 \cdot NO_2$	89.06
11	pseudocumene (1, 3, 4, 6)	....	$C_6H_2NO_2(CH_3)_3$....	165.10
12	pseudocumene (1, 3, 4, 5)	....	$C_6H_2NO_2(CH_3)_3$....	165.10
13	quinoline (5)....	....	$NO_2 \cdot C_9H_6N$.......	174.06
14	" (6)....	....	$NO_2 \cdot C_9H_6N$.......	174.06
15	" (7)....	....	$NO_2 \cdot C_9H_6N$.......	174.06
16	" (8)....	....	$NO_2 \cdot C_9H_6N$.......	174.06
17	salicylic acid (3)	....	$NO_2 \cdot C_6H_3(OH) \cdot COOH + H_2O$ (3, 2, 1)	201.06
18	" " (5)	....	$NO_2 \cdot C_6H_3(OH) \cdot COOH$ (5, 2, 1)	183.05
19	" " (1, 2, 6)	....	$NO_2 \cdot C_6H_3(OH) COOH$	183.05
20	styrene (o.).....	....	$NO_2 \cdot C_6H_4 \cdot CH: CH_2$	149.06
21	" (m.)....	....	$NO_2 \cdot C_6H_4 \cdot CH: CH_2$	149.06
22	" (p.).....	....	$NO_2 \cdot C_6H_4 \cdot CH: CH_2$	149.06
23	tartaric acid....	....	$(NO_3)_2C_2H_2(COOH)_2$	240.05
24	terephthalic acid	....	$C_6H_3NO_2(COOH)_2$	211.05
25	thiophene (2)...	....	$NO_2 \cdot C_4H_3S$........	129.10
26	toluene (o.).....	....	$NO_2 \cdot C_6H_4 \cdot CH_3$....	137.06
27	" (m.)....	....	$NO_2 \cdot C_6H_4 \cdot CH_3$....	137.06
28	" (p.)....	....	$NO_2 \cdot C_6H_4 \cdot CH_3$....	137.06
29	o-toluidine (3)..	....	$NO_2 \cdot C_6H_3 \cdot CH_3 (NH_2)$ (3, 1, 2)	152.08
30	" " (4)..	....	$NO_2 \cdot C_6H_3 \cdot CH_3 (NH_2)$ (4, 1, 2)	152.08
31	" " (5)..	....	$NO_2 \cdot C_6H_3 \cdot CH_3 (NH_2)$ (5, 1, 2)	152.08
32	" " (6)..	....	$NO_2 \cdot C_6H_3 \cdot CH_3 (NH_2)$ (6, 1, 2)	152.08
33	m- " (2)..	....	$NO_2 \cdot C_6H_3 \cdot CH_3 (NH_2)$ (2, 1, 3)	152.08
34	" " (4)..	....	$NO_2 \cdot C_6H_3 \cdot CH_3 (NH_2)$ (4, 1, 3)	152.08

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	prisms	....	45.2	214	v. sl. s. c.	v. s.	v. s.
2	tab.	....	96	......	sl. s. c.; s. h.	v. s.	v. s.
3	monocl.	....	114	279 d.	sl. s. c.; s. h.	v. s.	v. s.
4	need. f. h. w.	....	155.5 d.	......	v. s. h.	s.	s.; sl. s. chl.
5	need. f. al.	....	181 d.	......	sl. s.	s. h.	s.
6	yel. monocl. f. eth.	....	219–20	......	sl. s.	v. s.	v. s.
7	need.	....	161	......	s.	s.	s.
8	gr. leaf.	....	248–9	......	sl. s.	v. s.	....
9	need. f. al.	....	141	......	i. c.	s.	s.
10	liq.	1.011	......	131	v. sl. s.	∞	∞
11	lng. yel. need.	....	71	265	......	s.	....
12	grn. pr.	....	20	......	......	s.	....
13	need. f. w.	....	72	subl.	sl. s. h.	s. bz.	....
14	need.	....	149–50	subl.	v. sl. s. c. s. h.	v. sl. s.	v. sl. s.
15	need. f. al.	....	132–3	......	......	v. sl. s.	v. s.
16	need. f. al.	....	88–9	......	v. sl. s. c.	s.	s.
17	long need.	....	144 anh.	......	0.13 c.	v. s.	v. s.
18	need.	....	228–30	......	0.07 c.; s. h.	v. s.	v. s.
19	yel. need.	....	195	......	......	sl. s.	v. sl. s.
20	colorl. liq.	....	12–13.5	......	s. conc. H_2SO_4	......	....
21	....	....	−5	......	......	s. abs.	s.; s. lgr.
22	pr. f. lgr.	....	29	......	s. lgr.	v. s. h.	v. s.
23	cryst.	....	d.	......	......	s.	s.
24	....	....	270	......	v. s. h.	s. h.	....
25	monocl.	....	44	224–5	i.	v. s.	v. s.
26	yel. liq.	1.168	−10.5	220.4	v. sl. s. c.	∞	∞
27	....	$1.168^{22°}$	15.9	232	v. sl. s. c.	∞	∞
28	colorl. need.	$1.286^{20°}$	52	237.7	v. sl. s.	s.	v. s.
29	or. prisms	....	96	......	v. s. bz.	v. s.	v. s.
30	monocl.	1.365	179	......	......	s.	s.
31	yel. need.	1.366	127–8	......	v. sl. s. h.	v. s.	....
32	yel. leaf.	1.378	91.5	......	1.3 h.	v. s.	v. s.
33	yel. need.	....	53	......	sl. s.	v. s.	....
34	yel. leaf. f. w.	....	109	......	s. h.	v. s.	v. s.

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
	Nitro-			
1	m-toluidine (5)	....	$NO_2 \cdot C_6H_3 \cdot CH_3$ (NH_2) (5, 1, 3)	152.08
2	" " (6)	....	$NO_2 \cdot C_6H_3 \cdot CH_3$ (NH_2) (6, 1, 3)	152.08
3	p- " (2)	....	$NO_2 \cdot C_6H_3 \cdot CH_3$ (NH_2) (2, 1, 4)	152.08
4	" " (3)	....	$NO_2 \cdot C_6H_3 \cdot CH_3$ (NH_2) (3, 1, 4)	152.08
5	urethane.......	....	$NO_2 \cdot NH \cdot COO \cdot C_2H_5$	134.06
6	urea............	....	$NH_2 \cdot CO \cdot NHNO_2$..	105.05
7	xylene $CH_3CH_3NO_2$ 1, 2, 3	....	$C_6H_3(NO_2)(CH_3)_2$..	151.08
8	xylene $CH_3CH_3NO_2$ 1, 2, 4	....	$C_6H_3(NO)_2(CH_3)_2$...	151.08
9	xylene $CH_3CH_3NO_2$ 1, 3, 2	....	$C_6H_3(NO_2)(CH_3)_2$...	151.08
10	xylene $CH_3CH_3NO_2$ 1, 3, 5	....	$C_6H_3(NO_2)(CH_3)_2$...	151.08
11	xylene $CH_3CH_3NO_2$ 1, 4, 2	....	$C_6H_3(NO_2)(CH_3)_2$...	151.08
12	Nitroform.......	trinitro-methane..	$CH(NO_2)_3$.........	151.03
13	Nitroso- aniline (p.)	....	$NO \cdot C_6H_4 \cdot NH_2$.....	122.06
14	benzene........	....	C_6H_5NO..........	107.05
15	benzoic acid (o.)	....	$NO \cdot C_6H_4 \cdot COOH$ ..	151.05
16	diethylamine...	....	$(C_2H_5)_2N \cdot NO$......	102.10
17	diethylaniline (p.)	....	$NO \cdot C_6H_4 \cdot N(C_2H_5)_2$	178.13
18	diisopropylamine	....	$[(CH_3)_2 \cdot CH]_2N \cdot NO$	130.13
19	dimethylamine..	....	$(CH_3)_2N \cdot NO$......	74.06
20	dimethylaniline (p.)	....	$NO \cdot C_6H_4 \cdot N(CH_3)_2$.	150.10
21	diphenylamine..	....	$(C_6H_5)_2 \cdot N \cdot NO$.....	198.10
22	dipropylamine..	....	$(CH_3 \cdot CH_2 \cdot CH_2)_2N \cdot NO$	130.13
23	indoxyl........	....	$C_6H_4N(NO)CH{:}\ C(OH)$	162.06
24	naphthol (2, 1) .	....	$NO \cdot C_{10}H_6 \cdot OH$.....	173.06
25	" (4, 1) .	....	$NO \cdot C_{10}H_6 \cdot OH$.....	173.06
26	" (1, 2) .	....	$NO \cdot C_{10}H_6 \cdot OH$.....	173.06
27	naphthylamine (1, 2)	....	$NO \cdot C_{10}H_6NH_2$.....	172.08

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	or. need.	....	98	......	v. sl. s.	v. s.	v. s.
2	yel. need.	....	138	......	s. a.	s.	....
3	yel. monocl.	....	77.5	......	s.	sl. s. CS_2	....
4	red. pr. f. al.	1.312	114 (116–7)	......	v. sl. s. h.	v. s.	....
5	colorl. leaf. fr. lgr.	....	64	......	v. s.	s. lgr.	....
6	cryst. powd.	....	dec.	......	sl. s.	v. s.	v. s.
7	liq.	$1.147^{15°}$	.....	$250^{739mm.}$	......	......	....
8	pr.	$1.139^{30°}$	29	258	......	as abv. 30°	....
9	liq.	$1.112^{15°}$	......	225	......	......	....
10	grn. need.	....	74–5	273	......	......	s.
11	liq.	$1.132^{15°}$	......	234–7	......	......	....
12	colorl. oil	....	15	exp.	s.	......	....
13	steel blue need.	....	173–4	......	s. bz.	s.	....
14	colorl. monocl f. eth.	....	67.5–8.0	......	......	s.	s.
15	colorl. f. abs. al.	....	210 d.	......	v. sl. s. bz.	s.	v. sl. s.
16	yel. liq.	$0.951^{18°}$	......	175.4	s.	∞	∞
17	need.	....	84	......	sl. s.	v. s.	v. s.
18	....	....	46	194.5	v. sl. s.	v. s.	....
19	yel.	....	......	148	v. s.	∞	∞ M
20	green scales	....	87.8	......	v. sl. s.	s.	s.
21	yel. tab.	....	66.5	......	......	v. sl. s. c.; s. h.	s. bz.
22	yel. liq.	0.924	......	296 (200–5)	v. sl. s.	∞	∞
23	yel. need.	....	202	......	sl. s.	s.	....
24	yel. need. f. bz.	....	147–8 (152)	......	v. sl. s. c.	v. s.	s.
25	yel.	....	abt. 193 d.	......	i.	v. s.	v. s.
26	brown pr. f. al.	....	109.5 (106)	......	v. sl. s.	$2.4^{13°}$; v. s. h.	v. s.
27	gr'n. need. f. al.	....	150–2	......	sl. s. h.	v. s.	v. s.

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
	Nitro-			
1	phenol (p.)	quinone monoxime	$NO\cdot C_6H_4\cdot OH$	123.05
2	toluene (o.)		$NO\cdot C_6H_4\cdot CH_3$	121.06
3	Nonane (n.)		C_9H_{20}	128.16
4	" (α)		C_9H_{20}	128.16
5	" (β)		C_9H_{20}	128.16
6	Nondecylic acid		$C_{18}H_{37}\cdot COOH$	298.30
7	Nonyl alcohol		$C_9H_{19}OH$	144.16
8	Nonylene		C_9H_{18}	126.14
9	Nonylic acid	pelargonic acid	$C_8H_{17}\cdot COOH$	158.14
10	Octane (n.)		C_8H_{18}	114.14
11	Octyl alcohol (n.)		$C_8H_{17}OH$	130.14
12	aldehyde		$CH_3\cdot(CH_2)_6\cdot CHO$	128.13
13	amine		$CH_3\cdot(CH_2)_7\cdot NH_2$	129.16
14	" (sec.)		$CH_3(CH_2)_5CH(NH_2)CH_3$	129.16
15	chloride (n.)		$CH_3(CH_2)_6CH_2\cdot Cl$	148.59
16	" (sec.)		$CH_3(CH_2)_5CHCl\cdot CH_3$	148.59
17	formate		$H\cdot COO\cdot C_8H_{17}$	158.14
18	Octylene (n.)		$CH_3(CH_2)_5CH{:}\ CH_2$	112.13
19	Oenanthol	heptylic aldehyde	$C_6H_{13}\cdot CHO$	114.11
20	Oenanthylic acid	heptylic acid	$C_6H_{13}\cdot COOH$	130.11
21	Oleic acid		$C_{17}H_{33}\cdot COOH$	282.27
22	Olein	triolein	$(C_{18}H_{33}O_2)_3C_3H_5$	884.83
23	Opianic acid		$(CH_3O)_2C_6H_2(CHO)\cdot COOH$	210.08
24	Orceïn		$C_{28}H_{24}N_2O_7$	500.21
25	Orcin-phthalein		$C_{22}H_{16}O_5$	360.13
26	Orsellinic acid COOH, OH, CH₃, OH 1, 2, 4, 6		$C_6H_2(OH)_2CH_3COOH$	168.06
27	Oxalic acid		$(COOH)_2 + 2H_2O$	126.05
28	Oxaluramide	oxalan	$C_3H_5N_3O_3$	131.06
29	Oxaluric acid		$NH_2CO\cdot NH\cdot CO\cdot COOH$	132.05
30	Oxalyl chloride		$COCl\cdot COCl$	126.93
31	Oxamaethane		$NH_2\cdot CO\cdot COO\cdot C_2H_5$	117.06
32	Oxamic acid		$COOH\cdot CONH_2$	89.03
33	Oxamide		$CONH_2\cdot CONH_2$	88.05
34	Oxanilic acid		$COOH\cdot CONHC_6H_5$	165.06
35	Oxanilide		$C_6H_5\cdot NH\cdot CO\cdot CO\cdot NH\cdot C_6H_5$	240.11
36	Oxanthranol	anthrahydroquinone	$C_6H_4COCHOHC_6H_4$	210.08
37	Oximide		$NH\cdot CO\cdot CO$	71.02
38	Oxindol		C_8H_7ON	133.06
39	Palmitic acid		$CH_3\cdot(CH_2)_{14}\cdot COOH$	256.26
40	Palmitin	tripalmitin	$(C_{15}H_{31}\cdot COO)_3C_3H_5$	806.78

ORGANIC COMPOUNDS (Continued)

No	Crystal-line form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	yel. need.	....	120–30 d.	......	s.	v. s.	v. s.
2	cryst.	....	72–2.5	......	v. s. chl	v. s.	v. s.
3	colorl. liq.	0.718^{20°	–51	149.7	i.	v. s.	v. s.
4	....	$0.742^{12.4^\circ}$	......	135–7	......	......	......
5	....	$0.734^{12.7^\circ}$	......	129.5–31$^{751mm.}$	......	......	......
6	leaf. f. al.	....	66.5	......	i.	......	......
7	liq.	0.842^{0°	–5	213.5	......	∞	∞
8	....	$0.7433^{20^\circ}_{4}$	......	140	......	......	......
9	liq.	$0.689^{17^\circ}_{4}$	12.5	253–4	v. sl. s.	s.	s.
10	colorl. liq.	0.706	–56.6	125.5	i.	......	......
11	colorl. liq.	0.838^{0°	–17.9	195.5	s.	∞	∞
12	colorl. liq.	0.821^{20°	......	......	v. sl. s.	∞	∞
13	....	....	......	176	v. sl. s.	v. s.	v. s.
14	....	0.786	......	162.5	......	......	......
15	....	$0.892^{4^\circ}_{0}$	......	183.6–4.6	......	......	......
16	....	0.8707^{15°	......	171–3	......	......	......
17	colorl. liq.	0.893^{0°	......	198	i.	......	......
18	....	$0.7223^{20^\circ}_{4}$	......	124.6$^{769mm.}$	......	......	......
19	colorl. liq.	0.850^{20°	......	155	......	s.	∞
20	colorl. liq.	0.921	......	223	sl. s.	s.	s.
21	need.	0.891^{12°	14	286$^{100mm.}$	i.	∞	∞
22	oil	....	–5–6	......	i.	sl. s.	v. s.
23	pr.	....	150	......	0.25; 1.7^{100°	s.	s.
24	red.	....	......	......	......	s.	s. alk.
25	colorl. pr.	....	230 d.	......	i.	s.	i.; s. alk.
26	need. f. acet.	....	176 d.	......	s.	s.	s.
27	colorl. monocl.	1.653	99*	......	9.5^{15°	v. s. c.	1.2^{15°
28	cryst.	....	......	......	i.	s.	s. H_2SO_4
29	cryst. powd.	....	187	......	v. sl. s.	......	......
30	colorl. liq.	....	–12	64	d.	d.	s.
31	rhomb. leaf.	0.808^{19°	114–5	......	......	......	......
32	colorl.	....	210 d.	......	1.4^{14°	v. sl. s.	......
33	wh. powd.	1.476^{30°	417–9 d.	......	i.	i.	i.
34	rhombic	....	149	......	s. h.	v. s.	v. s.
35	scales	....	245 (252.5)	......	i.	v. sl. s. h.	i.
36	yel.	....	......	......	s. alk.	......	......
37	pr.	....	......	......	sl. s.	......	......
38	need. f. w.	....	120	......	v. s. h.	s.	s.
39	colorl. need.	0.853^{62°	62.6	dec.	i.	9.3^{20°	s.
40	colorl.	0.866^{80°...	65.5	......	i.	v. sl. s.	v. s.

* Anhydrous form melts at 187° C.

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
1	Palmitone		$(C_{15}H_{31})_2CO$	450.50
2	Palmitolic acid		$C_{15}H_{27}\cdot COOH$	252.22
3	Palmito-nitrile		$C_{15}H_{31}\cdot CN$	237.26
4	Papaverine		$C_{20}H_{21}O_4N$	339.18
5	Parabanic acid	oxalyl urea	$C_3H_2O_3N_2$	114.03
6	Paraconic acid	itamalic anhydride	$CH_2COOCH_2: CH\cdot COOH$	130.05
7	Paraconiin		$C_8H_{15}N$	125.13
8	Paracyanogen		$(CN)x$	(26.01)x
9	Paraformaldehyde		$(CH_2O)x$	(30.02)x
10	Paralactic acid (d.)		$CH_3\cdot CHOH\cdot COOH$	90.05
11	Paraldehyde		$(C_2H_4O)_3$	132.10
12	Paraldol		$(C_4H_8O_2)_2$	176.13
13	Paraleukaniline	triaminotriphenylmethane	$CH(C_6H_4NH_2)_3$	289.18
14	Param	dicyandiamide	$C_2N_2(NH_2)_2$	84.06
15	Pararosaniline	triamino triphenylcarbinol	$C(OH)(C_6H_4NH_2)_3$	305.18
16	Parvoline (α)		$C_9H_{13}N$	135.11
17	" (β)		$C_5H(CH_3)_4N$	135.11
18	Pelargonic acid		$CH_3\cdot(CH_2)_7COOH$	158.14
19	Penta-aminobenzene		$C_6H(NH_2)_5$	153.03
20	acetylglucose		$C_6H_7O(OC_2H_3O)_5$	390.18
21	bromobenzene		C_6HBr_5	472.59
22	chloraniline		$Cl_5C_6\cdot NH_2$	265.40
23	chlorbenzene		C_6HCl_5	250.29
24	chlorethane		$CCl_3\cdot CHCl_2$	202.29
25	decane (n.)		$CH_3\cdot(CH_2)_{13}\cdot CH_3$	212.26
26	erythrite		$C(CH_2OH)_4$	136.10
27	ethylbenzene		$C_6H\cdot(C_2H_5)_5$	218.21
28	glycerol		$CH_3\cdot C(CH_2OH)_3$	120.10
29	methyl aminobenzene		$C_6(CH_3)_5NH_2$	163.14
30	" benzene		$C_6H\cdot(CH_3)_5$	148.13
31	" benzoic acid		$(CH_3)_5\cdot C_6\cdot COOH$	192.13
32	" ethanol		$(CH_3)_3C\cdot C(OH)(CH_3)_2$	116.13
33	" phenol		$(CH_3)_5\cdot C_6\cdot OH$	164.13
34	" rosaniline	methylaniline violet	$C_{24}H_{29}N_3O$	375.26
35	methylene	cyclo pentane	C_5H_{10}	70.08
36	" bromide		$CH_2Br(CH_2)_3CH_2Br$	229.91
37	" diamine	cadaverine	$NH_2\cdot(CH_2)_5\cdot NH_2$	102.13
38	aminobenzene		$C_6H\cdot(NH_2)_5$	153.13
39	Pentane (n.)		C_5H_{12}	72.10
40	" (sec.)		$(CH_3)_2CH\cdot CH_2\cdot CH_3$	72.10
41	" (tert.)		$C(CH_3)_4$	72.10

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	leaf. f. al.	$0.7997^{4°}$	82.8	......	......	......	......
2	colorl. need.	....	47	......	i.	v. s.	v. s.
3	colorl. tab.	$0.822^{31°}$	29(31)	251.5 100mm	i.	s.	s.
4	colorl. need. f. al.	....	146–7	......	v.sl.s.s.h.	v. s.; v. s. chl.	$0.39^{10°}$
5	colorl. pl. f. w.	....	227–35 d.	......	$4.7^{8°}$	v. s.	sl. s.
6	deliq. cryst.	....	57–8	......	s.	......	......
7	liq.	$0.913^{0°}$	......	168–70	......	......	......
8	br. powd.	....	......	subl.	i.	i.	s. KOH
9	wh. amor. powd.	....	subl. abt. 120	......	v. s.	i.	i.
10	liq.	....	......	d.	∞	∞	∞
11	colorl.	0.999	10.5	124	10	......	......
12	wh. cryst.	....	80–90	......	......	......	......
13	colorl. leaf.	....	148	......	......	s.	......
14	leaf.	....	205	......	s.	s.	sl. s.
15	red. leaf.	....	188–9	......	i.	s.	s.
16	liq.	$0.986^{22°}$	......	188	......	......	......
17	liq.	....	......	220	......	......	......
18	colorl. leaf.	0.910	12.5	253–4	v. sl. s.	s.	s.
19	need.	....	......	......	v. s.	i.	i.
20	....	....	111	......	......	......	......
21	need. f. al.	....	159–60	subl.	s. bz.	sl. s.	sl. s.
22	need.	....	232	......	......	v. s.	v. s.
23	need. f. al.	$0.769^{20°}$	85–6	275–6	i.	v. sl. s.	v. s.
24	liq.	1.834	−22	161.7	i.	∞	∞
25	colorl.	$0.769^{20°}$	10	270.5	i.	v. s.	v. s.
26	....	....	250–5	......	......	......	......
27	colorl. liq.	$0.899^{19°}$	<−20	277	i.	......	......
28	....	....	......	199	s.	......	......
29	need. f. al.	....	151–2	277–8	i.	s.	s.
30	colorl.	....	53	230	i.	......	......
31	need. f. w.	....	210.5	subl.	v. sl. s.	s.	......
32	....	....	17	131–2	......	......	......
33	need. f. al.	....	125	267	i.	s.	......
34	red. br. powd.	....	130	......	i.	s.	i.
35	colorl. liq.	$0.751^{20°}$	......	50–1	i.	......	......
36	....	....	......	205	......	......	......
37	symp.	0.885	abt. 9	178–9	v. s.	sl. s.	sl. s.
38	need.	....	......	......	v. s.	i.	i.
39	colorl. liq.	0.634	......	37	i.	∞	∞
40	liq.	$0.6385^{14°}$	......	30	......	......	......
41	....	....	solid. −20	9.5	......	......	......

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Perchlorethane.	See *hexachlorethane*		
1	Perchlorether....	....	$C_2Cl_5 \cdot O \cdot C_2Cl_5$.....	418.57
2	Perchlormethyl-mercaptan	....	CCl_3SCl...........	185.89
3	Perseite (d. or l.)	....	$C_7H_{16}O_7$...........	212.13
4	Phellandrene.....	....	$C_{10}H_{16}$............	136.13
	Penacetin.	See *acetphenetidide*		
5	Phenacylbromide	bromacetophenone	$C_6H_5CO \cdot CH_2Br$....	198.97
6	Phenanthrene....	....	$C_{14}H_{10}$.............	178.08
7	Phenanthrenehy-droquinone	....	$C_{14}H_8(OH)_2$........	210.08
8	Phenanthrenequi-none	....	$C_{14}H_8O_2$...........	208.06
9	Phenanthranol...	....	$C_{14}H_9 \cdot OH$.........	194.08
10	Phenazine.......	....	$C_{12}H_8N_2$...........	180.08
11	Phenetidine (o.)..	aminophenylethyl-ether	$C_2H_5 \cdot O \cdot C_6H_4 \cdot NH_2$.	137.10
12	" (m.).	....	$C_2H_5 \cdot O \cdot C_6H_4 \cdot NH_2$.	137.10
13	" (p.)..	....	$C_2H_5 \cdot O \cdot C_6H_4 \cdot NH_2$.	137.10
14	Phenetol........	phenylethyl ether	$C_6H_6 \cdot O \cdot C_2H_5$......	122.08
15	Phenocoll........	aminoacetyl-phenetidine	$C_2H_5O \cdot C_6H_4 \cdot NH \cdot CO \cdot CH_2NH + H_2O$	211.14
16	Phenol..........	carbolic acid.....	$C_6H_5 \cdot OH$.........	94.05
17	phthalein......	....	$C_{20}H_{14}O_4$...........	318.11
18	sulfonic acid (o.)	....	$C_6H_4 \cdot OH \cdot SO_3H$....	174.11
19	" " (m.)	....	$C_6H_4 \cdot OH \cdot SO_3H + 2H_2O$	210.14
20	" " (p.)	....	$C_6H_4 \cdot OH \cdot SO_3H$....	174.11
21	tricarboxylic acid	....	$C_6H_2(OH)(COOH)_3$.	226.05
22	Phenthiazine.....	....	$C_6H_4 \cdot NH \cdot C_6H_4 \cdot S$ (ring)	199.14
23	Phenyl-acetanilide	....	$C_6H_5 \cdot NH \cdot OC \cdot CH_2 \cdot C_6H_5$	211.11
24	acetaldehyde...	....	$C_6H_5 \cdot CH_2 \cdot CHO$...	120.06
25	acetate........	....	$CH_3 \cdot COO \cdot C_6H_5$...	136.06
26	acetic acid.....	....	$C_6H_5 \cdot CH_2 \cdot COOH$..	136.06
27	acetylene.......	....	$C_6H_5 \cdot C \vdots CH$.....	102.05
28	acridine (9).....	....	$C_6H_5 \cdot C_{13}H_8N$......	255.11
29	amino-propionic acid (β, α)	phenyl alanine...	$C_6H_5 \cdot CH_2 \cdot CH(NH_2)COOH$	165.10
30	amino-propionic acid (β, β)	....	$C_6H_5 \cdot CH(NH_2) \cdot CH_2 \cdot COOH$	165.10
31	amyl ether.....	....	$C_6H_5 \cdot OC_5H_{11}$......	164.13
32	angelic acid....	....	$C_6H_5 \cdot CH{:}\ C(C_2H_5)COOH$	176.10
33	anthracene.....	....	$C_{14}H_9(C_6H_5)$.......	254.11

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O = 1$ (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	scales	1.900	69	d.	......	......	....
2	yel. liq.	1.712	......	147	i.	......	....
3	colorl. need.	....	188	......	$5.5^{18°}$	sl. s.	....
4	....	$0.8558^{10°}$	......	172^{766mm}	......	i.	s.
5	trim. pr. f. al.	....	50	......	......	v. s.	v. s.
6	colorl. leaf.	$1.063^{100°}$	100	340	i.	10 h.	v. s.
7	....	....	......	......	s. h.	......	....
8	or. need.	....	202	360	sl. s. h.	sl. s.	sl. s.
9	need.	 0	112 (152)	......	sl. s.	v. s.	v. s.
10	yel. need.	....	170–1	abt. 360	v. sl. s.	2	sl. s.
11	liq.	....	......	228	......	s.	....
12	liq.	....	......	180–205	......	s.	....
13	liq.	....	......	253	......	s.	....
14	colorl. liq.	$0.982^{0°}$	......	172	i.	s.	∞
15	wh. need.	....	abt. 95; anh.	......	sl. s.	s.	....
16	colorl. need.	$1.072^{20°}$	42.5–3.0	183	$6.7^{16°}$; $\infty^{68°}$	∞	v. s.
17	tricl.	....	250–3	......	sl. s.	s.	sl. s.
18	....	....	......	......	sl. s.	sl. s.	....
19	need.	....	......	......	s.	s.	....
20	symp.	....	......	......	s.	s.	....
21	+ H_2O warts; + $2H_2O$ need.	....	......	d. 180	0.5	......	sl. s.
22	leaf.	....	180	371	......	sl. s.	sl. s.
23	prisms f. al.	....	117	......	i.	3.3	s.
24	colorl. liq.	1.032	......	193–4	v. sl. s.	∞	∞
25	colorl. liq.	$1.093^{0°}$	......	196	v. sl. s.	∞	∞
26	colorl. leaf.	....	76.5	265.5	v. s. h. sl. s. c.	v. s.	v. s.
27	colorl. liq.	$0.937^{12°}$	......	139–42	i.	∞	∞
28	yel. need. f. al.	....	181.5–2.5	403–4	i.	sl. s.	s.; v. s. bz.
29	prisms	....	263–5 d.	......	s.	v. sl.	i.
30	monocl.	....	120–1	......	s.	v. s.	v. sl. s.
31	liq.	....	......	225	......	......	....
32	....	....	81	......	sl. s.	s.	....
33	leaf.	....	152–3	417	......	v. s.	v. s.

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
	Phenyl-			
1	benzoate		$C_6H_5 \cdot COO \cdot C_6H_5$	198.08
2	benzoic acid (o.)		$C_6H_5 \cdot C_6H_4 \cdot COOH$	198.08
3	" " (m.)		$C_6H_5 \cdot C_6H_4 \cdot COOH$	198.08
4	" " (p.)		$C_6H_5 \cdot C_6H_4 \cdot COOH$	198.08
5	benzylamine		$C_6H_5 \cdot NH \cdot CH_2 \cdot C_6H_5$	183.11
6	carbamate		$C_6H_5 \cdot COONH_2$	137.06
7	carbonate		$(C_6H_5)_2CO_3$	214.08
8	carbylamine chloride	isocyanophenyl chloride	$C_6H_5 \cdot NCCl_2$	173.96
9	cinnamic acid		$C_6H_5CH{:}\ C(C_6H_5)COOH$	224.10
10	crotonic acid	phenylmetacrylic acid	$C_6H_5CH{:}\ C(CH_3)COOH$	162.08
11	cyanamide		$NC \cdot NHC_6H_5$	118.06
	cyanide.	See *benzonitrile*		
12	dihydroquinazoline	orexin	$C_6H_4CH_2N(C_6H_5)CH{:}\ N$	208.11
13	disulfide		$(C_6H_5)_2S_2$	218.21
14	ditolylmethane		$C_6H_5 \cdot CH \cdot (C_6H_4 \cdot CH_3)_2$	272.16
15	ether		$C_6H_5 \cdot O \cdot C_6H_5$	170.08
16	ethyl alcohol	benzyl carbinol	$C_6H_5 \cdot CH_2 \cdot CH_2OH$	122.08
17	" " (sec.)		$C_6H_5 \cdot CH(OH) \cdot CH_3$	122.08
18	" amine β)		$C_6H_5 \cdot CH_2 \cdot CH_2 \cdot NH_2$	121.10
19	" " (α)		$C_6H_5 \cdot CH(NH_2) \cdot CH_3$	121.10
20	" hydrazine (unsym.)		$C_6H_5 \cdot N(C_2H_5) \cdot NH_2$	136.11
21	" " (sym.)		$C_6H_5 \cdot NH \cdot NH \cdot C_2H_5$	136.11
22	" ketone		$C_6H_5 \cdot CO \cdot C_2H_5$	134.08
23	" sulfone		$C_2H_5 \cdot SO_2 \cdot C_6H_5$	170.14
	ethylene.	See *styrene*		
24	formanilide		$(C_6H_5)_2NCOH$	197.10
25	glucosazone (d.)		$C_{18}H_{22}O_4N_4$	358.21
26	glycine	anilino acetic acid	$C_6H_5NH \cdot CH_2 \cdot COOH$	151.08
27	glycine carboxylic acid		$(COOH) \cdot C_6H_4NH \cdot CH_2 \cdot COOH$	195.08
28	glyoxylic acid	benzoyl formic acid	$C_6H_5 \cdot CO \cdot COOH$	150.05
29	hydrazine		$C_6H_5 \cdot NH \cdot NH_2$	108.08
30	hydroxycrotonic acid (α)		$C_6H_5 \cdot CH{:}\ CH \cdot CHOH \cdot COOH$	178.08
31	hydroxylamine (β)		$C_6H_5 \cdot NH \cdot OH$	109.06
32	isocrotonic acid		$C_6H_5 \cdot CH{:}\ CH \cdot CH_2 \cdot COOH$	162.08

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. monocl.	....	68–9	314	v. sl. s.	s.	s.
2	colorl. need.	....	110–1	343	sl. s. h.	v. s.	....
3	colorl. leaf.	....	160–1 (166)	......	sl. s.	v. s.	v. s.
4	colorl. need.	....	218–9 (224)	subl.	v. sl. s. h.	v. s.	v. s.
5	pr. f. al.	....	32	298–300	......	s.	....
6	leaf.	....	141	......	sl. s.; s. h.	v. s.	v. s.
7	need.	....	78	301–2	......	......	s. CCl_4
8	colorl. oil	....	......	209	......	......	....
9	need. f. al.	....	169–70	subl.	sl. s. h.	s.	s.
10	long. need. or pr.	....	78	288	......	s. CS_2	s. bz.
11	need. f. eth.	....	36–7	......	sl. s.	s.	s.
12	hex. pl.	....	95	.....	......	s.	s.
13	need.	....	60–1	310 d.	i.	s.	s.
14	need.	....	55–6	......	v. s. bz.	s.	v. s.
15	colorl. monocl.	$1.083^{20°}$	28	252–3 (259)	v. sl. s.	5	s.
16	colorl. liq.	1.024	......	212	$1.6^{20°}$	∞	∞
17	liq.	1.013	......	202–4	i.	......	....
18	wh.-yel. liq.	$0.958^{24°}$	......	197–8	4	v. s.	v. s.
19	liq.	....	......	187	sl. s.	......	....
20	oil	....	......	......	......	......	....
21	oil	....	......	......	sl. s.	s.	s.
22	liq.	....	......	208–10	......	......	....
23	pl. f. eth.	....	42	>300	s. h.	s.	s.
24	rhomb.	1.23	73–4	210–20 in. vac.	s. h.	s.	s.
25	yel need	....	217	......	v. sl. s.	s. h.	....
26	colorl.	....	125–7	......	s.	......	sl. s.
27	....	....	215	......	sl. s.	......	....
28	colorl.	....	65–6	......	v. s.	v. s.	....
29	yel.	$1.097^{23°}$	17.5	243.5 sl. d.	sl. s.	∞	∞
30	need.	....	46	98	......	......	....
31	need.	....	......	81–2	2 c.; 10 h.	v. s.	v. s.
32	need.	....	83–4	302	sl. s. h.	v. s.	v. s.

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
	Phenyl-			
1	isocyanide......	phenylcarbylamine	$C_6H_5 \cdot NC$.........	103.05
2	isopropylketone.	....	$C_6H_5 \cdot CO \cdot CH(CH_3)_2$	148.10
	mercaptan.	See *thiophenol*		
	methylketone.	See *acetophenone*		
3	methylpyrazolone	....	$C_{10}H_{10}N_2O$.........	174.10
4	mustard oil.....	phenyl isothio-cyanate	$C_6H_5 \cdot NCS$........	135.11
5	naphthalene (α)	....	$C_{10}H_7 \cdot C_6H_5$.......	204.10
6	" (β)	....	$C_{13}H_7 \cdot C_6H_5$.......	204.10
7	naphthylamine (α)	....	$C_{10}H_7 \cdot NH \cdot C_6H_5$...	219.11
8	" (β)	....	$C_{10}H_7 \cdot NH \cdot C_6H_5$...	219.11
9	naphthyl ketone (α)	....	$C_{10}H_7 \cdot CO \cdot C_6H_5$...	232.10
10	" " (β)	....	$C_{10}H_7 \cdot CO \cdot C_6H_5$...	232.10
11	nitramine......	....	$C_6H_6 \cdot NH(NO_2)$....	138.06
12	oxydisulfide....	....	$(C_6H_5)_2S_2O_2$........	250.21
13	phosphine......	....	$C_6H_5 \cdot PH_2$.........	110.08
14	propiolic acid...	....	$C_6H_5 \cdot C \vdots C \cdot COOH$	146.05
15	propyl alcohol (γ)	....	$C_6H_5 \cdot (CH_2)_2 \cdot CH_2OH$	136.10
16	" " (sec.)	....	$C_6H_5 \cdot CH(OH) \cdot C_2H_5$	136.10
17	propylglycolic acid	....	$C_6H_4 \cdot C_3H_7 \cdot CHOH \cdot COOH$	194.11
18	propylketone...	....	$C_6H_5 \cdot CO \cdot C_3H_7$....	148.10
19	pyridine (α)....	....	$C_6H_6 \cdot C_5H_4N$......	155.08
20	" (β)....	....	$C_6H_5 \cdot C_5H_4N$......	155.08
21	" (γ)....	....	$C_6H_5 \cdot C_5H_4N$......	155.08
22	quinoline (α)...	....	$C_6H_5 \cdot C_9H_6N$......	205.09
23	quinoline (o.)...	....	$C_9H_6N \cdot C_6H_5$......	205.09
24	" (p.)...	....	$C_9H_6N \cdot C_6H_5$......	205.09
25	salicylate.......	salol...........	$HO \cdot C_6H_4 \cdot COO \cdot C_6H_5$	214.08
26	salicylic acid....	....	$C_6H_4(OC_6H_5) \cdot COOH$	214.08
27	semicarbazide (1)	....	$C_6H_5 \cdot NH \cdot NH \cdot CO \cdot NH_2$	151.10
28	sulfide.........	....	$(C_6H_5)_2S$..........	186.14
29	thiourea.......	....	$CS(NH_2)NH \cdot C_6H_5$.	152.14
30	toluene (o.).....	....	$C_6H_5 \cdot C_6H_4 \cdot CH_3$...	168.10
31	" (m.)....	....	$C_6H_5 \cdot C_6H_4 \cdot CH_3$...	168.10
32	" (p.)....	....	$C_6H_5 \cdot C_6H_4 \cdot CH_3$...	168.10
33	totyl ketone (o.)	....	$C_6H_5 \cdot CO \cdot C_6H_4 \cdot CH_3$	196.10
34	" " (m.)	....	$C_6H_5 \cdot CO \cdot C_6H_4 \cdot CH_3$	196.10
35	" " (p.)	....	$C_6H_5 \cdot CO \cdot C_6H_4 \cdot CH_3$	196.10
36	urea...........	....	$C_6H_5 \cdot NH \cdot CO \cdot NH_2$	136.19
37	urethane.......	ethylphenyl carbamate	$C_6H_5 \cdot NH \cdot COO \cdot C_2H_5$	165.10
	Phenylene diamine.	See *diamino-benzene*		
38	Phloretic acid....	p-hydroxyhydratropic acid	$C_6H_4(OH) \cdot CH(CH_3)COOH$	166.08

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	color.-grn. liq.	0.978	......	165–6	dec.	dec.	s.
2	....	....	......	209–17	......	......	....
3	pr.	....	127	$287^{206mm.}$	s. h.	s. h.	v. sl. s.
4	liq.	1.138	–21	221	i.	s.	s.
5	colorl. liq.	....	......	324–5	......	v. s.	v. s.
6	colorl. leaf	....	102–2.5	345	......	v. s.	v. s.
7	colorl. leaf.	....	60–2	......	v. s. bz.	v. s.	v. s.
8	need.	....	107.5–8.0	395	s. chl.	s.	s.
9	rhombic	....	75.5	385	i.	$2.4^{12°}$	....
10	need.	....	82	......	i.	2 c.	....
11	leaf. f. lgr.	....	46–6.5	exp.	s.	v. s.	....
12	....	....	36	......	......	s. h.	s.
13	....	$1.001^{15°}$	......	160–1	......	......	....
14	long. need.	....	136–7	subl.	v. sl. s.	v. s.	v. s.
15	liq.	$1.007^{15°}$	<–18	235, $119^{12mm.}$	s.	∞	∞
16	liq.	$0.994^{23°}_{8}$	......	212	......	......	....
17	....	....	158	......	......	......	....
18	liq.	$1.992^{15°}$	......	220–2	......	......	....
19	liq.	....	......	269–71	i.	v. s.	v. s.
20	oil	....	......	269.5–70.5	i.	v. s.	v. s.
21	leaf. f. w.	....	77	274–5	v. sl. s. h.	s.	s.
22	need. f. al.	....	84–6	300	sl. s.	v. s.h.	v. s.
23	thk. fluor. oil.	....	......	270–6 $_{80mm.}$	......	s.	s.; s. bz.
24	pl. f. al.	$1.194^{20°}$	110–1	$260^{77mm.}$	v. sl. s.	s.	s.
25	colorl.	$1.261^{30°}$	42.5	......	v. sl. s.	$21.5^{25°}$	v. s.
26	need.	....	159	......	i.	s. $CHCl_3$	....
27	lvs. f. al.	....	172	......	sl. s. c.; s. h.	v. s.	....
28	liq.	$1.119^{15°}_{15}$	......	296	i.	s.	∞; ∞ bz.
29	need.	....	154	......	1: 400	$5.66^{25°}$	....
30	colorl. liq.	....	......	258–60	i.	s.	s.
31	colorl. liq.	$1.031^{0°}$	......	272–7	i.	s.	s.
32	colorl. liq.	$1.015^{27°}$	–2–3	263–7	i.	s.	s.
33	colorl. liq.	....	<–18	315–6	......	......	....
34	colorl. liq.	$1.088^{18°}$	......	314–6	∞ bz.	v. s.	v. s.
35	monocl.	....	59–60*	326	v. s. bz.	s.	v. s.
36	monocl.	....	146.5–7.0	......	sl. s. c.; v. s. h.	v. s.	v. s.
37	need. f. w.	....	51.5–2.0	....	v. sl. s.	v. s.	v. s.
38	monocl. f. eth.	....	128–30	......	s. h.	s.	s.

* A hexagonal form melts at 55° C.

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
1	Phloretin		$C_{15}H_{14}O_5$	274.11
2	Phloridzin		$C_{21}H_{24}O_{10} + 2H_2O$	472.22
3	Phloroglucinol	trihydroxybenzene (3, 1, 5)	$C_6H_3\cdot(OH)_3 + 2H_2O$	162.08
4	triethyl ether		$C_6H_3\cdot(OC_2H_5)_3$	210.14
5	trimethyl ether		$C_6H_3\cdot(OCH_3)_3$	168.10
6	trioxime		$C_6H_6(NOH)_3$	171.10
7	Phlorol		$C_8H_{10}O$	122.08
8	Phloron	xyloquinone	$[(CH_3)_2C{:}\,CH]_2{:}\,CO$	138.11
9	Phosgene. See	*carbonyl chloride*		
10	Phosphenylchloride		$C_6H_5PCl_2$	178.98
11	Phosphobenzene		$C_6H_5\cdot P{:}\,P\cdot C_6H_5$	216.13
12	Phthalamide (o.)		$C_6H_4(CONH_2)_2$	164.08
13	Phthalanil		$C_8H_4O_2{:}\,NC_6H_5$	223.07
14	Phthalic acid		$C_6H_4\cdot(COOH)_2$ (o.)	166.05
15	aldehyde		$C_6H_4\cdot(CHO)_2$ (o.)	134.05
16	anhydride		$C_6H_4\cdot(CO)_2O$ (o.)	148.03
17	Phthalide		$C_8H_6O_2$	134.05
18	Phthalimide		$C_6H_4{:}\,(CO)_2{:}\,NH$	147.05
19	Phthalonic acid		$C_6H_4(COOH)CO\cdot COOH$	194.05
20	Phthalophenone	triphenylcarbinol-o-carboxylic anhyd.	$(C_6H_5)_2{:}\,C\cdot C_6H_4\cdot COO$	286.11
21	Phthalylchloride (o.)		$C_6H_4(COCl)_2$	202.95
22	" (m.)		$C_6H_4(COCl)_2$	202.95
23	" (p.)		$C_6H_4(COCl)_2$	202.95
24	Picene		$C_{22}H_{14}$	278.11
25	Picoline (α)	methyl pyridine (2)	$CH_3\cdot C_5H_4N$	93.06
26	" (β)	" " (3)	$CH_3\cdot C_5H_4N$	93.06
27	" (γ)	" " (4)	$CH_3\cdot C_5H_4N$	93.06
28	Picolinic acid (2)	pyridine carbonic acid (2)	C_5H_4NCOOH	123.05
29	Picramic acid (4, 6, 2)	dinitroaminophenol (4, 6, 2, 1)	$(NO_2)_2(NH_2)\cdot C_6H_2\cdot OH$	199.06
30	Picramide	trinitroaniline	$NH_2\cdot C_6H_2\cdot(NO_2)_3$ (1, 2, 4, 6)	228.06
31	Picric acid	trinitrophenol (1, 2, 4, 6)	$HO\cdot C_6H_2\cdot(NO_2)_3$ (1, 2, 4, 6)	229.05
32	Picryl chloride		$Cl\cdot C_6H_2\cdot(NO_3)_3$	295.50
33	Pilocarpine		$C_{11}H_{16}O_2N_2$	208.14
34	hydrochloride		$C_{11}H_{16}O_2N_2\cdot HCl$	244.61
35	nitrate		$C_{11}H_{16}O_2N_2\cdot HNO_3$	271.16
36	Pimaric acid		$C_{20}H_{30}O_2$	302.24
37	Pinacoline		$CH_3\cdot CO\cdot C(CH_3)_3$	100.10

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	sm. leaf.	....	253–5	......	sl. s. h.	∞ acet. a.	v. sl. s.
2	need.	$1.430^{19°}$	108–9*	......	0.1 c.; v. s. h.	v. s.	v. sl. s.
3	rhombic	....	anh. 217–9	subl. d.	v. s.	v. s.	v. s.
4	colorl.	....	43	......	i.	v. s.	v. s.
5	colorl. pr.	....	52	255.5	......	v. s.	v. s.
6	powd.	....	exp. 155	......	v. sl. s.	v. sl. s.	s. chl.; s. acet. a.
7	liq.	$1.0374^{12°}$	......	220	......	......	....
8	pa. yel.	$0.885^{20°}$	28	198.5	......	s.	s.
9							
10	liq.	$1.319^{20°}$	......	224.6	d.	∞ bz.	∞ CS_2
11	pa. yel. powd.	....	149–50	......	i.	i.	i.
12	colorl. rh'b'dr.	....	219–20	......	i.	i.	i.
13	need.	....	205	subl.	i.	s.	....
14	colorl. rhomb.	1.585	184 d.	......	$0.54^{14°}$; $18^{99°}$	v. s.	$0.69^{15°}$
15	....	....	56	......	s.	s.	s.
16	colorl. pr.	$1.527^{4°}$	128	284.5	v. sl. s.	s.	sl. s.
17	need. f. w.	....	73	290	v. sl. s.	v. s.	....
18	need.	....	228.5	subl.	v. sl. s.	v. sl. s. bz.	sl. s.
19	cryst.	....	145	......	s.	s.	s.
20	leaf.	....	145	......	......	s.	....
21	colorl. liq.	$1.4089^{20°}$	0	281.5	d.	d.	s.
22	cryst.	....	41	276	......	......	....
23	need.	....	78	259	......	......	....
24	colorl.	....	364	518–20	sl. s. h. bz.	sl. s. chl.	....
25	colorl. liq.	0.950	......	129	v. s.	∞	∞
26	colorl. liq.	0.961	......	143.5	∞	∞	∞
27	colorl. liq.	0.957	......	143.1	∞	∞	∞
28	need. f. w.	....	136	subl.	v. s.	v. s.	v. sl. s.
29	monocl. f. chl.	....	168–9	......	$0.14^{22°}$	s.	sl. s.; v. s. bz.
30	yel. tab.	....	188	......	i.	i.	s. acet. a.
31	yel. leaf. f. w.	$1.767^{19°}$	122	exp.	$1.22^{20°}$ $6.33^{100°}$	$5.92^{14.8°}$	$1.08^{13°}$
32	yel. pr.	....	81–2	......	i.	s.	s.
33	colorl. need.	....	34	......	v. s.	v. s.	sl. s.
34	deliq. cryst.	....	200–4	......	333	43; 10 abs.	i.; sl. s. chl.
35	prisms	....	178	......	$16^{20°}$	$6.2^{60°}$	i.
36	....	....	148	......	i.	s.	....
37	colorl. liq.	0.800	......	106	v. sl. s.	s.	s.

* Anhydrous form melts about 170° C. with decomposition.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Pinacolyl alcohol.	....	$(CH_3)_3C\cdot CH(OH)CH_3$	102.11
2	Pinacone........	....	$(CH_3)_2\cdot C(OH)\cdot C(OH)\cdot (CH_3)_2$	118.11
3	Pinene (α).......	....	$C_{10}H_{16}$............	136.13
4	hydrochloride...	....	$C_{10}H_{16}\cdot HCl$........	172.59
5	Pinol...........	....	$C_{10}H_{16}O$	152.13
6	Piperazine See	*diethylenediamine*		
7	Piperic acid......	....	$C_{12}H_{10}O_4$...........	218.08
8	Piperidine.......	hexahydropyridine	$C_5H_{11}N$...........	85.10
9	Piperine.........	....	$C_5H_{10}N\cdot CO\cdot C_4H_4\cdot C_6H_3{:}\ O_2{:}\ CH_2$	285.16
10	Piperonal	heliotropin	$CH_2\cdot O_2\cdot C_6H_3\cdot CHO$	150.05
11	Piperonyl alcohol.	....	$CH_2(O_2)C_6H_3\cdot CH_2OH$	152.06
12	Piperonylic acid..	....	$C_8H_6O_4$............	166.05
13	Piperylene.......	....	$CH_2\ \ CH\cdot CH_2\cdot CH\ \ CH_2$	68.06
14	Pivalic acid. See	*trimethylacetic acid*		
15	Populin.........	benzoyl salicin...	$C_{20}H_{22}O_8 + 2H_2O$...	426.21
16	Prehnitic acid (1, 2, 3, 4)	....	$C_6H_2(COOH)_4$.....	254.05
17	Propane.........	....	$CH_3\cdot CH_2\cdot CH_3$.....	44.06
18	Propargyl acetate	....	$CH_3\cdot COO\cdot C_3H_3$....	98.05
19	alcohol.........	....	$CH\vdots C\cdot CH_2OH$....	56.03
20	Propiolic acid....	....	$CH\vdots C\cdot COOH$.....	70.02
21	Propionaldoxime .	....	$C_2H_5\cdot CH{:}\ NOH$...	73.06
22	Propionamide....	....	$C_2H_5\cdot CO\cdot NH_2$.....	73.06
23	Propionanilide...	....	$C_6H_5\cdot NH\cdot CO\cdot C_2H_5$	149.10
24	Propionic acid...	....	$CH_3\cdot CH_2\cdot COOH$...	74.05
25	aldehyde.......	....	$CH_3\cdot CH_2\cdot CHO$....	58.05
26	anhydride......	....	$[CH_3\cdot CH_2\cdot CO]_2O$..	130.08
27	Proponal........	dipropyl barbituric acid	$C_{10}H_{16}O_3N_2$........	212.14
28	Propyl acetate...	....	$CH_3\cdot COO\cdot C_3H_7$....	102.08
29	acetylene.......	....	$C_3H_7\cdot C\vdots CH$......	68.06
30	alcohol.........	....	$CH_3\cdot CH_2\cdot CH_2OH$..	60.06
31	amine (n.)......	....	$CH_3\cdot CH_2\cdot CH_2NH_2$.	59.08
32	aniline.........	....	$C_6H_5\cdot NH(C_3H_7)$...	135.11
33	benzene........	....	$C_6H_5\cdot CH_2\cdot CH_2\cdot CH_3$	120.10
34	benzoate.......	....	$C_6H_5\cdot COO\cdot C_3H_7$...	164.10
35	benzoic acid (o.)	....	$C_3H_7\cdot C_6H_4\cdot COOH$..	164.10
36	" " (p.)	....	$C_3H_7\cdot C_6H_4\cdot COOH$.	164.10
37	bromide........	....	$CH_3\cdot CH_2\cdot CH_2Br$...	122.97
38	butyrate.......	....	$C_3H_7\cdot COO\cdot C_3H_7$...	130.11
39	carbamate......	....	$NH_2\cdot COOC_3H_7$....	103.08
40	chloride........	....	$CH_3\cdot CH_2\cdot CH_2Cl$...	78.51
41	chloride (sec.) ..	....	$CH_3\cdot CHCl\cdot CH_3$....	78.51
42	cyanide........	butyro-nitrile....	$CH_3\cdot CH_2\cdot CH_2\cdot CN$.	69.14
43	ether..........	....	$C_3H_7\cdot O\cdot C_3H_7$......	102.11
44	formate........	....	$H\cdot COO\cdot C_3H_7$......	88.06
45	hexyl ketone....	....	$C_3H_7\cdot CO\cdot C_6H_{13}$....	156.16

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	need.	$0.8347^{0°}$	5.45	120–1	......	s.	......
2	colorl. need.	0.967	35–8	172–3	s. c.; v. s. h.	v. s.	......
3	colorl. liq.	$0.859^{20°}$	......	156	v. sl. s.	∞ abs.	∞
4	colorl.	....	125	......	i.	v. s.	s.
5	....	$0.9420^{20°}$	184	......	......	s.	......
6							
7	yel. need.	....	216–7	......	v. sl. s.	s. h.	s.
8	colorl. liq.	$0.862^{20°}$	–17	106	∞	∞	......
9	colorl. monocl.	....	129–30	......	v. sl. s. c.	6.7; $23^{60°}$	2.8
10	need, f. w.	....	37	263	0.2 c.	v. s.	v. s.
11	cryst.	....	51	d.	sl. s.	∞	∞
12	need. f. w. or al.	....	228	subl.	sl. s. h.	s. h.	......
13	liq.	....	......	42	......	......	......
14	colorl. need.	....	anh. 180	......	0.05 c.	s.	s.
15	pr.	....	237–50	d.anh.	s.	......	......
16							
17	colorl. gas	1.558 (A)	......	–38–9	$6.5c.c.^{18°}$	$790c.c.^{17°}$	$926c.c.^{17°}$
18	colorl. liq.	$1.005^{20°}$	......	124.5	......	s.	s.
19	colorl. liq.	$0.972^{20°}$	......	114–5	s.	∞	∞
20	need.	....	6	144 d.	s.	s.	s.
	....	$0.926^{20°}$	21.5	131–5	......	......	......
21	colorl. leaf.	$0.960^{80°}$	79	213	s.	s.	s.
22	colorl.	....	104	......	$0.42^{24°}$	v. s.	v. s.
23	leaf.						
24	colorl. liq.	$0.987^{20°}$	–22	140.7	∞	∞	∞
25	colorl. liq.	$0.870^{20°}$	–81	48.8	$20^{20°}$	∞	∞
	colorl. liq.	1.017	......	168.6	dec.	dec.	......
26	colorl.	....	145	......	0.06 c.; $1.4^{100°}$	v. s.	v. s.
27							
28	colorl. liq.	$0.891^{18°}$	......	102	$2.36^{20°}$	∞	∞
29	colorl. liq.	....	......	48–9	i.	......	s.
30	colorl. liq.	$0.804^{20°}$	......	97.4	∞	∞	∞
31	colorl. liq.	$0.719^{20°}$	......	49	s.	......	......
32	liq.	$0.949^{18°}$	......	222	......	......	......
33	colorl. liq.	$0.862^{20°}$	......	158	i.	s.	s.
34	colorl. liq.	1.032	......	229.5	v. sl. s.	∞	∞
	leaf. f. al.	....	58	272	s.	v. s.	v. s.
35	colorl.	....	......	140	sl. s. h.	v. s.	v. s.
36	leaf.						
37	liq.	1.364	......	71.5	$0.25^{20°}$	∞	......
38	colorl. liq.	0.879	......	143	......	∞	∞
39	colorl. pr.	....	53 (60)	194–5	v. s.	v. s.	s.
40	colorl. liq.	$0.895^{16°}_{15}$	......	46.5	$0.27^{20°}$	∞	∞
41	colorl. liq.	$0.859^{20°}$	......	36.5	......	∞	∞
42	....	$0.794^{20°}$	......	118	sl. s.	∞	∞
43	colorl. liq.	$0.744^{21°}$	......	90.7	s.	∞	∞
44	colorl. liq.	$0.9091^{20°}$	......	81	$2.87^{20°}$	∞	∞
45	colorl. liq.	$0.824^{20°}$	–9	267	v. sl. s.	∞	∞

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Propyl-hydroxylamine (β)	....	$C_3H_7 \cdot NHOH$	75.08
2	iodide	....	$CH_3 \cdot CH_2 \cdot CH_2I$	169.99
3	isovaleriate	....	$(CH_3)_2 \cdot CH \cdot CH_2 \cdot COO \cdot C_3H_7$	144.13
4	mercaptan	....	$CH_3 \cdot CH_2 \cdot CH_2SH$ ..	76.13
5	naphthylamine(α)	....	$C_{10}H_7 \cdot NH \cdot C_3H_7$ ...	185.13
6	nitramine	....	$C_3H_7 \cdot NH(NO_2)$	104.08
7	nitrate	....	$C_3H_7 \cdot NO_3$	105.06
8	nitrite	....	$C_3H_7 \cdot NO_2$	89.06
9	phenol (m.)	....	$C_3H_7 \cdot C_6H_4 \cdot OH$	136.10
10	phenyl ketone .	butyro-phenone . .	$C_3H_7 \cdot CO \cdot C_6H_5$	148.10
11	propionate ...	....	$C_2H_5 \cdot COO \cdot C_3H_7$ ...	116.10
12	pyridine (α) ...	....	$C_3H_7 \cdot C_5H_4N$	121.10
13	" (α), (iso)	....	$C_3H_7 \cdot C_5H_4N$	121.10
14	" (γ), (iso)	....	$C_3H_7 \cdot C_5H_4N$	121.10
15	sulfide	....	$(C_3H_7)_2S$	118.18
16	tartrate	....	$C_4H_4O_6 \cdot (C_3H_7)_2$.	234.14
17	urea	....	$C_3H_7 \cdot NH \cdot CO \cdot NH_2$	102.10
18	Propylene	....	$CH_3 \cdot CH{:}\ CH_2$	42.05
19	bromide	dibrompropane ...	$CH_3 \cdot CHBr.CH_2Br$.	201.88
20	chloride	dichlorpropane . .	$CH_3 \cdot CHCl \cdot CH_2Cl$.	112.98
21	glycol (α)	....	$CH_3 \cdot CH(OH) \cdot CH_2 OH$	76.06
22	oxide	....	$CH_3 \cdot (CH \cdot CH_2) \cdot O$.	58.05
23	Protocatechuic . .	....	$(HO)_2 \cdot C_6H_3 \cdot COOH + H_2O$	172.06
24	acid (3, 4, 1)			
25	aldehyde (3, 4, 1)	....	$(HO)_2 \cdot C_6H_3 \cdot CHO$ ..	138.05
26	Pseudo-cumene ..	trimethyl benzene (uns.)	$C_6H_3 \cdot (CH_3)_3$ (1, 2, 4)	120.10
27	Pseudo-cumidine .	....	$(CH_3)_3 \cdot C_6H_2 \cdot NH_2$ (1, 2, 4, 5)	135.11
28	Pseudo-morphine .	....	$C_{17}H_{19}NO_4$	301.16
29	Pseudo-tropine ...	....	$C_8H_{15}NO$	141.13
30	Pulegone	....	$C_{10}H_{16}O$	152.13
31	Purine	....	$C_5H_4N_4$	120.06
32	Purpurine (1, 2, 4)	trihydroxyanthra-quinone	$C_6H_4 \cdot (CO)_2 \cdot C_6H(OH)_3$	256.06
33	Purpurxanthine (1, 3)	....	$C_6H_4(CO)_2C_6H_2(OH)_2$	240.06
34	Pyrantin	....	$C_{12}H_{13}O_3N$	219.11
35	Pyrazine	....	$C_4H_4N_2$	80.05
36	Pyrazole	....	$C_3H_4N_2$	68.05
37	Pyrazoline	....	$C_3H_6N_2$	70.06
38	Pyrazolone	....	$CO \cdot CH_2 \cdot CH{:}\ N \cdot NH$	84.05
39	Pyrene	....	$C_{16}H_{10}$	202.08
40	Pyridazine	....	$C_4H_4N_2$	80.04
41	Pyridine	....	C_5H_5N	79.05
42	pentacarboxylic acid	....	$C_5N(COOH)_5 + 2H_2O$ or $3H_2O$	335.08 or 353.10

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O = 1$ (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	need. f. eth.	....	abt. 46	......	......	......	....
2	....	1.748	....	102.4	0.11$^{20°}$	∞	∞
3	colorl. liq.	....	......	153–6	i.	∞	∞
4	liq.	....	......	67–8	v. sl. s.	s.	s.
5	oil	....	......	abt. 317	i.	......	....
6	....	1.103$^{15°}$	–21	128$^{40mm.}$	sl. s.	v. s.	v. s.
7	liq.	1.063	......	110.5	......	s.	s.
8	liq.	0.935$^{21°}$	......	57	......	s.	s.
9	colorl.	....	26	228	v. sl. s.	s.	....
10	colorl. liq.	1.009$^{0°}$	8.5	220–2	i.	s.	....
11	colorl. liq.	....	......	122.4	0.5	∞	∞
12	liq.	<H_2O	......	165–8	......	......	....
13	....	0.9342$^{0°}$	......	158–9	sl. s.	......	....
14	pl.	pl.	205	......	......	......	....
15	....	0.814	.....	141.5–2.5	i.	s.	s.
16	liq.	1.134$^{20°}$	......	303	i.	v. s.	v. s.
17	colorl.	....	107	......	s.	......	....
18	colorl. gas.	1.498 (A)	......	–50.2	44.6 c.c.	1250 c.c.	....
19	colorl. liq.	1.931	......	141.6	0.25$^{20°}$	s.	v. s.
20	colorl. liq.	1.166	......	96.8	0.27$^{20°}$	v. s.	v. s.
21	colorl. liq.	1.051$^{0°}$	......	188	......	......	....
22	colorl. liq.	0.859	35	......	33	∞	∞
23	colorl.	1.542$^{4°}$	199 d.	......	s.	v. s.	s.
24	monocl.	anh.					
25	colorl. tab.	....	153–4	dec.	5	v. s.	v. s.
26	colorl. liq.	0.879$^{20°}$	–57.5	169.8	i.	......	....
27	colorl. need. f. al.	....	66	234–5	......	s.	....
28	....	....	245 d.	......	......	i.	i.
29	rh'b'dr.	....	106	241–3	......	s. chl.	sl. s.
30	colorl. liq.	0.932	......	221–2	i.	∞	∞
31	mic. need. f. al.	....	216–7	d.	v. s.	s.	v. sl. s.
32	red. need. f. al.	....	256	d.	s.	s.	s.
33	yel. need. f. acet. a.	....	262–3	subl.	......	......	....
34	pr. f. al.	....	155	......	0.075$^{17°}$; 1.2$^{100°}$	v. s. h.	i.
35	pr. f. w.	....	47	118	∞	v. s.	v. s.
36	need. f. al.	....	69.5–70.0	186–8	v. s.	v. s.	v. s.
37	colorl. liq.	....	......	144	∞	∞	....
38	need.	....	164	......	s.	s.	sl. s.
39	monocl. tab.	....	148–9	......	i.	1.4	v. s.
40	colorl. liq.	1.111$^{18°}_{18}$	–8	206	∞	v. s.	v. s.
41	liq.	0.990	......	115	∞	∞	∞
42	f. eth. $2H_2O$ f. w. $3H_2O$	....	d. 220	......	v. s.	......	v. sl. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
	Pyridine			
1	sulfonic acid (3)	....	$C_5H_4N\cdot SO_3H$	159.11
2	tricarboxylic acid (1, 2, 3, 4)	carbocinchomeronic	$C_5H_2N(COOH)_3 + 1\frac{1}{2}H_2O$	238.07
3	tricarboxylic acid (1, 2, 4, 5)	See *berberonic acid*		
4	tricarboxylic acid (1, 3, 4, 5)	β-carbocinchomeronic	$C_5H_2N(COOH)_3 + 3H_2O$	265.10
5	tricarboxylic acid (1, 2, 4, 6)	trimesitinic acid..	$C_5H_2N(COOH)_3 + 2\frac{1}{2}H_2O$	256.09
6	Pyridone. See	*hydroxypridine*		
7	Pyrimidine......	m-diazine........	$\overline{CH:CH\cdot CH:N\cdot CH:N}$	80.05
8	Pyrocatechin.	See *catechol*		
9	Pyrocoll.........	....	$C_4H_3\cdot N(CO)_2\cdot NC_4H_3$	186.06
10	Pyrogallol (1, 2, 3)	pyrogallic acid...	$C_6H_3(OH)_3$........	126.05
11	carboxylic acid (1, 2, 3, 4)	....	$C_6H_2(OH)_3COOH + H_2O$	188.06
12	dimethylether ..	....	$C_6H_3\cdot OH(OCH_3)_2$..	154.08
13	trimethylether..	....	$C_6H_3\cdot(OCH_3)_3$.....	168.10
14	Pyromellitic acid.	benzene tetracarbonic acid (1, 2, 4, 5)	$C_6H_2\cdot(COOH)_4 + 2H_2O$	290.08
15	Pyromucic acid ..	....	$C_4H_3O\cdot COOH$.....	112.03
16	Pyrone..........	....	$C_5H_4O_2$...........	96.03
17	Pyrotartaric acid.	....	$CH_3\cdot CH(COOH)\cdot CH_2\cdot COOH$	132.06
18	Pyrotritaric acid.	See *uvic acid*		
19	Pyroxylin.......	....	$C_{12}H_{14}(ONO_2)_6O_4$...	594.16
20	Pyrrol..........	....	$C_4H_4:NH$.........	67.05
21	carboxylic acid(*a*)	....	$C_4H_3NH(COOH)$...	111.05
22	Pyrrolidine......	pentazane.......	$C_4H_8:NH$.........	71.08
23	Pyrroline.......	....	$C_4H_6:NH$.........	69.06
24	Pyruvic acid.....	pyroracenic acid..	$CH_3\cdot CO\cdot COOH$...	88.03
25	Quercite (d.).....	....	$C_6H_7\cdot(OH)_5$.......	164.10
26	Quercetin........	....	$C_{15}H_{10}O_7 + 2H_2O$ ..	338.11
27	Quercitrine......	....	$C_{21}H_{22}O_{12} + 2H_2O$	502.21
28	Quinaldine. See	*methylquinoline* (2)		
29	Quinazoline......	....	$C_6H_4\overline{CH:N\cdot CH:N}$	130.06
30	Quinhydrone.....	....	$C_6H_4\cdot O_2\cdot C_6H_4\cdot(OH)_2$	218.08
31	Quinic acid......	....	$(HO)_4\cdot C_6H_7\cdot COOH$	192.10
32	Quinine.........	....	$C_{20}H_{24}O_2N_2$........	324.21
33	hydrochloride...	....	$C_{20}H_{24}O_2N_2\cdot HCl + 2H_2O$	396.70

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	need.	....	......	......	v. s.	v. sl. s.	i.
2	rhomb.	....	249–50	......	$1.2^{15°}$	sl. s.	i.
3							
4	leaf.	....	261	......	s. h.	......	......
5	....	....	244	......	v. s.	......	....
6							
7	cryst.	....	22	124	s.	s.	.....
8							
9	yel. leaf.	....	268.9	subl.	i.	v. sl. s.	v. sl. s.
10	need. or leaf.	....	·133	293 d.	v. s.	$100^{25°}$	v. s.
11	need.	....	195–200	subl.	sl. s.	v. s.	s.
12	....	....	51–2	253	......	......	....
13	colorl. need.	....	47	235 (241)	......	v. s.	v. s.
14	triclinic tab.	....	anh. 264 d.	......	$14.2^{16°}$	v. s.	....
15	monocl.	....	132–4	subl.	$3.6^{16°}$; v. s. h.	v. s.	v. s.
16	prisms	....	32.5	315	v. sl. s.	s.	v. s.
17	triclinic	1.411	112 (118)	......	v. s.	v. s.	v. s.
18							
19	....	....	exp.l	......	......	i. al. eth. mxt.	
20	colorl. liq.	$0.967^{21°}$	......	130	i.	v. s.	v. s.
21	pr.	....	192 d.	......	s.	s.	s.
22	colorl. liq.	$0.852^{22.5°}$	......	87.5–8.5	∞	∞	∞
23	liq.	$0.910^{20°}$	......	90	v. s.	∞	∞
24	colorl.	$1.288^{18°}$	13.6	165 sl. d.	∞	∞	∞
25	colorl. monocl.	$1.585^{13°}$	234 (225)	......	10 c.	sl. s.	i.
26	yel. need.	....	313–4 d.	subl.	0.35	......	....
27	yel. need. or leaf.	....	168 d.	......	v. sl. s.	sl. s.	0.8
28							
29	....	....	48	243	......	......	....
30	dk. gr'n. pr.	....	......	subl.	s. h.	v. s.	v. s.
31	colorl. monocl.	1.637	161.6	dec.	$40^{9°}$	s.	v. sl. s.
32	silky need. f. bz.	....	174–5	......	$0.057^{25°}$	166	22
33	silky need.	....	156–190	......	$5.6^{25°}$	$166^{25°}$	$0.42^{25°}$

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Quinine sulfate...	....	$(C_{20}H_{24}O_2N_2)_2H_2SO_4 + 7\ H_2O$	872.61
2	Quinizarin.......	p-dihydroxyanthraquinone	$C_6H_4(CO)_2C_6H_2(OH)_2$	240.06
3	Quinol..........	hydroquinone....	$C_6H_4\cdot(OH)_2$ (p.) ...	110.05
4	Quinoline.......	....	C_9H_7N............	129.06
5	Quinolinic acid...	pyridine dicarbonic acid (2, 3)	$C_5H_3N\cdot(COOH)_2$...	167.05
6	Quinone.........	benzoquinone....	$C_6H_4\cdot O_2$...........	108.03
7	chlorimide......	....	$C_6H_4N(Cl)O$.......	141.50
8	dichlordiimide.	....	$C_6H_4(NCl)_2$........	174.96
9	dioxime........	....	$C_6H_4(NOH)_2$.......	138.06
10	Quinoxaline......	quinazine........	C_6H_4N: CHCH: N.	130.09
11	Racemic acid....	....	$[CH(OH)\cdot COOH]_2 + H_2O$	168.06
12	Raffinose........	....	$C_{18}H_{32}O_{16} + 5H_2O$..	594.34
13	Resorcinol	dihydroxybenzene (m.)	$C_6H_4\cdot(OH)_2$ (m.)...	110.05
14	dimethyl ether..	....	$C_6H_4(OCH_3)_2$......	138.08
15	methyl ether...	....	$HO\cdot C_6H_4\cdot OCH_3$...	124.06
16	Resorcylic acid (α) COOH, $(OH)_2$ 1, 3, 5	....	$C_6H_3(OH)_2COOH + 1\frac{1}{2}H_2O$	181.07
17	Resorcylic acid (β) COOH, $(OH)_2$ (1, 2, 4)	....	$C_6H_3(OH)_2COOH + 3H_2O$	208.10
18	Retene..........	....	$C_{18}H_{18}$............	234.14
19	Rhamnite.......	....	$CH_3\cdot(CHOH)_4CH_2OH$	166.11
20	Rhamnose.......	isodulcite........	$C_6H_{12}O_5 + H_2O$....	182.11
21	Ricinoleic acid...	....	$C_{18}H_{34}O_3$...........	298.27
22	Rosaniline.......	....	$C(OH)\cdot(CH_3\cdot C_6H_3\cdot NH_2)\cdot(C_6H_4NH_2)_2$	319.19
23	Rosinduline......	....	$HN: C_{10}H_5 : NC_6H_4N(C_6H_5)$	321.14
24	Rosolic acid	....	$C_{20}H_{16}O_3$..........	304.13
25	Rufigallic acid...	....	$C_{14}H_2O_2(OH)_6$......	304.06
26	Rufiopin........	....	$C_{14}H_8O_6$...........	272.06
27	Rufol..........	β-dihydroxyanthracene	$C_{14}H_{10}O_2$..........	210.08
28	Sabinene........	....	$C_{10}H_{16}$............	136.13
29	Saccharic acid (d.)	....	$C_4H_4(OH)_4(COOH)_2$	210.08
30	Saccharine.......	benzoylsulfimide .	$C_6H_4\cdot CO\cdot NH\cdot SO_2$	183.11
31	Safrol..........	....	$C_{10}H_{10}O_2$..........	162.08
32	Salicin..........	....	$C_{13}H_{13}O_2(OH)_5$.....	286.14

ORGANIC COMPOUNDS (Continued)

No	Crystal-line form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms per 100 c.c. of Water	Alcohol	Ether
1	silky need.	....	205 ($2H_2O$)	......	$0.14^{25°}$	$1.16^{25°}$	sl. s.
2	red. need.	....	194	subl.	......	s.	s.; s. bz.; s. KOH
3	hex. pr. f. w.	....	169	285	$5.9^{15°}$	v. s.	v. s.
4	colorl. liq.	1.090	−22.6	236.2	sl. s.	∞	∞
5	monocl. pr.	....	231 d.	......	$0.55^{6.5°}$	sl. s.	v. sl. s.
6	yel. pr. f. w.	1.31	115.7	subl.	sl. s.	v. s.	v. s
7	yel. cryst.	....	84.7–5.0	d.	sl. s. c.; s. h.	v. s. h.	v. s.
8	need. f. w.	....	124 d.	......	sl. s. h.	s. h.	s.
9	need	....	......	240 d.	......	......	....
10	wh. cryst.	....	27	229.5	s.	s.	s.
11	colorl. tricl.	....	205–6	......	$20.6^{20°}$	2.1 c.	....
12	need...	1.465	118–9 anh.	......	$14^{20°}$	v. s.	....
13	colorl. tab.	1.272	116	276.5	v. s.	v. s.	v. s.
14	colorl. liq.	$1.080^{0°}$	......	214–5	v. sl. s.	s.	s.
15	liq.	....	......	243–4	sl. s.	∞	∞
16	pr. or. need.	....	232–3	......	v. s. h.	v. s.	v. s.
17	need. f. eth.	....	204–6	......	s. h.	v. s.	s.
18	leaf.	1.13	98.5	390	......	v. s. h.	s.
19	tricl. pr.	....	121	......	v. s.	v. s.	v. sl. s.
20	colorl. f. w.	1.471	92–3	......	50 c.	v. sl. s.	....
21	colorl.	0.945	16–7	......	i.	∞	∞
22	red. need. or tab.	....	......	......	sl. s.	s.	s.
23	br. leaf.	....	198–9	......	i.	v. s.	v. s.
24	red. leaf.	....	270	d.	v. sl. s.	v. s. h.	s.
25	or red.	....	......	......	i.	s. conc. H_2SO_4	s.; s. alk.
26	yel. red.	....	subl.	d.	sl. s. h.	s.	sl. s.; s. acet. a.
27	yel. need.	....	d.	......	......	v. s.	....
28	colorl. liq.	$0.840^{20°}$	......	162–6	i.	∞	∞
29	....	....	......	......	v. s.	v. s.	sl. s.
30	colorl. monocl.	....	220 d.	......	$0.43^{25°}$	3.1	....
31	colorl.	1.108	11	233	i.	v. s.	v. s.
32	colorl. leaf.	1.43	201	......	3.6^{15}	s.	i.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Salicylamide (o.)	....	$HO \cdot C_6H_4 \cdot CO \cdot NH_2$	137.06
2	Salicylic acid (o.)	....	$HO \cdot C_6H_4 \cdot COOH$ ..	138.05
3	acetate	....	$C_2H_3O_2 \cdot C_6H_4 \cdot COOH$	180.06
4	aldehyde	....	$HO \cdot C_6H_4 \cdot CHO$	122.05
5	anhydride	....	$(C_6H_4)_2O_2(CO)_2$	240.06
6	anilide	....	$HO \cdot C_6H_4 \cdot CO \cdot NHC_6H_5$	213.10
7	phenyl ether	....	$C_6H_5O \cdot C_6H_4 \cdot COOH$	214.08
8	Saligenin	....	$HO \cdot C_6H_4 \cdot CH_2OH$ (o.)	124.06
9	Salipyrine	antipyrene salicylate	$C_{18}H_{18}O_4N_2$	326.16
10	Salol.	See *phenyl salicytate*		
11	Santalic acid	....	$C_{15}H_{14}O_6$	274.11
12	Santonin	....	$C_{15}H_{18}O_3$	246.14
13	Sarcolactic acid	paralactic acid ...	$CH_3 \cdot CH(OH) \cdot COOH$	90.05
14	Sarcosine	methyl glycine ...	$CH_3NH \cdot CH_2 \cdot COOH$	89.06
15	Sebacic acid	....	$(CH_2)_8 \cdot (COOH)_2$ ...	202.14
16	Selenium ethyl	....	$(C_2H_5)_2Se$	137.28
17	methyl	....	$(CH_3)_2Se$	109.25
18	Semicarbazide	....	$NH_2 \cdot CO \cdot NH \cdot NH_2$.	75.06
19	hydrochloride	....	$NH_2 \cdot CO \cdot NH \cdot NH_2 \cdot HCl$	111.53
20	Serine	....	$C_2H_3(OH)(NH_2)COOH$	105.06
21	Silicoacetic acid	....	$CH_3 \cdot SiOOH$	76.09
22	Silicobenzoic acid	....	$C_6H_5 \cdot SiOOH$	138.13
23	Silicon ethyl	siliconanane	$(C_2H_5)_4Si$	144.22
24	methyl	....	$(CH_3)_4Si$	88.16
25	phenyl chloride	....	$C_6H_5 \cdot SiCl_3$	211.47
26	Silver fulminate	....	$Ag_2C_2N_2O_2$	299.78
27	Skatole	methylindole (3) .	C_9H_9N	131.08
28	Sobrerol (d. or l.)	pinol hydrate	$C_{10}H_{18}O_2$	170.14
29	Sodium acetanilide	....	$C_6H_5N(Na) \cdot C_2H_3O$.	157.07
30	ethyl	....	NaC_2H_5	52.04
31	glycerate	....	$NaC_3H_7O_3$	114.05
32	mercaptide	....	C_2H_5SNa	84.10
33	Solanidine	....	$C_{40}H_{61}O_2N$	587.50
34	Solanine	....	$C_{32}H_{51}O_{11}N(?)$	625.42
35	Sorbic acid	....	$CH_3 \cdot CH : CH \cdot CH : CH \cdot COOH$	112.06
36	Sorbinose	....	$C_6H_{12}O_6$	180.10
37	Sorbite (d.)	....	$C_6H_{14}O_6 + \frac{1}{2}H_2O$ ...	191.12
38	Sparteine	....	$C_{15}H_{26}N_2$	234.22

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c of Water	Alcohol	Ether
1	colorl. leaf.	....	138 (140)	270 d.	sl. s.	s. Na_2CO_3 sol.	....
2	colorl. need.	....	158	......	$0.27^{20°}$	$46.85^{25°}$	$47.68^{25°}$
3	sm. w. need.	....	132	d. >140	v. sl. s.	v. s.	v. s.
4	....	$1.173^{13°}$	-10	196.5	sl. s.	v. s.	v. s.
5	yel. amor.	....	200-20	d.	i.	v. s.	v. s.
6	pr.	....	135	......	sl. s. h.	s.	s.
7	leaf.	....	113	355 d.	v. sl. s.	v. s.	v. s.
8	colorl. rhomb.	$1.161^{25°}$	86	subl. 100	v. s.	v. s.	v. s.
9	cryst. powd.	....	92	......	$0.5^{15°}$; $4.0^{100°}$	v. s. chl.	s.
10							
11	red micr. pr.	....	104	......	i.	s.	s.
12	colorl. pr.	1.187	169-70	......	0.02 c.; 0.4 h.	s.	sl. s.
13	liq.	....	......	......	∞	∞	∞
14	rhomb.	....	210 d.	......	v. s.	sl. s.	....
15	thin colorl leaf.	....	133-3.5	$295^{100mm.}$	$0.1^{17°}$ $2.0^{100°}$	v. s.	v. s.
16	liq.	$>H_2O$	......	107-8	......	......	....
17	liq.	$>H_2O$	......	58.2	......	......	....
18	pr. fr. al.	....	96	......	v. s.	s.	s. b.
19	pr.	....	175 d.	......	v. s.	i. abs.	i.
20	monocl.	....	......	......	s.	i.	i.
21	....	....	......	......	i.	......	s.
22	....	....	92	......	i.	......	s.
23	....	0.8341°	......	159	i.	......	....
24	liq.	$<H_2O$	......	30-31	......	......	....
25	liq.	....	......	197	d.	d.	....
26	sm. need.	....	exp.	......	sl. s.	s. NH_4OH	i. HNO_3
27	leaf. f. lgr.	....	95	265-6	0.05 c.	v. s.	....
28	colorl.	....	150	270-1	$3.3^{15°}$	v. s.	v. s.
29	powd.	....	......	......	......	......	....
30	....	....	......	......	......	......	....
31	wh. powd.	....	......	......	d.	s.	....
32	wh. cryst.	....	......	......	s.	s.	....
33	need.	....	207	subl.	sl. s.	s. h.	sl. s.
34	need.	....	254	d.	sl. s.	s. h.	i.
35	colorl. need. f. w.	....	134.5	228 d.	sl. s.	v. s.	v. s.
36	colorl. rhomb.	1.654	164	......	200	v. sl. s. h.	....
37	colorl.	....	110-11	......	s.	v. sl. s.	....
38	colorl. oil.	$1.020^{20°}$	......	abt. 328 d.	v. sl. s.	v. s.	v. s.

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
1	Sparteine bisulfate		$C_{15}H_{26}N_2 \cdot H_2SO_4 + 5H_2O$	422.38
2	Starch		$(C_6H_{10}O_5)x$	162.08
3	Stearic acid		$CH_3 \cdot (CH_2)_{16} \cdot COOH$	284.29
4	Stearine	tristeraine	$(C_{18}H_{35}O_2)_3C_3H_5$	890.88
5	Stearolic acid		$C_{18}H_{32}O_2$	280.26
6	Stearone		$C_{35}H_{70}O$	506.56
7	Stearoxylic acid		$C_{18}H_{32}O_4$	312.26
8	Stilbene	diphenyl ethylene	$C_6H_5 \cdot CH : CH \cdot C_6H_5$	180.10
9	Strychnine		$C_{21}H_{22}O_2N_2$	334.19
10	hydrochloride		$C_{21}H_{22}O_2N_2 \cdot HCl + 1\frac{1}{2}H_2O$	397.68
11	nitrate		$C_{21}H_{22}O_2N_2 \cdot HNO_3$	397.21
12	sulphate		$(C_{21}H_{22}O_2N_2)_2 \cdot H_2SO_4 + 5H_2O$	856.54
13	Suberic acid		$(CH_2)_6 \cdot (COOH)_2$	174.11
14	Suberone	cycloheptanone	$C_7H_{12}O$	112.10
15	Succinamide		$NH_2 \cdot CO \cdot CH_2 \cdot CH_2 \cdot CO \cdot NH_2$	116.07
16	Succinic acid		$HOOC \cdot CH_2 \cdot CH_2 \cdot COOH$	118.05
17	aldehyde		$C_2H_4(CHO)_2$	86.05
18	anhydride		$(CH_2 \cdot CO)_2O$	100.03
19	Succinimide		$C_4H_5O_2N + H_2O$	117.06
20	Succinonitrile	See *ethylene cyanide*		
21	Succinyl chloride		$ClOC \cdot CH_2 \cdot CH_2 \cdot COCl$	154.96
22	Sucrose	cane sugar	$C_{12}H_{22}O_{11}$	342.18
23	Sulphaldehyde		$(CH_3 \cdot CHS)_3$	180.29
24	Sulfamine benzoic acid (o.)		$NH_2 \cdot SO_2 \cdot C_6H_4 \cdot COOH$	201.13
25	Sulfanilic acid	aminobenzene sulfonic acid (p.)	$NH_2 \cdot C_6H_4 \cdot SO_3H$ (p.) $+ H_2O$	191.14
26	Sulfoacetic acid		$SO_3H \cdot CH_2 \cdot COOH + H_2O$	158.11
27	Sulfobenzid		$(C_6H_5)_2 \cdot SO_2$	218.14
28	Sulfobenzoic acid (o.)		$SO_3H \cdot C_6H_4 \cdot COOH + 3H_2O$	256.16
29	Sulfobenzoic acid (m.)		$SO_3H \cdot C_6H_4 \cdot COOH + 2H_2O$	238.14
30	Sulfobenzoic acid (p.)		$SO_3H \cdot C_6H_4 \cdot COOH + 3H_2O$	256.16
31	Sulfocyanic acid	thiocyanic acid	$CNSH$	59.08
32	Sulfonal	acetone diethyl sulfone	$(CH_3)_2C(SO_2C_2H_5)_2$	228.26
33	Sylvestrene (d.)		$C_{10}H_{16}$	136.13
34	Tannic acid	tannin	$C_{14}H_{10}O_9$	322.08

ORGANIC COMPOUNDS (Continued)

No.	Crystal-line form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	rh'b'dr.	....	136	......	$91^{25°}$	$42^{25°}$	i.
2	wh. amor.	1.5	no m. p.	......	i.	i.	i.
3	colorl.	$0.843^{80°}$	69.3	$291^{100mm.}$	i.	2.5 c.	v. s.
4	colorl.	$0.862^{84°}$	71–1.5	......	i.	v. sl. s.	s.
5	colorl. pr. f. al.	....	48	260	i.	sl. s. c.	v. s.
6	leaf.	0.7979	87.8	......	......	sl. s. h.	sl. s. h.
7	leaf.	....	86	......	i.	s.	s.
8	colorl. tab.	....	124	306–7	i.	sl. s.	v. s.
9	tetr. f. al.	....	abt. 268 d.	......	$0.016^{25°}$	0.9	0.018
10	colorl. trim.	....	......	......	2.9 c.	1.7	......
11	colorl. need.	....	dec.	......	$2.4^{25°}$	$0.83^{25°}$	$0.04^{25°}$ chl.
12	colorl. pr	....	anh. 200	......	$3.2^{25°}$	$1.5^{25°}$	i.
13	colorl. need. or tab.	....	140	abt. 300	$0.14^{16°}$	s.	v. sl. s.
14	oil	$0.96^{20°}$	......	180	sl. s.	v. s.	s.
15	colorl need.	....	242–3	......	$0.45^{15°}$; $11^{100°}$	i.	i.
16	colorl. monocl.	1.564	187	234	$6.8^{20°}$; $121^{100°}$	sl. s.	sl. s.
17	liq.	......	......	201–3	s.	s.	s.
18	colorl need. f. al.	$1.104^{20°}$	119.6	......	i.	s.	v. sl. s.
19	octah'dr.	....	124	287–8	v. s.	s.	v. sl. s.
20							
21	colorl.	1.412	16–7	190–2	......	......	......
22	colorl. monocl.	$1.588^{18°}$	abt. 160–70 d.	......	200 c.	sl. s.	......
23	....	....	45–6	subl.	i.	s.	s.
24	rh'b'dr.	....	165–7 (155)	......	v. s.	v. s.	v. s.
25	rhomb. pl.	....	d. 280	......	$0.89^{15°}$	v. sl. s.	v. sl. s.
26	tab. f. w.	....	84–6	......	s.	v. s.	i.
27	tab.	....	123–4	......	i.	sl. s.	sl. s.
28	trim.	....	anh.250*	......	50....	v, s.	i.
29	....	....	anh. 141	......	......	......	v. s.
30	need.	....	259–50	......	v. s.	v. s.	v. s.
31	liq.	....	5	......	∞	v. s.	v. s.
32	prisms	....	126	300 d.	$2^{15°}$; $6.7^{100°}$	50 h. abs.	sl. s.
33	....	$0.8510^{16°}$	......	176–7	......	......	......
34	amor. powd.	....	abt. 200	......	20	167	v. sl. s.

* The anhydride melts at 118° C.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Tartaric acid (i.)	mesotartaric acid	$HOOC(CHOH)_2 \cdot COOH + H_2O$	168.06
2	" " (d. or l.)		$HOOC(CHOH)_2 \cdot COOH$	150.05
3	Tartronic acid		$CH(OH) \cdot (COOH)_2 + \frac{1}{2}H_2O$	129.04
4	Taurine		$NH_2 \cdot CH_2 \cdot CH_2 \cdot SO_3H$	125.13
5	Taurocholic acid		$C_{26}H_{45}NO_7S + H_2O$	533.45
6	Tellurium ethyl		$(C_2H_5)_2Te$	185.58
7	methyl		$(CH_3)_2Te$	157.55
8	Teraconic acid		$(CH_3)_2C : C(COOH) CH_2COOH$	158.08
9	Terebene		$C_{10}H_{16}$	136.13
10	Terebic acid		$C_7H_{10}O_4$	158.08
11	Terephthalic acid		$C_6H_4 \cdot (COOH)_2$ (p.)	166.05
12	aldehyde		$C_6H_4 \cdot (CHO)_2$ (p.)	134.05
13	nitrile		$C_6H_4 \cdot (CN)_2$ (p.)	128.05
14	Terpenol		$C_{10}H_{18}O$	154.14
15	Terpinene		$C_{10}H_{16}$	136.13
16	Terpineol		$C_{10}H_{18}O$	154.14
17	Terpine hydrate		$C_{10}H_{20}O_2 + H_2O$	190.18
18	Terpinolene		$C_{10}H_{16}$	136.13
19	Tetrabromo-benzene (sym.) (1, 2, 4, 5)		$C_6H_2Br_4$	393.68
20	Tetrabromo-benzene (uns.) (1, 3, 4, 5)		$C_6H_2Br_4$	393.68
21	Tetrabromo-benzene		$C_6H_2Br_4$	393.68
22	Tetrabromo-benzene		$C_6H_2Br_4$	393.68
23	Tetrabrom-ethane (sym.)		$CHBr_2 \cdot CHBr_2$	345.68
24	fluoresceïn.	See *eosine*		
25	Tetrachlor-acetone (sym.)		$CHCl_2 \cdot CO \cdot CHCl_2 + 2H_2O$	231.88
26	aniline		$NH_2 \cdot C_6HCl_4$ (1, 2, 3, 4, 5)	230.87
27	"		$NH_2 \cdot C_6HCl_4$ (2, 3, 5, 6)	230.87
28	benzene		$C_6H_2Cl_4$ (1, 2, 3, 4)	215.84
29	"		$C_6H_2Cl_4$ (1, 2, 3, 5)	215.84
30	"		$C_6H_2Cl_4$ (1, 2, 4, 5)	215.84
31	ethane. See *acetylene tetrachloride*			
32	" (uns.)		$CH_2Cl \cdot CCl_3$	167.84
33	ethylene		$CCl_2 : CCl_2$	165.83
34	hydroquinone		$C_6Cl_4(OH)_2$	247.84
35	Tetradecane (n.)		$C_{14}H_{30}$	198.24
36	Tetradecylene		$C_{14}H_{28}$	196.22
37	Tetraethyl-ammonium hydroxide		$(C_2H_5)_4NOH$	147.18

ORGANIC COMPOUNDS (Continued)

No	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	tab.	1.666	140–3 anh.	......	125 c	......	....
2	colorl. monocl.	1.76	168–70	......	$139^{20°}$	v. s.	v. sl. s.
3	colorl. pr. f. eth.	....	185–7 d.	......	v. s.	v. s.	sl. s.
4	tetr. need.	....	88	d.	$6.5^{12°}$	i.	i.
5	deliq. need.	....	......	......	v. s.	v. s.	sl. s.
6	liq.	....	......	<100	......	......	....
7	liq.	....	......	82	i.	......	....
8	tricl.	....	164 d.	to. anh.	v. s.	v. s.	v. s.
9	liq.	$0.876^{0°}$	......	156	......	......	....
10	monocl.	$0.815^{21°}_{4}$	174	d.	sl. s.	s.	s.
11	powd.	....	subl.	......	v. v. sl. s.	v. sl. s.	v. sl. s.
12	need. f. w.	....	116	245–8	$1.5^{100°}$	v. s.	v. sl. s.
13	colorl.	....	215 (222)	......	i.	sl. s.	sl. s.
14	pr.	....	69–70	......	......	......	....
15	colorl. liq.	$0.865^{20°}$	......	179–82	i.	∞	∞
16	colorl.	$0.936^{20°}$	25	218	i.	v. s.	v. s.
17	colorl. rhomb.	....	116–7	......	$0.5^{25°}$	10	v. s.
18	colorl. liq.	....	......	183–5	i.	∞	∞
19	pr.	$3.027^{20°}$	174–5	......	......	......	....
20	need.	....	98.5	329	......	v. sl. s.	v. s.
21	sm. need. f. al.	....	160	......	......	......	....
22	....	....	136–8	......	......	......	....
23	....	2.972	<–20	......	i.	∞	∞
24							
25	....	....	48	......	......	......	....
26	....	....	118	......	v. s. bz.	v. s.	v. s.
27	....	....	90	......	......	......	....
28	need.	....	45–6	254	......	sl. s.	v. s.
29	need.	....	50–1	246	i.	v. sl. s.	....
30	monocl.	$1.858^{21°}$	140–1	243–6	......	sl. s. h.	s.
31							
32	....	$1.6116^{0°}$	......	135	......	......	....
33	colorl. liq.	$1.608^{25°}$	–19	119	i.	∞	∞
34	monocl. f. bz.	....	232	subl.	i.	v. s.	v. s.; s. bz.
35	colorl. liq.	$0.765^{20°}$	5.5	252.5	i.	v. s.	v. s.
36	liq.	$0.785^{0°}_{4}$	......	$127^{15mm.}$	......	......	....
37	need.	....	d. 190	......	......	s.	....

PHYSICAL CONSTANTS OF

No	Name	Synonyms	Formula	Mol. wt.
1	Tetraethyl-benzene (sym.)	....	$C_6H_2(C_2H_5)_4$ (1, 2, 4, 5)	190.18
2	urea...........	....	$(C_2H_5)_2N\cdot CO\cdot N(C_2H_5)_2$	244.18
3	Tetrahydro-benzene	....	C_6H_{10}.............	82.08
4	Δ′-Tetrahydro-benzoic acid	....	$CH_2\cdot(CH_2)_3\cdot CH:C\cdot COOH$	126.08
5	Tetrahydro-naphthalene	....	$C_{10}H_{12}$.............	132.10
6	Tetrahydro-naphthol (α)	....	$HO\cdot C_6H_3CH_2(CH_2)_2CH_2$	148.10
7	Tetrahydro-naphthylamine	....	$C_{10}H_{11}\cdot NH_2$(α, ar.)	147.11
8	Tetrahydro-naphthylamine	....	$C_{10}H_{11}\cdot NH_2$(β, ac.)	147.11
9	Δ′-Tetrahydro-phthalic acid	....	$C_8H_{10}O_4$...........	170.08
10	Tetrahydro-quinoline	....	$C_9H_{11}N$...........	133.10
11	Tetrahydroquinone	....	$C_6H_4O_2H_4$........	112.06
12	Tetrahydroxy-benzene (sym.)	....	$C_6H_2(OH)_4$ (1, 2, 4, 5)	142.05
13	Tetrahydroxy-benzoic acid	....	$(HO)_4C_6H\cdot COOH$..	186.05
14	Tetrahydroxy-quinone	....	$(HO)_4C_6O_2$........	172.03
15	Tetraiodoethylene	....	$CI_2:CI_2$...........	531.73
16	Tetraiodopyrrol..	iodol............	C_4I_4NH...........	570.74
17	Tetramethyl-ammonium hydroxide	....	$(CH_3)_4\cdot NOH + 5H_2O$	181.19
18	benzene (1, 2, 3, 4)	....	$C_6H_2\cdot(CH_3)_4$.......	134.11
19	" (1, 2, 3, 5)	See *isodurene*		
20	" (1, 2, 4, 5)	durene..........	$C_6H_2\cdot(CH_3)_4$.......	134.11
21	diaminobenz-hydrol	....	$HO\cdot CH[C_6H_4N(CH_3)_2]_2$	270.19
22	diaminobenzo-phenone	Michler's ketone	$(CH_3)_2N\cdot C_6H_4\cdot CO\cdot C_6H_4\cdot N(CH_3)_2$	268.18
23	diaminodiphenyl-amine	....	$NH[C_6H_4N(CH_3)_2]_2$	255.19
24	diaminotri-phenylmethane	....	$C_6H_5CH[C_6H_4N(CH_3)_2]_2$	330.22
25	leuco-aniline....	....	$[(CH_3)_2\cdot N\cdot C_6H_4]_2\cdot CH\cdot C_6H_4\cdot NH_2$	345.24
26	succinic acid ..	....	$C_2(CH_3)_4(COOH)_2$..	174.11
27	urea..........	....	$(CH_3)_2N\cdot CO\cdot N(CH_3)_2$	116.11
28	Tetramethylene-diamine	putrescine.......	$NH_2\cdot(CH_2)_4\cdot NH_2$...	88.11

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	0.888	13	250	i.	v. s.	v. s.
2	liq.	....	......	210–5	s. a.	......	....
3	colorl. liq.	....	......	82–4	......	......	....
4	....	$1.109^{20°}$	29	243	sl. s.	......	....
5	colorl. liq.	$0.981^{13°}$	......	205	i.	v. s.	v. s.
6	monocl. wh. pl.	....	69	$265^{705mm.}$	sl. s. h	v. s.	v. s.
7	oil	....	......	277	s. dil. a.	......	....
8	liq.	$1.034\frac{15}{15}°$	......	251–2	......	......	....
9	leaf.	....	......	......	......	......	....
10	colorl.-br.	$1.063\frac{15}{15}°$	abt. 20	251	v. sl. s.	∞	∞
11	wh. pr.	....	78	......	......	......	....
12	leaf.	....	215–20	......	s.	s.	v. s.
13	....	....	148	......	......	......	....
14	cryst.	....	......	......	s. h.	v. s.	sl. s.
15	monocl. pr.	$2.983^{20°}$	192	subl.	v. s. CS_2	......	s.
16	yel. need.	....	......	d. 140–50	0.02	$5.8^{15°}$ 90%	50; s. bz.
17	....	....	62–3	dec.	$\infty^{63°}$	v. s.	....
18	colorl.	$0.882^{9°}$	–4	204	......	......	....
19							
20	monocl. leaf.	$0.838^{81°}$	79	abt. 190	v. s. bz.	v. s.	v. s.
21	pr.	....	96	......	......	s.	s.
22	glit. leaf.	....	171.5 (174)	d. 360	......	v. s.	v. s.
23	tetr. pl. f. CS_2	....	119	......	......	s.	....
24	tricl. need. (leaf.)	....	93 (102)	......	i.	s.	s.
25	glit. cryst.	....	151–2	......	......	v. sl. s.	....
26	....	....	95	subl.	1:45	s.	s.
27	liq.	0.972	......	177	......	v. s.	v. s.
28	leaf.	....	27–8	159	v. s.	......	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Tetranitro-diphenol	....	$[C_6H_2(NO_2)_2OH]_2$...	366.08
2	diphenyl	....	$C_{12}H_6(NO_2)_4$.......	334.08
3	diphenyl methane	....	$C_{13}H_8\cdot(NO_2)_4$......	348.10
4	methane.....	....	$C(NO_2)_4$...........	196.03
5	naphthalene (α)	....	$C_{10}H_4\cdot(NO_2)_4$......	308.06
6	" (1, 3, 6, 8)	....	$C_{10}H_4\cdot(NO_2)_4$......	308.06
7	" (1, 3, 5, 8)	....	$C_{10}H_4\cdot(NO_2)_4$......	308.06
8	phenol.........	....	$HO\cdot C_6H\cdot(NO_2)_4$ (1, 2, 3, 4, 6)	274.05
9	Tetraphenyl-ethane (sym.)	....	$(C_6H_5)_2CH\cdot CH(C_6H_5)_2$	334.18
10	ethylene.......	....	$(C_6H_5)_2C:C(C_6H_5)_2$	332.16
11	urea..........	....	$(C_6H_5)_2N\cdot CO\cdot N(C_6H_5)_2$	364.18
12	Tetrazole.	....	$CH:N\cdot NH\cdot N:N$	70.05
13	Tetrolic acid.....	....	$CH_3\cdot C:C\cdot COOH$..	84.03
14	Tetronal........	....	$C_9H_{20}O_4S_2$.........	256.29
15	Thallin..........	p-methoxytetra-hydroquinoline	$C_9H_{10}ON\cdot CH_3$.....	163.10
16	Thebaine........	paramorphine....	$C_{19}H_{21}O_3N$.........	311.18
17	hydrochloride...	....	$C_{19}H_{21}O_3N\cdot HCl + H_2O$	365.63
18	Theïne.	See *caffeïne*		
19	Theobromine.....	dimethylxanthine	$C_7H_8O_2N_4$.........	180.10
20	Theophylline.....	....	$C_7H_8O_2N_4 + H_2O$...	198.11
21	Thialdine........	....	$C_6H_{13}NS_2$..........	163.24
22	Thianthrene.....	....	$(C_6H_4)_2S_2$.........	216.19
23	Thiazole.........	....	C_3H_3NS...........	85.10
24	Thio-acetamide. .	....	$CH_3\cdot CS\cdot NH_2$......	75.11
25	acetanilide.....	....	$C_6H_5\cdot NH\cdot CS\cdot CH_3$	151.14
26	acetic acid.....	....	$CH_3\cdot COSH$.......	76.10
27	aniline........	....	$(C_6H_4\cdot NH_2)_2S$......	216.18
28	benzaldehyde (α)	....	$C_6H_5\cdot CHS$........	122.11
29	" (β)	....	$C_6H_5\cdot CHS$........	122.11
30	benzoic acid....	....	$C_6H_5\cdot COSH$.......	138.11
31	carbonyl chloride.	See *thiophosgene*		
32	cresol (o.)......	....	$C_6H_4\cdot CH_3\cdot SH$.....	124.13
33	" (m.).....	....	$C_6H_4\cdot CH_3\cdot SH$.....	124.13
34	" (p.).....	....	$C_6H_4\cdot CH_3\cdot SH$.....	124.13
35	cyanic acid. See	*sulfocyanic acid*		
36	cyanuric acid...	....	$C_3H_3N_3S_3$..........	177.24
37	diphenylamine..	....	$S\cdot(C_6H_4)_2\cdot NH$.....	199.14
38	hydroquinone...	....	$C_6H_4(SH)_2$.........	142.18
39	naphthene......	benzothiophene...	C_8H_6S............	134.11

ORGANIC COMPOUNDS (Continued)

No	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	yel. need.	....	225	......	i	s	....
2	....	....	140	......	i.	sl. s.	sl. s.
3	yel. pr. f. glac. acet. a.	....	172	......	......	i.	i.
4	....	1.650	13	126	i.	s.	s.
5	rhomb. f. chl.	....	259	exp.	v. sl. s.	v. sl. s.	v. sl. s.
6	long need. f. al.	....	203	exp.	i.	......	....
7	yel. tetr. f. acet.	....	194–5	......	v. s. acet.	sl. s.	sl. s. chl.
8	yel. need.	....	130	exp.!	v. s.	v. sl. s. bz.	v. sl. s. lgr
9	colorl. need. f. chl.	1.182	209	279–83	s. acet. a.	sl. s. h.	14 bz.
10	colorl. monocl.	....	221	415–25	i.	v. sl. s.	v. s. bz.
11	colorl.	....	183	......	i.	......	....
12	leaf.	....	156	subl.	s.	s.	i.
13	colorl. tab.	....	76	203	v. s.	v. s	v. s.
14	glit. leaf.	....	85	......	0.22 c.	v. s.	v. s.
15	rhombic.	....	42–3	283	s. h.	v. s.	v. s.
16	glit. pr. f. al.	....	193	......	v. sl. s.	10 c.; v. s. bz.	$0.71^{10°}$; v. s. chl.
17	rhomb.	....	......	......	......	$6.3^{10°}$	....
18							
19	rhomb. f. w.	....	337	subl.	$0.03^{18°}$; $0.67^{100°}$	$0.023^{17°}$	0.95 h. chl.
20	need. f. w.	....	264	......	$0.44^{15°}$, $1.3^{37°}$	sl. s.	sl. s.
21	monocl.	1.191	43	d.	sl. s.	s.	v. s.
22	....	....	158	360	......	......	....
23	colorl. liq.	$1.200^{17°}$	......	117	......	......	....
24	monocl. tab. f. eth.	....	108	......	v. s.	s.	s.
25	need.	....	75	dec.	i.	s. alk.	....
26	colorl. liq.	$1.074^{10°}$	......	93	∞	∞	∞
27	need. f. w.	....	105	......	v. sl. s.	s.	s.
28	wh.	....	160	d.	i.	i.	s. bz.
29	need.	....	225	......	......	sl. s.	s. acet. a.
30	....	....	24	......	i.	∞	∞
31							
32	leaf.	....	15	194	i.	s.	......
33	....	$1.0625^{20°}_{4}$	<–20	195.5	......	......	....
34	leaf. f. eth.	....	43	190–1	i.	s.	v. s.
35							
36	yel. need.	....	d. 200	......	v. s. h.	v. sl. s.	v. sl. s.
37	rhomb.	....	180	371 d.	v. s. bz	sl. s.	s.
38	leaf.	....	98	......	......	......	....
39	leaf.	....	31	221	......	......	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Thio-phenol	phenyl mercaptan	$C_6H_5 \cdot SH$	110.11
2	phosgene	thiocarbonyl chloride	$CSCl_2$	114.98
3	resorcinol (1, 3)		$C_6H_4(SH)_2$	142.18
4	semicarbazide		$NH_2 \cdot CS \cdot NH \cdot NH_2$	91.13
5	tolene		$C_4H_3 \cdot CH_2 \cdot S$	98.11
6	urea		$NH_2 \cdot CS \cdot NH_2$	76.11
7	urethane		$NH_2 \cdot CO \cdot SC_2H_5$	105.13
8	Thionin	Lauth's violet	$C_{12}H_9N_3S$	227.16
9	Thiophene		C_4H_4S	84.10
10	alcohol		$C_4H_3S \cdot CH_2OH$	114.11
11	aldehyde		$C_4H_3S \cdot CHO$	112.10
12	carboxylic acid (α) (1, 2)		$C_4H_3S \cdot COOH$	128.10
13	carboxylic acid (β) (1, 3)		$C_4H_3S \cdot COOH$	128.10
14	Thujone	tanacetone	$C_{10}H_{16}O$	152.13
15	Thymene		$C_{10}H_{16}$	136.13
16	Thymohydroquinone		$C_{10}H_{14}O_2$	166.11
17	Thymol	methyl-isopropyl phenol (3, 6)	$CH_3 \cdot C_6H_3(OH) \cdot C_3H_7$	150.11
18	Thymoquinone		$(CH_3)_2CH \cdot C_6H_2(CH_3)O_2$	164.10
19	Thymotic acid		$C_6H_2(CH_3)(C_3H_7)COOH \cdot OH$	194.11
20	Tiglic acid		$CH_3 \cdot CH : C(CH_3) \cdot COOH$	100.06
21	Tin diethyl		$Sn(C_2H_5)_2$	176.78
22	tetraethyl		$Sn(C_2H_5)_4$	234.86
23	tetramethyl		$Sn(CH_3)_4$	178.80
24	triethyl		$Sn_2(C_2H_5)_6$	411.64
25	Tolane	diphenyl acetylene	$C_6H_5 \cdot C : C \cdot C_6H_5$	178.08
26	Tolidine (o.)	4, 4′-diamino-3, 3′-dimethyl-diphenyl	$(NH_2)CH_3 : C_6H_3 \cdot C_6H_3 : CH_3(NH_2)$	212.14
27	" (m.)		$(CH_3 \cdot C_6H_3 \cdot NH_2)_2$	212.14
28	" (p.)		$(CH_3 \cdot C_6H_3 \cdot NH_2)_2$	212.14
29	Toluamide (o.)		$CH_3 \cdot C_6H_4 \cdot CO \cdot NH_2$	135.08
30	" (m.)		$CH_3 \cdot C_6H_4 \cdot CO \cdot NH_2$	135.08
31	" (p.)		$CH_3 \cdot C_6H_4 \cdot CO \cdot NH_2$	135.08
32	Toluene		$C_6H_5 \cdot CH_3$	92.06
33	sulfonic acid (o.)		$CH_3 \cdot C_6H_4 \cdot SO_3H + 2H_2O$	208.16
34	" " (m.)		$CH_3 \cdot C_6H_4 \cdot SO_3H + H_2O$	190.14
35	" " (p.)		$CH_3 \cdot C_6H_4 \cdot SO_3H + 4H_2O$	244.19
36	" amide (o.)		$CH_3 \cdot C_6H_4 \cdot SO_2 \cdot NH_2$	171.14
37	Toluic acid (o.)		$CH_3 \cdot C_6H_4 \cdot COOH$	136.06
38	" " (m.)		$CH_3 \cdot C_6H_4 \cdot COOH$	136.06

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	liq.	1.078	......	168	i.	v. s.	∞
2	red. liq.	1.508	......	73	i.	s.	s.
3	cryst.	....	27	243; $116.4^{1mm.}$	......	......	......
4	need. f. w.	....	181–3	......	s.	......	......
5	....	1.0194	18	113	......	......	......
6	pr	....	180	......	9	v. sl. s.	v. sl. s.
7	leaf. pl.	....	102	subl.	s. h.	s.	s.
8	br. leaf.	....	......	......	v. sl. s.	sl. s.	......
9	liq.	1.071	......	84	i.	s.	s. H_2SO_4
10	....	....	......	207	......	......	......
11	oil	$1.215^{21°}$	......	198	......	......	s.
12	need. f. w.	....	126.5	260	v. s. h.	v. s.	v. s.
13	need. f. w.	....	136	......	......	......	......
14	colorl. liq.	$0.913^{20°}$	......	203	......	......	......
15	liq.	....	......	165	......	......	......
16	....	....	139.5	subl.	s. h	......	......
17	colorl. pl.	$0.979^{49}_{4}°$	49.6	228–32	$0.083^{15°}$ $0.11^{100°}$	v. s.	v. s.
18	yel. pr. tab.	....	45.5	200	v. sl. s.	v. s.	v. s.
19	cryst.	....	120	subl.	sl. s. h.	s.	s.
20	colorl. pr.	$0.964^{76°}$	64.5	198.5	sl. s. c.; v. s. h.	s.	s.
21	oil	....	......	dec.	i.	s.	......
22	colorl. liq.	$1.187^{23°}$	......	181	i.	s.	......
23	colorl. liq.	$1.314^{0°}$	......	78	i.	......	s.
24	liq.	$1.4115^{0°}$	......	270 d.	......	i.	......
25	colorl. leaf.	....	60	275–300	......	s.	v. s.
26	colorl. sc. f. h. w.	....	129–30	......	sl. s.	v. s.	v. s.
27	cryst.	....	108–9	......	......	......	......
28	leaf.	....	103	......	s. h.	v. s.	v. s.
29	colorl. need.	....	abt. 139	......	sl. s. c.; v. s. h.	v. s.	v. s.
30	....	....	94 (97)	......	sl. s.	......	......
31	colorl. need. f. w.	....	158–9 (165)	......	sl. s. c.; v. s. h.	v. s.	sl. s.
32	colorl. liq.	$0.866^{20°}$	......	111	i.	∞	∞
33	cryst.	....	......	$129^{25mm.}$	v. s.	s.	......
34	need.	....	......	......	v. s.	s.	......
35	leaf. or pr.	....	92	......	v. s.	s.	......
36	octahd'r.	....	155	......	$0.1^{9°}$	$3.6^{5°}$	......
37	colorl. need.	....	102 (104)	259	s. h.	v. s.	s. chl.
38	colorl. pr. f. w.	....	110.5	263	$1.67^{100°}$	v. s.	v. s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Toluic acid (p.)...	....	$CH_3 \cdot C_6H_4 \cdot COOH$	136.06
2	" anhydride (o.)	....	$(CH_3 \cdot C_6H_4 \cdot CO)_2O$	254.11
3	Toluidine (o.)....	amino-toulene (o.)	$CH_3 \cdot C_6H_4 \cdot NH_2$....	107.08
4	" (m.)...	" " (m.)	$CH_3 \cdot C_6H_4 \cdot NH_2$...	107.08
5	" (p.)....	" " (p.)	$CH_3 \cdot C_6H_4 \cdot NH_2$...	107.08
6	Tolunitrile (o.)...	....	$CH_3 \cdot C_6H_4 \cdot CN$.....	117.06
7	" (m.)..	....	$CH_3 \cdot C_6H_4 \cdot CN$.....	117.06
8	" (p.)...	....	$CH_3 \cdot C_6H_4 \cdot CN$.....	117.06
9	Toluquinone CH_3, O, O (1, 2, 5)	....	$CH_3 \cdot C_6H_3O_2$.......	122.05
10	Toluylene diamine (2, 4)	diamino-toluene..	$CH_3 \cdot C_6H_3 \cdot (NH_2)_2$..	122.10
11	Toluylene diamine (3, 4)	" " ..	$CH_3 \cdot C_6H_3 \cdot (NH_2)_2$..	122.10
	Tolyl			
12	acetic acid (o.)..	....	$CH_3 \cdot C_6H_4 \cdot CH_2 \cdot COOH$	150.08
13	" " (p.)..	....	$CH_3 \cdot C_6H_4 \cdot CH_2 \cdot COOH$	150.08
14	carbinol (o.)....	....	$CH_3 \cdot C_6H_4 \cdot CH_2OH$	122.08
15	" (m.)...	....	$CH_3 \cdot C_6H_4 \cdot CH_2OH$	122.08
16	" (p.)....	....	$CH_3 \cdot C_6H_4 \cdot CH_2OH$	122.08
17	chloride (o.)....	....	$CH_3 \cdot C_6H_4 \cdot CH_2Cl$..	140.53
18	" (m.)...	....	$CH_3 \cdot C_6H_4 \cdot CH_2Cl$..	140.53
19	" (p.)....	....	$CH_3 \cdot C_6H_4 \cdot CH_2Cl$..	140.53
20	diphenylmethane (p.)	....	$(C_6H_5)_2CH \cdot C_6H_4(CH_3)$	258.14
21	" (m.)	....	$(C_6H_5)_2CH \cdot C_6H_4(CH_3)$	258.14
22	hydrazine (o.)...	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot NH_2$	122.10
23	" (m.)..	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot NH_2$	122.10
24	" (p.)..	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot NH_2$	122.10
25	hydroxylamine..	....	$CH_3 \cdot C_6H_4 \cdot NH(OH)$	123.08
26	mustard oil (o.)	....	$CH_3 \cdot C_6H_4 \cdot NCS$....	149.13
27	" " (p.)	....	$CH_3 \cdot C_6H_4 \cdot NCS$....	149.13
28	phenyl ketone.	See *phenyl tolyl ketone*		
29	Tolylene-alcohol (o.)	....	$C_6H_4(CH_2OH)_2$.....	138.08
30	" " (m.)	....	$C_6H_4(CH_2OH)_2$.....	138.08
31	" " (p.)	....	$C_6H_4(CH_2OH)_2$.....	138.08
32	chloride (o.)....	....	$C_6H_4(CH_2Cl)_2$......	174.98
33	" (m.)...	....	$C_6H_4(CH_2Cl)_2$......	174.98
34	" (p.)....	....	$C_6H_4(CH_2Cl)_2$......	174.98
35	cyanide (o.)....	....	$C_6H_4(CH_2CN)_2$.....	156.08
36	" (m.)....	....	$C_6H_4(CH_2CN)_2$.....	156.08
37	" (p.)....	....	$C_6H_4(CH_2CN)_2$.....	156.08
38	Triacetamide....	....	$(CH_3CO)_3N$........	143.08

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. $H_2O = 1$ (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. need.	....	176-7	275	s. h.	v. s.	v. s.
2	colorl. f. eth.	....	36-7	abt. 325	......	......	......
3	liq.	$1.003^{15°}$	......	199.5	sl. s.	∞	∞
4	liq.	$0.989^{20°}$	......	203	sl. s.	∞	∞
5	leaf.	....	42.9 (45)	200.5	$0.74^{21°}$	......	......
6	liq.	0.998	......	205.2	i.	∞	∞
7	liq.	....	......	208-10	0.085 c.; 1.67 h	......	......
8	....	....	38 (29.5)	217.3	i.	v. s.	v. s.
9	yel. leaf.	....	67	subl.	s. h.	v. s.	v. s.
10	colorl. need. f. lgr.	....	99	280	s.	v. s.	v. s.
11	colorl. sc.	....	88.5	265	s.	......	......
12	colorl. need.	....	88-9	......	v. s. h.	......	......
13	colorl. need.	....	91	266	sl. s. c.; v. s. h.	......	......
14	colorl. need.	$1.023^{40°}$	34	223	1 c.	v. s.	v. s.
15	colorl. liq.	$1.036^{0°}$	<-20	217	5 c.	......	s.
16	colorl. need.	....	59	217	sl. s. c.	v. s.	v. s.
17	colorl. liq.	....	......	197-9	i.	v. s.	v. s.
18	....	....	......	195-6	i.	v. s.	v. s.
19	....	....	......	200	i.	v. s.	v. s.
20	pr.	....	71	>360	i.	s. h.	s.
21	....	....	59.5	......	......	sl. s.	s.
22	colorl. tab. f. lgr.	....	56	......	v. s. chl.	v. s.	v. s.
23	liq.	....	......	240-4	......	......	......
24	colorl. leaf.	....	65-6 (61)	240-4 d	v. s. bz.	v. s.	v. s.
25	colorl. leaf. f. bz.	....	94	......	1 c.; 50 h.	v. s.	v. s.
26	....	....	......	238-9	i.	v. s.	∞
27	....	....	26-7	242.4	i.	v. s.	v. s.
28							
29	pl. f. eth.	....	64	......	s.	s.	s.
30	cryst.	$1.161^{18°}$	46-7	......	v. s.	......	s.
31	need.	....	112-3	......	v. s.	v. s.	v. s.
32	f. lgr.	$1.393^{0°}$	54	239-41	......	v. s.	v. s. lgr.
33	....	$1.302^{20°}$	34.2	250-5	......	......	......
34	pl. or leaf.	$1.417^{0°}$	100	240-50	......	......	......
35	cryst.	....	59-60	......	......	s.	s.
36	cryst.	....	28-9	305-10^{300mm}	......	s.	s. chl.
37	lng. pr. f. eth.	....	98	......	sl. s. h.	s. h.	s. chl.
38	sm. need.	....	78-9	......	......	......	s.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Triacetin	glyceryl triacetate	$(CH_3COO)_3C_3H_5$	218.11
2	Triacetonamine		$C_9H_{17}NO + H_2O$	173.16
3	Triamino-azobenzene	Bismarck brown	$NH_2 \cdot C_6H_4 \cdot N_2 \cdot C_6H_3 \cdot (NH_2)_2$ (3, 2′, 4′)	227.14
4	Triaminobenzene (1, 2, 3)		$C_6H_3(NH_2)_3$	123.10
5	" (1, 2, 4)		$C_6H_3(NH_2)_3$	123.10
6	Triaminobenzoic acid COOH, $(NH_2)_3$ (1, 3, 4, 5)		$(NH_2)_3C_6H_2COOH + \frac{1}{2}H_2O$	176.10
7	" (1, 2, 3, 5)		$(NH_2)_3C_6H_2COOH$	167.10
8	Triaminophenol (2, 4, 6)		$C_6H_2OH(NH_2)_3$	139.10
9	Triamylamine		$(C_5H_{11})_3N$	227.27
10	Triazole (sym.)	pyrrodiazole	$CH : N \cdot NH \cdot CH : N$	69.05
11	Tribenzoylmethane		$CH(COC_6H_5)_3$	328.13
12	Tribenzylamine		$(C_6H_5 \cdot CH_2)_3N$	287.18
13	Tribrom-acetic acid		$CBr_3 \cdot COOH$	296.76
14	aniline (2, 4, 6, 1)		$Br_3 \cdot C_6H_2 \cdot NH_2$	329.79
15	benzene (sym.) (1, 3, 5)		$C_6H_3 \cdot Br_3$	314.77
16	" (v.) (1, 2, 3)		$C_6H_3 \cdot Br_3$	314.77
17	" (uns.) (1, 3, 4)		$C_6H_3 \cdot Br_3$	314.77
18	hydrine	glyceryl tribromhydrine	$CH_2Br \cdot CHBr \cdot CH_2Br$	280.79
19	phenol (sym.) (2, 4, 6)		$HO \cdot C_6H_2Br_3$	330.77
20	resorcinol		$(HO)_2 \cdot C_6H \cdot Br_3$ (2, 4, 6)	346.77
21	Tributyl amine		$(C_4H_9)_3N$	185.22
22	Tributyrine.	See *butyrene*		
23	Tricarballylic acid		$(CH_2 \cdot COOH)_2 \cdot CH \cdot COOH$	176.06
24	Trichlor-acetal		$CCl_3 \cdot CH(OC_2H_5)_2$	221.46
25	acetamide		$CCl_3 \cdot CO \cdot NH_2$	162.40
26	acetic acid		$CCl_3 \cdot COOH$	163.38
27	acetyl chloride		$CCl_3 \cdot COCl$	181.83
28	aniline (v.) (1, 2, 3, 4)		$C_6H_2Cl_3 \cdot NH_2$	196.41
29	" (uns.) (1, 2, 4, 5)		$C_6H_2Cl_3 \cdot NH_2$	196.41
30	" (sym.) (1, 2, 4, 6)		$C_6H_2Cl_3 \cdot NH_2$	196.41
31	benzene (v.) (1, 2, 3)		$C_6H_3Cl_3$	181.40
32	" (uns.) (1, 2, 4)		$C_6H_3Cl_3$	181.40

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	colorl. liq.	$1.161^{15°}_{5°}$	......	258–9	sl. s.	∞	∞
2	tetrag. need.	....	58	......	s.	......	s.
3	or. red.	....	143.5	......	......	v. s.	v. s.
4	cryst.	....	103	330	v. s.	v. s.	v. s.
5	leaf f. chl.	....	44	abt 340	v. s.	v. s.	v. sl s.; s. chl
6	need.	....	......	......	s. h.	i.	i.
7	warts. f. w.	....	......	......	v. s. h.	v. sl. s. h.	i.
8	need.	....	......	257	......	......	....
9	liq.	....	......	257	......	......	....
10	need.	....	121	260	s.	s	sl. s
11	need	....	224–5	subl.	s. CS_2	v. sl. s.	v. sl. s
12	monocl. f. al.	....	91.3	......	v. sl. s.	s. h.	s.
13	colorl. tab.	....	135	245 d	v. s.	v. s.	v. s.
14	sm. need.	....	119	......	i.	sl. s.	s.
15	need.	....	119.6	278	i.	sl. s. h.	....
16	monocl. pr.	$2.658^{16°}$	87.4	......	......	......	....
17	need.	....	44	275–6	......	sl. s	....
18	pr.	$2.436^{23°}$	16	220	i.	......	....
19	monocl. pr.	....	92; (96)	subl.	sl. s.	v. s.	s.
20	need.	....	111	......	sl. s.	v. s.	s.
21	....	$0.778^{20°}$	......	216.5	......	v. s.	v. s.
22							
23	colorl. rhomb.	....	166	dec.	v. s.	v. s.	sl. s.
24	....	1.288	......	197	0.5	∞	∞
25	tab. f. w.	....	141	239	v. sl. s.	v. s.	v. s.
26	colorl. rhomb.	$1.630^{60°}$	57.3	195	v. s.	s.	s
27	colorl. liq.	....	......	118	......	......	....
28	need. f. lgr.	....	67.5	292	s. lgr.	......	....
29	need. f. lgr.	....	95–6	abt. 270	s. lgr.	......	....
30	lng. need. f. lgr.	....	77.5	262	......	s.	v. s. lgr.
31	pl. f. al.	....	53.4	218–9	......	sl. s.	....
32	colorl.	$1.466^{10°}$	16–7	213	i.	......	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	benzene (sym.) (1, 3, 5)	....	$C_6H_3Cl_3$	181.40
2	benzoic acid (uns.) (1, 2, 4, 5)	....	$C_6H_2Cl_3 \cdot COOH$	225.40
3	" (v.) (1, 2, 3, 4)	....	$C_6H_2Cl_3 \cdot COOH$	225.40
4	" COOH, Cl (1, 3, 4, 5)	....	$C_6H_2Cl_3 \cdot COOH$	225.40
5	ethane (α)	....	$CCl_3 \cdot CH_3$	133.40
6	" (β)	....	$CH_2Cl \cdot CHCl_2$	133.40
7	ethyl alcohol	....	$CCl_3 \cdot CH_2OH$	149.40
8	ethylene	....	$CHCl : CCl_2$	131.38
9	hydrine	glyceryl trichlorhydrine	$CH_2Cl \cdot CHCl \cdot CH_2Cl$	147.42
10	hydroquinone	....	$(HO)_2 \cdot C_6H \cdot Cl_3$ (2, 3, 5)	213.40
11	methane.	See *chloroform*		
12	methyl-chloroformate	disphosgene	$Cl \cdot COO \cdot CCl_3$	197.83
13	phenol	....	$HO \cdot C_6H_2 \cdot Cl_3$ (2, 4, 6)	197.40
14	" OH, Cl (1, 2, 3, 5)	....	$HO \cdot C_6H_2Cl_3$	197.40
15	propane (1, 2, 3).	See *trichlorhydrine*		
16	quinone	....	$O_2 \cdot C_6H \cdot Cl_3$ (2, 3, 5)	211.38
17	Tricyanogen chloride	cyanuric chloride	$C_3N_3Cl_3$	184.40
18	Tridecane (n.)	....	$C_{13}H_{28}$	184.22
19	Tridecylene	....	$C_{13}H_{26}$	182.21
	Triethyl			
20	amine	....	$(C_2H_5)_3N$	101.13
21	arsine	....	$(C_2H_5)_3As$	162.08
22	benzene (sym.)	....	$C_6H_3 \cdot (C_2H_5)_3$ (1, 3, 5)	162.14
23	carbinol	....	$(C_2H_5)_3 \cdot COH$	116.13
24	phosphine	....	$(C_2H_5)_3 \cdot P$	118.15
25	phosphine oxide	....	$(C_2H_5)_3PO$	134.15
26	phosphine sulfide	....	$(C_2H_5)_3PS$	150.21
27	phosphite	....	$(C_2H_5)_3PO_3$	166.15
28	silicol	....	$(C_2H_5)_3SiOH$	132.19
29	silicol ethylether	....	$(C_2H_5)_3SiOC_2H_5$	160.22
30	silicon hydride	....	$(C_2H_5)_3SiH$	116.19
31	silicon oxide	....	$[(C_2H_5)_3Si]_2O$	246.36
32	Triethylenediamine	....	$(C_2H_4)_3N_2$	112.11
33	Trihydroxy-benzoic acid	pyrogallol carbosylic acid	$(HO)_3C_6H_2COOH$ (2, 3, 4)	170.05
34	benzophenone	....	$C_{13}H_{10}O_4$	230.08
35	glutaric acid (d. or l.)	....	$(CHOH)_3(COOH)_2$	180.06
36	glutaric acid (i.)	....	$(CHOH)_3(COOH)_2$	180.06
37	methylene (α)	....	$C_3H_6O_3$	90.05
38	pyridine (sym.)	....	$NC_5H_2(OH)_3$ (2, 4, 6)	127.05
39	Triiodo-acetic acid	....	$CI_3 \cdot COOH$	437.80
40	benzene (uns.) (1, 2, 4)	....	$C_6H_3I_3$	455.82

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	lng.need.	....	63.4	208.5	......	s.	......
2	sm. need. f. w.	....	163	subl.	s. h.	s.	......
3	need. f. al.	....	129	......	sl. s.	......	......
4	need. f. al.	....	203	subl.	s. h.	s.	s. gbz
5	colorl. liq.	$1.325^{26°}$	......	74.5	i.	∞	∞
6	" "	$1.478^{0°}$	......	114	i.	∞	∞
7	rhomb. tab.	$1.550^{23°}$	18	151	sl. s.	∞	∞
8	colorl. liq.	$1.460^{25°}_{25}$	-70	87.1	i.	∞	∞
9	....	1.417	......	158	i.	......	......
10	prisms	....	134	subl.	$0.6^{15°}$	v. s.	v. s.
11							
12	....	....	......	127.5–80	......	......	......
13	rhomb.	....	68	244	$0.08^{25°}$	v. s.	v. s.
14	lng.need. f. al.	....	53–4	252–3	sl. s. h.	s.	s.
15							
16	yel. leaf.	....	165–6	......	i.	sl. s.	v. s.
17	....	....	146	190	sl. s.	v. s.	v. s.
18	colorl. liq.	$0.757^{20°}$	-6.2	234	i.	v. s.	v. s.
19	" "	0.845	......	233	i.	v. s.	v. s.
20	colorl. liq.	0.733	......	89	v. s.	∞	∞
21	....	1.151	......	140 d.	......	......	......
22	colorl. liq.	$0.864^{17°}$	......	214–8	i.	v. s.	v. s.
23	colorl. liq.	$0.840^{20°}$	......	140–2	sl. s.	s.	s.
24	colorl. liq.	0.812	......	127	i.	s.	s.
25	liq.	....	......	240	......	......	......
26	....	....	94	......	......	......	......
27	....	....	......	155.5–6.5	i.	v. s.	v. s.
28	liq.	$0.8709^{0°}$	......	154	i.	......	......
29	liq.	$0.8403^{0°}$	......	153	......	......	......
30	liq.	$0.751^{0°}$	......	107	......	......	......
31	liq.	$0.859^{0°}$	......	231	......	......	......
32	liq.	....	......	210	......	......	......
33	need. f. w.	....	d. 195–200	......	$0.13^{12°}$	s.	v. s.
34	yel. leaf	....	133	......	......	s. h.	......
35	colorl. f. acet.	....	128	......	v. s.	v. s.	s. acet.
36	colorl.tab. f. acet.	....	152 d.	......	v. s.	v. s. h.	s. acet.
37	need.	....	61	subl.	s.	s.	s.
38	cryst....	....	d. 220–30	......	s.	......	......
39	yel. leaf.	....	150 d.	......	s.	......	......
40	sm. need.	....	76	subl.	......	s.	......

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Triisobutyl amine	....	$(C_4H_9)_3N$	185.22
2	Trimellitic acid . .	....	$C_6H_3\cdot(COOH)_3$ (1, 2, 4)	210.05
3	Trimesic acid (sym.)	....	$C_6H_3\cdot(COOH)_3$ (1, 3, 5)	210.05
4	Trimethyl-acetic acid	....	$(CH_3)_3C\cdot COOH$ . .	102.08
5	amine..........	....	$(CH_3)_3N$	59.08
6	amine hydro-chloride	....	$(CH_3)_3N\cdot HCl$......	95.54
7	arsine..........	....	$(CH_3)_3As$	120.03
8	benzoic acid....	....	$(CH_3)_3\cdot C_6H_2\cdot COOH$ (1, 2, 4, 5)	164.10
9	" "	β-isodurylic acid..	$(CH_3)_3\cdot C_6H_2\cdot COOH$ (1, 3, 5)	164.10
10	carbinol........	....	$(CH_3)_3COH$........	74.08
11	citrate	....	$C_6H_5O_7(CH_3)_3$	234.11
12	ethylene.......	....	$(CH_3)_2C:CH(CH_3)$	70.08
13	phosphate......	....	$(CH_3)_3PO_4$	140.10
14	phosphine......	....	$(CH_3)_3P$...........	76.10
15	pyridine.	See *collidine* (γ)		
16	quinoline (α, β, γ)	....	$C_{12}H_{13}N$..........	171.11
17	" (o, p, a, n)	....	$C_{12}H_{13}N$	171.11
18	" (α, o, m)	....	$C_{12}H_{13}N$...........	171.11
19	" (α, o. p.)	....	$C_{12}H_{13}N$...........	171.11
20	" (α, γ, p.)	....	$C_{12}H_{13}N$...........	171.11
21	urea...........	....	$(CH_3)_2NH\cdot CO\cdot N(CH_3)_2$	102.10
22	Trimethylene....	cyclo-propane....	C_3H_6............	42.05
23	bromide	....	$CH_2Br\cdot CH_2\cdot CH_2Br$	201.88
24	diamine........	....	$NH_2\cdot(CH_2)_3\cdot NH_2$...	74.10
25	dicarboxylic acid (α)	....	$CH_2\cdot CH_2\cdot C(COOH)_2$	130.05
26	glycol..........	....	$CH_2(OH)\cdot CH_2\cdot CH_2(OH)$	76.06
27	Trimyristine.	See *myristin*		
28	Trinitraniline. .	" T. N. A. ".....	$C_6H_2(NO_2)_3NH_2$....	228.06
29	Trinitro-acetoni-trile	trinitrocyan-methane	$C(NO_2)_3CN$........	176.03
30	benzene (1, 2, 4)	....	$C_6H_3\cdot(NO_2)_3$.......	213.05
31	" (sym.) (1, 3, 5)	....	$C_6H_3\cdot(NO_2)_3$.......	213.05
32	chlorobenzene (sym.)	picryl chloride....	$C_6H_2\cdot Cl(NO_2)_3$.....	247.52
33	cresol.........	....	2, 4, 6–$(NO_2)_3\cdot C_6H\cdot CH_3(OH)$ (1, 3)	243.06
34	naphthalene....	....	$C_{10}H_5\cdot(NO_2)_3$ (1, 2, 5)	263.06
35	"	....	$C_{10}H_5\cdot(NO_2)_3$ (1, 3, 5)	263.06

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr $H_2O = 1$ (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq.	0.785^{-0}	......	184–6	i.	v. s.	∞
2	colorl.	....	216 d. (228)	......	s. h.	......	s.
3	colorl. pr. f. w	....	345–50	subl. <300	s.	v. s.	s.
4	colorl.	$0.905^{5°}$	35.5	163.7	2.2	v. s.	v. s.
5	colorl.	$0.662^{-5°}$	......	3.5	v. s.	v. s.	s.
6	....	....	271–5 d.	......	v. s.	s.	i.
7	liq.	....	......	<100	sl. s.	......	......
8	colorl. need. f. bz.	....	149–50	......	v. sl. s. h.	v. s.	v. s.
9	colorl.	....	152	......	v. sl. s.	v. s.	v. s.
10	colorl.	....	25	82.9	v. s.	s.	∞
11	colorl. tricl.	....	78.5–9.0	283–7 d.	......	......	......
12	....	$0.6783^{0°}$	......	36–8	......	......	......
13	....	1.220	......	197	......	s.	s.
14	....	>1	......	40	i.	......	s.
15							
16	....	....	abt. 65	285	......	......	......
17	pr.	....	43	285–7	v. s.	v. s.	v. s.
18	monocl.	....	......	......	......	......	......
19	monocl. pr. f. lgr	....	46	$260^{71.9mm.}$	i.	v. s.	v. s. lgr.
20	need. f. w	....	63–4	......	s.	......	......
21	....	....	75.5	232.5	v. s.	v. s.	s.
22	gas.....	....	−126.6	−34	i.	v. s.	v. s.
23	liq.	$1.973^{0°}$	......	165	......	s.	s.
24	....	....	......	135–6	......	∞	∞
25	pr. or need.	....	139	......	v. s.	......	s.
26	visc. liq.	$1.053^{18°}$	......	214	∞	......	......
27							
28	monocl. yel. need.	....	188	exp.	......	s.	......
29	....	....	41.5	exp. 220	d.	d.	s.
30	yel.	....	57.5	......	sl. s.	......	......
31	yel. pl. f. bz.	1.688	122	......	$0.04^{16°}$	$1.91^{0°}$	v. s.
32	....	....	85°	......	......	......	......
33	yel. need. f. w.	....	105–6	......	$0.22^{0°}$; $0.81^{100°}$	v. s.	v. s.
34	colorl. need. f. al.	....	112–3	......	......	s.	......
35	yel. monocl. f. chl.	....	122	......	v. s. chl.	v. s.	v. s. glac. acet. a.

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Trinitro-naphthalene....	....	$C_{10}H_5\cdot(NO_2)_3$ (1, 3, 8)	263.06
2	orcinol.........	....	$C_6(NO_2)_3CH_3(OH)_2$	259.06
3	phenol (sym.)	See *picric acid*		
4	" (2, 3, 6) (γ)	....	$(NO_2)_3\cdot C_6H_2OH$ ...	229.05
5	" (3, 4, 6) (β)	....	$(NO_2)_3\cdot C_6H_2OH$ ...	229.05
6	resorcinol (2, 4, 6)	stypynic acid...	$C_6H(NO_2)_3(OH)_2$...	245.05
7	tertiary-butyl-toluene (2, 4, 6)	artificial musk...	$(NO_2)_3C_6H\cdot CH_3$ $[C(CH_3)_3]$	283.13
8	toluene (sym.)..	"T. N. T."......	$CH_3\cdot C_6H_2\cdot(NO_2)_3$ (1, 2, 4, 6)	227.06
9	"	....	$CH_3\cdot C_6H_2\cdot(NO_2)_3$ (1, 2, 3, 4)	227.06
10	"	....	$CH_3\cdot C_6H_2\cdot(NO_2)_3$ (1, 2, 4, 5)	227.06
11	triphenyl carbinol	....	4, 4′, 4″-$(NO_2\cdot C_6H_4)_3\cdot COH$	395.13
12	" methane	....	4, 4′, 4″-$(NO_2\cdot C_6H_4)_3\cdot CH$	379.13
13	xylene.........	....	$(CH_3)_2\cdot C_6H\cdot(NO_2)_3$ (1, 4) (2, 4, 6)	241.08
14	"	....	$(CH_3)_2\cdot C_6H\cdot(NO_2)_3$ (1, 3) (2, 4, 6)	241.08
15	Trional.........	....	$C_8H_{18}O_4S_2$..........	242.27
16	Trioxymethylene	metaformaldehyde	$C_3H_6O_3$............	90.05
17	"	(isomer of above).	$C_3H_6O_3$............	90.05
18	Tripalmitin	See *palmitin*		
19	Triphenyl-acetic acid	....	$(C_6H_5)_3C\cdot COOH$...	288.13
20	amine.........	....	$(C_6H_5)_3N$..........	245.13
21	benzene........	....	$C_6H_3\cdot(C_6H_5)_3$ (1, 3, 5)	306.14
22	carbinol........	....	$(C_6H_5)_3COH$.......	260.13
23	guanidine (α)...	....	$C_6H_5N:C(NHC_6H_5)_2$	287.16
24	" (β)...	....	$HN:C(NHC_6H_5)N(C_6H_5)_2$	287.16
25	methane.......	....	$(C_6H_5)_3CH$........	244.13
26	methane carboxylic acid (o.)	....	$(C_6H_5)_2CH(C_6H_4)\cdot COOH$	288.13
27	phosphine......	....	$(C_6H_5)_3P$..........	262.15
28	Triquinoyl.......	....	$C_6H_{16}O_{14}$..........	312.13
29	Tripropylamine..	....	$(C_3H_7)_3N$..........	143.18
30	Tristearine.	See *stearine*		
31	Trithiocarbonic acid	....	$CS(SH)_2$...........	110.21
32	Tropacocaine....	....	$C_8H_{14}ON\cdot CO\cdot C_6H_5$	245.16
33	hydrochloride...	....	$C_8H_{14}ON\cdot CO\cdot C_6H_5\cdot HCl$	281.62

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A) Air = 1	Melting-point °C	Boiling-point °C	Solubility in grms. per 100 c.c. of Water	Alcohol	Ether
1	monocl. f. chl.	....	218	......	v. sl. s. chl.	0.046[illegible] (88%)	v. sl. s.
2	lng. yel. need.	....	147	......	......	sl. s.	....
3							
4	need	....	117	......	sl. s.	v. s.	v. s.
5	need.	....	96	......	......	v. s	v. s.
6	yel. pr.	....	174–5	......	sl s.	s.	sl. s.
7	need. f. al.	....	96–7	......	......	s.	....
8	colorl. monocl. f. al.	1.654	82 (80.8)	......	0.02^{15}	v. sl. s. c v. s. h.	sl. s.
9	leaf. f. al	1.62	112	......	i.	sl. s. c.	v. s.
10	....	....	104	......	i.	sl. s. c.	v. s.
11	cryst. f. bz.	....	171–2	......	s. bz.	sl. s. h.	sl. s.
12	sc. f. bz.	....	206–7 (203)	......	v. sl. s. glac. acet. a.	v. sl. s. bz	v. sl. s.
13	need.	....	139	......	v. sl. s.	......	....
14	need.	....	182	......	i.	v. sl. s. c.;	sl. s.
15	colorl. tab	....	76	dec.	0.3	v. s.	v. s.
16	wh	....	171	......	i.	i.	i.
17	long need.	....	60–1	subl.	s	s.	s.
18							
19	monocl. pr.	....	264 d.	......	sl. s.	s.	sl. s.
20	monocl. pr. f. eth.	....	127	347–8	s. acet.	sl. s.	v. s. bz.
21	rhomb. tab. f. eth.	1.206	169–70	......	s. bz.	sl. s.	sl. s.
22	hex. pr.	....	162	abt. 360	v. s. bz	v. s.	v. s.
23	need. or pr. f. al.	....	143	d.	v. sl. s.	s. h.	....
24	tab.	....	131	......	v. sl. s.	v. s.	v. s.
25	colorl. leaf.	$1.057^{85°}_{85}$	92	258–9	v. s. chl.	sl. s. c.; v. s. h.	v. s.
26	need. f. al	....	161–2	......	i.	s.	s.
27	monocl. pr.	....	75 (79)	abt. 360	i.	s.	v. s.
28	micr. need	....	95	......	s. h.	i.	i.
29	colorl. liq.	....	......	157	v. sl. s.	∞	s.
30							
31	br. oil.	....	γ 76	57 d.	i. d.	s. Na_2CO_3	s.
32	glit. cryst f. eth.	....	49	......	sl. s.	v. s.; v. s. bz.	v. s.; v. s. chl.
33	need.	....	271 (283 d.)	......	s.	......	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Tropaic acid	-phenylhydracrylic acid	$C_6H_5CH(COOH)CH_2OH$	166.08
2	Tropine		$C_8H_{15}ON$	141.13
3	Tryptophane	β-indole alanine	$C_6H_4NHCH:C\cdot CH_2CH(NH_2)COOH$	204.11
4	Tyrosine	p-hydroxyphenyl alanine	$HO\cdot C_6H_4\cdot CH_2\cdot CH(NH_2)COOH$	181.10
5	Umbellic acid		$C_9H_{10}O_4$	182.08
6	Umbelliferone		$C_9H_6O_3$	162.05
7	Undecane (n.)		$C_{11}H_{24}$	156.19
8	Undecylene		$C_{11}H_{22}$	154.18
9	Undecylenic acid		$CH_3\cdot C_2H_2\cdot C_7H_{14}\cdot COOH$	184.16
10	Undecylic acid		$C_{10}H_{21}\cdot COOH$	186.18
11	Uramil	murexan	$CONHCONHCOCH\cdot NH_2$	143.06
12	Urea	carbamide	$NH_2\cdot CO\cdot NH_2$	60.05
13	Urethane	ethyl carbamate	$NH_2\cdot COO\cdot C_2H_5$	89.06
14	Uric acid		$C_5H_4O_3N_4$	168.06
15	Usnic acid (d.)		$C_{18}H_{16}O_7$	344.13
16	" " (i.)		$C_{18}H_{16}O_7$	344.13
17	Uvic acid	pyrotritaric acid	$(CH_3)_2C_4HO\cdot COOH$	140.06
18	Uvitic acid (1, 3, 5)		$CH_3\cdot C_6H_3(COOH)_2$	180.06
19	Uvitonic acid	o-picoline-o, p-dicarboxylic acid	$CH_3\cdot C_5H_2N(COOH)_2$	181.06
20	Valeramide		$C_4H_9CONH_2$	101.09
21	Valeric acid		$CH_3\cdot(CH_2)_3\cdot COOH$	102.08
22	aldehyde		$C_4H_9\cdot CHO$	86.08
23	anhydride		$(C_5H_9O)_2\cdot O$	186.14
24	Valero nitrile	See *butyl cyanide*		
25	Valerylene		$CH_3C:C\cdot CH_2\cdot CH_3$	68.06
26	Valylene		$CH_2:C(CH_3)C:CH$	66.05
27	Vanillic acid		$CH_3O\cdot C_6H_3(OH)COOH$ (3, 4, 1)	168.06
28	alcohol		$CH_3O\cdot C_6H_3(OH)CH_2OH$ (3, 4, 1)	154.08
29	Vanilline		$CH_3O\cdot C_6H_3(OH)CHO$ (3, 4, 1)	152.06
30	Veratrine	cevadine	$C_{32}H_{49}NO_9$	591.40
31	Veratrol (o.)		$C_6H_4\cdot(OCH_3)_2$	138.08
32	Veronal		$C_8H_{12}O_3N_2$	184.11
33	Vinyl acetic acid		$CH_2:CH\cdot CH_2\cdot COOH$	86.05
34	amine		$C_2H_3NH_2$	43.07
35	bromide		$CH_2:CHBr$	106.94
36	chloride		$CH_2:CHCl$	62.48

ORGANIC COMPOUNDS (Continued)

No.	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of		
					Water	Alcohol	Ether
1	need. or pl.	....	117–8	d.	s.	s.	s.
2	need.	....	63	229	v. s.	v. s.	v. s.
3	....	....	......	......	s.	i.	i.
4	m. silk. need.	....	abt. 295 d.	......	$0.04^{17°}$; $0.65^{100°}$	$0.01^{17°}$; i. abs.	i.
5	....	....	125 d.	......	sl. s.	s.	s.
6	....	....	240	subl.	s. h.	s.	s.
7	colorl. liq	$0.741^{20°}$	–26.5	194.5	i.	∞	∞
8	colorl. liq	$0.772^{20°}$	......	abt. 195	i.	∞	∞
9	colorl.	$0.907^{24°}$	24.5	......	......	......	....
10	scales	....	28.5	212.5 100mm.	i.	v. s.	....
11	need.	....	......	......	sl. s. h.	s. NH_4OH	....
12	tetr.	1.323	132.6	dec.	v. s.	5 c.	sl. s.
13	colorl. need. f. lgr.	$0.986^{21°}$	49–50	180	v. s. c.	v. s.	v. s.
14	scales	1.85 +	dec.	......	0.06 h.	i.	i.
15	yel. pr	....	203	d.	i.	v. sl. s.	sl. s.
16	yel. monocl. pr.	....	192–3	......	i.	v. sl. s.	$0.3^{20°}$
17	colorl need.	....	135	......	$0.25^{100°}$	v. s.	v. s.
18	colorl. need f. w.	....	287–8	subl.	sl. s.	v. s.	v. s.
19	powd.	....	274	......	v. sl. s.	......	....
20	....	....	126–7	230–2	s.	s.	s.
21	colorl. liq	$0.942^{20°}$	–58.5	186–6.4	$3.7^{16°}$	∞	∞
22	colorl. liq.	$0.819^{11°}$	......	103.4	sl. s.	......	....
23	colorl. liq.	....	......	215	dec. h.	......	....
24							
25	....	....	......	55.5–6.0	......	......	....
26	....	....	......	50	......	......	....
27	colorl. need.	....	207	......	$0.12^{14°}$	v. s.	v. s.
28	colorl. need.	....	115	dec.	v. s. h.	v. s.	v. s.
29	colorl. need. f. w.	....	80–1	......	1.c.; 5 h.	v. s.	v. s.
30	cryst.	....	205	......	i.	s.	s.
31	colorl.	1.086	23	205–6	sl. s.	s.	s.
32	cryst. powd.	....	191 (182)	......	$0.69^{20°}$; $8.3^{100°}$	s.	v. s.
33	....	....	<–20	168	s.	∞	∞
34	....	....	......	56	......	s.	....
35	....	1.517	16(23)	......	i.	∞	∞
36	....	....	......	–18	......	s.	....

PHYSICAL CONSTANTS OF

No.	Name	Synonyms	Formula	Mol. wt.
1	Vinyl ether.....	....	$CH:CH_2 \cdot O \cdot CH:CH_2$	70.05
2	ethylether......	....	$C_2H_3OC_2H_5$........	72.06
3	sulfide..........	....	$CH_2:CH \cdot S \cdot CH:CH_2$	86.11
4	Violuric acid.....	....	$\underbrace{CONHCONHCO \cdot C}:$ NOH	157.05
5	Xanthene.......	....	$C_{13}H_{10}O$...........	182.08
6	Xanthine	....	$C_5H_4O_2N_4$.........	152.06
7	Xanthogenamide.	....	$CS(OC_2H_5)NH_2$....	105.13
8	Xanthogenic acid.	....	$CS(OC_2H_5)SH$.....	122.18
9	Xanthone.......	diphenylene ketone oxide	$CO:(C_6H_4)_2:O$ ...	196.06
10	Xanthopurpurin..	....	$C_6H_4(CO)_2C_6H_2(OH)_2$	240.06
11	Xylene (o.)......	xylol (o.)........	$C_6H_4 \cdot (CH_3)_2$.......	106.08
12	" (m.).....	" (m.).......	$C_6H_4 \cdot (CH_3)_2$......	106.08
13	" (p.)......	" (p.)........	$C_6H_4 \cdot (CH_3)_2$.......	106.08
14	sulfonic acid (1, 2, 4)	....	$C_6H_3(CH_3)_2SO_3H + 2H_2O$	222.18
15	Xylenol (1, 2, 3) .	....	$(CH_3)_2 \cdot C_6H_3 \cdot OH$..	122.08
16	" (1, 2, 4) .	....	$(CH_3)_2 \cdot C_6H_3 \cdot OH$...	122.08
17	" (1, 3, 2) .	....	$(CH_3)_2 \cdot C_6H_3 \cdot OH$...	122.08
18	" (1, 3, 4) .	....	$(CH_3)_2 \cdot C_6H_3 \cdot OH$..,	122.08
19	" (1, 3, 5) .	....	$(CH_3)_2 \cdot C_6H_3 \cdot OH$...	122.08
20	" (1, 4, 3) .	....	$(CH_3)_2 \cdot C_6H_3 \cdot OH$...	122.08
21	Xylic acid. See *di*	*methyl benzoic acid* (2, 4)		
22	Xylidine (1, 2, 3).	dimethyl-amino benzene (1, 2, 3)	$(CH_3)_2 \cdot C_6H_3 \cdot NH_2$..	121.10
23	" (1, 2, 4).	dimethyl-amino benzene (1, 2, 4)	$(CH_3)_2 \cdot C_6H_3 \cdot NH_2$.	121.10
24	" (1, 3, 2).	dimethyl-amino benzene (1, 3, 2)	$(CH_3)_2 \cdot C_6H_3 \cdot NH_2$..	121.10
25	" (1, 3, 4).	dimethyl-amino benzene (1, 3, 4)	$(CH_3)_2 \cdot C_6H_3 \cdot NH_2$..	121.10
26	" (1, 3, 5).	dimethyl-amino benzene (1, 3, 5)	$(CH_3)_2 \cdot C_6H_3 \cdot NH_2$..	121.10
27	" (1, 4, 3).	dimethyl-amino benzene (1, 4, 3)	$(CH_3)_2 \cdot C_6H_3 \cdot NH_2$..	121.10
28	Xylose	....	$C_5H_{10}O_5$..........	150.08
29	Xyloquinone (o.).	....	$(CH_3)_2C_6H_2O_2$......	136.06
30	" (m.)	....	$(CH_3)_2C_6H_2O_2$......	136.06
31	" (p.)	See *phlorone*		
32	Xylorcin (m.) (1, 3, 4, 6)	....	$(CH_3)_2C_6H_2(OH)_2$...	138.08
33	Xylyl hydrazine (1, 3, 4)	....	$(CH_3)_2C_6H_3 \cdot NH \cdot NH_2$	136.11
34	Yohimbine......	....	$C_{22}H_{28}O_3N_2$........	368.24
35	Zinc ethyl	....	$Zn(C_2H_5)_2$.........	123.46
36	methyl.........	zinc methide.....	$Zn(CH_3)_2$..........	95.43

ORGANIC COMPOUNDS (Continued)

No	Crystalline form and color	Sp. gr. H_2O = 1 (A)Air = 1	Melting-point °C	Boiling-point °C	Solubility in gms. per 100 c.c. of Water	Alcohol	Ether
1	colorl. liq	....	......	39	......	s.	∞
2	....	$0.7625^{14.5°}$	......	35.5	sl. s.	s.	....
3	oil	0.913	......	1.01	sl. s.	∞	∞
4	....	....	......	......	s. h.	s.	....
5	leaf. f. al.	....	99	312–15	v. sl. s.	sl. s.	s.
6	yel wh. powd.	....	>360	......	$0.067^{100°}$	$0.033^{17°}$	v. s. alk.
7	monocl.	....	38	......	......	s.	....
8	liq.	> H_2O	......	24 d.	i.	......	....
9	lng. need. f. al.	....	173–4	250	sl. s. h.	s. h.	sl. s. lgr.
10	....	....	252–3	subl.	......	......	....
11	colorl. liq.	$0.881^{20°}$	–28	142	i.	v. s.	v. s.
12	colorl. liq.	$0.866^{20°}$	–54	139.2	i.	v. s.	v. s.
13	colorl. monocl.	....	15	138	i.	s.	v. s.
14	tab.	....	d.	......	s.	......	....
15	long. need f. w.	....	75	218	s.	s.	....
16	need. f. w.	....	65	225	s.	s.	....
17	colorl. leaf.	....	49	211.2	s. h.	s.	....
18	colorl. need.	....	26	211.5	v. sl. s.	∞	∞
19	need. f. w.	....	64 or 68	219.5	sl. s.	s.	....
20	colorl. monocl.	1.169	74.5	211.5	s.	s.	v. s.
21							
22	liq.	0.991	<–15	224–6	v. sl. s.	v. s.	v. s.
23	monocl. tab.	$1.076^{17°}$	49	225	sl. s	v. s. lgr.	....
24	liq.	0.980	......	216 (212)	......	......	....
25	liq.	....	......	216.5 (212)	v. sl. s.	......	....
26	liq.	$0.993^{0°}$	......	220-1	......	......	......
27	....	....	15.5	217–8	v. sl. s.	0.980	....
28	need.	....	150–3	......	$117^{20°}$	v. sl. s. c.	v. ss. l.
29	yel.need.	....	55	subl.	sl. s.	s.	s
30	....	....	72–3	......	......	......	....
31							
32	micr.cryst	....	124–5	276–9	s.	s.	s.
33	need. f. eth.	....	85	......	......	......	v. s.
34	colorl. need.	....	234–4.5	......	v. sl. s.	v. s.	s.; s. chl.
35	colorl. liq.	1.18	–28	118	dec.	dec	s.
36	....	1.39	–40	46	dec.	dec.	....

CONSTANTS OF ANIMAL

No.	Name	Specific gravity at 15.5° C.	Solidifying point °C.
1	Almond	0.9178–0.9183	− 10 to − 20
2	Beech-nut	....	....
3	Black mustard	0.916–0.920	− 17
4	Candlenut	0.925	Below − 18
5	Castor	0.960–0.9679	− 10 to − 18
6	Coconut	0.9259	22–14
7	Cod liver	0.923–0.930	0 to − 10
8	Corn (maize)	0.9213–0.9250	− 10 to − 15
9	Cotton seed	0.922–0.925	− 1 to 0
10	Croton	0.9375–0.9428	− 16
11	Grape seed	0.926–0.9350	− 10 to 13
12	Hazel nut	0.9146–0.9170	− 10 to − 20
13	Hemp seed	0.9255–0.9280	− 27
14	Lard oil	0.915–0.9175	− 4 to 10
15	Linseed	0.932–0.937	− 17 to − 27
16	Menhaden	0.929–0.933	− 4
17	Neat's foot	0.9133–0.9175	0 to 1.5
18	Olive	0.9150–0.9180	− 6 to 2
19	Palm	0.9210–0.9240	....
20	Palm kernel	$0.9119^{40°}$	20.5–24
21	Peach kernel	0.9180–0.9215	Below − 20
22	Peanut (Arachis)	0.917–0.9209	− 3 to 0
23	Poppy seed	0.9255–0.9268	− 18
24	Porpoise (body oil)	0.9258–0.9350	− 16
25	Pumpkin seed	0.9197	− 16
26	Rape	0.9133–0.9168	− 2 to − 10
27	Safflower (saffron)	0.9246–0.9280	− 13 to − 18
28	Seal	0.9244–0.9336	− 2 to − 3
29	Sesame	0.9203–0.9237	− 4 to − 6
30	Soja bean (Soya, Soy)	0.924–0.9279	− 8 to − 15
31	Sperm	0.875–0.8808	15.5
32	Sunflower	0.924–0.9258	− 16 to − 18.5
33	Tung (Chinese wood oil)	0.9410–0.9440	2 to 3
34	Walnut	0.9259	− 27.5
35	Whale	0.9170–0.9272	....
36	White mustard	0.9142	− 15 to − 16.3

AND VEGETABLE OILS

No.	Saponification value	Iodine value	Hehner's number	Maumené number	Acid value
1	189–193	93–104	96.2	51–53	0.5–5.0
2	....	....	....	....	....
3	174	96–110	95.1	43	1.36–7.35
4	189–195	153–164	95.5	....	8.1
5	176–184	82–90	....	46–47	0.14–14.60
6	246–268	8–9.5	88.6–90	21	5–50
7	182–189	135–198	95.3–97.5	102–115	0.36–25
8	188–193	111–130	93–96	81–86	1.35–2.86
9	193–195	106–115	95–96	75–90	0.0
10	210–215	102–106	89.0	....	....
11	178.5	96	92	53	16.2
12	192	83–90	95.6	36	....
13	192.5	148–160	....	97	....
14	195–196	65–85	96.2	41–45	....
15	189–195	175–200	95.5	103–126	0.8–10
16	190–195	150–170	....	123–128	5–8
17	194–197	66–72	....	43–49	4–10
18	185–196	75–88	95	41.5–47	1.9–50
19	200–203	52–56	91–95	....	20–185
20	244–248	10–17	87.6–96	....	5–22
21	189–193	93–109	....	42.5	....
22	189–196	83–103	95.8	45–67	0.5–5.0
23	190.1–197	132.6–136	95.2	86–88	0.7–11
24	195–225	110–120	85.5	50–61	1.2
25	188.4–190.2	120–131	96.2	....	....
26	167.7–179	94–106	95.1	51–64	1.4–13.2
27	186.6–194.4	130–150	95.4	....	....
28	178–196	129.4–152.4	95.5	....	....
29	188–193	103–115	95.7	65.5	0.23
30	190.6–192.5	124–143	95	87–88	....
31	120–147.4	70.4–96.4	....	51	13.2
32	188–194	119–135	95	72	11.2
33	190–197	156–176	96.2	....	Under 12
34	188.7–191	143–151.7	95.4	96–110	....
35	188–194	110–136	93.5	85–92	....
36	170–178	92–103	96.2	44–49	5.4

CONSTANTS OF ANIMAL

No.	Name	Refractive index	Temperature of reading	Reichert-Meissl number
1	Almond	1.4555	60°	....
2	Beech-nut	....	....	....
3	Black mustard	1.4740–1.4770	15.5	....
4	Candlenut	1.4760	25	....
5	Castor	1.4799	15	1.1
6	Cocoanut	1.4410	60	6.7–8.4
7	Cod liver	1.4800–1.4852	15	0.8–0.9
8	Corn (maize)	1.4766	15	4–5
9	Cotton seed	1.4743–1.4752	15	0.95
10	Croton	1.4757–1.4770	27	12–13.6
11	Grape seed	1.4713	25	0.35–1.9
12	Hazel nut	....	....	....
13	Hemp seed	....	....	....
14	Lard oil	1.4702–1.4720	15.5	....
15	Linseed	1.4820–1.4852	15	0.00
16	Menhaden	1.4787	25	2.2
17	Neat's foot	1.4695–1.4708	15	2.0
18	Olive	1.4698–1.4716	15	0.6
19	Palm	1.4510	60	1.0
20	Palm kernel	1.4431	60	5.0–7.6
21	Peach kernel	1.4697–1.4705	25	....
22	Peanut (Arachis)	1.4707–1.4730	15.5	....
23	Poppy seed	1.4766–1.4774	15.5	0.0
24	Porpoise (body oil)	1.4677	25	46.9
25	Pumpkin seed	1.4724–1.4738	25	....
26	Rape	1.4720–1.4757	15	0.6
27	Safflower (saffron)	1.4770	16	0.0–1.63
28	Seal	1.4776	....	0.96–1.69
29	Sesame	1.4748–1.4762	15	1.2
30	Soja (Soya, Soy)	1.4760–1.4775	15.5	....
31	Sperm	1.4646–1.4655	20	0.6
32	Sunflower	1.4611	60	....
33	Tung (Chinese wood oil)	1.5110–1.5202	20	....
34	Walnut	1.4804	....	....
35	Whale	1.4762	20	0.7–2.0
36	White mustard	1.4750	15.5	....

AND VEGETABLE OILS (Continued)

No.	Unsaponifiable matter	Insoluble Fatty Acids			
		Melting-point °C.	Solidifying-point °C.	Iodine value	Acid value
1	0.5–1.0	13–14	9.5–12	93.5–96.5	204
2	....	24	17	114	....
3	....	16.2	....	87–93	179.2
4	....	20–21	13	185.7	....
5	0.3–0.6	13	3	86.6–88.3	192.1
6	0.2	24–27	16–20	8.4–8.8	258
7	0.5–1.5	22–25	13–24	164–171	204–207
8	1.5	18–20	14–16	113–125	198.4
9	.73–1.64	35–38	32–35	111–115	201.6–203.9
10	0.55	....	18.6–19	111–112	201
11	....	23–26	18–20	99–132	187.4
12	....	22–25	19–20	87.5–90.1	200.6
13	....	19	15	141	....
14	0.3–0.5	....	....	....	....
15	....	17–24	13.3–17	179–209.8	196–198.8
16	0.61–1.60	....	....	....	....
17	0.1–0.6	28.5–30.8	26.1	62–77	201.2–206.3
18	0.46–1.0	19–27	17–22	86–90	193
19	....	47–50	....	53.3	204–207
20	0.5	25–28.5	20–25	12	251–265
21	....	10–18.9	13.0–13.5	94.1–101.9	205–209.9
22	0.54–0.94	27–32	28–29	95.5–103.4	201.6
23	0.43	20.5	16.2	139	199
24	3.7	....	....	126	207
25	....	26.5–29.8	....	....	....
26	0.58–1.0	16–22	16–18.5	100–106	....
27	....	16–16.5	16	132.5–148.2	199
28	0.38–1.4	23–33	13–17	186.5–201.8	190.4–198
29	0.95–1.32	23–32	22.9–23.8	109–112	196–201.6
30	....	26–29	21.2	122	....
31	39–42	13.3–21.4	16.1	88–99	23.6
32	0.31	22–24	17–18	124–134	201.6
33	0.4–1.3	40–43.8	31.2–37	145–159.4	188.8
34	0.5–1.0	15–20	16	150	....
35	0.5–3.3	14–18	23	130.3–132	....
36	....	12–16	9–10	94.7–110.4	181–185.8

CONSTANTS OF

No.	Name	Specific Gravity	°C	Solidifying point
1	Beef marrow	0.9311–0.938	15	31–29
2	Beef tallow	0.943–0.952	15	35–27
3	Beeswax	0.962–0.970	15	60.5–63.4
4	Bone fat	0.914–0.916	15.5	15–17
5	Butter fat	0.936–0.942	15.5	19–24.5
6	Carnaüba wax	0.990–1.0	15.5	80–87
7	Chinese vegetable tallow	0.918	15	24–35
8	Cocoa butter	0.950–0.976	15	21.5–27.3
9	Cotton seed stearin	0.9188–0.923	15.5	16–22
10	Goose (domestic)	0.9229–0.9300	15	18–20
11	Goose (wild)	0.9158	15	18–20
12	Hare fat	0.9349	15	17–23
13	Horse fat	0.916–0.922	15	20–45
14	Human fat	0.9179	15	15
15	Insect (Chinese) wax	0.970	15	80.5–81
16	Japan wax (tallow)	0.975	15	48.5–50.8
17	Lard (hog fat)	0.934–0.938	15	27.1–29.9
18	Laurel (bayberry) oil	0.9332	15	24–25
19	Mutton tallow	0.937–0.953	15	36–41
20	Myrtle wax	0.995	15	39–45
21	Nutmeg (mace) butter	0.945–0.996	15	40–44
22	Rabbit fat (tame)	0.9342	15	22–24
23	Rabbit fat (wild)	0.9393	15	17–22
24	Spermaceti	0.905–0.960	15	42–49
25	Sperm oil	0.875–0.8808	15.5	15.5
26	Wool wax	0.9413–0.9449	17	30–30.2

No.	Name	Refractive index	°C	Reichert-Meissl number
1	Beef marrow	1.4628	25	2.2
2	Beef tallow	1.4510	60	0.5
3	Beeswax	1.4398–1.4451	75	0.34–0.54
4	Bone fat	....	....	....
5	Butter fat	1.4590–1.4620	25	20.6–33.2
6	Carnaüba wax	1.4520–1.4541	84	....
7	Chinese vegetable tallow	1.4510	50	0.69
8	Cocoa butter	1.4565–1.4578	40	0.2–0.83
9	Cotton seed stearin	....	....	....
10	Goose (domestic)	1.4593–1.4596	40	0.2–0.3
11	Goose (wild)	....	....	....
12	Hare fat	1.4586	40	2.64
13	Horse fat	1.4603–1.4717	40	1.64–2.14
14	Human fat	1.459–1.4613	40	0.25–0.55
15	Insect (Chinese) wax	....	....	....
16	Japan wax (tallow)	1.4577–1.4591	40	....
17	Lard (hog fat)	1.4539	60	0.49–1.1
18	Laurel (bayberry) oil	1.4643	40	3.2–5.4
19	Mutton tallow	1.4501	60	....
20	Myrtle wax	1.4363	80	0.5
21	Nutmeg (mace) butter	1.4704	40	1–4.2
22	Rabbit fat (tame)	1.4587	40	2.64
23	Rabbit fat (wild)	....	....	1.4–5.6
24	Spermaceti	....	....	....
25	Sperm oil	1.4646–1.4655	20	0.6
26	Wool wax	1.4781–1.4822	40	8

FATS AND WAXES

No.	Saponification value	Iodine value	Hehner's number	Unsaponifiable matter	Acid value
1	196–199 6	39–55.4	....	....	1 6
2	193 2–200	35.4–47.5	95 6	....	3 5–50
3	88–97.6	8.3–11	....	52–55	18–21
4	190–195	46.3–55 8	....	0.5–1 5	1–50
5	220–237	26–38	86.5–89.8	0.3–0.45	0.45–35 4
6	78–88	13 5	....	55	2–7
7	199–206	23–38	93	....	2 2–7 5
8	192–202	34 3–37	94 5	....	1 1–1 88
9	195	89–103	95 9	....	....
10	193	59–71 5	95	....	0 59
11	196	99 6	....	....	0 56
12	201–205	102.2–107	95.4	....	2 73
13	195–197	71.4–86.3	95	....	0 0–2 44
14	193.3–199	64	....	....	....
15	80.4–91.65	1.4	....	....	1 5
16	217.5–237.5	4.2–15.1	90.6	1.1–1.63	7.33
17	195.2–196 6	49.9–70.4	93–96	0 23	0 54–1 28
18	197–210	80.5	....	....	26 3
19	192–195.2	32.7–46.2	95.5	....	1 7–14
20	205.7–217	1.95	....	....	3–4.4
21	153.5–161	59.3–65	....	....	17–44.8
22	202.6	67.6	....	....	6 2
23	199 3	99.8	....	....	7.2
24	122.7–134.6	3.5–9.3	....	51 5	0.5–1 35
25	120–147.4	70.4–96.4	....	39–42	13 2
26	102.4	17.1–28 9	91	43.1–51.8	....

No.	Insoluble Fatty Acids			
	Melting-point °C.	Solidifying point °C.	Iodine value	Acid value
1	45–46	37.9–40	55.5	204.5
2	43–47	37.9–46.2	41.3	197.2
3	67.2	....	....	....
4	30	28	55.7–57.4	200
5	38–40	33–37	28–31	210–220
6	85	....	....	....
7	47–57	40–56	34.2	182–208.5
8	48–53	46–51	32.6–39	190
9	27–30	35.1	94	....
10	37–41	31–32	65.3	202.4
11	34–40	32–34	65.1	196 4
12	44–50	36–41	93.3	209
13	37.5–39.5	37.7	83.9–87.1	202.6
14	35.5	30.5	64	....
15	92.2	....	....	....
16	54.5–59.6	53–56.5	....	213.7
17	35–47	34–42	64.2	201.8
18	....	....	81.6–82	....
19	46–54	39–41	34 8	198
20	47.5–48.5	46	....	230.9
21	42 5	40–45	31.6	....
22	40–50	37–41	64.4	218.1
23	39–41	35–36	101.1	209.5
24	....	....	....	....
25	13.3–21 4	16.1	88–99	23.6
26	41.8	40	17	....

PHYSICAL CONSTANTS OF COMMON MINERALS

A table giving the crystalline form, specific gravity, hardness and mean index of refraction of the common minerals. The following abbreviations are used: amor., amorphous; hex., hexagonal; monocl., monoclinic; R, radioactive; reg., regular; rhomb., rhombic, tetrag., tetragonal; tricl., triclinic.

Hardness is given according to the following scale: 1 talc, 2 rock salt, 3 calcite, 4 fluorite, 5 apatite, 6 feldspar, 7 quartz, 8 topaz, 9 corundum, 10 diamond.

Name.	Synonym	Formula	Crystalline form.	Sp. Gr. $H_2O = 1$.	Hardness	Index of refraction.
Albite	....	$Na_2Al_2Si_6O_{16}$	tricl.	2.61–64	6–6.5	1.53
Amber, fossil resin	....	$C_{40}H_{64}O_4$	amor.	1.0–1.1	2–2.5	1.546
Anhydrite	....	$CaSO_4$	rhomb.	2.9–3.0	3–3.5	1.59
Anorthite	....	$Ca_2Al_4Si_4O_{16}$	tricl.	2.73–.76	6	1.58
Apatite	....	$Ca_5(Cl, F, OH)(PO_4)_3$	hex.	3.17–.23	5	1.64
Aragonite	....	$CaCO_3$	rhomb.	2.9–3.0	3.5–4.0	1.63
Augite	....	Mg, Fe, Ca, Al silicate	monocl.	2.88–3.50	5–6	1.71
Barytes	Heavy spar	$BaSO_4$	rhomb.	4.3–4.6	3–3.5	1.64
Beryl	....	$Be_3Al_2Si_6O_{18}$	hex.	2.68–.76	7.5–8.0	1.57
Bröggerite (R)	A pitchblende which contains thorium					
Calcite	Calcspar, Iceland spar	$CaCO_3$	hex.	2.6–8	3	1.60
Carnallite	....	$KCl \cdot MgCl_2 \cdot 6H_2O$	rhomb.	1.60	1	1.478
Carnotite (R)	....	$K_2O(U_2O_5)_2V_2O_5 \cdot 3H_2O$	hex.?			
Celestine	....	$SrSO_4$	rhomb.	3.9–4.0	3–3.5	1.62
Cerrusite	....	$PbCO_3$	rhomb.	6.46–.57	3–3.5	1.99
Chalcolite (R)	....	$Cu(UO_2)(PO_4)_2 \cdot 8H_2O$	tetrag.	3.4–.6	2–2.5	....
Clèveite (R)	A pitchblende which contains Th and Y; UO_3, UO_2, Y_2O_3, E_2O_3, ThO_2, PbO, Fe_2O_3, H_2O, (He, A)		reg.	7.45	5.5	....
Corundum	....	Al_2O_3	hex.	3.9–4.0	9	1.77
Dolomite	....	$CaMgC_2O_6$	hex.	2.85–.95	3.5–4.5	1.62
Felspar	....	$Al_2K_2Si_6O_{16}$	....	2.4–6	6	....

PHYSICAL CONSTANTS OF COMMON MINERALS (Continued)

Name.	Synonym.	Formula.	Crystalline form.	Sp. Mr. H_2O = 1.	Hardness	Index of refraction.
Flint	Agate	SiO_2	rhomb.?	2.59–.64	7	1.54
Fluorspar	Fluorite	CaF_2	reg.	3.1–.2	4	1.43
Galena	....	PbS	reg.	7.4–.6	2.5	....
Gummite (R)	....	$(Pb, Ca, Ba)SiU_3O_{12} + 5H_2O$	....	3.9–4.5	2.5–3.0	....
Gypsum	....	$CaSO_4 \cdot 2H_2O$	monocl.	2.2–.4	1.5–2.0	1.52
Haematite	....	Fe_2O_3	hex.	5.19–.28	5.5–6.5	3.08
Hornblende	....	$Ca(MgFe)_3[SiO_3]_4 \cdot (Na_2, K_2, Ca, Fe, Mg)_3 (Al, Fe)_2Si_3O_{12}$	monocl.	3.0–3.5	5–6	1.64—.71
Kainite	....	$MgSO_4 \cdot KCl \cdot 3H_2O$	monocl.	2.07–2.19	2.5–3.0	....
Kaolin	....	$H_4Al_2Si_2O_9$	monocl.	2.4–2.6	1–2.5	1.54
Kieserite	....	$MgSO_4 \cdot H_2O$	monocl.	2.52–.57	3	1.548
Lepidolite	....	$(F, OH)_2(Li, K, Na)Al_2Si_3O_9(+ Rb_2O, Cs_2O)$	monocl.	2.8–.9	2.5–3.0	1.60
Limestone	....	$CaCO_3$	....	2.5–.8	....	....
Magnesite	....	$MgCO_3$	hex.	2.9–3.1	4.0–4.5	1.65
Magnetite	....	Fe_3O_4	reg.	4.9–5.2	5.5–6.5	....
Meerschaum	....	$2MgO \cdot 3SiO_2 \cdot 2H_2O$	....	2.	2–2.5	1.54
Mica, common	Muscovite	$H_2(K, Na)Al_3Si_3O_{12}$	monocl.	2.76–3.10	2–3	1.58
Mica	Biotite, Magnesia mica	$(H, K)_2(Mg, Fe)_2(Al, Fe)_2[SiO_4]_3$	monocl.	2.8–3.2	2.5–3.0	1.60
Monazite (R)	....	$(Ce, Nd, Pr, La)PO_4(+ Th_3[PO_4]_4)$	monocl.	4.9–5.25	5.0–5.5	1.81
Nepheline	....	$(Na_2, K_2, Ca)Al_2Si_2O_8 \cdot n(Na_2, K, Ca)Al_2Si_3O_{10}$	hex.	2.58–.64	5.5–6.0	1.54
Olivine	....	$Mg_2Fe_2SiO_4$	rhomb.	3.27–.57	6.5–7.0	1.67
Orthoclase	....	$K_2Al_2Si_6O_{16}$	tricl.	2.54–.58	6	1.52
Pitchblende (R)	U_3O_8 with oxides of Pb, Ca, Fe, Bi, Mn, Mg, Cu, Si, Al, etc. (25–80%U; 1–6%Th)		....	6.4–9.7	5.5	....
Pyrites, iron	....	FeS_2	reg.	4.9–5.2	6–6.5	....
copper	....	$CuFeS_2$	tetrag.	4.1–4.3	3–4	....
Pyrolusite	....	MnO_2 (+ nH_2O)	?	4.7–.9	2–2.5	....
Quartz	....	SiO_2	hex.	2.5–.8	7	1.55
Rock salt	....	$NaCl$	reg.	2.1–.2	2	1.54

PHYSICAL CONSTANTS OF COMMON MINERALS (Continued)

Nam	Synonym.	Formula.	Crystalline form.	Sp. Gr. $H_2O = 1$.	Hardness.	Index of refraction.
Rutile	....	TiO_2	tetrag.	4.2–.3	6–6.5	2.71
Selenite	cryst. gypsum.					
Serpentine	....	$H_4Mg_3Si_2O_9$	rhomb.?	2.5–.7	3–4	1.54
Spinel	....	$MgOAl_2O_3$	reg.	3.52–3.71	8	1.71
Sylvine	....	KCl	reg.	1.9–2.0	2	1.48
Talc	....	$H_2Mg_3Si_4O_{12}$	monocl.	2.69–.80	1	1.57
Thorianite (R)	(4–10%U, 60%	Th)(ThU)O_2(+He, Ce, La, Pb, Fe)	reg.	8.–9.7	5–7	>1.8
Thorite (R)	(1–9%U; 40–60%	Th)$ThSiO_4$ + (He)	tetrag.	4.4–5.4	4	....
Tourmaline	(H, Li, Na, K)$_9$Al$_3$	[B·OH]$_2$Si$_4$O$_{19}$(+Fe_2O_3, FeO, MgO, MnO)	hex.	2.94–3.21	7–7.5	1.65
Trögerite (R)	....	$(UO_2)_3As_2O_8\cdot 12H_2O$	monocl.?	3.3	....	....
Uraninite (R)	cryst. pitchblende					
Uranite lime (R)	....	$CaO(UO_2)_2(PO_4)_2 8H_2O$(50%U)	rhomb.	3.05–3.19	2–2.5	1.57
Willemite	....	Zn_2SiO_4	hex.	3.9–4.2	5.5	....
Wolfram	....	(Fe, Mn)WO_4	monocl.	7.14–7.54	5–5.5	....
Wollastonite	....	$CaSiO_3$	....	2.7–.9	4.5–5.	....
Zeunerite (R)	....	(50%U)$Cu(UO_2)_2(AsO_4)_2$	tetrag.	3.53	2.5	....
Zircon (R)	....	$ZrSiO_4$	tetrag.	4.–4.7	7–8	1.95
Zincblende	....	ZnS	reg.	3.9–4.2	3.5–4.	2.37

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS

Composition	Name	Sp. gr.	Thermal expansion coefficient	Melting point °C.
Aluminum				
97Al, 3Cu	....	....	24×10^{-6}	640
90Al, 10Mg	Magnalium	2.50	24	608
70Al, 30Mg	Magnalium	2.00	....	....
91Al, 9Zn	....	2.80	....	....
70Al, 30Zn	....	....	....	600
Bismuth				
52.5Bi, 32Pb, 15.5Sn	....	....	....	96
50Bi, 27Pb, 13Sn, 10Cd	Lipowitz' alloy	....	....	65
50Bi, 25Pb, 12.5Sn, 12.5Cd	Wood's metal	9.70	....	65.5
50Bi, 27.1Pb, 22.9Sn	Rose metal	....	....	....
40Bi, 40Pb, 20Sn	Bismuth solder	....	....	111
Copper				
90Cu, 10Al	Aluminum bronze	7.6	16.5	1050
77Cu, 15Pb, 8Sn	"B" Alloy, P.R.R.	....	....	....
95Cu, 5Mn	Manganese bronze	8.8	....	1060
82Cu, 15Mn, 3Ni	Manganin	8.5	....	....
80Cu, 20Ni	Nickeline	8.5	....	1190
60Cu, 40Ni	Constantan	8.4	....	1290
90Cu, 10Sn	Bronze, gun metal	8.8	18	1010
78Cu, 22Sn	Bell metal	8.7	....	890
67Cu, 33Sn	Bronze, speculum metal	8.6	18.6	750
95Cu, 4Sn, 1Zn	Bronze coins	8.96	....	....
82Cu, 16Sn, 2Zn	Bronze bearings	....	....	....
79.7Cu, 10Sn, 9.5Sb, 0.8P	Phosphor bronze	8.8	....	....
90Cu, 10Zn	Red brass	8.60	....	....
67Cu, 33Zn	Brass, ordinary yellow	8.40	18.5	940
60Cu, 40Zn	Muntz metal	....	....	....
55Cu, 45Zn	For brazing	....	....	880
61.2Cu, 37.3Zn, 0.9Sn, 0.4Pb, 0.2Fe	Tobin bronze	....	....	....
52Cu, 26Zn, 22Ni	German silver	8.45	....	....
60Cu, 25Zn, 15Ni	German silver	....	18.4	....
Iridium				
95Ir, 5Pt	....	22.38	....	....
Iron				
80Fe, 20Al	Ferro-aluminum	6.30	....	1480
97Fe, 3C	Cast iron, white	7.60	....	1150
94Fe, 3.5C, 2.5Si	Cast iron, gray	7.0	11.2	1230
99Fe, 1C	Steel	7.83	12.0	1430
50Fe, 50Cr	Ferro-chromium	6.9	....	1458
50Fe, 50Mn	Ferro-manganese	....	....	1325
86Fe, 13Mn, 1C	Manganese steel	7.81	....	1510
96.5Fe, 3.5Ni	Nickel steel	....	....	....
74.2Fe, 25Ni, 0.8C	Ferro-nickel	8.1	18	1500
67.8Fe, 32Ni, 0.2C	Ferro-nickel, valve steel	8.0	4	1480
63.8Fe, 36Ni, 0.2C	Invar	8.0	0.8	1497
53.85Fe, 46Ni, 0.15C	Platinite	8.2	7.5	1470
95.1Fe, 3Ni, 1.5Cr. 0.4C	Nickel-chrome steel	....	....	....
97.6Fe, 2Si, 0.4C	Silicon steel	....	....	....
94.5Fe, 5W, 0.5C	Tungsten steel	....	....	....
75Fe, 18W, 6Cr, 0.3Va, 0.7C	High speed steel	....	....	....
Gold				
90Au, 10Cu	Coinage	17.17	....	940
84Au, 16Cu	Jewelry	....	....	....
75Au, 24Cu	Jewelry	....	....	....

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS (Continued)

Composition.	Name.	Specific gravity.	Thermal expansion coefficient.	Melting point °C.
Lead				
90Pb, 10Sb	Magnolia	....	....	.....
85Pb, 15Sb	....	10.4	19.5	230
82Pb, 15Sb, 3Sn	Type metal	....	....	.....
67Pb, 33Sn	Solder	9.4	25.0	240
75Pb, 5Sn, 19Sb, 1Cu	White metal	9.5	....	238
84.33Pb, 14.38Sb, 0.61Fe, 0.68Zn	Carbox metal	....	....	.....
Mercury				
80Hg, 20Bi	Bismuth amalgam	......	......	.....
70Hg, 30Cu	Dentists' amalgam	......	......	.....
Nickel				
60Ni, 33Cu, 6.5Fe	Monel metal	8.90	14	1360
Platinum				
90Pt, 10Ir	Platinum-iridium	21.61	8.8	.....
90Pt, 10Rh	Platinum-rhodium	....	....	.....
Silver				
90Ag, 10Cu	Coinage	10.3	....	875
80Ag, 20Cu	Jewelry	....	....	.....
Tin				
90Sn, 10Sb	Britannia	....	....	260
80Sn, 20Sb	....	....	....	.....
90Sn, 7Sb, 3Cu	Babbitt	....	....	.....
75Sn, 12.5Sb, 12.5Cu	Antifriction	7.53	....	233
97Sn, 3Cu	Rhine metal	7.35	....	300
68Sn, 32Cd	....	7.70	....	.....
82Sn, 12Sb, 6Cu	White metal	....	....	.....
Zinc				
95Zn, 5Al	....	6.80	....	.....

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ

Common Name	Chemical Name	Formula
Aldehyde	Acetaldehyde	CH_3CHO
Alum Alum flour Alum meal	Generally refers to potassium aluminum sulfate	$K_2Al_2(SO_4)_4 \cdot 24H_2O$
Alumina	Aluminum oxide	Al_2O_3
Amidol	Diaminophenol hydrochloride	$C_6H_3(NH_2)_2OH \cdot 2HCl$
Antichlor	Sodium thiosulfate	$Na_2S_2O_3 \cdot 5H_2O$
Antifebrin	Acetanilide	$C_6H_5NHCOCH_3$
Antimony bloom	Antimony trioxide	Sb_2O_3
Antimony black Antimony glance	Antimony trisulfide	Sb_2S_3
Antimony red Antimony vermilion	Antimonous oxysulfide	$Sb_2S_3 + Sb_2O_3$
Aqua fortis	Nitric acid	HNO_3
Aqua regia	Nitric acid + hydrochloric acid	$HNO_3 + 3HCl$
Arsenic glass	Arsenious oxide	As_2O_3
Aspirin	Acetyl-salicylic acid	$C_6H_4\begin{cases}OCOCH_3\\COOH\end{cases}$
Baking soda	Sodium bicarbonate	$NaHCO_3$
Baryta	Barium oxide	BaO
Barytes	Barium sulfate	$BaSO_4$
Benzol	Benzene	C_6H_6
Bitter salt	Magnesium sulfate	$MgSO_4 \cdot 7H_2O$
Black ash	Impure sodium carbonate	....
Blanc-fixe	Barium sulfate	$BaSO_4$
Bleaching powder	Calcium hypochlorite	$CaOCl_2$
Blue copperas Blue stone Blue vitriol	Copper sulfate	$CuSO_4 \cdot 5H_2O$
Blue salts	Nickel sulfate	$NiSO_4 \cdot 7H_2O$
Bone ash	Impure calcium phosphate	....
Boracic acid	Boric acid	H_3BO_3
Borax	Sodium tetraborate	$Na_2B_4O_7 \cdot 10H_2O$
Brimstone	Sulfur	....
Burnt alum	Anhydrous potassium aluminum sulphate	$K_2Al_2(SO_4)_4$
Burnt lime	Calcium oxide	CaO
"Butter of"	Refers to the chloride.	
Cadmium yellow	Cadmium sulfide	CdS
Calomel	Mercurous chloride	$HgCl$
Cane sugar	Sucrose	$C_{12}H_{22}O_{11}$
Carbolic acid	Phenol	C_6H_5OH
Carbonic anhydride	Carbon dioxide	CO_2
Carborundum	Silicon carbide	SiC
"Caustic" refers to the hydroxide of a metal.		
Chalk	Calcium carbonate	$CaCO_3$
Chili niter Chili saltpeter	Sodium nitrate	$NaNO_3$
Chrome alum	Potassium chromium sulfate	$K_2Cr_2(SO_4)_4 \cdot 24H_2O$
Chrome green	Chromium oxide	Cr_2O_3
Chrome yellow	Lead chromate	$PbCrO_4$
Chromic acid	Chromium trioxide	CrO_3
Cobalt black	Cobalt oxide	CoO
Common salt	Sodium chloride	$NaCl$
Copperas	Ferrous sulfate	$FeSO_4 \cdot 7H_2O$

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ (Continued)

Common Name	Chemical Name	Formula
Corn sugar	Glucose	$C_6H_{12}O_6 \cdot H_2O$
Corrosive sublimate	Mercuric chloride	$HgCl_2$
Corundum	Aluminum oxide	Al_2O_3
Cream of tartar	Potassium acid tartrate	$KHC_4H_4O_6$
Cresylic acid	Mixture of the three cresols	$C_6H_4(CH_3)OH$
Dermatol	Basic bismuth gallate	$Bi(OH)_2C_7H_5O_5$
Dextrose	Glucose	$C_6H_{12}O_6 \cdot H_2O$
Epsom salts	Magnesium sulfate	$MgSO_4 \cdot 7H_2O$
"Flowers of" a metal is a	synonym for the oxide.	
Fluorspar	Calcium fluoride	CaF_2
Formalin	Forty per cent solution of formaldehyde in water	
Fruit sugar	Fructose	$C_6H_{12}O_6$
Glauber's salt	Sodium sulfate	$Na_2SO_4 \cdot 10H_2O$
Grain alcohol	Ethyl alcohol	C_2H_5OH
Grape sugar	Glucose	$C_6H_{12}O_6 \cdot H_2O$
Green vitriol	Ferrous sulfate	$FeSO_4 \cdot 7H_2O$
Gypsum	Calcium sulfate	$CaSO_4 \cdot 2H_2O$
Hypo	Sodium thiosulfate	$Na_2S_2O_3 \cdot 5H_2O$
King's yellow	Arsenious sulfide	As_2S_3
Laughing gas	Nitrous oxide	N_2O
Lemon chrome	Barium chromate	$BaCrO_4$
Levulose	Fructose	$C_6H_{12}O_6$
Lime	Calcium oxide	CaO
Litharge	Lead monoxide	PbO
Lithopone	Zinc sulfide + barium sulfate	$ZnS+BaSO_4$
Lunar caustic	Silver nitrate	$AgNO_3$.
Magnesia	Magnesium oxide	MgO
Marble	Calcium carbonate	$CaCO_3$
Metol	Monomethylpara-amido-metacresol sulfate or chloride	$(C_6H_3(OH)CH_3NHCH_3)_2 \cdot H_2SO_4$
Microcosmic salt	Sodium ammonium Hydrogen phosphate	$Na(NH_4)HPO_4 \cdot 4H_2O$
Milk of barium	Barium hydroxide	$Ba(OH)_2 \cdot 8H_2O$
Milk of magnesium	Magnesium hydroxide	$Mg(OH)_2$
Milk sugar	Lactose	$C_{12}H_{22}O_{11} \cdot H_2O$
Minium	Lead tetroxide	Pb_3O_4
Mohr's salt	Ferrous ammonium sulfate	$Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$
"Muriate of" a metal is syn	onymous with the chloride.	
Muriatic acid	Hydrochloric acid	HCl
Niter	Potassium nitrate	KNO_3
Nordhausen acid	Fuming sulfuric acid	$H_2SO_4+SO_3$
Oil of almond, artificial	Benzaldehyde	C_6H_5CHO
Oil of mirbane	Nitrobenzene	$C_6H_5NO_2$
Oil of mustard, artificial	Allyl isothiocyanate	C_3H_5SCN
Oil of vitriol	Sulfuric acid	H_2SO_4
Oil of wintergreen, artificial	Methyl salicylate	$C_8H_8O_3$
Pearl ash	Potassium carbonate	K_2CO_3
Permanent white	Barium sulfate	$BaSO_4$
Phosgene	Carbonyl chloride	$COCl_2$
Plaster of Paris	Calcium sulfate	$2CaSO_4+1H_2O$
Plumbago	Graphite	....
Precipitated chalk	Calcium carbonate	$CaCO_3$
Prussian blue	Ferric ferrocyanide	$Fe_4(Fe(CN)_6)_3$
Prussic acid	Hydrocyanic acid	HCN

COMMON NAMES OF CHEMICALS, THEIR CORRECT CHEMICAL NAMES AND FORMULÆ (Continued)

Common Name	Chemical Name	Formula
Pyrolusite	Manganese dioxide	MnO_2
Quick lime	Calcium oxide	CaO
Quinol	Hydroquinone	$C_6H_4(OH)_2(1.4)$
Realgar	Arsenic disulfide	As_2S_2
Red lead	Lead tetroxide	Pb_3O_4
Red prussiate of potash	Potassium ferricyanide	$K_3Fe(CN)_6$
Rochelle salt	Potassium sodium tartrate	$KNaC_4H_4O_6 \cdot 4H_2O$
Sal ammoniac	Ammonium chloride	NH_4Cl
Sal soda	Sodium carbonate	$Na_2CO_3 \cdot 10H_2O$
Salol	Phenyl salicylate	$C_6H_4\left\langle\begin{array}{l}OH(1)\\COOC_6H_5(2)\end{array}\right.$
Salt	Sodium chloride	$NaCl$
Salt cake	Impure sodium sulfate	....
Salt of lemon	Potassium acid oxalate	$KHC_2O_4 \cdot H_2O$
Salt of sorrel	Potassium acid oxalate	$KHC_2O_4 \cdot H_2O$
Salt of tartar	Potassium carbonate	K_2CO_3
Salt of wormwood	Potassium carbonate	K_2CO_3
Salt peter	Potassium nitrate	KNO_3
Scheele's green	Copper hydrogen arsenite	$CuHAsO_3$
Silica	Silicon dioxide	SiO_2
Slaked lime	Calcium hydroxide	$Ca(OH)_2$
Soda	Sodium carbonate	$Na_2CO_3 \cdot 10H_2O$
Sodium hyposulfite	Sodium thiosulfate	$Na_2S_2O_3 \cdot 5H_2O$
Soluble glass	Sodium silicate	$Na_2SiO_3 + H_2O$
Soluble tartar	Potassium tartrate	$2K_2C_4H_4O_6 + 1H_2O$
Sulfuric ether	Diethyl ether	$(C_2H_5)_2O$
Sugar of lead	Lead acetate	$Pb(CH_3CO_2)_2 \cdot 3H_2O$
Sugar of milk	Lactose	$C_{12}H_{22}O_{11} \cdot 1H_2O$
Table salt	Sodium chloride	$NaCl$
Tartar emetic	Potassium antimonyl tartrate	$2K(SbO)C_4H_4O_6 \cdot 1H_2O$
T. N. T.	Trinitro toluene	$C_6H_2(CH_3)(NO_2)_3$ (1, 2, 4, 6)
Turnbull's blue	Ferrous ferricyanide	$Fe_3(Fe(CN)_6)_2$
Ultramarine yellow	Barium chromate	$BaCrO_4$
Unslaked lime	Calcium oxide	CaO
Venetian red	Ferric oxide	Fe_2O_3
Verdigris	Basic copper acetate	$2Cu(C_2H_3O_2)_2 + CuO$(?)
Vermilion	Red mercuric sulfide	HgS
"Vitriolate of" a metal is	synonymous with the sulfate.	
Washing soda	Sodium carbonate	$Na_2CO_3 \cdot 10H_2O$
Water glass	Sodium silicates dissolved in water	....
White lead	Basic lead carbonate	$2PbCO_3 + Pb(OH)_2$
White vitriol	Zinc sulfate	$ZnSO_4 \cdot 7H_2O$
Whiting	Calcium carbonate	$CaCO_3$
Wood alcohol	Methyl alcohol	CH_3OH
Yellow prussiate of potash	Potassium ferrocyanide	$K_4Fe(CN)_6 \cdot 3H_2O$
Zinc white	Zinc oxide	ZnO
Zinc vitriol	Zinc sulfate	$ZnSO_4 \cdot 7H_2O$

TRADE NAMES OF DYESTUFF INTERMEDIATES

Trade Name	Chemical Name
A acid	1, 7-Dihydroxy-3, 6-disulfonic acid
Alizarin	1, 2-dihydroxyanthraquinone
Amino-G acid	2-Naphthylamine-6, 8-disulfonic acid
Amino-R acid	2-Naphthylamine-3, 6-disulfonic acid
Andresen's acid	1-Naphthol-3, 8-disulfonic acid
Anisidine	o-Aminophenol methyl ether
Anthrachrysone	1, 3, 5, 7-Tetrahydroxyanthraquinone
Anthraflavic acid	2, 6-Dihydroxyanthraquinone
Anthranilic acid	o-Aminobenzoic acid
Anthrarufin	1, 5-Dihydroxyanthraquinone
Armstrong's acid	Naphthalene-1, 5-disulfonic acid
Badische acid	2-Naphthylamine-8-sulfonic acid
Bayer's acid	2-Naphthol-8-sulfonic acid
Benzidine	p, p′-Diamino-diphenyl
Brönner's acid	2-Naphthylamine-6-sulfonic acid
β acid	Anthraquinone-2-sulfonic acid
Chromotrope acid	1, 8-Dihydroxynaphthalene-3, 6-disulfonic acid
Chrysazin	1, 8-Dihydroxyanthraquinone
Cleve's acids	1-Naphthylamine-6- and -7-sulfonic acids
Cleve's acid	1-Naphthylamine-5-sulfonic acid
Cleve's acid	1-Naphthylamine-6-sulfonic acid
Cleve's acid	1-Naphthylamine-3-sulfonic acid
Cleve's acid	1-Naphthylamine-7-sulfonic acid
Cresotic acids	Cresol carboxylic acids
Croceine acid	2-Naphthol-8-sulfonic acid
Dahl's acid	2-Naphthylamine-5-sulfonic acid
Dahl's acid II	1-Naphthylamine-4, 6-disulfonic acid
Dahl's acid III	1-Naphthylamine-4, 7-disulfonic acid
Disulpho acid S	1-Naphthylamine-4, 8-disulfonic acid
DTS	Dehydrothio-p-toluidine sulfonic acid
δ acid	{1-Naphthol-4, 8-disulfonic acid {1-Naphthylamine-4, 8-disulfonic acid
Ebert and Merz's acid	Naphthalene-2, 7-disulfonic acid
Ebert and Merz's acid	Naphthalene-2, 6-disulfonic acid
Ewer and Pick's acid	Naphthalene-1, 6-disulfonic acid
ε acid	{1-Naphthol-3, 8-disulfonic acid {1-Naphthylamine-3, 8-disulfonic acid
F acid	2-Naphthol-7-sulfonic acid
Freund's acid	1-Naphthylamine-3, 6-disulfonic acid
G acid	2-Naphthol-6, 8-disulfonic acid
Gallic acid	3, 4, 5-Trihydroxybenzoic acid
γ-acid	2-Amino-8-naphthol-6-sulfonic acid
H acid	1-Amino-8-naphthol-3, 6-disulfonic acid
Histazarin	2, 3-Dihydroxyanthraquinone
Isoanthraflavic acid	2, 7-Dihydroxyanthraquinone
J acid	2-Amino-5-naphthol-7-sulfonic acid
K acid	1-Amino-8-naphthol-4, 6-disulfonic acid
Kalle's acid	1-Naphthylamine-2, 7-disulfonic acid
Ketone base	Tetramethyldiaminobenzophenone
Koch's acid	1-Naphthylamine-3, 6, 8-trisulfonic acid
L acid	1-Naphthol-5-sulfonic acid
Laurent's acid	1-Naphthylamine-5-sulfonic acid
Lepidine	4-Methylquinoline
Leucotrope	Phenyldimethylbenzylammonium chloride
M acid	1-Amino-5-naphthol-7-sulfonic acid
Mesidine	2, 4, 6-Trimethylaniline
Metanilic acid	Aniline-m-sulfonic acid
Michler's ketone	Tetramethyldiaminobenzophenone
Naphthazarin	5, 6-Dihydroxy-1, 4-naphthoquinone
Naphthionic acid	1-Naphthylamine-4-sulfonic acid
o-Naphthionic	1-Naphthylamine-2-sulfonic acid
Naphthol A. S.	Anilide of -hydroxynaphthoic acid

TRADE NAME OF DYESTUFF INTERMEDIATES (Continued)

Trade Name	Chemical Name
Naphthoresorcin	1, 3-Dihydroxynaphthalene
Nevile and Winther's acid	1-Naphthol-4-sulfonic acid
Nigrotic acid	1, 7, 3, 6-Dihydroxysulfonaphthoic acid
Nitroso base	p-Nitrosodimethylaniline
NW acid	Nevile and Winther's acid
Peri acid	1-Naphthylamine-8-sulfonic acid
p-Phenetidine	p-Aminophenol ethyl ether
Phenyl-gamma acid	2-Phenylamino-8-naphthol-6-sulfonic acid
Phenyl Peri acid	Phenyl-1-naphthylamine-8-sulfonic acid
Phosgene	Carbonyl chloride
Phthalic acid	o-Benzenedicarboxylic acid
Picramic acid	2-Amino-4, 6-dinitrophenol
Picric acid	2, 4, 6-Trinitrophenol
Primuline base	p-Toluidine heated with sulfur.
Purpurin	1, 2, 4-Trihydroxyanthraquinone
Pyrogallol	1, 2, 3-Trihydroxybenzene
Quinaldine	2-Methylquinoline
Quinazarin	1, 4-Dihydroxyanthraquinone
R acid	2-Naphthol-3, 6-disulfonic acid
2 R acid	2-Amino-8-naphthol-3, 6-disulfonic acid
Red acid	1, 5-Dihydroxynaphthalene-3, 7-disulfonic acid
RG acid	1-Naphthol-3, 6-disulfonic acid
Resorcinol	1, 3-Dihydroxybenzene
S acid	1-Amino-8-naphthol-4-sulfonic acid
2 S acid	1-Amino-8-naphthol-2, 4-disulfonic acid
Salicylic acid	o-Hydroxybenzoic acid
Schäffer's acid	2-Naphthol-6-sulfonic acid
Schollkopf's acid	1-Naphthol-4, 8-disulfonic acid 1-Naphthylamine-4, 8-disulfonic acid 1-Naphthylamine-8-sulfonic acid
Sulfanilic acid	Aniline-p-sulfonic acid
Thiocarbanilide	Diphenylthiourea
Tobias acid	2-Naphthylamine-1-sulfonic acid
Tolidine	Di-p-aminoditolyl
Toluidine	Amino toluene
Xylidine	Amino xylene
Yellow acid	1, 3-Dihydroxynaphthalene-5, 7-disulfonic acid

PERIODIC ARRANGEMENT OF THE ELEMENTS—

PERIOD	ZERO GROUP	GROUP I — R_2O	GROUP II — RO	GROUP III — R_2O_3	GROUP IV RH_4 RO_2
		Hydrogen H =1.008 No. 1			
1	Helium He =4.00 No. 2	Lithium Li =6.940 No. 3	Beryllium Be =9.02 No. 4	Boron B =10.82 No. 5	Carbon C =12.000 No. 6
2	Neon Ne =10.2 No. 10	Sodium Na =22.997 No. 11	Magnesium Mg =24.32 No. 12	Aluminum Al =26.97 No. 13	Silicon Si =28.06 No. 14
3	Argon A =39.91 No. 18	Potassium K =39.096 No. 19	Calcium Ca =40.07 No. 20	Scandium Sc =45.10 No. 21	Titanium Ti =48.1 No. 22
		Copper Cu =63.57 No. 29	Zinc Zn =65.38 No. 30	Gallium Ga =69.72 No. 31	Germanium Ge =72.60 No. 32
4	Krypton Kr =82.9 No. 36	Rubidium Rb =85.44 No. 37	Strontium Sr =87.63 No. 38	Yttrium Y =88.9 No. 39	Zirconium Zr =91 No. 40
		Silver Ag =107.880 No. 47	Cadmium Cd =112.41 No. 48	Indium In =114.8 No. 49	Tin Sn =118.70 No. 50
5	Xenon Xe =130.2 No. 54	Caesium Cs =132.81 No. 55	Barium Ba =137.37 No. 56	Lanthanum La =138.90 No. 57	Cerium Ce =140.25 No. 58
6					
		Gold Au =197.2 No. 79	Mercury Hg =200.61 No. 80	Thallium Tl =204.39 No. 81	Lead Pb =207.20 No. 82
7	Radon Rn =222 No. 86	No. 87	Radium Ra =225.95 No. 88	No. 89	Thorium Th =232.15 No. 90

Elements not classified in the table above:

Praseodymium Pr =140.92 No. 59	Neodymium Nd =144.27 No. 60	Samarium Sm =150.43 No. 62	Europium Eu =152.0 No. 63
Gadolinium Gd =157.26 No. 64	Terbium Tb =159.2 No. 65	Dysprosium Dy =162.52 No. 66	

MENDELEJEFF'S (REVISED TO 1925)

GROUP V RH_3 R_2O_5	GROUP VI RH_2 RO_3	GROUP VII RH R_2O_7	GROUP VIII		
Nitrogen N = 14.008 No. 7	Oxygen O = 16.000 No. 8	Fluorine F = 19.00 No. 9			
Phosphorus P = 31.027 No. 15	Sulfur S = 32.064 No. 16	Chlorine Cl = 35.457 No. 17			
Vanadium V = 50.96 No. 23	Chromium Cr = 52.01 No. 24	Manganese Mn = 54.93 No. 25	Iron Fe = 55.84 No. 26	Cobalt Co = 58.94 No. 27	Nickel Ni = 58.69 No. 28
Arsenic As = 74.96 No. 33	Selenium Se = 79.2 No. 34	Bromine Br = 79.916 No. 35			
Columbium Cb = 93.1 No. 41	Molybdenum Mo = 96.0 No. 42	No. 43	Ruthenium Ru = 101.7 No. 44	Rhodium Rh = 102.91 No. 45	Palladium Pd = 106.7 No. 46
Antimony Sb = 121.77 No. 51	Tellurium Te = 127.5 No. 52	Iodine I = 126.932 No. 53			
		No. 61			
Tantalum Ta = 181.5 No. 73	Tungsten W = 184.0 No. 74	No. 75	Osmium Os = 190.8 No. 76	Iridium Ir = 193.1 No. 77	Platinum Pt = 195.23 No. 78
Bismuth Bi = 209.00 No. 83	No. 84				
No. 91	Uranium U = 238.17 No. 92	No. 93			

Holmium Ho = 163.4 No. 67	Erbium Er = 167.7 No. 68	Thulium Tm = 169.4 No. 69	Ytterbium Yb = 173.6 No. 70	Lutecium Lu = 175.0 No. 71	Hafnium (Celtium) Hf. = 180.8 No. 72

Masurium
Ma =
No. 43

Rhenium
Re =
No. 75

QUALITATIVE ANALYSIS SCHEME

(From A. A. Noyes' Qualitative Analysis, published by the Macmillan Co., N. Y., by permission)

Basic Constituents

Separation of the Basic Constituents into Groups

<table>
<tr><td colspan="7">Solution in dilute nitric acid containing all the common basic constituents. Add NH_4Cl.</td></tr>
<tr><td rowspan="4">Precipitate:
Silver-Group
(Pb, Ag, Hg),
as chlorides.*</td><td colspan="6">Filtrate. Saturate with H_2S gas.</td></tr>
<tr><td colspan="2" rowspan="2">Precipitate: Copper-Group and Tin-Group as sulfides.
Treat with Na_2S–Na_2S_2 solution.</td><td colspan="4">Filtrate: Add NH_4OH and $(NH_4)_2S$.</td></tr>
<tr><td colspan="2">Precipitate: Aluminum-Group and Iron-Group, as hydroxides and sulfides. Dissolve in acid, add NaOH and Na_2O_2.</td><td colspan="2">Filtrate †: Add $(NH_4)_2CO_3$.</td></tr>
<tr><td>Residue:
Copper-Group
(Pb, Bi, Cu, Cd),
as sulfides.</td><td>Solution:
Tin-Group
(Hg, As, Sb, Sn),
as sodium
sulfo-salts.</td><td>Filtrate:
Aluminum-Group
(Al, Zn, Cr),
as sodium salts.</td><td>Precipitate:
Iron-Group
(Mn, Fe, Co, Ni),
as hydroxides.</td><td>Precipitate:
Alkaline-Earth
Group
(Ba, Sr, Ca, Mg),
as carbonates.</td><td>Filtrate:
Alkali-Group
(NH_4, K, Na),
as nitrates
and chlorides.</td></tr>
</table>

* Lead is precipitated with the silver-group only when a large quantity is present, and then only partially; mercury is precipitated only when it is in the mercurous state.

† Evaporate filtrate to 10 cc., cool, filter, add 15 cc. 95% alcohol and 15 cc. n$(NH_4)_2CO_3$.

QUALITATIVE ANALYSIS SCHEME (Continued)

Analysis of the Silver-Group

<table>
<tr><td colspan="4">Precipitate: $PbCl_2$, $AgCl$, Hg_2Cl_2. Treat with hot water.</td></tr>
<tr><td>Solution: $PbCl_2$. Add K_2CrO_4.</td><td colspan="3">Residue: $AgCl$, Hg_2Cl_2. Pour NH_4OH through the filter.</td></tr>
<tr><td rowspan="2">Precipitate: $PbCrO_4$.</td><td rowspan="2">Black residue: Hg and $Hg\genfrac{}{}{0pt}{}{Cl}{NH_2}$.</td><td colspan="2">Solution: $Ag(NH_3)_2Cl$. Add HNO_3.</td></tr>
<tr><td colspan="2">Precipitate: $AgCl$.</td></tr>
</table>

Separation of the Copper and Tin Groups

<table>
<tr><td colspan="3">Hydrogen Sulfide Precipitate: PbS, Bi_2S_3, CuS, CdS. HgS, As_2S_3, As_2S_5, Sb_2S_3, Sb_2S_5, SnS, SnS_2. Treat with Na_2S–Na_2S_2 solution.</td></tr>
<tr><td rowspan="2">Residue: PbS, Bi_2S_3, CuS, CdS.</td><td colspan="2">Solution: Na_2HgS_2, Na_3AsS_4, Na_3SbS_4, Na_2SnS_3. Acidify with HCl.</td></tr>
<tr><td>Precipitate: HgS, As_2S_5, Sb_2S_5, SnS_2, S.</td><td>Filtrate: NaCl. Reject.</td></tr>
</table>

Analysis of the Copper-Group

<table>
<tr><td colspan="5">Residue from the Sodium Sulfide Treatment: PbS, Bi_2S_3, CuS, CdS. Boil with HNO_3.</td></tr>
<tr><td colspan="5">Solution: Pb, Bi, Cu, Cd as nitrates. Add H_2SO_4, evaporate, add water.</td></tr>
<tr><td rowspan="2">Precipitate: $PbSO_4$.
Dissolve in NH_4Ac,
add K_2CrO_4.</td><td colspan="4">Filtrate. Add NH_4OH.</td></tr>
<tr><td>Precipitate: $Bi(OH)_3$.
Add Na_2SnO_2.</td><td colspan="3">Filtrate: $Cu(NH_3)_4SO_4$, $Cd(NH_3)_4SO_4$.</td></tr>
<tr><td rowspan="3">Yellow precipitate: $PbCrO_4$.</td><td rowspan="3">Black residue: Bi.</td><td>To a small part add HAc and $K_4Fe(CN)_6$</td><td colspan="2">To the remainder add H_2SO_4 and Fe.</td></tr>
<tr><td rowspan="2">Red precipitate:
$Cu_2Fe(CN)_6$.
White precipitate:
$Cd_2Fe(CN)_6$</td><td rowspan="2">Precipitate: Cu.</td><td>Solution: $CdSO_4$.
Add H_2S.</td></tr>
<tr><td>Yellow precipitate:
CdS.</td></tr>
</table>

QUALITATIVE ANALYSIS SCHEME (Continued)

Analysis of the Tin-Group

<table>
<tr><td colspan="4">Precipitate from Sodium Sulfide Solution: S, HgS, As_2S_5, Sb_2S_5, SnS_2. Heat with 12 n. HCl.</td></tr>
<tr><td colspan="2">Residue: S, HgS, As_2S_5. Add NH_4OH.</td><td colspan="2">Solution: $SbCl_3$, H_2SnCl_6. Dilute, heat, pass in H_2S.</td></tr>
<tr><td>Residue: S, HgS.
Add HCl and $KClO_3$.</td><td>Solution. Evaporate, add HNO_3, then NH_4OH</td><td>Orange precipitate: Sb_2S_3.
Dissolve in HCl, add Sn.</td><td>Solution: H_2SnCl_6. Partly neutralize, pass in H_2S</td></tr>
<tr><td>Solution: $HgCl_2$.
Add $SnCl_2$.</td><td>Solution: $(NH_4)_3AsO_4$.
Add $Mg(NO_3)_2$.</td><td>Black deposit: Sb. Add NaOBr.</td><td>Precipitate: SnS_2. Evaporate without filtering.</td></tr>
<tr><td>Precipitate: Hg_2Cl_2 or Hg.</td><td>Precipitate: $MgNH_4AsO_4$.
Add $AgNO_3$.</td><td>Black deposit: Sb.</td><td>Solution: H_2SnCl_6. Boil with Sb.</td></tr>
<tr><td></td><td>Red residue: Ag_3AsO_4.</td><td></td><td>Solution: $SnCl_2$. Add $HgCl_2$.</td></tr>
<tr><td></td><td></td><td></td><td>Precipitate: Hg_2Cl_2.</td></tr>
</table>

Separation of the Aluminum and Iron Groups

<table>
<tr><td colspan="3">Filtrate from the Hydrogen Sulfide Precipitate. Add NH_4OH in excess.</td></tr>
<tr><td colspan="3">Precipitate *: $Al(OH)_3$, $Cr(OH)_3$, $Fe(OH)_{2-3}$; $Mn(OH)_3$ after exposure to air.
Solution: Salts of $Zn(NH_3)_4$, $Ni(NH_3)_4$, Co, Mn, Ba, Sr, Ca, Mg, K, and Na. Add $(NH_4)_2S$ and filter.</td></tr>
<tr><td colspan="2">Precipitate *: $Al(OH)_3$, $Cr(OH)_3$, FeS, ZnS, MnS, CoS, NiS.
Dissolve in HCl and $KClO_3$, add NaOH.</td><td rowspan="3">Filtrate:
Alkaline-Earth and Alkali Groups.</td></tr>
<tr><td colspan="2">Precipitate *: $Fe(OH)_3$, $Mn(OH)_2$, $Co(OH)_2$, $Ni(OH)_2$.
Solution: $NaAlO_2$, $NaCrO_2$, Na_2ZnO_2. Add Na_2O_2 and filter.</td></tr>
<tr><td>Filtrate: Aluminum-Group.
$NaAlO_2$, Na_2ZnO_2, Na_2CrO_4.</td><td>Precipitate *: Iron-Group.
$MnO(OH)_2$, $Fe(OH)_3$, $Co(OH)_3$, $Ni(OH)_2$.</td></tr>
</table>

* When phosphate is present in the solution, these precipitates may contain the phosphates of the elements otherwise precipitated as hydroxides, and also the phosphates of barium, strontium, calcium, and magnesium.

QUALITATIVE ANALYSIS SCHEME (Continued)

Analysis of the Aluminum-Group

<table>
<tr><td colspan="3">Filtrate from the Sodium Hydroxide and Peroxide Treatment: $NaAlO_2$, Na_2ZnO_2, Na_2CrO_4. Acidify with HCl, add NH_4OH.</td></tr>
<tr><td>Precipitate: $Al(OH)_3$. Dissolve in HNO_3, add $Co(NO_3)_2$, evaporate, ignite.</td><td colspan="2">Filtrate: $Zn(NH_3)_4Cl_2$, Na_2CrO_4. Add Na_2CO_3, boil to expel NH_3.</td></tr>
<tr><td rowspan="2">Blue residue: $Co(AlO_2)_2$.</td><td>Precipitate: $ZnCO_3xZn(OH)_2$.
Dissolve in HCl, add NH_4OH and $(NH_4)_2S$.</td><td>Filtrate: Na_2CrO_4. Add HAc and $PbAc_2$.</td></tr>
<tr><td>White precipitate: ZnS.</td><td>Yellow precipitate: $PbCrO_4$.</td></tr>
</table>

Analysis of the Iron-Group

<table>
<tr><td colspan="4">Precipitate Produced by Sodium Hydroxide and Peroxide:
A. Phosphate absent: $MnO(OH)_2$, $Fe(OH)_3$,* $Zn(OH)_2$, $Co(OH)_3$, $Ni(OH)_2$.
B. Phosphate present: Also $FePO_4$, and alkaline-earth phosphates and carbonates.
Heat with HNO_3 and $KClO_3$.</td></tr>
<tr><td>Precipitate: MnO_2.
Add HNO_3 and H_2O_2.</td><td colspan="3">Solution:
A. $Fe(NO_3)_3$, $Zn(NO_3)_2$, $Co(NO_3)_2$, $Ni(NO_3)_2$. Add NH_4OH (P. 63).
B. Also $Ba(NO_3)_2$, etc., and H_3PO_4. Nearly neutralize with NH_4OH, add NH_4Ac and $Fe(NO_3)_3$, dilute, and boil.†</td></tr>
<tr><td>Solution: $Mn(NO_3)_2$.
Add BiO_2.</td><td rowspan="2">Precipitate:
A. $Fe(OH)_3$.
B. Also $FePO_4$.</td><td colspan="2">Filtrate. Add NH_4OH, pass in H_2S.</td></tr>
<tr><td>Purple color: $HMnO_4$.</td><td>Precipitate:
ZnS, CoS, NiS.</td><td>Filtrate:
A. NH_4 salts. Reject.
B. Ba, Ca, Sr, Mg, and NH_4 salts.</td></tr>
</table>

* All the zinc may be carried into this precipitate by elements of the iron-group when they are present in large quantity.
† First testing a small portion of the solution for iron with $K_4Fe(CN)_6$.

QUALITATIVE ANALYSIS SCHEME (Continued)

Separation of Zinc, Nickel and Cobalt

<table>
<tr><td colspan="4">Hydrogen Sulphide Precipitate: ZnS, CoS, NiS. Treat with cold 1 n. HCl.</td></tr>
<tr><td colspan="3">Solution: $ZnCl_2$, $CoCl_2$ *, $NiCl_2$ *. Add $NaOH$ and Na_2O_2.</td><td rowspan="2">Residue: CoS, NiS.</td></tr>
<tr><td>Filtrate: Na_2ZnO_2. Add $(NH_4)_2S$.</td><td colspan="2">Precipitate: $Co(OH)_3$, $Ni(OH)_2$.</td></tr>
<tr><td rowspan="2">White precipitate: ZnS.
Dissolve in HNO_3, add $Co(NO_3)_2$ and Na_2CO_3, ignite.</td><td colspan="3">Add HCl and $KClO_3$.</td></tr>
<tr><td colspan="3">Solution: $CoCl_2$, $NiCl_2$. Evaporate, add HAc and KNO_2.</td></tr>
<tr><td rowspan="2">Green residue: $CoZnO_2$.</td><td rowspan="2">Yellow precipitate: $K_3Co(NO_2)_6$.</td><td colspan="2">Filtrate: $NiCl_2$. Add $(CH_3)_2C_2(NOH)_2$.</td></tr>
<tr><td colspan="2">Red precipitate:
$[(CH_3)_2C_2(NOH)NO]_2Ni$</td></tr>
</table>

* A small proportion of the cobalt and nickel present always dissolves in the dilute HCl.

Analysis of the Alkaline-Earth Group

<table>
<tr><td colspan="5">Ammonium Carbonate Precipitate: $BaCO_3$, $SrCO_3$, $CaCO_3$, $MgCO_3 \cdot (NH_4)_2CO_3$.
Dissolve in HAc, add NH_4Ac and K_2CrO_4.</td></tr>
<tr><td rowspan="2">Precipitate: $BaCrO_4$.
Dissolve in HCl, evaporate, add HAc, NH_4Ac, and K_2CrO_4.</td><td colspan="4">Filtrate. Add NH_4OH and C_2H_5OH.</td></tr>
<tr><td colspan="2">Precipitate: $SrCrO_4$, ($CaCrO_4$).†
Boil with $(NH_4)_2CO_3$ and $K_2C_2O_4$.</td><td colspan="2">Filtrate: Ca and Mg salts. Add $K_2C_2O_4$.</td></tr>
<tr><td rowspan="3">Precipitate: $BaCrO_4$.</td><td colspan="2">Residue: $SrCO_3$, (CaC_2O_4). Treat with HAc.</td><td>Precipitate:
CaC_2O_4, (MgC_2O_4).
Treat with H_2SO_4.</td><td>Filtrate.
Add Na_2HPO_4.</td></tr>
<tr><td>Solution: $SrAc_2$.
Add Na_2SO_4.</td><td rowspan="2">Residue:
(CaC_2O_4).</td><td>Solution: $CaSO_4$, ($MgSO_4$).
Add C_2H_5OH.</td><td rowspan="2">Precipitate:
$MgNH_4PO_4$.</td></tr>
<tr><td>Precipitate: $SrSO_4$.</td><td>Precipitate: $CaSO_4$.</td></tr>
</table>

† Substances whose formulas are within parentheses are not normally found at the point indicated, but their presence (arising from faulty procedure or an excessive proportion of the element in the substance) is provided for in the confirmatory tests.

QUALITATIVE ANALYSIS SCHEME (Continued)

Analysis of the Alkali-Group

SHORTER LESS EXACT METHOD

<table>
<tr><td colspan="3">Filtrate from the Ammonium Carbonate Precipitate: NH_4, K, Na salts. Evaporate, ignite, add HCl, ignite again.</td></tr>
<tr><td rowspan="4">Vapor: NH_4 salts.</td><td colspan="2">Residue: KCl, NaCl. Add 3 cc. of water, and treat portions as follows:</td></tr>
<tr><td>Add $Na_3Co(NO_2)_6$.</td><td>Add KH_2SbO_4.</td></tr>
<tr><td>Yellow precipitate: $K_2NaCo(NO_2)_6$. Test in flame.</td><td rowspan="2">Crystalline precipitate: NaH_2SbO_4.</td></tr>
<tr><td>Violet color: K.</td></tr>
</table>

EXACT METHOD

<table>
<tr><td colspan="4">Filtrate from the Ammonium Carbonate Precipitate: NH_4, K, Na salts. Evaporate, and ignite the residue. Dissolve in water, add $BaCl_2$ (to remove sulfate), then $(NH_4)_2CO_3$ (to remove barium). Evaporate and ignite again.</td></tr>
<tr><td rowspan="4">Vapor: NH_4 salts.</td><td colspan="3">Residue: KCl, NaCl. Add $HClO_4$, evaporate, add alcohol.</td></tr>
<tr><td>Residue: $KClO_4$. Dissolve in hot water, add $Na_3Co(NO_2)_6$.</td><td colspan="2">Solution: $NaClO_4$. Saturate with HCl gas.</td></tr>
<tr><td rowspan="2">Yellow precipitate: $K_2NaCo(NO_2)_6$.</td><td>Precipitate: NaCl. Dissolve in water, add KH_2SbO_4.</td><td rowspan="2">Filtrate: Reject.</td></tr>
<tr><td>Crystalline precipitate: NaH_2SbO_4.</td></tr>
</table>

QUALITATIVE ANALYSIS SCHEME (Continued)

Supplementary Procedures for Basic Constituents

Boil the substance with NaOH solution.	Boil the substance with H_2SO_4; treat portions of the solution as follows:				
Vapor: NH_3. Absorb in water; add K_2HgI_4.	Add $K_3Fe(CN)_6$.	Add KSCN.	Add $HgCl_2$.	Add HCl.	
Orange precipitate: $HgO\cdot Hg^{I}_{NH_2}$. (Shows ammonium.)	Blue precipitate: $Fe_3(Fe(CN)_6)_2$. (Shows ferrous iron.)	Red color: $Fe(SCN)_3$. (Shows ferric iron.)	Precipitate: Hg_2Cl_2. (Shows stannous tin.)	Precipitate: Hg_2Cl_2 or AgCl. Add NH_4OH.	Filtrate. $HgCl_2$. Add $SnCl_2$.
				Black residue: Hg and $Hg^{Cl}_{NH_2}$. (Shows mercurous mercury.)	Precipitate: Hg_2Cl_2 or Hg. (Shows mercuric mercury.)

Acidic Constituents

Detection of Groups of Acidic Constituents

Sodium Carbonate solution containing all acidic constituents. Treat portions as follows:			
Add $AgNO_3$, $NaNO_2$, and HNO_3	Add HAc, $BaCl_2$, and $CaCl_2$.	Add $MnCl_2$ and HCl.	Add HCl, $FeCl_3$, and $K_3Fe(Cn)_6$.
Precipitate: Chloride-group (S, CN, $Fe(CN)_6{}^{iv}$, $Fe(CN)_6{}^{iii}$, SCN, Cl, Br, I, ClO_3, ClO), as Ag salts.	Precipitate: Sulfate-group (SO_4, SO_3, CrO_4, F, C_2O_4), as Ba and Ca salts.	Dark Color: $MnCl_3$. Shows oxidizing constituents: $Fe(CN)_6{}^{iii}$, ClO_3, ClO, CrO_4, NO_3, NO_2.	Blue precipitate: $Fe_4(Fe(CN)_6)_3$. Shows reducing constituents: S, $Fe(CN)_6{}^{iv}$, I, SO_3, NO_2

QUALITATIVE ANALYSIS SCHEME (Continued)

Separation of the Chloride-Group into Subgroups

<table>
<tr><td colspan="4">Sodium Carbonate solution containing all acidic constituents. To a portion add $Pb(NO_3)_2$.</td></tr>
<tr><td rowspan="4">Black Precipitate: PbS.
(Shows sulfide.)</td><td colspan="3">Filtrate. Add HAc and $Ni(NO_3)_2$.</td></tr>
<tr><td rowspan="3">Precipitate: $Ni_2Fe(CN)_6$, $Ni_3(Fe(CN)_6)_2$, $Ni(CN)_2$.
(Shows simple or complex cyanide.)</td><td colspan="2">Filtrate: NaSCN, NaI, NaBr, NaCl, $NaClO_3$.
Add $AgNO_3$ and HNO_3.</td></tr>
<tr><td rowspan="2">Precipitate: AgSCN, AgI, AgBr, AgCl.
(Shows halide or thiocyanate.)</td><td>Filtrate: $AgClO_3$. Add $NaNO_2$.</td></tr>
<tr><td>Precipitate: AgCl.
(Shows chlorate or hypochlorite.)</td></tr>
</table>

Detection of the Separate Cyanides

<table>
<tr><td colspan="4">Nickel Precipitate: $Ni_2Fe(CN)_6$, $Ni_3(Fe(CN)_6)_2$, $Ni(CN)_2$. Add NH_4OH.</td></tr>
<tr><td colspan="4">Solution: $(NH_3)_4Ni(OH)_2$, $(NH_4)_4Fe(CN)_6$, $(NH_4)_3Fe(CN)_6$, NH_4CN. Add $AgNO_3$ and Na_2SO_3.</td></tr>
<tr><td>Precipitate: $Ag_4Fe(CN)_6$.
Add HCl and $Fe(NO_3)_3$.</td><td colspan="3">Filtrate: $NH_4Ag(CN)_2$, $Ni(NO_3)_2$, $AgNO_3$, and NH_4NO_3. Add HNO_3.</td></tr>
<tr><td rowspan="3">Blue residue: $Fe_4(Fe(CN)_6)_3$ and AgCl.
(Shows ferro or ferricyanide.)</td><td colspan="2">Precipitate: $Ag_2(CN)_2$. Add $(NH_4)_2S$.</td><td rowspan="3">Filtrate: Ni, Ag, and NH_4 nitrates. Reject.</td></tr>
<tr><td rowspan="2">Residue: Ag_2S.
Reject.</td><td>Solution: NH_4CNS.
Add $Fe(NO_3)_3$.</td></tr>
<tr><td>Red color: $Fe(CNS)_3$.
(Shows cyanide.)</td></tr>
</table>

QUALITATIVE ANALYSIS SCHEME (Continued)

Detection of Thiocyanate, Iodide, Bromide, and Chloride

<table>
<tr><td colspan="6">Silver Precipitate: AgSCN, AgI, AgBr, AgCl. Treat with NH_4OH and $(NH_4)_2S$.</td></tr>
<tr><td rowspan="4">Residue: Ag_2S.</td><td colspan="5">Solution: NH_4SCN, NH_4I, NH_4Br, NH_4Cl. Add HNO_3, $Fe(NO_3)_3$, and CCl_4.</td></tr>
<tr><td rowspan="3">CCl_4 layer: I_2.
(Purple color shows iodide.)</td><td colspan="4">Water layer: I_2, HBr, HCl, $Fe(SCN)_3$. (Red color shows thiocyanate.)
Boil; then cool and add $KMnO_4$ and CCl_4.</td></tr>
<tr><td rowspan="2">Vapor: I_2.</td><td rowspan="2">CCl_4 layer: Br_2.
(Orange color shows bromide.)</td><td colspan="2">Water layer: Br_2, HCl, H_2SO_4.
Boil; then add $AgNO_3$.</td></tr>
<tr><td>Vapor: Br_2.</td><td>Precipitate: AgCl.
(Shows chloride.)</td></tr>
</table>

Detection of Sulfate, Sulfite, Chromate, Fluoride, and Oxalate

<table>
<tr><td colspan="4">Sodium Carbonate solution containing all acidic constituents. Acidify with HCl, and add $BaCl_2$.</td></tr>
<tr><td rowspan="6">Precipitate: $BaSO_4$.
(Shows sulfate.)</td><td colspan="3">Filtrate: Na_2SO_3, $Na_2Cr_2O_7$, NaF, $Na_2C_2O_4$, $BaCl_2$. Add Br_2.</td></tr>
<tr><td rowspan="5">Precipitate: $BaSO_4$.
(Shows sulfite.)</td><td colspan="2">Filtrate: $Na_2Cr_2O_7$, NaF, $Na_2C_2O_4$, $BaCl_2$. Add NaAc and $CaCl_2$.</td></tr>
<tr><td colspan="2">Yellow precipitate: $BaCrO_4$.
White precipitate: CaF_2, CaC_2O_4.
Treat portions as follows:</td></tr>
<tr><td>Heat with SiO_2 and H_2SO_4.</td><td>Dissolve in HNO_3, add $KMnO_4$, distill.</td></tr>
<tr><td>Gas: SiF_4. Test with water.</td><td>Vapors: CO_2. Collect in $Ba(OH)_2$.</td></tr>
<tr><td>Turbidity: H_2SiO_3. (Shows fluoride.)</td><td>Precipitate: $BaCO_3$. (Shows oxalate.)</td></tr>
</table>

QUALITATIVE ANALYSIS SCHEME (Continued)

Detection of Nitrate, Nitrite, Borate, Arsenate, and Arsenite

Sodium Carbonate solution containing all the acidic constituents. Treat portions as follows:

Boil with NaOH and Al.	Add HAc and CSN_2H_4.		Add HCl, C_2H_5OH, and turmeric.	Add HCl, NH_4OH, and $Mg(NO_3)_2$.	
Vapor: NH_3. Test with K_2HgI_4.	Gas: N_2.	Solution: NH_4SCN. Add $FeCl_3$.	Orange color. (Shows borate.)	Precipitate: $MgNH_4AsO_4$. Treat with $AgNO_3$.	Filtrate: NH_4AsO_2. Pass in H_2S.
Red precipitate: $HgO \cdot HgNH_2I$ (Shows nitrate or nitrite.)		Red color: $Fe(SCN)_3$.		Red residue: Ag_3AsO_4. (Shows arsenate.)	Yellow precipitate, As_2S_3. (Shows arsenite.)
	(Show nitrite.)				

Detection of Phosphate and the Separate Halides

To portions of the HNO_3 solution of the substance.

Add $(NH_4)_2MoO_4$.	Add $FeCl_3$.	Add NaAc, HAc, $KMnO_4$ and $CHCl_3$.		
Yellow precipitate: $(NH_4)_3PO_4$, $12MoO_3$. (Shows phosphate.)	Red color: $Fe(SCN)_3$. (Shows thiocyanate.)	Chloroform layer, purple: I_2. (Shows iodide.)	Water layer: add H_2SO_4, more $KMnO_4$ and $CHCl_3$.	
			Chloroform layer, orange: Br_2. (Shows bromide.)	Water layer: Boil out the Br_2, add HNO_3 and $AgNO_3$.

Detection of Readily Volatile Acidic Constituents

Heat the substance with dilute H_2SO_4.

Vapors: CO_2, SO_2, H_2S, NO_2, Cl_2, Br_2, I_2, HCN. Expose to the vapors:

$Ba(OH)_2$ solution.	PbAc paper	Starch and KI paper.	$Fe(OH)_2$ or $Fe(OH)_3$ and NaOH on paper.
White turbidity: $BaCO_3$ or $BaSO_3$. (Shows carbonate, sulphite or thiosulphate.)	Black color: PbS. (Shows sulphide.)	Blue color: I_2 (Shows nitrite, hypochlorite, chlorate, bromate, or iodide.)	Formation of $Na_4Fe(CN)_6$. Dip in HCl.
			Blue color: $Fe_4(Fe(CN)_6)_3$. (Shows cyanide.)

QUALITATIVE ANALYSIS SCHEME (Continued)

ANALYSIS OF NATURAL SUBSTANCES AND IGNEOUS PRODUCTS

Detection of Sulfate, Carbonate, Sulfide, and Cyanide

<table>
<tr><td colspan="3">Boil 0.5 g. of the substance with HCl and Zn, collecting the distillate in $Ba(OH)_2$ solution; filter the mixture left in the distilling flask.</td></tr>
<tr><td>Filtrate from mixture in distilling flask. Add $BaCl_2$.</td><td colspan="2">Distillate. Precipitate: $BaCO_3$. (Shows carbonate.) Solution: BaS, $Ba(CN)_2$.</td></tr>
<tr><td rowspan="2">Precipitate: $BaSO_4$. (Shows sulfate.)</td><td>To a part of the mixture add HAc and $PbAc_2$.</td><td>To the rest of the mixture add $FeCl_2$, boil, add HCl.</td></tr>
<tr><td>Black precipitate: PbS. (Shows sulfide.)</td><td>Blue precipitate: $Fe_4(FeCN_6)_3$. (Shows cyanide.)</td></tr>
</table>

Detection of Chloride, Fluoride, and Borate

<table>
<tr><td colspan="3">Distill 1 g. of the substance, first (A) with H_2SO_4 alone, then (B) with addition of CH_3OH.</td></tr>
<tr><td colspan="2">A. First distillate.</td><td rowspan="2">B. Second distillate: $B(OCH_3)_3$. Add HCl, C_2H_5OH, and turmeric.</td></tr>
<tr><td>To a portion add $AgNO_3$.</td><td>To the remainder add NaAc and $CaCl_2$.</td></tr>
<tr><td>Precipitate: AgCl. (Shows chloride.)</td><td>Precipitate: CaF_2. (Shows fluoride.) Confirm by special test.</td><td>Orange or red color. (Shows borate.)</td></tr>
</table>

FLAME AND BEAD TESTS

Flame Colorations

VIOLET.

Potassium compounds. Purple red through blue glass. Easily obscured by sodium flame. Bluish green through green glass. Rubidium and Cacsium compounds impart same flame as potassium compounds.

BLUES.

Azure. — Copper chloride. Copper bromide gives azure blue followed by green. Other copper compounds give same coloration when moistened with hydrochloric acid.

Light Blue. — Lead, Arsenic, Selenium.

GREENS.

Emerald. — Copper compounds except the halides, and when not moistened with hydrochloric acid.

Pure Green. — Compounds of thallium and tellurium.

Yellowish. — Barium compounds. Some molybdenum compounds. Borates, especially when treated with sulphuric acid or when burned with alcohol.

Bluish. — Phosphates with sulphuric acid.

Feeble. — Antimony compounds. Ammonium compounds.

Whitish. — Zinc.

REDS.

Carmine. — Lithium compounds. Violet through blue glass. Invisible through green glass. Masked by barium flame.

Scarlet. — Strontium compounds. Violet through blue glass. Yellowish through green glass. Masked by barium flame.

Yellowish. — Calcium compounds. Greenish through blue glass. Green through green glass. Masked by barium flame.

YELLOWS.

Yellow. All sodium compounds. Invisible with blue glass.

OXIDES WHICH IMPART DECIDED COLORS TO THE BEADS

Borax Beads

Oxides of	Oxidizing Flame	Reducing Flame
Chromium	Green	Green
Cobalt	Blue	Blue
Copper	Greenish blue	Red-opaque
Iron	Yellow	Green
Manganese	Violet	Colorless
Molybdenum	Colorless	Brown
Nickel	Brown	Gray-opaque
Titanium	Colorless	Yellow
Tungsten	Colorless	Brown
Uranium	Red	Green
Vanadium	Colorless	Green

FLAME AND BEAD TESTS (Continued)

Salt of Phosphorus Beads

Oxides of	Oxidizing Flame	Reducing Flame
Chromium	Green	Green
Cobalt	Blue	Blue
Copper	Blue	Red-opaque
Iron	Brown	Colorless
Manganese	Violet	Colorless
Molybdenum	Colorless	Green
Nickel	Yellow	Yellow
Titanium	Colorless	Violet
Tungsten	Colorless	Blue
Uranium	Green	Green
Vanadium	Yellow	Green

Sodium Carbonate Bead

Manganese	Green	Colorless

PREPARATION AND PROPER CONCENTRATION OF LABORATORY REAGENTS FOR GENERAL USE

Dilute Acids. Sulphuric acid. One volume strong acid to 6 volumes water.

Nitric Acid. One volume strong acid to 2 volumes water.

Hydrochloric acid. Five volumes strong acid to 8 volumes water.

Acetic acid. One volume strong acid to $2\frac{1}{2}$ volumes water.

Dilute Bases. Potassium hydroxide. 280 grams per liter of solution with water.

Sodium hydroxide. 200 grams per liter of solution with water.

Ammonium hydroxide. One volume strong ammonia (sp. gr. 90) to 2 volumes water.

Other Reagents. Ammonium sulphide. 600 cc. ammonium hydroxide is saturated with hydrogen sulphide. Dilute to one liter with ammonium hydroxide.

Sodium sulphide. Dissolve 200 grams sodium hydroxide in 800 cc. water. Saturate 400 cc. of this solution with hydrogen sulphide. Add the remaining 400 cc. of sodium hydroxide and dilute the whole to one liter.

Ammonium chloride. 267.5 grams per liter of solution with water.

Ammonium carbonate. 200 grams solid salt dissolved in 350 cc. ammonium hydroxide and dilute with water to 1 liter.

Ammonium acetate. Dilute 300 cc. strong acetic acid with 300 cc. water and neutralize with strong ammonia. Dilute to 1 liter.

Sodium acetate, 136.14 grams per liter with water.

Sodium phosphate, 119.45 grams per liter with water.

Calcium chloride, 109.51 grams per liter with water.

Magnesium sulphate, 123.28 grams per liter with water.

Barium chloride, 122.17 grams per liter with water.

Ferric chloride, 54.11 grams per liter with water and add sufficient HCl to keep in solution.

Potassium ferrocyanide, 105.72 grams per liter with water.

Lead acetate, 189.51 grams per liter with water.

Stannous chloride, 112.72 grams of the solid salt plus 200 cc. 5N HCl diluted to 1 liter with water. Add metallic tin to the solution in the bottle to keep it from oxidizing.

Mercurous nitrate, 262.34 grams per liter with water. Add sufficient nitric acid to keep solution clear and put metallic mercury in the bottle to prevent oxidation.

Cobalt nitrate, 145 grams per liter with water.

Ammonium oxalate, 35.5 grams per liter with water.

Mercuric chloride, 67.8 grams per liter with water.

Zinc sulphate, 71.9 grams per liter with water.

Manganese sulphate, 55.78 grams per liter with water.
Nickel sulphate, 70.22 grams per liter with water.
Cadmium sulphate, 64.05 grams per liter with water.
Copper sulphate, 62.4 grams per liter with water.

Miscellaneous Reagents. Aqua regia, mix 1 part HNO_3 with three parts of concentrated HCl.

Silver nitrate N/10, 17 grams per liter with water.

Magnesia mixture, dissolve 68 grams crystallized $MgCl_2$ and 165 grams NH_4Cl in 300 cc. water. Add 300 cc. dilute ammonium hydroxide and dilute to 1 liter.

Molybdate solution, dissolve 60 grams molybdic oxide (MoO_3) in 440 cc. of water and 60 cc. strong ammonia (sp. gr. 90). Pour into 500 cc. of cold nitric acid which has been diluted 250 cc. concentrated acid to 250 cc. water. Let stand in a warm place several days. Decant or filter before using.

Phenolsulphonic acid, dissolve 150 grams of phenol in 600 grams of concentrated sulphuric acid.

Yellow ammonium sulphide, 50 to 75 grams of sulphur to a liter of colorless ammonium sulphide.

Ferrous sulphate, dissolve 200 grams $FeSO_4.7H_2O$ in a liter of water. Place scraps of iron in the solution and add a few drops of H_2SO_4 from time to time.

SPECIAL SOLUTIONS AND REAGENTS

Acid Cuprous Chloride. Cover the bottom of a two-liter flask with copper oxide, extend from the top to the bottom of the bottle several pieces of copper wire, and fill the bottle with 1.10 sp. gr. hydrochloric acid. Shake occasionally, and when solution becomes nearly colorless pour into reagent bottles containing copper wire. The stock bottle should be kept filled with 1.10 hydrochloric acid.

Ammoniacal Cuprous Chloride. The acid solution, described above, is treated with ammonia until a slight odor of this reagent is noticeable. Copper wire should be kept in the solution.

Ammonium Molybdate. Mix well 100 gm. of molybdic acid with 400 cc. of distilled water and add 80 cc. of ammonia (sp. gr. 0.90). When complete solution has taken place pour slowly and with stirring into a mixture of 400 cc. of nitric acid (sp. gr. 1.42) and 600 cc. of distilled water. Add 50 milligrams of microcosmic salt, allow to stand 24 hrs. and filter.

Cochineal. Extract 1 gm. of cochineal for four days with 20 cc. of alcohol and 60 cc. of distilled water. Filter.

Congo Red. Dissolve 0.5 gm. of congo red in 90 cc. of distilled water and 10 cc. of alcohol.

Eschka's Compound. Two parts of calcined magnesia are thoroughly mixed with one part of anhydrous sodium carbonate.

Fehling Solution. A. *The Copper Sulphate Solution.* Dissolve 34.66 gm. of copper sulphate ($CuSO_4 \cdot 5H_2O$) in water and dilute to 500 cc. B. *The Alkaline Tartrate Solution.* Dissolve

173 gm. of potassium sodium tartrate (Rochelle salt, $KNaC_4H_4O_6 \cdot 4H_2O$) and 50 gm. of sodium hydroxide in water and dilute when cold to 500 cc. For use, mix equal volumes of the two solutions at the time of using.

Formaldehyde-Sulfuric Acid (Marquis Reagent). Add 10 cc. formaldehyde solution to 50 cc. sulfuric acid.

Fuchsin-Sulfurous Acid. To a solution of 0.5 gm. of fuchsin and 9 gm. of sodium bisulphite in 500 cc. of water add 10 cc. of hydrochloric acid. Keep in well-stoppered bottles and away from light.

Iodo-potassium Iodide (Wagner's Reagent). Dissolve 2 gm. of iodine and 6 gm. of potassium iodide in 100 cc. of water.

Litmus. Extract powder three times with boiling alcohol, each treatment consuming an hour. Treat residue with an equal weight of cold water and filter; then exhaust with five times its weight of boiling water, cool and filter.

Magnesia Mixture. Dissolve 110 gm. of magnesium chloride in a small amount of water. To this solution add 280 gm. of ammonium chloride and 700 cc. of ammonia (sp. gr. 0.90), and dilute to 2000 cc. After standing several hours the solution is filtered. From time to time filter off any silica that may accumulate from the reagent bottle.

Mayer's Reagent. Dissolve 1.35 gm. of mercuric chloride in 60 cc. of water and add to a solution of 5 gm. potassium iodide in 10 cc. of water; add sufficient water to make 100 cc.

Methyl Orange Solution. Dissolve 1 gm. of methyl orange in 1000 cc. of water.

Methyl Red. Dissolve 0.20 gm. of methyl red in 100 cc. of alcohol.

Millon's Reagent. Dissolve 1 part of mercury in 1 part of cold fuming nitric acid. Dilute with twice the volume of water and decant the clear solution after several hours.

Nessler's Solution. Dissolve 50 gm. of potassium iodide in the smallest possible quantity of cold water. Add a saturated solution of mercuric chloride until an excess is indicated by the formation of a precipitate. Add 400 cc. of a 50% solution of potassium hydroxide. Make up to 1 liter, allow to settle, and draw off the clear solution.

Phenolphthalein. Dissolve 1 gm. of phenolphthalein in 50 cc. of alcohol and add 50 cc. water.

Phosphomolybdic Acid (Sonnenschein's Reagent). Prepare ammonium phosphomolybdate and after washing with water, boil with nitric acid and expel NH_3; evaporate to dryness and dissolve in 10% nitric acid.

Phosphotungstic Acid (Scheibler's Reagent). Dissolve 20 gm. sodium tungstate and 15 gm. sodium phosphate in 100 cc. water containing a little nitric acid.

Picric Acid (Hager's Reagent). Dissolve 1 gm. picric acid in 100 cc. water.

Potassium-cadmium Iodide (Marme's Reagent). Add 2 gm. cadmium iodide to a boiling solution of 4 gm. potassium iodide in 12 cc. water and then mix with an equal volume of saturated potassium iodide solution.

Rosolic Acid. Dissolve 1 gm. rosolic acid in 10 cc. alcohol and add 100 cc. water.

Soap Solution. Dissolve 100 gm. of dry castile soap in 1 liter of 80% alcohol. Allow to stand several days and dilute with 70% to 80% alcohol until 6.4 cc. produces a permanent lather with 20 cc. of standard calcium solution. The latter solution is made by dissolving 0.2 gm. of calcium carbonate in a small amount of dilute hydrochloric acid, evaporating to dryness, and making up to 1 liter.

Sodium Cobaltic Nitrite. Dissolve 4 gm. of cobalt nitrate and 10 gm. of sodium nitrite in 50 cc. of water, add 2 cc. of 36% acetic acid and make up to 100 cc.

Sodium Nitroprusside. Use a freshly prepared solution of 1 gm. sodium nitroprusside in 10 cc. of water.

Sulfanilic Acid. Dissolve 0.5 gm. sulfanilic acid in a mixture of 15 cc. glacial acetic acid and 135 cc. of recently boiled water.

Sulfomolybdic Acid (Froehde's Reagent). Dissolve 10 gm. molybdic acid or sodium molybdate in 100 cc. concentrated sulfuric acid.

Sodium Cobaltic Nitrite. Dissolve 4 gm. of cobalt chloride and 10 gm. of sodium nitrite in 50 cc. of distilled water, add 2 cc. of acetic acid and make up to 100 cc.

Starch. Dissolve 5 gm. of soluble starch in cold water, pour the solution into 2 liters of hot water and boil for a few minutes. Keep in a glass-stoppered bottle.

Starch Solution from other than soluble starch. One part of starch is made into an emulsion with water and this is poured into 200 parts of boiling water, the boiling continued a few minutes, then the solution allowed to stand. Use only the clear solution.

Tannic Acid. Dissolve 1 gm. of tannic acid in 1 cc. of alcohol, and make up to 10 cc. with water.

Tincture of Iodine. To 50 cc. of water add 70 gm. of iodine and 50 gm. of potassium iodide. Make up to 1 liter with alcohol.

Trinitrophenol Solution. Dissolve 1 gm. of trinitrophenol in 100 cc. of water. Cool and filter.

Tumeric Tincture. Digest the ground tumeric root with several small quantities of water which are discarded. Dry the residue and digest it several days with six times its weight of alcohol and filter.

Tumeric Paper. Impregnate white, unsized paper with the tincture, and dry.

STANDARD SOLUTIONS FOR VOLUMETRIC ANALYSIS

Acids

Decinormal Succinic Acid. $H_2C_4H_4O_4$ (5.9024 g. per liter) Dry 5–6 g. of pure succinic acid in an open weighing bottle at 105° for about 10 hours; cool in a desiccator. Weigh out accurately 2.9512 g., brush into a 400 cc. beaker and dissolve in 150–200 cc. of water; pour the solution into a 500 cc. graduated flask, rinsing out the beaker several times to insure complete transference of the acid. Dilute to exactly 500 cc. and mix thoroughly. This prepares an exact decinormal solution.

Standard Hydrochloric Acid Solutions by the Method of G. A. Hulett and W. D. Bonner. *Jour. Am. Chem. Soc.* 31, 390 (1909). Standard HCl is easily prepared by starting with HCl of about d 1.10, made up with an ordinary hydrometer, distilling off and discarding the first three-fourths of the liquid taken; the distillate which is then collected does not differ by more than one part in 10,000 from the values in the table below. This constant boiling acid is not hygroscopic or noticeably volatile and is easily weighed in a small flask. By the use of a capillary pipette, to adjust the last amount of acid, it is a very simple matter to weigh out 180.155 g. to less than 10 mg. and this furnishes sufficient acid to make a liter of normal solution with an accuracy that is seldom attained even with very elaborate precautions.

Pressure mm Hg	%HCl	Grams of Constant Boiling Distillate for 1 Mol. HCl.
770	20.218	180.375
760	20.242	180.155
750	20.266	179.945
740	20.290	179.730
730	20.314	179.515

Normal Hydrochloric Acid. (36.465 g. per liter) (*a*) 180.155 g. of constant boiling point (760 mm.) acid diluted to 1 liter gives an exactly normal solution. (*b*) Concentrated HCl diluted to d 1.020 is approximately normal. (*c*) Concentrated HCl. contains about one-third of its weight of HCl and 120 g. diluted with water to 1 liter will give an acid slightly greater than normal. Solutions prepared as in *b* or *c* are most accurately standardized by precipitation as AgCl.

Normal Sulfuric Acid. (49.04 g. per liter) Take 30 cc. of pure, concentrated H_2SO_4, d 1.84 and pour it cautiously and slowly into about 3–4 volumes of water, cool, mix thoroughly and dilute to 1 liter. Standardize by titration with standard NaOH or KOH solutions with phenolphthalein as indicator. For a decinormal solution use 3 cc. H_2SO_4 per liter and proceed as above. Sulfuric acid is obtained easily in a pure form; the normal acid solution is not affected by boiling (advantage over similar HNO_3

or HCl solutions); when used with lime or similar compounds it gives precipitates and for such cases HCl is preferable.

Normal Nitric Acid. (63.016 g. per liter) Use a colorless acid, d 1.3±, free from chlorine and nitrous acid; a yellow color due to lower oxides of nitrogen is removed by adding about 2 volumes of water, boiling, cooling and then diluting to volume. 65 cc. or 93 g. of acid, d 1.42 diluted to 1 iter gives an acid slightly greater than normal. Standardize by titration with standard alkali.

Normal Oxalic Acid. $H_2C_2O_4$ (63.024 g. $H_2C_2O_4.2H_2O$ or 45.008 g. $H_2C_2O_4$ per liter) Because of the uncertainty in the amount of water of crystallization, standards can not be prepared directly by dissolving a weighed quantity of acid; it is necessary to standardize the solution against alkali of known concentration using phenolphthalein as an indicator. Decinormal or less concentrated solutions are unstable and should be prepared fresh when needed; more concentrated solutions may deposit some of the acid when cooled to low temperatures but they are fairly stable at room temperature when protected from light.

Alkalis

Normal Sodium Hydroxide. * (40.005 g. per liter) Dissolve about 42 g. NaOH in cold water which has been previously boiled to expel CO_2 and dilute to 1 liter with CO_2 free water; a small amount of $BaCl_2$ or $Ba(OH)_2$ solution may be added and after allowing the $BaCO_3$ to settle, the clear supernatant solution is decanted. In preparing the solution exposure to air should be avoided as much as possible. Standardize with normal H_2SO_4 using methyl orange indicator. Solutions thus prepared are slightly greater than normal but after preliminary titration with acid are easily adjusted by the addition of the proper amount of water. The solution must be kept in a bottle with the stopper lubricated with a small amount of vaseline.

Normal Potassium Hydroxide.* (56.104 g. per liter) Proceed as with normal sodium hydroxide using 58 g. KOH.

Decinormal Potassium Hydroxide.* (5.6104 g. per liter) Dissolve 7 g. KOH in about 400 cc. of water, add a little $BaCl_2$ solution to precipitate the carbonate and allow to stand about 15 minutes until the $BaCO_3$ settles, filter into a 1 liter flask and without washing the precipitate, dilute to 1 liter with CO_2 free water. Standardize with 0.1 N sulfuric, hydrochloric or succinic acids, using phenolphthalein or methyl orange indicator. Solutions thus prepared are slightly greater than 0.1 N but after preliminary titration with acid are easily adjusted by the addition of the proper amount of water.

Decinormal Sodium Hydroxide.* (4.0005 g. per liter) Dissolve 6 g. NaOH in water and proceed as with 0.1 N KOH.

* The correction factors of NaOH or KOH solutions may change rapidly because of absorption of CO_2 and for this reason should be protected as much as possible from exposure to the air. It is best to standardize these alkaline solutions just before use and when phenolphthalein is used as the indicator to use water which has been boiled recently to expel CO_2 and then cooled. The presence of CO_2 is without effect when methyl orange is the indicator.

Half Normal Ammonium Hydroxide. (17.524 g. per liter) Dilute 28 cc. of ammonium hydroxide, d 0.880 to 1 liter and standardize with sulfuric or hydrochloric acid using cochineal or methyl orange as indicator. Normal solutions of ammonium hydroxide are likely to lose NH_3 at room temperatures.

Oxidizing and Reducing Solutions

Decinormal Potassium Permanganate. $Mn^{vii} \rightarrow Mn^{ii}$ (3.1605 g. per liter) Dissolve 3.3 g. dry $KMnO_4$ in 1 liter distilled water and allow to stand at least 24 hours in a clean glass stoppered bottle. The reasons for not using the freshly prepared solution are: 1st the reducing agents in the water (dust, etc.) are thus all oxidized, and 2nd any MnO_2 formed by this reduction is permitted to settle. The solution is then carefully siphoned through a clean glass tube into clean beakers, discarding the first 25 cc. of solution and the last inch of the solution in the bottle which contains the precipitated MnO_2; the $KMnO_4$ solution should never be permitted to come in contact with rubber, filter paper or other organic matter. The solution in the beakers is now poured back into a clean bottle and standardized against sodium oxalate. Weigh out several samples of 0.25–0.3 g. of a very pure grade and previously dried sodium oxalate and transfer each to 250 cc. Erlenmeyer flasks, add 150 cc. water and 4 cc. concentrated H_2SO_4, heat nearly to boiling and when dissolved run in $KMnO_4$ not faster than 10–15 cc. per minute, swirling the flask rapidly to mix the solutions; the last 1 cc. is added dropwise allowing the solution to decolorize completely before the next addition. The temperature of the solution must be kept above 60°C. and may be heated again if necessary. The addition of $KMnO_4$ is continued until a *faint*, permanent pink is obtained. The first titration may not be exact but will give a fair approximation of the amount necessary for the remaining samples of oxalate. 1 cc. of 0.1 N $KMnO_4$ is equivalent to 0.0067 g. sodium oxalate.

Decinormal Potassium Dichromate. $Cr^{vi} \rightarrow Cr^{iii}$ (4.9035 g. per liter) Dry about 6 g. of $K_2Cr_2O_7$ crystals in an oven for an hour and cool in a desiccator. Weigh out exactly 4.9035 g., place in a liter flask and dilute to exactly 1 liter. This solution is exactly decinormal and can be used for titrating in the standardization of thiosulfate solution. For use in Fe titration it should be checked against pure iron wire by weighing out accurately two samples of wire of 150–200 mg. each. These samples are dissolved separately in beakers with 20 cc. H_2O and 6 cc. HCl. A few particles of carbon may remain undissolved. The solutions are heated nearly to boiling and 2–3 drops of $SnCl_2$ solution are added to reduce any ferric salt formed by oxidation during solution. After cooling and diluting to about 50 cc., an excess of $HgCl_2$ is added (10 cc. of a saturated solution of $HgCl_2$) to reduce the excess $SnCl_2$. The $K_2Cr_2O_7$ solution is added from a burette until within 2 cc. of the quantity calculated from the amount of iron dissolved. The last amount of $K_2Cr_2O_7$ is added slowly and the end point determined using $K_3Fe(Cn)_6$

as an external indicator (one small crystal of $K_3Fe(CN)_6$ in 30 cc. H_2O). A blue color is obtained as long as ferrous iron is present. When no blue color is obtained after 30 seconds the end point is attained. Since the Fe wire is not absolutely pure, the weight of iron sample is multiplied by the percentage of iron in the wire. 0.005584 g. Fe is equivalent to 1 cc. 0.1 N solution.

Decinormal Sodium Thiosulfate. $2Na_2S_2O_3 \rightarrow Na_2S_4O_6$ (24.8202 g. $Na_2S_2O_3.5H_2O$ per liter) Do not dry the sodium thiosulfate in an oven as it can be obtained almost pure; weigh out 28.50 g. and dilute to exactly 1 liter. After mixing thoroughly the solution is allowed to stand two weeks. If free sulfur has separated, the clear liquid is siphoned off. The solution is standardized indirectly by titration with potassium dichromate (*see above*). Dissolve 5 g. KI and 4 g. $NaHCO_3$ in 300 cc. H_2O in a 500 cc. Erlenmeyer flask at room temperature and then add HCl slowly, swirling the flask, until there is no more evolution of CO_2 and then add about 10 cc. more acid; add 35 cc. 0.1 N $K_2Cr_2O_7$, mixing the solutions, rinse the sides of the flask with a few cc. of water, allowing it to form a layer over the solution without mixing; stopper the flask and allow to stand about 10 minutes. Then with thorough mixing run in thiosulfate until the solution is a light yellow, add a few drops of starch solution and continue with a slow addition of thiosulfate until the bright blue color has disappeared and only the pale green color of $CrCl_3$ remains.

Decinormal Iodine. $I_2 \rightarrow 2HI$ (12.6932 g. per liter) Dissolve about 13.5 g. pure sublimed iodine in a sulution of 24 g. KI in 200 cc. H_2O and dilute to 1 liter. The solution is standardized by adding the iodine to a known volume of standard thiosulfate with a few drops of starch solution for the indicator.

Decinormal Alkaline Arsenite $As^{iii} \rightarrow As^{v}$ (4.948 g. As_2O_3 per liter; equivalent to 0.0126932 g. I or 0.0035457 g. Cl per cc.) Dissolve 4.948 g. pure sublimed As_2O_3 in a concentrated solution of 4 g. NaOH, add 100 cc. of a saturated $NaHCO_3$ solution and dilute to 1 liter. Do not warm the solution above 60° C. when dissolving the As_2O_3. Standardize against standard iodine solution with a starch indicator.

DECI-NORMAL SOLUTIONS OF SALTS AND OTHER REAGENTS

The weight in grams of the compound in 1 c.c. of the following deci-normal solutions is found by dividing the H equivalent in the last column by 1000.

Name	Formula	At. or mol. wt.	Hydrogen equivalent	One H equiv. in grms.
Acetic acid	$HC_2H_3O_2$	60.03	$HC_2H_3O_2$	6.003
Ammonia	NH_3	17.03	NH_3	1.703
Ammonium	NH_4	18.04	NH_4	1.804
Ammonium chloride	NH_4Cl	53.50	NH_4Cl	5.350
Ammonium sulphate	$(NH_4)_2SO_4$	132.14	$\frac{1}{2}(NH_4)_2SO_4$	[illegible]07
Ammonium sulphocyanate	NH_4CNS	76.11	NH_4CNS	7.611
Barium	Ba	137.37	$\frac{1}{2}$Ba	[illegible].869
Barium carbonate	$BaCO_3$	197.37	$\frac{1}{2}BaCO_3$	9.869
Barium chloride	$BaCl_2.2H_2O$	244.32	$\frac{1}{2}BaCl_2.2H_2O$	12.216
Barium hydroxide	$Ba(OH)_2$	171.39	$\frac{1}{2}Ba(OH)_2$	8.5[illegible]
Barium oxide	BaO	153.37	$\frac{1}{2}$BaO	7.6[illegible]
Bromine	Br	79.92	Br	7.9[illegible]2
Calcium	Ca	40.07	$\frac{1}{2}$Ca	2.004
Calcium carbonate	$CaCO_3$	100.07	$\frac{1}{2}CaCO_3$	5.004
Calcium chloride	$CaCl_2$	110.98	$\frac{1}{2}CaCl_2$	5.549
Calcium chloride	$CaCl_2.6H_2O$	219.08	$\frac{1}{2}CaCl_2.6H_2O$	10.954
Calcium hydroxide	$Ca(OH)_2$	74.09	$\frac{1}{2}Ca(OH)_2$	3.704
Calcium oxide	CaO	56.07	$\frac{1}{2}$CaO	2.804
Chlorine	Cl	35.46	Cl	3.546
Citric acid	$C_6H_8O_7.H_2O$	210.08	$\frac{1}{3}C_6H_8O_7.H_2O$	7.003
Cobalt	Co	58.94	$\frac{1}{2}$Co	2.948
Copper	Cu	63.57	$\frac{1}{2}$Cu	3.179
Copper Oxide	CuO	79.57	$\frac{1}{2}$CuO	3.979
Copper sulphate	$CuSO_4.5H_2O$	249.71	$\frac{1}{2}CuSO_4.5H_2O$	12.486
Cyanogen	CN	26.01	CN	2.601
Hydrochloric acid	HCl	36.47	HCl	3.647
Hydrocyanic acid	HCN	27.02	HCN	2.702
Iodine	I	126.93	I	12.693
Lactic acid	$C_3H_6O_3$	90.05	$C_3H_6O_3$	9.005
Malic acid	$C_4H_6O_5$	134.05	$\frac{1}{2}C_4H_6O_5$	6.702
Magnesium	Mg	24.32	$\frac{1}{2}$Mg	1.216
Magnesium carbonate	$MgCO_3$	84.32	$\frac{1}{2}MgCO_3$	4.216
Magnesium chloride	$MgCl_2$	95.23	$\frac{1}{2}MgCl_2$	4.762
Magnesium chloride	$MgCl_2.6H_2O$	203.33	$\frac{1}{2}MgCl_2.6H_2O$	10.167
Magnesium oxide	MgO	40.32	$\frac{1}{2}$MgO	2.016
Manganese	Mn	54.93	$\frac{1}{2}$Mn	2.747
Manganese sulphate	$MnSO_4$	150.99	$\frac{1}{2}MnSO_4$	7.550
Mercuric chloride	$HgCl_2$	271.52	$\frac{1}{2}HgCl_2$	13.576
Nickel	Ni	58.69	$\frac{1}{2}$Ni	2.935
Nitric acid	HNO_3	63.02	HNO_3	6.302
Nitrogen	N	14.01	N	1.401
Nitrogen pentoxide	N_2O_5	108.02	$\frac{1}{2}N_2O_5$	5.401
Oxalic acid	$H_2C_2O_4$	90.02	$\frac{1}{2}H_2C_2O_4$	4.501
Oxalic acid	$H_2C_2O_4.2H_2O$	126.05	$\frac{1}{2}H_2C_2O_4.2H_2O$	6.302
Oxalic anhydride	C_2O_3	72.00	$\frac{1}{2}C_2O_3$	3.600
Phosphoric acid	H_3PO_4	98.05	$\frac{1}{3}H_3PO_4$	3.268
Potassium	K	39.10	K	3.910
Potassium bicarbonate	$KHCO_3$	100.10	$KHCO_3$	10.010
Potassium carbonate	K_2CO_3	138.19	$\frac{1}{2}K_2CO_3$	6.910
Potassium chloride	KCl	74.55	KCl	7.455
Potassium cyanide	KCN	65.10	KCN	6.510
Potassium hydroxide	KOH	56.10	KOH	5.610
Potassium oxide	K_2O	94.19	$\frac{1}{2}K_2O$	4.710
Potassium permanganate for Co estimation	$KMnO_4$	158.03	$\frac{1}{6}KMnO_4$	2.634

DECI-NORMAL SOLUTIONS OF SALTS AND OTHER REAGENTS (Continued.)

Name	Formula	At. or mol wt.	Hydrogen equivalent	One H equiv. in gms.
Potassium permanganate for Mn estimation	$KMnO_4$	158.03	$\frac{1}{3}KMnO_4$	5.268
Potassium tartrate	$K_2H_4C_4O_6$	226.22	$\frac{1}{2}K_2H_4C_4O_6$	11.311
Silver	Ag	107.88	Ag	10.788
Silver nitrate	$AgNO_3$	169.89	$AgNO_3$	16.989
Sodium	Na	23.00	Na	2.300
Sodium bicarbonate	$NaHCO_3$	84.01	$NaHCO_3$	8.401
Sodium carbonate	Na_2CO_3	105.99	$\frac{1}{2}Na_2CO_3$	5.300
Sodium chloride	NaCl	58.45	NaCl	5.845
Sodium hydroxide	NaOH	40.01	NaOH	4.001
Sodium oxide	Na_2O	61.99	$\frac{1}{2}Na_2O$	3.100
Sodium sulphide	Na_2S	78.06	$\frac{1}{2}Na_2S$	3.903
Succinic acid	$H_2C_4H_4O_4$	118.05	$\frac{1}{2}H_2C_4H_4O_4$	5.902
Sulphuric acid	H_2SO_4	98.08	$\frac{1}{2}H_2SO_4$	4.904
Sulphur trioxide	SO_3	80.06	$\frac{1}{2}SO_3$	4.003
Tartaric acid	$C_4H_6O_6$	150.05	$\frac{1}{2}C_4H_6O_6$	7.502
Zinc	Zn	65.38	$\frac{1}{2}Zn$	3.269
Zinc sulphate	$ZnSO_4.7H_2O$	287.56	$\frac{1}{2}ZnSO_4.7H_2O$	14.378

DECI-NORMAL SOLUTIONS OF OXIDATION AND REDUCTION REAGENTS

Name	Formula	At. or mol. wt.	Hydrogen equivalent	One H equiv. in gms.
Antimony	Sb	121.77	$\frac{1}{2}Sb$	6.089
Arsenic	As	74.96	$\frac{1}{2}As$	3.748
Arsenic trisulphide	As_2S_3	246.11	$\frac{1}{4}As_2S_3$	6.153
Arsenious oxide	As_2O_3	197.92	$\frac{1}{4}As_2O_3$	4.948
Barium peroxide	BaO_2	169.37	$\frac{1}{2}BaO_2$	8.469
Barium peroxide, hydrated	$BaO_2.8H_2O$	313.50	$\frac{1}{2}BaO_2.8H_2O$	15.675
Calcium	Ca	40.07	$\frac{1}{2}Ca$	2.004
Calcium carbonate	$CaCO_3$	100.07	$\frac{1}{2}CaCO_3$	5.004
Calcium hypochlorite	$Ca(ClO)_2$	142.98	$\frac{1}{2}Ca(ClO)_2$	7.149
Calcium oxide	CaO	56.07	$\frac{1}{2}CaO$	2.804
Chlorine	Cl	35.46	Cl	3.546
Chromium trioxide	CrO_3	100.01	$\frac{1}{3}CrO_3$	3.334
Ferrous ammonium sulphate	$FeSO_4(NH_4)_2SO_4.6H_2O$	391.14	$FeSO_4(NH_4)_2SO_4.6H_2O$	39.114
Hydroferrocyanic acid	$H_4Fe(CN)_6$	215.92	$H_4Fe(CN)_6$	21.592
Hydrogen peroxide	H_2O_2	34.02	$\frac{1}{2}H_2O_2$	1.701
Hydrogen sulphide	H_2S	34.08	$\frac{1}{2}H_2S$	1.704
Iodine	I	126.93	I	12.693
Iron	Fe	55.84	Fe	5.584
Iron oxide, ferrous	FeO	71.84	FeO	7.184
Iron oxide, ferric	Fe_2O_3	159.68	$\frac{1}{2}Fe_2O_3$	7.984
Lead peroxide	PbO_2	239.20	$\frac{1}{2}PbO_2$	11.960
Manganese peroxide	MnO_2	86.93	$\frac{1}{2}MnO_2$	4.347
Nitric acid	HNO_3	63.02	$\frac{1}{3}HNO_3$	2.101
Nitrogen trioxide	N_2O_3	76.02	$\frac{1}{4}N_2O_3$	1.800
Nitrogen pentoxide	N_2O_5	108.02	$\frac{1}{6}N_2O_5$	1.800
Oxalic acid	$C_2H_2O_4$	90.02	$\frac{1}{2}C_2H_2O_4$	4.501
Oxalic acid	$C_2H_2O_4.2H_2O$	126.05	$\frac{1}{2}C_2H_2O_4.2H_2O$	6.302
Oxygen	O	16.00	$\frac{1}{2}O$	0.800
Potassium bichromate	$K_2Cr_2O_7$	294.21	$\frac{1}{6}K_2Cr_2O_7$	4.903
Potassium chlorate	$KClO_3$	122.55	$\frac{1}{6}KClO_3$	2.043
Potassium chromate	K_2CrO_4	194.20	$\frac{1}{3}K_2CrO_4$	6.473
Potassium ferrocyanide	$K_4Fe(CN)_6$	368.27	$K_4Fe(CN)_6$	36.833
Potassium ferrocyanide	$K_4Fe(CN)_6.3H_2O$	422.32	$K_4Fe(CN)_6.3H_2O$	42.232
Potassium iodide	KI	166.03	KI	16.603
Potassium nitrate	KNO_3	101.10	$\frac{1}{3}KNO_3$	3.370
Potassium perchlorate	$KClO_4$	138.55	$\frac{1}{8}KClO_4$	1.732
Potassium permanganate	$KMnO_4$	158.03	$\frac{1}{5}KMnO_4$	3.161
Sodium chlorate	$NaClO_3$	106.45	$\frac{1}{6}NaClO_3$	1.774
Sodium nitrate	$NaNO_3$	85.01	$\frac{1}{3}NaNO_3$	2.834
Sodium thiosulphate	$Na_2S_2O_3.5H_2O$	248.20	$Na_2S_2O_3.5H_2O$	24.820
Stannous chloride	$SnCl_2$	189.61	$\frac{1}{2}SnCl_2$	9.481
Stannous oxide	SnO	134.70	$\frac{1}{2}SnO$	6.735
Sulphur dioxide	SO_2	64.06	$\frac{1}{2}SO_2$	3.203
Tin	Sn	118.70	$\frac{1}{2}Sn$	5.935

SOLUBILITY CHART

	Acetate.	Arsenate.	Arsenite.	Borate.	Bromide.	Carbonate.	Chlorate.	Chloride.	Chromate.	Cyanide.	Ferricyanide.	Ferrocyanide.	Fluoride.	Hydroxide.	Iodide.	Nitrate.	Oxalate.	Oxide.	Phosphate.	Silicate.	Sulphate.	Sulphide.	Tartrate.
Al	W	a	..	A	W		W	W	..	..	..	w	I	A	W	W	A	A	A	a	W	A	W
NH_4	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	..	W	..	W	W	W
Sb		a	A	..	w	..	..	w	A	..	..	..	W	..	w	..	A	A	w	..	w	A	A
Ba	W	A	A	A	W	A	W	W	A	w	w	w	a	W	W	W	A	W	A	A	I	W	A
Bi	W	A	..	A	w	A	W	w	A	w	..	w	A	A	A	W	A	A	A	..	W	A	A
Cd	W	A	..	w	W	A	W	W	A	A	A	..	w	A	W	W	A	A	A	A	W	A	w
Ca	W	A	A	w	W	A	W	W	w	W	W	W	a	w	W	W	A	w	A	A	A	W	A
Cr	W	A	..	A	W	..	W	W	A	A	..	..	W	A	W	W	w	A	A	A	W	A	W
Co	W	A	A	A	W	A	W	W	A	a	I	I	w	A	W	W	A	A	A	A	W	A	W
Cu	W	A	A	W	W	A	W	W	W	A	I	I	A	A	W	W	A	A	A	A	W	A	W
Au	..	..	..	..	W	..	..	W	..	A	..	..	..	A	A	..	..	A	..	..	..	A	..
H	W	W	..	W	W	..	W	W	..	W	W	W	W	W	W	W	W	W	W	W	W	w	W
Fe''	W	A	A	A	W	A	W	W	..	a	I	I	w	A	W	W	A	A	A	A	W	A	w
Fe'''	W	A	A	A	W	..	W	W	W	..	W	I	W	A	W	W	A	A	A	A	W	A	W
Pb	W	A	A	A	a	A	W	a	a	A	w	A	A	A	w	W	A	A	A	A	a	A	A
Mg	W	A	A	w	W	A	W	W	W	W	W	W	a	A	W	W	A	A	A	A	W	A	W
Mn	W	A	A	A	W	A	W	W	W	W	I	A	A	A	W	W	w	A	A	A	W	A	w
Hg'	w	A	A	..	a	A	W	a	A	A	..	..	W	..	A	W	A	A	A	..	w	A	w
Hg''	W	A	A	..	W	A	W	W	w	A	A	A	w	..	A	W	A	A	A	..	W	A	A
Ni	W	A	A	A	W	A	W	W	A	a	I	I	w	A	W	W	A	A	A	A	W	A	A
K	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Ag	w	A	A	A	I	A	W	I	A	I	I	I	W	..	I	W	A	A	A	..	w	A	A
Na	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Sn''''	W	A	..	..	W	..	..	W	..	..	..	I	W	A	W	w	W	A	A	..	W	A	..
Sn''	W	A	A	A	W	..	W	W	A	..	..	I	W	A	W	..	A	A	A	..	W	A	A
Sr	W	A	A	A	W	A	W	W	w	A	W	W	a	A	W	W	A	w	A	A	a	W	A
Zn	W	A	A	A	W	A	W	W	W	A	A	I	w	A	W	W	A	A	A	A	W	A	A

W Soluble in water.
A Insoluble in water but soluble in acids.
w Sparingly soluble in water but soluble in acids.
a Insoluble in water and only sparingly soluble in acids.
I Insoluble in both water and acids.

SOLUBILITY OF INORGANIC SALTS IN WATER

The table shows the number of grams of the substance indicated by the formula at the side which can be dissolved in 100 grams of water at the temperature in degrees Centigrade given at the top.

Substance.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
$AgNO_3$	115.0	160.0	215.0	270.0	335.0	400.0	470.0	550.0	650.0	760.0	910.0
$Al_2(SO_4)_3$	31.3	33.5	36.2	40.4	45.7	52.1	59.1	66.2	73.1	80.8	89.1
$Al_2K_2(SO_4)_4$	3.0	.....	.....	8.4	.....	.....	24.8	.....	.....	.....	154.6
$Al_2(NH_4)_2(SO_4)_4$	2.6	4.5	6.6	9.1	12.4	15.9	21.1	27.0	35.2	.....	.....
B_2O_3	1.1	1.5	2.2	.....	4.0	.....	6.2	.....	9.5	.....	15.7
$BaCl_2$	31.6	33.3	35.7	38.2	40.8	43.6	46.4	49.4	52.4	55.6	58.8
$Ba(NO_3)_2$	5.0	7.0	9.2	11.6	14.2	17.1	20.3	23.6	27.0	30.6	34.2
$Ba(OH)_2.8H_2O$	1.7	2.5	3.9	.....	8.2	.....	20.9	.....	101.4	.....	.....
$CaCl_2$	59.5	65.0	74.5	101.0	115.3	.....	136.8	141.7	147.0	152.7	159.0
$Ca(OH)_2$	0.185	0.176	0.165	.....	0.141	.....	0.116	.....	0.094	.....	0.077
$CdSO_4.\frac{8}{3}H_2O$	76.5	76.0	76.6	.....	78.5	.....	83.7	Bec	omes H_2O	CdS at	O_4.- 74°
$CoCl_2$	40.5	45.0	50.0	56.5	65.0	93.5	94.0	95.0	96.0	.....	103.0
$CsCl$	161.4	174.4	186.5	197.3	208.0	218.5	229.0	239.5	250.0	260.1	270.5
$CsNO_3$	9.3	14.9	23.0	33.9	47.2	64.4	83.8	107.0	134.0	163.0	197.0
Cs_2SO_4	167.1	173.1	178.7	184.1	189.9	194.9	199.9	205.0	210.3	214.9	220.3
$Cu(NO_3)_2$	81.8	.....	125.0	.....	159.8	.....	179.1	.....	207.8	.....	.....
$CuSO_4$	14.9	.....	20.0	25.5	29.5	33.6	39.0	45.7	53.5	62.7	73.5
$FeCl_2$	.....	.....	68.5	.....	.....	82.0	.....	.....	104.0	105.0	106.0
Fe_2Cl_6	74.4	81.9	91.8	.....	.....	315.1	.....	.....	525.8	.....	535.7
$FeSO_4$	15.6	20.8	26.4	33.0	40.2	48.6	55.0	56.0	50.6	43.0	.....
H_3BO_3	1.0	2.5	4.0	5.5	7.0	9.0	11.0	13.0	17.0	22.0	27.5
$HgCl_2$	4.3	6.6	7.4	8.4	9.6	11.3	13.9	17.3	24.3	37.1	54.0
KBr	54.0	.....	65.0	.....	76.0	.....	86.0	.....	95.5	.....	105.0
K_2CO_3	105.0	.....	.....	114.0	117.0	121.0	127.0	133.0	140.0	147.0	156.0
KCl	28.5	31.2	34.3	37.3	40.1	42.9	45.5	48.3	51.0	53.8	56.6
$KClO_3$	3.3	5.0	7.1	10.1	14.5	19.7	26.0	32.5	39.6	47.5	56.0
K_2CrO_4	58.9	60.9	62.9	65.0	67.0	69.0	71.0	73.0	75.1	77.1	79.1
$K_2Cr_2O_7$	5.0	8.5	13.1	.....	29.2	.....	50.5	.....	73.0	.....	102.0
$KHCO_3$	22.5	27.7	33.2	39.0	45.3	52.2	60.0	.....	.....	.....	.....
KI	127.9	136.1	144.2	152.3	160.0	168.0	176.0	184.0	192.0	201.0	209.0
KNO_3	13.3	20.9	31.6	45.8	63.9	85.5	109.9	138.0	169.0	204.0	246.0
KOH	97.0	103.0	112.0	126.0	136.0	140.0	146.0	151.0	159.0	168.0	178.0
K_2PtCl_6	0.7	0.9	1.1	1.4	1.8	2.2	2.6	3.2	3.8	4.5	5.2
K_2SO_4	7.4	9.2	11.1	13.0	14.8	16.5	18.2	19.8	21.4	22.8	24.1
$LiOH$	12.7	12.7	12.8	12.9	13.0	13.3	13.8	14.4	15.3	.....	17.5
$MgCl_2$	52.8	53.5	54.5	.....	57.5	.....	61.0	.....	66.0	.....	73.0
$MgSO_4.7H_2O$	26.0	30.9	35.6	40.9	45.6	.....	.....	.....	.....	.....	.....
$MgSO_4.6H_2O$	40.8	42.2	43.9	45.3	.....	50.4	55.0	59.6	64.2	68.9	73.8
NH_4Cl	29.7	33.3	37.2	41.4	45.8	50.4	55.2	60.2	65.6	71.3	77.3
NH_4HCO_3	11.9	15.9	21.0	27.0	.....	.....	.....	.....	.....	.....	.....
NH_4NO_3	118.3	.....	.....	241.8	297.0	.....	.....	.....	580.0	740.0	871.0
$(NH_4)_2SO_4$	70.6	73.0	75.4	78.0	81.0	84.4	88.0	91.6	95.3	99.2	103.3
$NaBr$	79.5	84.5	90.3	.....	105.8	116.0	117.0	.....	118.5	.....	120.5
$Na_2B_4O_7$	.....	1.6	.....	3.9	.....	10.5	20.0	24.4	31.4	40.8	52.3
$Na_2CO_3.10H_2O$	7.1	12.6	21.4	40.9	.....	.....	.....	.....	.....	.....	.....
$Na_2CO_3.7H_2O$	20.4	26.3	33.5	43.5	(1 H_2O)	47.5	46.4	45.8	45.2	45.2	45.2
$NaCl$	35.6	35.7	35.8	36.0	36.3	36.7	37.1	37.5	38.0	38.5	39.1
$NaClO_3$	82.0	89.0	99.0	.....	123.5	.....	147.0	.....	175.0	.....	204.0
Na_2CrO_4	31.7	50.2	90.0	.....	96.0	105.0	115.0	.....	124.0	.....	126.0
$Na_2Cr_2O_7$	163.0	170.0	180.0	197.0	220.0	248.0	283.0	323.0	386.0	.....	433.0
$NaHCO_3$	6.9	8.2	9.6	11.1	12.7	14.5	16.4	.....	.....	.....	.....
Na_2HPO_4	2.5	3.9	9.3	24.1	63.9	.....	.....	94.9	.....	.....	98.8
NaI	159.0	169.0	179.0	190.0	205.0	228.0	257.0	.....	295.0	.....	302.0
$NaNO_3$	73.0	80.5	88.0	96.2	104.9	114.0	124.6	136.0	148.0	161.0	175.5
$NaOH$	42.0	51.5	109.0	119.0	129.0	145.0	174.0	.....	313.0	.....	.....
$Na_4P_2O_7$	3.2	3.9	6.2	9.9	13.5	17.4	22.0	25.5	30.0	.....	.....

SOLUBILITY OF INORGANIC SALTS IN WATER (Cont.)

Substance.	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
Na_2SO_3	14.1	.....	28.7	.....	49.5	.....	.....	.....	.....	.....	33.0
$Na_2SO_4.10H_2O$	5.0	9.0	19.4	40.0	Becomes Na_2SO_4 at 32°					.....	.....
$Na_2SO_4.7H_2O$	19.6	30.5	44.7	Na_2-SO_4	48.2	46.8	45.5	44.5	43.7	42.9	42.7
$Na_2S_2O_3$	52.5	61.0	70.0	84.7	102.6	169.7	206.7	.....	248.8	254.2	266.0
$NiCl_2$	.....	60.0	64.0	68.0	72.0	76.0	81.0	.....	.....	.....	.....
$NiSO_4$	27.2	.....	.....	42.5	.....	50.2	54.8	59.4	63.2	68.8	77.6
$PbBr_2$	0.5	0.6	0.8	1.2	1.5	2.0	2.4	2.8	3.3	.....	4.8
$Pb(NO_3)_2$	36.5	44.4	52.3	60.7	69.4	78.7	88.0	97.7	107.6	117.4	127.0
$RbCl$	77.0	84.4	91.1	97.6	103.5	109.3	115.5	121.4	127.2	133.1	138.9
$RbNO_3$	19.5	33.0	53.3	81.3	116.7	155.6	200.0	251.0	309.0	375.0	452.0
Rb_2SO_4	36.4	42.6	48.2	53.5	58.5	63.1	67.4	71.4	75.0	78.7	81.8
SnI_2	.....	.....	1.0	1.2	1.4	1.7	2.1	2.5	3.0	3.4	4.0
$SrCl_2$	44.2	48.3	53.9	60.0	66.7	74.4	83.1	89.6	92.4	96.2	101.9
$Sr(NO_3)_2$	39.5	54.9	70.8	87.6	91.3	92.6	94.0	95.6	97.2	99.0	101.1
$Th(SO_4)_2.9H_2O$	0.7	1.0	1.4	2.0	3.0	5.1	.....	.....	.....	.....	.....
$Th(SO_4)_2.4H_2O$	.....	.....	.....	.....	4.0	2.5	1.6	1.1	.....	.....	.....
$TlCl$	0.2	0.2	0.3	0.5	0.6	0.8	1.0	1.3	1.6	2.0	.....
$TlNO_3$	3.9	6.2	9.6	14.3	20.9	30.4	46.2	69.5	111.0	200.0	414.0
Tl_2SO_4	2.7	3.7	4.9	6.2	7.6	9.2	10.9	12.7	14.6	16.5	.....
$Yb_2(SO_4)_3$	44.2	.....	.....	.....	.....	.....	10.4	7.2	6.9	5.8	4.7
$Zn(NO_3)_2$	94.8	.....	.....	.....	206.9	.....	.....	.....	.....	.....	.....
$ZnSO_4$	.....	.....	.....	.....	70.0	76.8	.....	89.0	86.0	92.0	78.5

SOLUBILITY OF CANE SUGAR IN WATER

Grams of sugar in 100 grams of water, temperature in degrees Centigrade.

	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
$C_{12}H_{22}O_{11}$	179.2	190.5	203.9	219.5	238.1	260.4	287.3	320.5	362.1	415.7	487.2

INDICATORS

R. T. Thomson's table, showing the hydrogen atoms replaced by NaOH or KOH when a compound neutral to the indicator is formed. The blank spaces indicate that the end-reaction is obscure.

(From Cohn's Indicators and Test-papers, John Wiley and Sons, publishers, by permission.)

Acid	Formula	Methyl-orange Cold	Phenolphthalein		Litmus	
			Cold	Boiling	Cold	Boiling
Sulphuric	H_2SO_4	2	2	2	2	2
Hydrochloric	HCl	1	1	1	1	1
Nitric	HNO_3	1	1	1	1	1
Thiosulphuric	$H_2S_2O_3$	2	2	2	2	2
Carbonic	H_2CO_3	0	1 dilute	0	..	0
Sulphurous	H_2SO_3	1	2	..	..	..
Hydrosulphuric	H_2S	0	1 dilute	0	..	0
Phosphoric	H_3PO_4	1	2	..	..	..
Arsenic	H_3AsO_4	1	2	..	..	..
Arsenous	H_3AsO_3	4	..	..	0	0
Nitrous	HNO_2	indicator destroyed	1	..	1	..
Silicic	H_4SiO_4	0	..	..	0	0
Boric	H_3BO_3	0	..	..	..	..
Chromic	H_2CrO_4	1	2	2	..	..
Oxalic	$H_2C_2O_4$	..	2	2	2	2
Acetic	$HC_2H_3O_2$	..	1	..	1 nearly	..
Butyric	$HC_4H_7O_2$	..	1	..	1 nearly	..
Succinic	$H_2C_4H_4O_4$	..	2	..	2 nearly	..
Lactic	$HC_3H_5O_3$	..	1	..	1	..
Tartaric	$H_2C_4H_4O_6$	..	2	..	2	..
Citric	$H_3C_6H_5O_7$	..	3	..	..	..

TABLE OF INDICATORS

The hydrogen ion concentration or pH value is the logarithm of the reciprocal of gram ionic hydrogen equivalents per liter; i.e., $pH = \log \frac{1}{[H^+]}$ per liter. Water has a concentration of H^+ ion of 10^{-7} and of OH^- ion of 10^{-7} moles per liter or a pH of 7. Due to hydrolysis the composition of a weak acid solution titrated against a strong base is basic and of a weak base against a strong acid is acid. A truly neutral titrated solution of a strong acid or base has the same concentration of H^+ and OH^- as water. Those indicators in the table below with a * are the Sörensen selected indicators; those with a # are the Clark and Lubs selected indicators; those with an *E* are the Eastman indicators.

Conversion Factors — pH to E.M.F.

Relation between voltage and hydrogen ion concentration (pH) at a temperature t (°C.):

For calomel electrode (0.1 N KCl) $E.M.F. = 0.3410 + 0.0008(t - 25) + 0.0591pH$

For calomel electrode (N KCl) $E.M.F. = 0.2822 + 0.0008(t - 25) + 0.0591pH$

For calomel electrode (satd. KCl) $E.M.F. = 0.2440 + 0.0002(t - 25) + 0.0591pH$

TABLE OF INDICATORS (Continued)

Indicator	Synonym	pH Range	Observer
Mauveine		0.1–2.9 *	
α-Naphtholbenzein		0–1, 8–9 E	
Methyl Red (para)		0–2 E	
Methyl Violet		0–2 E 0.1–3.1 *	
Iodeosin	Tetraiodofluorescein	0.3–0 E 4–5 E	
Benzoyl Auramine		0.1–1 E	
Quinaldine Red		1–2 E	
Diphenylamino-azo-benzene		1.2–2.1 *	
Tropeolin 00	Orange IV; diphenylamino azo-p-benzene sulfonic acid	1.4–2.6 * 1–3 E	
Metanil Yellow	Diphenylamino-azo-m-benzene sulfonic acid	1.2–2.3 *E	
Thymol Blue	Thymolsulfonphthalein	1.2–2.8 # 8.0–9.6	
Benzylaniline-azo-benzene sulfonic acid		1.9–3.3 *	
Ethyl Orange	Diethylaniline orange; sodium (or ammonium) diethylaniline-azo-benzene sulfonate	2–4 E	
Benzopurpurin 4B		2–4 E	
Benzylaniline-azo-benzene		2.3–3.3 *	
Red Cabbage Extract	Wild cabbage; sea cabbage; *Brassica oleracea*	2.4–4.5	Walbum
m-Chloro-diethyl aniline-azo-p-benzene sulfonic acid		2.6–4.0 *	
p-Dimethylamino-azo-benzene	Butter yellow; benzene-azo-dimethylaniline	2.9–4.0 * 3–4 E	
Congo Red	Sodium tetrazodiphenyl-naphthionate	3–5 E	Prideaux
2, 5-Dinitrohydro-quinone		3–9	Henderson and Forbes
Bromophenol Blue	Tetrabromophenolsulfon-phthalein	3.0–4.6 #E	
Methyl Orange [1]	Tropeolin D; orange III; Helianthine; Lunge's Indicator	2.9–4.0 E 3.1–4.4 *	
α-Naphthylamino-azo-p-benzene sulfonic acid		3.5–5.7 *	
α-Naphthylamino-azo-benzene		3.7–5.0 *	
p-Sulfo-o-methoxy-benzene-azo-dimethyl-α-napthylamine		4.0–4.6 E	
Iodeosin	*See iodeosin above*	4–5, 0.3–0 E	
Dinitrohydroquinone Acetate		4–5, 9–10 E	
Sodium Alizarin-sulfonate		4–5, 5–6 E	

[1] Methyl Orange may be used in the presence of carbon dioxide or hydrogen sulfide.

TABLE OF INDICATORS (Continued)

Indicator	Synonym	pH Range	Observer
Dichlorofluorescein		4–6 E	Hottinger
Lacmosol		4.4–5.5	
Methyl Red		4.4–6.0 # 4.2–6.3 E	
Lacmoid		4.4–6.2	Sörensen
Tetrabromo-m-cresolsulfonphthalein		4.5–5.5 E	
Azolitmin (Litmus)		4.5–8.3	Sörensen
Cochineal	Dried female insect, *Coccus cacti* Lin.; carminic acid	4.8–6.2	Sörensen
Propyl Red		4.8–6.4 E	Lubs and Clark
Hematoxylin	From logwood, *Haematoxylon campechia* L.	5–6 E	
p-Nitrophenol		5.0–7.0 * 5–6 E	
Sodium Alizarinsulfonate		4–5 5–6 E	
Bromocresol Purple	Dibromo-o-cresolsulfonphthalein	5.2–6.8 #E	
Alizarin	Roots of madder; *Rubia tinctorum*, Lin. Dihydroxyanthraquinone; Schaal's Indicator.	5.5–6.8 10.1–12.1	Sörensen
Dinitrobenzoyleneurea		7–8 E 6–8	Bogart and Scatchard
Bromothymol Blue	Dibromothymolsulfonphthalein	6.0–7.6 #E	
Anisolesulfonphthalein		6–8 E	
Curcumin	Turmeric Yellow; curcummin; roots of *Curcuma longa* L.	6–8 E	
Brilliant Yellow		6–8 E	
Neutral Red	Toluylene Red	6.8–8.0 *E	
Phenol Red	Phenolsulfonphthalein	6.8–8.4 #E	
Rosolic acid	Aurin; aurin red; corallin; p-rosolic acid	6.9–8.0 *E	
Cyanin	Quinoline Blue; diamylcyanine iodide	7–8	Prideaux
β-Naphtholphthalein		7.2–8.6 7–9 E	Sörensen and Palitzsch
Cresol Red	o-Cresolsulfonphthalein	7.2–8.8 #E	
Tropeolin 000	Orange I; Orange B; sodium-naphthol-azo-benzene sulfonate; von Muller's indicator	7.6–8.9 *	
Thymol Blue	*See thymol blue above*	8.0–9.6 } #E 1.2–2.8 }	
α-Naphtholbenzein		8.9 E	
Cresolphthalein	o-Cresolphthalein	8.2–9.8 # 8–10 E	
Phenolphthalein [2]	Dihydroxyphthalophenone; Luck's indicator	8.3–10 *E	
Dinitrohydroquinone Acetate		9–10 E	
Alizarin Yellow R	Sodium p-nitrobenzene-azo-salicylate	9–10 E	

[2] Phenolphthalein may be used in the presence of weak acids.

TABLE OF INDICATORS (Continued)

Indicator	Synonym	pH Range	Observer
Tetranitrophenol-sulfonphthalein	....	9–10 E	
Thymolphthalein......	....	9.3–10.5 * 10–11 E	
Alizarin Yellow G....	p-nitrobenzene-azo-salicylic acid	10.1–12.1 *	
Alizarin Blue S......	....	11–13	Prideaux
Poirrier's Blue......	....	11–13	Prideaux
Tropeolin 0.........	Resorcine-azo-benzene-sulfonic acid	11.1–12.7 *E	
Sodium Indigodisulfonate............	....	12–14 E	
1,3,5-Trinitrobenzene	....	14–14.3 E	

CONDENSED TABLE OF GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Weighed.	Sought	Factor.	Logarithm −10.
$AgBr$	Ag	0.57445	9.75925
	Br	0.42555	9.62895
	HBr	0.43091	9.63439
$AgCl$	Ag	0.75263	9.87658
	Cl	0.24737	9.39334
	HCl	0.25440	9.40552
AgI	I	0.54056	9.73285
	HI	0.54486	9.73629
Al_2O_3	Al	0.52914	9.72357
As_2O_3	As	0.75748	9.87937
As_2S_3	As_2O_3	0.80420	9.90536
$BaSO_4$	Ba	0.58848	9.76973
	BaO	0.65702	9.81758
	H_2SO_4	0.42016	9.62342
	S	0.13736	9.13786
	SO_2	0.27444	9.43845
	SO_3	0.34299	9.53528
	SO_4	0.41153	9.61440
Bi_2O_3	Bi	0.89700	9.95279
CaO	Ca	0.71465	9.85409
$CaSO_4$	Ca	0.29434	9.46885
	CaO	0.41187	9.61476
CdO	Cd	0.87540	9.94221
CoO	Co	0.78650	9.89570
CO_2	C	0.27273	9.43573
Cr_2O_3	Cr	0.68426	9.83522
	CrO_3	1.3157	10.11917
	CrO_4	1.5263	10.18362
CuO	Cu	0.79891	9.90250
Fe_2O_3	Fe	0.69940	9.84473
	FeO	0.89980	9.95415
H_2O	H	0.11190	9.04884
HgS	Hg	0.86220	9.93561
K_2PtCl_6	K	0.16084	9.20639
	K_2O	0.19375	9.28723
K_2SO_4	K	0.44871	9.65196
	K_2O	0.54053	9.73282
Li_3PO_4	Li	0.17972	9.25460
$Mg_2As_2O_7$	As_2O_3	0.63730	9.80434
$Mg_2P_2O_7$	Mg	0.21842	9.33928
	MgO	0.36211	9.55884
	P	0.27865	9.44506
	PO_4	0.85344	9.93117
	P_2O_5	0.63789	9.80474
$MnSO_4$	Mn	0.36379	9.56086

CONDENSED TABLE OF GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed.	Sought.	Factor.	Logarithm −10
Mn_3O_4	Mn	0.72026	9.85749
MoO_2	Mo	0.75000	9.87506
Na_2SO_4	Na	0.32377	9.51024
	Na_2O	0.43641	9.63989
$(NH_4)_2PtCl_6$	N	0.063093	8.79998
	NH_3	0.076712	8.88486
NiO	Ni	0.78578	9.89530
$NiSO_4$	Ni	0.37925	9.57892
$PbCrO_4$	Cr	0.16092	9.20661
PbO	Pb	0.92832	9.96770
PbS	Pb	0.86598	9.93751
$PbSO_4$	Pb	0.68323	9.83457
Pt	N	0.14350	9.15686
	NH_3	0.17448	9.24174
Sb_2O_4	Sb	0.79188	9.89866
Sb_2S_3	Sb	0.71685	9.85543
SiO_2	Si	0.46720	9.66950
$SrCO_3$	Sr	0.59357	9.77347
	SrO	0.70195	9.84631
$SrSO_4$	Sr	0.47703	9.67855
	SrO	0.56414	9.75139
TiO_2	Ti	0.60051	9.77852
U_3O_8	U	0.84806	9.92843
WO_3	W	0.79310	9.89933
ZnO	Zn	0.80338	9.90492
ZnS	Zn	0.67093	9.82668
	ZnO	0.83514	9.92176

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

omputed from the atomic weights of 1925 by Irwin C. Clare and Eric A. Arnold, ructors in Chemistry at Case School of Applied Science.

o facilitate the use of the table the group of substances weighed given under each ment as well as the substances sought under each substance weighed are arranged he alphabetical order of their formulae.

eighed	Sought	Factor	Logarithm
uminum l = 26.97			−10
l	Al_2O_3	1.8899	10.27643
	$AlPO_4$	4.5234	10.65547
l_4C_3	Al_2O_3	1.4170	10.15137
lCl_3	Al_2O_3	0.38225	9.58235
lF_3	CaF_2	1.3946	10.14445
l_2O_3	Al	0.52914	9.72357
	Al_4C_3	0.70571	9.84863
	$AlCl_3$	2.6161	10.41765
	$AlPO_4$	2.3936	10.37904
	$Al_2(SO_4)_3$	3.3562	10.52585
	$Al_2(SO_4)_3 \cdot 18H_2O$	6.5373	10.81540
	$K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	9.3072	10.96882
	$(NH_4)_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	8.8940	10.94910
lPO_4	Al	0.22107	9.34453
	Al_2O_3	0.41779	9.62096
	P_2O_5	0.58220	9.76507
$l_2(SO_4)_3$	Al_2O_3	0.29795	9.47415
$l_2(SO_4)_3 \cdot 18H_2O$	Al_2O_3	0.15297	9.18460
aF_2	AlF_3	0.71705	9.85555
$_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	Al_2O_3	0.10744	9.03118
$NH_4)_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	Al_2O_3	0.11244	9.05090
$_2O_5$	$AlPO_4$	1.7176	10.23493
nmo-nium: NH_4 = 18.040			
g	NH_4Br	0.90800	9.95809
	NH_4Cl	0.49590	9.69539
	NH_4I	1.3438	10.12835
gBr	NH_4Br	0.52160	9.71734
gCl	NH_4Cl	0.37323	9.57197
gI	NH_4I	0.61740	9.79057
aSO_4	$(NH_4)_2SO_4$	0.56610	9.75289
r	NH_4Br	1.2257	10.08839
l	NH_4	0.50879	9.70654
	NH_4Cl	1.5088	10.17863
Cl	NH_4Cl	1.4671	10.16645
	NH_4I	1.1421	10.05772
$gNH_4PO_4 \cdot 6H_2O$	NH_3	0.069381	8.84124

Weighed	Sought	Factor	Logarithm
Ammonium:			−10
$MgNH_4PO_4 \cdot 6H_2O$	NH_4	0.073488	8.86622
	$(NH_4)_2O$	0.10608	9.02562
N	NH_3	1.2158	10.08477
	NH_4	1.2877	10.10980
	NH_4Cl	3.8190	10.58195
	NH_4NO_3	5.7138	10.75693
	$(NH_4)_2O$	1.8587	10.26920
	$(NH_4)_2SO_4$	4.7167	10.67364
NH_3	$MgNH_4PO_4 \cdot 6H_2O$	14.413	11.15876
	N	0.82268	9.91523
	NH_4	1.0592	
	NH_4Cl	3.1410	10.49707
	$(NH_4)_2CO_3$	2.8206	10.45034
	NH_4HCO_3	4.6412	10.66663
	NH_4NO_3	4.6994	10.67204
	$(NH_4)_2O$	1.5288	10.18435
	NH_4OH	2.0577	10.31338
	$(NH_4)_2PtCl_6$	13.036	11.11514
	$(NH_4)_2SO_4$	3.8794	10.58876
	N_2O_5	3.1714	10.50126
	Pt	5.7314	10.75826
	SO_3	2.3505	10.37115
NH_4	Cl	1.9655	10.29346
	$MgNH_4PO_4 \cdot 6H_2O$	13.608	11.13378
	N	0.77660	9.89020
	NH_3	0.94412	9.97503
	NH_4Cl	2.9655	10.47209
	$(NH_4)_2PtCl_6$	12.307	11.09016
	Pt	5.4110	10.73328
NH_4Br	Ag	1.1013	10.04191
	AgBr	1.9172	10.28266
	Br	0.81585	9.91161
NH_4Cl	Ag	2.0166	10.30461
	AgCl	2.6794	10.42803
	Cl	0.66278	9.82137
	HCl	0.68163	9.83355
	N	0.26185	9.41805
	NH_3	0.31837	9.50293
	NH_4	0.33722	9.52791
	$(NH_4)_2O$	0.48676	9.68731
	NH_4OH	0.65513	9.81633
	$(NH_4)_2PtCl_6$	4.1502	10.61807
	Pt	1.8247	10.26119
$(NH_4)_2CO_3$	NH_3	0.35453	9.54966
NH_4HCO_3	NH_3	0.21546	9.33337

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS
(Continued)

Weighed	Sought	Factor	Logarithm
Ammonium:			−10
NH_4I	Ag	0.74413	9.87165
	AgI	1.6197	10.20943
	I	0.87554	9.94228
NH_4NO_3	NH_3	0.21274	9.32785
	$(NH_4)_2PtCl_6$	2.7736	10.44305
	N_2O_5	0.67470	9.82911
	Pt	1.2195	10.08617
$(NH_4)_2O$	$MgNH_4PO_4\cdot 6H_2O$	9.4272	10.97438
	NH_4Cl	2.0544	10.31269
	N	0.53802	9.73080
	NH_3	0.65418	9.81570
	$(NH_4)_2PtCl_6$	8.5262	10.93076
	N_2O_5	2.0741	10.31683
	Pt	3.7487	10.57388
NH_4OH	N	0.39971	9.60175
	NH_3	0.48599	9.68663
	NH_4	0.51475	9.71160
	NH_4Cl	1.5264	10.18367
	$(NH_4)_2PtCl_6$	6.3349	10.80174
	Pt	2.7852	10.44486
$(NH_4)_2PtCl_6$	NH_3	0.076712	8.88480
	NH_4	0.081253	8.90984
	NH_4Cl	0.24095	9.38193
	NH_4NO_3	0.36053	9.55695
	$(NH_4)_2O$	0.11729	9.06924
	NH_4OH	0.15786	9.19826
	$(NH_4)_2SO_4$	0.29759	9.47362
$(NH_4)_2SO_4$	$BaSO_4$	1.7665	10.24711
	H_2SO_4	0.74222	9.87053
	N	0.21201	9.32636
	NH_3	0.25778	9.41124
	$(NH_4)_2PtCl_6$	3.3603	10.52638
	Pt	1.4774	10.16950
	SO_3	0.60589	9.78239
N_2O_5	NH_3	0.31531	9.49874
	NH_4NO_3	1.4821	10.17089
	$(NH_4)_2O$	0.48214	9.68317
Pt	NH_3	0.17448	9.24174
	NH_4	0.18481	9.26672
	NH_4Cl	0.54804	9.73881
	NH_4NO_3	0.82003	9.91383
	$(NH_4)_2O$	0.26676	9.42612
	NH_4OH	0.35904	9.55514
	$(NH_4)_2SO_4$	0.67687	9.83050
SO_3	NH_3	0.42545	9.62885
	$(NH_4)_2SO_4$	1.6505	10.21761
Antimony Sb = 121.77			
$KSbOC_4H_4O_6\cdot \frac{1}{2}H_2O$	Sb	0.36468	9.56191
	Sb_2O_3	0.43656	9.64004

Weighed	Sought	Factor	Logarithm
Antimony			−10
$KSbOC_4H_4O_6\cdot \frac{1}{2}H_2O$	Sb_2O_4	0.46052	9.6632
	Sb_2S_3	0.50872	9.7064
Sb	$KSbOC_4H_4O_6\cdot \frac{1}{2}H_2O$	2.7421	10.4380
	Sb_2O_3	1.1971	10.0781
	Sb_2O_4	1.2628	10.1013
	Sb_2O_5	1.3285	10.1233
	Sb_2S_3	1.3950	10.1445
	Sb_2S_5	1.6583	10.2196
Sb_2O_3	$KSbOC_4H_4O_6\cdot \frac{1}{2}H_2O$	2.2906	10.3599
	Sb	0.83536	9.9218
	Sb_2O_4	1.0549	10.0232
	Sb_2O_5	1.10[illegible]8	10.0452
	Sb_2S_3	1.1653	10.0664
	Sb_2S_5	1.3853	10.1415
Sb_2O_4	$KSbOC_4H_4O_6\cdot \frac{1}{2}H_2O$	2.1715	10.3367
	Sb	0.79188	9.8986
	Sb_2O_3	0.94796	9.9767
	Sb_2O_5	1.0520	10.0220
	Sb_2S_3	1.1047	10.0432
	Sb_2S_5	1.3132	10.1183
Sb_2O_5	Sb	0.75273	9.8766
	Sb_2O_3	0.90110	9.9547
	Sb_2O_4	0.95056	9.9779
	Sb_2S_5	1.2483	10.0963
Sb_2S_3	$KSbOC_4H_4O_6\cdot \frac{1}{2}H_2O$	1.9657	10.2935
	Sb	0.71685	9.8554
	Sb_2O_3	0.85814	9.9335
	Sb_2O_4	0.90526	9.9567
	Sb_2O_5	0.95234	9.9787
Sb_2S_5	Sb	0.60303	9.7803
	Sb_2O_3	0.72188	9.8584
	Sb_2O_4	0.76152	9.8816
	Sb_2O_5	0.80112	9.9037
Arsenic: As = 74.96			
As	As_2O_3	1.3202	10.1206
	As_2O_5	1.5336	10.1857
	As_2S_3	1.6416	10.2152
	As_2S_5	2.0694	10.3158
	$BaSO_4$	4.6711	10.6694
	$Mg_2As_2O_7$	2.0715	10.3162
	$MgNH_4AsO_4\cdot \frac{1}{2}H_2O$	1.9227	10.2840
As_2O_3	As	0.75748	9.8793
	As_2O_5	1.1616	10.0650
	As_2S_3	1.2435	10.0946
	As_2S_5	1.5675	10.1952
	$BaSO_4$	3.5383	10.5487
	$Mg_2As_2O_7$	1.5691	10.1956

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Arsenic:			−10
As_2O_3	$MgNH_4AsO_4 \cdot \frac{1}{2}H_2O$	1.9227	10.28405
As_2O_5	As	0.65203	9.81429
	As_2O_3	0.86082	9.93491
	As_2S_3	1.0705	10.02955
	As_2S_5	1.3493	10.13012
	$BaSO_4$	3.0458	10.48370
	$Mg_2As_2O_7$	1.3504	10.13057
	$MgNH_4AsO_4 \cdot \frac{1}{2}H_2O$	1.6556	10.21897
AsO_3	$BaSO_4$	2.8476	10.45448
	$Mg_2As_2O_7$	1.2629	10.10136
	$MgNH_4AsO_4 \cdot \frac{1}{2}H_2O$	1.5479	10.18975
AsO_4	$BaSO_4$	2.5198	10.40136
	$Mg_2As_2O_7$	1.1175	10.04823
	$MgNH_4AsO_4 \cdot \frac{1}{2}H_2O$	1.3700	10.13672
As_2S_3	As	0.60916	9.78473
	As_2O_3	0.80420	9.90536
	As_2O_5	0.93422	9.97045
	As_2S_5	1.2606	10.10057
	$Mg_2As_2O_7$	1.2619	10.10101
As_2S_5	As	0.48323	9.68416
	As_2O_3	0.63796	9.80479
	As_2O_5	0.74110	9.86988
	As_2S_3	0.79330	9.89944
$BaSO_4$	As	0.21408	9.33058
	As_2O_3	0.28263	9.45121
	As_2O_5	0.32832	9.51630
	AsO_3	0.35118	9.54552
	AsO_4	0.39686	9.59864
$Mg_2As_2O_7$	As	0.48273	9.68371
	As_2O_3	0.63730	9.80434
	As_2O_5	0.74033	9.86943
	AsO_3	0.79183	9.89864
	AsO_4	0.89490	9.95177
	As_2S_3	0.79248	9.89899
$MgNH_4AsO_4 \cdot \frac{1}{2}H_2O$	As	0.39383	9.59532
	As_2O_3	0.51993	9.71595
	As_2O_5	0.60399	9.78103
	AsO_3	0.64603	9.81025
	As_5O_4	0.72993	9.86328
Barium: Ba = 137.37			
Ba	$BaCO_3$	1.4368	10.15739
	$BaCrO_4$	1.8445	10.26589
	$BaSiF_6$	2.0342	10.30839
	$BaSO_4$	1.6993	10.23027
$BaCl_2$	$BaCO_3$	0.94758	9.97662
Barium:			−10
$BaCl_2$	$BaCrO_4$	1.2165	10.08512
	$BaSO_4$	1.1207	10.04950
$BaCl_2 \cdot 2H_2O$	$BaSO_4$	0.95545	9.98021
$BaCO_3$	Ba	0.69600	9.84261
	$BaCl_2$	1.0553	10.02338
	$BaCrO_4$	1.2838	10.10850
	$Ba(HCO_3)_2$	1.3142	10.11867
	BaO	0.77707	9.89046
	$BaSO_4$	1.1827	10.07288
	CO_2	0.22293	9.34817
$BaCrO_4$	Ba	0.54214	9.73411
	$BaCl_2$	0.82202	9.91488
	$BaCO_3$	0.77893	9.89150
	BaO	0.60529	9.78196
BaF_2	$BaSiF_6$	1.5934	10.20232
$Ba(HCO_3)_2$	$BaCO_3$	0.76090	9.88133
$Ba(NO_3)_2$	$BaSO_4$	0.89304	9.95087
BaO	$BaCO_3$	1.2869	10.10954
	$BaCrO_4$	1.6521	10.21804
	$BaSiF_6$	1.8220	10.26054
	$BaSO_4$	1.5220	10.18242
	CO_2	0.28689	9.45771
BaO_2	$BaSO_4$	1.3782	10.13932
BaS	$BaSO_4$	1.3777	10.13916
$BaSiF_6$	Ba	0.49160	9.69161
	BaF_2	0.62760	9.79768
	BaO	0.54886	9.73946
$BaSO_4$	Ba	0.58848	9.76973
	$BaCl_2$	0.89228	9.95050
	$BaCl_2 \cdot 2H_2O$	1.0466	10.01979
	$BaCO_3$	0.84552	9.92712
	$Ba(NO_3)_2$	1.1198	10.04913
	BaO	0.65702	9.81758
	BaO_2	0.72557	9.86068
	BaS	0.72583	9.86084
CO_2	BaO	3.4857	10.54229
	$BaCO_3$	4.4857	10.65183
Beryllium: (Glucinum) Be = 9.02			
BeO	Be	0.36051	9.55692
	$BeCl_2$	3.1948	10.50444
	$BeSO_4 \cdot 4H_2O$	7.0803	10.85005
Be	BeO	2.7738	10.44308
$BeCl_2$	BeO	0.31301	9.49556
$BeSO_4 \cdot 4H_2O$	BeO	0.14124	9.14996
Bismuth: Bi = 209.00			
Bi	Bi_2O_3	1.1148	10.04721
	$BiAsO_4$	1.6649	10.22139
	BiOCl	1.2462	10.09559

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS
(Continued)

Weighed	Sought	Factor	Logarithm
Bismuth:			−10
Bi	Bi_2S_3	1.2301	10.08994
$BiAsO_4$	Bi	0.60064	9.77862
	Bi_2O_3	0.66962	9.82583
$Bi(NO_3)_3 \cdot 5H_2O$	Bi_2O_3	0.48032	9.68153
	BiOCl	0.53693	9.72991
Bi_2O_3	Bi	0.89700	9.95279
	$BiAsO_4$	1.4934	10.17418
	BiOCl	1.1178	10.04838
	$Bi(NO_3)_3 \cdot 5H_2O$	2.0820	10.31847
	$BiONO_3$	1.2318	10.09053
	Bi_2S_3	1.1034	10.04273
BiOCl	Bi	0.80243	9.90441
	$Bi(NO_3)_3 \cdot 5H_2O$	1.8625	10.27009
	Bi_2O_3	0.89458	9.95162
	$BiONO_3$	1.1019	10.04215
$BiONO_3$	Bi_2O_3	0.81184	9.90947
	BiOCl	0.90750	9.95785
Bi_2S_3	Bi	0.81294	9.91006
	Bi_2O_3	0.90630	9.95727
Boron: B = 10.82			
B	B_2O_3	3.2181	10.50760
	KBF_4	11.637	11.06585
B_2O_3	B	0.31074	9.49240
	BO_2	1.2298	10.08983
	BO_3	1.6893	10.22771
	B_4O_7	1.1149	10.04724
	H_3BO_3	1.7761	10.24947
	KBF_4	3.6162	10.55825
	$Na_2B_4O_7 \cdot 10H_2O$	2.7386	10.43753
BO_2	B_2O_3	0.81317	9.91018
BO_3	B_2O_3	0.59198	9.77231
B_4O_7	B_2O_3	0.89696	9.95277
H_3BO_3	B_2O_3	0.56303	9.75053
	KBF_4	2.0360	10.30878
KBF_4	B	0.085932	8.93415
	B_2O_3	0.27653	9.44175
	H_3BO_3	0.49116	9.69122
	$Na_2B_4O_7 \cdot 10H_2O$	0.75732	9.87928
$Na_2B_4O_7 \cdot 10H_2O$	B_2O_3	0.36515	9.56247
	KBF_4	1.3204	10.12071
Bromine: Br = 79.916			
Ag	Br	0.74080	9.86970
	BrO_3	1.1857	10.07398
	HBr	0.75013	9.87514
AgBr	Br	0.42555	9.62895
	BrO_3	0.68113	9.83323
	HBr	0.43091	9.63439
AgCl	Br	0.55754	9.74628

Weighed	Sought	Factor	Logarithm
Bromine:			−10
Br	Ag	1.3499	10.13030
	AgBr	2.3499	10.37105
	AgCl	1.7936	10.25373
	O	0.10010	9.00045
BrO_3	Ag	0.84338	9.92602
	AgBr	1.4681	10.16677
HBr	Ag	1.3331	10.12486
	AgBr	2.3206	10.36561
O	Br	9.9896	10.99955
Cadmium: Cd = 112.41			
Cd	$CdCl_2$	1.6308	10.21241
	$Cd(NO_3)_2$	2.1032	10.32288
	CdO	1.1423	10.05779
	CdS	1.2852	10.10898
	$CdSO_4$	1.8546	10.26825
$CdCl_2$	Cd	0.61319	9.78759
	CdO	0.70045	9.84538
	CdS	0.78808	9.89657
	$CdSO_4$	1.1372	10.05584
$Cd(NO_3)_2$	Cd	0.47546	9.67711
	CdO	0.54313	9.73490
	CdS	0.61107	9.78609
	$CdSO_4$	0.88178	9.94536
CdO	Cd	0.87540	9.94221
	$CdCl_2$	1.4276	10.15462
	$Cd(NO_3)_2$	1.8412	10.26510
	CdS	1.1251	10.05119
	$CdSO_4$	1.6235	10.21046
CdS	Cd	0.77807	9.89102
	$CdCl_2$	1.2689	10.10343
	$Cd(NO_3)_2$	1.6365	10.21391
	CdO	0.88882	9.94881
	$CdSO_4$	1.4430	10.15927
$CdSO_4$	Cd	0.53920	9.73175
	$CdCl_2$	0.87934	9.94416
	$Cd(NO_3)_2$	1.1341	10.05464
	CdO	0.61594	9.78954
	CdS	0.69301	9.84074
Caesium: Cs = 132.81			
AgCl	CsCl	1.1739	10.06963
Cl	Cs	3.7457	10.57353
	CsCl	4.7457	10.67630
Cs	Cl	0.26698	9.42648
	CsCl	1.2670	10.10278
	Cs_2CO_3	1.2259	10.08846
	Cs_2O	1.0602	10.02539
	Cs_2PtCl_6	2.5359	10.40413
	Cs_2SO_4	1.3617	10.13408
CsCl	AgCl	0.85184	9.93036
	Cl	0.21072	9.32371
	Cs	0.78928	9.89723
	Cs_2O	0.83682	9.92263
	Cs_2PtCl_6	2.0016	10.30138

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS
(Continued)

Weighed	Sought	Factor	Logarithm
Caesium:			−10
CsCl	Cs_2SO_4	1.0747	10.03129
Cs_2CO_3	Cs	0.81574	9.91155
	Cs_2PtCl_6	2.0686	10.31568
	Cs_2SO_4	1.1108	10.04564
Cs_2O	Cs	0.94319	9.97460
	CsCl	1.1950	10.07737
	Cs_2SO_4	1.2843	10.10867
	Cs_2PtCl_6	2.3918	10.37872
	SO_3	0.28430	9.45378
Cs_2PtCl_6	Cs	0.39433	9.59586
	CsCl	0.49961	9.69863
	Cs_2CO_3	0.48341	9.68432
	Cs_2O	0.41809	9.62127
Cs_2SO_4	Cs	0.73440	9.86593
	CsCl	0.93046	9.96870
	Cs_2CO_3	0.90029	9.95438
	Cs_2O	0.77864	9.89134
SO_3	Cs_2O	3.5174	10.54622
Calcium: Ca = 40.07			
$BaSO_4$	CaS	0.30901	9.48998
	$CaSO_4$	0.58319	9.76581
	$CaSO_4\cdot 2H_2O$	0.73755	9.86779
Ca	$CaCl_2$	2.7698	10.44244
	$CaCO_3$	2.4974	10.39748
	CaF_2	1.9483	10.28966
	CaO	1.3993	10.14591
	$CaSO_4$	3.3974	10.53115
	Cl	1.7698	10.24791
$Ca_3(AsO_4)_2$	$Mg_2As_2O_7$	0.77995	9.89207
$CaCl_2$	Ca	0.36104	9.55756
	$CaCO_3$	0.90166	9.95504
	CaO	0.50521	9.70347
	$CaSO_4$	1.2266	10.08871
	Cl	0.63896	9.80547
$CaCO_3$	Ca	0.40043	9.60252
	$CaCl_2$	1.1091	10.04496
	$Ca(HCO_3)_2$	1.6197	10.20944
	CaO	0.56031	9.74843
	$CaSO_4$	1.3604	10.13367
	$CaSO_4\cdot 2H_2O$	1.7205	10.23565
	CO_2	0.43969	9.64315
	HCl	0.72880	9.86261
CaF_2	Ca	0.51325	9.71033
	$CaSO_4$	1.7438	10.24149
$Ca(HCO_3)_2$	$CaCO_3$	0.61739	9.79056
	CaO	0.34593	9.53899
$Ca(NO_3)_2$	N_2O_5	0.65830	9.81842
CaO	Ca	0.71465	9.85409
	$CaCl_2$	1.9794	10.29653
	$CaCO_3$	1.7847	10.25157
	CaF_2	1.3924	10.14376
	$Ca(HCO_3)_2$	2.8907	10.46101
Calcium:			−10
CaO	$Ca_3(PO_4)_2$	1.8445	10.26588
	$CaSO_4$	2.4279	10.38524
	$CaSO_4\cdot 2H_2O$	3.0706	10.48722
	Cl	1.2647	10.10200
	CO_2	0.78473	9.89472
	MgO	0.71910	9.85679
	SO_3	1.4279	10.15471
$Ca_3(PO_4)_2$	CaO	0.54215	9.73412
	$CaSO_4$	1.3163	10.11936
	$Mg_2P_2O_7$	0.71777	9.85598
	$(NH_4)_3PO_4\cdot 12MoO_3$	12.100	11.08280
	P_2O_5	0.45784	9.66072
CaS	$BaSO_4$	3.2361	10.51002
$CaSO_4$	$BaSO_4$	1.7148	10.23419
	Ca	0.29434	9.46885
	$CaCl_2$	0.81525	9.91129
	$CaCO_3$	0.73507	9.86633
	CaF_2	0.57347	9.75851
	CaO	0.41187	9.61476
	$Ca_3(PO_4)_2$	0.75970	9.88064
	SO_3	0.58813	9.76947
$CaSO_4\cdot 2H_2O$	$BaSO_4$	1.3558	10.13221
	$CaCO_3$	0.58123	9.76435
	CaO	0.32567	9.51278
	SO_3	0.46504	9.66749
$CaWO_4$	WO_3	0.80536	9.90599
Cl	Ca	0.56505	9.75209
	$CaCl_2$	1.5651	10.19453
	CaO	0.79068	9.89800
CO_2	CaO	1.2743	10.10528
	$CaCO_3$	2.2743	10.35685
HCl	$CaCO_3$	1.3721	10.13739
$Mg_2As_2O_7$	$Ca_3(AsO_4)_2$	1.2821	10.10793
MgO	CaO	1.3906	10.14321
$Mg_2P_2O_7$	$Ca_3(PO_4)_2$	1.3932	10.14402
$(NH_4)_3PO_4\cdot 12MoO_3$	$Ca_3(PO_4)_2$	0.082642	8.91720
N_2O_5	$Ca(NO_3)_2$	1.5191	10.18158
P_2O_5	$Ca_3(PO_4)_2$	2.1842	10.33928
SO_3	CaO	0.70031	9.84529
	$CaSO_4$	1.7003	10.23053
	$CaSO_4\cdot 2H_2O$	2.1504	10.33251
WO_3	$CaWO_4$	1.2418	10.09404
Carbon: C = 12.000			
Ag	CN	0.24108	9.38216
	HCN	0.25043	9.39868
	KCN	0.60349	9.78067
AgCN	CN	0.19425	9.28836
	HCN	0.20178	9.30488

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS
(Continued)

Weighed	Sought	Factor	Logarithm
Carbon:			−10
AgCN...	KCN......	0.48627	9.68687
AgCNS.	CNS.......	0.34993	9.54398
$BaCO_3$..	C.........	0.060800	8.78390
	CO_2.......	0.22293	9.34817
	CO_3.......	0.30400	9.48287
BaO....	CO_2.......	0.28689	9.45771
	CO_2, bicarbonate...	0.57378	9.75874
$BaSO_4$...	CNS.......	0.24877	9.39580
C.......	$BaCO_3$.....	16.447	11.21610
	CO_2.......	3.6667	10.56427
$CaCO_3$..	CO_2.......	0.43969	9.64315
$Ca(HCO_3)_2$....	CO_2.......	0.54293	9.73474
CN.....	AgCN.....	5.1480	10.71164
	Ag........	4.1480	10.61784
CNS....	AgCNS....	2.8577	10.45602
	CuCNS....	2.0947	10.32112
	$BaSO_4$.....	4.0197	10.60419
CaO....	CO_2.......	0.78473	9.89472
	CO_2, bicarbonate...	1.5695	10.19575
CO_2.....	$BaCO_3$.....	4.4857	10.65183
	$Ba(HCO_3)_2$	2.9476	10.46947
	BaO.......	3.4857	10.54229
	C.........	0.27273	9.43573
	$CaCO_3$.....	2.2743	10.35685
	$Ca(HCO_3)_2$	1.8419	10.26526
	CaO.......	1.2743	10.10528
	CO_3.......	1.3636	10.13470
	Cs_2CO_3.....	7.4009	10.86928
	$CsHCO_3$....	4.4050	10.64395
	$FeCO_3$.....	2.6328	10.42041
	$Fe(HCO_3)_2$..	2.0211	10.30559
	K_2CO_3.....	3.1407	10.49703
	$KHCO_3$....	2.2751	10.35700
	K_2O.......	2.1407	10.33056
	Li_2CO_3.....	1.6791	10.22508
	$LiHCO_3$....	1.5443	10.18873
	Li_2O.......	0.67910	9.83193
	$MgCO_3$....	1.9164	10.28248
	$Mg(HCO_3)_2$	1.6629	10.22087
	MgO......	0.91636	9.96207
	$MnCO_3$....	2.6121	10.41698
	$Mn(HCO_3)_2$.	2.0108	10.30336
	MnO......	1.6120	10.20738
	Na_2CO_3....	2.4090	10.38184
	$NaHCO_3$...	1.9091	10.28083
	Na_2O......	1.4090	10.14890
	$(NH_4)_2CO_3$..	2.1837	10.33918
	NH_4HCO_3..	1.7965	10.25444
	$PbCO_3$.....	6.0729	10.78339
	Rb_2CO_3....	5.2473	10.71994
	$RbHCO_3$...	3.3284	10.52224
	Rb_2O......	4.2473	10.62811
	$SrCO_3$.....	3.3553	10.52573

Weighed	Sought	Factor	Logarithm
Carbon:			−10
CO_2.....	$Sr(HCO_3)_2$	2.3824	10.377[illegible]
	SrO.......	2.3553	10.37[illegible]
CO_3.....	$BaCO_3$....	3.2885	10.51713
	CO_2.......	0.73333	9.86530
Cs_2CO_3..	CO_2.......	0.13513	9.13075
$CsHCO_3$.	CO_2.......	0.22702	9.35606
CuCNS..	CNS.......	0.47740	9.67888
$FeCO_3$...	CO_2.......	0.37983	9.57959
$Fe(HCO_3)_2$...	CO_2.......	0.49478	9.69441
HCN....	Ag........	3.9932	10.60132
	AgCN.....	4.9559	10.69512
KCN....	Ag........	1.6570	10.21933
	AgCN.....	2.0565	10.31313
K_2CO_3...	CO_2.......	0.31840	9.50297
$KHCO_3$..	CO_2.......	0.43954	9.64300
K_2O.....	CO_2.......	0.46713	9.66944
Li_2CO_3...	CO_2.......	0.59556	9.77492
$LiHCO_3$.	CO_2.......	0.64754	9.81127
Li_2O....	CO_2.......	1.4720	10.16807
$MgCO_3$..	CO_2.......	0.52182	9.71752
$Mg(HCO_3)_2$...	CO_2.......	0.60136	9.77913
MgO....	CO_2.......	1.0913	10.03794
$MnCO_3$..	CO_2.......	0.38284	9.58302
$Mn(HCO_3)_2$....	CO_2.......	0.49733	9.69664
MnO....	CO_2.......	0.62033	9.79262
Na_2CO_3..	CO_2.......	0.41511	9.61815
$NaHCO_3$.	CO_2.......	0.52380	9.71917
Na_2O....	CO_2.......	0.70974	9.85110
$(NH_4)_2CO_3$...	CO_2.......	0.45795	9.66082
NH_4HCO_3.	CO_2.......	0.55663	9.74558
$PbCO_3$...	CO_2.......	0.16467	9.21661
Rb_2CO_3..	CO_2.......	0.19058	9.28008
$RbHCO_3$.	CO_2.......	0.30045	9.47777
Rb_2O....	CO_2.......	0.23545	9.37189
$SrCO_3$...	CO_2.......	0.29804	9.47427
$Sr(HCO_3)_2$...	CO_2.......	0.41975	9.62299
SrO.....	CO_2.......	0.42458	9.62794
Cerium: Ce = 140.25			
Ce......	$Ce_2(C_2O_4)_3 \cdot 3H_2O$...	2.1339	10.32917
	$Ce(NO_3)_4$...	2.7685	10.44224
	$Ce(NO_3)_4 \cdot (NH_4NO_3)_2 \cdot H_2O$....	4.0385	10.60622
	CeO_2......	1.2282	10.08927
	Ce_2O_3.....	1.1711	10.06859
	$Ce_2(SO_4)_3$...	2.0274	10.30694

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Cerium:			−10
$Ce_2(C_2O_4)_3 \cdot 3H_2O$	$Ce_2(SO_4)_3$	0.95012	9.97778
	Ce	0.46863	9.67083
$Ce(NO_3)_4$	Ce	0.36121	9.55776
	Ce_2O_3	0.42302	9.62636
	CeO_2	0.44362	9.64701
$Ce(NO_3)_4 \cdot (NH_4NO_3)_2 \cdot H_2O$	Ce	0.24762	9.39379
	Ce_2O_3	0.28999	9.46238
	CeO_2	0.30412	9.48305
CeO_2	Ce	0.81422	9.91074
	$Ce(NO_3)_4$	2.2542	10.35299
	$Ce(NO_3)_4 \cdot (NH_4NO_3)_2 \cdot H_2O$	3.2882	10.51696
	Ce_2O_3	0.95356	10.97935
Ce_2O_3	Ce	0.85388	9.93140
	$Ce(NO_3)_4$	2.3640	10.37365
	$Ce(NO_3)_4 \cdot (NH_4NO_3)_2 \cdot H_2O$	3.4484	10.53762
	CeO_2	1.0487	10.02065
	$Ce_2(SO_4)_3$	1.7312	10.23835
$Ce_2(SO_4)_3$	Ce	0.49324	9.69306
	Ce_2O_3	0.57764	9.76166
	$Ce_2(C_2O_4)_3 \cdot 3H_2O$	1.0525	10.02222
Chlorine: Cl = 35.457			
Ag	Cl	0.32867	9.51676
	HCl	0.33802	9.52894
AgCl	Cl	0.24737	9.39334
	ClO_3	0.58224	9.76510
	ClO_4	0.69387	9.84128
	HCl	0.25440	9.40552
$BaCrO_4$	Cl	0.27987	9.44695
Ca	Cl	1.7698	10.24791
Cl	Ag	3.0426	10.48324
	AgCl	4.0426	10.60666
	$BaCrO_4$	3.5732	10.55305
	Ca	0.56505	9.75209
	HCl	1.0284	10.01218
	K	1.1027	10.04244
	KCl	2.1027	10.32277
	Li	0.19573	9.29166
	Mg	0.34295	9.53523
	$MgCl_2$	1.3429	10.12806
	MnO_2	1.2259	10.08844
	Na	0.64859	9.81197
	NaCl	1.6486	10.21711
	NH_4	0.50879	9.70654
	$PbCrO_4$	4.5578	10.65875

Weighed	Sought	Factor	Logarithm
Chlorine:			−10
ClO_3	AgCl	1.7175	10.23490
	KCl	0.89331	9.95100
	NaCl	0.70041	9.84535
ClO_4	AgCl	1.4412	10.15872
	KCl	0.74960	9.87483
	NaCl	0.58773	9.76918
HCl	Ag	2.9584	10.47106
	AgCl	3.9308	10.59448
	NH_4Cl	1.4671	10.16645
	$(NH_4)_2SO_4$	1.8119	10.25814
K	Cl	0.90690	9.95756
KCl	Cl	0.47559	9.67723
	ClO_3	1.1194	10.04899
	ClO_4	1.3340	10.12516
Li	Cl	5.1090	10.70834
Mg	Cl	2.9159	10.46477
$MgCl_2$	Cl	0.74463	9.87194
MnO_2	Cl	0.81576	9.91156
Na	Cl	1.5418	10.18803
NaCl	Cl	0.60659	9.78289
	ClO_3	1.4277	10.15464
	ClO_4	1.7015	10.23083
NH_4	Cl	1.9655	10.29346
NH_4Cl	HCl	0.68163	9.83355
$(NH_4)_2SO_4$	HCl	0.55190	9.74186
$PbCrO_4$	Cl	0.21941	9.34125
Chromium Cr = 52.01			
$BaCrO_4$	Cr	0.20526	9.31231
	Cr_2O_3	0.29998	9.47709
	CrO_3	0.39469	9.59626
	CrO_4	0.45784	9.66072
	$Cr_2(SO_4)_3 \cdot 18H_2O$	1.4139	10.15041
Cr	$BaCrO_4$	4.8718	10.68769
	Cr_2O_3	1.4614	10.16478
	$PbCrO_4$	6.2143	10.79339
Cr_2O_3	$BaCrO_4$	3.3335	10.52291
	Cr	0.68426	9.83522
	CrO_3	1.3157	10.11917
	CrO_4	1.5263	10.18362
	$PbCrO_4$	4.2522	10.62861
CrO_3	$BaCrO_4$	2.5336	10.40374
	Cr_2O_3	0.76003	9.88083
	K_2CrO_4	1.9418	10.28821
	$K_2Cr_2O_7$	1.4709	10.16759
	$PbCrO_4$	3.2318	10.50944
CrO_4	$BaCrO_4$	2.1842	10.33928
	$PbCrO_4$	2.7860	10.44498
$Cr_2(SO_4)_3 \cdot 18H_2O$	$BaCrO_4$	0.70728	9.84959
	$PbCrO_4$	0.90218	9.95529
K_2CrO_4	CrO_3	0.51498	9.71179
	$PbCrO_4$	1.6643	10.22123

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS
(Continued)

Weighed	Sought	Factor	Logarithm
Chromium			−10
$K_2Cr_2O_7$	CrO_3	0.67984	9.83241
	$PbCrO_4$	2.1971	10.34185
$PbCrO_4$	Cr	0.16092	9.20661
	Cr_2O_3	0.23517	9.37139
	CrO_3	0.30943	9.49056
	CrO_4	0.35894	9.55502
	$Cr_2(SO_4)_3 \cdot 18H_2O$	1.1084	10.04471
	K_2CrO_4	0.60086	9.77877
	$K_2Cr_2O_7$	0.45514	9.65815
Cobalt: Co = 58.94			
Co	$Co(NO_3)_2 \cdot 6H_2O$	4.9381	10.69356
	$Co(NO_2)_3 \cdot (KNO_2)_3$	7.6736	10.88500
	CoO	1.2714	10.10430
	Co_3O_4	1.3620	10.13417
	$CoSO_4$	2.6298	10.41993
	$CoSO_4 \cdot 7H_2O$	4.7696	10.67848
	$(CoSO_4)_2 \cdot (K_2SO_4)_3$	7.0647	10.84909
$Co(NO_2)_2 \cdot 6H_2O$	Co	0.20250	9.30644
$Co(NO_2)_3 \cdot (KNO_2)_3$	Co	0.13032	9.11500
	CoO	0.16569	9.21930
CoO	Co	0.78650	9.89570
	$Co(NO_2)_3 \cdot (KNO_2)_3$	6.0353	10.78070
	Co_3O_4	1.0712	10.02987
	$CoSO_4$	2.0684	10.31563
	$(CoSO_4)_2 \cdot (K_2SO_4)_3$	5.5564	10.74479
Co_3O_4	Co	0.73423	9.86583
	CoO	0.93354	9.97013
$CoSO_4$	Co	0.38025	9.58007
	CoO	0.48347	9.68437
$CoSO_4 \cdot 7H_2O$	Co	0.20966	9.32152
	CoO	0.26658	9.42582
$(CoSO_4)_2 \cdot (K_2SO_4)_3$	Co	0.14155	9.15091
	CoO	0.17998	9.25521
Columbium: (niobium) Cb = 93.1			
Cb_2O_5	Cb	0.69947	9.84477
Cb	Cb_2O_5	1.4296	10.15521

Weighed	Sought	Factor	Logarithm
Copper Cu = 63.57			−10
Cu	$Cu_2C_2H_3O_2(AsO_2)_3$	3.9880	10.60076
	CuCNS	1.9135	10.28183
	CuO	1.2517	10.09750
	Cu_2O	1.1258	10.05147
	Cu_2S	1.2522	10.09767
	$CuSO_4 \cdot 5H_2O$	3.9282	10.59419
$Cu_2C_2H_3O_2(AsO_2)_3$	Cu	0.25075	9.39924
	$Mg_2As_2O_7$	0.91874	9.96319
CuCNS	Cu	0.52260	9.71817
	CuO	0.65414	9.81567
CuO	Cu	0.79891	9.90250
	CuCNS	1.5287	10.18433
	Cu_2S	1.0004	10.00017
	$CuSO_4 \cdot 5H_2O$	3.1383	10.496[illegible]
Cu_2O	Cu	0.88824	9.94853
	Cu_2S	1.1122	10.04619
$CuSO_4 \cdot 5H_2O$	Cu	0.25457	9.40581
	CuO	0.31865	9.50331
	Cu_2S	0.31877	9.50348
Cu_2S	Cu	0.79860	9.90233
	CuO	0.99960	9.99983
	Cu_2O	0.89910	9.95381
	$CuSO_4 \cdot 5H_2O$	3.1370	10.49651
$Mg_2As_2O_7$	$Cu_2C_2H_3O_2(AsO_2)_3$	1.0885	10.08681
Erbium: Er = 167.7			
Er_2O_3	Er	0.87480	9.94191
Er	Er_2O_3	1.1431	10.05808
Fluorine: F = 19.00			
BaF_2	$BaSiF_6$	1.5934	10.20232
$BaSiF_6$	BaF_2	0.62760	9.79768
	F	0.40796	9.61062
	HF	0.42962	9.63308
	H_2SiF_6	0.51560	9.71231
	SiF_4	0.37239	9.57100
	SiF_6	0.50838	9.70619
CaF_2	F	0.48675	9.68730
	HF	0.51258	9.70976
	H_2SiF_6	0.61516	9.78899
	SiF_6	0.60655	9.78287
$CaSO_4$	F	0.29395	9.44581
	HF	0.27913	9.46827
F	$BaSiF_6$	2.4512	10.38938
	CaF_2	2.05447	10.31270
	$CaSO_4$	3.5825	10.55419

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS
(Continued)

Weighed	Sought	Factor	Logarithm
Fluorine:			−10
$CaSO_4$	H_2SiF_6	1.2638	10.10169
	$K2SiF_6$	1.9320	10.28602
HF	$BaSiF_6$	2.3277	10.36692
	CaF_2	1.9509	10.29024
	$CaSO_4$	3.4020	10.53173
	K_2SiF_6	1.8347	10.26356
2HF	H_2SiF_6	3.6004	10.55635
6HF	H_2SiF_6	1.2001	10.07923
H_2SiF_6	$BaSiF_6$	1.9395	10.28769
	CaF_2	1.6256	10.21101
	F	0.79124	9.89831
	2HF	0.27775	9.44365
	6HF	0.83324	9.92077
	K_2SiF_6	1.5287	10.18432
	SiF_4	0.72225	9.85869
	SiF_6	0.98600	9.99388
KF	K_2SiF_6	1.8956	10.27774
K_2SiF_6	F	0.51759	9.71398
	HF	0.54505	9.73644
	H_2SiF_6	0.65414	9.81567
	KF	0.52755	9.72226
	SiF_6	0.64199	9.80955
SiF_4	$BaSiF_6$	2.6854	10.42900
	H_2SiF_6	1.3845	10.14131
SiF_6	$BaSiF_6$	1.9670	10.29381
	CaF_2	1.6487	10.21714
	H_2SiF_6	1.0142	10.00612
	K_2SiF_6	1.5504	10.19045
Gallium: Ga = 69.72			
Ga_2O_3	Ga	0.74392	9.87153
Ga_2S_3	Ga	0.59177	9.77215
Ga	Ga_2O_3	1.3442	10.12846
	Ga_2S_3	1.6898	10.22784
Germanium: Ge = 72.60			
GeO_2	Ge	0.69407	9.84140
K_2GeF_6	Ge	0.27418	9.43804
Ge	GeO_2	1.4408	10.15860
	K_2GeF_6	3.6473	9.56197
Gold: Au = 197.2			
Au	$AuCl_3$	1.5394	10.18735
	$HAuCl_4 \cdot 4H_2O$	2.0897	10.32009
	$KAu(CN)_4 \cdot H_2O$	1.8172	10.25939
$AuCl_3$	Au	0.64960	9.81265
$HAuCl_4 \cdot 4H_2O$	Au	0.47853	9.67991
$KAu(CN)_4 \cdot H_2O$	Au	0.55031	9.74061

Weighed	Sought	Factor	Logarithm
Hydrogen: H = 1.008			−10
H	O	7.9365	10.89963
	H_2O	8.9365	10.95117
H_2O	H	0.11190	9.04884
O	H	0.12595	9.10020
HCNS	AgCNS	2.8089	10.44854
	CuCNS	2.0589	10.31364
	$BaSO_4$	3.9512	10.59673
AgCNS	HCNS	0.35601	9.55146
CuCNS	HCNS	0.48569	9.68636
$BaSO_4$	HCNS	0.25309	9.40328
Indium: In = 114.8			
In	In_2O_3	1.2091	10.08246
	In_2S_3	1.4190	10.15198
In_2O_3	In	0.82709	9.91755
In_2S_3	In	0.70474	9.84803
Iodine: I = 126.932			
Ag	HI	1.1860	10.07407
	I	1.1766	10.07063
AgCl	I	0.88555	9.94721
AgI	HI	0.54486	9.73629
	I	0.54056	9.73285
	IO_3	0.74498	9.87215
	IO_4	0.81313	9.91016
	I_2O_6	0.71092	9.85182
	I_2O_7	0.77906	9.89157
HI	Ag	0.84320	9.92593
	AgI	1.8353	10.26371
	Pd	0.41698	9.62012
	PdI_2	1.4091	10.14895
	TlI	2.5896	10.41324
I	Ag	0.84990	9.92937
	AgCl	1.1292	10.05277
	AgI	1.8499	10.26715
	Pd	0.42040	9.62366
	PdI_2	1.4203	10.15239
	TlI	2.6102	10.41668
IO_3	AgI	1.3423	10.12785
	PdI_2	1.0306	10.01309
	TlI	1.8940	10.27738
IO_4	AgI	1.2298	10.08984
	PdI_2	0.94424	9.97503
	TlI	1.7353	10.23937
I_2O_6	AgI	1.4066	10.14818
	PdI_2	1.0800	10.03342
	TlI	1.9848	10.29771
I_2O_7	AgI	1.2836	10.10843
	PdI_2	0.98553	9.99367
	TlI	1.8112	10.25796
Pd	HI	2.3982	10.37988
	I	2.3793	10.37644
PdI_2	HI	0.70967	9.85105

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Iodine:			−10
PdI_2	I	0.70407	9.84761
	IO_3	0.97030	9.98691
	IO_4	1.0590	10.02492
	I_2O_5	0.92594	9.96658
	I_2O_7	1.0147	10.00633
TlI	HI	0.38615	9.58676
	I	0.38311	9.58332
	IO_3	0.52799	9.72262
	IO_4	0.57628	9.76063
	I_2O_5	0.50384	9.70229
	I_2O_7	0.55213	9.74204
Iron: Fe = 55.84			
Ag	$Fe_7(CN)_{18}$, prussian blue	0.44237	9.64579
CN	$Fe_7(CN)_{18}$	1.8341	10.26362
CO_2	FeO	1.6327	10.21292
	$FeCO_3$	2.6328	10.42041
	$Fe(HCO_3)_2$	2.0211	10.30559
Fe	$Fe(HCO_3)_2$	3.1851	10.50312
	FeO	1.2865	10.10943
	Fe_2O_3	1.4298	10.15527
	$FePO_4$	2.7017	10.43164
	FeS	1.5742	10.19706
	$FeSO_4$	2.7203	10.43462
	$FeSO_4 \cdot 7H_3O$	4.9788	10.69712
	$FeSO_4 \cdot (NH_4)_2 \cdot SO_4 \cdot 6H_2O$	7.0227	10.84650
$FeAsO_4$	$Mg_2As_2O_7$	0.79714	9.90162
$FeCl_3$	Fe_2O_3	0.49220	9.69214
$Fe_7(CN)_{18}$, prussian blue	Ag	2.2605	10.35421
	CN	0.54498	9.73638
$FeCO_3$	CO_2	0.37983	9.57959
	FeO	0.62017	9.79251
	Fe_2O_3	0.68922	9.83836
$Fe(HCO_3)_2$	CO_2	0.49478	9.69441
	Fe	0.31396	9.49688
	FeO	0.40393	9.60630
	Fe_2O_3	0.44890	9.65215
FeO	CO_2	0.61246	9.78708
	Fe	0.77728	9.89058
	$FeCO_3$	1.6125	10.20749
	$Fe(HCO_3)_2$	2.4757	10.39370
	Fe_2O_3	1.1114	10.04585
	$FePO_4$	2.1000	10.32222
	FeS	1.2236	10.08764
	SO_3	1.1145	10.04707
Fe_3O_4	Fe_2O_3	1.0346	10.01477

Weighed	Sought	Factor	Logarithm
Iodine:			−10
Fe_2O_3	Fe	0.69940	9.84473
	$FeCl_3$	2.0317	10.30786
	$FeCO_3$	1.4509	10.16164
	$Fe(HCO_3)_2$	2.2277	10.34785
	$Fe(HCO_3)_3$	2.9918	10.47593
	FeO	0.89980	9.95415
	Fe_3O_4	0.96657	9.98523
	$FePO_4$	1.8896	10.27637
	FeS	1.1010	10.04179
	$FeSO_4$	1.9026	10.27935
	$FeSO_4 \cdot 7H_2O$	3.4822	10.54185
	$FeSO_4 \cdot (NH_4)_2 \cdot SO_4 \cdot 6H_2O$	4.9117	10.69123
	$Fe_2(SO_4)_3$	2.5042	10.39867
$FePO_4$	Fe	0.37013	9.56836
	FeO	0.47619	9.67778
	Fe_2O_3	0.52921	9.72363
FeS	Fe	0.63524	9.80294
	FeO	0.81726	9.91236
	Fe_2O_3	0.90826	9.95821
$FeSO_4$	Fe	0.36760	9.56538
	Fe_2O_3	0.52559	9.72065
	SO_3	0.52708	9.72187
$FeSO_4 \cdot 7H_2O$	Fe	0.20085	9.30288
	Fe_2O_3	0.28718	9.45815
$FeSO_4 \cdot (NH_4)_2 \cdot SO_4 \cdot 6H_2O$	Fe	0.14240	9.15350
	Fe_2O_3	0.20360	9.30877
$Fe_2(SO_4)_3$	Fe_2O_3	0.39933	9.60133
$Mg_2As_2O_7$	$FeAsO_4$	1.2542	10.09838
SO_3	FeO	0.89728	9.95293
	$FeSO_4$	1.8973	10.27813
Lanthanum: La = 138.90			
La	La_2O_3	1.1728	10.06922
La_2O_3	La	0.85267	9.93078
Lead: Pb = 207.20			
$BaSO_4$	$PbSO_4$	1.2992	10.11366
Pb	$PbCl_2$	1.3422	10.12783
	$PbCO_3$	1.2896	10.11045
	$(PbCO_3)_2 \cdot Pb(OH)_2$	1.2478	10.09614
	$PbCrO_4$	1.5599	10.19309
	$Pb(OH)_2$	1.1641	10.06599
	PbO	1.0772	10.03230
	PbO_2	1.1544	10.06236
	PbS	1.1548	10.06249
	$PbSO_4$	1.4636	10.16543

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS
(Continued)

Weighed	Sought	Factor	Logarithm
Lead:			−10
$PbCl_2$	Pb	0.74502	9.87217
	PbO	0.80254	9.90447
$Pb(C_2H_3O_2)_2 \cdot 3H_2O$	$PbCrO_4$	0.85212	9.93050
	$PbSO_4$	0.79954	9.90284
$PbCO_3$	Pb	0.77544	9.88955
	PbO	0.83532	9.92185
	$PbSO_4$	1.1349	10.05498
$(PbCO_3)_2 \cdot Pb(OH)_2$	Pb	0.80142	9.90386
	$PbCrO_4$	1.2501	10.09695
	$PbSO_4$	1.1730	10.06929
$PbCrO_4$	Pb	0.64107	9.80691
	$Pb(C_2H_3O_2)_2 \cdot 3H_2O$	1.1735	10.06950
	$(PbCO_3)_2 \cdot Pb(OH)_2$	0.79992	9.90305
	PbO	0.69057	9.83921
	Pb_3O_4	0.70708	9.84947
	$PbSO_4$	0.93830	9.97234
$Pb(NO_3)_2$	PbO	0.67387	9.82858
	PbO_2	0.72218	9.85865
	$PbSO_4$	0.91560	9.96171
PbO	Pb	0.92832	9.96770
	$PbCl_2$	1.2460	10.09553
	$PbCO_3$	1.1972	10.07815
	$PbCrO_4$	1.4481	10.16079
	$Pb(NO_3)_2$	1.4840	10.17143
	PbO_2	1.0717	10.03007
	PbS	1.0720	10.03019
	$PbSO_4$	1.3587	10.13313
PbO_2	Pb	0.86622	9.93763
	$Pb(NO_3)_2$	1.3847	10.14136
	PbO	0.93311	9.96993
	$PbSO_4$	1.2678	10.10306
Pb_3O_4	$PbCrO_4$	1.4143	10.15053
	$PbSO_4$	1.3270	10.12287
$Pb(OH)_2$	Pb	0.85898	9.93398
PbS	Pb	0.86598	9.93751
	PbO	0.93284	9.96981
	$PbSO_4$	1.2675	10.10294
$PbSO_4$	$BaSO_4$	0.76973	9.88634
	Pb	0.68323	9.83457
	$Pb(C_2H_3O_2)_2 \cdot 3H_2O$	1.2507	10.09716
	$PbCO_3$	0.88108	9.94502
	$(PbCO_3)_2 \cdot Pb(OH)_2$	0.85253	9.93071
	$PbCrO_4$	1.0658	10.02766
	$Pb(NO_3)_2$	1.0922	10.03829
	PbO	0.73598	9.86687
	PbO_2	0.78875	9.89694
	Pb_3O_4	0.75358	9.87713
	PbS	0.78897	9.89706

Weighed	Sought	Factor	Logarithm
Lithium: Li = 6.940			−10
CO_2	Li_2CO_3	1.6791	10.22508
	$LiHCO_3$	1.5443	10.18873
	Li_2O	0.67910	9.83193
Li	LiCl	6.1091	10.78598
	Li_2CO_3	5.3228	10.72614
	Li_2O	2.1539	10.33322
	Li_3PO_4	5.5641	10.74540
	Li_2SO_4	7.9210	10.89878
LiCl	Li	0.16369	9.21402
	Li_2CO_3	0.87128	9.94016
	Li_2O	0.35238	9.54701
	Li_3PO_4	0.91080	9.95942
	Li_2SO_4	1.2966	10.11280
Li_2CO_3	CO_2	0.59556	9.77492
	Li	0.18787	9.27386
	LiCl	1.1477	10.05984
	$LiHCO_3$	1.8394	10.26468
	Li_2O	0.40444	9.60685
	Li_3PO_4	1.0453	10.01926
$LiHCO_3$	CO_2	0.64754	9.81127
	Li_2CO_3	0.54365	9.73532
	Li_2O	0.21987	9.34217
	Li_3PO_4	0.56831	9.75459
Li_2O	CO_2	1.4726	10.16807
	Li	0.46452	9.66700
	LiCl	2.8379	10.45299
	Li_2CO_3	2.4726	10.39315
	$LiHCO_3$	4.5481	10.65783
	Li_3PO_4	2.5847	10.41241
	Li_2SO_4	3.6795	10.56579
	SO_3	2.6796	10.42806
Li_3PO_4	Li	0.17972	9.25460
	LiCl	1.0979	10.04058
	Li_2CO_3	0.95662	9.98074
	$LiHCO_3$	1.7596	10.24542
	Li_2O	0.38689	9.58759
	Li_2SO_4	1.4236	10.15338
	$Li_2SO_4 \cdot H_2O$	1.6568	10.21928
Li_2SO_4	Li	0.12625	9.10122
	LiCl	0.77126	9.88720
	Li_2O	0.27178	9.43421
	Li_3PO_4	0.70246	9.84662
	SO_3	0.72823	9.86227
$Li_2SO_4 \cdot H_2O$	Li_3PO_4	0.60356	9.78072
SO_3	Li_2O	0.37320	9.57194
	Li_2SO_4	1.3732	10.13773
Magnesium: Mg = 24.32			
$BaSO_4$	$MgSO_4$	0.51571	9.71241
	$MgSO_4 \cdot 7H_2O$	1.0560	10.02365
Br	Mg	0.15216	9.18229

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Magnesium:			−10
Br	$MgBr_2$	1.1521	10.06150
	$MgBr_2 \cdot 6H_2O$	1.8284	10.26208
Cl	Mg	0.34295	9.53523
	$MgCl_2$	1.3429	10.12806
	$MgCl_2 \cdot 6H_2O$	2.8673	10.45747
CO_2	$MgCO_3$	1.9164	10.28248
	MgO	0.91636	9.96207
I	Mg	0.095798	8.98136
	MgI_2	1.0958	10.03973
Mg	Br	6.5722	10.81771
	Cl	2.9159	10.46477
	I	1.0439	10.01864
	$MgCO_3$	3.4671	10.53997
	MgO	1.6579	10.21956
	$Mg_2P_2O_7$	4.5784	10.66072
	$MgSO_4$	4.9500	10.69461
$MgBr_2$	Br	0.86796	9.93850
$MgBr_2 \cdot 6H_2O$	Br	0.54691	9.73792
$MgCl_2$	Cl	0.74463	9.87194
	$Mg_2P_2O_7$	1.1692	10.06789
$MgCl_2 \cdot 6H_2O$	Cl	0.34876	9.54253
	$Mg_2P_2O_7$	0.54763	9.73848
$MgCl_2 \cdot KCl \cdot 6H_2O$	$Mg_2P_2O_7$	0.40070	9.60282
$MgCO_3$	CO_2	0.52182	9.71752
	Mg	0.28843	9.46004
	$Mg(HCO_3)_2$	1.7355	10.23942
	MgO	0.47818	9.67959
	$Mg_2P_2O_7$	1.3205	10.12075
$Mg(HCO_3)_2$	$MgCO_3$	0.57621	9.76058
	MgO	0.27553	9.44017
	$Mg_2P_2O_7$	0.76090	9.88133
MgI_2	I	0.91258	9.96027
MgO	CO_2	1.0913	10.03793
	Mg	0.60317	9.78044
	$MgCO_3$	2.0913	10.32041
	$Mg(HCO_3)_2$	3.6293	10.55983
	$Mg_2P_2O_7$	2.7616	10.44116
	$MgSO_4$	2.9857	10.47505
	SO_3	1.9857	10.29791
$Mg_2P_2O_7$	Mg	0.21842	9.33928
	$MgCl_2$	0.85528	9.93211
	$MgCl_2 \cdot 6H_2O$	1.8261	10.26152
	$MgCl_2 \cdot KCl \cdot 6H_2O$	2.4956	10.39718
	$MgCO_3$	0.75727	9.87925
	$Mg(HCO_3)_2$	1.3142	10.11867
	MgO	0.36211	9.55884
	$MgSO_4$	1.0812	10.03389
	$MgSO_4 \cdot 7H_2O$	2.2138	10.34513
$MgSO_4$	$BaSO_4$	1.9390	10.28759

Weighed	Sought	Factor	Logarithm
Magnesium:			−10
$MgSO_4$	Mg	0.20202	9.3[illegible]9
	MgO	0.33493	9.524[illegible]5
	$Mg_2P_2O_7$	0.92494	9.96611
	SO_3	0.[illegible]07	9.82[illegible]7
$MgSO_4 \cdot 7H_2O$	$BaSO_4$	0.94700	9.97635
	$Mg_2P_2O_7$	0.45172	9.[illegible]7
	SO_3	0.32[illegible]81	9.511[illegible]
SO_3	MgO	0.50359	9.7[illegible]
	$MgSO_4$	1.5036	10.17713
	$MgSO_4 \cdot 7H_2O$	3.0787	10.48837
Manganese: Mn = 54.93			
$BaSO_4$	$MnSO_4$	0.64684	9.81080
CO_2	$MnCO_3$	2.6121	10.416[illegible]8
	MnO	1.6120	10.207[illegible]8
Mn	$MnCO_3$	2.0923	10.32062
	MnO	1.2913	10.11102
	Mn_2O_3	1.4369	10.157[illegible]4
	Mn_3O_4	1.3884	10.14251
	$Mn_2P_2O_7$	2.5843	10.41234
$MnCO_3$	CO_2	0.38284	9.58302
	Mn	0.47794	9.67938
	MnS	1.5837	10.19967
	$MnSO_4$	2.7488	10.43914
	$Mn(HCO_3)_2$	1.5396	10.18741
	MnO	0.61716	9.79040
	Mn_3O_4	0.66357	9.82189
	$Mn_2P_2O_7$	1.2352	10.09173
	MnS	0.75693	9.87906
$Mn(HCO_3)_2$	$MnCO_3$	0.64951	9.81259
	MnO	0.40085	9.60299
	Mn_3O_4	0.43100	9.63448
MnO	CO_2	0.62033	9.79262
	Mn	0.77442	9.88898
	$MnCO_3$	1.6203	10.20960
	$Mn(HCO_3)_2$	2.4946	10.39701
	Mn_2O_3	1.1128	10.04641
	Mn_2O_4	1.0752	10.03149
	$Mn_2P_2O_7$	2.0014	10.30133
	MnS	1.2265	10.08866
	$MnSO_4$	2.1288	10.32813
	SO_3	1.1288	10.05261
Mn_2O_3	Mn	0.69593	9.84256
	MnO	0.89865	9.95359
	Mn_3O_4	0.96623	9.98508
Mn_3O_4	Mn	0.72026	9.85749
	$MnCO_3$	1.5070	10.17811
	$Mn(HCO_3)_2$	2.3202	10.36552
	MnO	0.93006	9.96851
	Mn_2O_3	1.0349	10.01492
	MnO_2	1.1398	10.05685

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS
(Continued)

Weighed	Sought	Factor	Logarithm
Manganese:			−10
Mn_3O_4	$MnSO_4$	1.9799	10.29664
MnO_2	$Mn_2P_2O_7$	1.6330	10.21299
	Mn_3O_4	0.87730	9.94315
$Mn_2P_2O_7$	Mn	0.38695	9.58765
	$MnCO_3$	0.80960	9.90827
	MnO	0.49966	9.69867
	MnO_2	0.61236	9.78701
	$MnSO_4$	1.0637	10.02680
MnS	Mn	0.63143	9.80032
	$MnCO_3$	1.3211	10.12094
	MnO	0.81534	10.91134
	$MnSO_4$	1.7357	10.23947
$MnSO_4$	$BaSO_4$	1.5460	10.18920
	MnO	0.46975	9.67187
	Mn_3O_4	0.50508	9.70336
	$Mn_2P_2O_7$	0.94016	9.97320
	MnS	0.57614	9.76053
	Mn	0.36379	9.56086
	SO_3	0.53025	9.72448
SO_3	MnO	0.88592	9.94739
	$MnSO_4$	1.8859	10.27552
Mercury: Hg = 200.61			
Hg	HgCl	1.1768	10.07069
	$HgCl_2$	1.3535	10.13146
	HgO	1.0798	10.03333
	HgS	1.1598	10.06440
HgCl	Hg	0.84978	9.92931
	$HgCl_2$	1.1502	10.06077
	$HgNO_3$	1.1125	10.04628
	Hg_2O	0.88368	9.94629
	HgO	0.91758	9.96264
	HgS	0.98563	9.99371
$HgCl_2$	Hg	0.73882	9.86854
	HgCl	0.86942	9.93923
	HgS	0.85692	9.93294
$Hg(CN)_2$	HgS	0.92102	9.96427
$HgNO_3$	HgCl	0.89892	9.95372
	HgS	0.88600	9.94743
$Hg(NO_3)_2$	HgS	0.71675	9.85537
$Hg(NO_3)_2 \cdot H_2O$	HgS	0.67907	9.83191
Hg_2O	HgCl	1.1316	10.05371
	HgS	1.1154	10.04742
HgO	Hg	0.92613	9.96667
	HgCl	1.0898	10.03736
	HgS	1.0742	10.03107
HgS	HgCl	1.0146	10.00629
	$HgCl_2$	1.1670	10.06706
	$Hg(CN)_2$	1.0858	10.03573
	$HgNO_3$	1.1287	10.05257
	$Hg(NO_3)_2$	1.3952	10.14463
Mercury:			−10
HgS	$Hg(NO_3)_2 \cdot H_2O$	1.4726	10.16809
	Hg_2O	0.89656	9.95258
	HgO	0.93096	9.96893
	Hg	0.86220	9.93561
	$HgSO_4$	1.2751	10.10553
$HgSo_4$	HgS	0.78428	9.89447
Molybdenum: Mo = 96.0			
Mo	MoO_3	1.5000	10.17609
	MoS_3	2.0020	10.30146
	$PbMoO_4$	3.8239	10.58251
MoO_3	Mo	0.66667	9.82391
	MoS_3	1.3347	10.12537
	$(NH_4)_2MoO_4$	1.3617	10.13408
	$(NH_4)_3PO_4 \cdot 12MoO_3$	1.0863	10.03596
	$PbMoO_4$	2.5500	10.40654
MoS_3	Mo	0.49950	9.69854
	MoO_3	0.74925	9.87463
	$(NH_4)_2MoO_4$	1.0203	10.00871
$(NH_4)_2MoO_4$	MoO_3	0.73437	9.86592
	MoS_3	0.98015	9.99129
	$(NH_4)_3PO_4 \cdot 12MoO_3$	0.79778	9.90188
	$PbMoO_4$	1.8727	10.27247
$(NH_4)_3PO_4 \cdot 12MoO_3$	MoO_3	0.92054	9.96404
	$(NH_4)_2MoO_4$	1.2535	10.09812
$PbMoO_4$	Mo	0.26144	9.41737
	MoO_3	0.39216	9.59346
	$(NH_4)_2MoO_4$	0.53399	9.72753
Neodymium: Nd = 144.27			
Nd	Nd_2O_3	1.1664	10.06685
Nd_2O_3	Nd	0.85737	9.93317
Nickel: Ni = 58.69			
Ni	Ni-glyoxime	4.9214	10.69209
	$Ni(NO_3)_2 \cdot 6H_2O$	4.9549	10.69503
	NiO	1.2726	10.10470
	$NiSO_4$	2.6368	10.42108
	$NiSO_4 \cdot 7H_2O$	4.7857	10.67994

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm	Weighed	Sought	Factor	Logarithm
Nickel:			−10	Nitrogen:			−10
Ni-glyoxime...	Ni........	0.20320	9.30791	NO.....	NO_2.......	1.5332	10.1[illegible]
	NiO.......	0.25859	9.41261		N_2O_3.......	1.2[illegible]	10.1[illegible]4
$Ni(NO_3)_2\cdot 6H_2O$.	Ni........	0.20182	9.30497		NO_3.......	2.0[illegible]1	10.[illegible]1
	NiO.......	0.25684	9.40967		N_2O_5.......	1.7[illegible]	10.[illegible]2
	$NiSO_4$.....	0.53218	9.72605	N_2O_3....	$AgNO_2$.....	4.0487	10.[illegible]731
NiO.....	Ni.........	0.78578	9.89530		N........	0.3[illegible]8	9.[illegible]634
	Ni-glyoxime....	3.8671	10.58739		NO.......	0.78[illegible]3	9.[illegible]7
	$Ni(NO_3)_2\cdot 6H_2O$....	3.8934	10.59033	N_2O_5....	KNO_3.....	1.8720	10.27[illegible]1
	$NiSO_4$......	2.0720	10.31638		N.........	0.25[illegible]40	9.41[illegible]7
	$NiSO_4\cdot 7H_2O$....	3.7605	10.57524		$NaNO_3$.....	1.5749	10.1[illegible]
$NiSO_4$...	Ni.........	0.37925	9.57892		NH_3.......	0.31531	9.49[illegible]4
	$Ni(NO_3)_2\cdot 6H_2O$....	1.8791	10.27395		NH_4Cl.....	0.99054	9.99[illegible]7
	NiO.......	0.48263	9.68362		$(NH_4)_2PtCl_6$......	4.1109	10.613[illegible]4
	$NiSO_4\cdot 7H_2O$....	1.8149	10.25886		$(NH_4)_2SO_4$..	1.2234	10.08756
$NiSO_4\cdot 7H_2O$..	Ni.........	2.0896	9.32006		NO.......	0.55562	9.74478
	NiO.......	0.26593	9.42476		Pt.........	1.8074	10.25706
	$NiSO_4$.....	0.55099	9.74114		SO_3.......	0.74122	9.869[illegible]5
Nitrogen: N = 14.008				NO_2.....	N.........	0.30450	9.48359
$AgNO_2$..	HNO_2......	0.30554	9.48507		NO.......	0.65226	9.18442
	N_2O_3.......	0.24699	9.39269	NO_3.....	N.........	0.22593	9.35398
HNO_2...	$AgNO_2$.....	3.2729	10.51493		NH_3......	0.27467	9.43881
HNO_3...	N.........	0.22231	9.34696		NH_4Cl.....	0.86274	9.93588
	NH_3.......	0.27023	9.43173		NO.......	0.48393	9.68478
	NH_4Cl.....	0.84894	9.92888		Pt.........	1.5742	10.19706
	$(NH_4)_2PtCl_6$......	3.5233	10.54695	NH_3....	HNO_3.....	3.7006	10.56827
	NO........	0.47620	9.67779		N.........	0.82268	9.91523
	Pt.........	1.5491	10.19007		N_2O_5.......	3.1710	10.50126
	SO_3........	0.63527	9.80296		NO_3.......	3.6407	10.56118
KNO_3...	N_2O_5.......	0.53419	9.72769	NH_4Cl...	HNO_3.....	1.1779	10.07112
N........	HNO_3......	4.4982	10.65304		NO_3......	1.1591	10.06412
	$NaNO_3$.....	6.0683	10.78307		N_2O_5.......	1.0096	10.00415
	NH_3	1.2155	10.08477		N.........	0.26185	9.41805
	NH_4Cl.....	3.8190	10.58195	$(NH_4)_2PtCl_6$..	HNO_3.....	0.28383	9.45305
	$(NH_4)_2PtCl_6$......	15.850	11.20002		N.........	0.063093	8.799[illegible]8
	$(NH_4)_2SO_4$..	4.7167	10.67364		N_2O_5......	0.24326	9.38[illegible]6
	NO_2.......	3.2841	10.51641		NO_3.......	0.27928	9.44[illegible]
	N_2O_3.......	2.7131	10.43346	$(NH_4)_2SO_4$...	N.........	0.21201	9.32[illegible]6
	NO_3.......	4.4261	10.64602		N_2O_5.......	0.81742	9.91[illegible]
	N_2O_5.......	3.8551	10.58603	Pt	HNO_3......	0.64555	9.80[illegible]3
	Pt.........	6.9685	10.84314		N	0.14350	9.1[illegible]
	SO_3........	2.8578	10.45603		NO_3......	0.63524	9.80[illegible]4
$NaNO_3$..	N.........	0.16479	9.21693		N_2O_5.......	0.55328	9.74294
	N_2O_5.......	0.63534	9.80301	SO_3.....	HNO_3......	1.5741	10.19704
NO.....	HNO_3......	2.1000	10.32222		N........	0.34992	9.543[illegible]7
					N_2O_5.......	1.34[illegible]1	10.13005
				Osmium: Os = 190.8			
				Os......	OsO_4.......	1.3354	10.12561
				OsO_4....	Os.........	0.74882	9.87438
				Palladium: Pd = 106.7			
				Pd......	K_2PdCl_6....	3.7267	10.57132

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
			−10
Palladium:			
Pd	PdI_2	3.3792	10.52881
	$PdCl_2 \cdot 2H_2O$	2.0023	10.30153
	$Pd(NO_3)_2$	2.1623	10.33492
$PdCl_2 \cdot 2H_2O$	K_2PdCl_6	1.8612	10.26979
	Pd	0.49942	9.69847
$Pd(NO_3)_2$	Pd	0.46247	9.66508
PdI_2	Pd	0.29593	9.47119
K_2PdCl_6	Pd	0.26834	9.42869
	$PdCl_2 \cdot 2H_2O$	0.53729	9.73021
Phosphorus: P = 31.027			
Ag_3PO_4	P	0.074108	8.86987
	PO_4	0.22698	9.35598
	P_2O_5	0.16965	9.22955
$Ag_4P_2O_7$	P	0.10247	9.01060
	PO_4	0.31384	9.49671
	P_2O_5	0.23457	9.37028
Al_2O_3	P_2O_5	1.3935	10.14411
$AlPO_4$	PO_4	0.77893	9.89150
	P_2O_5	0.58223	9.76507
$Ca_3(PO_4)_2$	P_2O_5	0.45786	9.66073
$FePO_4$	PO_4	0.62969	9.79926
	P_2O_5	0.47079	9.67283
$Mg_2P_2O_7$	Na_2HPO_4	1.2755	10.10570
	$Na_2HPO_4 \cdot 12H_2O$	3.2172	10.50748
	$NaNH_4HPO_4 \cdot 4H_2O$	1.8782	10.27375
	P	0.27865	9.44506
	PO_4	0.85344	9.93117
	P_2O_5	0.63789	9.80474
Na_2HPO_4	$Mg_2P_2O_7$	0.78397	9.89430
	P_2O_5	0.50008	9.69904
$Na_2HPO_4 \cdot 12H_2O$	$Mg_2P_2O_7$	0.31083	9.49252
	P_2O_5	0.19827	9.29726
$NaNH_4HPO_4 \cdot 4H_2O$	$Mg_2P_2O_7$	0.53241	9.72625
	P_2O_5	0.33962	9.53099
$(NH_4)_3PO_4 \cdot 12MoO_3$	P	0.016529	8.21824
	PO_4	0.050623	8.70435
	P_2O_5	0.037837	8.57792
P	Ag_3PO_4	13.494	11.13013
	$Ag_4P_2O_7$	9.7588	10.98940
	$Mg_2P_2O_7$	3.5888	10.55494
	$(NH_4)_3PO_4 \cdot 12MoO_3$	60.500	11.78176
	P_2O_5	2.2892	10.35968
	$P_2O_5 \cdot 24MoO_3$	57.983	11.76330

Weighed	Sought	Factor	Logarithm
			−10
Phosphorus:			
P	$U_2P_2O_{11}$	11.512	11.06117
PO_4	Ag_3PO_4	4.4058	10.64402
	$Ag_4P_2O_7$	3.1863	10.50329
	$AlPO_4$	1.2838	10.10850
	$FePO_4$	1.5876	10.20074
	$Mg_2P_2O_7$	1.1717	10.06883
	$(NH_4)_3PO_4 \cdot 12MoO_3$	19.754	11.29565
	$P_2O_5 \cdot 24MoO_3$	18.932	11.27720
	$U_2P_2O_{11}$	3.7589	10.57506
P_2O_5	Ag_3PO_4	5.8946	10.77045
	$Ag_4P_2O_7$	4.2630	10.62972
	Al_2O_3	0.71762	9.85589
	$AlPO_4$	1.7176	10.23493
	$Ca_3(PO_4)_2$	2.1841	10.33927
	$FePO_4$	2.1241	10.32717
	$Mg_2P_2O_7$	1.5677	10.19526
	Na_2HPO_4	1.9997	10.30096
	$Na_2HPO_4 \cdot 12H_2O$	5.0436	10.70274
	$NaNH_4HPO_4 \cdot 4H_2O$	2.9445	10.46901
	$(NH_4)_3PO_4 \cdot 12MoO_3$	26.429	11.42208
	P	0.43683	9.64031
	$P_2O_5 \cdot 24MoO_3$	25.329	11.40362
	$U_2P_2O_{11}$	5.0291	10.70149
$P_2O_5 \cdot 24MoO_3$	P	0.01725	8.23679
	PO_4	0.05282	8.72280
	P_2O_5	0.03948	8.59638
$U_2P_2O_{11}$	P	0.086862	8.93883
	PO_4	0.26604	9.42494
	P_2O_5	0.19884	9.29851
Platinum: Pt = 195.23			
$H_2PtCl_6 \cdot 6H_2O$	K_2PtCl_6	0.93838	9.97238
	Pt	0.37683	9.57615
K_2PtCl_6	$H_2PtCl_6 \cdot 6H_2O$	1.0657	10.02762
	Pt	0.40158	9.60377
	$PtCl_4$	0.69332	9.84093
	$PtCl_4 \cdot 5H_2O$	0.87860	9.94379
$(NH_4)_2PtCl_6$	Pt	0.43966	9.64312
	$PtCl_4$	0.75903	9.88028
	$PtCl_6$	0.91876	9.96320
Pt	$H_2PtCl_6 \cdot 6H_2O$	2.6537	10.42385
	K_2PtCl_6	2.4902	10.39623
	$(NH_4)_2PtCl_6$	2.2745	10.35688

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Platinum:			−10
Pt	$PtCl_4$	1.7265	10.23716
	$PtCl_4 \cdot 5H_2O$	2.1879	10.34002
$PtCl_4$	K_2PtCl_6	1.4423	10.15907
	$(NH_4)_2PtCl_6$	1.3174	10.11972
	Pt	0.57921	9.76284
$PtCl_6$	$(NH_4)_2PtCl_6$	1.0884	10.03680
$PtCl_4 \cdot 5H_2O$	K_2PtCl_6	1.1382	10.05621
	Pt	0.45707	9.65998
Potassium K = 39.096			
Ag	KBr	1.1032	10.04265
	KCl	0.69108	9.83953
	$KClO_3$	1.1360	10.05539
	$KClO_4$	1.2843	10.10867
	KCN	0.60349	9.78067
	KI	1.5390	10.18724
AgBr	KBr	0.63373	9.80190
	$KBrO_3$	0.88932	9.94906
AgCl	KCl	0.52013	9.71611
	$KClO_3$	0.85500	9.93197
	$KClO_4$	0.96660	9.98525
AgCN	KCN	0.48627	9.68687
AgI	KI	0.70707	9.84946
	KIO_3	0.91148	9.95975
$BaCrO_4$	K_2CrO_4	0.76642	9.88447
	$K_2Cr_2O_7$	0.58056	9.76385
$BaSO_4$	$KHSO_4$	0.58334	9.76592
	K_2S	0.47232	9.67424
	K_2SO_4	0.74650	9.87303
Br	K	0.48921	9.68950
	KBr	1.4892	10.17295
CaF_2	$KF \cdot 2H_2O$	2.4114	10.38227
$CaSO_4$	$KF \cdot 2H_2O$	1.3829	10.14078
Cl	K	1.1027	10.04244
	KCl	2.1027	10.32277
	$KClO_3$	3.4565	10.53863
	$KClO_4$	3.9076	10.59191
	K_2O	1.3283	10.12328
CO_2	K_2O	2.1407	10.33056
	K_2CO_3	3.1407	10.49703
I	KI	1.3080	10.11661
	KIO_3	1.6862	10.22690
K	Br	2.0441	10.31050
	Cl	0.90690	9.95756
	KBr	3.0441	10.48345
	KCl	1.9069	10.28033
	$KClO_3$	3.1347	10.49620
	$KClO_4$	3.5439	10.54948
	KI	4.2466	10.62804
	K_2O	1.2046	10.08084
	KNO_3	2.5860	10.41263
	K_2PtCl_6	6.2174	10.79361
	K_2SO_4	2.2285	10.34802
Potassium			−10
K	Pt	2.4968	10.39738
K_3AsO_4	$Mg_2As_2O_7$	0.60597	9.78245
KBr	Ag	0.90646	9.95735
	AgBr	1.5780	10.19811
	Br	0.67150	9.82705
	K	0.32851	9.51655
	K_2O	0.39572	9.59738
$KBrO_3$	AgBr	1.1244	10.05094
KCl	Ag	1.4470	10.16047
	AgCl	1.9225	10.28387
	Cl	0.47559	9.67723
	K	0.52441	9.71967
	$KClO_3$	1.6438	10.21585
	$KClO_4$	1.8584	10.26914
	K_2CO_3	0.92678	9.96698
	$K_2Cr_2O_7$	1.9731	10.29516
	$KHCO_3$	1.3427	10.12798
	KNO_3	1.3561	10.13230
	K_2O	0.63170	9.80051
	K_2PtCl_6	3.2605	10.51328
	K_2SO_4	1.1684	10.06769
	Pt	1.3093	10.11705
$KClO_3$	Ag	0.88026	9.94461
	AgCl	1.1696	10.06803
	Cl	0.28931	9.46137
	KCl	0.60833	9.78414
$KClO_4$	Ag	0.77865	9.89133
	AgCl	1.0345	10.01475
	Cl	0.25591	9.40809
	K	0.28218	9.45053
	KCl	0.53810	9.73086
	K_2O	0.33992	9.53137
KCN	AgCN	2.0565	10.31313
	Ag	1.6570	10.21932
K_2CO_3	CO_2	0.31840	9.50297
	KCl	1.0790	10.03302
	KOH	0.81197	9.90954
	K_2O	0.68160	9.83353
	K_2PtCl_6	3.5180	10.54630
	K_2SO_4	1.2610	10.10071
K_2CrO_4	$BaCrO_4$	1.3048	10.11553
$K_2Cr_2O_7$	$BaCrO_4$	1.7225	10.23615
	KCl	0.50680	9.70484
	K_2O	0.32015	9.50535
$KF \cdot 2H_2O$	CaF_2	0.41470	9.61773
	$CaSO_4$	0.72313	9.85922
K_2HAsO_4	$Mg_2As_2O_7$	0.71177	9.85234
$KHCO_3$	KCl	0.74477	9.87202
	K_2O	0.47047	9.67253
	K_2PtCl_6	2.4283	10.38530
	K_2SO_4	0.87038	9.93971
$KHSO_4$	$BaSO_4$	1.7143	10.23408
	K_2SO_4	0.63986	9.80608
KI	Ag	0.64977	9.81276
	AgI	1.4143	10.15054
	I	0.76452	9.88339
	K	0.23548	9.37196

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Potassium			−10
KI	K_2O	0.28366	9.45280
KIO_3	AgI	1.0971	10.04025
	I	0.59306	9.77310
K_2MnO_4	Mn_2O_3	0.40041	9.60250
	MnS	0.44132	9.64475
$KMnO_4$	Mn_2O_3	0.49947	9.69851
	MnS	0.55050	9.74076
KNO_2	K_2SO_4	1.0238	10.01021
	N_2O_3	0.44661	9.64993
KNO_3	K	0.38670	9.58737
	KCl	0.73740	9.86770
	K_2O	0.46581	9.66821
	K_2PtCl_6	2.4043	10.38098
	K_2SO_4	0.86177	9.93539
	N	0.13855	9.14161
	NH_3	0.16846	9.22649
	NO	0.29681	9.47247
	N_2O_5	0.53119	9.72769
K_2O	Cl	0.75287	9.87672
	CO_2	0.46713	9.66944
	K	0.83016	9.91916
	KBr	2.5270	10.40261
	KCl	1.5830	10.19949
	$KClO_3$	2.6022	10.41534
	$KClO_4$	2.9419	10.46863
	K_2CO_3	1.4671	10.16647
	$K_2Cr_2O_7$	3.1236	10.49465
	$KHCO_3$	2.1256	10.32747
	KI	3.5253	10.54720
	KOH	1.1913	10.07601
	KNO_3	2.1468	10.33179
	K_2PtCl_6	5.1614	10.71277
	K_2SO_4	1.8500	10.26718
	N_2O_5	1.1468	10.05948
KOH	K_2CO_3	1.2316	10.09046
	K_2O	0.83944	9.92399
K_2PtCl_6	K	0.16084	9.20639
	K_2CO_3	0.28425	9.45370
	KCl	0.30671	9.48672
	$KHCO_3$	0.41181	9.61470
	KNO_3	0.41593	9.61902
	K_2O	0.19375	9.28723
	K_2SO_4	0.35843	9.55441
	$K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	1.9515	10.29038
	$K_2SO_4 \cdot Cr_2(SO_4)_3 \cdot 24H_2O$	2.0546	10.31272
K_2S	$BaSO_4$	2.1172	10.32576
	K_2SO_4	1.5805	10.19879
K_2SiO_3	SiO_2	0.38937	9.59036
K_2SO_4	$BaSO_4$	1.3396	10.12697
	KCl	0.85568	9.93231
	K_2CO_3	0.79303	9.89929
	$KHCO_3$	1.1489	10.06029
	$KHSO_4$	1.5629	10.19392
Potassium			−10
K_2SO_4	KNO_2	0.97676	9.98979
	KNO_3	1.1604	10.06461
	K	0.44871	9.65196
	K_2O	0.54053	9.73282
	K_2PtCl_6	2.7809	10.44559
	K_2S	0.63271	9.80121
	SO_3	0.45946	9.66225
$K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	K_2PtCl_6	0.51241	9.70962
$K_2SO_4 \cdot Cr_2(SO_4)_3 \cdot 24H_2O$	K_2PtCl_6	0.48672	9.68728
$Mg_2As_2O_7$	K_3AsO_4	1.6503	10.21755
	K_2HAsO_4	1.4049	10.14765
Mn_2O_3	K_2MnO_4	2.4975	10.39750
	$KMnO_4$	2.0021	10.30149
MnS	K_2MnO_4	2.2659	10.35525
	$KMnO_4$	1.8165	10.25924
N	KNO_3	7.2175	10.85839
NH_3	KNO_3	5.9363	10.77351
NO	KNO_3	3.3692	10.52753
N_2O_3	KNO_2	2.2391	10.35007
N_2O_5	K_2O	0.87200	9.94052
	KNO_3	1.8720	10.27231
Pt	K	0.40052	9.60262
	KCl	0.76375	9.88295
SiO_2	K_2SiO_3	2.5683	10.40964
SO_3	K_2SO_4	2.1765	10.33775
Praseodymium Pr = 140.92			
Pr	Pr_2O_3	1.1703	10.06830
Pr_2O_3	Pr	0.85447	9.93170
Rhodium: Rh = 102.91			
Rh	Na_3RhCl_6	3.7377	10.57260
	$RhCl_3$	2.0336	10.30827
$RhCl_3$	Rh	0.49173	9.69173
Na_3RhCl_6	Rh	0.26755	9.42741
Rubidium: Rb = 85.44			
AgCl	Rb	0.59608	9.77530
	RbCl	0.84345	9.92606
Cl	Rb	2.4097	10.38196
	RbCl	3.4097	10.53272
Rb	AgCl	1.6776	10.22469
	Cl	0.41499	9.61804
	RbCl	1.4150	10.15076
	Rb_2CO_3	1.3511	10.13069
	Rb_2O	1.0936	10.03886

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Rubidium:			−10
Rb	Rb_2PtCl_6	3.3875	10.52988
	Rb_2SO_4	1.5622	10.19374
RbCl	AgCl	1.1856	10.07394
	Cl	0.29328	9.46728
	Rb	0.70672	9.84925
	Rb_2CO_3	0.95486	9.97994
	Rb_2O	0.77289	9.88812
	Rb_2PtCl_6	2.3940	10.37912
	Rb_2SO_4	1.1040	10.04297
Rb_2CO_3	Rb	0.74012	
	RbCl	1.0473	10.02007
	$RbHCO_3$	1.2686	10.10332
	Rb_2PtCl_6	2.5072	10.39919
	Rb_2SO_4	1.1562	10.06303
$RbHCO_3$	Rb_2CO_3	0.78827	9.89668
	Rb_2PtCl_6	1.9763	10.29585
	Rb_2SO_4	0.91140	9.95971
Rb_2O	Rb	0.91438	9.96113
	RbCl	1.2938	10.11187
	Rb_2PtCl_6	3.0975	10.49101
	Rb_2SO_4	1.4284	10.15485
Rb_2PtCl_6	Rb	0.29520	9.47012
	RbCl	0.41771	9.62087
	Rb_2CO_3	0.39886	9.60082
	$RbHCO_3$	0.50600	9.70415
	Rb_2O	0.32285	9.50900
Rb_2SO_4	Rb	0.64013	9.80627
	RbCl	0.90579	9.95703
	Rb_2CO_3	0.86490	9.93697
	$RbHCO_3$	1.0972	10.04029
	Rb_2O	0.70007	9.84514
Selenium: Se = 79.2			
Se	H_2SeO_3	1.6315	10.21259
	H_2SeO_4	1.8335	10.26328
	SeO_2	1.4040	10.14737
	SeO_3	1.6061	10.20577
H_2SeO_3	Se	0.61293	9.78741
H_2SeO_4	Se	0.54539	9.73672
SeO_2	Se	0.71223	9.85263
SeO_3	Se	0.62264	9.79423
Silicon: Si = 28.06			
$BaSiF_6$	SiF_4	0.37239	9.57100
	SiO_2	0.21494	9.33231
H_2SiO_3	SiO_2	0.76925	9.88607
K_2SiF_6	SiF_4	0.47246	9.67436
	SiO_2	0.27269	9.43567
Si	SiO_2	2.1404	10.33050
SiF_4	$BaSiF_6$	2.6854	10.42900
	K_2SiF_6	2.1166	10.32564
	SiO_2	0.57718	9.76131
SiO_2	$BaSiF_6$	4.6526	10.66769
	H_2SiO_3	1.3000	10.11393

Weighed	Sought	Factor	Logarithm
Silicon:			−10
SiO_2	K_2SiF_6	3.6672	10.56433
	Si	0.46720	9.66950
	SiF_4	1.7326	10.23869
	SiO_3	1.2664	10.10257
	SiO_4	1.5328	10.18548
	Si_2O	0.60040	9.77844
	$Si(OH)_4$	1.5999	10.20410
SiO_3	SiO_2	0.78964	9.89743
SiO_4	SiO_2	0.65241	9.81452
Si_2O	SiO_2	1.6656	10.22156
$Si(OH)_4$	SiO_2	0.62503	9.79590
Silver: Ag = 107.880			
Ag	AgBr	1.7408	10.24075
	AgCl	1.3287	10.12342
	AgCN	1.2411	10.09380
	AgI	2.1766	10.33778
	$AgNO_3$	1.5748	10.19723
	Ag_2O	1.0742	10.03107
	Ag_3PO_4	1.2936	10.11181
	$Ag_4P_2O_7$	1.4034	10.14717
	Br	0.74080	9.86970
	Cl	0.32867	9.51676
	I	1.1766	10.07063
AgBr	Ag	0.57445	9.75925
	Br	0.42555	9.62895
AgCl	Ag	0.75263	9.87658
	$AgNO_3$	1.1852	10.07380
	Ag_2O	0.80844	9.90765
	Br	0.55754	9.74628
	Cl	0.24737	9.39334
AgCN	Ag	0.80575	9.90620
$AgNO_3$	Ag	0.63501	9.80278
	AgCl	0.84371	9.92619
AgI	Ag	0.45943	9.66222
	I	0.54056	9.73285
Ag_2O	Ag	0.93095	9.96893
	AgCl	1.2369	10.09235
Ag_3PO_4	Ag	0.77302	9.88819
$Ag_4P_2O_7$	Ag	0.71257	9.85283
Br	Ag	1.3499	10.13030
	AgBr	2.3499	10.37105
	AgCl	1.7936	10.25372
Cl	Ag	3.0426	10.48324
	AgCl	4.0426	10.60666
I	Ag	0.84900	9.92937
	AgI	1.8499	10.26715
Sodium: Na = 22.997			
Ag	NaBr	0.95396	9.97953
	NaCl	0.54184	9.73387
	NaI	1.3898	10.14294
AgBr	NaBr	0.54800	9.73878
AgCl	NaCl	0.40780	9.61045
	$NaClO_3$	0.74268	9.87080

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Sodium:			−10
$AgCl$	$NaClO_4$	0.85431	9.93162
AgI	NaI	0.63850	9.80516
$BaSO_4$	$NaHSO_4$	0.51436	9.71127
	$NaHSO_4 \cdot H_2O$	0.59154	9.77198
	Na_2S	0.33439	9.52426
	Na_2SO_3	0.54003	9.73241
	$Na_2SO_3 \cdot 7H_2O$	1.0803	10.03354
	Na_2SO_4	0.60856	9.78430
	$Na_2SO_4 \cdot 10H_2O$	1.3804	10.13999
B_2O_3	$Na_2B_4O_7$	1.4451	10.15990
	$Na_2B_4O_7 \cdot 10H_2O$	2.7386	10.43753
Br	Na	0.28776	9.45903
	$NaBr$	1.2877	10.10983
	Na_2O	0.38786	9.58868
$CaCl_2$	$NaCl$	1.0534	10.02258
$CaCO_3$	Na_2CO_3	1.0592	10.02409
CaF_2	NaF	1.0759	10.03177
CaO	Na_2CO_3	1.8904	10.27656
$CaSO_4$	Na_2CO_3	0.77862	9.89132
Cl	Na	0.64859	9.81197
	$NaCl$	1.6486	10.21711
	Na_2O	0.87422	9.94162
CO_2	Na_2CO_3	2.4090	10.38184
	Na_2O	1.4090	10.14890
H_3BO_3	$Na_2B_4O_7$	0.81364	9.91043
	$Na_2B_4O_7 \cdot 10H_2O$	1.5419	10.18806
I	Na	1.8118	9.25810
	NaI	1.1812	10.07231
	Na_2O	0.24420	9.38775
KBF_4	$Na_2B_4O_7$	0.39962	9.60165
	$Na_2B_4O_7 \cdot 10H_2O$	0.75732	9.87928
$Mg_2As_2O_7$	Na_2HAsO_3	1.0946	10.03924
	Na_2HAsO_4	1.1976	10.07831
$MgCl_2$	$NaCl$	1.2276	10.08905
$Mg_2P_2O_7$	Na_2HPO_4	1.2756	10.10570
	$Na_2HPO_4 \cdot 12H_2O$	3.2172	10.50748
	$NaNH_4HPO_4 \cdot 4H_2O$	1.8782	10.27375
	$Na_4P_2O_7 \cdot 10H_2O$	2.0036	10.30182
Na	Br	3.4752	10.54097
	Cl	1.5418	10.18803
	I	5.5195	10.74190
	$NaBr$	4.4751	10.65080
	$NaCl$	2.5418	10.40514
	Na_2CO_3	2.3046	10.36259
	$NaHCO_3$	3.6529	10.56264
	NaI	6.5194	10.81421
	Na_2O	1.3479	10.12965
Sodium:			−10
Na	Na_2SO_4	3.0886	10.48976
$Na_2B_4O_7$	B_2O_3	0.69199	9.84010
	H_3BO_3	1.2291	10.08957
	KBF_4	2.5024	10.39835
$Na_2B_4O_7 \cdot 10H_2O$	B_2O_3	0.36515	9.56247
	H_3BO_3	0.64854	9.81194
	KBF_4	1.3205	10.12072
$NaBr$	Ag	1.0483	10.02047
	$AgBr$	1.8248	10.26122
	Br	0.77655	9.89017
	Na	0.22346	9.34920
	Na_2O	0.30120	9.47885
$NaCl$	Ag	1.8456	10.26613
	$AgCl$	2.4522	10.38955
	Cl	0.60659	9.78289
	Na	0.39343	9.59486
	$NaClO_3$	1.8212	10.26036
	$NaClO_4$	2.0949	10.32116
	Na_2CO_3	0.90668	9.95745
	$NaHCO_3$	1.4371	10.15750
	Na_2HPO_4	1.2149	10.08454
	Na_2O	0.53029	9.72451
	Na_2SO_4	1.2151	10.08462
$NaClO_3$	$AgCl$	1.3465	10.12921
	$NaCl$	0.54910	9.73965
$NaClO_4$	$AgCl$	1.1705	10.06837
	$NaCl$	0.47735	9.67884
Na_2CO_3	$CaCO_3$	0.94408	9.97501
	CaO	0.52898	9.72344
	$CaSO_4$	1.2843	10.10868
	CO_2	0.41511	9.61816
	Na	0.43392	9.63741
	$NaCl$	1.1029	10.04255
	$NaHCO_3$	1.5851	10.20005
	Na_2O	0.58487	9.76706
	$NaOH$	0.75485	9.87786
	Na_2SO_4	1.3402	10.12717
$Na_2CO_3 \cdot 10H_2O$	Na_2SO_4	0.49643	9.69586
NaF	CaF_2	0.92946	9.96823
Na_2HAsO_3	$Mg_2As_2O_7$	0.91360	9.96075
Na_2HAsO_4	$Mg_2As_2O_7$	0.83500	9.92169
$NaHCO_3$	Na	0.27376	9.43736
	$NaCl$	0.69583	9.84250
	Na_2CO_3	0.63089	9.79995
	Na_2O	0.36898	9.56701
$NaNH_4HPO_4 \cdot 4H_2O$	$Mg_2P_2O_7$	0.53241	9.72625
	NH_3	0.081438	8.91083
	P_2O_5	0.33962	9.53099
Na_2HPO_4	$Mg_2P_2O_7$	0.78397	9.89430
	$NaCl$	0.82313	9.91547
	Na_2O	0.43649	9.63997

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS
(Continued)

Weighed	Sought	Factor	Logarithm
Sodium:			−10
Na_2HPO_4	$Na_4P_2O_7$	0.93658	9.97154
	P_2O_5	0.50008	9.69904
$Na_2HPO_4 \cdot 12H_2O$	$Mg_2P_2O_7$	0.31083	9.49252
	$Na_4P_2O_7$	0.37133	9.56976
	P_2O_5	0.19827	9.29726
$NaHSO_3$	SO_2	0.61559	9.78929
$NaHSO_4$	$BaSO_4$	1.9441	10.28873
$NaHSO_4 \cdot H_2O$	$BaSO_4$	1.6905	10.22802
NaI	Ag	0.71955	9.85706
	AgI	1.5662	10.19484
	I	0.84662	9.92769
	Na	0.15339	9.18579
	Na_2O	0.20675	9.31544
$NaNO_3$	Na_2O	0.36464	9.56187
	N	0.16479	9.21693
	NH_3	0.20036	9.30181
	NO	0.35302	9.54779
	N_2O_5	0.63534	9.80301
Na_2O	Br	2.5782	10.41132
	Cl	1.1439	10.05838
	CO_2	0.70974	9.85110
	I	4.0950	10.61225
	Na	0.74190	9.87035
	$NaBr$	3.3201	10.52115
	$NaCl$	1.8858	10.27549
	Na_2CO_3	1.70[illegible]8	10.23294
	$NaHCO_3$	2.7101	10.43299
	NaI	4.8368	10.68456
	Na_2HPO_4	2.2910	10.36003
	$NaNO_3$	2.7424	10.43813
	$NaOH$	1.2906	10.11080
	Na_2SO_4	2.2914	10.36011
	N_2O_5	1.7424	10.24114
	SO_3	1.2915	10.11109
$NaOH$	Na_2CO_3	1.3248	10.12214
	Na_2O	0.77482	9.88920
$Na_4P_2O_7$	Na_2HPO_4	1.0677	10.02845
	$Na_2HPO_4 \cdot 12H_2O$	2.6930	10.43024
$Na_4P_2O_7 \cdot 10H_2O$	$Mg_2P_2O_7$	0.49909	9.69818
Na_2S	$BaSO_4$	2.9905	10.47574
Na_2SO_3	$BaSO_4$	1.8518	10.26759
	SO_2	0.50821	9.70604
$Na_2SO_3 \cdot 7H_2O$	$BaSO_4$	0.92568	9.96646
	SO_2	0.25405	9.40491
Na_2SO_4	$BaSO_4$	1.6433	10.21570
	Na	0.32377	9.51024
	$NaCl$	0.82296	9.91538
	Na_2CO_3	0.74615	9.87283
	$Na_2CO_3 \cdot 10H_2O$	2.0144	10.30414
Sodium:			−10
Na_2SO_4	Na_2O	0.43641	[illegible]
	SO_3	0.5[illegible]61	9.75[illegible]8
$Na_2SO_4 \cdot 10H_2O$	$BaSO_4$	0.724[illegible]	9.8[illegible]1
N	$NaNO_3$	6.0683	10.78307
NH_3	$NaNO_3$	4.9910	10.[illegible]10
	$NaNH_4HPO_4 \cdot 4H_2O$	12.279	11.08917
NO	$NaNO_3$	2.8[illegible]28	10.4[illegible]1
N_2O_5	$NaNO_3$	1.5740	10.19[illegible]
	Na_2O	0.573[illegible]3	9.7[illegible]
P_2O_5	Na_2HPO_4	1.[illegible]7	10.30[illegible]6
	$Na_2HPO_4 \cdot 12H_2O$	5.0436	10.70274
	$NaNH_4HPO_4 \cdot 4H_2O$	2.9445	10.4[illegible]01
SO_2	$NaHSO_3$	1.6245	10.21071
	Na_2SO_3	1.9677	10.29[illegible]6
	$Na_2SO_3 \cdot 7H_2O$	3.9363	10.59509
SO_3	Na_2O	0.77430	9.888[illegible]1
	Na_2SO_4	1.7743	10.24902
Strontium: Sr = 87.63			
CO_2	$SrCO_3$	3.3553	10.52573
SO_3	SrO	1.2944	10.11205
	$SrSO_4$	2.2944	10.3[illegible]066
Sr	$SrCO_3$	1.6847	10.22653
	$Sr(NO_3)_2$	2.4152	10.38295
	SrO	1.1826	10.07284
	$SrSO_4$	2.0963	10.32145
$SrCl_2$	$SrCO_3$	0.93118	9.96903
	SrO	0.653[illegible]4	9.81534
	$SrSO_4$	1.1586	10.06395
$SrCO_3$	CO_2	0.29804	9.47427
	Sr	0.59357	9.77347
	$SrCl_2$	1.0739	10.03097
	$Sr(HCO_3)_2$	1.4201	10.15231
	$Sr(NO_3)_2$	1.4336	10.15643
	SrO	0.70195	9.84631
	$SrSO_4$	1.2443	10.09492
$Sr(HCO_3)_2$	$SrCO_3$	0.70419	9.84769
	SrO	0.4[illegible]431	9.69400
$Sr(NO_3)_2$	Sr	0.414[illegible]4	9.61704
	$SrCO_3$	0.69754	9.84357
	SrO	0.489[illegible]4	9.68[illegible]88
	$SrSO_4$	0.867[illegible]4	9.9384[illegible]
SrO	SO_3	0.772[illegible]0	9.88795
	Sr	0.845[illegible]0	9.92716
	$SrCl_2$	1.5295	10.18466
	$SrCO_3$	1.4246	10.15369
	$Sr(HCO_3)_2$	2.0230	10.30600
	$Sr(NO_3)_2$	2.0423	10.31012
	$SrSO_4$	1.7726	10.24861

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS
(Continued)

Weighed	Sought	Factor	Logarithm
Strontium:			−10
$SrSO_4$	SO_3	0.43585	9.63934
	Sr	0.47703	9.67855
	$SrCl_2$	0.86308	9.93605
	$SrCO_3$	0.80368	9.90508
	$Sr(NO_3)_2$	1.1522	10.06151
	SrO	0.56414	9.75139
Sulphur: S = 32.064			
As_2S_3	H_2S	0.41542	9.61849
	S	0.39085	9.59201
$BaSO_4$	FeS_2	0.25696	9.40987
	H_2S	0.14600	9.16434
	H_2SO_3	0.35163	9.54608
	H_2SO_4	0.42016	9.62342
	S	0.13736	9.13786
	SO_2	0.27444	9.43845
	SO_3	0.34299	9.53528
	SO_4	0.41153	9.61440
CdS	H_2S	0.23589	9.37271
	S	0.22194	9.34623
FeS_2	$BaSO_4$	3.8916	10.59013
H_2S	As_2S_3	2.4072	10.38151
	$BaSO_4$	6.8495	10.83566
	CdS	4.2393	10.62729
	SO_3	2.3493	10.37094
H_2SO_3	$BaSO_4$	2.8439	10.45392
H_2SO_4	$BaSO_4$	2.3800	10.37658
	$(NH_4)_2SO_4$	1.3473	10.12947
	SO_3	0.81632	9.91186
$(NH_4)_2SO_4$	SO_3	0.60589	9.78239
	H_2SO_4	0.74222	9.87053
S	As_2S_3	2.5585	10.40799
	$BaSO_4$	7.2802	10.86214
	CdS	4.5058	10.65377
SO_2	$BaSO_4$	3.6438	10.56155
SO_3	$BaSO_4$	2.9155	10.46472
	H_2S	0.42566	9.62906
	$(NH_4)_2SO_4$	1.6505	10.21762
SO_4	$BaSO_4$	2.4299	10.38560
Tantalum: Ta = 181.5			
Ta	Ta_2O_5	1.2204	10.08650
	$TaCl_5$	1.9768	10.29596
$TaCl_5$	Ta	0.50587	9.70404
	Ta_2O_5	0.61736	9.79054
Ta_2O_4	Ta_2O_5	1.0375	10.01539
Ta_2O_5	Ta	0.81941	9.91350
	$TaCl_5$	1.6198	10.20946
	Ta_2O_4	0.96388	9.98402
Tellurium: Te = 127.5			
Te	H_2TeO_4	1.5178	10.18121

Weighed	Sought	Factor	Lagarithm
Tellurium:			−10
Te	$H_2TeO_4 \cdot 2H_2O$	1.8004	10.25537
	TeO_2	1.2510	10.09726
	TeO_3	1.3765	10.13878
	$(TeO_2)_2SO_3$	1.5650	10.19451
H_2TeO_4	Te	0.65886	9.81879
$H_2TeO_4 \cdot 2H_2O$	Te	0.55544	9.74464
TeO_2	Te	0.79937	9.90275
TeO_3	Te	0.72650	9.86124
$(TeO_2)_2SO_3$	Te	0.63900	9.80550
Thallium: Tl = 204.39			
Tl	Tl_2CO_3	1.1468	10.05948
	$TlCl$	1.1735	10.06948
	Tl_2CrO_4	1.2838	10.10850
	$TlHSO_4$	1.4749	10.16876
	TlI	1.6210	10.20978
	$TlNO_3$	1.3034	10.11508
	Tl_2O	1.0391	10.01666
	Tl_2PtCl_6	1.9980	10.30060
	Tl_2SO_4	1.2350	10.09167
Tl_2CO_3	Tl	0.87201	9.94052
	Tl_2PtCl_6	1.7423	10.24112
$TlCl$	Tl	0.85217	9.93053
	Tl_2PtCl_6	1.7027	10.23114
Tl_2CrO_4	Tl	0.77894	9.89150
$TlHSO_4$	Tl	0.67800	9.83123
TlI	Tl	0.61689	9.79021
	Tl_2PtCl_6	1.2326	10.09082
$TlNO_3$	Tl	0.76724	9.88493
	Tl_2PtCl_6	1.5329	10.18551
Tl_2O	Tl	0.96233	9.98332
	Tl_2PtCl_6	1.9228	10.28393
Tl_2PtCl_6	Tl	0.50049	9.69940
	$TlCl$	0.58732	9.76887
	Tl_2CO_3	0.57396	9.75888
	TlI	0.81132	9.90919
	$TlNO_3$	0.65234	9.81447
	Tl_2O	0.52010	9.71609
	Tl_2SO_4	0.61811	9.79107
Tl_2SO_4	Tl	0.80971	9.90833
	Tl_2PtCl_6	1.6178	10.20892
Thorium: Th = 232.15			
Th	ThO_2	1.1378	10.05607
$ThCl_4$	ThO_2	0.70632	9.84900
$Th(NO_3)_4 \cdot 6H_2O$	ThO_2	0.44902	9.65227
ThO_2	Th	0.87886	9.94392
	$ThCl_4$	1.4158	10.15100
	$Th(NO_3)_4 \cdot 6H_2O$	2.2271	10.34774

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS (Continued)

Weighed	Sought	Factor	Logarithm
Tin: Sn = 118.70			−10
Sn	$SnCl_2$	1.5974	10.20342
	$SnCl_2 \cdot 2H_2O$	1.9010	10.27898
	$SnCl_4$	2.1949	10.34141
	$SnCl_4 \cdot (NH_4Cl)_2$	3.0963	10.49084
	SnO	1.1318	10.05492
	SnO_2	1.2696	10.10367
$SnCl_2$	Sn	0.62601	9.79658
	SnO_2	0.79477	9.90024
$SnCl_2 \cdot 2H_2O$	Sn	0.52604	9.72102
	SnO_2	0.66785	9.82468
$SnCl_4$	Sn	0.45561	9.65859
	SnO_2	0.57843	9.76225
$SnCl_4(NH_4Cl)_2$	Sn	0.32297	9.50916
	SnO_2	0.41004	9.61283
SnO	Sn	0.88122	9.94508
	SnO_2	1.1188	10.04875
SnO_2	Sn	0.78766	9.89634
	$SnCl_2$	1.2582	10.09976
	$SnCl_2 \cdot 2H_2O$	1.4973	10.17532
	$SnCl_4$	1.7289	10.23775
	$SnCl_4(NH_4Cl)_2$	2.4388	10.38718
	SnO	0.89383	9.95125
Titanium: Ti = 48.1			
Ti	TiO_2	1.6652	10.22148
TiO_2	Ti	0.60051	9.77852
Tungsten: W = 184.			
W	WO_2	1.1739	10.06963
	WO_3	1.2609	10.10067
WO_2	W	0.85187	9.93037
WO_3	W	0.79310	9.89933
Uranium: U = 238.17			
U	UO_2	1.1344	10.05475
	$(UO_2)_2P_2O_7$	1.4998	10.17603
	U_3O_8	1.1792	10.07157
	$U_2P_2O_{11}$	1.4998	10.17602
UO_2	U	0.88156	9.94525
	U_3O_8	1.0395	10.01682
	$U_2P_2O_{11}$	1.3221	10.12127
U_3O_8	U	0.84806	9.92843
	UO_2	0.96200	9.98318
	$UO_2(NO_3)_2 \cdot 6H_2O$	1.7885	10.25249
$UO_2(NO_3)_2 \cdot 6H_2O$	U_3O_8	0.55913	9.74751

Weighed	Sought	Factor	Logarithm
Uranium:			−10
$(UO_2)_2P_2O_7$	U	0.66677	9.82398
$U_2P_2O_{11}$	U	0.66677	9.82398
	UO_2	0.75637	9.87873
Vanadium V = 50.96			
V	V_2O_5	1.7849	10.25162
VO_4	V_2O_5	0.79122	9.89830
V_2O_5	V	0.56025	9.74838
	VO_4	1.2639	10.10170
Ytterbium: Yb = 173.6			
Yb	Yb_2O_3	1.1382	10.05622
Yb_2O_3	Yb	0.87854	9.94376
Yttrium: Y = 88.9			
Y	Y_2O_3	1.2700	10.10380
Y_2O_3	Y	0.78742	9.89621
Zinc: Zn = 65.38			
$BaSO_4$	ZnS	0.41744	9.62059
	$ZnSO_4 \cdot 7H_2O$	1.2319	10.09056
Zn	$ZnNH_4PO_4$	2.7294	10.43607
	ZnO	1.2447	10.09508
	$Zn_2P_2O_7$	2.3311	10.36756
	ZnS	1.4904	10.17332
$ZnCl_2$	ZnO	0.59709	9.77604
$ZnCO_3$	ZnO	0.64907	9.81229
$ZnNH_4PO_4$	Zn	0.36638	9.56393
	ZnO	0.45605	9.65901
ZnO	Zn	0.80338	9.90492
	$ZnCl_2$	1.6748	10.22396
	$ZnCO_3$	1.5407	10.18771
	$ZnNH_4PO_4$	2.1928	10.34100
	$Zn_2P_2O_7$	1.8727	10.27248
	ZnS	1.1974	10.07824
	$ZnSO_4 \cdot 7H_2O$	2.7471	10.43887
$Zn_2P_2O_7$	Zn	0.42898	9.63244
	ZnO	0.53398	9.72752
ZnS	$BaSO_4$	2.3955	10.37940
	Zn	0.67093	9.82668
	ZnO	0.83514	9.92176
	$ZnSO_4 \cdot 7H_2O$	2.9509	10.46996
$ZnSO_4 \cdot 7H_2O$	$BaSO_4$	0.81178	9.90944
	ZnO	0.28301	9.45180
	ZnS	0.33888	9.53004
Zirconium Zr = 91.			
Zr	ZrO_2	1.3516	10.13085
ZrO_2	Zr	0.73984	9.86914

HEATS OF FORMATION AND SOLUTION

The following table gives the heat of formation and heat of solution in small calories. To convert to British Thermal Units multiply the values by 0.003968.

The values are given for a temperature of about 15° C. unless otherwise stated. The heat of solution is given in most cases for a definite number of water molecules to one of the substance. Where this is not stated the dilution may be understood to be such that additional dilution produces a negligible thermal effect.

In the second column the formulæ indicate the substances entering the reaction or the nature of the compound where only the heat of solution is given.

(Compiled from various sources.)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water. mols.	Heat of solution. Calories.
Acetic Acid	C_2, H_4, O_2	liquid	117,200	200	+375
Aluminum					
bromide	Al, Br_3	solid	121,950	2970	+85,300$^{9°}$
carbide	Al_4, C_3	solid	232,000		
chloride	Al, Cl_3	solid	161,800	2500	+153,690
chloride	$AlCl_3$			1250	+76,845
fluoride	Al, F_3	dil. sol.	275,220		
hydroxide	Al, O_3, H_3	solid	301,300		
hydroxide	Al_2, O_3, $3H_2O$	solid	288,920		
iodide	Al, I_3	solid	70,300	2250	+89,900$^{9°}$
oxide	Al_2, O_3	solid	392,600		
potassium sulphate	$K_2Al_2(SO_4)_4.24H_2O$			2400	−20,240
silicate	Al_2, Si_2, O_7	solid	767,500		
silicate	Al_2, Si_2, O_9, H_4	solid	927,420		
sulphate	Al_2, S_3, O_{12}	dil. sol.	879,700		
sulphide	Al_2, S_3	solid	126,400		
Ammonia	N, H_3	gas	12,000		
ammonia	N, H_3	liquid	21,000		
Ammonium					
acetate	N, H_7, C_2, O_2	solid	150,250	300	+250$^{24°}$
bromide	N, H_4, Br	solid	65,350	200	−4,380
bromide	NH_3, HBr	solid	45,500		
carbonate	N_2, H_8, C, O_3, Aq	dil. sol.	221,600		
carbonate, acid	N_2, H_6, C, O_3	solid	208,600	220–440	−6,300°
chloride	N, H_4, Cl	solid	76,800	200	−3,088$^{15°}$
chloride	NH_3, HCl	solid	41,900		
chloride	NH_4, Cl		75,790		
chloroplatinite	$(NH_4)_2PtCl_4$			660	−8,480
cyanate	N_2, H_4, C, O, Aq	dil. sol.	68,900		
cyanide	N_2, H_4, C	solid	2,300	820	−4,400
cyanide	NH_3, HCN	solid	20,600		
ferrocyanide	$(NH_4)_4Fe(CN)_6.3H_2O$				−6,800$^{14°}$
fluoride	N, H_4, F	solid	101,250		−1,500
fluoride	NH_3, HF	solid	37,300		
fluosilicate	N_2, H_8, Si, F_6	solid	458,900	2400	−8,400$^{7°}$
hydroxide	N, H_5, O		88,800		
hydroxide	N, H_5, O, Aq	dil. sol.	90,000		
iodide	N, H_4, I	solid	49,300	200	−3,550
iodide	NH_3, HI	solid	43,460		
iodide	NH_4, I	solid	49,310		
nitrate	N_2, H_4, O_3	solid	88,060	220–440	−6,200$^{15°}$
				200	−6,320
nitrate	NH_3, HNO_3		34,800		
nitrite	N_2, H_4, O_2		68,950	400	−4,750$^{12.5°}$

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Ammonium					
oxalate	N_2, H_8, C_2, O_4	solid	270,1[illegible]	145–[illegible]	−8,[illegible]
oxalate	$(NH_4)_2C_2O_4.H_2O$	....	....	[illegible]05–700	−11,500
phosphate	N_3, H_{12}, P, O_4, Aq	dil. sol.	403,000	......	....
" (di-basic)	N_2, H_9, P, O_4, Aq	dil. sol.	375,000	......	....
" (m.-bas.)	N, H_6, P, O_4, Aq	dil. sol.	341,2[illegible]	......	....
sulphate	N_2, H_8, S, O_4	solid	2[illegible]3,500	4[illegible]0	−[illegible]
sulphate, acid	N, H[illegible], S, O_4	solid	244,600	200	−20
sulphate, per-	N_2, H_8, S_2, O_8	solid	3[illegible]2,900	11[illegible]0	−[illegible],70[illegible]$^{.4°}$
sulphide	N_2, H_8, S	solid	66,200	......	....
sulphide, acid	N_2, H[illegible], S	solid	40,000	800	−3,2[illegible]
sulphide, acid	NH_3, H_2S	solid	22,400	......	....
sulphite	N_2, H_8, S, O_3	solid	215,500	440	$-1{,}540^{8°}$
sulphite	$(NH_4)_2SO_3.H_2O$	....	....	440	−5,36[illegible]
sulphocyanate	N_2, H_4, C, S	solid	20,700	......	−5,670[illegible]
sulphydrate	NH_3, H_2S	solid	22,400	800	$-3{,}250^{3°}$
sulphydrate	N, H_5, S	solid	40,000	......	....
Antimony					
acid (stibnic)	$3H_2O$, Sb_2, O_5	solid	228,780	......	....
acid (stibnous)	$3H_2O$, Sb_2, O_3	solid	167,420	......	....
bromide	Sb, Br_3	solid	61,400	......	....
chloride, tri-	Sb, Cl_3	solid	91,390	......	+8.910
chloride, penta-	Sb, Cl_5	liquid	104,870	1100	+35,200
fluoride	Sb, F_3	solid	141,000	......	....
hydride (stibine)	Sb, H_3	gas const vol.	−34,270	......	....
hydride	Sb, H_3	const. press.	−33,960	......	....
iodide	Sb, I_3	solid	28,800	......	....
oxide, tri-	Sb_2, O_3	solid	166,900	......	....
oxide, penta-	Sb_2,O_5	solid	131,200	......	....
oxychloride	Sb_2, O_2, Cl_2	solid	179,600	......	....
sulphide	Sb_2, S_3	solid	34,400	......	....
Arsenic					
acid	H_3, As, O_4	solid	215,630	......	−400
bromide	As, Br_3	solid	45,500	......	....
chloride	As, Cl_3	liquid	71,390	......	....
chloride	As, Cl_3	solid	−71,500	......	....
iodide	As, I_3	solid	13,500	......	....
hydride (arsine)	As (cryst.), H_3	gas	44,200	......	....
oxide, tri-	As_2, O_3	solid	154,670	......	−7,550
oxide	As_2, O_3, Aq	dil. sol.	147,120	......	....
oxide	As_2(cryst.), O_3	solid	156,400	......	−7,500
oxide, tri-	As_2(cryst.), O_3, Aq	dil. sol.	148,900	......	....
oxide, penta-	As_2, O_5	solid	219,380	......	....
oxide, penta-	As_2, O_5, Aq	dil. sol.	225,380	......	....
Aurichlorhydric Acid	Au, Cl_4, H, $4H_2O$	solid	76,950	400	−5,830
Aurobromhydric Acid	Au, Br_4, H, Aq	dil. sol.	41,165	1000 ($5H_2O$)	−11,400
Barium					
acetate	$Ba(C_2H_3O_2)_2.3H_2O$	....	....	800	−1,150
acetate	Ba, C_4, H_6, O_4	solid	349,300	600	$+5{,}200^{10.8}$
arsenate	Ba_3, As_2, O_8 p'p't'd.	solid	629,200	......	....
bromide	Ba, Br_3	solid	172,100	400	+4,980
bromide	Ba, Br_2, $2H_2O$	solid	181,210	400	−4,130
carbonate	Ba, C, O_3	amorph.	282,500	......	....
carbonate	Ba, C, O_3	cryst.	283,000	......	....
carbonate	BaO, CO_2	solid	63,440	......	....
chlorate	Ba, Cl_2, O_6	solid	171,200	500–1000	$-6{,}700^{10°}$
chlorate	$Ba(ClO_3).H_2O$	....	....	600	−11,240

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories
Barium					
chlorate	$Ba, Cl_2, O_6, 6H_2O$	solid	179,710	......	......
chlorate, per-	Ba, Cl_2, O_8	solid	201,400	550–1100	−1,800$^{10°}$
chlorate, per-	$Ba, (ClO_4)_2, 3H_2O$	....	....	650–1300	−9,400
chloride	Ba, Cl_2	solid	196,880	400	+2,070
chloride	$Ba, Cl_2, 2H_2O$	solid	203,880	400	−4,930
cyanide	Ba, C_2, N_2	solid	48,300	......	+1,800$^{9°}$
cyanide	$Ba(CN)_2.2H_2O$	....	....	......	−2,560$^{7°}$
ferrocyanide	$Ba_2Fe(CN)_6.6H_2O$	....	....	......	−11,400$^{14°}$
fluoride	Ba, F_2	precip.	222,600	......	−1,900
hydride	Ba, H_2	solid	37,500	......	....
hydroxide	Ba, O_2, H_2	solid	217,000	......	+12,260
hydroxide	$Ba(OH)_2, 8H_2O$	....	....	400	−15,210
hypobromite	Ba, Br_2, O_2, Aq	dil. sol.	168,400	......	....
hypochlorite	Ba, Cl_2, O_2, Aq	dil. sol.	175,200	......	....
hypophosphite	Ba, H_4, P_2, O_4, Aq	dil. sol.	403,000	......	....
hypophosphite	$BaH_4(PO_2)_2, H_2O$	....	....	800	+290
iodide	Ba, I_2	solid	136,100	......	+10,300$^{16°}$
iodide	$Ba, I_2, 7H_2O$	solid	153,510	500	−6,850
nitrate	Ba, N_2, O_6	solid	228,400	400	−9,400
nitrate	$Ba(NO_3)_2.H_2O$	....	....	800	−8,600$^{12°}$
nitride	Ba_3, N_2	solid	149,400	......	....
nitrite	Ba, N_2, O_4	solid	179,600	......	....
oxide	Ba, O	solid	126,380	......	+34,520
oxide	$BaO.2H_2O$	....	....	666	+7,060
oxide, per-	Ba, O_2	solid	139,400	......	....
oxide, per-	BaO, O	solid	18,360	......	....
phosphate, tri-	Ba_3, P_2, O_8	cryst.	969,100	......	....
phosphate, di-	Ba, H, P, O_4	solid	424,600	......	....
phosphate, mono	Ba, H_4, P_2, O_8	solid	735,900	......	....
selenide	Ba, Se	solid	69,900	......	....
silicate	Ba, Si, O_3	solid	328,100	......	....
sulphate	Ba, S, O_4	solid	340,200	......	−5,580
sulphide	Ba, S	solid	102,900	......	+7,300
sulphide	Ba, S, Aq	dil. sol.	107,800	......	....
Beryllium					
chloride	Be, Cl_2	solid	155,000	......	+44,500
sulphate	$BeSO_4.4H_2O$	....	....	400	+1,100
Bismuth					
chloride	Bi, Cl_3	solid	90,630	1600	+7,830$^{18°}$
hydroxide	Bi, O_3, H_3	solid	171,700	......	....
hydroxide	$Bi_2, O_3, 3H_2O$	solid	137,740	......	....
oxide	Bi_2, O_3	solid	137,800	......	....
Boric Acid	$B_2O_3, 3H_2O$	solid	16,400	800	−10,790$^{18°}$
Boron					
bromide	B, Br_3	liquid	43,200	......	....
chloride	B, Cl_3	gas	89,100	......	....
chloride	B, Cl_3	liquid	93,400	......	....
fluoride	B, F_3	gas	234,300	......	....
oxide	B_2, O_3	solid	272,600	......	+7,300
Bromic Acid	H, Br, O_3	dil. sol.	12,500	......	....
Bromine					
chloride	Br, Cl	liquid	700	......	....
Cadmium					
bromide	Cd, Br_2	solid	75,200	......	....
bromide	$Cd, Br_2, 4H_2O$	solid	82,930	......	....
carbonate	Cd, C, O_3	solid	181,890	......	....
chloride	Cd, Cl_2	solid	93,240	400	+3,010
chloride	$Cd, Cl_2, 2H_2O$	solid	98,530	400	+760
cyanide	Cd, C_2, N_2	solid	−35,200	......	....
cyanide	$Cd, 2CN, Aq$	dil. sol.	+33,960	......	....

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Cadmium					
fluoride	Cd, F_2, Aq	dil. sol.	123,500	.....	....
hydroxide	Cd, O, H_2O	solid	65,680	.....	....
iodide	Cd, I_2	solid	48,830	400	−960
nitrate	Cd, N_2, O_6, H_2O	solid	113,300	400	+4,180
nitrate	$Cd, N_2, O_6, 4H_2O$	solid	121,160	400	−5,040
oxide	Cd, O	solid	66,300	.....	....
selenide	Cd, Se	solid, cry.	14,300	.....	....
selenide	Cd, Se	solid precip.	23,700	.....	....
sulphate	Cd, SO_2, O_2	solid	150,470	400	+10,740
sulphate	Cd, S, O_4	solid	219,900	.....	....
sulphate	$CdSO_4.H_2O$	....	....	400	+6,050
sulphate	$CdSO_4.\frac{8}{3}H_2O$	....	....	400	+2,660
sulphide	Cd, S, xH_2O	solid	34,350	.....	....
telluride	Cd, Te	solid, cry.	16,600	.....	....
Caesium					
bromide	Cs, Br	solid	47,700	.....	−3,250
carbonate	Cs_2O, CO_2	solid	97,530	.....	....
carbonate	Cs_2, C, O_3	solid	274,540	.....	....
carbonate, acid	Cs, H, C, O_3	solid	232,920	.....	....
carbonate, acid	$CsOH, CO_2$	solid	11,250	.....	....
chloride	Cs, Cl	solid	109,860	.....	$-4,750^{15°}$
fluoride	Cs, F	solid	106,600	.....	+8,350
hydroxide	Cs, O, H	solid	101,300	330	+15,880
hydroxide	$CsOH.H_2O$	....	....	.....	+4,317
iodide	Cs, I	solid	83,600	.....	−1,450
oxide, mon-	Cs_2, O	solid	82,700	.....	+83,200
oxide, di-	Cs_2O, O	solid	28,260	.....	....
oxide, tri-	Cs_2O_2, O	solid	18,000	.....	....
oxide, tetr-	Cs_2O_3, O	solid	12,500	.....	....
sulphate	Cs_2, S, O_4	solid	349,830	.....	−4,970
sulphate, acid	Cs, H, S, O_4	solid	282,900	.....	−3,730
Calcium					
acetate	Ca, C_4, H_6, O_4	solid	335,000	440	$+7,000^{15°}$
acetate	$Ca(C_2H_3O_2)_2.1H_2O$	....	....	600	$+5,400^{17°}$
aluminate, mono-	Ca, Al_2, O_4	solid	524,550	.....	....
" di-	Ca_2, Al_2, O_6	solid	658,900	.....	....
" tri-	Ca_3, Al_2, O_6	solid	789,050	.....	....
aluminum silicate	Ca_3, Al_2, Si_2, O_{10}	solid	1,195,600	.....	....
arsenate	Ca_3, As_2, O_8	solid	732,800	.....	....
bromide	Ca, Br_2	solid	154,920	400	+24,510
bromide	$Ca, Br_2, 6H_2O$	solid	180,520	400	−1,090
carbide	Ca, C_2	solid	13,150	.....	....
carbonate	Ca, C, O_3	solid	269,100	.....	....
carbonate	Ca, C, O_3	precip. solid	270,800	.....	....
carbonate	CaO, CO_2	rhomb. solid	43,300	.....	....
carbonate	CaO, CO_2	precip. (calcite)	42,000	.....	....
chloride	Ca, Cl_2	solid	190,400	300	+17,410
chloride	$Ca, Cl_2, 6H_2O$	solid	205,640	400	$-4,055^{16°}$
cyanide	Ca, C_2, N_2, Aq	dil. sol.	38,300	.....	....
ferrocyanide	$Ca_2Fe(CN)_6.12H_2O$	....	....	.....	$-4,600^{10°}$
fluoride	Ca, F_2	solid	218,400	.....	....
fluoride	Ca, F_2	precip. solid	239,200	.....	−2,700
hydride	Ca, H_2	solid	46,200	.....	....
hydroxide	Ca, O, H_2O	solid	160,540	2500	+2,790

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Calcium					
hydroxide	Ca, O_2, H_2	solid	236,000	.....	....
iodide	Ca, I_2	solid	127,400	400	+27,690
nitrate	Ca, N_2, O_6	solid	216,770	400	+3,950
nitrate	$Ca(NO_3)_2.4H_2O$	....	....	400	−7,250
nitride	Ca_3, N_2	solid	112,200	.....	....
nitrite	$H_2N_2O_2, Ca(OH)_2, 2H_2O$	dil. sol.	21,600	.....	....
oxalate	Ca, C_2, O_4	precip.	312,900	.....	....
oxide	Ca, O	solid	151,900	2500	+18,330
oxide, per-	CaO, O	solid	5,400	.....	....
oxide, per-	Ca, O_2	solid	156,010	.....	....
phosphate	Ca_3, P_2, O_8	solid	919,200	.....	....
silicate	Ca, Si, O_3	solid	344,400	.....	....
silicate	CaO, SiO_2	solid	33,100	.....	....
selenide	Ca, Se	solid	58,000	.....	....
sulphate	Ca, SO_2, O_2	solid	261,360	.....	$+2,920^{9°}$
sulphate	$Ca, SO_2, O_2, 2H_2O$	solid (gypsum)	266,100	.....	$-600^{10°}$
sulphate	$CaSO_4.\frac{1}{2}H_2O$	....	....	.....	$+3,560^{10°}$
sulphate	$CaSO_4.4H_2O$	....	....	400	−7,970
sulphide	Ca, S	solid	112,200	.....	+6,310
sulphydrate	Ca, S_2, H_2, Aq	dil. sol.	125,300	.....	....
Carbon					
chloride, di-	C_2, Cl_4	gas	−1,150	.....	....
chloride, di-	C_2, Cl_4	liquid	+6,000	.....	....
chloride, di-	C_2 (diamond), Cl_4	liquid	45,500	.....	....
chloride, tri-	C_2 (diamond), Cl_6	solid	107,400	.....	....
chloride, tetra-	C, Cl_4	gas	21,030	.....	....
chloride, tetra-	C, Cl_4	liquid	28,200	.....	....
chloride, tetra-	C (diamond), Cl_4	gas	68,500	.....	....
chloride, tetra-	C (diamond), Cl_4	liquid	75,700	.....	....
oxide, mon-	C, O	gas	29,000	.....	....
oxide, mon-	C (diamond), O	gas	26,100	.....	....
oxide, di-	C, O_2	gas	97,000	.....	....
oxide, di-	C (diamond), O_2	gas	94,310	.....	....
oxychloride	C, O, Cl_2	gas	44,000	.....	....
oxysulphide	C, O, S	solid	37,030	.....	....
sulphide, di-	C, S_2	gas	−25,400	.....	....
sulphide, di-	C, S_2	liquid	−19,000	.....	....
Cerium					
oxide	Ce, O_2	solid	+224,600	.....	....
Chloric acid	Cl, O_3, H, Aq	dil. sol.	22,000	.....	....
Chlorine					
oxide, mon-	Cl_2, O	gas	−17,930	.....	....
Chlorosulphonic acid	S, O_3, H, Cl	gas	+127,400	.....	....
acid	S, O_3, H, Cl	liquid	140,200	.....	....
Chromium					
bromide (ic)	$CrBr_3.6H_2O$	green	....	.....	+700
bromide (ic)	$CrBr_3.6H_2O$	blue	....	.....	+14,350
chloride (ic)	$CrCl_2, Aq, Cl$	dil. sol.	56,700	.....	....
chloride (ic)	$CrCl_3$	violet	....	.....	+35,900
chloride (ic)	$2CrCl_3.13H_2O$	green	....	.....	−100
chloride (ic)	$2CrCl_3.13H_2O$	gray	....	.....	+24,040
chloride (ous)	$CrCl_2$	....	....	.....	+18,600
chloride (ous)	$CrCl_2.4H_2O$	....	....	.....	+2,000
oxide (ic)	Cr_2, O_3	cryst.	267,800	.....	....
oxide (ic)	Cr_2, O_3	amorph.	243,800	.....	....
oxide, tri-	Cr, O_3	solid	140,000	220	$+1,900^{19°}$

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Chromium					
sulphate (ic)....	$Cr_2(SO_4)_3.8H_2O$.......	green	....	.....	+13,600
sulphate (ic)....	$Cr_2(SO_4)_3.16H_2O$......	violet	....	.....	+6,200
Cobalt					
bromide (ous)..	Co, Br_2, Aq..........	dil. sol.	72,940	.....	....
chloride (ous)..	Co, Cl_2..............	solid	76,700	400	+18,340
chloride (ous)..	$CoCl_2.6H_2O$..........	....	....	400	−2,850
fluoride (ous)...	Co, F_2, Aq..........	dil. sol.	122,200	.....	....
hydroxide (ic)..	Co_2, O_3, $3H_2O$........	solid	149,380	.....	....
hydroxide (ic)..	$2Co(OH)_2$, O, H_2O....	solid	22,580	.....	....
hydroxide (ous)	Co, O, H_2O..........	solid	63,400	.....	....
iodide (ous)....	Co, I_2, Aq...........	dil. sol.	40,700	.....	....
nitrate (ous)....	CoO, N_2O_5, Aq.......	dil. sol.	84,540	.....	....
nitrate (ous)....	Co, N_2, O_6, $6H_2O$.....	solid	120,680	400	−4,960
oxide (ous).....	Co, O................	cryst.	57,500	.....	....
oxide (ous).....	Co, O................	amorph.	57,500	.....	....
oxide (ous, ic)..	Co_3, O_4..............	solid	193,400	.....	....
selenide (ous)...	Co, Se...............	cryst.	9,900	.....	....
selenide (ous)...	Co, Se...............	precip.	13,900	.....	....
sulphate (ous)..	Co, O, SO_3, Aq.......	dil. sol.	88,070	.....	....
sulphate (ous)..	Co, O_2, SO_2, $7H_2O$....	solid	164,970	800	−3,570
sulphide (ous)..	Co, S, xH_2O..........	solid	19,730	.....	....
telluride (ous)..	Co, Te...............	solid	13,000	.....	....
Copper					
acetate (ic).....	Cu, C_4, H_6, O_4........	solid	213,900	320	$+2,400^{16°}$
acetate (ic).....	$Cu(C_2H_6O_2)_2.H_2O$....	....	....	440	$+800^{16°}$
bromide (ic)....	Cu, Br_2..............	solid	32,600	400	+8,250
bromide (ic)....	$CuBr_2.4H_2O$..........	....	....	.....	$-1,500^{8°}$
bromide (ous)..	Cu, Br...............	solid	24,980	.....	....
carbonate (ic)..	Cu, C, O_3............	precip.	142,800	.....	....
chlorate (ic)....	Cu, Cl_2, O_6, Aq.......	dil. sol.	28,600	.....	....
choride (ic).....	Cu, Cl_2..............	solid	51,400	600	+11,800
chloride (ic)....	Cu, Cl_2, $2H_2O$........	solid	58,500	400	+4,210
chloride (ous)..	Cu, Cl...............	solid	35,400	.....	....
cyanide (ous)...	Cu, C, N.............	solid	−22,050	.....	....
fluoride (ic)....	Cu, F_2, Aq..........	dil. sol.	+89,600	.....	....
iodide (ous)....	Cu, I.................	solid	16,260	.....	....
nitrate (ic).....	Cu, N_2, O_6, $6H_2O$.....	solid	92,940	400	−10,710
oxide (ic).......	Cu, O................	solid	37,700	.....	....
oxide (ic).......	Cu_2O, O.............	solid	36,200	.....	....
oxide (ous).....	Cu_2, O..............	solid	43,800	.....	....
selenide (ic)....	Cu, Se...............	precip.	4,800	.....	....
selenide (ous)...	Cu_2, Se..............	cryst.	8,000	.....	....
sulphate (ic)....	Cu, O_2, SO_2..........	solid	111,490	400	+15,800
sulphate (ic)....	Cu, O_2, SO_2, H_2O.....	solid	117,950	400	+9,340
sulphate (ic)....	Cu, O_2, SO_2, $5H_2O$....	solid	130,040	400	−2,750
sulphate (ic)....	Cu, S, O_4............	solid	181,700	.....	....
sulphide (ic)....	Cu, S................	solid	10,100	.....	....
sulphide (ous)..	Cu_2, S..............	solid	20,300	.....	....
telluride.......	Cu_2, Te..............	solid	8,200	.....	....
Cyanic acid......	C (diam.), N, O, H, Aq.................	dil. sol.	74,000	.....	....
Cyanogen........	C_2, N_2...............	gas	−65,700	.....	....
cyanogen.......	C_2 (diamond), N_2....	gas	−73,900	.....	....
cyanogen.......	C_2 (diamond), N_2....	liquid	+68,500	.....	....
chloride........	C (diamond), N, Cl..	gas	35,200	.....	....
chloride........	C (diamond), N, Cl..	liquid	−26,800	.....	....
iodide..........	C (diamond), N, I....	solid	−39,200	.....	−2,800
Dysprosium					
sulphate........	$Dy_2(SO_4)_3.8H_2O$	....	....	1200	+6,300
Erbium acetate...	$Er(C_2H_3O_2)_3.4H_2O$....	....	....	1500	+700

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Ferric and Ferrous salts, see under Iron					
Fluosilicic acid..	Si, F_6, H_2, Aq	dil. sol.	374,400	.....	....
Glucinum (Beryllium)					
chloride	Gl, Cl_2..............	solid	155,000	.....	+44,500
sulphate........	$GlSO_4.4H_2O$.........	....	....	400	+ 1,100
Gold					
bromide (ic)...	Au, Br_3..............	solid	8,850	2000	− 3,760
bromide (ous).	Au, Br..............	solid	−80	.....	....
chloride (ic)....	Au, Cl_3	solid	+22,820	900	+ 4,450
chloride (ic)....	$AuCl_3.2H_2O$.........	....	....	600	− 1,690
chloride (ous)..	Au, Cl..............	solid	5,810	.....	....
hydroxide (ic).	$Au_2, O_3, 3H_2O$........	solid	−13,190	.....	....
iodide (ous)....	Au, I..............	solid	−5,520	.....	....
Hydrazine.......	N_2, H_4, Aq..........	dil. sol.	+1,700	.....	....
Hydrazoic acid.	N_3, H, Aq..........	dil. sol.	58,200	.....	....
Hydrobromic acid	H, Br................	gas	8,600	.....	+20,000
Hydrochloric acid	H, Cl..............	gas	22,000	.....	+17,400
Hydrocyanic acid	C (diamond), N, H...	gas	−30,500	.....	....
" "	C (diamond), N, H...	liquid	−24,800	.....	....
" "	C (diamond), N, H...	dil. sol.	−24,400	.....	....
Hydroferricyanic acid	H_3, Fe, C_6N_6, Aq...	dil. sol.	−127,500	.....	....
acid	H_3, Fe, C_6, N_6, Aq...	dil. sol.	−147,500	.....	....
Hydroferrocyanic acid	H_4, Fe, C_6, N_6........	solid	−102,000	.....	+500
acid	H_4, Fe, C_6, N_6........	solid	−122,000	.....	....
Hydrofluoric acid	H, F................	gas	+38,500	.....	....
" "	H, F................	liquid	45,700	.....	....
" "	H, F................	dil. sol.	50,300	.....	....
Hydr(o)iodic acid	H, I................	gas	−6,400	.....	+19,600
Hydrogen					
oxide (water)...	H_2, O................	liquid	+69,000$^{0°}$	.....	....
oxide..........	H_2, O................	solid	70,400$^{0°}$	.....	....
oxide..........	H_2, O................	gas	58,300$^{0°}$	.....	....
peroxide........	H_2, O_2, Aq..........	dil. sol.	45,300	.....	....
peroxide........	H_2O, O, Aq..........	dil. sol.	−23,060	.....	....
peroxide........	H_2, O_2..............	liquid	+46,840	.....	....
selenide........	H_2, Se..............	gas	−19,400	.....	+ 9,300
sulphide........	H_2, S................	gas	+2,730	.....	+ 4,560
telluride.......	H_2, Te..............	gas	−34,900	.....	....
Hydrosulphurous acid	S_2, O_4, H_2, Aq........	dil. sol.	+156,100	.....	....
Hydroxylamine	N, H_3, O, Aq........	dil. sol.	24,290	.....	....
"	N, H_3, O............	solid	27,600	.....	− 2,800
Iodic acid.......	I, O_3, H..............	solid	57,960	.....	− 2,160
Iodine					
bromide........	I, Br................	solid	2,500	.....	....
chloride, mono-	I, Cl................	solid	6,800	.....	....
chloride, mono-	I, Cl................	liquid	5,820	.....	....
chloride, tri-....	I, Cl_3................	solid	21,490	.....	....
oxide, pent-.....	I_2, O_5................	solid	45,030	.....	− 1,790
Iron					
acetate (ic).....	Fe, C_6, H_9, O_6, Aq...	dil. sol.	359,350	.....	....
ammonium sulphate (ic)	$(NH_4)Fe(SO_4)_2.12H_2O$	....	....	500	−16,600
ammonium sulphate (ous)	$(NH_4)_2Fe(SO_4)_2.6H_2O$	....	....	.....	− 9,800
bromide (ic)....	Fe, Br_3, Aq..........	dil. sol.	95,450	.....	....

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Iron					
bromide (ous)	Fe, Br_2, Aq	dil. sol.	78,070	...	...
carbonate (ous)	Fe, C, O_3	cryst.	184,500	...	...
carbonate	Fe, C, O_3	precip.	178,800	...	...
carbonate	FeO, CO_2	solid	24,500	...	...
chloride (ic)	Fe, Cl_3	solid	96,040	1000	+32,680
chloride (ic)	$FeCl_2, Cl$	solid	13,990	...	...
chloride (ic)	$2FeCl_3.5H_2O$	...	...	2400	+2×21,000
chloride (ic)	$FeCl_3.6H_2O$	...	...	1200	+ 5,650
chloride (ous)	Fe, Cl_2	solid	82,200	350	+17,850
chloride (ous)	$FeCl_2.2H_2O$	...	...	1000	+ 9,700$^{20°}$
chloride (ous)	$FeCl_2.4H_2O$	...	...	400	+ 2,750
ferrocyanide (ic)	Fe_7, C_{18}, N_{18}	precip.	−317,000	...	...
fluoride (ic)	Fe, F_3, Aq	dil. sol.	+162,900	...	...
fluoride (ous)	Fe, F_2, Aq	dil. sol.	127,000	...	...
hydroxide (ic)	$Fe_2, O_2, 3H_2O$	solid	2×95,570	...	...
hydroxide (ic)	$2Fe(OH)_2, O, H_2O$	solid	2×27,290	...	...
hydroxide (ous)	Fe, O, H_2O	solid	68,280	...	...
iodide (ic)	Fe, I_3, Aq	dil. sol.	23,850	...	...
iodide (ous)	Fe, I_2, Aq	dil. sol.	47,650	...	...
nitrate (ic)	Fe, N_3, O_9, Aq	dil. sol.	314,300	...	...
nitrate (ous)	Fe, N_2, O_6, Aq	dil. sol.	119,000	...	...
oxide (ic)	Fe_2, O_3	solid	197,700	...	...
oxide (ous)	Fe, O	solid	65,700	...	...
oxide (ous, ic)	Fe_3, O_4	solid	270,800	...	...
pot. sul. (ic)	$KFe(SO_4)_2.12H_2O$	...	...	500	−16,000
pot. sul. (ous)	$K_2Fe(SO_4)_2.6H_2O$	...	...	...	−10,700
selenide (ous)	Fe, Se	cryst.	16,000	...	...
selenide (ous)	Fe, Se	precip.	15,200	...	...
silicate	Fe, Si, O_3	solid	254,600	...	...
sulphate (ic)	Fe_2, S_3, O_{12}, Aq	dil. sol.	650,500	...	...
sulphate (ic)	$Fe_2, O_3, 3SO_3, Aq$	dil. sol.	224,900	...	...
sulphate (ous)	Fe, SO_2, O_2, Aq	dil. sol.	93,200	...	...
sulphate (ous)	$Fe, SO_2, O_2, 7H_2O$	solid	169,040	400	− 4,510
sulphate (ous)	Fe, S, O_4, Aq	dil. sol.	234,900	...	...
sulphide (ous)	Fe, S, xH_2O	solid	24,000	...	...
telluride (ous)	Fe, Te	cryst.	12,000	...	...
Lanthanum					
chloride	La, Cl_3	solid	175,300	...	...
oxide	La_2, O_3	solid	447,300	...	...
Lead					
acetate	Pb, C_4, H_6, O_4	solid	231,100	440	+ 1,400$^{16°}$
acetate	$Pb(C_2H_3O_2)_2.3H_2O$	...	...	800	− 6,140
acetate	$Pb(C_2H_3O_2)_2.3H_2O$	...	...	240	− 5,500$^{11°}$
bromide	Pb, Br_2	solid	64,450	25,000	−10,040
carbonate	Pb, C, O_3	solid	166,700	...	...
chloride	Pb, Cl_2	solid	83,900	1800	− 6,800
dithionate	$PbS_2O_6.4H_2O$	...	...	400	− 8,540
fluoride	Pb, F_2	precip.	107,600	...	...
iodide	Pb, I_2	solid	39,800	...	...
nitrate	Pb, N_2, O_6	solid	105,460	400	− 7,610
oxalate	Pb, C_2, O_4	precip.	205,300	...	...
oxide, mon-	Pb, O	solid	50,300	...	...
oxide, per-	PbO, O	solid	12,600	...	...
oxide, per-	Pb, O_2	solid	62,400	...	...
oxybromide	$PbBr_2, PbO$	solid	3,300	...	...
oxybromide	$PbBr_2, 2PbO$	solid	4,700	...	...
oxybromide	$PbBr_2, 3PbO$	solid	6,300	...	...
oxychloride	$PbCl_2, PbO$	solid	5,300	...	...
oxychloride	$PbCl_2, 2PbO$	solid	6,600	...	...
oxychloride	$PbCl_2, 3PbO$	solid	6,700	...	...

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Lead					
oxyiodide	PbI_2, PbO	solid	3,600	.....	....
phosphite	Pb, H, P, O_3	solid	227,700	.....	....
selenide	Pb, Se	precip.	14,300	.....	....
selenide	Pb, Se	cryst.	17,000	.....	....
sulphate	Pb, S, O_4	solid	216,210	.....	....
sulphate	Pb, SO_2, O_2	solid	145,130	.....	....
sulphide	Pb, S	precip.	20,300	.....	....
sulphocyanate	Pb, C_2, N_2, S_2	solid	6,100	.....	....
telluride	Pb, Te	solid	6,200	.....	....
thiosulphate	Pb, S_2, O_3	solid	145,600	.....	....
Lithium					
bromide	Li, Br	solid	79,9[illegible]0	.....	+11,[illegible]21
carbide	Li_2, C_2	solid	11,300	.....	....
carbonate	LiO, (CO_2)	solid	54,230	.....	....
chloride	Li, Cl	solid	93,810	230	+ 8,440
cyanide	Li, C, N, Aq	dil. sol.	32,600	.....	....
fluoride	Li, F	solid	1[illegible]0,000	.....	− 3,120
fluosilicate	2LiF, SiF_4	solid	25,200	800	+ 1,800
hydride	Li, H	solid	21,600	.....	....
hydroxide	Li, O, H	solid	112,300	400	+ 5,800
hydroxide	$LiOH.H_2O$	....	....	.....	+[illegible]10$^{15°}$
iodide	Li, I	solid	61,210	.....	+14,886
nitrate	Li, N, O_3	solid	111,610	100	+300
nitride	Li_6, N_2	solid	93,500	.....	....
oxide	Li_2, O	solid	143,300	222	+31,200$^{15°}$
oxide	$4Li_2O$, $5H_2O$	....	....	888	+ 8,182$^{15°}$
oxide	$4Li_2O$, $3H_2O$	....	....	888	+16,026$^{15°}$
selenide	Li_2, Se	solid	83,000	.....	+10,700$^{20°}$
selenide	$Li_2Se.9H_2O$	....	....	1146–6426	−12,200
silicate	Li_2, Si, O_3	solid	347,100	.....	....
sulphate	Li_2, S, O_4	solid	334,170	200	+ 6,050
sulphate	Li_2, S, O_4, H_2O	solid	336,810	400	+ 3.410
sulphide	Li_2, S, Aq	dil. sol.	115,400	.....	....
sulphydrate	Li, S, H, Aq	dil. sol.	64,110	.....	....
Magnesium					
ammonium phosphate	Mg, N, H_4, P, O_4	cryst.	898,800	.....	....
ammonium sulphate	$MgSO_4$ $(NH_4)_2SO_4$. $6H_2O$	....	....	.....	− 9,700
ammonium sulphite	$3(MgSO_3.6H_2O)$, $(NH_4)_2SO_3$	solid	−2,100	.....	....
arsenate	Mg_3, As_2, O_8	cryst.	+712,600	.....	....
bromide	Mg, Br_2	solid	121,700	.....	+43,300
carbonate	Mg, C, O_3	precip.	266,600	.....	....
chloride	Mg, Cl_2	solid	151,010	800	+35,920
chloride	Mg, Cl_2, $6H_2O$	solid	183,980	400	+ 2,950
cyanide	Mg, C_2, N_2, Aq	dil. sol.	34,000	.....	....
dithionate	Mg, S_2, O_6, $6H_2O$	solid	390,570	400	+ 2,960
fluoride	Mg, F_2	precip.	208,100	.....	+ 2,778
hydroxide	Mg, O_2, H_2	solid	217,800	.....	....
iodide	Mg, I_2	solid	84,800	.....	49,800
nitrate	Mg, N_2, O_6, $6H_2O$	solid	210,520	400	− 4,220
oxide	Mg, O	solid	143,900	.....	....
phosphate	Mg_3, P_2, O_8	colloid	910,600	.....	....
pot. chloride	$MgCl_2$, KCl	solid	3,100	.....	....
pot. chloride	$MgCl_2$, $6H_2O$, KCl	solid	2,700	.....	....
pot. sulphate	$MgSO_4$, K_2SO_4	solid	3,300	600	+10,600
pot. sulphate	$MgSO_4$, K_2SO_4, $6H_2O$	solid	23,920	600	−10,020
sodium sulphate	$MgSO_4$, Na_2SO_4	solid	3,700	.....	....

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Magnesium					
sulphate	Mg, S, O_4	solid	301,500	400	+20,280
sulphate	$MgSO_4.H_2O$	....	....	400	+13,300
sulphate	$MgSO_4.7H_2O$	....	....	400	− 3,800
sulphide	Mg, S	solid	79,400	.....	....
sulphite	Mg, S, O_3	solid	282,000	.....	....
sulphydrate	Mg, S_2, H_2, Aq	dil. sol.	110,860	.....	....
Manganese					
bromide	Mn, Br_2, Aq	dil. sol.	107,000	.....	....
carbide	Mn_3, C	solid	9,900	.....	....
carbonate	Mn, C, O_3	amorp.	207,000	.....	....
carbonate	Mn, C, O	crystal	208,600	.....	....
carbonate	MnO, CO_2	solid	27,600	.....	....
chloride	Mn, Cl_2	solid	111,990	350	+16,010
chloride	Mn, Cl_2, $4H_2O$	solid	126,460	400	+ 1,540
dithionate	Mn, $2SO_2$, O_2, $6H_2O$	solid	188,600	400	+ 1,930
fluoride	Mn, F_2, Aq	dil. sol.	156,800	.....	....
fluoride	Mn, F_2	solid	209,500	.....	....
hydroxide	Mn, O, H_2O	solid	94,770	.....	....
iodide	Mn, I_2, Aq	dil. sol.	76,200	.....	....
nitrate	Mn, N_2, O_6, 6H O	solid	153,050	400	− 6,150
oxide (ous)	Mn, O	solid	90,800	.....	....
oxide (di-)	Mn, O_2	solid	126,000	.....	....
oxide (ous, ic)	Mn_3 O_4	solid	324,900	.....	....
phosphate	Mn_3, P , O_8	colloid	737,500	.....	....
pot. sulphate	$MnSO_4$, K_2SO	solid	990	600	+ 6,380
pot. sulphate	$MnSO_4$, K_2SO_4, $4H_2O$	solid	13,840	600	− 6,440
selenide	Mn, Se	precip.	22,400	.....	....
selenide	Mn, Se	cryst.	21,600	.....	....
silicate	MnO, SiO_2	solid	5,400	.....	....
sodium sulphate	$MnSO_4$, Na_2SO_4	solid	1,200	.....	− 9,700
sulphate	Mn, SO_2, O_2	solid	249,400	400	+13,790
sulphate	Mn, SO_2, O_2, H_2O	solid	184,760	400	+ 7,820
sulphate	Mn, SO_2, O_2, $5H_2O$	solid	192,540	400	+40
sulphide	Mn, S, xH_2O	solid	45,600	.....	....
Mercury					
acetate (ic)	Hg, C_4, H_6, O_4	solid	196,900	222	− 3,800
acetate (ous)	Hg, C_2, H , O_2	solid	101,050	.....	....
bromide (ic)	Hg, Br_2	solid	40,600	.....	$-3{,}400^{12^\circ}$
bromide (ous)	Hg, Br	solid	24,500	.....	....
chloride (ic)	Hg, Cl_2	solid	53,300	300	− 3,300
chloride (ous)	Hg, Cl	solid	31,300	.....	....
cyanide (ic)	Hg, $(CN)_2$	solid	11,400	1010	$-3{,}000^{15^\circ}$
fulminate	Hg, N_2, C_2, O_2	solid	−62,900	.....	....
iodide (ic)	Hg, I_2	solid	+25,200	.....	....
iodide (ous)	Hg, I	solid	14,300	.....	....
nitrate (ic)	Hg, N_2, O_6, Aq	dil. sol.	57,400	.....	....
nitrate (ic)	Hg, N_2, O_6, $\frac{1}{2}$ H_2O	solid	57,400	.....	....
nitrate (ous)	Hg, N, O_3, H_2O	solid	34,700	.....	....
nitrate (ous)	Hg, N, O_3, Aq	dil. sol.	28,900	.....	....
nitride, tri-(ous)	Hg, N_3	solid	−144,600	.....	....
oxide (ic)	Hg, O	solid	+21,500	.....	....
oxide (ous)	Hg_2, O	solid	2,200	.....	....
oxybromide (ic)	$HgBr_2$, HgO	solid	3,300	.....	....
oxychloride (ic)	$HgCl_2$, HgO	solid	3,300	.....	....
oxychloride	$HgCl_2$, 2HgO	solid	6,300	.....	....
oxychloride	$HgCl_2$, 3HgO	solid	8,000	.....	....
oxychloride	$HgCl_2$, 4HgO	solid	10,000	.....	....
potassium bromide (ic)	$HgBr_2$, KBr	solid	−1,000	.....	....
potassium bromide (ic)	$HgBr_2$, 2KBr	....	....	600	−9,750

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Mercury					
potassium chloride (ic)	$HgCl_2, KCl$	solid	2,400	770	− 9,500[14°]
pot. chlo. (ic)	$HgCl_2, 2KCl$	solid	3,800	930	−15,000[15°]
pot. chlo. (ic)	$Hg, Cl_2, 2KCl, H_2O$	solid	60,620	600	−16,390
pot. iodide (ic)	$HgI_2, 2KI$	solid	28,680	800	− [illegible],510
selenide (ic)	Hg, Se	precip.	6,300	.....	....
sulphate (ic)	Hg, S, O_4	solid	165,100	.....	....
sulphate (ous)	Hg_2, S, O_4	solid	175,000	.....	....
sulphide	Hg, S	precip.	10,600	.....	....
sulphocyanate	Hg, C_2, N_2, S_2	solid	−50,200	.....	....
Molybdenum					
oxide, di-	Mo, O_2	solid	+142,800	.....	....
oxide, tri-	Mo, O_3	solid	167,000	.....	....
Neodymium					
chloride	Nd, Cl_3	solid	249,500	.....	+35,400[17°]
chloride	$Nd, Cl_3, 6H_2O$	solid	268,900	.....	+ 7,600[14°]
iodide	Nd, I_3	solid	157,700	.....	+48,900[19°]
oxide	Nd_2, O_3	solid	435,100	.....	....
sulphate	$Nd_2, S_3, 6O_2$	solid	928,200	.....	+36,500[14°]
sulphide	Nd_2, S_3	solid	285,900	.....	....
Nickel					
bromide	Ni, Br_2, Aq	dil. sol.	71,820	.....	....
chloride	Ni, Cl_2	solid	74,530	400	+19,170
chloride	$NiCl_2, 6H_2O$	solid	20,330	400	− 1,160
cyanide	Ni, C_2, N_2	precip.	−23,400	.....	....
dithionate	$Ni, O_2, 2SO_2.6H_2O$	solid	+154,790	400	− 2,420
fluoride	Ni, F_2, Aq	dil. sol.	120,800	.....	....
hydroxide (ic)	$Ni_2, O_3, 3H_2O$	solid	120,380	.....	....
hydroxide (ic)	$2Ni(OH)_2, O, H_2O$	solid	−1,300	.....	....
hydroxide (ous)	Ni, O, H_2O	solid	+60,840	.....	....
iodide	Ni, I_2, Aq	dil. sol.	41,400	.....	....
nitrate	Ni, O, N_2O_5, Aq	dil. sol.	83,420	.....	....
nitrate	$Ni, N_2, O_6, 6H_2O$	solid	120,710	400	− 7,470
oxide	Ni, O	solid	57,900	.....	....
selenide	Ni, Se	precip.	14,700	.....	....
selenide	Ni, Se	cryst.	9,900	.....	....
sulphate	Ni, O, SO_3, Aq	dil. sol.	86,950	.....	....
sulphate	$Ni, O_2, SO_2, 7H_2O$	solid	162,530	800	− 4,250
sulphide	Ni, S, xH_2O	solid	17,390	.....	....
telluride	Ni, Te	cryst.	11,600	.....	....
Nitric acid	N, O_3, H	liquid	41,600	300	+ 7,480
acid	N, O_3, H	gas	34,400	.....	....
Nitrogen					
carbide	N_2C_2	gas	....	.....	−73,000
oxide (ic)	N, O	gas	−21,600	.....	....
oxide (ous)	N_2, O	gas	−20,600	.....	....
oxide (ous)	N_2, O	liquid	−18,000	.....	....
oxide, pent-	N_2, O_5	gas	−1,200	.....	....
oxide, pent-	N_2, O_5	liquid	+3,600	.....	....
oxide, pent-	N_2, O_5	solid	11,900	.....	....
oxide, tetr-	N_2, O_4	gas	−2,650	.....	....
oxide, tri-	N_2, O_3	gas	−21,400	.....	....
selenide	N, Se	solid	−42,300	.....	....
sulphide	N, S	solid	−31,900	.....	....
Oxalic acid	H_2, C_2, O_4	solid	+197,600	.....	....
oxalic acid	$H_2C_2O_4.2H_2O$	....	....	530	− 8,590
Palladium					
am. chloride	$PdCl_2, 2NH_3$	solid	40,000	.....	....
am. chloride	$PdCl_2, 2NH_3, 2NH_3$	solid	31,000	.....	....
am. iodide	$PdI_2, 2NH_3$	solid	34,000	.....	....

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Palladium					
amm. iodide	PdI_2, $2NH_3$, $2NH_3$	solid	25,800	.....	....
bromide	Pd, Br_2	solid	24,900	.....	....
cyanide	Pd, C_2, N_2	solid	−52,600	.....	....
hydroxide	Pd, O, H_2O	solid	+21,000	.....	....
hydroxide	Pd, O_2, $2H_2O$	solid	30,430	.....	....
iodide	Pd, I_2	precip.	13,400	.....	....
iodide	Pd, I_2, H_2O	solid	18,180	.....	....
pot. bromide	$PdBr_2$, 2KBr, Aq	dil. sol.	2,800	.....	....
pot. chloride	Pd, Cl_2, 2KCl	solid	52,670	.....	....
Perchloric acid	Cl, O_4, H	liquid	18,800	.....	+20,300
Periodic acid	I, O_4, H, Aq	dil. sol.	47,680	.....	....
Permanganic acid	Mn_2, O_7, H_2O, Aq	dil. sol.	2×93,550	.....	....
Phosphonium					
bromide	P,* H_4, Br	solid	40,300	.....	....
iodide	P,* H_4, I	solid	28,100	.....	....
Phosphoric acid					
meta-	P, O_3, H	solid	226,600	.....	+10,100
ortho-	P, O_4, H_3	liquid	300,080	200	+ 5,350
ortho-	P, O_4, H_3	solid	302,600	120	+ 2,690
pyro-	P_2, O_7, H_4	liquid	533,400	.....	....
pyro-	P_2, O_7, H_4	solid	535,700	.....	+ 7,900
Phosphorous acid					
hypo-	P, O_2, H_3	liquid	137,660	.....	....
hypo-	P, O_2, H_3	solid	139,970	.....	−170
ortho-	P, O_3, H_3	liquid	224,630	120	+ 2,940
ortho-	P, O_3, H_3	solid	227,700	120	−130
pyro-	P_2, O_5, H_4, Aq	solid	369,900	550	+35,600
Phosphorus					
bromide, tri-	P, Br_3	solid	44,800	.....	....
bromide, penta-	P, Br_5	solid	59,050	.....	....
chloride, tri-	P, Cl_3	liquid	76,600	1000	+65,140
chloride, tri-	P, Cl_3	gas	69,700	.....	....
chloride, penta-	P, Cl_5	solid	109,200	.....	....
hydride (phosphine)	P,* H_3	gas	4,900	.....	....
hydride (solid)	P_{12},* H_6	solid	53,400	.....	....
iodide, tri-	P, I_3	solid	10,900	.....	....
iodide, tetr-	P_2, I_4	solid	19,800	.....	....
nitride	P_3,* N_5	solid	81,500	.....	....
oxide, pent-	P_2, O_5	solid	365,200	550	+35,600
oxybromide	P, O, Br_3	solid	105,800	.....	....
oxychloride	P, O, Cl_3	solid	143,900	.....	....
sulphide, sesqui-	P_4, S_3	solid	77,530	.....	....
Platinic acid					
brom-	$H_2PtBr_6.9H_2O$	....	....	.....	− 2,900
chlor-	$H_2PtCl_6.6H_2O$	....	....	450	+ 4,340
Platinum					
bromide	Pt, Br_4	solid	42,400	.....	+ 9,860
chloride	Pt, Cl_4	solid	60,400	.....	+19,600
hydride	Pt_{10}, H	solid	14,200	.....	....
hydroxide	Pt, O, H_2O	solid	19,220	.....	....
iodide	Pt, I_4	solid	17,400	.....	....
oxide	Pt, O	solid	17,000	.....	....
Potassium					
acetate	K, C_2, H_3, O_2	solid	175,700	200	+ 3,340
arsenate	K_3, As, O_4, Aq	dil. sol.	396,200	.....	....
arsenate	K_2, H, As, O_4, Aq	dil. sol.	339,800	.....	....
arsenate, acid	K, H_2, As, O_4, Aq	dil. sol.	284,000	.....	....
bromate	K, Br, O_3	solid	84,300	200	− 9,760
bromide	K, Br	solid	95,310	200	− 5,080

* P refers to white phosphorus where starred.

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Potassium					
bromoplatinate	$Pt, Br_4, 2KBr$	solid	59,260	2000	−12,260
bromoplatinite	$Pt, Br_2, 2KBr$	solid	32,310	800	−10,610
carbonate	K_2, C, O_3	solid	281,100	400	+ 6,490
carbonate	K_2O, CO_2	solid	94,260	.....	....
carbonate	$K_2CO_3.\frac{1}{2}H_2O$	....	....	400	+ 4,280
carbonate	$K_2CO_3.1\frac{1}{2}H_2O$	....	....	400	−380
carbonate, acid (bicarbonate)	K, H, C, O_3	solid	233,300	.....	− 5,300
chlorate	K, Cl, O	solid	95,860	400	−10,040
chloride	K, Cl	solid	105,610	200	− 4,440
chloropalladate	K_2PdCl_6	....	....	.....	−15,000
chloroplatinate	$Pt, Cl_4, 2KCl$	solid	89,500	.....	−13,760
chloroplatinite	$Pt, Cl_2, 2KCl$	solid	45,170	600	−12,220
chlorostannate	$SnCl_4, 2KCl$	solid	24,160	800	− 3,380
chromate	K_2CrO_4	....	....	543	− 5,250
cyanide	K, C, N	solid	30,100	180	− 2,900$^{20°}$
cyanide	K, CN	solid	67,100	175	− 3,010
cyanate	K, C, N, O	solid	102,500	660	− 5,200$^{20°}$
dichromate	K_2, C_2O_3, O_4	solid	226,440	400	−16,700
dithionate see *thionate, di-*					
ferricyanide	K_3, Fe, C_6, N_6	solid	41,600	400	−14,400$^{12°}$
ferricyanide	$K_3, Fe, 6CN$	solid	263,300	.....	....
ferrocyanide	K_4, Fe, C_6, N_6	solid	137,200	820	−12,000$^{12°}$
ferrocyanide	$K_4, Fe, 6CN$	solid	358,900	.....	....
ferrocyanide	$K_4Fe(CN)_6.3H_2O$	....	....	940	−16,900$^{11°}$
fluoride	K, F	solid	118,100	.....	+ 3,600$^{20°}$
fluoride	$KF.2H_2O$	....	....	.....	− 1,000$^{20°}$
fluoride, acid	KF, HF	solid	21,100	400	− 6,000
fluosilicate	$2KF, SiF_4$	solid	52,800	.....	....
hydroxide	K_2, O, H_2O	solid	137,980	.....	....
hydroxide	K, O, H	solid	104,600	250	+13,290
hypochlorite	K, Cl, O, Aq	dil. sol.	88,010	.....	....
iodate	K, I, O_3	solid	124,490	500	− 6,780
iodate, acid	KIO_3, HIO_3	solid	3,300	865	−11,800
iodide	K, I	solid	80,130	200	− 5,110
iodide, tri-	KI, I_2	solid	13,600	.....	....
nitrate	K, N, O_3	solid	119,000	200	− 8,520
nitrite	K, N, O_2, Aq	dil. sol.	88,900	.....	....
oxalate	K_2, C_2, O_4	solid	324,700	465-93	− 4,740$^{15°}$
oxalate	$K_2C_2O_4.H_2O$	....	....	800	− 7,410
oxalate, acid	K, H, C_2, O_4	solid	266,900	.....	− 9,600
oxalate, tetra-	$KHC_2O_4.H_2C_2O_4$	....	....	.....	−15,700
oxide	K_2, O	solid	86,800	.....	+75,000
perchlorate	K, Cl, O_4	solid	113,500	200-400	12,100$^{10°}$
periodate	K, I, O_4, Aq	dil. sol.	107,700	.....	....
permanganate	K, Mn, O_4	solid	200,050	700	−10,200$^{16°}$
phos., ortho-	K_3, P, O_4, Aq	dil. sol.	483,600	.....	....
phos. hydrogen	K_2, H, P, O_4, Aq	dil. sol.	429,200	.....	....
phos. dihydro-	K, H_2, P, O_4, Aq	dil. sol.	374,400	.....	....
phos. dihydro-	KH_2PO	....	....	.....	− 4,850
selenide	K_2, Se	solid	79,600	1762-1965	+ 8,500$^{13°}$
selenide	$K_2Se.9H_2O$	....	....	921-4844	−19,200$^{14°}$
selenide	$K_2Se.14H_2O$	....	....	2145-5914	−20,400$^{13°}$
selenide	$K_2Se.19H_2O$	....	....	.....	−29,300$^{14°}$
sulphate	K_2, S, O_4	solid	344,300	400	− 6,380
sulphate	K_2, SO_2, O_2	solid	273,560	.....	....

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Potassium					
sulphate, acid	K, H, S, O_4	solid	276,100	200	−3,800
sulphate, per-	K_2, S_2, O_8	solid	454,500	3300	−14,550
sulphate, pyro-	K_2, S_2, O_7	solid	474,200	.....	....
sulphide mono-	K_2, S	solid	103,500	732	+10,000[18°]
sulphide mono-	$K_2S.2H_2O$	....	....	.....	+3,800[18°]
sulphide mono-	$K_2S.5H_2O$	....	....	.....	−5,200[16°]
sulphide tetra-	K_2, S_4	solid	118,600	600	+1,400[10°]
sulphide tetra-	$K_2S_4.\frac{1}{2}H_2O$	....	....	.....	−1,212[16°]
sulphite	K_2, S, O_3	solid	273,200	350	+1,440[12°]
sulphite	$K_2SO_3.H_2O$	....	....	245	+1,100[12°]
sulphide, acid	K, H, S, O_3, Aq	dil. sol.	211,300	.....	....
sulphocyanate	K, C, N, S	solid	49,800	200	−6,100[13°]
sulphocyanate	K, C N, S	solid	86,700	.....	....
sulphydrate	K, S, H	solid	64,500	154-1568	+770[17°]
sulphydrate	$KSH.\frac{1}{4}H_2O$	....	....	.....	+600[16°]
thionate, di-	K_2, S_2, O_6	solid	415,720	500	−13,010
thionate, tri-	K_2, S_3, O_6	solid	405,850	500	−12,460
thionate, tetra-	K_2, S_4, O_6	solid	397,210	500	−13,150
thionate, penta-	K_2, S_5, O_6	solid	390,100	.....	....
thionate, penta-	$K_2S_5O_6.1\frac{1}{2}H_2O$	....	....	2030	−13,100[10°]
thiosulphate	K_2, S_2, O_3	solid	272,300	950	−5,000[10°]
thiosulphate	$K_2S_2O_3.H_2O$	....	....	.....	−6,200[14°]
Praseodymium					
oxide, tri-	Pr_2, O_3	solid	412,400	.....	....
Rubidium					
bromide	Rb, Br	solid	95,700	.....	−2,450
carbonate	Rb_2O, CO_2	solid	97,420	.....	+9,077
carbonate, acid	Rb, H, C, O	solid	231,920	.....	+4,731
chloride	Rb, Cl	solid	105,000	.....	−4,460[15°]
fluoride	Rb, F	solid	107,950	.....	+5,800
hydroxide	Rb, O, H	solid	101,990	.....	+14,264[15°]
hydroxide	$RbOH.H_2O$	....	....	.....	+3,700[15°]
hydroxide	$RbOH.2H_2O$	....	....	.....	−650[15°]
iodide	Rb, I	solid	80,650	.....	+300
oxide	Rb_2, O	solid	83,500	.....	+80,000
sulphate	Rb_2, S, O_4	solid	344,680	.....	−6 600
sulphate, acid	Rb, H, S, O_4	solid	277,370	.....	−3,730
Selenium					
chloride	Se_2,* Cl_2	liquid	22,150	.....	....
chloride, tetra-	Se,* Cl_4	solid	46,160	.....	....
hydride	Se,* H_2	gas	−19,400	.....	+9,300
hydride	Se (cryst.), H_2	gas	−25,100	.....	+9,300
hydroxide (ic)	Se, O_3, H_2	dil. sol.	+79,300	.....	....
hydroxide (ous)	Se, O_2, H_2	solid	52,400	.....	....
nitride	Se, N	solid	−42,300	.....	....
oxide, di-	Se,* O_2	solid	+57,080	.....	−740
Selenic acid	Se, O_4, H_2	liquid	128,220	.....	+16,800
Selenious acid	Se, O_3, H_2, Aq	dil. sol.	124,500	.....	....
Silicon					
carbide	Si, C	solid	2,000	.....	....
bromide, tetra-	Si, Br_4	liquid	71,000	.....	....
chloride, tetra-	Si, Cl_4	gas	121,800	.....	....
chloride, tetra-	Si, Cl_4	liquid	128,100	.....	....
fluoride, tetra-	Si, F_4	gas	239,800	.....	....
hydride	Si, H_4	gas	−6,700	.....	....
iodide, tetra-	Si, I_4	solid	+6,700	.....	....
oxide, di-	Si, O_2	solid	191,000	.....	....
sulphide	Si, S_2	solid	10,400	.....	....
Silver acetate	Ag, C_2, H_3, O_2	solid	95,600	120	−4,300[10°]

* Amorphous selenuim.

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution Calories.
Silver					
bromide	Ag, Br	solid	23,400	.....	....
carbide	Ag, C	solid	43,575	.....	....
carbonate	Ag_2, O, CO_2	solid	120,500	.....	....
chloride	Ag, Cl	solid	29,000	.....	−15,900
chloride	$2Ag, Cl$	solid	29,500	.....	....
cyanate	Ag, C, N, O	solid	+23,100	.....	....
cyanide	Ag, C, N	solid	−31,410	.....	....
fluoride	Ag, F	solid	23,200	.....	+ 3,400$^{10°}$
fluoride	$AgF.2H_2O$	....	....	.....	− 1,500$^{10°}$
iodide	Ag, I	solid	14,200	.....	....
nitrate	Ag, N, O_3	solid	28,700	200	− 5,440
nitrite	Ag, N, O_2	solid	11,300	.....	− 8,800
oxide	Ag_2, O	solid	7,000	.....	....
pot. bromide	$AgBr, KBr$	solid	−400	.....	....
pot. cyanide	$AgCN, KCN$	solid	+11,900	440	− 8,350$^{11°}$
pot. iodide	AgI, KI	solid	−1,800	.....	....
pot. iodide	$AgI, 3KI$	solid	−900	.....	....
selenide	Ag_2, Se	precip.	+2,000	.....	....
sulphate	Ag_2, SO_2, O_2	solid	96,200	1400	− 4,430
sulphate	Ag_2, S, O_4	solid	167,100	.....	....
sulphide	Ag_2, S	solid	3,000	.....	....
sulphocyanate	Ag, C, N, S	solid	−21,900	.....	....
thionate, di-	$Ag_2S_2O_6.2H_2O$	....	....	400	−10,360
Sodium					
acetate	Na, C_2, H_3, O_2	solid	+170,300	200	+ 3,870
acetate	$NaC_2H_3O_2$	....	....	400	− 4,810
aluminate	Na_2O, Al_2O_3	solid	30,000	.....	....
amide	Na, N, H_2	solid	33,500	.....	....
ammon. phos.	$Na(NH_4)HPO_4.4H_2O$	....	....	800	−10,750
arsenate	Na_3, As, O_4	solid	360,800	.....	....
arsenate	$Na_3AsO_4.12H_2O$	....	....	670	−12,600$^{20°}$
arsenate, acid	Na_2, H, As, O_4, Aq	dil. sol.	329,700	.....	....
arsenate, acid	Na, H_2, As, O_4, Aq	dil. sol.	273,700	.....	....
borate, tetra-	Na_2, B_4, O_7	solid	748,100	.....	+10,200
borate, tetra- (borax)	$Na_2B_4O_7.10H_2O$	....	....	1600	−25,860
bromide	Na, Br	solid	86,100	330 200	−300$^{10°}$ −190
bromide	$Na, Br, 2H_2O$	solid	90,290	450 300	− 4,450$^{11°}$ − 4,710
bromoplatinate	$2NaBr, Br_4, Pt$	solid	46,790	600	9,990
bromoplatinate	$2NaBr, Br_4, Pt, 6H_2O$	solid	65,330	800	− 8,550
carbide	Na, C	solid	−4,400	.....	....
carbonate	Na_2, C, O_3	solid	+ 272,640	400	+ 5,640
carbonate	Na_2O, CO_2	solid	76,880	.....	....
carbonate, acid (bicarb.)	Na, H, C, O_3	solid	227,700	.....	− 4,300
chlorate	Na, Cl, O_3	solid	84,800	180-360	− 5,600$^{10°}$
chloride	Na, Cl	solid	97,900	325 100	− 1,010 1,180
chloroplatinate	$2NaCl, Pt, Cl_4$	solid	73,720	800	− 8,540
chloroplatinate	$2NaCl, Pt, Cl_4, 6H_2O$	solid	92,890	900	−10,630
chromate	Na_2O, CrO_3	solid	77,000	360–720	+ 2,200$^{11°}$
chromate	$Na_2CrO_4.10H_2O$	....	....	760	−15,800$^{11°}$
cyanate	Na, C, N, O	solid	101,700	.....	− 4,800$^{13°}$
cyanide	Na, C, N	solid	23,100	100	−500$^{9°}$
cyanide	$NaCN.\frac{1}{2}H_2O$	....	....	100	− 1,000$^{6°}$
cyanide	$NaCN.2H_2O$	....	....	.....	− 4,400$^{9°}$
dithionate see under *thionate.*					

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Sodium					
fluoride	Na, F	solid	109,300	400	$-600^{12°}$
fluosilicate	2NaF, SiF_4	solid	35,400	.....	....
formate	$NaCHO_2$	....	....	150	-5[illegible]$^{12°}$
hydroxide	Na, O, H	solid	102,700	200	+ 9,940
hydroxide	Na_2, O, H_2O	solid	135,380	.....	....
hypochlorite	Na, Cl, O, Aq	dil. sol.	84,700	.....	....
hypophosphite	Na_2, H, P, O_2, Aq	dil. sol.	198,400	.....	....
iodide	Na, I	solid	69,080	200	+ 1,200
iodide	Na, I, $2H_2O$	solid	74,310	300	− 4,010
manganate	Mn, O_4, Na_2O	solid	169,000	.....	....
manganate	MnO_2, O, Na_2O	solid	49,400	.....	....
molybdate	MoO_2, Na_2O_2	solid	101,200	.....	....
molybdate	MoO_3, Na_2O	solid	181,500	.....	....
nitrate	Na, N, O_3	solid	110,700	200	− 5,030
oxalate	Na_2, C_2, O_4	solid	315,000	.....	....
oxalate, acid	Na, H, C_2, O_4	solid	258,200	.....	....
oxide	Na_2, O	solid	100,700	.....	+56,500
oxide, per-	Na_2, O_2	solid	119,800	.....	....
perchlorate	Na, Cl, O_4	solid	100,300	200–400	$-3{,}500^{10°}$
phos. (trisod.)	Na_3, P, O_4	solid	452,400	.....	....
phos. (trisod.)	$Na_3PO_4.12H_2O$	....	....	670	$-14{,}500^{20°}$
phos. (disod.)	Na_2, H, P, O_4	solid	414,900	400	+ 5,640
phos. (disod.)	$Na_2HPO_4.2H_2O$	....	....	400	−390
phos. (disod.)	$Na_2HPO_4.7H_2O$	....	....	.....	−11,000
phos. (disod.)	$Na_2HPO_4.12H_2O$	....	....	400	−22,830
phos. (monosodium)	Na, H_2, P, O_4, Aq	dil. sol.	355,000	.....	....
phos. pyro-	Na_4, P_2O_7	....	....	800	+11,850
phos. pyro-	$Na_4P_2O_7.10H_2O$	....	....	800	−11,670
phosphite	Na_2, H, P, O	solid	285,100	550	+ 9,150
phosphite, acid	Na, H_2, P, O_3	solid	333,800	550	$+750^{15°}$
phosphite, acid	$NaH_2PO_3.2\frac{1}{2}H_2O$	....	....	550	$-5{,}300^{15°}$
selenate	Na_2, Se, O_4, Aq	dil. sol.	262,300	.....	....
selenate, acid	Na, H, Se, O_4, Aq	dil. sol.	203,200	.....	....
selenide	Na_2, Se	solid	60,900	789–2587	$+18{,}600^{14°}$
selenide, acid	Na, H, Se, Aq	dil. sol.	35,300	.....	....
selenide	$Na_2Se.4\frac{1}{2}H_2O$	....	....	1030–2125	$-7{,}900^{13°}$
selenide	$Na_2Se.9H_2O$	....	....	723–1352	$-10{,}600^{12°}$
selenide	$Na_2Se.16H_2O$	....	....	1476–3572	$-22{,}000^{14°}$
stannate	Na_2O, Sn, O_2	solid	172,600	.....	....
sulphate	Na_2, S, O_4	solid	328,100	400	fused +460 efflor. +170
sulphate	$Na_2SO_4.H_2O$	....	....	400	− 1,900
sulphate	Na_2, SO_2, O_2, $10H_2O$	solid	276,730	400	−18,760
sulphate, acid	Na, H, S, O_4	solid	269,100	200 330–600	+ 1,190 −800
sulphide	Na_2, S	solid	89,300	584–1027	$+15{,}000^{14°}$
sulphide	$Na_2S.4\frac{1}{2}H_2O$	....	....	589–1059	$-5{,}000^{17°}$
sulphide	$Na_2S.5H_2O$	....	....	513–1167	$-6{,}600^{17°}$
sulphide	$Na_2S.9H_2O$	....	....	774–1495	$-16{,}720^{18°}$
sulphide, bi-	Na_2, S_2, Aq	dil. sol.	105,200	.....	....
sulphide, tri-	Na_2, S_3, Aq	dil. sol.	107,000	.....	....

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Sodium					
sulphide, tetra-	Na_2, S_4	solid	99,000	600	$+ 9{,}800^{17°}$
sulphocyanate	Na, C, N, S, Aq	dil. sol.	39,200	.....	....
sulphydrate	Na, S, H	solid	56,300	.....	$+ 4{,}400^{6°}$
sulphydrate	$NaSH.2H_2O$	....	....	.....	$- 1{,}500^{18°}$
thionate, di-	Na_2, S_2, O_6	solid	398,810	400	− 5,370
thionate, di-	$Na_2, S_2, O_6, 2H_2O$	solid	405,090	400	−11,650
thionate, tri-	Na_2, S_3, O_6, Aq	dil. sol.	387,500	.....	....
thionate, tri-	$Na_2, S_3, O_6, 3H_2O$	....	....	675	$-10{,}100^{10°}$
thionate, tetra-	Na_2, S_4, O_6, Aq	dil. sol.	375,800	.....	....
thionate, tetra-	$Na_2, S_4O_6.2H_2O$	....	....	620	$- 9{,}700^{10°}$
thiosulphate	Na_2, S_2, O_3	solid	256,300	440	$+ 1{,}700^{15°}$
thiosulphate	$Na_2, S_2, O_3, 5H_2O$	solid	265,070	400	−11,370
tungstate	N_2O, WO_3	solid	94,700	.....	....
Stannic acid	Sn, O_2, H_2O	solid	133,500	.....	....
Stannic and Stannous salts, see under Tin					
Strontium acetate	Sr, C_4, H_6, O_4	solid	345,600	300	$+ 5{,}600^{12}$
acetate	$Sr(C_2H_3O_2)_2.\frac{1}{2}H_2O$	....	....	440	$+ 5{,}300^{12}$
arsenate	Sr_3, As_2, O_8	precip.	761,000	.....	....
bromide	Sr, Br_2	solid	158,100	400	+16,110
bromide	$Sr, Br_2, 6H_2O$	solid	181,010	400	− 7,220
carbonate	Sr, C, O_3	amorp.	278,100	.....	....
carbonate	Sr, C, O_3	cryst.	279,200	.....	....
carbonate	SrO, CO_2	solid	57,300	.....	....
chloride	Sr, Cl_2	solid	184,700	400	+11,140
chloride	$Sr, Cl_2, 6H_2O$	solid	203,190	400	− 7,500
cyanide	Sr, C_2, N_2, Aq	dil. sol.	47,000	.....	....
cyanide	$Sr(CN)_2.4H_2O$	....	....	100	$- 4{,}150^{8°}$
dithionate	$Sr, 2SO_2, O_2, 4H_2O$	solid	263,610	400	− 9,250
fluoride	Sr, F_2	solid	234,400	.....	− 2,100
hydrate	Sr, H_2	solid	45,600	.....	....
hydroxide	Sr, O_2, H_2	solid	217,300	.....	+11,640
hydroxide	Sr, O, H_2O	solid	146,140	.....	....
hydroxide	$Sr(OH)_2.8H_2O$	....	....	.....	−14,640
hydroxide	$Sr(OH)_2.9H_2O$	....	....	.....	−14,600
iodide	Sr, I_2	solid	122,900	.....	$+20{,}500^{12°}$
iodide	$SrI_2.7H_2O$	....	....	.....	− 4,470
nitrate	Sr, N_2, O_6	solid	219,900	400	− 4,620
nitrate	$Sr(NO_3)_2.4H_2O$	....	....	400	−12,300
oxide	Sr, O	solid	131,200	.....	+29,340
oxide, per-	Sr, O_2	solid	151,710	.....	....
phosphate	Sr_3, P_2, O_8	precip.	94,700	.....	....
selenide	Sr, Se	solid	67,600	.....	+ 7,400
sulphate	Sr, S, O_4	solid	330,090	.....	....
sulphydrate	Sr, S_2, H_2, Aq	dil. sol.	119,750	.....	....
Sulphur					
bromide	S_2, Br_2	liquid	2,000	.....	....
chloride	S_2, Cl_2	liquid	14,260	.....	....
iodide	S_2, I_2	solid	13,600	.....	....
oxide, di-	S, O_2	gas	69,260	.....	....
oxide, di-	S, O_2	liquid	74,700	300	+ 1,500
oxide, tri-	S, O_3	gas	91,900	.....	....
oxide, tri-	S, O_3	liquid	103,240	1600	+39,170
oxide, di	S, O_3	solid	103,700	.....	....
oxide, hept-	$2S_2O_3, O$	solid	−9,710	.....	+37,290
oxychloride (ic)	S_2, O_2, Cl_2	liquid	+89,780	.....	....
oxychloride (ic)	SO_2, Cl_2	liquid	18,700	.....	....
oxychl. (ous)	S, O, Cl_2	gas	40,900	.....	....
oxychl. (ous)	S, O, Cl_2	liquid	47,400	.....	....

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Sulphur					
peroxy dichloride	S_2, O_5, Cl_2	liquid	159,400	.....	....
Sulphuric acid	S, O_4, H_2	liquid	192,200	1600	+17,850
" "	SO_3, H_2O	liquid	21,300	.....	....
sulp. acid, per-	S_2, O_8, H_2, Aq	dil. sol.	316,400	.....	....
sulp. acid, thio-	S_2, O_3, H_2, Aq	dil. sol.	141,700	.....	....
Tantalum					
oxide	Ta_2, O_5	solid	301,500	.....	....
Telluric acid	Te, O_4, H_2, Aq	dil. sol.	166,740	.....	....
Tellurium					
chloride	Te, Cl_4	solid	77,380	.....	....
oxide	Te, O_2	solid	78,300	.....	....
Tellurous acid	Te, O_3, H_2	solid	145,600	.....	....
Thallium					
bromide	Tl, Br	solid	41,290	.....	....
bromide, tri-	Tl, Br_3, Aq	dil. sol.	56,450	.....	....
chloride	Tl, Cl	solid	48,580	4500	−10,100
chloride, tri-	Tl, Cl_3, Aq	dil. sol.	89,250	.....	....
fluoride	Tl, F, Aq	dil. sol.	52,000	.....	....
hydroxide (ic)	$Tl_2, O_3, 3H_2O$	solid	2×43,170	.....	....
hydroxide (ous)	Tl, O, H	solid	56,910	235	− 3,150
iodide	Tl, I	solid	30,180	.....	....
iodide, tri-	Tl, I_3, Aq	dil. sol.	10,820	.....	....
nitrate (ous)	Tl, N, O_3	solid	58,150	300	− 9,970
oxide	Tl_2, O	solid	42,240	570	− 3,080
selenide	Tl_2, Se	precip.	13,400	.....	....
sulphate (ous)	Tl_2, S, O_4	solid	220,980	1600	− 8,280
sulphate (ous)	Tl_2, SO_2, O_2	solid	149,900	.....	....
sulphide	Tl_2, S	solid	19,650	.....	....
Thionic acid					
thionic, di-	S_2, O_6, H_2, Aq	dil. sol.	279,440	.....	....
thionic, tri-	S_3, O_6, H_2, Aq	dil. sol.	272,900	.....	....
thionic, tetra-	S_4, O_6, H_2, Aq	dil. sol.	260,790	.....	....
thionic, penta-	S_5, O_6, H_2, Aq	dil. sol.	261,200	.....	....
Thorium					
chloride	Th, Cl_4	solid	300,200	.....	....
oxide	Th, O_2	solid	326,000	.....	....
Tin					
bromide (ic)	Sn, Br_4	solid	98,000	970	+16,600
bromide (ous)	Sn, Br_2	solid	61,500	.....	− 1,600
chloride (ic)	Sn, Cl_4	solid	129,800	300	+29,920
chloride (ous)	Sn, Cl_2	solid	80,790	300	+350
chloride (ous)	$SnCl_2.2H_2O$	....	....	200	− 5,370
hydroxide (ous)	Sn, O, H_2O	solid	68,090	.....	....
oxide (ic)	Sn, O_2	cryst.	137,200	.....	....
oxide (ous)	Sn, O	solid	70,700	.....	....
pot. chloride	$SnCl_4, 2KCl$	solid	24,160	800	− 3,380
Titanium					
oxide	Ti, O_2	amorp.	215,600	.....	....
oxide	Ti, O_2	cryst.	218,400	.....	....
Tungsten					
oxide, di-	W, O_2	solid	131,400	.....	....
oxide, tri-	W, O_3	solid	196,300	.....	....
Vanadium					
oxide	V_2, O_5	solid	310,500	.....	....
Water see *hydrogen oxide.*					
Zinc					
acetate	Zn, C_4, H_6, O_4	solid	267,400	720	+ 9,800[23°]
acetate	$Zn(C_2H_3O_2)_2.H_2O$	....	....	800	+ 7,000[23°]

HEATS OF FORMATION AND SOLUTION (Continued)

Name.	Formula.	Physical state.	Heat of formation. Calories.	Water mols.	Heat of solution. Calories.
Zinc					
acetate	$Zn(C_2H_3O_2)_2.2H_2O$	....	....	500	+ 4,200 10°C
bromide	Zn, Br_2	solid	76,000	400	+15,030
carbonate	Zn, C, O_3	precip.	194,200	.....	....
chloride	Zn, Cl_2	solid	97,400	300	+15,630
cyanide	Zn, C_2, N_2	solid	27,900	.....	....
dithionate	$Zn, 2SO_2, O_2, 6H_2O$	solid	173,850	.....	....
fluoride	Zn, F_2, Aq	dil. sol.	140,000	.....	....
hydroxide	Zn, O, H_2O	solid	82,680	.....	....
hydroxide	Zn, O_2, H_2	solid	83,500	.....	....
iodide	Zn, I_2	solid	49,231	400	+11,310
nitrate	$Zn, O_2, N_2O_4, 6H_2O$	solid	140,820	400	− 5,840
oxide	Zn, O	solid	84,800	.....	....
pot. sulphate	$ZnSO_4, K_2SO_4$	solid	4,145	600	+ 7,910
pot. sulphate	$ZnSO_4, K_2SO_4, 6H_2O$	solid	23,950	600	−11,900
selenide	Zn, Se	precip.	30,300	.....	....
selenide	Zn, Se	cryst.	29,600	.....	....
sulphate	Zn, S, O_4	solid	229,600	400	+18,430
sulphate	Zn, O_2, SO_2	solid	158,990	.....	....
sulphate	Zn, O_2, SO_2, H_2O	solid	167,470	400	+ 9,950
sulphate	$Zn, O_2, SO_2, 7H_2O$	solid	181,680	400	− 4,260
sulphide	Zn, S, xH_2O	solid	43,000	.....	....
telluride	Zn, Te	solid	31,000	.....	....
Zirconium					
oxide	Zr, O_2	solid	177,500	.....	....

HEATS OF FORMATION AND COMBUSTION

For Organic Compounds

The heat of formation is given in gram calories per gram molecular weight for the formation of the compound from the elements in the state in which they exist at ordinary temperatures. Carbon is assumed to be in its crystalline form, the diamond.

The heat of combustion is also given in gram calories per gram molecular weight. The compound is assumed to be originally at ordinary temperature and the products of combustion returned to ordinary temperature.

Name	Formula	Physical state	Heat of formation. Calories	Heat of combustion. Calories
Acetaldehyde	CH_3CHO	liquid	57,100	2[illegible],500
		gas	51,000	....
Acetamide	CH_3CONH_2	solid	78,400	2[illegible]2,700
Acetic acid	$CH_3.COOH$	solid	119,700	....
		liquid	117,200	2[illegible],400
		gas	112,100	....
anhydride	$(CH_3CO)_2O$	liquid	152,300	431,000
		gas	145,600	....
Acetone	$CH_3\cdot CO\cdot CH_3$	liquid	66,300	423,000
		gas	58,800	....
Acetonitrile (*methyl cyanide*)	$CH_3\cdot CH$	liquid	450	291,600
Acetylene	$HC:CH$	gas	−58,100	315,700
Acetylurea	$NH_2\cdot CO\cdot NH\cdot COCH_3$	solid	129,000	360,900
Alcohol, *see Ethyl alcohol*				
Amyl alcohol	$C_5H_{12}O$	liquid	91,600	793,900
		gas	80,900	....
Aniline	$C_6H_5\cdot NH_2$	liquid	−11,200	818,500
		gas	−19,800	....
Anthracene	$C_6H_4:(CH)_2:C_6H_4$	solid	−42,400	1,707,600
Benzene	C_6H_6	solid	−1,800	....
		liquid	−4,100	776,900
		gas	−11,300	....
Benzoic acid	$C_6H_5.COOH$	solid	94,200	772,900
		liquid	91,900	....
Bromomethane (*Bromoform*)	$CHBr_3$	gas	13,700	....
Butyric acid	$CH_3\cdot(CH_2)_2\cdot COOH$	solid	130,300	....
		liquid	128,800	524,400
Camphor	$C_{10}H_{16}O$	solid	80,300	1,414,700
Carbon hexachloride	C_2Cl_6	solid	85,600	....
Carbon tetrachloride	CCl_4	liquid	75,700	....
		gas	68,500	....
Catechol	$C_6H_4(OH)_2$	solid	87,600	685,200
Chloroform	$CHCl_3$	liquid	53,900	107,000
		gas	46,600	....
Dichlormethane (*Methylene chloride*)	CH_2Cl_2	liquid	37,800	....
		gas	31,400	....
Dimethylamine	$(CH_3)_2NH$	gas	4,100	426,000
Ethane	$CH_3\cdot CH_3$	gas	23,300	372,300
Ether	$C_2H_5\cdot O\cdot C_2H_5$	liquid	70,500	651,700
		gas	62,800	....
Ethyl acetate	$CH_3\cdot COO\cdot C_2H_5$	liquid	116,100	537,100
		gas	105,200	....
alcohol	$C_2H_5\cdot OH$	liquid	69,900	325,700
		gas	59,800	....
Ethylene	$CH_2:CH_2$	gas	−14,600	341,100

HEATS OF FORMATION AND COMBUSTION (Continued)

FOR ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of formation. Calories	Heat of combustion. Calories
Formic acid	$H\cdot COOH$	solid	104,000	....
		liquid	101,500	61,700
		gas	96,700	....
Fructose	$C_6H_{12}O_6$	solid	303,900	675,900
Glucose	$C_6H_{12}O_6$	solid	302,600	677,200
Glycerine	$HOCH_2\cdot CHOH\cdot CH_2OH$	solid	165,600	....
		liquid	161,700	397,200
Hydroquinone	$C_6H_4\cdot(OH)_2$	solid	87,300	685,500
Lactose	$C_{12}H_{22}O_{11}$	solid	537,400	1,351,400
Maltose	$C_{12}H_{22}O_{11}$	solid	538,100	1,350,700
Methane	CH_4	gas	18,900	213,500
Methyl alcohol	CH_3OH	liquid	61,700	170,600
		gas	53,300	....
amine	CH_3NH_2	gas	9,900	256,900
chloride	CH_3Cl	liquid	33,900	....
		gas	29,000	....
formate	$H\cdot COO\cdot CH_3$	liquid	94,800	238,700
		gas	87,900	....
oxalate	$C_4H_6O_4$	solid	186,000	398,200
		liquid	181,700	....
Naphthalene	$C_{10}H_8$	solid	−22,800	1,241,800
		liquid	−27,400	....
Nitrobenzene	$C_6H_5\cdot NO_2$	solid	7,800	....
		liquid	5,100	733,200
		gas	−2,000	....
Nitroglycerine	$C_3H_5(NO_3)_3$	liquid	14,700	....
Nitromethane	$CH_3\cdot NO_2$	liquid	28,800	169,800
		gas	21,800	....
Oleïc acid	$C_{17}H_{33}\cdot COOH$	liquid	188,000	2,682,000
Oxalic acid	$COOH\cdot COOH$	solid	197,600	60,200
Palmitic acid	$CH_3\cdot(CH_2)14\cdot COOH$	solid	214,400	2,398,400
		liquid	207,200	....
Phenol (*Carbolic acid*)	$C_6H_5\cdot OH$	solid	36,800	....
		liquid	34,500	736,000
Propane	$CH_3\cdot CH_2\cdot CH_3$	gas	30,500	528,400
Propylene	$CH_3\cdot CH{:}CH_2$	gas	−9,400	499,300
Resorcinol	$C_6H_4\cdot(OH)_2$	solid	89,400	683,400
Sucrose (*Cane sugar*)	$C_{12}H_{22}O_{11}$	solid	535,600	1,355,000
Stearic acid	$CH_3\cdot(CH_2)_{16}\cdot COOH$	solid	227,600	2,711,800
Succinic acid	$HOOC\cdot CH_2\cdot CH_2\cdot COOH$	solid	229,800	354,400
Tartaric acid	$HOOC(CHOH)_2\cdot COOH$	solid	302,300	281,000
Tetrachlor-ethylene	$CCl_2{:}CCl_2$	liquid	45,500	....
Toluene	$C_6H_6\cdot CH_3$	liquid	2,300	933,800
		gas	−5,400	....
Toluidine	$CH_3\cdot C_6H_4\cdot NH_2$	liquid	5,900	951,700
Trimethylamine	$(CH_3)_3N$	liquid	5,600	....
		gas	1,400	592,000
Urea	$NH_2\cdot CO\cdot NH_2$	solid	80,800	151,500
Xylenes	$C_6H_4\cdot(CH_3)_2$	liquid	15,200	1,084,300

HEATS OF COMBUSTION

Heat of combustion in gram calories per gram. Products of combustion gaseous unless stated.

Substance	Calories per gram of substance	Observer
Acetylene	11,923	Thomsen
Alcohol, *see Ethyl alcohol*	....	....
Amyl alcohol	8,958	Favre & Silbermann
Asphalt	9,532	Slossen & Colburn
Benzene	9,977	Stohmann
Butter	9,200	....
Carbon, crystal to CO_2	7,859	Berthelot
Carbon disulphide	3,404	"
Casein	5,860	....
Charcoal to CO_2	8,080	Favre & Silbermann
	8,137	Berthelot
Coal, anthracite	7,000–8,400	....
bituminous	6,100–8,700	....
lignite	4,500–7,900	....
Coke	8,000	....
Copper to CuO	590	Thomsen
Dynamite, 75 %	1,290	Roux and Sarran
Egg white	5,700	....
yolk	8,100	....
Ethyl alcohol	7,080	....
Ethylene	12,143	Berthelot & Matignon
Fats, animal, mean	9,500	....
Gas, coal	5,400–6,000 *	....
Glycerine, CO_2 and liq. H_2O	4,316	Stohmann
Graphite	7,901	Berthelot
Gunpowder	720–750	....
Hemoglobin	5,900	....
Hydrogen, to liquid	33,900	Mean
	34,500	Berthelot
to gas	29,150	"
Iron to Fe_2O_3	1,582	....
Magnesium to MgO	6,077	....
Methane	13,063	Favre & Silbermann
	13,275	Berthelot
Methyl alcohol	5,307	Favre & Silbermann
Naphthalene	9,354	Berthelot
	9,631	Leroux, 1910
Oil, cotton seed	9,500	....
lard	9,200–9,400	....
olive	9,328–9,442	Stohmann

* Calories per cubic meter.

HEATS OF COMBUSTION (Continued)

Substance	Calories per gram of substance	Observer
Oil,		
paraffin	9,800	Mohler
petroleum, crude	11,094	"
" refined	11,045	"
" Russian	10,800	
rape	9,489	Stohmann
sperm	10,000	Gibson
Paraffin	10,340	Stohmann
Peat	5,940	Bainbridge
Pitch	8,400	....
Silicon to SiO_2	7,407	Berthelot
Sulfur to SO_2, gas	2,221	Thomsen
	2,164	Berthelot
Wood		
Beech	4,774	....
Birch	4,771	....
Oak	4,620	....
Pine	5,085	....

SULPHURIC ACID

Specific Gravity of Aqueous Solutions.
Lunge, Isler and Naef

Sp. gr. at 15° C.	Deg. Bé.	Deg. Twaddell.	Per cent H_2SO_4 by wt.	Total H_2SO_4 kg. in 1 liter.	Sp. gr. at 15° C.	Deg. Bé.	Deg. Twaddell.	Per cent H_2SO_4 by wt.	Total H_2SO_4 kg. in 1 liter.
1.000	0.0	0	0.09	0.001	1.210	25.0	42	28.58	0.346
1.005	0.7	1	0.95	0.009	1.215	25.5	43	29.21	0.355
1.010	1.4	2	1.57	0.016	1.220	26.0	44	29.84	0.364
1.015	2.1	3	2.30	0.023	1.225	26.4	45	30.48	0.373
1.020	2.7	4	3.03	0.031	1.230	26.9	46	31.11	0.382
1.025	3.4	5	3.76	0.039	1.235	27.4	47	31.70	0.391
1.030	4.1	6	4.49	0.046	1.240	27.9	48	32.28	0.400
1.035	4.7	7	5.23	0.054	1.245	28.4	49	32.86	0.409
1.040	5.4	8	5.96	0.062	1.250	28.8	50	33.43	0.418
1.045	6.0	9	6.67	0.071	1.255	29.3	51	34.00	0.426
1.050	6.7	10	7.37	0.077	1.260	29.7	52	34.57	0.435
1.055	7.4	11	8.07	0.085	1.265	30.2	53	35.14	0.444
1.060	8.0	12	8.77	0.093	1.270	30.6	54	35.71	0.454
1.065	8.7	13	9.47	0.102	1.275	31.1	55	36.29	0.462
1.070	9.4	14	10.19	0.109	1.280	31.5	56	36.87	0.472
1.075	10.0	15	10.90	0.117	1.285	32.0	57	37.45	0.481
1.080	10.6	16	11.60	0.125	1.290	32.4	58	38.03	0.490
1.085	11.2	17	12.30	0.133	1.295	32.8	59	38.61	0.500
1.090	11.9	18	12.99	0.142	1.300	33.3	60	39.19	0.510
1.095	12.4	19	13.67	0.150	1.305	33.7	61	39.77	0.519
1.100	13.0	20	14.35	0.158	1.310	34.2	62	40.35	0.529
1.105	13.6	21	15.03	0.166	1.315	34.6	63	40.93	0.538
1.110	14.2	22	15.71	0.175	1.320	35.0	64	41.50	0.548
1.115	14.9	23	16.36	0.183	1.325	35.4	65	42.08	0.557
1.120	15.4	24	17.01	0.191	1.330	35.8	66	42.66	0.567
1.125	16.0	25	17.66	0.199	1.335	36.2	67	43.20	0.577
1.130	16.5	26	18.31	0.207	1.340	36.6	68	43.74	0.536
1.135	17.1	27	18.96	0.215	1.345	37.0	69	44.28	0.596
1.140	17.7	28	19.61	0.223	1.350	37.4	70	44.82	0.605
1.145	18.3	29	20.26	0.231	1.355	37.8	71	45.35	0.614
1.150	18.8	30	20.91	0.239	1.360	38.2	72	45.88	0.624
1.155	19.3	31	21.55	0.248	1.365	38.6	73	46.41	0.633
1.160	19.8	32	22.19	0.257	1.370	39.0	74	46.94	0.643
1.165	20.3	33	22.83	0.266	1.375	39.4	75	47.47	0.653
1.170	20.9	34	23.47	0.275	1.380	39.8	76	48.00	0.662
1.175	21.4	35	24.12	0.283	1.385	40.1	77	48.53	0.672
1.180	22.0	36	24.76	0.292	1.390	40.5	78	49.06	0.682
1.185	22.5	37	25.40	0.301	1.395	40.8	79	49.59	0.692
1.190	23.0	38	26.04	0.310	1.400	41.2	80	50.11	0.702
1.195	23.5	39	26.68	0.319	1.405	41.6	81	50.63	0.711
1.200	24.0	40	27.32	0.328	1.410	42.0	82	51.15	0.721
1.205	24.5	41	27.95	0.337	1.415	42.3	83	51.66	0.730

SULPHURIC ACID (Continued)

Sp. gr. at 15° C	Deg. Bé.	Deg. Twaddell.	Per cent. H_2SO_4 by wt.	Total H_2SO_4 kg. in 1 liter.	Sp. gr. at 15° C.	Deg. Bé.	Deg. Twaddell.	Per cent H_2SO_4 by wt.	Total H_2SO_4 kg. in 1 liter.
1.420	42.7	84	52.15	0.740	1.645	56.6	129	72.55	1.193
1.425	43.1	85	52.63	0.750	1.650	56.9	130	72.96	1.204
1.430	43.4	86	53.11	0.759	1.655	57.1	131	73.40	1.215
1.435	43.8	87	53.59	0.769	1.660	57.4	132	73.81	1.225
1.440	44.1	88	54.07	0.779	1.665	57.7	133	74.24	1.230
1.445	44.4	89	54.55	0.789	1.670	57.9	134	74.66	1.246
1.450	44.8	90	55.03	0.798	1.675	58.2	135	75.08	1.259
1.455	45.1	91	55.50	0.808	1.680	58.4	136	75.50	1.268
1.460	45.4	92	55.97	0.817	1.685	58.7	137	75.94	1.278
1.465	45.8	93	56.43	0.827	1.690	58.9	138	76.38	1.289
1.470	46.1	94	56.90	0.837	1.695	59.2	139	76.76	1.301
1.475	46.4	95	57.37	0.846	1.700	59.5	140	77.17	1.312
1.480	46.8	96	57.83	0.856	1.705	59.7	141	77.60	1.323
1.485	47.1	97	58.28	0.865	1.710	60.0	142	78.04	1.334
1.490	47.4	98	58.74	0.876	1.715	60.2	143	78.48	1.346
1.495	47.8	99	59.22	0.885	1.720	60.4	144	78.92	1.357
1.500	48.1	100	59.70	0.896	1.725	60.6	145	79.36	1.369
1.505	48.4	101	60.18	0.906	1.730	60.9	146	79.80	1.381
1.510	48.7	102	60.65	0.916	1.735	61.1	147	80.24	1.392
1.515	49.0	103	61.12	0.926	1.740	61.4	148	80.68	1.404
1.520	49.4	104	61.59	0.936	1.745	61.6	149	81.12	1.416
1.525	49.7	105	62.06	0.946	1.750	61.8	150	81.56	1.427
1.530	50.0	106	62.53	0.957	1.755	62.1	151	82.00	1.439
1.535	50.3	107	63.00	0.967	1.760	62.3	152	82.44	1.451
1.540	50.6	108	63.43	0.977	1.765	62.5	153	83.01	1.465
1.545	50.9	109	63.85	0.987	1.770	62.8	154	83.51	1.478
1.550	51.2	110	64.26	0.996	1.775	63.0	155	84.02	1.491
1.555	51.5	111	64.67	1.006	1.780	63.2	156	84.50	1.504
1.560	51.8	112	65.20	1.017	1.785	63.5	157	85.10	1.519
1.565	52.1	113	65.65	1.027	1.790	63.7	158	85.70	1.534
1.570	52.4	114	66.09	1.038	1.795	64.0	159	86.30	1.549
1.575	52.7	115	66.53	1.048	1.800	64.2	160	86.92	1.564
1.580	53.0	116	66.95	1.058	1.805	64.4	161	87.60	1.581
1.585	53.3	117	67.40	1.068	1.810	64.6	162	88.30	1.598
1.590	53.6	118	67.83	1.078	1.815	64.8	163	89.16	1.618
1.595	53.9	119	68.26	1.089	1.820	65.0	164	90.05	1.639
1.600	54.1	120	68.70	1.099	1.821	....	...	90.20	1.643
1.605	54.4	121	69.13	1.110	1.822	65.1	...	90.40	1.647
1.610	54.7	122	69.56	1.120	1.823	....	...	90.60	1.651
1.615	55.0	123	70.00	1.131	1.824	65.2	...	90.80	1.656
1.620	55.2	124	70.42	1.141	1.825	....	165	91.00	1.661
1.625	55.5	125	70.85	1.151	1.826	65.3	...	91.25	1.666
1.630	55.8	126	71.27	1.162	1.827	....	...	91.50	1.671
1.635	56.0	127	71.70	1.172	1.828	65.4	...	91.70	1.676
1.640	56.3	128	72.12	1.182	1.829	....	...	91.90	1.681

SULPHURIC ACID (Continued)

Sp. gr. at 15°C.	Deg. Bé.	Deg. Twad-dell	Per cent. H_2SO_4 by wt.	Total H_2SO_4 kg. in 1 liter.	Sp. gr. at 15°C.	Deg. Bé.	Deg. Twad-dell.	Per. cent. H_2SO_4 by wt.	Total H_2SO_4 kg. in 1 liter.
1.830	....	166	92.10	1.685	1.840	65.9	168	95.60	1.759
1.831	65.5	...	92.43	1.692	1.8405	....	...	95.95	1.765
1.832	....	...	92.70	1.698	1.8410	....	...	96.38	1.774
1.833	65.6	...	92.97	1.704	1.8415	....	...	97.35	1.792
1.834	....	...	93.25	1.710	1.8410	....	...	98.20	1.808
1.835	65.7	167	93.56	1.717	1.8405	....	...	98.52	1.814
1.836	....	...	93.80	1.722	1.8400	....	...	98.72	1.816
1.837	....	...	94.25	1.730	1.8395	....	...	98.77	1.817
1.838	65.8	...	94.60	1.739	1.8390	....	...	99.12	1.823
1.839	....	...	95.00	1.748	1.8385	....	...	99.31	1.826

ACETIC ACID

Specific Gravity of Aqueous Solutions, at 15° C.

Oudemans

Specific gravity.	Pr. ct. by wt.	Specific gravity.	Per cent.	Specific gravity.	Per cent.	Specific gravity.	Per cent.
0.9992	0	1.0363	26	1.0631	52	1.0748	78
1.0007	1	1.0375	27	1.0638	53	1.0748	79
1.0022	2	1.0388	28	1.0646	54	1.0748	80
1.0037	3	1.0400	29	1.0653	55	1.0747	81
1.0052	4	1.0412	30	1.0660	56	1.0746	82
1.0067	5	1.0424	31	1.0666	57	1.0744	83
1.0083	6	1.0436	32	1.0673	58	1.0742	84
1.0098	7	1.0447	33	1.0679	59	1.0739	85
1.0113	8	1.0459	34	1.0685	60	1.0736	86
1.0127	9	1.0470	35	1.0691	61	1.0731	87
1.0142	10	1.0481	36	1.0697	62	1.0726	88
1.0157	11	1.0492	37	1.0702	63	1.0720	89
1.0171	12	1.0502	38	1.0707	64	1.0713	90
1.0185	13	1.0513	39	1.0712	65	1.0705	91
1.0200	14	1.0523	40	1.0717	66	1.0696	92
1.0214	15	1.0533	41	1.0721	67	1.0686	83
1.0228	16	1.0543	42	1.0725	68	1.0674	94
1.0242	17	1.0552	43	1.0729	69	1.0660	95
1.0256	18	1.0562	44	1.0733	70	1.0644	96
1.0270	19	1.0571	45	1.0737	71	1.0625	97
1.0284	20	1.0580	46	1.0740	72	1.0604	98
1.0298	21	1.0589	47	1.0742	73	1.0580	99
1.0311	22	1.0598	48	1.0744	74	1.0553	100
1.0324	23	1.0607	49	1.0746	75		
1.0337	24	1.0615	50	1.0747	76		
1.0350	25	1.0623	51	1.0748	77		

NITRIC ACID

Specific Gravity of Aqueous Solutions

Sp. gr. at 15° C.	Degrees Baumé.	Degrees Twaddell.	Per cent HNO_3 by weight.	Total HNO_3 kg. in 1 liter.
1.000	0.0	0	0.10	0.001
1.005	0.7	1	1.00	0.010
1.010	1.4	2	1.90	0.019
1.015	2.1	3	2.80	0.028
1.020	2.7	4	3.70	0.038
1.025	3.4	5	4.60	0.047
1.030	4.1	6	5.50	0.057
1.035	4.7	7	6.38	0.066
1.040	5.4	8	7.26	0.075
1.045	6.0	9	8.13	0.085
1.050	6.7	10	8.99	0.094
1.055	7.4	11	9.84	0.104
1.060	8.0	12	10.68	0.113
1.065	8.7	13	11.51	0.123
1.070	9.4	14	12.33	0.132
1.075	10.0	15	13.15	0.141
1.080	10.6	16	13.95	0.151
1.085	11.2	17	14.74	0.160
1.090	11.9	18	15.53	0.169
1.095	12.4	19	16.32	0.179
1.100	13.0	20	17.11	0.188
1.105	13.6	21	17.89	0.198
1.110	14.2	22	18.67	0.207
1.115	14.9	23	19.45	0.217
1.120	15.4	24	20.23	0.227
1.125	16.0	25	21.00	0.236
1.130	16.5	26	21.77	0.246
1.135	17.1	27	22.54	0.256
1.140	17.7	28	23.31	0.266
1.145	18.3	29	24.08	0.276
1.150	18.8	30	24.84	0.286
1.155	19.3	31	25.60	0.296
1.160	19.8	32	26.36	0.306
1.165	20.3	33	27.12	0.316
1.170	20.9	34	27.88	0.326
1.175	21.4	35	28.63	0.336
1.180	22.0	36	29.38	0.347
1.185	22.5	37	30.13	0.357
1.190	23.0	38	30.88	0.367
1.195	23.5	39	31.62	0.378
1.200	24.0	40	32.36	0.388
1.205	24.5	41	33.09	0.399
1.210	25.0	42	33.82	0.409
1.215	25.5	43	34.55	0.420

NITRIC ACID (Continued)

Sp. gr. at 15° C.	Degrees Baumé.	Degrees Twaddell.	Per cent HNO_3 by weight.	Total HNO_3 kg. in 1 liter.
1.220	26.0	44	35.28	0.430
1.225	26.4	45	36.03	0.441
1.230	26.9	46	36.78	0.452
1.235	27.4	47	37.53	0.463
1.240	27.9	48	38.29	0.475
1.245	28.4	49	39.05	0.486
1.250	28.8	50	39.82	0.498
1.255	29.3	51	40.58	0.509
1.260	29.7	52	41.34	0.521
1.265	30.2	53	42.10	0.533
1.270	30.6	54	42.87	0.544
1.275	31.1	55	43.64	0.556
1.280	31.5	56	44.41	0.568
1.285	32.0	57	45.18	0.581
1.290	32.4	58	45.95	0.593
1.295	32.8	59	46.72	0.605
1.300	33.3	60	47.49	0.617
1.305	33.7	61	48.26	0.630
1.310	34.2	62	49.07	0.643
1.315	34.6	63	49.89	0.656
1.320	35.0	64	50.71	0.669
1.325	35.4	65	51.53	0.683
1.330	35.8	66	52.37	0.697
1.3325	36.0	66.5	52.80	0.704
1.335	36.2	67	53.22	0.710
1.340	36.6	68	54.07	0.725
1.345	37.0	69	54.93	0.739
1.350	37.4	70	55.79	0.753
1.355	37.8	71	56.66	0.768
1.360	38.2	72	57.57	0.783
1.365	38.6	73	58.48	0.798
1.370	39.0	74	59.39	0.814
1.375	39.4	75	60.30	0.829
1.380	39.8	76	61.27	0.846
1.3833	40.0	.....	61.92	0.857
1.385	40.1	77	62.24	0.862
1.390	40.5	78	63.23	0.879
1.395	40.8	79	64.25	0.896
1.400	41.2	80	65.30	0.914
1.405	41.6	81	66.40	0.933
1.410	42.0	82	67.50	0.952
1.415	42.3	83	68.63	0.971
1.420	42.7	84	69.80	0.991
1.425	43.1	85	70.98	1.011
1.430	43.4	86	72.17	1.032
1.435	43.8	87	73.39	1.053
1.440	44.1	88	74.68	1.075

NITRIC ACID (Continued)

Sp. gr. at 15° C.	Degrees Baumé.	Degrees Twaddell.	Per cent HNO_3 by weight.	Total HNO_3 kg. in 1 liter.
1.445	44.4	89	75.98	1.098
1.450	44.8	90	77.28	1.121
1.455	45.1	91	78.60	1.144
1.460	45.4	92	79.98	1.168
1.465	45.8	93	81.42	1.193
1.470	46.1	94	82.90	1.219
1.475	46.4	95	84.45	1.246
1.480	46.8	96	86.05	1.274
1.485	47.1	97	87.70	1.302
1.490	47.4	98	89.60	1.335
1.495	47.8	99	91.60	1.369
1.500	48.1	100	94.09	1.411
1.505	48.4	101	96.39	1.451
1.510	48.7	102	98.10	1.481
1.515	49.0	103	99.07	1.501
1.520	49.4	104	99.67	1.515

HYDROCHLORIC ACID

Specific Gravity of Aqueous Solutions

Sp. gr. at 15° C.	Deg. Bé.	Deg. Twad-dell.	Per cent. HCl.	Total HCl kg. per liter.	Sp. gr. at 15° C.	Deg. Bé.	Deg. Twad-dell.	Per cent. HCl.	Total HCl kg. per liter.
1.000	0.0	0.0	0.16	0.0016	1.115	14.9	23	22.86	0.255
1.005	0.7	1	1.15	0.012	1.120	15.4	24	23.82	0.267
1.010	1.4	2	2.14	0.022	1.125	16.0	25	24.78	0.278
1.015	2.1	3	3.12	0.032	1.130	16.5	26	25.75	0.291
1.020	2.7	4	4.13	0.042	1.135	17.1	27	26.70	0.303
1.025	3.4	5	5.15	0.053	1.140	17.7	28	27.66	0.315
1.030	4.1	6	6.15	0.064	1.1425	18.0	..	28.14	0.322
1.035	4.7	7	7.15	0.074	1.145	18.3	29	28.61	0.328
1.040	5.4	8	8.16	0.085	1.150	18.8	30	29.57	0.340
1.045	6.0	9	9.16	0.096	1.152	19.0	..	29.95	0.345
1.050	6.7	10	10.17	0.107	1.155	19.3	31	30.55	0.353
1.055	7.4	11	11.18	0.118	1.160	19.8	32	31.52	0.366
1.060	8.0	12	12.19	0.129	1.163	20.0	..	32.10	0.373
1.065	8.7	13	13.19	0.141	1.165	20.3	33	32.49	0.379
1.070	9.4	14	14.17	0.152	1.170	20.9	34	33.46	0.392
1.075	10.0	15	15.16	0.163	1.171	21.0	..	33.65	0.394
1.080	10.6	16	16.15	0.174	1.175	21.4	35	34.42	0.404
1.085	11.2	17	17.13	0.186	1.180	22.0	36	35.39	0.418
1.090	11.9	18	18.11	0.197	1.185	22.5	37	36.31	0.430
1.095	12.4	19	19.06	0.209	1.190	23.0	38	37.23	0.443
1.100	13.0	20	20.01	0.220	1.195	23.5	39	38.16	0.456
1.105	13.6	21	20.97	0.232	1.200	24.0	40	39.11	0.469
1.110	14.2	22	21.92	0.243					

AMMONIUM HYDROXIDE

Specific Gravity of Aqueous Solutions at 15° C.

Specific gravity	Per cent NH_3	Total NH_3 g. per liter	Specific gravity	Per cent NH_3	Total NH_3 g. per liter
1.000	0.00	0.0	0.940	15.63	146.9
0.998	0.45	4.5	0.938	16.22	152.1
0.996	0.91	9.1	0.936	16.82	157.4
0.994	1.37	13.6	0.934	17.42	162.7
0.992	1.84	18.2	0.932	18.03	168.1
0.990	2.31	22.9	0.930	18.64	173.4
0.988	2.80	27.7	0.928	19.25	178.6
0.986	3.30	32.5	0.926	19.87	184.2
0.984	3.80	37.4	0.924	20.49	189.3
0.982	4.30	42.2	0.922	21.12	194.7
0.980	4.80	47.0	0.920	21.75	200.1
0.978	5.30	51.8	0.918	22.39	205.6
0.976	5.80	56.6	0.916	23.03	210.9
0.974	6.30	61.4	0.914	23.68	216.3
0.972	6.80	66.1	0.912	24.33	221.9
0.970	7.31	70.9	0.910	24.99	227.4
0.968	7.82	75.7	0.908	25.65	232.9
0.966	8.33	80.5	0.906	26.31	238.3
0.964	8.84	85.2	0.904	26.98	243.9
0.962	9.35	89.9	0.902	27.65	249.4
0.960	9.91	95.1	0.900	28.33	255.0
0.958	10.47	100.3	0.898	29.01	260.5
0.956	11.03	105.4	0.896	29.69	266.0
0.954	11.60	110.7	0.894	30.37	271.5
0.952	12.17	115.9	0.892	31.05	277.0
0.950	12.72	121.0	0.890	31.75	282.6
0.948	13.31	126.2	0.888	32.50	288.6
0.946	13.88	131.3	0.886	33.25	294.6
0.944	14.46	136.5	0.884	34.10	301.4
0.942	15.04	141.7	0.882	34.95	308.3

POTASSIUM HYDROXIDE

Specific Gravity of Aqueous Solutions at 15° C.

Specific gravity	Deg. Baumé	Deg. Twaddell	Per cent KOH by wt.	KOH, kg. per cu. m.
1·007	1	1·4	0.9	9
1·014	2	2·8	1·7	17
1·022	3	4·4	2.6	26
1·029	4	5·8	3·5	36
1·037	5	7·4	4·5	46
1·045	6	9·0	5·6	58
1·052	7	10·4	6·4	67
1·060	8	12·0	7·4	78
1·067	9	13·4	8·2	88
1·075	10	15·0	9·2	99
1·083	11	16·6	10·1	109
1·091	12	18·2	10·9	119
1·100	13	20·0	12·0	132
1·108	14	21·6	12·9	143
1·116	15	23·2	13·8	153
1·125	16	25·0	14·8	167
1·134	17	26·8	15·7	178
1·142	18	28·4	16·5	188
1·152	19	30·4	17·6	203
1·162	20	32·4	18·6	216
1·171	21	34·2	19·5	228
1·180	22	36·0	20·5	242
1·190	23	38·0	21·4	255
1·200	24	40·0	22·4	269
1·210	25	42·0	23·3	282
1·220	26	44·0	24·2	295
1·231	27	46·2	25·1	309
1·241	28	48·2	26·1	324
1·252	29	50·4	27·0	338
1·263	30	52·6	28·0	353
1·274	31	54·8	28·9	368
1·285	32	57·0	29·8	385
1·297	33	59·4	30·7	398
1·308	34	61·6	31·8	416
1·320	35	64.0	32·7	432
1·332	36	66·4	33·7	449
1·345	37	69.0	34·9	469
1·357	38	71·4	35.9	487
1·370	39	74·0	36·9	506
1·383	40	76·6	37·8	522
1·397	41	79.4	38.9	543
1·410	42	82.0	39·9	563
1·424	43	84·8	40.9	582
1·438	44	87·6	42·1	605
1·453	45	90·6	43·4	631
1·468	46	93·6	44·6	655
1·483	47	96·6	45·8	679
1·498	48	99.6	47·1	706
1·514	49	102·8	48·3	731
1·530	50	106·0	49·4	756
1·546	51	109·2	50·6	779
1·563	52	112·6	51·9	811
1·580	53	116·0	53·2	840
1·597	54	119.4	54·5	870
1·615	55	123·0	55·9	902
1·634	56	126·8	57·5	940

SODIUM HYDROXIDE

Specific Gravity of Aqueous Solutions at 15° C.

Specific gravity	Deg. Baumé	Deg. Twaddell	Per cent NaOH by wt.	NaOH, kg. per cu. m.
1·007	1	1·4	0·59	6·0
1·014	2	2·8	1·20	12·0
1·022	3	4·4	1·85	18·9
1·029	4	5·8	2·50	25·7
1·036	5	7·2	3·15	32·6
1·045	6	9·0	3·79	39·6
1·052	7	10·4	4·50	47·3
1·060	8	12·0	5·20	55·0
1·067	9	13·4	5·86	62·5
1·075	10	15·0	6·58	70·7
1·083	11	16·6	7·30	79·1
1·091	12	18·2	8·07	88·0
1·100	13	20·0	8·78	96·6
1·108	14	21·6	9·50	105·3
1·116	15	23·2	10·30	114·9
1·125	16	25·0	11·06	124·4
1·134	17	26·8	11·90	134·9
1·142	18	28·4	12·69	145·0
1·152	19	30·4	13·50	155·5
1·162	20	32·4	14·35	166·7
1·171	21	34·2	15·15	177·4
1·180	22	36·0	16·00	188·8
1·190	23	38·0	16·91	201·2
1·200	24	40·0	17·81	213·7
1·210	25	42·0	18·71	226·4
1·220	26	44·0	19·65	239·7
1·231	27	46·2	20·60	253·6
1·241	28	48·2	21·55	267·4
1·252	29	50·4	22·50	281·7
1·263	30	52·6	23·50	296·8
1·274	31	54·8	24·48	311·9
1·285	32	57·0	25·50	327·7
1·297	33	59·4	26·58	344·7
1·308	34	61·6	27·65	361·7
1·320	35	64·0	28·83	380·6
1·332	36	66·4	30·00	399·6
1·345	37	69·0	31·20	419·6
1·357	38	71·4	32·50	441·0
1·370	39	74·0	33·73	462·1
1·383	40	76·6	35·00	484·1
1·397	41	79·4	36·36	507·9
1·410	42	82·0	37·65	530·9
1·424	43	84·8	39·06	556·2
1·438	44	87·6	40·47	582·0
1·453	45	90·6	42·02	610·6
1·468	46	93·6	43·58	639·8
1·483	47	96·6	45·16	669·7
1·498	48	99·6	46·73	700·0
1·514	49	102·8	48·41	732·9
1·530	50	106·0	50·10	766·5

POTASSIUM CARBONATE

Specific Gravity of Aqueous Solutions at 15° C.

Specific gravity	Per cent K_2CO_3	Specific gravity	Per cent K_2CO_3	Specific gravity	Per cent K_2CO_3
1·00914	1	1·18265	19	1·38279	37
1·01829	2	1·19286	20	1·39476	38
1·02743	3	1·20344	21	1·40673	39
1·03658	4	1·21402	22	1·41870	40
1·04572	5	1·22459	23	1·43104	41
1·05513	6	1·23517	24	1·44338	42
1·06454	7	1·24575	25	1·45573	43
1·07396	8	1·25681	26	1·46807	44
1·08337	9	1·25787	27	1·48041	45
1·09278	10	1·27893	28	1·49314	46
1·10258	11	1·28999	29	1·50588	47
1·11238	12	1·30105	30	1·51861	48
1·12219	13	1·31261	31	1·53135	49
1·13199	14	1·32417	32	1·54408	50
1·14179	15	1·33573	33	1·55728	51
1·15200	16	1·34729	34	1·57048	52
1·16222	17	1·35885	35	1·57079	51·024
1·17243	18	1·37082	36	......	..

SODIUM CARBONATE

Specific Gravity of Aqueous Solutions at 15° C.

Specific gravity	Per cent Na_2CO_3 $+10H_2O$	Per cent Na_2CO_3	Specific gravity	Per cent Na_2CO_3 $+10H_2O$	Per cent Na_2CO_3
1·0038	1	·370	1·0628	16	5·929
1·0076	2	.741	1·0668	17	6·299
1·0141	3	1·112	1·0708	18	6·670
1·0153	4	1·482	1·0748	19	7·011
1·0192	5	1·853	1·0789	20	7·412
1·0231	6	2·223	1·0830	21	7·782
1·0270	7	2·594	1·0871	22	8·153
1·0309	8	2·965	1·0912	23	8·523
1·0348	9	3·335	1·0953	24	8·894
1·0388	10	3·706	1·0994	25	9·264
1·0428	11	4·076	1·1035	26	9·635
1·0468	12	4·447	1·1076	27	10·005
1·0508	13	4·817	1·1117	28	10·376
1·0548	14	5·188	1·1158	29	10·746
1·0588	15	5·558	1·1200	30	11·118

SODIUM CHLORIDE

Specific Gravity of Aqueous Solutions at 15° C. (Gerlach).

Specific gravity.	Per cent NaCl.	Specific gravity.	Per cent NaCl.	Specific gravity.	Per cent NaCl.
1.00725	1	1.07335	10	1.14315	19
1.01450	2	1.08097	11	1.15107	20
1.02174	3	1.08859	12	1.15931	21
1.02899	4	1.09622	13	1.16755	22
1.03624	5	1.10384	14	1.17580	23
1.04366	6	1.11146	15	1.18404	24
1.05108	7	1.11938	16	1.19228	25
1.05851	8	1.12730	17	1.20098	26
1.06593	9	1.13523	18	1.20433	26.395

POTASSIUM CHLORIDE

Specific Gravity of Aqueous Solutions at 15° C. (Gerlach).

Specific gravity.	Per cent KCl.	Specific gravity.	Per cent KCl.	Specific gravity.	Per cent KCl.
1.00650	1	1.06580	10	1.12179	18
1.01300	2	1.07271	11	1.12894	19
1.01950	3	1.07962	12	1.13608	20
1.02600	4	1.08652	13	1.14348	21
1.03250	5	1.09345	14	1.15088	22
1.03916	6	1.10036	15	1.15828	23
1.04582	7	1.10750	16	1.16568	24
1.05248	8	1.11465	17	1.17234	24.9
1.05914	9				

AMMONIUM CHLORIDE

Specific Gravity of Aqueous Solutions at 15° C. (Gerlach).

Specific gravity.	Per cent NH_4Cl.	Specific gravity.	Per cent NH_4Cl.	Specific gravity.	Per cent NH_4Cl.
1.00316	1	1.03081	10	1.05648	19
1.00632	2	1.03370	11	1.05929	20
1.00948	3	1.03658	12	1.06204	21
1.01264	4	1.03947	13	1.06479	22
1.01580	5	1.04325	14	1.06754	23
1.01880	6	1.04524	15	1.07029	24
1.02180	7	1.04805	16	1.07304	25
1.02481	8	1.05806	17	1.07575	26
1.02781	9	1.05367	18	1.07658	26.297

ETHYL ALCOHOL

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Giving the specific gravity at 15.56° C. referred to water at the same temperature. To reduce to specific gravity referred to water at 4° C. multiply by 0.99908.

(U. S. Department of Agriculture.)

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
1.00000	0.00	0.00	0.00	0.99431	3.90	3.12	3.10
0.99984	0.10	0.08	0.08	0.99417	4.00	3.20	3.18
0.99968	0.20	0.16	0.16	0.99403	4.10	3.28	3.26
0.99953	0.30	0.24	0.24	0.99390	4.20	3.36	3.34
0.99937	0.40	0.32	0.32	0.99376	4.30	3.44	3.42
0.99923	0.50	0.40	0.40	0.99363	4.40	3.52	3.50
0.99907	0.60	0.48	0.48	0.99349	4.50	3.60	3.58
0.99892	0.70	0.56	0.56	0.99335	4.60	3.68	3.66
0.99877	0.80	0.64	0.64	0.99322	4.70	3.76	3.74
0.99861	0.90	0.71	0.71	0.99308	4.80	3.84	3.81
0.99849	1.00	0.79	0.79	0.99295	4.90	3.92	3.89
0.99834	1.10	0.87	0.87	0.99281	5.00	4.00	3.97
0.99819	1.20	0.95	0.95	0.99268	5.10	4.08	4.05
0.99805	1.30	1.03	1.03	0.99255	5.20	4.16	4.13
0.99790	1.40	1.11	1.11	0.99241	5.30	4.24	4.21
0.99775	1.50	1.19	1.19	0.99228	5.40	4.32	4.29
0.99760	1.60	1.27	1.27	0.99215	5.50	4.40	4.37
0.99745	1.70	1.35	1.35	0.99202	5.60	4.48	4.44
0.99731	1.80	1.43	1.43	0.99189	5.70	4.56	4.52
0.99716	1.90	1.51	1.51	0.99175	5.80	4.64	4.60
0.99701	2.00	1.59	1.59	0.99162	5.90	4.72	4.68
0.99687	2.10	1.67	1.66	0.99149	6.00	4.80	4.76
0.99672	2.20	1.75	1.74	0.99136	6.10	4.88	4.84
0.99658	2.30	1.83	1.82	0.99123	6.20	4.96	4.92
0.99643	2.40	1.91	1.90	0.99111	6.30	5.05	5.00
0.99629	2.50	1.99	1.98	0.99098	6.40	5.13	5.08
0.99615	2.60	2.07	2.06	0.99085	6.50	5.21	5.16
0.99600	2.70	2.15	2.14	0.99072	6.60	5.29	5.24
0.99586	2.80	2.23	2.22	0.99059	6.70	5.37	5.32
0.99571	2.90	2.31	2.30	0.99047	6.80	5.45	5.40
0.99557	3.00	2.39	2.38	0.99034	6.90	5.53	5.48
0.99543	3.10	2.47	2.46	0.99021	7.00	5.61	5.56
0.99529	3.20	2.55	2.54	0.99009	7.10	5.69	5.64
0.99515	3.30	2.64	2.62	0.98996	7.20	5.77	5.72
0.99501	3.40	2.72	2.70	0.98984	7.30	5.86	5.80
0.99487	3.50	2.80	2.78	0.98971	7.40	5.94	5.88
0.99473	3.60	2.88	2.86	0.98959	7.50	6.02	5.96
0.99459	3.70	2.96	2.94	0.98947	7.60	6.10	6.04
0.99445	3.80	3.04	3.02	0.98934	7.70	6.18	6.11

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.98922	7.80	6.26	6.19	0.98435	12.00	9.67	9.52
0.98909	7.90	6.34	6.27	0.98424	12.10	9.75	9.60
0.98897	8.00	6.42	6.35	0.98413	12.20	9.83	9.68
0.98885	8.10	6.50	6.43	0.98402	12.30	9.92	9.76
0.98873	8.20	6.58	6.51	0.98391	12.40	10.00	9.84
0.98861	8.30	6.67	6.59	0.98381	12.50	10.08	9.92
0.98849	8.40	6.75	6.67	0.98370	12.60	10.16	10.00
0.98837	8.50	6.83	6.75	0.98359	12.70	10.24	10.07
0.98825	8.60	6.91	6.83	0.98348	12.80	10.33	10.15
0.98813	8.70	6.99	6.91	0.98337	12.90	10.41	10.23
0.98801	8.80	7.07	6.99	0.98326	13.00	10.49	10.31
0.98789	8.90	7.15	7.07	0.98315	13.10	10.57	10.39
0.98777	9.00	7.23	7.14	0.98305	13.20	10.65	10.47
0.98765	9.10	7.31	7.22	0.98294	13.30	10.74	10.55
0.98754	9.20	7.39	7.30	0.98283	13.40	10.82	10.63
0.98742	9.30	7.48	7.38	0.98273	13.50	10.90	10.71
0.98730	9.40	7.56	7.46	0.98262	13.60	10.98	10.79
0.99719	9.50	7.64	7.54	0.98251	13.70	11.06	10.87
0.98707	9.60	7.72	7.62	0.98240	13.80	11.15	10.95
0.98695	9.70	7.80	7.70	0.98230	13.90	11.23	11.03
0.98683	9.80	7.88	7.78	0.98219	14.00	11.31	11.11
0.98672	9.90	7.96	7.85	0.98209	14.10	11.39	11.19
0.98660	10.00	8.04	7.93	0.98198	14.20	11.47	11.27
0.98649	10.10	8.12	8.01	0.98188	14.30	11.56	11.35
0.98637	10.20	8.20	8.09	0.98177	14.40	11.64	11.43
0.98626	10.30	8.29	8.17	0.98167	14.50	11.72	11.51
0.98614	10.40	8.37	8.25	0.98156	14.60	11.80	11.59
0.98603	10.50	8.45	8.33	0.98146	14.70	11.88	11.67
0.98592	10.60	8.53	8.41	0.98135	14.80	11.97	11.75
0.98580	10.70	8.61	8.49	0.98125	14.90	12.05	11.82
0.98569	10.80	8.70	8.57	0.98114	15.00	12.13	11.90
0.98557	10.90	8.78	8.65	0.98104	15.10	12.21	11.98
0.98546	11.00	8.86	8.73	0.98093	15.20	12.29	12.06
0.98535	11.10	8.94	8.81	0.98083	15.30	12.38	12.14
0.98524	11.20	9.02	8.89	0.98073	15.40	12.46	12.22
0.98513	11.30	9.11	8.97	0.98063	15.50	12.54	12.30
0.98502	11.40	9.19	9.05	0.98052	15.60	12.62	12.37
0.98491	11.50	9.27	9.13	0.98042	15.70	12.70	12.45
0.98479	11.60	9.35	9.21	0.98032	15.80	12.79	12.53
0.98468	11.70	9.43	9.29	0.98021	15.90	12.87	12.61
0.98457	11.80	9.51	9.36	0.98011	16.00	12.95	12.69
0.98446	11.90	9.59	9.44	0.98001	16.10	13.03	12.77

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.97991	16.20	13.12	12.85	0.97568	20.40	16.59	16.18
0.97980	16.30	13.20	12.93	0.97558	20.50	16.67	16.26
0.97970	16.40	13.29	13.01	0.97547	20.60	16.75	16.34
0.97960	16.50	13.37	13.09	0.97537	20.70	16.84	16.42
0.97950	16.60	13.45	13.17	0.97527	20.80	16.92	16.50
0.97940	16.70	13.53	13.25	0.97517	20.90	17.01	16.58
0.97929	16.80	13.62	13.33	0.97507	21.00	17.09	16.66
0.97917	16.90	13.70	13.41	0.97497	21.10	17.17	16.74
0.97909	17.00	13.78	13.49	0.97487	21.20	17.26	16.82
0.97899	17.10	13.86	13.57	0.97477	21.30	17.34	16.90
0.97889	17.20	13.94	13.65	0.97467	21.40	17.43	16.98
0.97879	17.30	14.03	13.73	0.97457	21.50	17.51	17.06
0.97869	17.40	14.11	13.81	0.97446	21.60	17.59	17.14
0.97859	17.50	14.19	13.89	0.97436	21.70	17.67	17.22
0.97848	17.60	14.27	13.96	0.97426	21.80	17.76	17.30
0.97838	17.70	14.35	14.04	0.97416	21.90	17.84	17.38
0.97828	17.80	14.44	14.12	0.97406	22.00	17.92	17.46
0.97818	17.90	14.52	14.20	0.97396	22.10	18.00	17.54
0.97808	18.00	14.60	14.28	0.97386	22.20	18.09	17.62
0.97798	18.10	14.68	14.36	0.97375	22.30	18.17	17.70
0.97788	18.20	14.77	14.44	0.97365	22.40	18.26	17.78
0.97778	18.30	14.85	14.52	0.97355	22.50	18.34	17.86
0.97768	18.40	14.94	14.60	0.97345	22.60	18.42	17.94
0.97758	18.50	15.02	14.68	0.97335	22.70	18.51	18.02
0.97748	18.60	15.10	14.76	0.97324	22.80	18.59	18.10
0.97738	18.70	15.18	14.84	0.97314	22.90	18.68	18.18
0.97728	18.80	15.27	14.92	0.97304	23.00	18.76	18.26
0.97718	18.90	15.38	15.00	0.97294	23.10	18.84	18.33
0.97708	19.00	15.43	15.08	0.97283	23.20	18.92	18.41
0.97698	19.10	15.51	15.15	0.97273	23.30	19.01	18.49
0.97688	19.20	15.59	15.23	0.97263	23.40	19.09	18.57
0.97678	19.30	15.68	15.31	0.97253	23.50	19.17	18.65
0.97668	19.40	15.76	15.39	0.97242	23.60	19.25	18.73
0.97658	19.50	15.84	15.47	0.97232	23.70	19.34	18.18
0.97648	19.60	15.93	15.55	0.97222	23.80	19.42	18.88
0.97638	19.70	16.01	15.63	0.97211	23.90	19.51	18.96
0.97628	19.80	16.09	15.71	0.97201	24.00	19.59	19.04
0.97618	19.90	16.18	15.79	0.97191	24.10	19.67	19.12
0.97608	20.00	16.26	15.87	0.97180	24.20	19.76	19.20
0.97598	20.10	16.34	15.95	0.97170	24.30	19.84	19.28
0.97588	20.20	16.42	16.03	0.97159	24.40	19.93	19.36
0.97578	20.30	16.51	16.10	0.97149	24.50	20.01	19.44

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.97139	24.60	20.09	19.52	0.96681	28.80	23.64	22.85
0.97128	24.70	20.18	19.60	0.96669	28.90	23.72	22.93
0.97118	24.80	20.26	19.68	0.96658	29.00	23.81	23.01
0.97107	24.90	20.35	19.76	0.96646	29.10	23.89	23.09
0.97097	25.00	20.43	19.84	0.96635	29.20	23.98	23.17
0.97086	25.10	20.51	19.92	0.96623	29.30	24.06	23.25
0.97076	25.20	20.60	20.00	0.96611	29.40	24.15	23.33
0.97065	25.30	20.68	20.08	0.96600	29.50	24.23	23.41
0.97055	25.40	20.77	20.16	0.96587	29.60	24.32	23.49
0.97044	25.50	20.85	20.24	0.96576	29.70	24.40	23.57
0.97033	25.60	20.93	20.32	0.96564	29.80	24.49	23.65
0.97023	25.70	21.02	20.40	0.96553	29.90	24.57	23.73
0.97012	25.80	21.10	20.47	0.96541	30.00	24.66	23.81
0.97001	25.90	21.19	20.55	0.96529	30.10	24.74	23.89
0.96991	26.00	21.27	20.63	0.96517	30.20	24.83	23.97
0.96980	26.10	21.35	20.71	0.96505	30.30	24.91	24.04
0.96969	26.20	21.44	20.79	0.96493	30.40	25.00	24.12
0.96959	26.30	21.52	20.87	0.96481	30.50	25.08	24.20
0.96949	26.40	21.61	20.95	0.96469	30.60	25.17	24.28
0.96937	26.50	21.69	21.03	0.96457	30.70	25.25	24.36
0.96926	26.60	21.77	21.11	0.96445	30.80	25.34	24.44
0.96915	26.70	21.86	21.19	0.96433	30.90	25.42	24.52
0.96905	26.80	21.94	21.27	0.96421	31.00	25.51	24.60
0.96894	26.90	22.03	21.35	0.96409	31.10	25.60	24.68
0.96883	27.00	22.11	21.43	0.96396	31.20	25.68	24.76
0.96872	27.10	22.20	21.51	0.96384	31.30	25.77	24.84
0.96861	27.20	22.28	21.59	0.96372	31.40	25.85	24.92
0.96850	27.30	22.37	21.67	0.96360	31.50	25.94	25.00
0.96839	27.40	22.45	21.75	0.96347	31.60	26.03	25.08
0.96828	27.50	22.54	21.83	0.96335	31.70	26.11	25.16
0.96816	27.60	22.62	21.90	0.96323	31.80	26.20	25.24
0.96805	27.70	22.71	21.98	0.96310	31.90	26.28	25.32
0.96794	27.80	22.79	22.06	0.96298	32.00	26.37	25.40
0.96783	27.90	22.88	22.14	0.96285	32.10	26.46	25.48
0.96772	28.00	22.96	22.22	0.96273	32.20	26.54	25.56
0.96761	28.10	23.04	22.30	0.96260	32.30	26.63	25.64
0.96749	28.20	23.13	22.38	0.96248	32.40	26.71	25.71
0.96738	28.30	23.21	22.45	0.96235	32.50	26.80	25.79
0.96726	28.40	23.30	22.53	0.96222	32.60	26.89	25.87
0.96715	28.50	23.38	22.61	0.96210	32.70	26.97	25.95
0.96704	28.60	23.47	22.69	0.96197	32.80	27.06	26.03
0.96692	28.70	23.55	22.77	0.96185	32.90	27.14	26.11

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.96172	33.00	27.23	26.19	0.95603	37.20	30.88	29.52
0.96159	33.10	27.32	26.27	0.95589	37.30	30.96	29.60
0.96146	33.20	27.40	26.35	0.95574	37.40	31.05	29.68
0.96133	33.30	27.49	26.43	0.95560	37.50	31.14	29.76
0.96120	33.40	27.57	26.51	0.95545	37.60	31.23	29.84
0.96108	33.50	27.66	26.59	0.95531	37.70	31.32	29.92
0.96095	33.60	27.75	26.67	0.95516	37.80	31.40	30.00
0.96082	33.70	27.83	26.75	0.95502	37.90	31.49	30.08
0.96069	33.80	27.92	26.82	0.95487	38.00	31.58	30.16
0.96056	33.90	28.00	26.90	0.95472	38.10	31.67	30.24
0.96043	34.00	28.09	26.98	0.95457	38.20	31.76	30.32
0.96030	34.10	28.18	27.06	0.95442	38.30	31.85	30.40
0.96016	34.20	28.26	27.14	0.95427	38.40	31.94	30.48
0.96003	34.30	28.35	27.22	0.95413	38.50	32.03	30.56
0.95990	34.40	28.43	27.30	0.95398	38.60	32.12	30.64
0.95977	34.50	28.52	27.38	0.95383	38.70	32.20	30.72
0.95963	34.60	28.61	27.46	0.95368	38.80	32.29	30.79
0.95950	34.70	28.70	27.54	0.95353	38.90	32.37	30.87
0.95937	34.80	28.78	27.62	0.95338	39.00	32.46	30.95
0.95923	34.90	28.87	27.70	0.95323	39.10	32.55	31.03
0.95910	35.00	28.96	27.78	0.95307	39.20	32.64	31.11
0.95896	35.10	29.05	27.86	0.95292	39.30	32.72	31.18
0.95883	35.20	29.13	27.94	0.95277	39.40	32.81	31.26
0.95869	35.30	29.22	28.02	0.95262	39.50	32.90	31.34
0.95855	35.40	29.30	28.09	0.95246	39.60	32.99	31.42
0.95842	35.50	29.38	28.17	0.95231	39.70	33.08	31.50
0.95828	35.60	29.48	28.25	0.95216	39.80	33.17	31.58
0.95814	35.70	29.57	28.33	0.95200	39.90	33.27	31.66
0.95800	35.80	29.65	28.41	0.95185	40.00	33.35	31.74
0.95787	35.90	29.74	28.49	0.95169	40.10	33.44	31.82
0.95773	36.00	29.83	28.57	0.95154	40.20	33.53	31.90
0.95759	36.10	29.92	28.65	0.95138	40.30	33.61	31.98
0.95745	36.20	30.00	28.73	0.95122	40.40	33.70	32.06
0.95731	36.30	30.09	28.81	0.95107	40.50	33.79	32.14
0.95717	36.40	30.17	28.88	0.95091	40.60	33.88	32.22
0.95703	36.50	30.26	28.96	0.95075	40.70	33.97	32.30
0.95688	36.60	30.35	29.04	0.95059	40.80	34.06	32.38
0.95674	36.70	30.44	29.12	0.95044	40.90	34.15	32.46
0.95660	36.80	30.52	29.20	0.95028	41.00	34.24	32.54
0.95646	36.90	30.61	29.29	0.95012	41.10	34.33	32.62
0.95632	37.00	30.70	29.36	0.94996	41.20	34.42	32.70
0.95618	37.10	30.79	29.44	0.94980	41.30	34.50	32.78

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.94964	41.40	34.59	32.86	0.94258	45.60	38.39	36.19
0.94948	41.50	34.68	32.93	0.94241	45.70	38.48	36.26
0.94932	41.60	34.77	33.01	0.94223	45.80	38.57	36.34
0.94916	41.70	34.86	33.09	0.94206	45.90	38.66	36.42
0.94900	41.80	34.95	33.17	0.94188	46.00	38.75	36.50
0.94884	41.90	35.04	33.25	0.94170	46.10	38.84	36.58
0.94868	42.00	35.13	33.33	0.94152	46.20	38.93	36.66
0.94852	42.10	35.22	33.41	0.94134	46.30	39.03	36.74
0.94835	42.20	35.31	33.49	0.94116	46.40	39.12	36.82
0.94810	42.30	35.40	33.57	0.94098	46.50	39.21	36.90
0.94802	42.40	35.49	33.65	0.94080	46.60	39.30	36.98
0.94786	42.50	35.58	33.73	0.94062	46.70	39.39	37.06
0.94770	42.60	35.67	33.81	0.94044	46.80	39.49	37.13
0.94753	42.70	35.76	33.89	0.94026	46.90	39.58	37.21
0.94737	42.80	35.85	33.97	0.94008	47.00	39.67	37.29
0.94720	42.90	35.94	34.04	0.93990	47.10	39.76	37.37
0.94704	43.00	36.03	34.12	0.93971	47.20	39.85	37.45
0.94687	43.10	36.12	34.20	0.93953	47.30	39.95	37.53
0.94670	43.20	36.21	34.28	0.93934	47.40	40.04	37.61
0.94654	43.30	36.30	34.36	0.93916	47.50	40.13	37.69
0.94637	43.40	36.39	34.44	0.93898	47.60	40.22	37.77
0.94620	43.50	36.48	34.52	0.93879	47.70	40.32	37.85
0.94603	43.60	36.57	34.60	0.93861	47.80	40.41	37.93
0.94586	43.70	36.66	34.68	0.93842	47.90	40.51	38.01
0.94570	43.80	36.75	34.76	0.93824	48.00	40.60	38.09
0.94553	43.90	36.84	34.84	0.93805	48.10	40.69	38.17
0.94536	44.00	36.93	34.91	0.93786	48.20	40.78	38.25
0.94519	44.10	37.02	34.99	0.93768	48.30	40.88	38.33
0.94502	44.20	37.11	35.07	0.93749	48.40	40.97	38.41
0.94484	44.30	37.21	35.15	0.93730	48.50	41.06	38.49
0.94467	44.40	37.30	35.23	0.93711	48.60	41.15	38.57
0.94450	44.50	37.39	35.31	0.93692	48.70	41.24	38.65
0.94433	44.60	37.48	35.39	0.93679	48.80	41.34	38.72
0.94416	44.70	37.57	35.47	0.93655	48.90	41.43	38.80
0.94398	44.80	37.66	35.55	0.93636	49.00	41.52	38.88
0.94381	44.90	37.76	35.63	0.93617	49.10	41.61	38.96
0.94364	45.00	37.84	35.71	0.93598	49.20	41.71	39.04
0.94346	45.10	37.93	35.79	0.93578	49.30	41.80	39.12
0.94329	45.20	38.02	35.87	0.93559	49.40	41.90	39.20
0.94311	45.30	38.12	35.95	0.93540	49.50	41.99	39.28
0.94294	45.40	38.21	36.03	0.93521	49.60	42.08	39.36
0.94276	45.50	38.30	36.11	0.93502	49.70	42.18	39.44

ETHYL ALCOHOL (Continued)

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Volume and by Weight

Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.	Specific gravity.	Per cent alcohol by volume.	Per cent alcohol by weight.	Grams alcohol per 100 c.c.
0.93482	49.80	42.27	39.52	0.8773	75.00	....	....
0.93463	49.90	42.37	39.60	0.8747	76.00	....	....
0.9344	50.00	....*	....	0.8721	77.00	....	....
0.9325	51.00	....	....	0.8694	78.00	....	....
0.9305	52.00	....	....	0.8667	79.00	....	....
0.9285	53.00	....	....	0.8639	80.00	....	....
0.9264	54.00	....	....	0.8611	81.00	....	....
0.9244	55.00	....	....	0.8583	82.00	....	....
0.9222	56.00	....	....	0.8554	83.00	....	....
0.9201	57.00	....	....	0.8525	84.00	....	....
0.9180	58.00	....	....	0.8496	85.00	....	....
0.9158	59.00	....	....	0.8465	86.00	....	....
0.9136	60.00	....	....	0.8435	87.00	....	....
0.9113	61.00	....	....	0.8404	88.00	....	....
0.9091	62.00	....	....	0.8372	89.00	....	....
0.9068	63.00	....	....	0.8339	90.00	....	....
0.9044	64.00	....	....	0.8306	91.00	....	....
0.9021	65.00	....	....	0.8272	92.00	....	....
0.8997	66.00	....	....	0.8236	93.00	....	....
0.8974	67.00	....	....	0.8199	94.00	....	....
0.8949	68.00	....	....	0.8161	95.00	....	....
0.8925	69.00	....	....	0.8121	96.00	....	....
0.8900	70.00	....	....	0.8079	97.00	....	....
0.8876	71.00	....	....	0.8035	98.00	....	....
0.8850	72.00	....	....	0.7989	99.00	....	....
0.8825	73.00	....	....	0.7939	100.00	....	....
0.8799	74.00	....	....	......	......	....	....

* For specific gravity of mixtures by weight see following table.

ETHYL ALCOHOL

Specific Gravity of Mixtures of Ethyl Alcohol and Water by Weight

The table gives the specific gravity at the temperature indicated referred to water at 4° C.

(U. S. Bureau of Standards.)

Per cent alcohol by weight.	15° C.	20° C.	25° C.	Per cent alcohol by weight.	15° C.	20° C.	25° C.
0	0.99913	0.99821	0.99708	51	0.91566	0.91164	0.90754
1	0.99725	0.99636	0.99521	52	0.91344	0.90940	0.90535
2	0.99543	0.99453	0.99338	53	0.91120	0.90715	0.90307
3	0.99366	0.99274	0.99159	54	0.90895	0.90488	0.90079
4	0.99197	0.99102	0.98984	55	0.90670	0.90262	0.89851
5	0.99033	0.98936	0.98815	56	0.90443	0.90034	0.89622
6	0.98877	0.98776	0.98651	57	0.90215	0.89805	0.89392
7	0.98726	0.98620	0.98491	58	0.89987	0.89576	0.89162
8	0.98581	0.98470	0.98336	59	0.89758	0.89346	0.88931
9	0.98442	0.98325	0.98185	60	0.89528	0.89115	0.88700
10	0.98307	0.98185	0.98038	61	0.89297	0.88883	0.88467
11	0.98176	0.98047	0.97893	62	0.89066	0.88651	0.88234
12	0.98049	0.97913	0.97752	63	0.88834	0.88418	0.88000
13	0.97925	0.97781	0.97612	64	0.88601	0.88185	0.87766
14	0.97803	0.97651	0.97474	65	0.88368	0.87950	0.87530
15	0.97683	0.97522	0.97336	66	0.88134	0.87716	0.87295
16	0.97563	0.97393	0.97199	67	0.87899	0.87480	0.87058
17	0.97444	0.97264	0.97061	68	0.87664	0.87244	0.86821
18	0.97324	0.97134	0.96922	69	0.87428	0.87008	0.86583
19	0.97203	0.97003	0.96782	70	0.87192	0.86770	0.86344
20	0.97080	0.96870	0.96640	71	0.86954	0.86532	0.86105
21	0.96956	0.96736	0.96497	72	0.86716	0.86292	0.85864
22	0.96829	0.96599	0.96352	73	0.86477	0.86052	0.85622
23	0.96699	0.96459	0.96203	74	0.86237	0.85812	0.85380
24	0.96566	0.96317	0.96052	75	0.85997	0.85570	0.85137
25	0.96430	0.96171	0.95897	76	0.85755	0.85328	0.84893
26	0.96289	0.96021	0.95739	77	0.85513	0.85084	0.84648
27	0.96145	0.95868	0.95577	78	0.85270	0.84840	0.84403
28	0.95997	0.95711	0.95412	79	0.85026	0.84595	0.84157
29	0.95845	0.95550	0.95244	80	0.84781	0.84349	0.83909
30	0.95688	0.95385	0.95071	81	0.84534	0.84101	0.83660
31	0.95526	0.95215	0.94894	82	0.84286	0.83852	0.83410
32	0.95360	0.95042	0.94713	83	0.84037	0.83602	0.83159
33	0.95191	0.94865	0.94529	84	0.83786	0.83350	0.82906
34	0.95017	0.94684	0.94342	85	0.83534	0.83097	0.82652
35	0.94839	0.94499	0.94152	86	0.83279	0.82842	0.82396
36	0.94657	0.94311	0.93957	87	0.83022	0.82583	0.82137
37	0.94471	0.94119	0.93760	88	0.82762	0.82323	0.81876
38	0.94282	0.93924	0.93560	89	0.82500	0.82060	0.81613
39	0.94089	0.93725	0.93356	90	0.82235	0.81795	0.81348
40	0.93893	0.93524	0.93151	91	0.81966	0.81527	0.81080
41	0.93694	0.93320	0.92943	92	0.81694	0.81255	0.80809
42	0.93491	0.93113	0.92732	93	0.81418	0.80979	0.80534
43	0.93286	0.92904	0.92519	94	0.81138	0.80700	0.80256
44	0.93078	0.92693	0.92305	95	0.80854	0.80417	0.79974
45	0.92868	0.92480	0.92088	96	0.80564	0.80129	0.79689
46	0.92655	0.92264	0.91870	97	0.80271	0.79838	0.79400
47	0.92441	0.92047	0.91650	98	0.79972	0.79541	0.79106
48	0.92225	0.91828	0.91429	99	0.79668	0.79240	0.78809
49	0.92006	0.91608	0.91207	100	0.79358	0.78933	0.78507
50	0.91787	0.91386	0.90983	.....	....	....	....

METHYL ALCOHOL

(Wood Alcohol; Methanol)

Specific Gravity of Mixtures of Methyl Alcohol and Water in Grams per 100 Grams of Solution.

Doroshewski and Rostdestwenski.

Specific gravity 15°/4°	Per cent alcohol by weight	Specific gravity 15°/4°	Per cent alcohol by weight
0.99727	1	0.91653	51
99543	2	91451	52
99370	3	91248	53
99198	4	91044	54
99029	5	90839	55
98864	6	90631	56
98701	7	90421	57
98547	8	90210	58
98394	9	89996	59
98241	10	89780	60
98091	11	89563	61
97945	12	89341	62
97802	13	89117	63
97660	14	88890	64
97518	15	88662	65
97377	16	88433	66
97237	17	88203	67
97096	18	88071	68
96955	19	87739	69
96814	20	87508	70
96674	21	87271	71
96533	22	87033	72
96392	23	86792	73
96251	24	86546	74
96108	25	86301	75
95963	26	86051	76
95817	27	85801	77
95668	28	85551	78
85518	29	85299	79
95366	30	85048	80
95213	31	84794	81
95056	32	84536	82
94896	33	84274	83
94734	34	84009	84
94570	35	83742	85
94405	36	83475	86
94237	37	83207	87
94067	38	82937	88
93894	39	82668	89
93720	40	82396	90
93543	41	82124	91
93365	42	81849	92
93185	43	81568	93
93001	44	81285	94
92815	45	80999	95
92627	46	80713	96
92436	47	80428	97
92242	48	80143	98
92048	49	79859	99
91852	50	79578	100

TABLES OF THE MANUFACTURING CHEMISTS' ASSOCIATION

SULPHURIC ACID

Authorities — W. C. Ferguson; H. P. Talbot

This table has been approved and adopted as a standard by the Manufacturing Chemists' Association of the United States.

Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = 145 - \frac{145}{\text{Sp. Gr.}}.$$

Baumé Hydrometers for use with this table must be graduated by the above formula, which formula should always be printed on the scale.

66° Baumé = Sp. Gr. 1.8354.

1 cu. ft. water at 60° F. weighs 62.37 lbs. av.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

H_2SO_4 = 100 per cent.

	H_2SO_4	O. V.	60°
O. V.	93.19	100.00	119.98
60°	77.67	83.35	100.00
50°	62.18	66.72	80.06

Acids stronger than 66° Bé. should have their percentage compositions determined by chemical analysis.

Bé.°	Sp. gr.	Tw.°	Per cent H_2SO	Weight of 1 cu. ft. in lbs. av.	Per cent O. V.	Pounds O. V. in 1 cu. ft.	* Freezing (melting) point.
0	1.0000	0.0	0.00	62.37	0.00	0.00	32.0° F.
1	1.0069	1.4	1.02	62.80	1.09	.68	31.2 "
2	1.0140	2.8	2.08	63.24	2.23	1.41	30.5 "
3	1.0211	4.2	3.13	63.69	3.36	2.14	29.8 "
4	1.0284	5.7	4.21	64.14	4.52	2.90	28.9 "
5	1.0357	7.1	5.28	64.60	5.67	3.66	28.1 "
6	1.0432	8.6	6.37	65.06	6.84	4.45	27.2 "
7	1.0507	10.1	7.45	65.53	7.99	5.24	26.3 "
8	1.0584	11.7	8.55	66.01	9.17	6.06	25.1 "
9	1.0662	13.2	9.66	66.50	10.37	6.89	24.0 "
10	1.0741	14.8	10.77	66.99	11.56	7.74	22.8 "
11	1.0821	16.4	11.89	67.49	12.76	8.61	21.5 "
12	1.0902	18.0	13.01	68.00	13.96	9.49	20.0 "
13	1.0985	19.7	14.13	68.51	15.16	10.39	18.3 "
14	1.1069	21.4	15.25	69.04	16.36	11.30	16.6 "

* Calculated from Pickering's results, Journal of London Chemical Society, vol. 57, p. 363.

SULPHURIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent H_2SO_4	Weight of 1 cu. ft. in lbs. av.	Per cent O. V.	Pounds O. V. in 1 cu. ft.	* Freezing (melting) point.
15	1.1154	23.1	16.38	69.57	17.58	12.23	14.7 F.
16	1.1240	24.8	17.53	70.10	18.81	13.19	12.6 "
17	1.1328	26.6	18.71	70.65	20.08	14.18	10.2 "
18	1.1417	28.3	19.89	71.21	21.34	15.20	7.7 "
19	1.1508	30.2	21.07	71.78	22.61	16.23	4.8 "
20	1.1600	32.0	22.25	72.35	23.87	17.27	+ 1.6 "
21	1.1694	33.9	23.43	72.94	25.14	18.34	− 1.8 "
22	1.1789	35.8	24.61	73.53	26.41	19.42	− 6.0 "
23	1.1885	37.7	25.81	74.13	27.69	20.53	−11 "
24	1.1983	39.7	27.03	74.74	29.00	21.68	−16 "
25	1.2083	41.7	28.28	75.36	30.34	22.87	−23 "
26	1.2185	43.7	29.53	76.00	31.69	24.08	−30 "
27	1.2288	45.8	30.79	76.64	33.04	25.32	−39 "
28	1.2393	47.9	32.05	77.30	34.39	26.58	−49 "
29	1.2500	50.0	33.33	77.96	35.76	27.88	−61 "
30	1.2609	52.2	34.63	78.64	37.16	29.22	−74 "
31	1.2719	54.4	35.93	79.33	38.55	30.58	−82 "
32	1.2832	56.6	37.26	80.03	39.98	32.00	−96 "
33	1.2946	58.9	38.58	80.74	41.40	33.42	−97 "
34	1.3063	61.3	39.92	81.47	42.83	34.90	−91 "
35	1.3182	63.6	41.27	82.22	44.28	36.41	−81 "
36	1.3303	66.1	42.63	82.97	45.74	37.95	−70 "
37	1.3426	68.5	43.99	83.74	47.20	39.53	−60 "
38	1.3551	71.0	45.35	84.52	48.66	41.13	−53 "
39	1.3679	73.6	46.72	85.32	50.13	42.77	−47 "
40	1.3810	76.2	48.10	86.13	51.61	44.45	−41 "
41	1.3942	78.8	49.47	86.96	53.08	46.16	−35 "
42	1.4078	81.6	50.87	87.80	54.58	47.92	−31 "
43	1.4216	84.3	52.26	88.67	56.07	49.72	−27 "
44	1.4356	87.1	53.66	89.54	57.58	51.56	−23 "
45	1.4500	90.0	55.07	90.44	59.09	53.44	−20 "
46	1.4646	92.9	56.48	91.35	60.60	55.36	−14 "
47	1.4796	95.9	57.90	92.28	62.13	57.33	−15 "
48	1.4948	99.0	59.32	93.23	63.65	59.34	−18 "
49	1.5104	102.1	60.75	94.20	65.18	61.40	−22 "

* Calculated from Pickering's results, Journal of London Chemical Society vol. 57, p. 363.

SULPHURIC ACID (Continued)

Bé.*	Sp. gr.	Tw.°	Per cent H_2SO_4	Weight of 1 cu. ft. in lbs. av.	Per cent O. V.	Pounds O. V. in 1 cu.ft.	*Freezing (melting) point
50	1.5263	105.3	62.18	95.20	66.72	63.52	−27 F.
51	1.5426	108.5	63.66	96.21	68.31	65.72	−33 "
52	1.5591	111.8	65.13	97.24	69.89	67.96	−39 "
53	1.5761	115.2	66.63	98.30	71.50	70.28	−49 "
54	1.5934	118.7	68.13	99.38	73.11	72.66	−59 "
55	1.6111	122.2	69.65	100.48	74.74	75.10	..
56	1.6292	125.8	71.17	101.61	76.37	77.60	..
57	1.6477	129.5	72.75	102.77	78.07	80.23	.. Below − 40
58	1.6667	133.3	74.36	103.95	79.79	82.95	..
59	1.6860	137.2	75.99	105.16	81.54	85.75	− 7
60	1.7059	141.2	77.67	106.40	83.35	88.68	+12.6 F.
61	1.7262	145.2	79.43	107.66	85.23	91.76	27.3 "
62	1.7470	149.4	81.30	108.96	87.24	95.06	39.1 "
63	1.7683	153.7	83.34	110.29	89.43	98.63	46.1 "
64	1.7901	158.0	85.66	111.65	91.92	102.63	46.4 "
64¼	1.7957	159.1	86.33	112.00	92.64	103.75	43.6 "
64½	1.8012	150.2	87.04	112.34	93.40	104.93	41.1 "
64¾	1.8068	161.4	87.81	112.69	94.23	106.19	37.9 "
65	1.8125	162.5	88.65	113.05	95.13	107.54	33.1 "
65¼	1.8182	163.6	89.55	113.40	96.10	108.97	24.6 "
65½	1.8239	164.8	90.60	113.76	97.22	110.60	13.4 "
65¾	1.8297	165.9	91.80	114.12	98.51	112.42	− 1 "
66	1.8354	167.1	93.19	114.47	10.00	114.47	−29 "

* Calculated from Pickering's results, Journal of London Chemical Society, vol. 57, p. 363.

APPROXIMATE BOILING POINTS

50° Bé. 295 F.
60° " 386 "
61° " 400 "
62° " 415 "
63° " 432 "
64° " 451 "
65° " 485 "
66° " 538 "

Per cent 60°	Pounds 60° in 1 cu. ft.	Per cent 50°	Pounds 50° in 1 cu. ft
61.93	53.34	77.36	66.63
63.69	55.39	79.56	69.19
65.50	57.50	81.81	71.83
67.28	59.66	84.05	74.53
69.09	61.86	86.30	77.27
70.90	64.12	88.56	80.10
72.72	66.43	90.83	82.98
74.55	68.79	93.12	85.93
76.37	71.20	95.40	88.94
78.22	73.68	97.70	92.03

SULPHURIC ACID (Continued)

FIXED POINTS

Sp. gr.	Per cent H_2SO_4	Sp. gr.	Per cent H_2SO_4
1.0000	.00	1.5281	62.34
1.0048	.71	1.5440	63.79
1.0347	5.14	1.5748	66.51
1.0649	9.48	1.6272	71.00
1.0992	14.22	1.6679	74.46
1.1353	19.04	1.7044	77.54
1.1736	23.94	1.7258	79.40
1.2105	28.55	1.7472	81.32
1.2513	33.49	1.7700	83.47
1.2951	38.64	1.7959	86.36
1.3441	44.15	1.8117	88.53
1.3947	49.52	1.8194	89.75
1.4307	53.17	1.8275	91.32
1.4667	56.68	1.8354	93.19
1.4822	58.14		

Per cent 60°	Pounds 60° in 1 cu. ft.	Per cent 50°	Pounds 50° in 1 cu. ft.
80.06	76.21	100.00	95.20
81.96	78.85	102.38	98.50
83.86	81.54	104.74	101.85
85.79	84.33	107.15	105.33
87.72	87.17	109.57	108.89
89.67	90.10	112.01	112.55
91.63	93.11	114.46	116.30
93.67	96.26	117.00	120.24
95.74	99.52	119.59	124.31
97.84	102.89	122.21	128.52
100.00	106.40	124.91	132.91
102.27	110.10	127.74	137.52
104.67	114.05	130.75	142.47
107.30	118.34	134.03	147.82
110.29	123.14	137.76	153.81
111.15	124.49	138.84	155.50
112.06	125.89	139.98	157.25
113.05	127.40	141.22	159.14
114.14	129.03	142.57	161.17
115.30	130.75	144.02	163.32
116.65	132.70	145.71	165.76
118.19	134.88	147.63	168.48
119.98	137.34	149.87	171.56

ALLOWANCE FOR TEMPERATURE

At 10° Bé. .029° Bé. or .00023 Sp. Gr. = 1° F.
At 20° Bé. .036° Bé. or .00034 Sp. Gr. = 1° F.
At 30° Bé. .035° Bé. or .00039 Sp. Gr. = 1° F.
At 40° Bé. .031° Bé. or .00041 Sp. Gr. = 1° F.
At 50° Bé. .028° Bé. or .00045 Sp. Gr. = 1° F.
At 60° Bé. .026° Bé. or .00053 Sp. Gr. = 1° F.
At 63° Bé. .026° Bé. or .00057 Sp. Gr. = 1° F.
At 66° Bé. .0235° Bé. or .00054 Sp. Gr. = 1° F.

NITRIC ACID

Authority — W. C. Ferguson

This table has been approved and adopted as a Standard by the Manufacturing Chemists' Association of the United States.

Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities, the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = 145 - \frac{145}{\text{Sp. Gr.}}.$$

Baumé Hydrometers for use with this table must be graduated by the above formula, which formula should *always* be printed on the scale.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

Allowance for Temperature

At 10°–20°	Bé. — 1/30° Bé.	or .00029	Sp. Gr.	= 1° F.
20°–30°	Bé. — 1/23° Bé.	or .00044	" "	= 1° F.
30°–40°	Bé. — 1/20° Bé.	or .00060	" "	= 1° F.
40°–48.5°	Bé. — 1/17° Bé.	or .00084	" "	= 1° F.

Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.	Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.
10.00	1.0741	14.82	12.86	15.25	1.1176	23.52	19.70
10.25	1.0761	15.22	13.18	15.50	1.1197	23.94	20.02
10.50	1.0781	15.62	13.49	15.75	1.1219	24.38	20.36
10.75	1.0801	16.02	13.81	16.00	1.1240	24.80	20.69
11.00	1.0821	16.42	14.13	16.25	1.1262	25.24	21.03
11.25	1.0841	16.82	14.44	16.50	1.1284	25.68	21.36
11.50	1.0861	17.22	14.76	16.75	1.1306	26.12	21.70
11.75	1.0881	17.62	15.07	17.00	1.1328	26.56	22.04
12.00	1.0902	18.04	15.41	17.25	1.1350	27.00	22.38
12.25	1.0922	18.44	15.72	17.50	1.1373	27.46	22.74
12.50	1.0943	18.86	16.05	17.75	1.1395	27.90	23.08
12.75	1.0964	19.28	16.39	18.00	1.1417	28.34	23.42
13.00	1.0985	19.70	16.72	18.25	1.1440	28.80	23.77
13.25	1.1006	20.12	17.05	18.50	1.1462	29.24	24.11
13.50	1.1027	20.54	17.38	18.75	1.1485	29.70	24.47
13.75	1.1048	20.96	17.71	19.00	1.1508	30.16	24.82
14.00	1.1069	21.38	18.04	19.25	1.1531	30.62	25.18
14.25	1.1090	21.80	18.37	19.50	1.1554	31.08	25.53
14.50	1.1111	22.22	18.70	19.75	1.1577	31.54	25.88
14.75	1.1132	22.64	19.02	20.00	1.1600	32.00	26.24
15.00	1.1154	23.08	19.36	20.25	1.1624	32.48	26.61

NITRIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.	Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.
20.50	1.1647	32.94	26.96	31.50	1.2775	55.50	43.89
20.75	1.1671	33.42	27.33	31.75	1.2804	56.08	44.34
21.00	1.1694	33.88	27.67	32.00	1.2832	56.64	44.78
21.25	1.1718	34.36	28.02	32.25	1.2861	57.22	45.24
21.50	1.1741	34.82	28.36	32.50	1.2889	57.78	45.68
21.75	1.1765	35.30	28.72	32.75	1.2918	58.36	46.14
22.00	1.1789	35.78	29.07	33.00	1.2946	58.92	46.58
22.25	1.1813	36.26	29.43	33.25	1.2975	59.50	47.04
22.50	1.1837	36.74	29.78	33.50	1.3004	60.08	47.49
22.75	1.1861	37.22	30.14	33.75	1.3034	60.68	47.95
23.00	1.1885	37.70	30.49	34.00	1.3063	61.26	48.42
23.25	1.1910	38.20	30.86	34.25	1.3093	61.86	48.90
23.50	1.1934	38.68	31.21	34.50	1.3122	62.44	49.35
23.75	1.1959	39.18	31.58	34.75	1.3152	63.04	49.83
24.00	1.1983	39.66	31.94	35.00	1.3182	63.64	50.32
24.25	1.2008	40.16	32.31	35.25	1.3212	64.24	50.81
24.50	1.2033	40.66	32.68	35.50	1.3242	64.84	51.30
24.75	1.2058	41.16	33.05	35.75	1.3273	65.46	51.80
25.00	1.2083	41.66	33.42	36.00	1.3303	66.06	52.30
25.25	1.2109	42.18	33.80	36.25	1.3334	66.68	52.81
25.50	1.2134	42.68	34.17	36.50	1.3364	67.28	53.32
25.75	1.2160	43.20	34.56	36.75	1.3395	67.90	53.84
26.00	1.2185	43.70	34.94	37.00	1.3426	68.52	54.36
26.25	1.2211	44.22	35.33	37.25	1.3457	69.14	54.89
26.50	1.2236	44.72	35.70	37.50	1.3488	69.76	55.43
26.75	1.2262	45.24	36.09	37.75	1.3520	70.40	55.97
27.00	1.2288	45.76	36.48	38.00	1.3551	71.02	56.52
27.25	1.2314	46.28	36.87	38.25	1.3583	71.66	57.08
27.50	1.2340	46.80	37.26	38.50	1.3615	72.30	57.65
27.75	1.2367	47.34	37.67	38.75	1.3647	72.94	58.23
28.00	1.2393	47.86	38.06	39.00	1.3679	73.58	58.82
28.25	1.2420	48.40	38.46	39.25	1.3712	74.24	59.43
28.50	1.2446	48.92	38.85	39.50	1.3744	74.88	60.06
28.75	1.2473	49.46	39.25	39.75	1.3777	75.54	60.71
29.00	1.2500	50.00	39.66	40.00	1.3810	76.20	61.38
29.25	1.2527	50.54	40.06	40.25	1.3843	76.86	62.07
29.50	1.2554	51.08	40.47	40.50	1.3876	77.52	62.77
29.75	1.2582	51.64	40.89	40.75	1.3909	78.18	63.48
30.00	1.2609	52.18	41.30	41.00	1.3942	78.84	64.20
30.25	1.2637	52.74	41.72	41.25	1.3976	79.52	64.93
30.50	1.2664	53.28	42.14	41.50	1.4010	80.20	65.67
30.75	1.2692	53.84	42.58	41.75	1.4044	80.88	66.42
31.00	1.2719	54.38	43.00	42.00	1.4078	81.96	67.18
31.25	1.2747	54.94	43.44	42.25	1.4112	82.24	67.95

NITRIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.	Bé.°	Sp. gr.	Tw.°	Per cent HNO_3.
42.50	1.4146	82.92	68.73	45.50	1.4573	91.46	79.03
42.75	1.4181	83.62	69.52	45.75	1.4610	92.20	80.04
43.00	1.4216	84.32	70.33	46.00	1.4646	92.92	81.08
43.25	1.4251	85.02	71.15	46.25	1.4684	93.68	82.18
43.50	1.4286	85.72	71.98	46.50	1.4721	94.42	83.33
43.75	1.4321	86.42	72.82	46.75	1.4758	95.16	84.48
44.00	1.4356	87.12	73.67	47.00	1.4796	95.92	85.70
44.25	1.4392	87.84	74.53	47.25	1.4834	96.68	86.98
44.50	1.4428	88.56	75.40	47.50	1.4872	97.44	88.32
44.75	1.4464	89.28	76.28	47.75	1.4910	98.20	89.76
45.00	1.4500	90.00	77.17	48.00	1.4948	98.96	91.35
45.25	1.4536	90.72	78.07	48.25	1.4987	99.74	93.13
				48.50	1.5026	100.52	95.11

HYDROCHLORIC ACID

Authority — W. C. Ferguson

This table has been approved and adopted as a standard by the Manufacturing Chemists' Association of the United States.

Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities, the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = 145 - \frac{145}{\text{Sp. Gr.}}.$$

Baumé Hydrometers for use with this table must be graduated by the above formula which formula should *always* be printed on the scale.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

Allowance for Temperature

10° – 15° Bé. — 1/40° Bé. or .0002 Sp. Gr. for 1° F.
15° – 22° Bé. — 1/30° Bé. or .0003 " " " 1° F.
22° – 25° Bé. — 1/28° Bé. or .00035 " " " 1° F.

Bé.°	Sp. gr.	Tw.°	Per cent HCl	Bé.°	Sp. gr.	Tw.°	Per cent HCl
1.00	1.0069	1.38	1.40	10.25	1.0761	15.22	15.22
2.00	1.0140	2.80	2.82	10.50	1.0781	15.62	15.62
3.00	1.0211	4.22	4.25	10.75	1.0801	16.02	16.01
4.00	1.0284	5.68	5.69	11.00	1.0821	16.42	16.41
5.00	1.0357	7.14	7.15	11.25	1.0841	16.82	16.81
5.25	1.0375	7.50	7.52	11.50	1.0861	17.22	17.21
5.50	1.0394	7.88	7.89	11.75	1.0881	17.62	17.61
5.75	1.0413	8.26	8.26	12.00	1.0902	18.04	18.01
6.00	1.0432	8.64	8.64	12.25	1.0922	18.44	18.41
6.25	1.0450	9.00	9.02	12.50	1.0943	18.86	18.82
6.50	1.0469	9.38	9.40	12.75	1.0964	19.28	19.22
6.75	1.0488	9.76	9.78	13.00	1.0985	19.70	19.63
7.00	1.0507	10.14	10.17	13.25	1.1006	20.12	20.04
7.25	1.0526	10.52	10.55	13.50	1.1027	20.54	20.45
7.50	1.0545	10.90	10.94	13.75	1.1048	20.96	20.86
7.75	1.0564	11.28	11.32	14.00	1.1069	21.38	21.27
8.00	1.0584	11.68	11.71	14.25	1.1090	21.80	21.68
8.25	1.0603	12.06	12.09	14.50	1.1111	22.22	22.09
8.50	1.0623	12.46	12.48	14.75	1.1132	22.64	22.50
8.75	1.0642	12.84	12.87	15.00	1.1154	23.08	22.92
9.00	1.0662	13.24	13.26	15.25	1.1176	23.52	23.33
9.25	1.0681	13.62	13.65	15.50	1.1197	23.94	23.75
9.50	1.0701	14.02	14.04	15.75	1.1219	24.38	24.16
9.75	1.0721	14.42	14.43	16.0	1.1240	24.80	24.57
10.00	1.0741	14.82	14.83	16.1	1.1248	24.96	24.73

HYDROCHLORIC ACID (Continued)

Bé.°	Sp. gr.	Tw.°	Per cent HCl	Bé.°	Sp. gr.	Tw.°	Per cent HCl
16.2	1.1256	25.12	24.90	20.9	1.1684	33.68	33.12
16.3	1.1265	25.30	25.06	21.0	1.1694	33.88	33.31
16.4	1.1274	25.48	25.23	21.1	1.1703	34.06	33.50
16.5	1.1283	25.66	25.39	21.2	1.1713	34.26	33.69
16.6	1.1292	25.84	25.56	21.3	1.1722	34.44	33.88
16.7	1.1301	26.02	25.72	21.4	1.1732	34.64	34.07
16.8	1.1310	26.20	25.89	21.5	1.1741	34.82	34.26
16.9	1.1319	26.38	26.05	21.6	1.1751	35.02	34.45
17.0	1.1328	26.56	26.22	21.7	1.1760	35.20	34.64
17.1	1.1336	26.72	26.39	21.8	1.1770	35.40	34.83
17.2	1.1345	26.90	26.56	21.9	1.1779	35.58	35.02
17.3	1.1354	27.08	26.73	22.0	1.1789	35.78	35.21
17.4	1.1363	27.26	26.90	22.1	1.1798	35.96	35.40
17.5	1.1372	27.44	27.07	22.2	1.1808	36.16	35.59
17.6	1.1381	27.62	27.24	22.3	1.1817	36.34	35.78
17.7	1.1390	27.80	27.41	22.4	1.1827	36.54	35.97
17.8	1.1399	27.98	27.58	22.5	1.1836	36.72	36.16
17.9	1.1408	28.16	27.75	22.6	1.1846	36.92	36.35
18.0	1.1417	28.34	27.92	22.7	1.1856	37.12	36.54
18.1	1.1426	28.52	28.09	22.8	1.1866	37.32	36.73
18.2	1.1435	28.70	28.26	22.9	1.1875	37.50	36.93
18.3	1.1444	28.88	28.44	23.0	1.1885	37.70	37.14
18.4	1.1453	29.06	28.61	23.1	1.1895	37.90	37.36
18.5	1.1462	29.24	28.78	23.2	1.1904	38.08	37.58
18.6	1.1471	29.42	28.95	23.3	1.1914	38.28	37.80
18.7	1.1480	29.60	29.13	23.4	1.1924	38.48	38.03
18.8	1.1489	29.78	29.30	23.5	1.1934	38.68	38.26
18.9	1.1498	29.96	29.48	23.6	1.1944	38.88	38.49
19.0	1.1508	30.16	29.65	23.7	1.1953	39.06	38.72
19.1	1.1517	30.34	29.83	23.8	1.1963	39.26	38.95
19.2	1.1526	30.52	30.00	23.9	1.1973	39.46	39.18
19.3	1.1535	30.70	30.18	24.0	1.1983	39.66	39.41
19.4	1.1544	30.88	30.35	24.1	1.1993	39.86	39.64
19.5	1.1554	31.08	30.53	24.2	1.2003	40.06	39.86
19.6	1.1563	31.26	30.71	24.3	1.2013	40.26	40.09
19.7	1.1572	31.44	30.90	24.4	1.2023	40.46	40.32
19.8	1.1581	31.62	31.08	24.5	1.2033	40.66	40.55
19.9	1.1590	31.80	31.27	24.6	1.2043	40.86	40.78
10.0	1.1600	32.00	31.45	24.7	1.2053	41.06	41.01
20.1	1.1609	32.18	31.64	24.8	1.2063	41.26	41.24
20.2	1.1619	32.38	31.82	24.9	1.2073	41.46	41.48
20.3	1.1628	32.56	32.01	25.0	1.2083	41.66	41.72
20.4	1.1637	32.74	32.19	25.1	1.2093	41.86	41.99
20.5	1.1647	32.94	32.38	25.2	1.2103	42.06	42.30
20.6	1.1656	33.12	32.56	25.3	1.2114	42.28	42.64
20.7	1.1666	33.32	32.75	25.4	1.2124	42.48	43.01
20.8	1.1675	33.50	32.93	25.5	1.2134	42.68	43.40

AQUA AMMONIA

Authority — W. C. Ferguson

This table has been approved and adopted as a standard by the Manufacturing Chemists' Association of the United States.

Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities, the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = \frac{140}{\text{Sp. Gr.}} - 130.$$

Baumé Hydrometers for use with this table must be graduated by the above formula, which formula should *always* be printed on the scale.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

Allowance for Temperature

The coefficient of expansion for Ammonia Solutions varying with the temperature, correction must be applied according to the following table:

	Corrections to be added for each degree below 60° F.		Corrections to be subtracted for each degree above 60° F.			
Degrees Baumé	40° F.	50° F.	70° F.	80° F.	90° F.	100° F.
14	0.015 Bé.	0.017 Bé.	0.020 Bé.	0.022 Bé.	0.024 Bé.	0.026 Bé.
16	0.021 "	0.023 "	0.026 "	0.028 "	0.030 "	0.032 "
18	0.027 "	0.029 "	0.031 "	0.033 "	0.035 "	0.037 "
20	0.033 "	0.036 "	0.037 "	0.038 "	0.040 "	0.042 "
22	0.039 "	0.042 "	0.043 "	0.045 "	0.047 "	
26	0.053 "	0.057 "	0.057 "	0.059 "		

Bé.°	Sp. gr.	Per cent NH_3.	Bé.°	Sp. gr.	Per cent NH_3.
10.00	1.0000	0.00	12.25	0.9842	3.73
10.25	0.9982	0.40	12.50	0.9825	4.16
10.50	0.9964	0.80	12.75	0.9807	4.59
10.75	0.9947	1.21	13.00	0.9790	5.02
11.00	0.9929	1.62	13.25	0.9773	5.45
11.25	0.9912	2.04	13.50	0.9756	5.88
11.50	0.9894	2.46	13.75	0.9739	6.31
11.75	0.9876	2.88	14.00	0.9722	6.74
12.00	0.9859	3.30	14.25	0.9705	7.17

AQUA AMMONIA (Continued)

Be.°	Sp. Gr.	Per cent NH_3.	Be.°	Sp. gr.	Per cent NH_3.
14.50	0.9689	7.61	22.00	0.9211	21.60
14.75	0.9672	8.05	22.25	0.9195	22.08
15.00	0.9655	8.49	22.50	0.9180	22.56
15.25	0.9639	8.93	22.75	0.9165	23.04
15.50	0.9622	9.38	23.00	0.9150	23.52
15.75	0.9605	9.83	23.25	0.9135	24.01
16.00	0.9589	10.28	23.50	0.9121	24.50
16.25	0.9573	10.73	23.75	0.9106	24.99
16.50	0.9556	11.18	24.00	0.9091	25.48
16.75	0.9540	11.64	24.25	0.9076	25.97
17.00	0.9524	12.10	24.50	0.9061	26.46
17.25	0.9508	12.56	24.75	0.9047	26.95
17.50	0.9492	13.02	25.00	0.9032	27.44
17.75	0.9475	13.49	25.25	0.9018	27.93
18.00	0.9459	13.96	25.50	0.9003	28.42
18.25	0.9444	14.43	25.75	0.8989	28.91
18.50	0.9428	14.90	26.00	0.8974	29.40
18.75	0.9412	15.37	26.25	0.8960	29.89
19.00	0.9396	15.84	26.50	0.8946	30.38
19.25	0.9380	16.32	26.75	0.8931	30.87
19.50	0.9365	16.80	27.00	0.8917	31.36
19.75	0.9349	17.28	27.25	0.8903	31.85
20.00	0.9333	17.76	27.50	0.8889	32.34
20.25	0.9318	18.24	27.75	0.8875	32.83
20.50	0.9302	18.72	28.00	0.8861	33.32
20.75	0.9287	19.20	28.25	0.8847	33.81
21.00	0.9272	19.68	28.50	0.8833	34.30
21.25	0.9256	20.16	28.75	0.8819	34.79
21.50	0.9241	20.64	29.00	0.8805	35.28
21.75	0.9226	21.12			

SPECIFIC GRAVITY OF GASES AND VAPORS

Name	Formula	Mol. wt.	Mass of 1 liter in g. 760mm 0° C.	Density, air = 1		Density, O = 1	
				Observed	Computed	Observed	Theoret.
Acetylene	C_2H_2	26.02	1.1708	0.9056	0.9056	0.8193	0.8133
Air	......	......	1.2928	......	1.0000	......	
Ammonia	NH_3	17.03	0.7708	0.5962	0.5963	0.5394	0.5321
Argon	A	39.91	1.7828	1.379	1.378	1.248	1.247
Bromine	Br_2	159.83	7.1388	5.524	5.524		
Butane	C_4H_{10}	58.08	2.5985	2.01	....	1.82	1.8155
Carbon dioxide	CO_2	44.	1.9768	1.5288	1.5289	1.3832	1.3766
monoxide	CO	28.	1.2501	0.9670	0.9670	0.8749	0.8752
oxychloride	$COCl_2$	98.91	4.5313	3.505	....	3.171	3.0914
oxysulphide	COS	60.06	2.7201	2.104	....	1.904	1.8786
Chlorine	Cl_2	70.91	3.2204	2.491	2.4906	2.251	2.2162
monoxide	Cl_2O	86.91	3.8874	3.007	....	2.72	2.716
Cyanogen	C_2N_2	52.02	2.3348	1.806	1.8353	1.634	1.6257
Ethane	C_2H_6	30.05	1.3567	1.0494	1.0496	0.9494	0.9392
Ethyl chloride	C_2H_5Cl	64.50	2.8700	2.22	2.257	2.01	2.0159
Ethylene	C_2H_4	28.03	1.2644	0.978	0.9753	0.885	0.8762
Fluorine	F_2	38.	1.6354	1.265	....	1.145	1.187
Helium	He	4.00	0.1769	0.1368	....	0.1238	0.125
Hydrochloric acid	HCl	36.47	1.6394	1.2681	1.2683	1.1473	1.1396
Hydrofluoric acid	HF	20.01	0.9218	0.713	....	0.645	0.625
Hydriodic acid	HI	127.94	5.7245	4.428	....	4.01	4.029
Hydrogen	H_2	2.016	0.08982	0.06948	0.06949	0.06286	0.06297
selenide	H_2Se	81.22	3.6134	2.795	2.850	2.529	2.538
sulphide	H_2S	34.08	1.5392	1.1895	1.1773		
telluride	H_2Te	129.52	5.8034	4.489	....	4.062	4.066
Krypton	Kr	82.90	3.6431	2.818	2.832	2.550	2.556
Methane	CH_4	16.03	0.7167	0.5544	0.5544	0.5016	0.5011
Methyl Chloride	CH_3Cl	50.48	2.3044	1.7825	1.785	1.6127	1.578
Neon	Ne_2	20.40	0.8713	0.674	....	0.610	0.625
Nitric oxide	NO	30.01	1.3401	1.0366	1.0366	0.9397	0.9391
Nitrogen	N_2	28.02	1.2507	0.9673	0.9682	0.8752	
Nitrous oxide	N_2O	44.02	1.9781	1.5301	1.5303	1.3844	1.3754
Nitrosyl chloride	NOCl	65.47	2.9864	2.31	....	2.09	2.046
Oxygen	O_2	32.	1.4289	1.1053	1.1053	1.000	1.0000
Phosphine	PH_3	34.05	1.5293	1.1829	1.1830	1.0702	1.063
Silicon fluoride	SiF_4	104.06	4.6541	3.60	....	3.26	3.259
Sulphur dioxide	SO_2	64.06	2.9268	2.2639	2.2638	2.0482	2.0034
Xenon	X	130.2	5.7168	4.422	4.506	4.001	4.00

DEHYDRATION OF METALLIC SULPHATES

Metallic sulphates.	Temp. of beginning of decomposition, ° C.	Products formed.	Color of products.
$CaSO_4.2H_2O$	38	$CaSO_4.H_2O$	White
$CaSO_4.H_2O$	80	$2CaSO_4.H_2O$	White
$2CaSO_4.H_2O$	149	$CaSO_4$	White
$MgSO_4.7H_2O$	19	$MgSO_4.6H_2O$	White
$MgSO_4.6H_2O$	38	$MgSO_4.2H_2O$	White
$MgSO_4.2H_2O$	112	$MgSO_4.H_2O$	White
$MgSO_4.H_2O$	203	$MgSO_4$	White
$CdSO_4.\frac{8}{3}H_2O$	30	$CdSO_4.2H_2O$	White
$CdSO_4.2H_2O$	41	$CdSO_4.H_2O$	White
$CdSO_4.H_2O$	170	$CdSO_4$	White
$CoSO_4.7H_2O$	14	$CoSO_4.4H_2O$	Rose
$CoSO_4.4H_2O$	58	$CoSO_4.H_2O$	Lilac
$CoSO_4.H_2O$	276	$CoSO_4$	Lilac
$NiSO_4.7H_2O$	40	$NiSO_4.4H_2O$	Green
$NiSO_4.4H_2O$	106	$NiSO_4.H_2O$	Yellow
$NiSO_4.H_2O$	279	$NiSO_4$	Orange
$ZnSO_4.7H_2O$	25	$ZnSO_4.6H_2O$	White
$ZnSO_4.6H_2O$	28	$ZnSO_4.2H_2O$	White
$ZnSO_4.2H_2O$	115	$ZnSO_4.H_2O$	White
$ZnSO_4.H_2O$	225	$ZnSO_4$	White
$MnSO_4.5H_2O$	25	$MnSO_4.2H_2O$	Pale peach blossom
$MnSO_4.2H_2O$	60	$MnSO_4.H_2O$	Paler than above
$MnSO_4.H_2O$	152	$MnSO_4$	Paler than above
$CuSO_4.5H_2O$	27	$CuSO_4.3H_2O$	Blue
$CuSO_4.3H_2O$	93	$CuSO_4.H_2O$	Pale blue
$CuSO_4.H_2O$	155	$CuSO_4$	White
$Al_2(SO_4)_3.16H_2O$	51	$Al_2(SO_4)_3.13H_2O$	White
$Al_2(SO_4)_3.13H_2O$	82	$Al_2(SO_4)_3.10H_2O$	White
$Al_2(SO_4)_3.10H_2O$	97	$Al_2(SO_4)_3.7H_2O$	White
$Al_2(SO_4)_3.7H_2O$	109	$Al_2(SO_4)_3.4H_2O$	White
$Al_2(SO_4)_3.4H_2O$	180	$Al_2(SO_4)_3.H_2O$	White
$Al_2(SO_4)_3.H_2O$	316	$Al_2(SO_4)_3$	White
$FeSO_4.7H_2O$	21	$FeSO_4.4H_2O$	Light apple green
$FeSO_4.4H_2O$	80	$FeSO_4.H_2O$	White
$FeSO_4.H_2O$	406	Fe_2O_3, SO_3	Yellowish green

DECOMPOSITION OF ANHYDROUS METALLIC SULPHATES

Metallic sulphate.	Temp. at beginning of decomposition, ° C.	Temp. of energetic decomposition, ° C.	Products of decomposition.	Color of product.
$FeSO_4$	167	480	Fe_2O_3, $2SO_4$	Yellow brown
Fe_2O_3, $2SO_3$	492	560	Fe_2O_3	Red
$Bi_2(SO_4)_3$	570	639	$5Bi_2O_3$, $4(SO_3)_3$	White
$Al_2(SO_4)_3$	590	639	Al_2O_3	White
$PbSO_4$	637	705	$6PbO$, $5SO_3$	White
$CuSO_4$	653	670	$2CuO$, SO_3	Orange
$MnSO_4$	699	790	Mn_3O_4	Dark red to black
$ZnSO_4$	702	720	$3ZnO$, $2SO_3$	White
$2CuO$, SO_3	702	736	CuO	Black
$NiSO_4$	703	764	NiO	Brownish green
$CoSO_4$	720	770	CoO	Brown to black
$3ZnO$, $2SO_3$	755	767	ZnO	White
$CdSO_4$	827	846	$5CdO$, SO_3	White
$5Bi_2O_3$, $4(SO_3)_2$	870	890	Bi_2O_3(?)	Yellow
$5CdO$, SO_3	878	890	CdO	Brown
$MgSO_4$	890	972	MgO	White
Ag_2SO_4	917	925	Ag	Silver white
$6PbO$, $5SO_3$	952	962	$2PbO$, SO_3(?)	White to yellow
$CaSO_4$	1200	....	CaO	White
$BaSO_4$	1510	....	BaO	White

DEGREE OF IONIZATION

In Normal Solution at 18° Unless Indicated

Acids

Nitric acid	0.82
Hydrochloric acid	0.784
Sulfuric acid	0.510
Hydrofluoric acid	0.070
* Oxalic acid	0.500
* Tartaric acid	0.082
* Acetic acid	0.004
* Carbonic acid	0.0017
* Hydrogen sulfide	0.0007
* Boric acid	0.0001
* Hydrocyanic acid	0.0001
† Permanganic acid	0.933
† Hydriodic acid	0.901
† Hydrobromic acid	0.889
† Perchloric acid	0.880
† Chloric acid	0.878
† Hydrochloric acid	0.876
† Phosphoric acid	0.170

* In 0.1 M. solution; primary ionization.
† In N/2 solution, at 25°.

Bases

Potassium hydroxide	0.77
Sodium hydroxide	0.73
Barium hydroxide	0.69
Lithium hydroxide	0.63
Ammonium hydroxide	0.004
Tetramethyl ammonium hydroxide	0.96
‡ Strontium hydroxide	0.93
‡ Barium hydroxide	0.92
‡ Calcium hydroxide	0.90

‡ In N/64 solution, at 25°.

Salts

Approximate degree of ionization for active salts in N/10 solution:

Type R^+R^- (e.g. KCl)	0.86
Type $R^{+}\ (R^-)_2$ (e.g. $BaCl_2$)	0.72
Type $(R^+)_2R^{--}$ (e.g. K_2SO_4)	0.72
Type $R^{++}\ R^{--}$ (e.g. $BaSO_4$)	0.45

SOLUBILITY PRODUCT

The solubility product (or ion product constant) is the product of the concentrations of the ions in the saturated solution of a difficultly soluble salt. The concentrations are expressed as moles per liter of solution. The number of cations (or anions) resulting from the dissociation of one molecule of the salt, appears in the formula for calculations of the solubility product as the exponent of the concentration of the cation (or anion).

If two solutions, each containing one of the ions of a difficultly soluble salt, are mixed, no precipitation takes place unless the product of the ion concentrations in the mixture is greater than the solubility product.

In a solution containing two salts which yield a common ion the ratio of solubilities of the two salts is the ratio of the solubility products.

Substance	Solubility product at temperature noted
Aluminum hydroxide	4×10^{-13} (15°)
Aluminum hydroxide	1.1×10^{-15} (18°)
Aluminum hydroxide	3.7×10^{-15} (25°)
Barium carbonate	7×10^{-9} (16°)
Barium carbonate	8.1×10^{-9} (25°)
Barium chromate	1.6×10^{-10} (18°)
Barium chromate	2.4×10^{-10} (28°)
Barium fluoride	1.6×10^{-6} (9.5°)
Barium fluoride	1.7×10^{-6} (18°)
Barium fluoride	1.73×10^{-6} (25.8°)
Barium iodate, $Ba(IO_3)_2.2H_2O$	8.4×10^{-11} (10°)
Barium iodate, $Ba(IO_3)_2.2H_2O$	6.5×10^{-10} (25°)
Barium oxalate, $BaC_2O_4.3\frac{1}{2}H_2O$	1.62×10^{-7} (18°)
Barium oxalate, $BaC_2O_4.2H_2O$	1.2×10^{-7} (18°)
Barium oxalate, $BaC_2O_4.\frac{1}{2}H_2O$	2.18×10^{-7} (18°)
Barium sulfate	0.87×10^{-10} (18°)
Barium sulfate	1.08×10^{-10} (25°)
Barium sulfate	1.98×10^{-10} (50°)
Calcium carbonate (calcite)	0.99×10^{-8} (15°)
Calcium carbonate (calcite)	0.87×10^{-8} (25°)
Calcium fluoride	3.4×10^{-11} (18°)
Calcium fluoride	3.95×10^{-11} (26°)
Calcium iodate, $Ca(IO_3)_2.6H_2O$	22.2×10^{-8} (10°)
Calcium iodate, $Ca(IO_3)_2.6H_2O$	64.4×10^{-8} (18°)
Calcium oxalate, $CaC_2O_4.H_2O$	1.78×10^{-9} (18°)
Calcium oxalate, $CaC_2O_4.H_2O$	2.57×10^{-9} (25°)
Calcium sulfate	6.1×10^{-5} (10°)
Calcium tartrate, $CaC_4H_4O_6.2H_2O$	0.77×10^{-6} (18°)
Cadmium oxalate $CdC_2O_4.3H_2O$	1.53×10^{-8} (18°)
Cadmium sulfide	3.6×10^{-29} (18°)
Cobalt sulfide	3×10^{-26} (18°)
Cupric iodate	1.4×10^{-7} (25°)
Cupric oxalate	2.87×10^{-8} (25°)
Cupric sulfide	8.5×10^{-45} (18°)
Cuprous bromide	4.15×10^{-8} (18–20°)
Cuprous chloride	1.02×10^{-6} (18–20°)
Cuprous iodide	5.06×10^{-12} (18–20°)
Cuprous sulfide	2×10^{-47} (16–18°)
Cuprous thiocyanate	1.6×10^{-11} (18°)
Ferric hydroxide	1.1×10^{-36} (18°)
Ferrous hydroxide	1.64×10^{-14} (18°)
Ferrous oxalate	2.1×10^{-7} (25°)
Ferrous sulfide	3.7×10^{-19} (18°)
Lead carbonate	3.3×10^{-14} (18°)
Lead chromate	1.77×10^{-14} (18°)
Lead fluoride	2.7×10^{-8} (9°)
Lead fluoride	3.2×10^{-8} (18°)
Lead fluoride	3.7×10^{-8} (26.6°)
Lead iodate	5.3×10^{-14} (9.2°)
Lead iodate	1.2×10^{-13} (18°)
Lead iodate	2.6×10^{-13} (25.8°)
Lead iodide	7.47×10^{-9} (15°)
Lead iodide	1.39×10^{-8} (25°)
Lead oxalate	2.74×10^{-11} (18°)
Lead sulfate	1.06×10^{-8} (18°)
Lead sulfide	3.4×10^{-28} (18°)
Lithium carbonate	1.7×10^{-3} (25°)
Magnesium ammonium phosphate	2.5×10^{-13} (25°)

SOLUBILITY PRODUCT (Continued)

Substance	Solubility product at temperature noted	Substance	Solubility product at temperature noted
Magnesium carbonate	2.6×10^{-5} (12°)	Silver carbonate	[illegible]$.15 \times 10^{-12}$ (25°)
Magnesium fluoride	7.1×10^{-9} (18°)	Silver chloride . . .	0.21×10^{-10} (4.7°)
Magnesium fluoride	6.4×10^{-9} (27°)	Silver chloride . . .	0.37×10^{-10} (9.7°)
Magnesium hydroxide	1.2×10^{-11} (18°)	Silver chloride . . .	1.56×10^{-10} (25°)
Magnesium oxalate	8.57×10^{-5} (18°)	Silver chloride . . .	13.2×10^{-10} (50°)
Manganese hydroxide	4×10^{-14} (18°)	Silver chloride . . .	21.5×10^{-10} (100°)
Manganese sulfide	1.4×10^{-15} (18°)	Silver chromate. .	1.2×10^{-12} (14.8°)
Mercuric sulfide	4×10^{-53} to 2×20^{-49} (18°)	Silver chromate. .	9×10^{-12} (25°)
Mercurous bromide	$1.3 \times 10^{-[illegible]}$ (25°)	Silver cyanide $[Ag^+][Ag(CN)^-_2]$	2.2×10^{-12} (20°)
Mercurous chloride	2×10^{-18} (25°)	Silver dichromate	2×10^{-7} (25°)
Mercurous iodide	1.2×10^{-28} (25°)	Silver hydroxide. .	1.52×10^{-8} (20°)
Nickel sulfide	1.4×10^{-24} (18°)	Silver iodate.	0.92×10^{-8} (9.4°)
Potassium acid tartrate $[K^+][HC_4H_4O_6^-]$	3.8×10^{-4} (18°)	Silver iodide. . . .	0.32×10^{-16} (13°)
Silver bromate. . .	3.97×10^{-5} (20°)	Silver iodide.	1.5×10^{-16} (25°)
Silver bromate. . .	5.77×10^{-5} (25°)	Silver sulfide.	1.6×10^{-49} (18°)
Silver bromide. . .	4.1×10^{-13} (18°)	Silver thiocyanate	0.49×10^{-12} (18°)
Silver bromide. . .	7.7×10^{-13} (25°)	Silver thiocyanate	1.16×10^{-12} (25°)
		Strontium carbonate	1.6×10^{-9} (25°)
		Strontium fluoride	2.8×10^{-9} (18°)
		Strontium oxalate	5.61×10^{-8} (18°)
		Strontium sulfate	2.77×10^{-7} (2.9°)
		Strontium sulfate	2.81×10^{-7} (17.4°)
		Zinc hydroxide. . .	1.8×10^{-14} (18-20°)
		Zinc oxalate, $ZnC_2O_4.2H_2O$	1.35×10^{-9} (18°)
		Zinc sulfide.	1.2×10^{-23} (18°)

DISSOCIATION CONSTANTS OF ACIDS

Acid	Formula	Constant for the first hydrogen	Temp. °C.	Constant for the second hydrogen	Temp. °C.
Acetic	$C_2H_4O_2$	1.86×10^{-5}	25		
α-Alanine	$C_3H_7O_2N$	9×10^{-10}	25		
Arsenic	H_3AsO_4	5×10^{-3}	25	4×10^{-5}	25
				6×10^{-10} (3H)	25
Arsenious	H_3AsO_3	6×10^{-10}	25		
Barbituric	$C_4H_4O_3N$	1.05×10^{-4}	25		
Benzoic	$C_7H_6O_2$	6.6×10^{-5}	25		
Boric	H_3BO_3	6.4×10^{-10}	25		
Bromacetic	$C_2H_3O_2Br$	1.38×10^{-3}	25		
α-Brompropionic	$C_3H_5O_2Br$	1.08×10^{-3}	25		
β-Brompropionic	$C_3H_5O_2Br$	9.8×10^{-5}	25		
Butyric	$C_4H_8O_2$	1.48×10^{-5}	25		
Carbonic	H_2CO_3	3×10^{-7}	18	6×10^{-11}	25
Chloracetic	$C_2H_3O_2Cl$	1.55×10^{-3}	25		
α-Chlorpropionic	$C_3H_5O_2Cl$	1.47×10^{-3}	25		
β-Chlorpropionic	$C_3H_5O_2Cl$	8.59×10^{-5}	25		
Citric	$C_6H_8O_7$	8×10^{-4}	25		
Dichloracetic	$C_2H_2O_2Cl_2$	5×10^{-2}	25		
Formic	CH_2O_2	2.14×10^{-4}	25		
Fumaric	$C_4H_4O_4$	1×10^{-3}	25	3×10^{-5}	25
Hippuric	$C_9H_9O_3N$	2.3×10^{-4}	25		
Hydrocyanic	CHN	7.2×10^{-10}	25		
Hydroquinone	$C_6H_6O_2$	1.1×10^{-10}	18		
Hydrosulfuric	H_2S	9.1×10^{-8}	18		
Hydrazoic	HN_3	1.9×10^{-5}	25		
Hypochlorous	$HOCl$	3.7×10^{-8}	17		
Iodic	HIO_3	1.9×10^{-1}	25		
Isobutyric	$C_4H_8O_2$	1.5×10^{-5}	25		
Isovaleric	$C_5H_{10}O_2$	1.7×10^{-5}	25		
Lactic	$C_3H_6O_3$	1.38×10^{-4}	25		
Maleic	$C_4H_4O_4$	1.5×10^{-2}	25	2.6×10^{-7}	25
Malic	$C_4H_6O_5$	4×10^{-4}	25	9×10^{-6}	25
Malonic	$C_3H_4O_4$	1.61×10^{-3}	25	2.1×10^{-6}	25
Mandelic	$C_8H_8O_3$	4.29×10^{-4}	25		
α-Naphthoic	$C_{11}H_8O_2$	2×10^{-4}	25		
β-Naphthoic	$C_{11}H_8O_2$	6.8×10^{-5}	25		
Nicotinic	$C_6H_5O_2N$	1.4×10^{-5}	25		
Nitrous	HNO_2	4×10^{-4}	18		
Oxalic	$C_2H_2O_4$	3.8×10^{-2}	25	4.9×10^{-5}	25
Periodic	HIO_4	2.3×10^{-2}	25		
Phenol	C_6H_6O	1.3×10^{-10}	25		
Phosphoric	H_3PO_4	1.1×10^{-2}	18	2×10^{-7}	18
				3.6×10^{-13}(3H)	18
Phosphorous	H_3PO_3	5×10^{-2}	25	2×10^{-5}	25
Phthalic	$C_8H_6O_4$	1.26×10^{-3}	25	3.1×10^{-6}	25
Picolinic	$C_6H_5O_2N$	3×10^{-6}	25		
Picric	$C_6H_3O_7N_3$	1.6×10^{-1}	18		
Propionic	$C_3H_6O_2$	1.4×10^{-5}	25		
Pyromucic	$C_5H_4O_3$	7.1×10^{-4}	25		
Pyrophosphoric	$H_4P_2O_7$	1.4×10^{-1}	18	1.1×10^{-2}	18
				2.9×10^{-7}(3H)	18
				3.6×10^{-9}(4H)	18
Pyrotartaric	$C_5H_8O_4$	8.7×10^{-5}	25		
Salicylic	$C_7H_6O_3$	1.06×10^{-3}	25	1×10^{-13}	20
Selenious	H_2SeO_3	3×10^{-3}	25	5×10^{-8}	25
Succinic	$C_4H_6O_4$	6.6×10^{-5}	25	2.8×10^{-6}	25
Sulfanilic	$C_6H_7O_3NS$	6.2×10^{-4}			
Sulfuric	H_2SO_4	....	......	2×10^{-2}	18

DISSOCIATION CONSTANTS OF ACIDS (Continued)

Acid	Formula	Constant for the first hydrogen	Temp. °C.	Constant for the second hydrogen	Temp. °C.
Sulfurous	H_2SO_3	1.7×10^{-2}	25	5×10^{-6}	25
Tartaric	$C_4H_6O_6$	1.1×10^{-3}	25	6.9×10^{-5}	25
Telluric	H_2TeO_4	6×10^{-7}	25	4×10^{-11}	25
Tellurous	H_2TeO_3	3×10^{-3}	25	2×10^{-8}	25
Trichloracetic	$C_2HO_2Cl_3$	2×10^{-1}	18		
Uric	$C_5H_4O_3N_4$	1.5×10^{-6}	25		
Valeric	$C_5H_{10}O_2$	1.6×10^{-5}	25		

DISSOCIATION CONSTANTS OF BASES

Name	Formula	Constant for first OH	Temp. °C.	Constant for second OH	Temp. °C.
Acetamide	C_2H_5ON	$3.1\times10^{-}$[illegible]	25		
Acetanilide	C_8H_9ON	4.1×10^{-14}	40		
α-Alanine	$C_3H_7O_2N$	5.1×10^{-12}	25		
o-Aminobenzoic	$C_7H_7O_2N$	1.4×10^{-12}	25		
Ammonium Hydroxide	NH_4OH	1.8×10^{-5}	25		
Aniline	C_6H_7N	4.6×10^{-10}	25		
Brucine	$C_{23}H_{26}O_4N_2$	7.2×10^{-4}	25	2.5×10^{-11}	25
Butylamine (sec.)	$C_4H_{11}N$	4.4×10^{-4}	25		
Caffeine	$C_8H_{10}O_2N_4$	4.1×10^{-14}	40		
Cinchonine	$C_{19}H_{22}ON_2$	1.6×10^{-7}	15	3.3×10^{-10}	15
Cocaine	$C_{17}H_{21}O_4N$	4×10^{-7}	25		
Diethylbenzylamine	$C_{11}H_{17}N$	3.6×10^{-5}	25		
Diethylamine	$C_4H_{11}N$	1.26×10^{-3}	25		
Diisoamylamine	$C_{10}H_{23}N$	9.6×10^{-4}	25		
Diisobutylamine	$C_8H_{19}N$	4.8×10^{-4}	25		
Dimethylamine	C_2H_7N	7.4×10^{-4}	25		
Dimethylbenzylamine	$C_9H_{13}N$	1.05×10^{-5}	25		
Dipropylamine	$C_6H_{15}N$	1.02×10^{-3}	25		
Ethylamine	C_2H_7N	5.6×10^{-4}	25		
Ethylenediamine	$C_2H_8N_2$	8.5×10^{-5}	25		
Isoamylamine	$C_5H_{13}N$	5×10^{-4}	25		
Isobutylamine	$C_4H_{11}N$	3.1×10^{-4}	25		
Isopropylamine	C_3H_9N	5.3×10^{-4}	25		
Methylamine	CH_5N	5×10^{-4}	25		
Methyldiethylamine	$C_5H_{13}N$	2.7×10^{-4}	25		
α-Naphthylamine	$C_{10}H_9N$	9.9×10^{-11}	25		
β-Naphthylamine	$C_{10}H_9N$	2×10^{-1}[illegible]	25		
o-Phenylenediamine	$C_6H_8N_2$	3.3×10^{-1}[illegible]	25		
Phenylhydrazine	$C_6H_8N_2$	1.6×10^{-9}	40		
Piperidine	$C_5H_{11}N$	1.6×10^{-3}	25		
Propylamine (norm.)	C_3H_9N	4.7×10^{-4}	25		
Pyridine	C_5H_5N	2.3×10^{-9}	25		
Quinine	$C_{20}H_{24}O_2N_2$	2.2×10^{-7}	15	3.3×10^{-10}	15
Quinoline	C_9H_7N	1×10^{-9}	25		
Semicarbazide	CH_5ON_3	2.7×10^{-11}	40		
Silver Hydroxide	$AgOH$	1.1×10^{-4}	25		
Strychnine	$C_{21}H_{22}O_4N_2$	1×10^{-7}	15	6×10^{-11}	15
Tetramethylenediamine	$C_4H_{12}N_2$	5.1×10^{-4}	25		
Thiourea	CH_4N_2S	1.1×10^{-15}	25		
m-Toluidine	C_7H_9N	5.5×10^{-10}	25		
o-Toluidine	C_7H_9N	3.3×10^{-10}	25		
p-Toluidine	C_7H_9N	2×10^{-9}	25		
Triethylamine	$C_6H_{15}N$	6.4×10^{-4}	25		
Triisobutylamine	$C_{12}H_{27}N$	2.6×10^{-4}	25		
Trimethylamine	C_3H_9N	7.4×10^{-5}	25		
Trimethylenediamine	$C_3H_{10}N_2$	3.5×10^{-4}	25		
Tripropylamine	$C_9H_{21}N$	5.5×10^{-4}	25		
Urea	CH_4ON_2	1.5×10^{-14}	25		

ELECTROMOTIVE FORCE SERIES OF METALS

Alkali	Cs.Rb.K.Na.Li.	
Alkaline-earth	Ba.Sr.Ca.	
Magnesium	Mg	
Aluminum	Al	1.276
Manganese	Mn	1.075
Zinc	Zn	0.770
Chromium	Cr	
Cadmium	Cd	0.420
Iron	Fe	0.340
Cobalt	Co	0.232
Nickel	Ni	0.228
Tin	Sn	0.192
Lead	Pb	0.148
Hydrogen	(H)	0.000
Copper	Cu	0.336
Arsenic	As	
Bismuth	Bi	
Antimony	Sb	
Mercury	Hg	0.748
Silver	Ag	0.771
Palladium	Pd	
Platinum	Pt	0.863
Gold	Au	1.079

1. Any metal will replace any other metal, *below it* in the series, thus:

$$Fe + CuSO_4 = FeSO_4 + Cu$$
$$Zn + FeSO_4 = ZnSO_4 + Fe$$
$$Fe + 2HCl = FeCl_2 + H_2$$
$$Zn + H_2SO_4 = ZnSO_4 + H_2$$
$Cu + HCl$ = No action. Cu insoluble.
$Ag + HCl$ = No action. Ag insoluble.
$Cu +$ (dilute) H_2SO_4 = No action.
$Ag + CuSO_4$ = No action. Ag below Cu.

Note.—It is true that dilute and conc. HNO_3 and *hot conc.* H_2SO_4 will dissolve most of the metals. When they thus dissolve metals below hydrogen in the series, the action is an oxidizing one, and the acids are reduced to NO and SO_2 respectively. The metal is first oxidized to the oxide, the acid being thus at the same time reduced, and the oxide thus formed then reacts with the acid molecule present, and goes into solution as a salt.

(*a*) $Cu +$ (dilute) H_2SO_4 = No action.
(*b*) $Cu + 2$ (hot conc.) $H_2SO_4 = CuSO_4 + SO_2 + 2H_2O$.

In (*b*), the Cu is first converted to CuO, thus

$$Cu + H_2SO_4 = CuO + H_2O + SO_2,$$

then the CuO reacts with another molecule of H_2SO_4, thus

$$CuO + H_2SO_4 = CuSO_4 + H_2O.$$
$$3Cu + 2HNO_3 = 3CuO + 2NO + H_2O$$
$$3CuO + 6HNO_3 = 3Cu(NO_3)_2 + 3H_2O$$
Added $$3Cu + 8HNO_3 = 3Cu(NO_3)_2 + 2NO + 4H_2O.$$

2. **In Regard to Ease of Reduction of Oxides.**—The metallic oxides down to and including Mn can not be completely reduced to the metal state, even in a current of hydrogen. The oxides of Cd and succeeding metals are easily reduced, and far down the list, the oxides of silver, platinum, mercury, and gold are reduced (decomposed into metal and oxygen) even by heat alone.

3. **In Regard to Ease of Rusting.** (Oxidation in the Air.)—The alkali and alkaline-earth metals rust very rapidly and with considerable evolution of heat. All the metals down to copper rust with comparative ease. The metals below copper do not rust. Assuming the electrolytic theory of the process of rusting to be true, these facts are just about what might have been predicted.

4. **In Regard to the Occurence of the Metals in the Free State in Nature.**—Natural waters are frequently dilute solutions of carbonic, nitric, humic, etc., acids. As such they contain displaceable hydrogen. Metals *above* hydrogen in the E.M.F. series scarcely, if ever, occur in the free state in nature, but are practically without exception found in the combined state, as sulphides, carbonates, etc. Metals *below* hydrogen are frequently found in the free state in nature. Thus gold is found in the form of nuggets of metallic gold. However, metals below hydrogen are also found in the combined state, as cinnabar, HgS, etc.

5. **In Regard to Action of the Metals on Water.**—The alkali and alkaline-earths metal displace hydrogen from water, even in the cold,

and with evolution of much heat. Mg and succeeding metals will displace hydrogen from steam. Metals at the bottom of the list will not displace hydrogen from steam.

6. **In Regard to the Solubility and Stability of Hydroxides.**—The alkali metal oxides have great avidity for water, forming hydroxides. The alkaline-earth metal oxides react with less readiness, forming hydroxides. MgO reacts slowly and incompletely with water, forming the hydroxide. All the other metallic oxides and hydroxides are insoluble in water and have no perceptible reaction therewith. When a solution of NaOH acts on solutions of salts of the metals, the alkali metal salts are not precipitated The alkaline-earth metal salts are not precipitated unless in very concentrated solution. All the other metal solutions are acted upon, with precipitation of hydroxides, except in the case of copper which first gives copper hydroxide (blue), and which, on warming, changes to copper oxide (black). Also in the case of arsenic, no precipitate falls, sodium arsenite being formed. In the case of the last metals in the series, the *oxide* is precipitated, instead of the hydroxide, thus NaOH acting on salts of Sb, Hg, Ag, Pd, Pt, and Au, causes a precipitation of the *oxides* of these metals. Bismuth, as an exception, gives a normal hydroxide.

7. **In Regard to Carbonates.**—The alkali metals form normal stable, soluble carbonates, not easily decomposed on heating. The alkaline-earth metals form normal carbonates, which are insoluble in water, and which decompose upon heating, leaving the oxide, carbon dioxide being evolved. When sodium carbonate solution acts on solutions of all the other metals, as a rule, a basic carbonate is precipitated, being insoluble in water, and decomposed by heat into oxide and carbon dioxide. If the solution is cold, Ag, Hg, Cd, Fe, and Mn give normal carbonates. It the solution is warm, Sb, Hg, Ag, Pd, Pt, and Au give a precipitate of the *oxide*, instead of the carbonate, thus showing the instability of the carbonates of the lowest metals in the series.

8. **In Regard to Voltaic Cells.**—In choosing metals to acts as electrodes in voltaic cells, the farther apart the metals chosen, the greater the electromotive force of the voltaic cell. Thus the Al-Au couple gives a greater E.M.F. than the Zn-Cu couple.

For complete information, see Alex. Smith's Gen. Inorganic Chem., pages 361-363: 664–680. J. W. Mellor's Modern Inorg. Chem., pages 362–376.

TABLES SHOWING THE FUNCTIONS, USES AND COMPOSITIONS OF FOODS

Functions and Uses of Food in the Body.

Protein. — Builds and repairs tissue:

Albumen (white of eggs)
Casein (curd of milk)
Lean meat
Gluten of grains

Fats. — Are stored as fat:

Fat of meats, butter, olive oil, oils of corn, wheat and other grains.

Carbohydrates. — Are transformed into fat:

Sugar, starch, etc.

All serve as fuel to yield energy in the forms of heat and muscular power.

Mineral Matter of Ash. — Shares in forming bones and assist in processes of digestion.

Phosphates of lime potash, soda, etc.

Food is that which, taken into the body, builds tissue and yields energy.

TABLES SHOWING THE FUNCTIONS, USES AND COMPOSITIONS OF FOOD (Continued)

Dietary Standards

For a man in full vigor at moderate muscular work, per day

	Protein	Energy
	Grams	Large calories
Food eaten	100	3500
Food digested	95	3200

Mineral Matter (Required per Day)

	grams
Phosphoric acid, (P_2O_5)	3 to 4
Sulphuric acid, (SO_3)	2 to 3.5
Potassium oxide, (K_2O)	2 to 3
Sodium oxide, (Na_2O)	4 to 6
Calcium oxide, (CaO)	0.7 to 1.0
Magnesium oxide, (MgO)	0.3 to 0.5
Iron, (Fe)	0.006 to 0.012
Chlorine, (Cl)	6 to 8

These tables are compiled from charts of the United States Department of Agriculture, prepared by C. F. Langworthy, expert in charge of nutrition investigations.

Name of the food material	Protein.	Fat.	Carbo-hydrates.	Ash.	Water.	Fuel value in calories per lb.
Apple	0.4	0.5	14.2	0.3	84.6	290
Bacon	9.4	67.4	....	4.4	18.8	3030
Beef suet	4.7	81.8	....	0.3	13.2	3510
Butter	1.0	85.0	....	3.0	11.0	3410
Buckwheat	10.0	2.2	73.2	2.0	12.6	1600
Beefsteak	18.6	18.5	....	1.0	61.9	1130
Buttermilk	3.0	0.5	4.8	0.7	91.0	160
Bean, fresh shelled	9.4	0.6	29.1	2.0	58.9	740
Bean, green string	2.3	0.3	7.4	0.8	89.2	195
Bean, navy dry	22.5	1.8	59.6	3.5	12.6	1600
Banana	1.3	0.6	22.0	0.8	75.3	460
Codfish, fresh	12.8	0.4	....	1.2	82.6	325
Codfish, salt	21.5	0.3	....	24.7	53.5	410
Corn, dried	10.0	4.3	73.4	1.5	10.8	1800
Corn, green	3.1	1.1	19.7	0.7	75.4	500
Corn bread	7.9	4.7	46.3	2.2	38.9	1205
Cream cheese	25.9	33.7	2.4	3.8	34.2	1950
Cottage cheese	20.9	1.0	4.3	1.8	72.0	510
Cream	2.5	18.5	4.5	0.5	74.0	865

TABLES SHOWING THE FUNCTIONS, USES AND COMPOSITIONS OF FOODS—Continued

NAME OF THE FOOD MATERIAL	PROTEIN	FAT	CARBO-HYDRATES	ASH	WATER	FUEL VALUE IN CALORIES PER LB.
Candy stick			96.5	0.5	3.0	1785
Celery	1.1		3.4	1.0	94.5	85
Chestnut	10.7	7.0	74.2	2.2	5.9	1875
Cocoanut, dried	6.3	57.4	31.5	1.3	3.5	3125
Dried beef	30.0	6.6		9.1	54.3	840
Egg, whole	14.8	10.5		1.0	73.7	700
Egg, white	13.0	0.2		0.6	86.2	265
Egg, yolk	16.1	33.3		1.1	49.5	1608
Fig, dried	4.3	0.3	74.2	2.4	18.8	1475
Fruit, canned	1.1	0.1	21.1	0.5	77.2	415
Grapes	1.3	1.6	19.2	0.5	77.4	450
Grape juice, unfermented	0.2		7.4	0.2	92.2	150
Herring, smoked	36.4	15.8		13.2	34.6	1355
Honey	0.4		81.2	0.2	18.2	1520
Jelly, fruit			78.3	0.7	21.0	1455
Lard		100.0				4080
Lamb chop	17.6	28.3		1.0	53.1	1540
Mackerel	18.3	7.1		1.2	73.4	645
Macaroni	3.0	1.5	15.8	1.3	78.4	415
Milk, whole	3.3	4.0	5.0	0.7	87.0	310
Milk, skimmed	3.4	0.3	5.1	0.7	90.5	165
Molasses	2.4		69.3	3.2	25.1	1290
Oat	11.8	5.0	69.2	3.0	11.0	1720
Olive oil		100.0				4080
Oyster	6.2	1.2	3.7	2.0	86.9	235
Onion	1.6	0.3	9.9	0.6	87.6	225
Pork chop	16.9	30.1		1.0	52.0	1580
Parsnip	1.6	0.5	13.5	1.4	83.0	230
Potato	2.2	0.1	18.4	1.0	78.3	385
Peanut	25.8	38.6	22.4	2.0	9.2	2500
Peanut butter	29.3	46.5	17.1	5.0	2.1	2825
Rye	12.2	1.5	73.9	1.9	10.5	1750
Rice	8.0	2.0	77.0	1.0	12.0	1720
Rolled oats, cooked	2.8	0.5	11.5	0.7	84.5	285
Raisins	2.6	3.3	76.1	3.4	14.6	1605
Smoked ham	16.1	38.8		4.8	40.3	1940
Sugar granulated			100.0			1860
Sugar, maple			82.8	0.9	16.3	1540
Strawberry	1.0	0.6	7.4	0.6	90.4	180
Toasted bread	11.5	1.6	61.2	1.7	24.0	1420
Wheat	12.2	1.7	73.7	1.8	10.6	1750
White bread	9.2	1.3	53.1	1.1	35.3	1215
Whole wheat bread	9.7	0.9	49.7	1.3	38.4	1140
Walnut	16.6	63.4	16.1	1.4	2.5	3285

PROPERTIES OF MATTER

DENSITY OF ELEMENTS

The density is given in grams per cubic centimeter at the temperature stated. Where no temperature is given ordinary atmospheric temperature is understood.

Element.	Temp. ° C.	Density gm./c.c.	Observer
Aluminum, hard drawn	20	2.70	Wolf, Dellinger, 1910
wrought	......	2.65–2.80	
Antimony, vacuo-distilled	20	6.618	Kahlbaum, 1902
compressed	20	6.691	Kahlbaum, 1902
amorphous	......	6.22	Herard
Argon, liquid	−183	1.3845	Baly-Donnan
	−189	1.4233	Baly-Donnan
Arsenic, crystallized	14	5.73	
amorphous, brown — black	......	3.70	Guenther
yellow	......	3.88	Linck
Barium	......	3.78	Guntz
Bismuth, electrolytic	......	9.747	Classen, 1890
vacuo-distilled	20	9.781	Kahlbaum, 1902
liquid	271	10.00	Vincentini-Omodei
solid	271	9.67	Vincentini-Omodei
Boron, crystal	......	2.535	Wigand
amorphous	......	2.45	Moissan
Bromine, liquid	......	3.12	Richards-Stull
Cadmium, cast	......	8.54–57	
wrought	......	8.67	
vacuo-distilled	20	8.648	Kahlbaum, 1902
solid	318	8.37	Vincentini-Omodei
liquid	318	7.99	Vincentini-Omodei
Caesium	20	1.873	Richards-Brink
Calcium	......	1.54	Brink
Carbon, crystal	......	3.52	Wigand
graphite	......	2.25	Wigand
Cerium, electrolytic	......	6.79	Muthmann-Weiss
pure	......	7.02	Muthmann-Weiss
Chlorine, liquid	−33.6	1.507	Drugman-Ramsay
Chromium	......	6.52–73	
pure	20	6.92	Moissan
Cobalt	21	8.71	Tilden
Columbium	15	8.4	Muthmann-Weiss
Copper, cast	......	8.30–95	
annealed	20	8.89	Dellinger, 1911
wrought	......	8.85–95	
hard-drawn	20	8.89	Dellinger, 1911
vacuo-distilled	20	8.9326	Kahlbaum, 1902
compressed	20	8.9376	Kahlbaum, 1902
liquid	......	8.217	Roberts-Wrightson
Erbium	......	4.77	St. Meyer
Fluorine, liquid	−200	1.14	Moissan-Dewar
Gallium	23	5.93	de Boisbaudran
Germanium	20	5.46	Winkler
Glucinum	......	1.85	

DENSITY OF ELEMENTS (Continued)

Element.	Temp. ° C.	Density gm./c.c.	Observer.
Gold, cast	......	19.3	
wrought	......	19.33	
vacuo-distilled	20	18.88	Kahlbaum, 1902
compressed	20	19.27	Kahlbaum, 1902
Helium, liquid	—269	0.15	Onnes, 1908
Hydrogen, liquid	—252	0.070	Dewar, 1904
Indium	......	7.28	Richards
Iridium	17	22.42	Deville-Debray
Iodine	20	4.940	Richards-Stull
Iron, pure	......	7.85–88	
gray cast	......	7.03–13	
white cast	......	7.58–73	
wrought	......	7.80–90	
liquid	......	6.88	Roberts-Austen
steel	......	7.60–80	
Krypton, liquid	—146	2.16	Ramsay-Travers
Lanthanum	......	6.15	Muthmann-Weiss
Lead, vacuo-distilled	20	11.342	Kahlbaum, 1902
compressed	20	11.347	Kahlbaum, 1902
solid	325	11.005	Vicentini-Omodei
liquid	325	10.645	Vicentini-Omodei
	400	10.597	Day, Sosman, 1914
	850	10.078	Day, Sosman, 1914
Lithium	20	0.534	Richards-Brink, 1907
Magnesium	......	1.741	Voigt
Manganese	......	7.42	Prelinger
Mercury, liquid	0	13.596	Regnault, Volkmann
	20	13.546	
	—38.8	13.690	Vincentini-Omodei
solid	—38.8	14.193	Vincentini-Omodei
	—188	14.383	Dewar, 1902
Molybdenum	......	9.01	Moissan
Neodymium	......	6.96	Muthmann-Weiss
Nickel	......	8.60–90	
Nitrogen, liquid	—195	0.810	Baly-Donnan, 1902
	—205	0.854	Baly-Donnan, 1902
Osmium	......	22.5	Deville-Debray
Oxygen, liquid	—184	1.14	
Palladium	......	12.16	Richards-Stull
Phosphorus, white	......	1.83	
red	......	2.20	
metallic	15	2.34	Hittorf
Platinum	20	21.37	Richards-Stull
Potassium	20	0.870	Richards-Brink, 1907
solid	62.1	0.851	Vincentini-Omodei
liquid	62.1	0.830	Vincentini-Omodei
Praesodymium	......	6.475	Muthmann-Weiss
Rhodium	......	12.44	Holborn-Henning
Rubidium	20	1.532	Richards-Brink, 1907
Ruthenium	0	12.06	Toby
Samarium	......	7.7–8	Muthmann-Weiss
Selenium	......	4.3–8	
Silicon, crystal	20	2.42	Richards-Stull-Brink
amorphous	15	2.35	Vigoroux
Silver, cast	......	10.42–53	
wrought	......	10.6	
vacuo-distilled	20	10.492	Kahlbaum, 1902
compressed	20	10.503	Kahlbaum, 1902
liquid	......	9.51	Wrightson

DENSITY OF ELEMENTS (Continued)

Element	Temp. °C	Density gm./c.c.	Observer
Sodium	20	0.9712	Richards-Brink, 1907
solid	97.6	0.9519	Vincentini-Omodei
liquid	97.6	0.9287	Vincentini-Omodei
solid	—188	1.0066	Dewar
Strontium	......	2.50–58	Matthiessen
Sulphur	......	2.0–1	
liquid	......	1.811	Vincentini-Omodei
Tantalum	......	16.6	
Tellurium, crystal	......	6.25	
amorphous	20	6.02	Beljankin
Thallium	......	11.86	Richards-Stull [1925
Thorium	......	11.3–11.7	Rentschler, Marden,
Tin, white cast	......	7.29	Matthiessen
wrought	......	7.30	
crystallized	......	6.97–7.18	
solid	226	7.184	Vincentini-Omodei
liquid	226	6.99	Vincentini-Omodei
gray	......	5.8	
Titanium	18	4.5	Mixter
Tungsten	......	18.6–19.1	
Uranium	13	18.7	Zimmermann
Vanadium	......	5.69	Ruff-Martin
Xenon, liquid	—109	3.52	Ramsay-Travers
Yttrium	......	3.80	St. Meyer
Zinc, cast	......	7.04–16	
wrought	......	7.19	
vacuo-distilled	20	6.92	Kahlbaum, 1902
compressed	20	7.13	Kahlbaum, 1902
liquid	......	6.48	Roberts-Wrightson
Zirconium	......	6.44	

DENSITY OF ALLOYS

The density is given in grams per cubic centimeter at ordinary atmospheric temperatures.

Alloy.	Composition.	Density
Aluminum and copper	10 Al, 90 Cu	7.69
	5 Al, 95 Cu	8.37
	3 Al, 97 Cu	8.69
Aluminum and zinc	91 Al, 9 Zn	2.80
Bell metal	78 Cu, 22 Zn	8.70
Bismuth, lead and tin	53 Bi, 40 Pb, 7 Sn	10.56
Brass, yellow	70 Cu, 30 Zn cast	8.44
	rolled	8.56
	drawn	8.70
red	90 Cu, 10 Zn	8.60
white	50 Cu, 50 Zn	8.20
Bronze	90 Cu, 10 Sn (gun metal)	8.78
	85 Cu, 15 Sn	8.89
	80 Cu, 20 Sn	8.74
	75 Cu, 25 Sn	8.83

DENSITY OF ALLOYS (Continued)

Alloy.	Composition.	Density.
Cadmium and tin. . . .	32 Cd, 68 Sn	7.70
Constantan.	60 Cu, 40 Ni	8.88
German silver	26.3 Cu, 36.6 Zn, 36.8 Ni	8.30
	52 Cu, 26 Zn, 22 Ni	8.45
	59 Cu, 30 Zn, 11 Ni	8.34
	63 Cu, 30 Zn, 6 Ni	8.30
Gold and copper.	98 Au, 2 Cu	18.84
	96 Au, 4 Cu	18.36
	94 Au, 6 Cu	17.95
	92 Au, 8 Cu	17.52
	90 Au, 10 Cu	17.16
	88 Au, 12 Cu	16.81
	86 Au, 14 Cu	16.47
Invar.	63.8 Fe, 36 Ni, 0.2 C	8.00
Lead and tin.	87.5 Pb, 12.5 Sn	10.60
	84 Pb, 16 Sn	10.33
	77.8 Pb, 22.2 Sn	10.05
	63.7 Pb, 36.3 Sn	9.43
	46.7 Pb, 53.3 Sn	8.73
	30.5 Pb, 69.5 Sn	8.24
Magnalium.	90 Al, 10 Mg	2.50
	70 Al, 30 Mg	2.00
Manganese bronze. . .	95 Cu, 5 Mn	8.80
Manganin.	84 Cu, 12 Mn, 4 Ni	8.50
Monel metal.	71 Ni, 27 Cu, 2 Fe	8.90
Nickelin.	. . . .	8.77
Phosphor bronze.	79.7 Cu, 10 Sn, 9.5 Sb, 0.8 P	8.80
Platinum and iridium	90 Pt, 10 Ir	21.62
	85 Pt, 15 Ir	21.62
	66.67 Pt, 33.33 Ir	21.87
	5 Pt, 95 Ir	22.38
Speculum metal.	67 Cu, 33 Sn	8.60
Steel.	99 Fe, 1 C	7.83
manganese.	86 Fe, 13 Mn, 1 C	7.81
Wood's metal.	50 Bi, 25 Pb, 12.5 Cd, 12 5 Sn	10.56

DENSITY OF VARIOUS SOLIDS

The approximate density of various solids at ordinary atmospheric temperature.

(Selected principally from the Smithsonian Tables.)

Substance.	Grams per cu. cm.	Pounds per cu. ft.
Agate	2.5–2.7	156–168
Alabaster, carbonate	2.69–2.78	168–173
sulphate	2.26–2.32	141–245
Albite	2.62–2.65	163–165
Amber	1.06–1.11	66–69
Amphoboles	2.9–3.2	180–200
Anorthite	2.74–2.76	171–172
Asbestos	2.0–2.8	125–175
Asphalt	1.1–1.5	69–94
Basalt	2.4–3.1	150–190
Beeswax	0.96–0.97	60–61
Beryl	2.69–2.7	168
Biotite	2.7–3.1	170–190
Bone	1.7–2.0	106–125
Brick	1.4–2.2	87–137
Butter	0.86–0.87	53–54
Calamine	4.1–4.5	255–280
Calcspar	2.6–2.8	162–175
Caoutchouc	0.92–0.99	57–62
Celluloid	1.4	87
Cement, set	2.7–3.0	170–190
Chalk	1.9–2.8	118–175
Charcoal, oak	0.57	35
pine	0.28–0.44	18–28
Cinnabar	8.12	507
Clay	1.8–2.6	122–162
Coal, anthracite	1.4–1.8	87–112
bituminous	1.2–1.5	75–94
Cocoa butter	0.89–0.91	56–57
Coke	1.0–1.7	62–105
Copal	1.04–1.14	65–71
Cork	0.22–0.26	14–16
Corundum	3.9–4.0	245–250
Diamond	3.01–3.52	188–220
Dolomite	2.84	177
Ebonite	1.15	72
Emery	4.0	250
Epidote	3.25–3.50	203–218
Feldspar	2.55–2.75	159–172
Flint	2.63	164
Fluorite	3.18	198
Galena	7.3–7.6	460–470
Gamboge	1.2	75
Garnet	3.15–4.3	197–268
Gas carbon	1.88	117
Gelatine	1.27	80
Glass, common	2.4–2.8	150–175
flint	2.9–5.9	180–370
Glue	1.27	80
Granite	2.64–2.76	165–172
Graphite	2.30–2.72	144–170
Gum arabic	1.3–1.4	80–85
Gypsum	2.31–2.33	144–145
Hematite	4.9–5.3	306–330
Hornblende	3.0	187
Ice	0.917	57.2
India rubber	0.91–0.93	57–58
Ivory	1.83–1.92	114–120
Leather, dry	0.86	54
Lime, slaked	1.3–1.4	81–87
Limestone	2.68–2.76	167–171
Magnetite	4.9–5.2	306–324
Malachite	3.7–4.1	231–256
Marble	2.6–2.8	160–177
Meerschaum	0.99–1.28	62–80
Mica	2.6–3.2	165–200
Muscovite	2.76–3.00	172–225
Ochre	3.5	218
Opal	2.2	137
Paper	0.7–1.15	44–72
Paraffin	0.87–0.91	54–57
Peat	0.84	52
Pitch	1.07	67
Porcelain	2.3–2.5	143–156
Porphyry	2.6–2.9	162–181
Pyrite	4.95–5.1	309–318
Quartz	2.65	165
Resin	1.07	67
Rock salt	2.18	136
Sandstone	2.14–2.36	134–147
Serpentine	2.50–2.65	156–165
Silica, fused transparent	2.21	142
translucent	2.07	133
Slag	2.0–3.9	125–240
Slate	2.6–3.3	162–205
Soapstone	2.6–2.8	162–175
Starch	1.53	95
Sugar	1.61	100
Talc	2.7–2.8	168–174
Tallow	0.91–0.97	57–60
Tar	1.02	66
Topaz	3.5–3.6	219–223

DENSITY OF VARIOUS SOLIDS (Continued)

Substance.	Grams per cu. cm.	Pounds per cu. ft.	Substance.	Grams per cu. cm.	Pounds per cu. ft.
Tourmaline	3.0-3.2	190-200	lignum vitæ....	1.17-1.33	73-83
Wax, sealing	1.8	117	locust..........	0.67-0.71	42-44
Wood (seasoned)			logwood........	0.91	57
alder..........	0.42-0.68	26-42	mahogany		
apple..........	0.66-0.84	41-52	Honduras	0.66	41
ash...........	0.65-0.85	40-53	Spanish.....	0.85	53
bamboo	0.31-0.40	19-25	maple..........	0.62-0.75	39-47
basswood......	0.32-0.59	20-37	oak............	0.60-0.90	37-56
beech..........	0.70-0.90	43-56	pear............	0.61-0.73	38-45
blue gum.......	1.00	62	pine, pitch......	0.83-0.85	52-53
birch..........	0.51-0.77	32-48	white	0.35-0.50	22-31
box	0.95-1.16	59-72	yellow.......	0.37-0.60	23-37
butternut......	0.38	24	plum...........	0.66-0.78	41-49
cedar..........	0.49-0.57	30-35	poplar..........	0.35-0.50	22-31
cherry	0.70-0.90	43-56	satinwood......	0.95	59
dogwood......	0.76	47	spruce.........	0.48-0.70	30-44
ebony..........	1.11-1.33	69-83	sycamore.......	0.40-0.60	24-37
elm...........	0.54-0.60	34-37	teak, Indian....	0.66-0.88	41-55
hickory........	0.60-0.93	37-47	African.......	0.98	61
holly	0.76	47	walnut	0.64-0.70	40-43
juniper........	0.56	35	water gum.....	1.00	62
larch..........	0.50-0.56	31-35	willow.........	0.40-0.60	24-37

For the specific gravity of *alloys* see Composition and Physical Properties of Alloys.

For the specific gravity of the *elements* see Physical Constants of the Elements.

For specific gravity of *inorganic compounds* see Physical Constants of Inorganic Compounds.

For specific gravity of *organic compounds* see Physical Constants of Organic Compounds.

For specific gravity of *minerals* see Physical Constants of Common Minerals.

DENSITY OF WATER

The temperature of maximum density for pure water, free from air = 3°.98 C.

The density at this temperature = **0.999973** (C. G. S.).

(International Bureau of Weights and Measures, 1910.)

DENSITY OF VARIOUS LIQUIDS

(Selected from Smithsonian Tables.)

Liquid.	Grams per cu.cm.	Pounds per cu.ft.	Temp. °C.
Acetone	0.792	49.4	0°
Alcohol, ethyl	0.791	49.4	0
methyl	0.810	50.5	0
Benzene	0.899	56.1	0
Carbolic acid	0.950–0.965	59.2–60.2	15
Chloroform	1.480	92.3	18
Ether	0.736	45.9	0
Gasoline	0.66–0.69	41.0–43.0	..
Glycerine	1.260	78.6	0
Milk	1.028–1.035	64.2–64.6	..
Naphtha, wood	0.848–0.810	52.9–50.5	0
Naphtha, petroleum ether	0.665	41.5	15
Oils:			
castor	0.969	60.5	15
cocoanut	0.925	57.7	15
cotton seed	0.926	60.2	16
creosote	1.040–1.100	64.9–68.6	15
linseed, boiled	0.942	58.8	15
olive	0.918	57.3	15
turpentine	0.873	54.2	16
Sea water	1.025	64.0	15

HYDROMETER CONVERSION TABLES

Showing the Relation between Density (C. G. S.) and Degrees Baumé for Densities less than Unity.

Density.	Degrees Baumé.				
	.00	.01	.02	.03	.04
0.60	103.33	99.51	95.81	92.22	88.75
.70	70.00	67.18	64.44	61.78	59.19
.80	45.00	42.84	40.73	38.68	36.67
.90	25.56	23.85	22.17	20.54	18.94
1.00	10.00	.....	.....	.....	.....

Density.	Degrees Baumé.				
	.05	.06	.07	.08	.09
0.60	85.38	82.12	78.95	75.88	72.90
.70	56.67	54.21	51.82	49.49	47.22
.80	34.71	32.79	30.92	29.09	27.30
.90	17.37	15.83	14.33	12.86	11.41
1.00	.....	.....	.....	.....	.....

HYDROMETER CONVERSION TABLES
(Continued)

SHOWING THE RELATION BETWEEN DENSITY (C. G. S.) AND THE BAUMÉ AND TWADDELL SCALES FOR DENSITIES ABOVE UNITY.

Density.	Degrees Baumé.	Degrees Twaddell.	Density.	Degrees Baumé.	Degrees Twaddell.
1.00	0.00	0	1.41	42.16	82
1.01	1.44	2	1.42	42.89	84
1.02	2.84	4	1.43	43.60	86
1.03	4.22	6	1.44	44.31	88
1.04	5.58	8	1.45	45.00	90
1.05	6.91	10	1.46	45.68	92
1.06	8.21	12	1.47	46.36	94
1.07	9.49	14	1.48	47.03	96
1.08	10.74	16	1.49	47.68	98
1.09	11.97	18	1.50	48.33	100
1.10	13.18	20	1.51	48.97	102
1.11	14.37	22	1.52	49.60	104
1.12	15.54	24	1.53	50.23	106
1.13	16.68	26	1.54	50.84	108
1.14	17.81	28	1.55	51.45	110
1.15	18.91	30	1.56	52.05	112
1.16	20.00	32	1.57	52.64	114
1.17	21.07	34	1.58	53.23	116
1.18	22.12	36	1.59	53.80	118
1.19	23.15	38	1.60	54.38	120
1.20	24.17	40	1.61	54.94	122
1.21	25.16	42	1.62	55.49	124
1.22	26.15	44	1.63	56.04	126
1.23	27.11	46	1.64	56.58	128
1.24	28.06	48	1.65	57.12	130
1.25	29.00	50	1.66	57.65	132
1.26	29.92	52	1.67	58.17	134
1.27	30.83	54	1.68	58.69	136
1.28	31.72	56	1.69	59.20	138
1.29	32.60	58	1.70	59.71	140
1.30	33.46	60	1.71	60.20	142
1.31	34.31	62	1.72	60.70	144
1.32	35.15	64	1.73	61.18	146
1.33	35.98	66	1.74	61.67	148
1.34	36.79	68	1.75	62.14	150
1.35	37.59	70	1.76	62.61	152
1.36	38.38	72	1.77	63.08	154
1.37	39.16	74	1.78	63.54	156
1.38	39.93	76	1.79	63.99	158
1.39	40.68	78	1.80	64.44	160
1.40	41.43	80	....	.....	...

ABSOLUTE DENSITY OF WATER

Density in Grams per Cubic Centimeter, Computed from the Relative Values by Thiesen, Scheel and Disselhorst (1900), and the Absolute Value at 3°.98 C. by the International Bureau of Weights and Measures (1910).

Degrees	0	1	2	3	4	5	6	7	8	9
0	0.999841	847	854	860	866	872	878	884	889	895
1	900	905	909	914	918	923	927	930	934	938
2	941	944	947	950	953	955	958	960	962	964
3	965	967	968	969	970	971	972	972	973	973
4	973	973	973	972	972	972	970	969	968	966
5	965	963	961	959	957	955	952	950	947	944
6	941	938	935	931	927	924	920	916	911	907
7	902	898	893	888	883	877	872	866	861	855
8	849	843	837	830	824	817	810	803	796	789
9	781	774	766	758	751	742	734	726	717	709
10	700	691	682	673	664	654	645	635	625	615
11	605	595	585	574	564	553	542	531	520	509
12	498	486	475	463	451	439	427	415	402	390
13	377	364	352	339	326	312	299	285	272	258
14	244	230	216	202	188	173	159	144	129	114
15	099	084	069	054	038	023	007	*991	*975	*959
16	0.998943	926	910	893	877	860	843	826	809	792
17	774	757	739	722	704	686	668	650	632	613
18	595	576	558	539	520	501	482	463	444	424
19	405	385	365	345	325	305	285	265	244	224
20	203	183	162	141	120	099	078	056	035	013
21	0.997992	970	948	926	904	882	860	837	815	792
22	770	747	724	701	678	655	632	608	585	561
23	538	514	490	466	442	418	394	369	345	320
24	296	271	246	221	196	171	146	120	095	069
25	044	018	*992	*967	*941	*914	*888	*862	*836	*809
26	0.996783	756	729	703	676	649	621	594	567	540
27	512	485	457	429	401	373	345	317	289	261
28	232	204	175	147	118	089	060	031	002	*973
29	0.995944	914	885	855	826	796	766	736	706	676
30	646	616	586	555	525	494	464	433	402	371

RELATIVE DENSITY AND VOLUME OF WATER

The mass of one cubic centimeter of water at 4° C is taken as unity.
The absolute density in C. G. S. units is obtained by multiplying the relative density by 0.999973.

(Smithsonian Tables, compiled from Various Authors.)

Temp. °C.	Density.	Volume.	Temp. °C.	Density.	Volume
−10	0.99815	1.00186	+35	0.99406	1.00598
−9	843	157	36	371	633
−8	869	131	37	336	669
−7	892	108	38	299	706
−6	912	088	39	262	743
−5	0.99930	1.00070	40	0.99224	1.00782
−4	945	055	41	186	821
−3	958	042	42	147	861
−2	970	031	43	107	901
−1	979	021	44	066	943
+0	0.99987	1.00013	45	0.99025	1.00985
1	993	007	46	0.98982	1.01028
2	997	003	47	940	072
3	999	001	48	896	116
4	1.00000	1.00000	49	852	162
5	0.99999	1.00001	50	0.98807	1.01207
6	997	003	51	762	254
7	993	007	52	715	301
8	988	012	53	669	349
9	981	019	54	621	398
10	0.99973	1.00027	55	0.98573	1.01448
11	963	037	60	324	705
12	952	048	65	059	979
13	940	060	70	0.97781	1.02270
14	927	073	75	489	576
15	0.99913	1.00087	80	0.97183	1.02899
16	897	103	85	0.96865	1.03237
17	880	120	90	534	590
18	862	138	95	192	959
19	843	157	100	0.95838	1.04343
20	0.99823	1.00177	110	0.9510	1.0515
21	802	198	120	0.9434	1.0601
22	780	221	130	0.9352	1.0693
23	756	244	140	0.9264	1.0794
24	732	268	150	0.9173	1.0902
25	0.99707	1.00294	160	0.9075	1.1019
26	681	320	170	0.8973	1.1145
27	654	347	180	0.8866	1.1279
28	626	375	190	0.8750	1.1429
29	597	405	200	0.8628	1.1590
30	0.99567	1.00435	210	0.850	1.177
31	537	466	220	0.837	1.195
32	505	497	230	0.823	1.215
33	473	530	240	0.809	1.236
34	440	563	250	0.794	1.259

DENSITY AND VOLUME OF MERCURY

Based on the Density of Mercury at 0° C. by Thiesen and Scheel (1898)

(Selected from Smithsonian Tables.)

Temp. ° C.	Mass in gr. per cu.cm.	Vol. of 1 gr. in cu.cms.	Temp. ° C.	Mass in gr. per cu.cm.	Vol. in 1 gr. in cu.cms.
−10	13.6202	0.0734205	30°	13.5217	0.0739552
−9	6177	4338	31	5193	9686
−8	6152	4472	32	5168	9820
−7	6128	4606	33	5144	9953
−6	6103	4739	34	5119	40087
−5	13.6078	0.0734873	35	13.5095	0.0740221
−4	6053	5006	36	5070	0354
−3	6029	5140	37	5046	0488
−2	6004	5273	38	5021	0622
−1	5979	5407	39	4997	0756
0	13.5955	0.0735540	40	13.4973	0.0740891
1	5930	5674	50	4729	2229
2	5906	5808	60	4486	3569
3	5881	5941	70	4244	4910
4	5856	6075	80	4003	6252
5	13.5832	0.0736209	90	13.3762	0.0747594
6	5807	6342	100	3522	8939
7	5782	6476	110	3283	50285
8	5758	6610	120	3044	1633
9	5733	6744	130	2805	2982
10	13.5708	0.0736877	140	13.2567	0.0754334
11	5684	7011	150	2330	5688
12	5659	7145	160	2093	7044
13	5634	7278	170	1856	8402
14	5610	7412	180	1620	9764
15	13.5585	0.0737546	190	13.1384	0.0761128
16	5561	7680	200	1148	2495
17	5536	7813	210	0913	3865
18	5512	7947	220	0678	5239
19	5487	8081	230	0443	6616
20	13.5462	0.0738215	240	13.0209	0.0767996
21	5438	8348	250	12.9975	9381
22	5413	8482	260	9741	70769
23	5389	8616	270	9507	2161
24	5364	8750	280	9273	3558
25	13.5340	0.0738883	290	12.9039	0.0774958
26	5315	9017	300	8806	6364
27	5291	9151	310	8572	7774
28	5266	9285	320	8339	9189
29	5242	9419	330	8105	80609
30	13.5217	0.0739552	340	12.7872	0.0782033
			350	7638	3464
			360	7405	4900

DENSITY OF AQUEOUS SOLUTIONS

(Selected from Smithsonian Tables.)

Substance.	Density in grams per cubic centimeter.									Temp. ° C.
	Parts of solute in 100 parts of solution by weight.									
	5	10	15	20	25	30	40	50	60	
Ammonium chloride	1.015	1.030	1.044	1.058	1.072	...	...	...	...	15
Barium chloride	1.045	1.094	1.147	1.205	1.269	...	...	...	...	15
Cadmium chloride	1.043	1.087	1.138	1.193	1.254	1.319	1.469	1.653	1.887	19.5
Calcium chloride	1.041	1.086	1.132	1.181	1.232	1.286	1.402	...	...	15.
Cane sugar	1.019	1.039	1.060	1.082	1.129	1.178	1.289	...	...	17.5
Copper sulphate	1.031	1.064	1.098	1.134	1.173	1.213	...	...	...	18.
Mercuric chloride	1.041	1.092	...	...	...	...	...	...	...	20.
Potassium bichromate	1.035	1.071	1.108	...	...	...	...	...	...	19.5
hydroxide	1.040	1.082	1.127	1.176	1.229	1.286	1.410	1.538	1.666	15.
chloride	1.031	1.065	1.099	1.135	...	...	...	...	...	15.
bromide	1.035	1.073	1.114	1.157	1.205	1.254	1.364	...	...	19.5
iodide	1.036	1.076	1.118	1.164	1.216	1.269	1.394	1.544	1.732	19.5
nitrate	1.031	1.064	1.099	1.135	...	...	...	...	...	15.
Sodium hydroxide	1.058	1.114	1.169	1.224	1.279	1.331	1.436	1.539	1.642	15.
chloride	1.035	1.072	1.110	1.150	1.191	...	...	...	...	15.
Silver nitrate	1.044	1.090	1.140	1.195	1.255	1.322	1.479	1.675	1.918	15.
Zinc chloride	1.043	1.089	1.135	1.184	1.236	1.289	1.417	1.563	1.737	19.5
sulphate	1.027	1.057	1.089	1.122	1.156	1.191	1.269	1.351	1.443	20.5

DENSITY OF ALCOHOL

Density of Ethyl Alcohol in Grams per Cubic Centimeter, Computed from Mendelejeff's Formula

(Selected from Smithsonian Tables.)

Temp. ° C.	0	1	2	3	4
0	.80625	.80541	.80457	.80374	.80290
10	.79788	.79704	.79620	.79535	.79451
20	.78945	.78860	.78775	.78691	.78606
30	.78097	.78012	.77927	.77841	.77756

Temp. ° C.	5	6	7	8	9
0	.80207	.80123	.80039	.79956	.79872
10	.79367	.79283	.79198	.79114	.79029
20	.78522	.78437	.78352	.78267	.78182
30	.77671	.77585	.77500	.77414	.77329

DENSITY OF DRY AIR

AT THE TEMPERATURE t, AND UNDER THE PRESSURE H CM. OF MERCURY, THE DENSITY OF AIR

$$= \frac{0.001293}{1+0.00367\,t}\,\frac{H}{76}.$$

(From Miller's Laboratory Physics, Ginn & Co. publishers, by permission.)

t	Pressure H in Centimeters.					
	72.0	73.0	74.0	75.0	76.0	77.0
°						
10	0.001182	0.001198	0.001215	0.001231	0.001247	0.001264
11	178	193	210	227	243	259
12	173	190	206	222	239	255
13	169	186	202	218	234	251
14	165	181	198	214	230	246
15	0.001161	0.001177	0.001193	0.001210	0.001226	0.001242
16	157	173	189	205	221	238
17	153	169	185	201	217	233
18	149	165	181	197	213	229
19	145	161	177	193	209	225
20	0.001141	0.001157	0.001173	0.001189	0.001205	0.001221
21	137	153	169	185	201	216
22	134	149	165	181	197	212
23	130	145	161	177	193	208
24	126	142	157	173	189	204
25	0.001122	0.001138	0.001153	0.001169	0.001185	0.001200
26	118	134	149	165	181	196
27	115	130	146	161	177	192
28	111	126	142	157	173	188
29	107	123	138	153	169	184
30	0.001104	0.001119	0.001134	0.001150	0.001165	0.001180

Proportional Parts.

cm.	17	16	15
0.1	2	2	1
0.2	3	3	3
0.3	5	5	4
0.4	7	6	6
0.5	8	8	7
0.6	10	10	9
0.7	12	11	10
0.8	14	13	12
0.9	15	14	13

DENSITY OF SATURATED VAPORS AT THE TEMPERATURE OF NORMAL EBULLITION

Vapor.	Temp. ° C.	Density.
Acetic acid	118.5	0.00315
Benzene	80.2	0.00275
Chloroform	61.2	0.00443
Ether	34.6	0.00311
Ethyl alcohol	78.3	0.00164
Methyl alcohol	64.7	0.00121
Water	100.0	0.000596

DENSITY OF GASES IN LIQUID AND SOLID FORM

Temperatures marked * are the temperatures of normal ebullition.

Gas.	Liquid. Temp. °C	Liquid. D g/cm³.	Solid. Temp. °C.	Solid. D g/cm³.	Observer.
Acetylene	− 23.5	0.52	.....	....	Mathias, 1909
	30.8	0.40	.....	....	
Air (20.9% oxygen).	−147.	0.92	.....	....	
Ammonia	− 10.7	0.65	.....	....	Andreeff, 1859
	+ 16.3	0.61	.....	....	Andreeff, 1859
Argon	−187.*	1.41	.....	....	Baly & Donnan, 1902
Carbon dioxide	− 60.	1.19	− 79.	1.53	Behn, 1910
	+ 20.	0.77	.....	....	Amagat
Carbon monoxide	−190.*	.79	.....	....	
	− 68	.86	.....	....	Baly & Donnan
Chlorine	− 33.6*	1.56	.....	....	Knietsch, 1890
Chlorine	+ 20.	1.41	.....	....	Knietsch, 1890
Ethylene	− 21.	0.41	.....	....	Cailletet & Mathias, 1886
Ethylene	+ 10.	0.21			
Helium	−269.*	0.122	.....	....	Kamerling-Onnes & Perrier, 1910
Hydrogen	−253.*	0.07	−260.	.076	Dewar, 1904
Hydrogen sulphide	− 61.	0.86			
Nitrogen	−196.*	0.804	−253.	1.03	Dewar, 1904
Nitrous oxide	− 20.	1.0	.....	....	Cailletet & Mathias
Nitrous oxide	+ 17.	.80	.....	....	Villard, 1897
Oxygen	− 23.	0.89	.....	....	Cailletet & Hautefeuille, 1881
	−182.7*	1.14	−253.	−1.41	Kamerling-Onnes & Perrier, 1910
	−205.	1.25	.....	....	Baly & Donnan
Sulphur dioxide	− 10.*	1.46	.....	....	Pierre
	+ 20.	1.38	.....	....	Cailletet & Mathias

ELASTIC CONSTANTS FOR SOLIDS

YOUNG'S MODULUS AND MODULUS OF RIGIDITY

The values can be considered only as approximations. They are for ordinary atmospheric temperatures.

Material.	Young's Modulus. Dynes per sq.cm.	Young's Modulus. Pounds per sq.in.	Modulus of rigidity. Dynes per sq.cm.	Modulus of rigidity. Pounds per sq.in.
Aluminum	7×10^{11}	10.2×10^{6}	2.5×10^{11}	3.63×10^{6}
Bismuth	3.2	4.65	1.24	1.80
Brass	9.2	13.4	3.7	5.38
Bronze	10.6	15.4	4.06	5.91
phosphor	12.0	17.4	4.36	6.32
Cadmium	5.0	7.26	2.45	3.56
Copper	10.	14.5	4.2	6.10
German silver	10.8	15.7	4.5	6.54
Glass ordinary	4.7–7.8	6.83–11.3	1.8–3.2	2.62–4.65
crown	6.5–7.8	9.45–11.3	2.6–3.2	3.78–4.65
flint	5.0–6.0	7.26–8.52	2.0–2.5	2.91–3.63
Gold, pure	8.0	11.6	3.0	4.36
Granite	1.46	2.12		
Ice	.28	.407		
Iron, drawn	20.0	29.1	8.00	11.6
cast	11.5	16.8	5.10	7.41

ELASTIC CONSTANTS FOR SOLIDS (Continued)

Young's Modulus and Modulus of Rigidity (Continued)

Gas.	Young's Modulus.		Modulus of rigidity.	
	Dynes per sq.cm.	Pounds per sq.in.	Dynes per sq.cm.	Pounds per sq.in.
Ivory	$.9\times10^{11}$	1.31×10^{6}		
Lead	1.7	2.47	0.7×10^{11}	1.02×10^{6}
Magnesium	4.2	6.10	1.7	2.47
Manganin	12.4	18.0	4.65	6.70
Nickel	22.0	32.0	8.0	11.6
Platinum	17.0	24.7	6.5	9.45
Platinum-iridium	21.4	31.1		
Quartz, crystal:				
‖ to axis	10.30	15.0		
⊥ to axis	7.85	11.4		
fiber	5.6	8.14	3.0	4.36
Rhodium	28.0	40.7		
Silver, pure	7.5	10.9	2.7	3.94
Steel, ordinary mild	22.0	32.0	8.00	11.6
cast	19.5	28.3	7.50	10.9
drawn	18.8	27.3		
invar	14.1	20.3	5.63	8.18
Tantalum	18.6	27.0		
Tin	5.0	7.26	2.0	2.91
Wood	.03–1.0	.0436–1.45		
Zinc	9.0	13.1	3.4	4.94

Bulk Modulus, Limit of Elasticity and Breaking Strain

The values can be considered only as approximations. They are for ordinary atmospheric temperatures.

Material.	Limit of Elasticity.		Breaking Strain.		Bulk Modulus Dynes per sq.cm.
	Dynes per sq.cm.	Pounds per sq.in.	Dynes per sq.cm.	Pounds per sq.in.	
Aluminum	5.0×10^{8}	7.25×10^{3}	$10\text{–}25\times10^{8}$	$14.5\text{–}36.3\times10^{3}$	7.0×10^{11}
Bismuth	......	....	....	....	3.0
Brass	......	....	22.–48.	32.–70.	6.1
Bronze	5.0–12.	7.25–17.4	20.–40.	29.–58.	8.9
Cadmium	......	....	....	....	4.12
Copper	0.5–20.0	0.73–29.0	16.–45.	23.2–65.3	12.0
German silver	......	....	....	....	15.0
Glass:					
crown	......	....	....	....	4.0–5.9
flint	......	....	....	....	3.6–3.8
Gold	......	....	11.0	15.6	16.0
Iron:					
drawn	20.	29.	66.	96.	15.4
cast	17.	25.	33.	48.	9.6
Lead	......	....	3.	4.4	0.76
Manganin	......	....	....	....	12.1
Nickel	......	....	42.	61.	17.0
Platinum	......	....	36.	52.	24.0
Quartz	......	....	....	....	3.7
Silver	15.	22.	28.	41.	10.0
Steel, mild	20.–100.	29.–145.	35.–150.	51.–218.	16.0
Tin	......	....	8.	12.	5.0
Zinc	......	....	6.	8.7	3.5

COMPRESSIBILITY OF LIQUIDS

Contraction in unit volume per atmosphere.

Liquid.	Temp. °C.	Pressures in atmospheres.	Coefficient.	Observer.
Acetone.......	0.	1–500	82×10^{-6}	Amagat, 1893
	0.	500–1000	59.	"
	0.	1000–1500	47.	"
	99.5	8.94–36.5	276.	"
Amyl alcohol..	17.7	8	90.5	Röntgen, 1891
Benzene C_6H_6.	12.9	0.4–18	87.	Suchodski, 1910
	34.9	2–18	100.	"
	99.9	4.5–19	190.	"
Butyl alcohol..	17.4	8	90.	Röntgen
Carbon disulphide.....	0.	1–500	66.	Amagat, 1893
	49.2	1000–1500	51.	"
Carbon tetrachloride.....	20.	100–200	90.7	Richards, 1907
Chlorobenzene	13.	0.4–18	67.	Suchodski, 1910
	35.	0.4–18	77.	"
	100.	0.4–18	127.	"
Chloroform....	0.	....	101.	Grimaldi, 1887
	20.	....	128.	"
	40.	....	162.	"
	60.	....	204.	"
	100.	8–9	211.	Amagat
	100.	19–34	206.	"
	20.	1–98	94.	Richards&Stall, 1904
	20.	98.7–197.4	89.	Richards&Stall, 1904
	20.	197.4–296.1	80.	Richards&Stall, 1904
Ether.........	12.2	0.4–17.5	163.	Suchodski, 1910
	34.8	2–19	207.	"
	63.	8.6–34.3	293.	Amagat, 1893
	78.5	8.6–34.3	363.	"
	99.	8.6–36.5	523.	"
Ethyl acetate..	13.3	8.1–37.4	104.	"
Ethyl alcohol..	28.	150–400	81.	Barus, 1890
	65.	150–400	100.	"
	100.	150–400	132.	"
	185.	150–400	245.	"
	310.	150–400	1530.	"
	28.	150–200	86.	"
	100.	150–200	168.	"
	310.	150–200	4200.	"

COMPRESSIBILITY OF LIQUIDS (Continued)

Contraction in unit volume per atmosphere.

Liquid.	Temp. °C.	Pressures in atmospheres.	Coefficient.	Observer.
Ethyl alcohol:				
	0.	1–50	$96. \times 10^{-6}$	Amagat, 1893
	20.	1–50	112.	"
	40.	1–50	125.	"
	0.	100–200	85.	"
	0.	300–400	73.	"
	0.	500–600	64.	"
	0.	900–1000	52.	"
Ethyl bromide .	10.1	1–500	89.6	Amagat
	10.1	500–1000	63.4	"
	13.7	0.4–18.5	113.	Suchodski, 1910
	35.	2–19	138.	"
Ethyl chloride .	0.	1–500	103.	Amagat, 1893
	0.	500–1000	69.2	"
	11.	8.5–34.2	138.	"
	62.	12.7–32.8	255.	"
	99.	12.8–34.5	495.	"
Ethyl iodide...	10.6	1–500	73.8	Amagat
		500–1000	56.2	"
Fluor-benzene .	13.9	0.4–18	88.	Suchodski, 1910
	35.3	0.4–18	103.	"
	99.7	4.3–18.5	190.	"
Glycerine.....	14.9	1–10	22.	De Metz, 1890
Mercury......	0.	....	3.92	Amagat
	15.	100–200	3.76	Richards, 1907
Methyl acetate	14.3	8.1–37.5	97.	Amagat
	99.	8.3–37	250.	"
Methyl alcohol	0.	1–500	79.4	"
	0.	500–1000	58.3	"
	14.7	8.5–371	104.	"
	100.	8.7–37.3	221.	"
Nitric acid....	20.3	1–32	338.	....
Palmitic acid..	65.	20–100	88.	Barus, 1890
	100.	20–100	99.	"
Paraffine......	64.	20–100	84.	"
	100.	20–100	107.	"
Oil, almond...	17.	....	55.	Quincke
olive........	20.5	....	63.	"
turpentine...	19.7	....	79.	"
Toluene.......	10.	1–5.25	79.	DeHeen, 1885
	100.	1–5.25	150.	" "
Xylene.......	10.	1–5.25	74.	" "
	100.	1–5.25	132.	" "

COMPRESSIBILITY OF LIQUIDS (Continued)

Contraction in unit volume per atmosphere.

Liquid.	Temp. °C.	Pressures in atmospheres.	Coefficient.	Observer.
Water........	0.	1–25	52.5×10^{-6}	Amagat, 1893
	10.	1–25	50.0	"
	20.	1–25	49.1	"
	0.	25–50	51.6	"
	10.	25–50	49.2	"
	20.	25–50	47.6	"
	0.	100–200	49.2	"
	10.	100–200	46.1	"
	20.	100–200	44.2	"
	50.	100–200	42.5	"
	100.	100–200	46.8	"
	0.	500–1000	41.6	"
	0.	1000–1500	35.8	"
	0.	1500–2000	32.4	"
	0.	2000–2500	29.2	"
	0.	2500–3000	26.1	"

ELASTIC CONSTANTS FOR GASES

For short ranges of pressure, at a constant temperature, the volume of a gas is inversely proportional to the pressure or pressure × volume = a constant. (Boyle's Law.)

For high pressures, the table below shows the relative volumes at various temperatures. The volume at 0° C. and 76 cm. pressure (1 atmosphere) being taken as 1,000,000.

(From Smithsonian Tables.)

Atm.	Oxygen.			Air.		
	0°	99°.5	199°.5	0°	99°.4	200°.4
100	9265	......	......	9730		
200	4570	7000	9095	5050	7360	9430
300	3208	4843	6283	3658	5170	6622
400	2629	3830	4900	3036	4170	5240
500	2312	3244	4100	2680	3565	4422
600	2115	2867	3570	2450	3180	3883
700	1979	2610	3202	2288	2904	3502
800	1879	2417	2929	2168	2699	3219
900	1800	2268	2718	2070	2544	3000
1000	1735	2151	......	1992	2415	2828

Atm.	Nitrogen.			Hydrogen.		
	0°	99°.5	199°.6	0°	99°.3	200°.5
100	9910					
200	5195	7445	9532	5690	7567	9420
300	3786	5301	6715	4030	5286	6520
400	3142	4265	5331	3207	4147	5075
500	2780	3655	4515	2713	3462	4210
600	2543	3258	3973	2387	3006	3627
700	2374	2980	3589	2149	2680	3212
800	2240	2775	3300	1972	2444	2900
900	2149	2616	3085	1832	2244	2657
1000	2068	......	......	1720	2093	

COEFFICIENT OF FRICTION

(From Rankine's Compilation, 1858; Smithsonian Tables.)

Materials.	Coefficient of friction.	Angle of repose in degrees.
Wood on wood, dry	.25–.50	14.0–26.5
Wood on wood, soapy	.20	11.5
Metals on oak, dry	.50–.60	26.5–31.0
Metals on oak, wet	.24–.26	13.5–14.5
Metals on oak, soapy	.20	11.5
Metals on elm, dry	.20–.25	11.5–14.0
Hemp on oak, dry	.53	28.0
Hemp on oak, wet	.33	18.5
Leather on oak	.27–.38	15.0–19.5
Leather on metals, dry	.56	29.5
Leather on metals, wet	.36	20.0
Leather on metals, greasy	.23	13.0
Leather on metals, oily	.15	8.5
Metals on metals, dry	.15–.20	8.5–11.5
Metals on metals, wet	.3	16.5
Smooth surfaces occasionally greased	.07–.08	4.0–4.5
Smooth surfaces continually greased	.05	3.0
Smooth surfaces, best results	.03–.036	1.75–2.0
Steel on agate, dry	.20	11.5
Steel on agate, oiled	.107	6.1
Iron on stone	.30–.70	16.7–35.0
Wood on stone	about .40	22.0
Masonry and brick work, dry	.60–.70	33.0–35.0
Masonry and brick work, damp mortar	.74	36.5
Masonry on dry clay	.51	27.0
Masonry on moist clay	.33	18.25
Earth on earth	.25–1.00	14.0–45.0
Earth on earth, dry sand, clay and mixed earth	.38–.75	21.0–37.0
Earth on earth, damp clay	1.00	45.0
Earth on earth, wet clay	.31	17.0
Earth on earth, shingle and gravel	.81–1.11	39.0–48.0

RESISTANCE TO CRUSHING FOR VARIOUS MATERIALS

Approximate values in pounds per square inch.

Material.	Resistance to crushing in lbs. per sq. in.	Material.	Resistance to crushing in lbs. per sq. in.
Brick:		Granite	9700–34000
soft burned	3000–6000	Limestone	6000–25000
hard burned	4500–6500	Marble	7600–20700
vitrified	8500–25000	Sandstone	2400–29300
Brownstone	7300–23600	Tufa	7700–11600
Concrete	800–3800		

TENSILE STRENGTH OF METALS

(Selected from Smithsonian Tables.)

Given in pounds per square inch. The values can be considered only as approximations.

Metal.	Tensile Strength in lbs. per sq. in.
Aluminum wire	30000–40000
Brass wire	50000–150000
Bronze wire, phosphor, hard drawn	110000–140000
Bronze wire, silicon, hard drawn	95000–115000
Bronze	60000–75000
Cobalt, cast	33000
Copper wire, hard drawn	60000–70000
German silver	40000–50000
Gold wire	20000
Iron, cast	13000–33000
Iron wire, hard drawn	80000–120000
Iron wire, annealed	50000–60000
Lead, cast or drawn	2600–3300
Magnesium, hard drawn	33000
Monel metal, cold drawn	80000–100000
Nickel, hard drawn	155000
Palladium	39000
Platinum wire	50000
Silver wire	42000
Steel	80000–330000
Steel wire, maximum	460000
Steel, specially treated nickel steel	250000
Steel, piano wire, 0.033 in. diam	357000–390000
Steel, piano wire, 0.051 in. diam	325000–337000
Tantalum	130000
Tin, cast or drawn	4000–5000
Tungsten, hard drawn	590000
Zinc, cast	7000–13000
Zinc, drawn	22000–30000

MODULUS OF RUPTURE. TRANSVERSE TESTS FOR VARIOUS WOODS

(Smithsonian Tables.)

Material.	Modulus, lbs. per sq.in.	Material.	Modulus, lbs. per sq.in.
Ash, white	10,800	Maple, sugar	16,500
Basswood	8,340	Maple, white	14,640
Beech	16,200	Oak, red	11,400
Cedar, red	11,800	Oak, white	13,100
Cedar, white	6,300	Pine, white	7,900
Cypress, bald	7,900	Pine, red	9,100
Elm, white	10,300	Poplar	9,400
Fir, red	13,270	Spruce, pine	10,000
Hemlock	9,480	Walnut, black	11,900
Hickory, pignut	18,700		

HARDNESS

Scale of Hardness

1	Talc	4	Fluorite	8	Topaz
2	Rocksalt	5	Apatite	9	Corundum
3	Calcite	6	Feldspar	10	Diamond
		7	Quartz		

Hardness of Materials

The numbers give only the order of arrangement as to hardness.

(From Smithsonian Tables.)

Agate	7.	Hematite	6.
Alabaster	1.7	Hornblende	5.5
Alum	2–2.5	Iridium	6.
Aluminum	2.	Iridosmium	7.
Amber	2–2.5	Iron	4–5.
Andalusite	7.5	Kaolin	1.
Anthracite	2.2	Lead	1.5
Antimony	3.3	Loess (0°)	0.3
Apatite	5.	Magnetite	6.
Aragonite	3.5	Marble	3–4.
Arsenic	3.5	Meerschaum	2–3.
Asbestos	5.	Mica	2.8
Asphalt	1–2.	Opal	4–6.
Augite	6.	Orthoclase	6.
Barite	3.3	Palladium	4.8
Beryl	7.8	Phosphor bronze	4.
Bell-metal	4.	Platinum	4.3
Bismuth	2.5	Plat-iridium	6.5
Boric acid	3.	Pyrite	6.3
Brass	3–4.	Quartz	7.
Calanime	5.	Rock-salt	2.
Calcite	3.	Ross' metal	2.5–3.0
Copper	2.5–3.	Silver chloride	1.3
Corundum	9.	Sulphur	1.5–2.5
Diamond	10.	Stibnite	2.
Dolomite	3.5–4.	Serpentine	3–4.
Feldspar	6.	Silver	2.5–3.
Flint	7.	Steel	5–8.5
Fluorite	4.	Talc	1.
Galena	2.5	Tin	1.5
Garnet	7.	Topaz	8.
Glass	4.5–6.5	Tourmaline	7.3
Gold	2.5–3.	Wax (0°)	0.2
Graphite	0.5–1.	Wood's metal	3.
Gypsum	1.6–2.	Zinc	2.5

SURFACE TENSION OF VARIOUS LIQUIDS IN CONTACT WITH AIR

(Compiled from Various Sources.)

Liquid.	Temp. ° C.	Tension, dynes per cm.	Observer.
Acetic acid	20	23.5	Ramsay & Shields
Acetone	17.6	23.3	Jaeger
Alcohol, ethyl	20	21.7	Magie
Alcohol, methyl	20	23.0	Ramsay & Shields
Anilin	17.5	44.1	Volkmann
Benzol (C_6H_6)	22.5	29.4	Cantor
Bromine	−21	62.1	Quincke
Carbon disulphide	20	31.7	Magie
Chloroform	20	26.7	Magie
Ether	20	16.8	Brunner
Glycerine	18	65.2	Cantor
Hydrochloric acid	20	72.9	Quincke
Mercury	18	520.	
Oil, olive	20	33.5	Mean of various
Oil, turpentine	20	27.1	Mean of various
Petroleum	20	25.9	Magie

SURFACE TENSION OF AQUEOUS SOLUTIONS

Salt in solution.	Density of solution.	Temp. ° C.	Tension in dynes per cm. against air.
Barium chloride	1.282	15–16	81.8
Calcium chloride	1.351	19	95.0
Calcium chloride	1.277	19	90.2
Copper sulphate	1.178	15–16	78.6
Hydrochloric acid	1.119	20	73.6
Hydrochloric acid	1.089	20	74.5
Hydrochloric acid	1.024	20	75.3
Potassium chloride	1.170	15–16	82.8
Potassium chloride	1.101	15–16	80.1
Sodium chloride	1.193	20	85.8
Sodium chloride	1.107	20	80.5
Sodium nitrate	1.302	12	83.5
Sodium oleate	saturated	20	25.0
Sulphuric acid	1.445	15	79.7
Sulphuric acid	1.264	15	79.7
Zinc sulphate	1.398	15–16	83.3
Zinc sulphate	1.104	15–16	77.8

SURFACE TENSION OF FUSED SOLIDS

(With One Exception from Quincke, 1868.)

Substance.	Gas with which liquid is in contact.	Temp. ° C.	Surface tension, dynes per cm.
Antimony	CO_2	432.	245.
Borax	air	fusion	212.
Copper	air	fusion	581.
Gold *	air	1070	612.
Iron	air	fusion	950.
Lead	CO_2	330	448.
Phosphorus	CO_2	fusion	41.2
Platinum	air	2000	1658.
Potassium	....	58	371.
Potassium chloride	....	fusion	93.
Silver	air	1000	782.
Selenium	air	fusion	70.
Sodium	....	90	258.
Sodium chloride	....	fusion	115.
Sugar	air	160	66.9
Sulphur	air	111	42.
Tin	CO_2	fusion	352.
Zinc	....	360	877.

* Heydweiller.

SURFACE TENSION OF WATER AND ALCOHOL

SURFACE TENSION FOR WATER AND ALCOHOL (ETHYL) IN CONTACT WITH AIR IN DYNES PER CENTIMETER

(From Smithsonian Tables.)

Temp. ° C.	Surface tension, dynes per centimeter.		Temp. ° C.	Surface tension, dynes, per centimeter.	
	Water.	Ethyl alcohol.		Water.	Ethyl alcohol.
0	75.6	23.5	55	67.8	18.6
5	74.9	23.1	60	67.1	18.2
10	74.2	22.6	65	66.4	17.8
15	73.5	22.2	70	65.7	17.3
20	72.8	21.7	75	65.0	16.9
25	72.1	21.3	80	64.3	
30	71.4	20.8	85	63.6	
35	70.7	20.4	90	62.9	
40	70.0	20.0	95	62.2	
45	69.3	19.5	100	61.5	
50	68.6	19.1			

VISCOSITY

The coefficient of viscosity of a substance is defined as the tangential force per unit area of either of two horizontal planes at unit distance apart, one of which is fixed, while the other moves with unit velocity, the space being filled with the substance.

In the case of a liquid flowing slowly through a long tube of small diameter, the volume V of liquid which escapes in a time t is given by the equation,

$$V = \frac{\pi p r^4}{8 l \eta} t$$

where p is the difference in pressure between the two ends of the tube; r, its radius; l, its length and η, the coefficient of viscosity. (Law of Poiseuille.)

A more complete equation is now generally used:

$$\eta = \frac{\pi d g r^4 t}{8Q(l + \lambda)}\left(h - \frac{m v^2}{g}\right)$$

where η is the coefficient of viscosity; d, the density in gm./cm³; r, the radius and l the length of the tube in cm.; Q, the volume in cm.³ discharged in t sec.; λ a correction to the length of the tube; h, the average head in cm.; m, the coefficient of the kinetic energy correction, mv^2/g; g, the acceleration due to gravity in cm./sec.²; v, the mean velocity in cm./sec. See Technologic Papers of the Bureau of Standards 100 and 112, 1917 and 1918 for a full discussion.

The coefficient of viscosity is expressed in dyne-seconds per cm.² or poises.

Specific viscosity is the ratio of the coefficient of viscosity of any substance to that of water at 0° C. or other specified temperature.

VISCOSITY OF WATER

Temperature C	Coefficient of Viscosity C. G. S. Thorpe-Rodger 1894	Hosking 1909	Bingham and Jackson, 1917	Specific Viscosity Hosking 1909
0	0.01778	0.01793	0.01792	1.000
5	.01510	.01522	.01519	.849
10	.01303	.01310	.01308	.730
15	.01134	.01142	.01140	.637
20	.01002	.01006	.01005	.561
25	.00891	.00893	.00894	.498
30	.00798	.00800	.00801	.446
35	.00720	.00724	.00723	.404
40	.00654	.00657	.00656	.367

VISCOSITY OF WATER (Continued)

Temperature C	Coefficient of Viscosity C. G. S. — Thorpe-Rodger 1894	Hosking 1909	Bingham and Jackson, 1917	Specific Viscosity Hosking 1909
45	.00597	.00600	.00599	.335
50	.00548	.00550	.00549	.307
55	.00506	.00508	.00506	.283
60	.00468	.00469	.00469	.262
65	.00436	.00436	.00436	.243
70	.00406	.00406	.00406	.226
75	.00380	.00380	.00380	.212
80	.00356	.00356	.00357	.199
85	.00335	.00335	.00336	.187
90	.00316	.00316	.00317	.176
95	.00299	.00300	.00299	.167
100	.00283	.00284 *	.00284	.158
124	......	......	......	.124 *
153	.00181 *	......	......	.101 *

* Values by Haas, 1894.

VISCOSITY OF WATER BELOW 0° C.

White-Twining, 1914

Temperature	Coefficient of Viscosity	Temperature	Coefficient of Viscosity
0° C.	0.01798	−7.23	0.02341
−2.10	.01330	−8.48	.02458
−4.70	.02121	−9.30	.02549
−6.20	.02250		

VISCOSITY OF LIQUIDS

Coefficient of viscosity of liquids including elements, organic and inorganic compounds, and mixtures. C. G. S. units.

Liquid.	Temp. ° C.	Coefficient of viscosity.	Observer.
Acetaldehyde.......	20	0.0022	Mussell-Thole-Dunstan, 1912
Acetanilide	130	.0190	Thorpe-Rodger, 1894
Acetic acid.........	20	.01219	Thorpe-Rodger, 1894
	40	.00901	Thorpe-Rodger, 1894
	60	.00700	Thorpe-Rodger, 1894
	80	.00560	Thorpe-Rodger, 1894
	100	.00457	Thorpe-Rodger, 1894
	0	.0238	Faust, 1912

VISCOSITY OF LIQUIDS (Continued)

Liquid.	Temp. °C.	Coefficient of viscosity.	Observer.
Acetic acid:	18	.0130	Faust, 1912
	41	.0100	Faust, 1912
	59	.0070	Faust, 1912
	70	.0060	Faust, 1912
	100	.0043	Faust, 1912
anhydride........	0	.0124	Faust, 1912
	18	.0090	Faust, 1912
	100	.0049	Faust, 1912
Acetone...........	20	.0033	Thorpe-Rodger, 1894
	—13	.0047	Faust, 1912
	—10	.00450	Faust, 1912
	0	.00395	Faust, 1912
	14.5	.00330	Faust, 1912
	19	.00303	Faust, 1912
	35	.00278	Faust, 1912
	41	.00280	Faust, 1912
Air, liquid........	......	.0033	Forch, 1900
	—192.3	.00172	Verschaffelt, 1917
Alcohol. See *Ethyl alcohol.*			
Allyl alcohol.......	0	.02144	Thorpe-Rodger, 1894
	20	.01361	Thorpe-Rodger, 1894
	40	.00911	Thorpe-Rodger, 1894
	60	.00642	Thorpe-Rodger, 1894
	80	.00470	Thorpe-Rodger, 1894
amine...........	130	.00506	Mussell-Thole-Dunstan, 1921
Ammonia, NH_3...	—33.5	.00266	Fitzgerald, 1912
Amyl acetate....	10	.0106	Pribram-Handl, 1912
	20	.0089	Pribram-Handl, 1912
	30	.0077	Pribram-Handl, 1912
	40	.0065	Pribram-Handl, 1912
Aniline...........	20	.0440	Wijkander, 1897
	30	.0319	Wijkander, 1897
	40	.0241	Wijkander, 1897
	50	.0189	Wijkander, 1897
	0	.0865	Faust, 1912
Anisol............	20	.0111	Gartenmeister
Benzene...........	0	.00902	Thorpe-Rodger, 1894
	20	.00649	Thorpe-Rodger, 1894
	40	.00492	Thorpe-Rodger, 1894
	60	.00390	Thorpe-Rodger, 1894
	80	.00327	Thorpe-Rodger, 1894
	0	.00850	Faust, 1912
	19.4	.00619	Faust, 1912
	50	.00418	Faust, 1912
Benzylamine.......	25	.0159	Mussell-Thole-Dunstan, 1912
Benzylaniline.......	130	.0120	Mussell-Thole-Dunstan, 1912
Bismuth	285	.0161	Plüss, 1915
	365	.0146	Plüss, 1915
Bromine...........	16	.010	Thorpe-Rodger, 1894
Butyl alcohol......	0	.05185	Thorpe-Rodger, 1894
	20	.02947	Thorpe-Rodger, 1894
	40	.01780	Thorpe-Rodger, 1894
	60	.01136	Thorpe-Rodger, 1894
	80	.00762	Thorpe-Rodger, 1894
	100	.00534	Thorpe-Rodger, 1894
Butyric acid.......	0	.02284	Thorpe-Rodger, 1894
	20	.01538	Thorpe-Rodger, 1894
	40	.01117	Thorpe-Rodger, 1894
	60	.00853	Thorpe-Rodger, 1894
	80	.00678	Thorpe-Rodger, 1894
	100	.00545	Thorpe-Rodger, 1894

VISCOSITY OF LIQUIDS (Continued)

Liquid.	Temp. ° C.	Coefficient of viscosity.	Observer.
	20	.0163	Gartenmeister, 1890
	40	.0118	Gartenmeister, 1890
	60	.0102	Gartenmeister, 1890
Carbon dioxide, liquid	0	.00099	Warburg-Babo, 1882
	10	.00085	Warburg-Babo, 1882
	20	.00071	Warburg-Babo, 1882
	30	.00053	Warburg-Babo, 1882
pressure, 59 atm.	20	.000697	Phillips, 1912
pressure, 72 atm.	30	.000458	Phillips, 1912
disulphide........	—13	.00514	Faust, 1912
	—10	.00495	Faust, 1912
	0	.00429	Faust, 1912
	0	.00429	Thorpe-Rodger, 1894
	20	.00367	Thorpe-Rodger, 1894
	40	.00319	Thorpe-Rodger, 1894
tetrachloride.....	20	.0096	Thorpe-Rodger, 1894
Chloroform........	0	.00700	Thorpe-Rodger, 1894
	20	.00564	Thorpe-Rodger, 1894
	40	.00466	Thorpe-Rodger, 1894
	—13	.00855	Faust, 1912
	0	.00715	Faust, 1912
	19	.00615	Faust, 1912
	39	.00500	Faust, 1912
Carbolic acid. See *phenol.*			
Copal lac.........	22	4.80	Metz, 1903
Diethylamine.......	25	.00346	Kournakoff-Zemezuzny, 1912
	25	.00367	Mussell-Thole-Dunstan, 1912
Diethylaniline......	25	.0195	Mussell-Thole-Dunstan, 1912
Dimethylaniline	25	.01285	Mussell-Thole-Dunstan, 1912
Dimethyl-α-naphthylamine......	130	.00868	Mussell-Thole-Dunstan, 1912
Dimethyl-β-naphthylamine......	130	.00952	Mussell-Thole-Dunstan, 1912
Diphenylamine.....	130	.0104	Mussell-Thole-Dunstan, 1912
Ether (diethyl-).....	0	.00286	Thorpe-Rodger, 1894
	6.7	.00276	Thorpe-Rodger, 1894
	10	.00258	Thorpe-Rodger, 1894
	20	.00234	Thorpe-Rodger, 1894
	30	.00212	Thorpe-Rodger, 1894
	25	.00226	Baker, 1912
	0	.00300	Faust, 1912
	14	.00250	Faust, 1912
	32	.00215	Faust, 1912
Ethyl acetate......	10	.0051	Pribram-Handl, 1878
	20	.0044	Pribram-Handl, 1878
	40	.0035	Pribram-Handl, 1878
alcohol..........	0	.01770	Thorpe-Rodger, 1894
	10	.01449	Thorpe-Rodger, 1894
	20	.01192	Thorpe-Rodger, 1894
	30	.00990	Thorpe-Rodger, 1894
	40	.00827	Thorpe-Rodger, 1894
	50	.00698	Thorpe-Rodger, 1894
	60	.00591	Thorpe-Rodger, 1894
	25	.010786	Kernot-Pomilio, 1912
aniline..........	25	.0204	Mussell-Thole-Dunstan, 1912
bromide.........	20	.00392	Thorpe-Rodger, 1894
formate..........	20	.00402	
iodide...........	20	.00583	
malate..........	24.7	.03016	Thole, 1912
Ethylene bromide...	0	.02435	Thorpe-Rodger, 1894
	20	.01716	Thorpe-Rodger, 1894

VISCOSITY OF LIQUIDS (Continued)

Liquid.	Temp. ° C.	Coefficient of viscosity.	Observer.
Ethylene bromide . .	40	.01280	Thorpe-Rodger, 1894
	70	.00895	Thorpe-Rodger, 1894
chloride.	0	.01128	Thorpe-Rodger, 1894
	20	.00833	Thorpe-Rodger, 1894
	70	.00470	Thorpe-Rodger, 1894
Eugenol.	25	.06931	Dunstan-Hilditch, 1912
Formic acid	10	.02262	Gartenmeister, 1890
	20	.01804	Gartenmeister, 1890
	30	.01465	Gartenmeister, 1890
	40	.01224	Gartenmeister, 1890
	50	.01025	Gartenmeister, 1890
Glucose.	83	1600.	Tammann, 1899
	67	27000.	Tammann, 1899
Glycerine.	2.8	42.20	Schöttner, 1878
	8.1	25.18	Schöttner, 1878
	14.3	13.87	Schöttner, 1878
	20.3	8.30	Schöttner, 1878
Glycerine.	26.5	4.94	Schöttner, 1878
Glycol.	0	.0218	Arrhenius
Heptane.	0	.00519	Thorpe-Rodger, 1894
	20	.00410	Thorpe-Rodger, 1894
	40	.00344	Thorpe-Rodger, 1894
	60	.00276	Thorpe-Rodger, 1894
Hexane.	0	.00397	Thorpe-Rodger, 1894
	20	.00320	Thorpe-Rodger, 1894
	40	.00264	Thorpe-Rodger, 1894
	60	.00221	Thorpe-Rodger, 1894
Hydrogen.	liq.	.00011	Verschaffelt, 1917
Isoamyl-amine.	25	.00724	Mussell-Thole-Dunstan, 1912
Isobutyl-amine	25	.00553	Mussell-Thole-Dunstan, 1912
Isobutyric acid.	20	1.318	Thorpe-Rodger, 1894
Isoeugenol.	25	.2672	Dunstan-Hilditch, 1912
Isoheptane.	0	.00477	Thorpe-Rodger, 1894
	20	.00379	Thorpe-Rodger, 1894
	40	.00309	Thorpe-Rodger, 1894
Isohexane.	0	.00371	Thorpe-Rodger, 1894
	20	.00300	Thorpe-Rodger, 1894
	40	.00247	Thorpe-Rodger, 1894
Isopentane.	0	.00273	Thorpe-Rodger, 1894
	20	.00223	Thorpe-Rodger, 1894
Isoquinoline.	25	.0357	Mussell-Thole-Dunstan, 1912
Isosafrol.	25	.03981	Dunstan-Hilditch, 1912
Menthol.	34.9	.069	Heydweiller
Mercury.	—20	.0184	Koch, 1881
	0	.0170	Koch, 1881
	20	.0157	Koch, 1881
	100	.0122	Koch, 1881
	200	.01015	Koch, 1881
	300	.00928	Koch, 1881
	0	.01661	Plüss, 1915
	20	.01547	Plüss, 1915
	34	.01476	Plüss, 1915
	98	.01263	Plüss, 1915
	193	.01079	Plüss, 1915
	299	.00975	Plüss, 1915
Methyl acetate.	0	.00478	
alcohol.	0	.00813	Thorpe-Rodger, 1894
	20	.00591	Thorpe-Rodger, 1894
	40	.00450	Thorpe-Rodger, 1894
	60	.00349	Thorpe-Rodger, 1894
amine	0	.00236	Fitzgerald, 1912
aniline	25	.0200	Kournakoff-Zemczuzny, 1912

VISCOSITY OF LIQUIDS (Continued)

Liquid.	Temp. °C.	Coefficient of viscosity.	Observer.
Methyl aniline	25	.0202	Mussell-Thole-Dunstan, 1912
iodide	0	.00594	
	20	.00487	
	40	.00409	
Nitric acid	0	.02275	
	10	.01770	
Octane	0	.00703	Thorpe-Rodger, 1894
	20	.00538	Thorpe-Rodger, 1894
	40	.00428	Thorpe-Rodger, 1894
Oil, castor	10	24.2	Kahlbaum-Raber, 1918
	20	9.86	Kahlbaum-Raber, 1918
	30	4.51	Kahlbaum-Raber, 1918
	40	2.31	Kahlbaum-Raber, 1918
	100	.169	Kahlbaum-Raber, 1918
cylinder, filtered	37.8	2.406	Archbutt-Deeley, 1912
	100	.187	Archbutt-Deeley, 1912
dark	37.8	4.224	Archbutt-Deeley, 1912
	100	.240	Archbutt-Deeley, 1912
linseed	30	.331	White, 1912
	50	.176	White, 1912
	90	.071	White, 1912
machine, light	15.6	1.138	Archbutt-Deeley, 1912
	37.8	.342	Archbutt-Deeley, 1912
	100	.049	Archbutt-Deeley, 1912
heavy	15.6	6.606	Archbutt-Deeley, 1912
	37.8	1.274	Archbutt-Deeley, 1912
olive	10	1.38	Higgins, 1914
	20	.840	Higgins, 1914
	40	.363	Higgins, 1914
	70	.124	Higgins, 1914
rape	0	25.3	Meyer
	10	3.85	Meyer
	20	1.63	Meyer
	30	.96	Meyer
soya bean	30	.406	White, 1912
	50	.206	White, 1912
	90	.078	White, 1912
sperm	15.6	.420	Archbutt-Deeley, 1912
	37.8	.185	Archbutt-Deeley, 1912
	100	.046	Archbutt-Deeley, 1912
Pentane	0	.00283	Thorpe-Rodger, 1894
	20	.00232	Thorpe-Rodger, 1894
Phenol	18.3	.127	Scarpa, 1903
	90	.0126	Scarpa, 1903
Potassium bromide	745	.0148	Lorenz, 1912
	775	.0134	Lorenz, 1912
	805	.0119	Lorenz, 1912
nitrate	334	.021	
	358	.017	
	333	.0297	Lorenz, 1912
	418	.0200	Lorenz, 1912
Propionic acid	10	.0125	Rellstab, 1868
	20	.0107	Rellstab, 1868
	40	.0080	Rellstab, 1868
Propyl acetate	10	.0066	Pribram-Handl, 1879
	20	.0059	Pribram-Handl, 1879
	40	.0044	Pribram-Handl, 1879
alcohol	0	.03882	Thorpe-Rodger, 1894
	20	.02255	Thorpe-Rodger, 1894
	40	.01403	Thorpe-Rodger, 1894
	60	.00919	Thorpe-Rodger, 1894
	80	.00628	Thorpe-Rodger, 1894

VISCOSITY OF LIQUIDS (Continued)

Liquid.	Temp. °C.	Coefficient of viscosity.	Observer.
Propyl aldehyde	10	.0047	Thorpe-Rodger, 1894
	20	.0041	Thorpe-Rodger, 1894
	40	.0033	Thorpe-Rodger, 1894
bromide	0	.00645	Thorpe-Rodger, 1894
	20	.00517	Thorpe-Rodger, 1894
	40	.00291	Thorpe-Rodger, 1894
chloride	0	.00436	Thorpe-Rodger, 1894
	20	.00352	Thorpe-Rodger, 1894
	40	.00291	Thorpe-Rodger, 1894
Salicylic acid	10	.0320	Rellstab, 1868
	20	.0271	Rellstab, 1868
	40	.0181	Rellstab, 1868
Sodium bromide	762	.0142	Lorenz, 1912
	780	.0128	Lorenz, 1912
chloride	841	.0130	Lorenz, 1912
	896	.0101	Lorenz, 1912
	924	.0097	Lorenz, 1912
nitrate	308	.02919	Lorenz, 1912
	348	.02439	Lorenz, 1912
	398	.01977	Lorenz, 1912
	418	.01828	Lorenz, 1912
Sugar	124.6	1900	Tammann, 1899
	109	28000	Tammann, 1899
Sulphur	86	.22	Rotinjanz, 1908
	100	.16	Rotinjanz, 1908
	110	.12	Rotinjanz, 1908
	170	320	Rotinjanz, 1908
	180	550	Rotinjanz, 1908
	187	560	Rotinjanz, 1908
	200	500	Rotinjanz, 1908
	300	24	Rotinjanz, 1908
	340	6.2	Rotinjanz, 1908
	380	2.5	Rotinjanz, 1908
	420	1.13	Rotinjanz, 1908
	448	.80	Rotinjanz, 1908
Sulphur dioxide, liquid	—33.5	.005508	Fitzgerald, 1912
	—10.5	.004285	Fitzgerald, 1912
	0.1	.003936	Fitzgerald, 1912
Sulphuric acid	20	.22	Graham, 1849
	11.2	.31953	Poiseuille
Toluene	0	.00768	Thorpe-Rodger, 1894
	20	.00586	Thorpe-Rodger, 1894
	40	.00466	Thorpe-Rodger, 1894
	60	.00381	Thorpe-Rodger, 1894
Turpentine	0	.0225	Glaser
	10	.0178	Glaser
	2	.0149	Glaser
	30	.0127	Glaser
Turpentine, Venice	17.3	1300	Landenburg, 1906
Xylene (xylol)			
ortho	0	.01102	Thorpe-Rodger, 1894
	20	.00807	Thorpe-Rodger, 1894
	40	.00623	Thorpe-Rodger, 1894
meta	0	.00802	Thorpe-Rodger, 1894
	20	.00615	Thorpe-Rodger, 1894
	40	.00491	Thorpe-Rodger, 1894
para	20	.00643	Thorpe-Rodger, 1894
	40	.00508	Thorpe-Rodger, 1894
Zinc	380	.0168	Plüss, 1915
	357	.0142	Plüss, 1915
	389	.0131	Plüss, 1915

VISCOSITY OF GASES

Coefficient of viscosity of gases and vapors. C. G. S. units.

Gas or vapor.	Temp. C.	Coefficient of viscosity.	Observer.
Acetic acid, vap.	119.1	107.0 × 10^{-6}	Meyer-Schumann, 1881
Acetone, vap.	0	72.5	Puluj, 1874
	18	78.0	Puluj, 1874
Air.	—21.5	157.3	Puluj, 1874
	0	170.5	Puluj, 1874
	197.3	253.8	Puluj, 1874
	272.4	284.0	Puluj, 1874
	340	304.0	Puluj, 1874
	0	167.9	Schumann, 1884
	10	178.0	Schumann, 1884
	20	172.4	Schumann, 1884
	30	183.6	Schumann, 1884
	40	189.6	Schumann, 1884
	60	202.2	Schumann, 1884
	80	215.3	Schumann, 1884
	100	229.0	Schumann, 1884
	—24.4	163.9	Breitenbach, 1901
	0	173.3	Breitenbach, 1901
	15	180.7	Breitenbach, 1901
	99.1	220.3	Breitenbach, 1901
	182.4	255.9	Breitenbach, 1901
	302.0	299.3	Breitenbach, 1901
	15	181.0	Markowski, 1904
	99.6	221.0	Markowski, 1904
	0	171.0	Hogg, 1905
	0	170.0	Grindlay-Gibson, 1908
	0	171.0	Fisher, 1909
	20.2	181.2	Gilchrist
	23	184.40	"Probable value," Millikan, 1913
	0	172.4	Vogel, 1914
Alcohol. See *ethyl*, *methyl*, etc.			
Ammonia.	0	96	Graham, 1846
	20	108	Graham, 1846
Argon.	0	210.4	Schultz, 1901
	14.7	220.8	Schultz, 1901
	17.8	224.1	Schultz, 1901
	99.7	273.3	Schultz, 1901
	183.7	322.1	Schultz, 1901
Benzene, vapor.	0	68.9	Schumann, 1884
	19	79.2	Schumann, 1884
	70.1	100.7	Schumann, 1884
	100	117.6	Schumann, 1884
Bromine, vapor.	285.9	151.1	Rankine, 1914
	338.8	170.5	Rankine, 1914
	372.8	188.5	Rankine, 1914
	412.8	207.9	Rankine, 1914
	452.8	227.3	Rankine, 1914
	493.4	248.0	Rankine, 1914
Bromoform, vapor. . . .	151.2	253.0	Steudel, 1882
Butyl alcohol			
normal vapor	116.9	143	Steudel, 1882
tertiary vapor. . . .	82.9	160	Steudel, 1882
chloride, normal vapor	78	149.5	Steudel, 1882
iodide, vapor	130	202	Steudel, 1882
Butyric acid, vapor . .	161.7	130.0	Meyer-Schumann, 1881
Carbon dioxide.	0	141.4	Graham, 1846
	20	160.0	Graham, 1846
	20	161.4	Maxwell, 1860

VISCOSITY OF GASES (Continued)

Gas or vapor.	Temp. C.	Coefficient of viscosity.	Observer.
Carbon dioxide	20	160.0	Mayer-Springmuhl, 1873
	—21	129.4	Breitenbach, 1901
	0	139.0	Breitenbach, 1901
	15	145.7	Breitenbach, 1901
	99.1	186.1	Breitenbach, 1901
	182.4	222.1	Breitenbach, 1901
	302.0	268.2	Breitenbach, 1901
	12.6	145.0	Roberts, 1912
pressure, 1 atm	20	148.0	Phillips, 1912
	30	153	Phillips, 1912
	32	155	Phillips, 1912
	35	156	Phillips, 1912
	40	157	Phillips, 1912
pressure, 20 atm	20	156	Phillips, 1912
pressure, 40 atm	20	166	Phillips, 1912
pressure, 50 atm	20	177	Phillips, 1912
pressure, 56 atm	20	186	Phillips, 1912
disulphide, vapor	16.9	92.4	Puluj, 1874
monoxide	0	163.0	Graham, 1846
	20	184.0	Graham, 1846
	—149.2	86.9	Zimmer, 1912
	—78.9	128.7	Zimmer, 1912
	—42.3	148.3	Zimmer, 1912
	0.0	168.9	Zimmer, 1912
	11.4	174.9	Zimmer, 1912
tetrachloride, vapor	76.7	195.0	Steudel, 1882
Chlorine	0	128.7	Graham, 1846
	20	147.0	Graham, 1846
	12.7	129.7	Rankine, 1912
	99.1	168.8	Rankine, 1912
Chloroform, vapor	0	95.9	Puluj, 1874
	17.4	102.9	Puluj, 1874
	0	99.0	Breitenbach, 1901
	17.4	103	Breitenbach, 1901
	61	189	Breitenbach, 1901
Cyanogen	0	94.8	Graham, 1846
	20	107.0	Graham, 1846
Ether (diethyl-), vapor	0	68.9	Puluj, 1874
	16.1	73.2	Puluj, 1874
	36.5	79.3	Puluj, 1874
Ethyl acetate, vapor	77.1	152.0	Meyer-Schumann, 1881
alcohol, vapor	0	87.4	Puluj, 1874
	16.8	88.5	Puluj, 1874
	78.4	142.0	Steudel, 1882
bromide, vapor	38.4	186.5	Steudel, 1882
butyrate, vapor	119.8	160.0	Meyer-Schumann, 1881
chloride, vapor	0	93.5	Graham, 1846
	20	105.0	Graham, 1846
	16.4	94.1	Obermayer, 1875
	53.5	105.0	Obermayer, 1875
	157.3	144.0	Obermayer, 1875
formate, vapor	53.7	156.0	Meyer-Schumann, 1881
iodide, vapor	72.3	216.0	Steudel, 1882
Ethylene	0	96.6	Graham, 1846
	20	109.0	Graham, 1846
	—21.2	89.1	Breitenbach, 1901
	15	101.6	Breitenbach, 1901
	99.3	127.8	Breitenbach, 1901
	182.4	153.0	Breitenbach, 1901
	302.6	182.6	Breitenbach, 1901
	—75.7	69.9	Zimmer, 1912
	—44.1	76.9	Zimmer, 1912

VISCOSITY OF GASES (Continued)

Gas or vapor.	Temp. C.	Coefficient of viscosity.	Observer.
Ethylene	—38.6	78.5	Zimmer, 1912
	0	90.7	Zimmer, 1912
	13.8	95.4	Zimmer, 1912
bromide, vapor	131.6	221.0	Steudel, 1882
chloride, vapor	83.5	168.0	Steudel, 1882
Helium	0	189.1	Schultz, 1901
	15.3	196.9	Schultz, 1901
	66.6	234.8	Schultz, 1901
	184.6	269.9	Schultz, 190
Hydrogen	W 20	93.0	Graham, 1846
	15.3	89.2	Obermayer, 1877
	15.9	92.9	Puluj, 1878
	20	97.0	Maxwell, 1868
	15	97.0	Rossander, 1900
	—20.6	81.9	Breitenbach, 1901
	15	88.9	Breitenbach, 1901
	99.2	105.9	Breitenbach, 1901
	182.4	121.5	Breitenbach, 1901
	302.0	139.2	Breitenbach, 1901
	12.3	86.4	Roberts, 1912
	0	86.7	Jeans, 1916
Hydrogen sulphide	0	115.4	Graham, 1846
	20	130.0	Graham, 1846
Iodine, vapor	124	184.3	Rankine, 1915
	247	240.1	Rankine, 1915
Isobutyl acetate, vapor	16.1	76.4	Schumann, 1884
	116.4	155.0	Schumann, 1884
alcohol, vapor	108.4	144.5	Steudel, 1882
bromide, vapor	92.3	179.5	Steudel, 1882
butyrate, vapor	156.9	167.0	Meyer-Schumann, 1881
chloride, vapor	68.5	150.0	Steudel, 1882
iodide, vapor	120	204.7	Steudel, 1882
Isopropyl alcohol, vapor	82.8	162.0	Steudel, 1882
bromide, vapor	60	176.0	Steudel, 1882
chloride, vapor	37	148.5	Steudel, 1882
iodide, vapor	89.3	201.5	Steudel, 1882
Krypton	15	246	Rankine, 1910
Mercury, vapor	0	183	Koch, 1883
	300	532	Koch, 1883
	380	656	Koch, 1883
Methane	0	104.0	Graham, 1846
	20	120.1	Graham, 1846
Methyl acetate, vapor	57.3	152.0	Meyer-Schumann, 1881
alcohol, vapor	66.8	135.0	Steudel, 1882
chloride	0	102.5	Graham, 1846
	20	116.0	Graham, 1846
	—15.3	93.6	Breitenbach, 1901
	15	105.2	Breitenbach, 1901
	99.1	138.4	Breitenbach, 1901
	182.4	170.6	Breitenbach, 1901
	302.0	213.9	Breitenbach, 1901
iodide, vapor	44	232	Steudel, 1882
Neon	15	312	Rankine, 1910
Nitrogen	0	163.5	Graham, 1846
	20	184.0	Graham, 1846
	—21.5	156.3	Obermayer, 1875
	10.9	170.7	Obermayer, 1875
	53.5	189.4	Obermayer, 1875
Nitric oxide	0	164.5	Graham, 1846
	20	186.0	Graham, 1846
Nitrous oxide	0	140.8	Graham, 1846
	20	160.0	Graham, 1846

VISCOSITY OF GASES (Continued)

Gas or vapor.	Temp. C.	Coefficient of viscosity.	Observer.
Nitious oxide	—21.5	124.9	Obermayer, 1875
	53.6	160.6	Obermayer, 1875
	100.3	182.9	Obermayer, 1875
Oxygen..............	20	212.0	Graham, 1846
	15.4	195.7	Obermayer, 1876
	53.5	215.9	Obermayer, 1876
	20	206.0	Meyer-Springmuhl, 1873
Propyl alcohol, vapor	97.4	142.0	Steudel, 1882
bromide, vapor...	70.8	184.5	Steudel, 1882
iodide, vapor	102	210.0	Steudel, 1882
Sulphur dioxide......	0	122.5	Graham, 1846
	20	138.0	Graham, 1846
Water, vapor........	0	90.4	Puluj, 1874
	16.7	96.7	Puluj, 1874
	100	132.0	Meyer-Schumann, 1881
	15	97.5	Kundt-Warburg, 1875
Xenon	15	222.0	Rankine, 1910

VISCOSITY OF SOLIDS

C. G. S. Units.

Substance.	Temp. C.	Coefficient of viscosity.	Observer.
Glass, soda.......	575	11×10^{12}	Trouton and Andrews, 1904
Ice, glacier.......	.....	12×10^{13}	Deeley, 1908
Menthol	14.9	2×10^{12}	Heydweiller, 1897
Pitch............	0	51×10^{10}	Trouton and Andrews, 1904
	15	1.3×10^{10}	Trouton and Andrews, 1904
Turpentine, Venice	18.3	1300	Trouton and Andrews, 1904
Wax, shoe makers	8	4.7×10^{6}	Trouton and Andrews, 1904

DIFFUSION

Gases into Air

Gas or vapor.	Temp. C.	Coefficient of diffusion, sq.cm./sec.	Observer.
Alcohol, vapor	40.4	0.137	Winkelmann
Carbon dioxide	0.0	0.139	Mean of various
Carbon disulphide	19.9	0.102	Winkelmann
Ether, vapor	19.9	0.089	Winkelmann
Hydrogen	0.0	0.634	Obermayer
Oxygen	0.0	0.178	Obermayer
Water, vapor	8.0	0.239	Guglielmo

Aqueous Solutions into Pure Water

Concentration in gram-molecules per liter.

Substance.	Concentration.	Temp. ° C.	Diffusion sq.cm./day.	Observer.
Acetic acid	0.2	13.5	0.77	Scheffer
	1.0	12.	0.74	Arrhenius
	2.0	12.	0.69	Arrhenius
	3.0	12.	0.68	
	4.0	12.	0.66	Arrhenius
Ammonia	1.0	15.23	1.54	Abegg
Barium chloride	0.2	8.	0.66	Scheffer
Bromine	0.1	12.	0.8	Euler
Cadmium sulphate	2.0	19.04	0.246	Seitz
Calcium chloride	2.0	10.	0.68	Schuhmeister
Chlorine	0.1	12.	1.22	Euler
Copper sulphate	0.1	17.	0.39	Thovert
Formic acid	1.0	12.	0.97	Abegg
Glycerine	0.1	10.14	0.357	Heimbrodt
	0.2	10.1	3.55	Heimbrodt
	1.0	10.14	0.339	Heimbrodt
Hydrochloric acid	0.1	19.2	2.21	Thovert
	1.0	12.	2.09	Arrhenius
	2.0	12.	2.21	Arrhenius
Iodine	0.1	12.	(0.5)	Euler
Magnesium sulphate	1.0	7.	0.30	Scheffer
Nitric acid	0.1	19.5	2.07	Thovert
Potassium bromide	1.0	10.	1.13	Schuhmeister
carbonate	3.0	10.	0.60	Schuhmeister
chloride	0.1	17.5	1.38	Thovert
chloride	4.0	10.	1.27	Schuhmeister
hydrate	0.1	13.5	1.72	Thovert
	1.0	12.	1.72	Arrhenius
	3.0	12.	1.89	Arrhenius
Silver nitrate	0.1	12.	0.985	Thovert
Sodium acetate	0.2	12.	0.67	Kawalki
chloride	0.1	15.0	0.94	Thovert
	0.2	15.0	0.94	Thovert
	1.0	15.0	0.94	Thovert
	1.0	14.3	0.964	Heimbrodt
hydrate	1.0	12.	1.11	Thovert
iodide	1.0	10.	0.80	Schuhmeister
	2.0	10.	0.90	Schuhmeister
Sugar	1.0	12.	0.254	Arrhenius
Sulphuric acid	1.0	12.	1.12	Arrhenius
	2.0	12.	1.16	Arrhenius
Urea	0.1	14.8	0.97	Heimbrodt
	0.2	14.8	0.969	Heimbrodt
Zinc acetate	2.0	18.05	0.210	Seitz
	2.0	0.04	0.120	Seitz
sulphate	1.0	14.8	0.236	Seitz

OSMOTIC PRESSURE OF AQUEOUS SOLUTIONS

For a Membrane of Ferrocyanide of Copper

Dissolved Substance.	Gms.substance in 1 cm. sol.	Temp. ° C.	Pressure, cm. Hg.	Observer.
Glycerine..........	.00199	0	36.7	
Gum arabic.........	0.0099	15.5	7.0	Pfeffer
Gum arabic.........	0.164	15.6	119.3	Pfeffer
Phenol (carbolic acid)	.00127	0	23.3	Naccari
	Gm.-mol. substance per gm. sol.		Pressure in atm.	
Glucose............	.0001	10.2	2.39	Morse,1911
	.0005	10.2	11.55	Morse,1911
	.0010	10.0	23.80	Morse,1911
Saccharose (cane sugar)...........	.0001	10.0	2.50	Morse,1911
	.0005	10.0	12.30	Morse,1911
	.0010	10.0	25.69	Morse,1911
	Gm.-mol. substance in 1 ccm. sol.			
Potassium carbonate	.00005	15	1.17	Adie, 1891
ferrocyanide......	.00005	15	3.44	Adie, 1891
nitrate...........	.00005	15	1.56	Adie, 1891
Sodium citrate (acid)	.00005	15	4.32	Adie, 1891

CONVERSION OF THERMOMETER SCALES

Degrees C. $\times 1.8 + 32$ = Degrees F. Degrees $\frac{(F.-32)4}{9}$ = Degrees R.

Degrees $\frac{F.-32}{1.8}$ = Degrees C. Degrees $\frac{R. \times 5}{4}$ = Degrees C.

Degrees $\frac{R. \times 9}{4} + 32$ = Degrees F. Degrees $\frac{C. \times 4}{5}$ = Degrees R.

For Centigrade-Fahrenheit Conversion Tables see under Measures and Units.

REDUCTION OF MERCURY IN GLASS THERMOMETER READING TO THE HYDROGEN SCALE

JENA NORMAL GLASS, 16III

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission.)

Reading	0°	10	20	30	40	50
Correction	0°.000	−0.055	−0.090	−0.109	−0.115	−0.109
Reading	50°	60	70	80	90	100
Correction	−0°.109	−0.096	−0.076	−0.053	−0.027	0.000

COEFFICIENT OF THERMAL EXPANSION

LINEAR

The coefficient given is the increase in length per unit length (measured at 0° C.) per degree Centigrade.

Substance	Temp. °C.	Coefficient	Observer
		$\times 10^{-4}$	
Aluminum	−191 to +16	0.1835	Henning, 1907
	20	0.255	Voigt, 1893
	40	0.2313	Fizeau, 1869
	600	0.3150	Chatelier
Aluminum-bronze	20	0.170	National Physical Laboratory
Antimony	−180 to +13	0.1023	Grüneisen, 1910
	20	0.12	Fizeau, 1869
	15–101	0.1088	Grüneisen, 1910
parallel to axis	10–90	0.1730	Fizeau, 1869
perpendicular to axis	10–90	0.0828	"
Arsenic	10–90	0.0386	"
Bismuth	−180 to +15	0.1298	
	19–101	0.1345	
parallel to axis	10–90	0.1537	
perpendicular to axis	10–90	0.1084	
Brass			
cast	0–100	0.1875	Smeaton
wire	0–100	0.1930	"
66Cu, 34Zn	20	0.189	National Physical Laboratory
Brick	....	0.095	National Physical Laboratory
Bronze			
3Cu, 1Sn	16.6–100	0.1844	Daniell
	16.6–350	0.2116	"
	16.6–957	0.1737	"
93.5Cu, 6.5Sn	16–100	0.365	Bein, 1912
90Cu, 10Sn	0–900	0.220	Le Chatelier, 1889
80Cu, 20Sn	0–800	0.270	"
70Cu, 30Sn	0–700	0.295	"
phosphor			
97.6Cu, 2Sn, 0.2P	0–85	0.168	Mean
Cadmium	−183 to +14	0.446	Grüneisen, 1901
	20	0.288	Matthiessen, 1866
	0–100	0.3159	"
	10–90	0.2939	Fizeau
	315	0.316	Vicentini & Omodei

COEFFICIENT OF THERMAL EXPANSION (Continued)

Linear

The coefficient given is the increase in length per unit length (measured at 0° C.) per degree Centigrade

Substance	Temp. °C.	Coefficient	Observer
Calcite, parallel to axis	0–85	0.2514×10^{-4}	Benoit, 1888
perpendicular to axis	0–85	−0.0558	"
Caoutchouc	....	0.657–0.686	Various
	17–25	0.770	Kohlrausch
Carbon			
diamond	40	0.0118	Fizeau, 1869
gas carbon	40	0.0540	"
graphite	40	0.0786	"
Cement and concrete		0.10–0.14	"
Cobalt	40	0.1236	"
Constantan	4–29	0.1523	....
60Cu, 40Ni	20	0.170	National Physical Laboratory
	−191 to +16	0.1202	Henning, 1907
	0–38	0.1448	Guillaume, 1896
	0–500	0.1481	Holborn & Day, 1900
Copper	−191 to +16	0.1409	Henning, 1907
	10–90	0.1596	Fizeau, 1869
	0–625	0.1607	Dittenberger, 1902
Diamond, *see Carbon*			
Ebonite	25–35	0 842	Kohlrausch
Emerald, parallel to axis	0–85	−0.0135	Benoit
perpendicular to axis	0–85	+0.0100	
Fluor spar, CaF_2	0–100	0.195	Pfaff
Galena	....	0.199	....
German silver	0–100	0.1836	Pfaff
60Cu, 15Ni, 25Zn			
Glass			
tube	0–100	0.0833	Fizeau
soft	....	0 085	Schott
hard	....	0.097	"
plate	0–100	0.0891	Lavoisier & Laplace
crown	0–100	0.0897	" "
flint	50–60	0.0788	Pulfrich
Jena thermometer			
16^{III} normal	0–100	0.081	Schott
59^{III}	0–100	0.058	"
59^{III}	−191 to +16	0.0424	Henning, 1907
Gold	−183 to +16	0.132	Grüneisen, 1910
	16–100	0 143	"
Gold-copper	0–100	0.1552	Matthiessen
2Au, 1Cu			
Gold-platinum	0–100	0.1523	"
2Au, 1Pt			
Granite	....	0.083	....
Gun metal	....	0.183	Nat. Phys. Lab.
Gutta percha	....	1.983	Russner, 1882
Ice	−20 to −1	0.510	....
	−10 to 0	0.507	Vincent, 1902
Indium	40	0.417	Fizeau, 1869
Invar, *see Nickel steel*			
Iodine	−188 to 16	0.837	Dewar, 1902
Iridium	−183 to +19	0.0571	Grüneisen, 1910
Iron	−190 to +17	0.0907	Henning, 1907
soft	40	0.1210	Fizeau, 1869
cast	40	0.1061	"
cast	−190 to +16	0.0850	Henning, 1907

COEFFICIENT OF THERMAL EXPANSION (Continued)

Substance	Temp. °C.	Coefficient	Observer
Iron, wrought	−18 to +100	0.1140×10^{-4}	Andrews
steel	40	0.1322	Fizeau, 1869
steel, annealed	40	0.1095	Fizeau, 1869
steel, 1.2% C.	0–100	0.105	Le Chatelier, 1899
"	100–200	0.115	"
"	200–300	0.13	"
"	300–400	0.15	"
"	400–500	0.14	"
"	500–600	0.16	"
"	600–700	0.16	"
"	above 900	0.29	"
Lead	−183 to +14	0.2708	Grüneisen, 1910
	18–100	0.2940	"
Lead-tin 2Pb, 1Sn	0–100	0.2508	Smeaton
Magnesium	−183 to +15	0.2140	Grüneisen, 1910
	18–100	0.2608	"
cast	20–100	0.2696	C. D. H., 1917
wrought	20–100	0.2673	"
Magnalium 96Al, 4Mg	0–13	0.22	Guillaume, 1902
86Al, 14Mg	12–39	0.238	Stadhagen, 1901
Marble	15–100	0.117	Fröhlich
Masonry	....	0.04–0.07	....
Mercury	−183 to −39	0.30	Dewar, 1902
	−78 to −38	0.41	Grunmach, 1901
Monel metal	25–100	0.14	
	25–300	0.15	
	25–600	0.16	
Nickel	−191 to +16	0.1012	Henning, 1907
	40	0.1279	Fizeau
	16–250	0.1397	Holborn & Day, 1901
	375–1000	0.1346	Holborn & Day, 1901
Nickel steel			
10% Ni	20	0.130	Nat. Phys. Lab.
20	20	0.195	" " "
30	20	0.120	" " "
36 (Invar)	20	0.009	" " "
40	20	0.060	" " "
50	20	0.097	" " "
80	20	0.125	" " "
Osmium	40	0.0657	Fizeau
Palladium	40	0.1176	"
	0–100	0.1104	Matthiessen
Paraffine	0–16	1.066	Rodwell
	16–38	1.303	"
	38–49	4.771	"
Phosphorous	0–44	1.24	Laduc, 1891
Phosphor bronze, *see Bronze*			
Platinum	40	0.0899	Fizeau
Platinum iridium 10Pt, 1Ir	40	0.0884	Fizeau
Platinum silver 33Pt, 67Ag	0–100	0.1523	Matthiessen
Porcelain	20–790	0.0413	Braun
Berlin	0–100	0.031	Holborn & Grüneisen
Bayeux	0	0.025	Tutton, 1902
	1000–1400	0.0553	Deville & Troost

COEFFICIENT OF THERMAL EXPANSION (Continued)

Linear

The coefficient given is the increase in length per unit length (measured at 0° C.) per degree Centigrade.

Substance	Temp. °C.	Coefficient	Observer
Quartz (crystal)			
parallel to axis	−190 to +16	0.0521×10^{-4}	Scheel
	0–80	0.0797	Benoit, 1888
perpendicular to axis	0–80	0.1337	"
fused	−191 to +16	0.00256	Henning, 1907
	0–30	0.0042	Chappius, 1903
	0–100	0.0050	Scheel, 1907
	0–800	0.00546	Randall, 1910
	0–1200	0.00585	"
Rhodium	40	0.0850	Fizeau
Rock salt	40	0.4040	"
Rubidium	2–17	0.862	Elsa Deuss, 1911
Ruthenium	40	0.0963	Fizeau
Sandstone	20	0.07–0.12	....
Selenium	−180 to 0	0.372	Dorsey, 1908
	40	0.3680	Fizeau
Silicon	40	0.0763	"
Silver	−191 to +16	0.1704	Henning, 1907
	20	0.188	Voigt, 1893
Slate	20	0.06–0.10	....
Solder, *see Lead-tin*			
Speculum metal 68Cu, 32Sn	20	0.193	Smeaton
Sodium	−188 to +17	0.622	Dewar, 1902
Sulphur, crystal	40	0.6413	Fizeau, 1869
Tellurium	40	0.1675	"
Thallium	40	0.3021	"
Thorium	0–100	0.123	Rentschler, Marden [1925
Tin	−183 to +16	0.2257	Grüneisen, 1910
	18–100	0.2692	"
Topaz, axis a	0–100	0.0832	Pfaff
" b	0–100	0.0836	"
" c	0–100	0.0472	"
Tourmaline			
parallel to axis	0–100	0.0937	"
perpendicular to axis	0–100	0.0773	"
Tungsten	20–100	0.0336	Colin, 1910
Type metal	17–254	0.1952	Daniell
Vulcanite	0–18	0.6360	Mayer
Wood			
parallel to fiber			
ash	0–100	0.0951	Glatzel
beech	2–34	0.0257	Villari
chestnut	2–34	0.0649	"
elm	2–34	0.0565	"
mahogany	2–34	0.0361	"
maple	2–34	0.0638	"
oak	2–34	0.0492	"
pine	2–34	0.0541	"
walnut	2–34	0.0658	"
across fiber			
beech	2–34	0.614	"
chestnut	2–34	0.325	"
elm	2–34	0.443	"
mahogany	2–34	0.404	"
maple	2–34	0.484	"
oak	2–34	0.544	"
pine	2–34	0.341	"
walnut	2–34	0.484	"
Zinc	−180 to 0	0.264	Dorsey, 1908
	10–100	0.2628	Thiesen, 1895

THERMAL EXPANSION OF GLASSES

The following table gives the mean coefficient of linear expansion for various types of glass as determined by Peters and Cragoe of the Bureau of Standards. 1920.

Glass sample	Temp. interval	Coefficient	Temp. interval	Coefficient
1 Barium flint	22–494	0.088	519–550	0.331
4 Plate, American	20–508	.108	540–560	.401
6 German	21–496	.099	564–589	.477
7 French	21–513	.094	597–613	.424
8 Light crown	24–422	.104	494–507	.548
10 Borosilicate crown	22–498	.090	539–562	.393
11 Barium crown	23–499	.090	589–610	.649
12 Medium flint	23–402	.097	452–478	.396
13 Light flint	22–451	.088	494–512	.347
16 Commercial glass	23–445	.107	510–534	.309
20 McBeth-Evans flask	22–449	.069	567–586	.454
21 Pyrex	21–471	.036	552–571	.151
22 Schott-Genossen flask	19–414	.056	540–562	.404
23 Soda tubing	21–372	.120	506–525	.234
24 Lead tubing	21–338	.091	464–483	.236
26 Fluorite tubing	22–364	.098	510–551	.284
29 Fusing in glass, German	23–383	.090	456–481	.283
30 Fusing in glass, Corning	22–376	.083	460–485	.258

More complete data, including the composition of the samples named above, will be found in Scientific Paper No. 393, Bureau of Standards.

EQUATION FOR THE LINEAR EXPANSION OF SOLIDS

If l_0 is the length at 0° C. the length at t° C. is $l_t = l_0\ (1 + \alpha t + \beta t^2)$.

The table gives the values of these coefficients.

Substance.	Temp. limits. ° C.	α.	β.	Observer.
Aluminum	10–90	$.2221 \times 10^{-4}$	$.114 \times 10^{-7}$	Fizeau
Brass	10–90	.1781	.098	Fizeau
Copper	10–90	.1596	.102	Fizeau
Gold	10–90	.1410	.042	Fizeau
Iron, pure	0–38	.1145	.071	Guillaume
Lead	10–90	.2829	.120	Fizeau
Nickel	0–38	.1255	.057	Guillaume
Platinum	0–1000	.0868	.013	Holborn and Valentine
Silver	10–90	.1862	.074	Fizeau
Tin	10–90	.2094	.175	Fizeau
Zinc	10–90	.2969	−.0635	Fizeau

CUBICAL EXPANSION OF SOLIDS

The coefficient of cubical expansion for a solid is approximately three times the linear coefficient.

The experimental values for various solids are given in the following table. The coefficient is the increase in volume per unit volume per degree Centigrade.

Substance.	Temp. ° C.	Coefficient.	Observer.
Antimony	0–100	0.3167×10^{-4}	Matthieson
Bismuth	......	0.4000	Kopp
Diamond	40	0.0354	Fizeau
Fluor spar	14–47	0.6235	Kopp
Glass, white tube	0–100	0.2648	Regnault
green tube	0–100	0.2299	Regnault
Jena	0–100	0.2533	Reichsanstalt
Ice	−20 to −1	1.1250	Brunner
Iceland spar	50–60	0.1447	Pulfrich
Iron	0–100	0.3550	Dulong and Petit
Porcelain	0–100	0.1080	Deville and Troost
Quartz	50–60	0.3530	Pulfrich
Rock salt	50–60	1.2120	Pulfrich

CUBICAL EXPANSION OF LIQUIDS

The table gives the mean coefficient of cubical expansion for the range 0–100° C. and the values of the quantities α, β and γ in the equation $V_t = V_0(1 + \alpha t + \beta t^2 + \gamma t^3)$.

(From Smithsonian Tables.)

Liquid.	Temp. Range ° C.	Mean coef. 0-100° C.	α	β	γ	Observer.
Acetic acid	16–107	.001433	1.0630×10^{-3}	0.1264×10^{-6}	1.0876×10^{-8}	Zander
Acetone	0–54	1616	1.3240	3.8090	0.8798	Zander
Alcohol:						
amyl	−15 to +80	.....	0.8900	0.6573	1.1846	Pierre
ethyl, sp.gr. .8095	0–80	.....	1.0414	0.7836	1.7168	Kopp
ethyl, 50% by volume	0–39	.....	0.7450	1.850	0.730	Recknagel
ethyl, 30% by volume	18–39	.....	0.2928	17.900	11.87	Recknagel
methyl	−38 to +70	1433	1.1856	1.5649	0.9111	Pierre
Benzene	11–81	1385	1.1763	1.2775	0.8065	Kopp
Bromine	− 7 to +60	1168	1.0382	1.7114	0.5447	Pierre
Calcium chloride:						
$CaCl_2$, 5.8% solution	18–25	0506	0.0788	4.2742	....	Decker
$CaCl_2$, 40.9% solution	17–24	0510	0.4238	0.8571	....	Decker
Carbon disulphide	−34 to +60	1468	1.1398	1.3706	1.9122	Pierre
Chloroform	0–63	1399	1.1071	4.6647	1.7433	Pierre
Ether	−15 to +38	2150	1.5132	2.3592	4.0051	Pierre
Glycerine	....	0534	0.4853	0.4895	....	Emo
Hydrochloric acid:						
$HCl + 6.25H_2O$	0–30	0489	0.4460	0.430	....	Marignac
$HCl + 50H_2O$	0–30	0933	0.0625	8.710	....	Marignac

CUBICAL EXPANSION OF LIQUIDS (Continued)

Liquid.	Temp. Range ° C.	Mean coef. 0-100° C.	α	β	γ	Observer.
Mercury	24–299	.....	0.18182×10^{-3}	0.00078×10^{-6}	....	Scheel
Olive oil	....	.000742	0.6821	1.1405	$-.539 \times 10^{-8}$	Spring
Potassium chloride:						
KCl, 2.5% solution	....	0572	....	....	....	Decker
KCl, 24.3% solution	....	0477	....	....	....	Decker
Potassium nitrate:						
KNO_3, 5.3% solution	....	0539	....	....	....	Nicol
KNO_3, 21.9% solution	....	0577	....	....	....	Nicol
Phenol, C_6H_6O	36–157	0899	0.8340	0.1073	0.4446	Pinette
Petroleum, sp.gr. 0.8467	24–120	1039	0.8994	1.396	....	Frankenheim
Sodium chloride, NaCl, 1.6% solution	....	1067	0.0213	10.462	....	Marignac
Sodium sulphate, Na_2SO_4, 24% solution	10–40	0611	0.3599	2.516	....	Marignac
Sodium nitrate, $NaNO_3$, 36.2% solution	20–78	0627	0.5408	1.075	....	Nicol
Sulphuric acid:						
H_2SO_4	0–30	0489	0.5758	0.864	....	Marignac
$H_2SO_4+50H_2O$	0–30	0799	0.2835	5.160	....	Marignac
Turpentine	−9 to +106	1051	0.9003	1.959	....	Kopp
Water	0–33	.....	−.0643	8.505	6.790	Scheel

COEFFICIENTS OF EXPANSION OF GASES AT CONSTANT PRESSURE

Change in volume per unit volume per degree Centigrade.

(From Smithsonian Tables.)

Gas.	Temp. °C.	Pressure in cm. of mercury.	Coefficient.	Observer.
Acetylene	0	76.	.003772	Leduc, 1912
Acetylene	0–100	76.	3739	Leduc, 1912
Air	0–100	76.	3670	Regnault, 1842
Air	0–100	100.1	36728	Chappuis, 1903
Ammonia	0	76.	3860	Leduc, 1912
Ammonia	0–100	76.	3800	Leduc, 1912
Carbon dioxide	0	76.	3751	Leduc, 1912
Carbon dioxide	0–100	76.	3723	Leduc, 1912
Carbon dioxide	0–20	51.8	37128	Chappuis, 1903
Carbon dioxide	0–40	51.8	37100	Chappuis, 1903
Carbon dioxide	0–100	51.8	37073	Chappuis, 1903
Carbon dioxide	0–20	99.8	37602	Chappuis, 1903
Carbon dioxide	0–100	99.8	37410	Chappuis, 1903
Carbon dioxide	0–20	137.7	37972	Chappuis, 1903
Carbon dioxide	0–100	137.7	37703	Chappuis, 1903
Carbon dioxide	0–7.5	2621.	1097	Baly-Ramsay, 1894
Carbon dioxide	64–100	2621.	6574	Baly-Ramsay, 1894
Carbon monoxide	0–100	76.	3669	Regnault, 1842
Chlorine	0	76.	3900	Leduc, 1912
Chlorine	0–100	76.	3830	Leduc, 1912
Cyanogen	0	76.	396	Leduc, 1912
Cyanogen	0–100	76.	387	Leduc, 1912
Hydrochloric acid	0	76.	3770	Leduc, 1912
Hydrochloric acid	0–100	76.	3734	Leduc, 1912
Hydrogen	0–100	100.0	36600	Chappuis, 1903
Hydrogen	0–100	200. atm	332	Amagat, 1890
Hydrogen	0–100	400. atm	295	Amagat, 1890
Hydrogen	0–100	600. atm	261	Amagat, 1890
Hydrogen	0–100	800. atm	242	Amagat, 1890
Nitrogen	0	76.	3673	Leduc, 1912
Nitrogen	0–100	76.	3671	Leduc, 1912
Nitrous oxide	0–100	76.	3719	Regnault, 1842
Oxygen	0–100	100. atm	486	Amagat
Oxygen	0–100	200. atm	534	Amagat
Oxygen	0–100	400. atm	459	Amagat
Oxygen	0–100	600. atm	357	Amagat
Oxygen	0–100	800. atm	288	Amagat
Oxygen	0–100	1000. atm	241	Amagat
Sulphur dioxide	0–100	76.	3903	Regnault, 1842
Sulphur dioxide	....	98.	3980	Regnault, 1842
Water vapor	0–119	76.	4187	Hirn, 1862
Water vapor	0–141	76.	4189	Hirn, 1862
Water vapor	0–162	76.	4071	Hirn, 1862
Water vapor	0–200	76.	3938	Hirn, 1862
Water vapor	0–247	76.	3799	Hirn, 1862

COEFFICIENT OF EXPANSION OF GASES AT CONSTANT VOLUME

Change in pressure per unit pressure per degree Centigrade.

(From Smithsonian Tables.)

Gas.	Temp. °C.	Pressure cm. of Hg.	Coefficient.	Observer.
Acetylene	0	76.	003741	Leduc, 1912
Acetylene	0–100	76.	3726	Leduc, 1912
Air	.....	.6	37666	Meleander, 1890–92
Air	.....	1.3	37127	Meleander, 1890–92
Air	.....	10.0	36630	Meleander, 1890–92
Air	.....	25.4	36580	Meleander, 1890–92
Air	.....	75.2	36660	Meleander, 1890–92
Air	0–100	100.1	36744	Chappuis, 1903
Air	.....	76.0	36650	Regnault, 1842
Air	.....	200.0	36903	Regnault, 1842
Air	.....	2000.	38866	Regnault, 1842
Air	.....	10000.	4100	Regnault, 1842
Ammonia	0	76.	3800	Leduc, 1912
Ammonia	0–100	76.	3770	Leduc, 1912
Argon	.....	51.7	3668	Keunen-Randall, 1896
Carbon dioxide	0–20	51.8	36985	Chappuis, 1903
Carbon dioxide	0–40	51.8	36972	Chappuis, 1903
Carbon dioxide	0–100	51.8	36981	Chappuis, 1903
Carbon dioxide	0–20	99.8	37335	Chappuis, 1903
Carbon dioxide	0–100	99.8	37262	Chappuis, 1903
Carbon dioxide	0–100	100.0	37248	Chappuis, 1892
Carbon dioxide	0	76.	3724	Leduc, 1912
Carbon dioxide	0–100	76.	3714	Leduc, 1912
Carbon monoxide	.....	76.	36667	Regnault, 1842
Cyanogen	0	76.	3870	Leduc, 1912
Cyanogen	0–100	76.	3830	Leduc, 1912
Ethane	0	76.	3780	Leduc, 1912
Ethane	0–100	76.	3750	Leduc, 1912
Helium	.....	56.7	3665	Keunen-Randall, 1896
Hydrochloric acid	.....	76.	3740	Leduc, 1912
Hydrochloric acid	0–100	76.	3721	Leduc, 1912
Hydrogen	0	76.	3663	Leduc, 1912
Hydrogen	0–100	76.	3664	Leduc, 1912
Hydrogen	16–132	.0077	3328	Baly-Ramsay, 1894
Hydrogen	15–132	.025	3623	Baly-Ramsay, 1894
Hydrogen	12–105	.47	3656	Baly-Ramsay, 1894
Hydrogen	0–100	100.0	36626	Chappuis, 1903
Methane	0	76.	3680	Leduc, 1912
Methane	0–100	76.	3678	Leduc, 1912
Nitrogen	0	76.	3672	Leduc, 1912
Nitrogen	0–100	76.	3672	Leduc, 1912
Nitrogen	13–132	.06	3021	Baly-Ramsay, 1894
Nitrogen	9–133	.53	3290	Baly-Ramsay, 1894
Nitrogen	0–20	100.2	36754	Chappuis, 1903
Nitrogen	0–100	100.2	36744	Chappuis, 1903
Oxygen	0	76.	3673	Leduc, 1912
Oxygen	0–100	76.	3672	Leduc, 1912
Oxygen	11–132	.007	4161	Baly-Ramsay, 1894
Oxygen	9–132	.25	3984	Baly-Ramsay, 1894
Oxygen	11–132	.51	3831	Baly-Ramsay, 1894
Oxygen	.....	1.9	36683	Meleander, 1891
Oxygen	.....	18.5	36690	Meleander, 1891
Nitrous oxide	.....	76.	3676	Regnault, 1842
Sulphur dioxide, SO_2	.....	76.	3845	Regnault, 1842

REDUCTION OF GAS VOLUME

Values of (1+αt) for Temperatures from 0 to 120° C.

T	0	1	2	3	4	5	6	7	8	9
00	1.0000	1.0037	1.0073	1.0110	1.0147	1.0183	1.0220	1.0257	1.0294	1.0330
10	1.0367	1.0404	1.0440	1.0477	1.0514	1.0550	1.0587	1.0624	1.0661	1.0697
20	1.0734	1.0771	1.0807	1.0844	1.0881	1.0917	1.0954	1.0991	1.1028	1.1064
30	1.1101	1.1138	1.1174	1.1211	1.1248	1.1284	1.1321	1.1358	1.1395	1.1431
40	1.1468	1.1505	1.1541	1.1578	1.1615	1.1651	1.1688	1.1725	1.1762	1.1798
50	1.1835	1.1872	1.1908	1.1945	1.1982	1.2018	1.2055	1.2092	1.2129	1.2165
60	1.2202	1.2239	1.2275	1.2312	1.2349	1.2385	1.2422	1.2459	1.2496	1.2532
70	1.2569	1.2606	1.2642	1.2679	1.2716	1.2752	1.2789	1.2826	1.2863	1.2899
80	1.2936	1.2973	1.3009	1.3046	1.3083	1.3119	1.3156	1.3193	1.3230	1.3266
90	1.3303	1.3340	1.3376	1.3413	1.3450	1.3486	1.3523	1.3560	1.3597	1.3633
100	1.3670	1.3707	1.3743	1.3780	1.3817	1.3853	1.3890	1.3927	1.3964	1.4000
110	1.4037	1.4074	1.4110	1.4147	1.4184	1.4220	1.4257	1.4294	1.4331	1.4367
120	1.4404									

Values of H/760 for Pressures from 700 to 780 mm. of Mercury.

H	0	1	2	3	4	5	6	7	8	9
700	0.9211	0.9224	0.9237	0.9250	0.9263	0.9276	0.9289	0.9303	0.9316	0.9329
710	0.9342	0.9355	0.9368	0.9382	0.9395	0.9408	0.9421	0.9434	0.9447	0.9461
720	0.9474	0.9487	0.9500	0.9513	0.9526	0.9539	0.9553	0.9566	0.9579	0.9592
730	0.9605	0.9618	0.9632	0.9645	0.9658	0.9671	0.9684	0.9697	0.9711	0.9724
740	0.9737	0.9750	0.9763	0.9776	0.9789	0.9803	0.9816	0.9829	0.9842	0.9855
750	0.9868	0.9882	0.9895	0.9908	0.9921	0.9934	0.9947	0.9961	0.9974	0.9987
760	1.0000	1.0013	1.0026	1.0039	1.0053	1.0066	1.0079	1.0092	1.0105	1.0118
770	1.0132	1.0145	1.0158	1.0171	1.0184	1.0197	1.0211	1.0224	1.0237	1.0250
780	1.0263									

SPECIFIC HEAT OF WATER AND MERCURY

Values for water from 0–100° C. are the mean of various determinations including Calendar and Blonsfield, 1912; above 100, Regnault's values recomputed by Guillaume, 1912.

Values for mercury 0–80° C. due to Barnes and Cooke; 90–140°, mean of Winkelmann, Naccari and Milthaler; above 140°, mean of Naccari and Milthaler.

Specific heat in normal calories (15° C.).

Temp. ° C.	Water.	Mercury.	Temp. ° C.	Water.	Mercury.
0	1.00874	.03346	80	1.00239	.03284
5	1.00477	.03340	85	1.00329	
10	1.00184	.03335	90	1.00433	.03277
15	1.00000	.03330	95	1.00534	
20	0.99859	.03325	100	1.00645	.03269
25	0.99765	.03320	110	1.0116	.03262
30	0.99745	.03316	120	1.0144	.03255
35	0.99743	.03312	130	1.0174	.03248
40	0.99761	.03308	140	1.0206	.03241
45	0.99790		150	1.0240	.0324
50	0.99829	.03300	160	1.0275	
55	0.99873		170	1.0313	.0322
60	0.99934	.03294	180	1.0353	
65	1.00001		190	1.0395	.0320
70	1.00077	.03289	200	1.0439	
75	1.00158				

SPECIFIC HEAT OF WATER

Temperatures on the normal (hydrogen) scale: specific heat in normal calories (15°)

Ice

Temp. C.	Specific Heat.	Observer.	Temp. C.	Specific Heat.	Observer.
—252 to —188	0.146	Dieterici, 1903	—160	0.230	Nernst, 1910
			—140	.262	Nernst, 1910
—188 to —78	.285	Dieterici, 1903	—100	.325	Nernst, 1910
			—60	.392	Nernst, 1910
—78 to —18	.463	Dieterici, 1903	—20	.480	Nernst, 1910
			—10	.53	Nernst, 1910
—200	.168	Nernst, 1910	—21 to 0	.505	Person, 1847
—180	.199	Nernst, 1910			
		Water Below 0° C.			
—6	1.0119	Martinetti, 1890	—2	1.0097	Martinetti, 1890
—5	1.0113	Martinetti, 1890	—1	1.0092	Martinetti, 1890
—4	1.0105	Martinetti, 1890	—5	1.0155	Barnes, 1902
—3	1.0102				

Water 0–100° C.

Temp. ° C.	Barnes, 1902.	Dieterici,* 1905.	Callendar, 1912.	Blousfield, 1912.	Mean.**
0	....	1.0089	1.00934	1.0070	1.00874
5	1.00502	1.0051	1.00494	1.0039	1.00477
10	1.00201	1.0021	1.00187	1.0016	1.00184
15	1.00000	1.0000	1.00000	1.0000	1.00000
20	.99864	.9987	.99878	.9991	.99859
25	.99775	.9983	.99800	.9989	.99765
30	.99725	.9983	.99755	.9990	.99745
35	.99708	.9984	.99734	.9997	.99743
40	.99708	.9984	.99734	1.0006	.99761
45	.99730	.9989	.99749	1.0018	.99790
50	.99768	.9994	.99779	1.0031	.99829
55	.99818	.9998	.99820	1.0045	.99873
60	.99880	1.0005	.99872	1.0058	.99934
65	.99940	1.0013	.99933	1.0070	1.00001
70	1.00007	1.0022	1.00003	1.0083	1.00077
75	1.00072	1.0032	1.00081	1.0088	1.00158
80	1.00141	1.0041	1.00166	1.0091	1.00239
85	1.00208	1.0053	1.00260	......	1.00329
90	1.00275	1.0066	1.00357	......	1.00433
95	1.00341	1.0080	1.00462	......	1.00534
100	1.00410	1.0095	1.00574	......	1.00645

* Temperature by air thermometer. ** Mean of observations by Rowland, Bartoli and Stracciati, Griffiths, Barnes, Dieterici, and Callendar.

SPECIFIC HEAT OF WATER (Continued)

Water Above 100° C.

Temp. ° C.	Regnault, 1847, recomputed by Guillaume, 1912.	Dieterici, 1905.	Temp. ° C.	Dieterici, 1905.
110	1.0116	1.0126	210	1.0695
120	1.0144	1.0168	220	1.0769
130	1.0174	1.0214	230	1.0857
140	1.0206	1.0255	240	1.0939
150	1.0240	1.0310	250	1.1035
160	1.0275	1.0359	260	1.1126
170	1.0313	1.0422	270	1.1230
180	1.0353	1.0479	280	1.1329
190	1.0395	1.0550	290	1.1442
200	1.0439	1.0616	300	1.1549

MECHANICAL EQUIVALENT OF HEAT

Observer	Ergs per calorie (15°).	Observer.	Ergs per calorie (15°).
Joule, 1878	4.177×10^7	Callendar and Barnes, 1900	4.186×10^7
Rowland, 1879.......	4.188	Dieterici, 1905.....	4.1879
Griffiths, 1893.......	4.196	Bousfield, 1912.....	4.1791
Schuster and Gannon, 1898	4.196	Jaeger and Steinwehr, 1921	4.184

Value adopted by the Bureau of Standards: 1 gram-calorie (20°) = 4.183 joules (based on international electrical units).

SPECIFIC HEAT OF ELEMENTS

Element.	Temp. °C.	Specific heat, Cal./gm.	Observer.
Aluminum......	−240.6	0.0092	Nernst, 1911
	−233.	0.0165	"
	−190.	0.0889	"
	−190 to −82	0.1466	Koref, 1911
	−76 to −1	0.1962	"
	17–100	0.217	Schimpff, 1910
	15–435	0.236	Tilden, 1902
	500	0.274	Bontschew
Antimony......	−186 to −79	0.0462	Behn, 1900
	−188 to +20	0.0468	Richards & Jackson, 1910
	20	0.0503	Gaede, 1902
	100	0.0513	"
	200	0.0520	Naccari, 1887
	300	0.0537	"
Arsenic, gray, crystal.......	0–100	0.0822	Wigand, 1903
black amor....	0–100	0.0861	"
	−188 to +20	0.0704	Richards & Jackson, 1910
Barium........	−185 to +20	0.068	Nordmeyer-Bernouli, 1907
Beryllium......	0–100	0.425	Nilson & Pettersson, 1880
Bismuth.......	−188 to +20	0.0284	Richards & Jackson, 1910
	−79 to +17	0.0285	Schimpff, 1910
	17–100	0.0303	"
liquid	280–360	0.0363	Person
Boron, amor.....	−191 to −78	0.071	Koref, 1911
	−78–0	0.165	"
	0–100	0.307	Moissan & Gautier
	0–234	0.357	" "
Bromine, solid...	−191 to −81	0.070	Koref, 1911
	−78 to −20	0.084	Regnault, 1849
liquid........	1–32	0.107	Andrews, 1848
Cadmium......	−186 to −79	0.0498	Behn, 1910
	−79 to +18	0.0537	"
	20	0.0549	Gaede, 1902
	100	0.0566	"
	200	0.0594	Naccari, 1887
	300	0.0617	"
Caesium........	0–26	0.048	Eckardt & Graefe, 1900
Calcium........	−185 to +20	0.157	Nordmeyer & Bernouli, 1906
	0–20	0.145	Bernini, 1907

SPECIFIC HEAT OF ELEMENTS (Continued)

Element.	Temp. °C.	Specific heat, Cal./gm.	Observer.
Calcium	0–157	0.152	Bernini, 1907
Carbon:			
gas carbon....	24–68	0.204	Bettendorff & Wüllner
charcoal......	0–24	0.165	Weber, 1875
graphite......	–243	0.005	Nernst, 1911
	–203	0.0175	"
	–188 to –78	0.060	Dewar, 1905
	11	0.160	Weber, 1875
	138	0.254	"
	642	0.445	"
diamond.....	–233	0.0005	Nernst, 1911
	–185	0.0025	"
	–188 to –78	0.019	Dewar, 1905
	–78 to +18	0.079	"
	11	0.113	Weber, 1875
	140	0.222	"
	247	0.303	"
	606	0.441	"
Cerium.........	0–100	0.0448	Hillebrand, 1876
Chlorine, liquid..	0–24	0.226	Knietsch
Chromium......	–188 to +20	0.0793	Richards & Jackson, 1910
	–79 to +17	0.098	Schimpff, 1910
	17–100	0.110	"
	100	0.112	Adler, 1903
	400	0.133	"
Cobalt.........	–188 to +20	0.0827	Richards & Jackson, 1910
	15–100	0.1035	Tilden, 1900
	15–185	0.1047	" 1902
	300	0.121	Göbl, 1911
	*508	{0.145 {0.125	" "
	800	0.160	"
	1000	0.184	"
	*1112	{0.270 {0.170	" "
Copper........	–253	0.0031	Nernst, 1911
	–213	0.029	"
	–193	0.047	"
	–188 to +20	0.0788	Richards & Jackson, 1910
	–79 to +18	0.0883	Behn, 1900
	20	0.0912	Gaede, 1902
	15–100	0.09305	Bartoli & Stracciati

* Temperatures of Transformation.

SPECIFIC HEAT OF ELEMENTS (Continued)

Element.	Temp. °C.	Specific heat, Cal./gm.	Observer.
Copper:			
	100	0.0942	Gaede, 1900
	200	0.0963	Naccari, 1887
	900	0.1259	Richards, 1893
Didymium.....	0–100	0.046	Hillebrand, 1876
Gallium, liquid..	13–110	0.080	Berthelot, 1878
solid..........	12–23	0.079	"
Germanium.....	0–100	0.074	Pettersson-Hedellius, 1881
Glucinium......	0–46	0.397	Nilson & Pettersson, 1880
	0–300	0.505	Nilson & Pettersson, 1880
Gold...........	−188 to −20	0.0297	Richards & Jackson, 1910
	−79 to +17	0.0297	Schimpff, 1910
	0–100	0.0316	Voille, 1877
	17–100	0.031	Schimpff
	0–900	0.0345	Voille, 1879
Hydrogen, liq...	−253	6.0	Dewar, 1901
Indium........	−186 to −79	0.0263	Behn, 1900
	−79 to +18	0.0303	"
	18–100	0.0323	"
Iodine.........	−243	0.031	Nernst, 1911
	−193	0.043	"
	−189 to −76	0.0467	" 1910
	−76–0	0.0516	"
	9–98	0.054	Regnault
liquid........	107–180	0.108	Favre & Silbermann, 1863
Iridium........	−186 to −79	0.0263	Behn, 1900
	−79 to +18	0.0302	"
	18–100	0.0323	"
	0–900	0.0371	Violle, 1879
Iron...........	−186 to −79	0.0721	Behn, 1900
	−79 to +18	0.1000	"
	18–100	0.113	"
	300	0.138	Naccari, 1887
	0–650	0.138	Weiss & Beck, 1908
	650	0.195	" "
	850	0.23	" "
cast..........	20–100	0.1189	Schmitz, 1903
wrought......	15–100	0.1152	Nichol, 1881
hard drawn...	20–100	0.1146	Hill, 1901
Lanthanum.....	0–100	0.0448	Hillebrand, 1876

SPECIFIC HEAT OF ELEMENTS (Continued)

Element.	Temp. °C.	Specific heat, Cal./gm.	Observer.
Lead...........	−253	0.0120	Nernst, 1911
	−233	0.0220	"
	−173	0.0275	"
	−192 to +20	0.0293	Schmitz, 1903
	−186 to −79	0.0291	Behn, 1910
	−79 to +18	0.0300	"
	20–100	0.0305	Schmitz, 1903
	100	0.0313	Gaede, 1902
	300	0.0338	Naccari, 1887
liquid.........	360	0.0410	Spring, 1886
Lithium.........	−191 to −80	0.52	Koref, 1911
	−100	0.5997	Laemmel, 1905
	0	0.7951	"
	50	0.9063	"
	100	1.0407	"
	190	1.3745	"
	0–100	1.09	Bernini, 1907
Magnesium.....	−185 to +20	0.222	Nordmeyer-Bernouli, 1907
	−186 to −79	0.189	Behn, 1900
	− 79 to +18	0.233	"
	17–100	0.248	Schimpff, 1910
	325	0.3235	Stücker, 1905
	625	0.4352	"
Manganese.....	−188 to +20	0.093	Richards & Jackson, 1910
	−100	0.0979	Laemmel, 1905
	0	0.1072	"
	100	0.1143	"
	325	....	Stücker, 1905
Mercury:			
solid.........	−213	0.0266	Pollitzer, 1911
"	−183	0.0285	"
"	−185 to +20	0.032	Nordmeyer-Bernouli, 1907
"	−78 to −40	0.0315	Regnault, 1849
liquid........	0	0.03346	Barnes & Cooke, 1903
"	20	0.03326	" "
"	40	0.03309	" "
"	60	0.03295	" "
"	100	0.0328	Naccari, 1888
"	200	0.0323	"
"	250	0.0321	"
Molybdenum...	−185 to +20	0.062	Nordmeyer-Bernouli, 1907

SPECIFIC HEAT OF ELEMENTS (Continued)

Element.	Temp. °C.	Specific heat, Cal./gm.	Observer.
Molybdenum:			
	15–93	0.072	Guichard & Defacqz, 1901
	60	0.0647	Stücker, 1905
	475	0.0750	"
Nickel.........	−185 to +20	0.092	Nordmeyer-Bernouli, 1907
	−186 to −79	0.0743	Behn, 1900
	−79 to +18	0.0983	"
	15–100	0.1089	Tilden, 1900
	100	0.1128	Pionchon, 1886
	0–200	0.1140	Weiss & Beck, 1908
	0–400	0.1256	" "
	0–800	0.131	" "
Nitrogen, liquid.	−208 to −196	0.0284	Alt, 1904
Osmium.........	19–98	0.311	Regnault
Oxygen, liquid..	−200 to −183	0.35	Andrews
Palladium......	−186 to +18	0.0528	Behn, 1900
	−79 to +18	0.0567	"
	0–100	0.0592	Violle, 1878
	0–500	0.0632	"
	0–900	0.0672	"
Phosphorus, yellow........	−188 to +20	0.169	Richards & Jackson, 1910
	−186 to +20	0.17-	Nordmeyer-Bernouli, 1907
	7–30	0.190	Regnault
red...........	0–51	0.1829	Wiegand, 1906
Platinum.......	−180 to +18	0.0293	Behn, 1900
	15–100	0.03224	Bartoli & Stracciati, 1895
	0–500	0.0347	Violle, 1878
	100	0.0275	Tilden, 1903
	500	0.0356	White
	600	0.0344	"
	800	0.0369	"
	1000	0.0382	"
	1200	0.0398	"
	1500	0.0368	"
Potassium......	−185 to +20	0.170	Nordmeyer-Bernouli, 1907
	0–22	0.188	Bernini, 1906
	22–56	0.192	"
liquid........	78–100	0.217	"
	100–157	0.224	"

SPECIFIC HEAT OF ELEMENTS (Continued)

Element.	Temp. °C.	Specific heat, Cal./gm.	Observer.
Rhodium........	10–97	0.0580	Regnault, 1861
Ruthenium.....	0–100	0.061	Bunsen, 1870
Selenium........	−188 to +18	0.068	....
crystal........	22–63	0.084	Bettendorf&Wüllner
Silicon..........	−185 to +20	0.123	Nordmeyer-Bernouli, 1907
amorphous...	−190 to −80	0.091	Russell, 1912
	−79 to +17	0.147	Schimpff, 1910
	3–50	0.179	Russell, 1912
crystal.......	−40	0.136	Weber, 1875
	21	0.170	"
	129	0.196	"
Silver...........	−186 to −70	0.0496	Behn, 1900
	−79 to +18	0.0544	"
	−233	0.0175	Nernst, 1911
	−193	0.040	"
	15–100	0.05625	Bartoli & Stracciati, 1895
	500	0.0581	Tilden, 1900
	800	0.076	Pionchon, 1886
fluid..........	907–1100	0.0748	"
Sodium.........	−185 to +20	0.253	Nordmeyer-Bernouli, 1907
	−80	0.266	Thum, 1906
	−40	0.279	"
	0	0.293	"
	100	0.323	"
Sulphur.........	−188 to +18	0.137	....
rhombic......	0–54	0.1728	Wiegand, 1906
monocl........	0–52	0.1809	"
liquid.........	119–147	0.235	Naccari, 1887
Tantalum......	−185 to +20	0.033	Nordmeyer-Bernouli, 1907
	58	0.036	v. Bolton, 1905
	1400	0.043	....
Tellurium......	−188 to +18	0.047	....
crystal.......	15–100	0.0483	Kopp, 1865
	15–300	0.0490	Tilden, 1904
Thallium.......	−185 to +20	0.038	Nordmeyer-Bernouli, 1907
	20–100	0.0326	Schmitz, 1903
Thorium........	0–100	0.0276	Nilson, 1883
Tin.............	−186 to −79	0.0486	Behn, 1900
	−79 to +18	0.0518	"
	20	0.0541	Gaede, 1902

SPECIFIC HEAT OF ELEMENTS (Continued)

Element.	Temp. °C.	Specific heat, Cal./gm.	Observer.
Tin			
	100	0.0565	Gaede, 1902
liquid	250–350	0.0608	Pionchon, 1887
"	1100	0.0758	"
gray	0–18	0.0589	Wigand, 1907
Titanium	−185 to +20	0.082	Nordmeyer-Bernouli, 1907
	20	0.142	Weiss, 1910
Tungsten	−185 to +20	0.036	Nordmeyer-Bernouli, 1907
	15–93	0.034	Guichard & Defacqz, 1901
	20–100	0.034	Gin, 1908
Uranium	0–98	0.028	Blümcke, 1885
	11–98	0.062	Regnault, 1840
Vanadium	0–100	0.1153	Mache, 1897
Zinc	−192 to +20	0.0836	Schmitz, 1903
	−186 to −79	0.080	Behn, 1900
	−79 to +18	0.0895	"
	−233	0.0268	Nernst, 1911
	−193	0.063	"
	20	0.0924	Gaede, 1900
	100	0.0951	"
	300	0.1040	Naccari, 1887
Zirconium	0–100	0.0660	Mixter-Dana, 1873
	0–100	0.068	Wedekind & Lewis, 1910

COLOR SCALE OF TEMPERATURE

This table is the result of an effort to interpret in terms of thermometric readings, the common expressions used in describing temperatures. It is obvious that the values are only approximations.

Color.	Temperature, °C.
Incipient red heat	500–550
Dark red heat	650–750
Bright red heat	850–950
Yellowish red heat	1050–1150
Incipient white heat	1250–1350
White heat	1450–1550

SPECIFIC HEAT OF ALLOYS AND VARIOUS SOLIDS

Values given in calories per gram.

Substance.	Temp. ° C.	Sp. heat.	Observer.
Alloys			
aluminum bronze, 88.7 Cu, 11.3 Al	20–100	0.104	Louguinine
antimony bismuth tin, 21.6Sb, 36.7Bi, 41.7Sn	22–99	.046	Regnault
antimony lead, 37.1Sb, 62.9Pb	10–98	.0388	"
bell metal, 80Cu, 20Sn	14–98	.0862	"
Bismuth tin, 63.8Bi, 36.2Sn...	20–99	.0400	"
46.9Bi, 53.1Sn	20–99	.0450	"
56.9Bi, 43.1Sn	17–99	.0450	Person
brass, 60Cu, 40Zn	−186– −79	.0743	Behn
	−79– +18	.0873	"
	20–100	.0917	Voigt
72Cu, 28Zn	14–98	.094	Regnault
bronze, 80Cu, 20Sn	15–98	.086	"
88Cu, 12Sn, 0.94P	20–100	.0874	Voigt
constantan	0	.098	Jaeger, Diesselhorst
	100	.102	" "
German silver	0	.094	Tomlinson
	100	.095	"
invar, 64Fe, 36Ni	−182– +15	.095	"
	15–100	.120	"
	15–600	.126	"
lead bismuth, 39.9Pb, 60.1Bi..	16–99	.0317	Person
lead bismuth tin,			
32.5Pb, 49.0Bi, 18.5Sn....	14–80	.0600n	Person
31.8Pb, 32.0Bi, 36.2Sn....	11–98	.0448	Regnault
lead tin, 63.7Pb, 36.3Sn......	12–99	.0407	"
46.7Pb, 53.3Sn........	10–99	.0451	"
Lipowitz alloy, 24.97Pb, 10.13Cd, 50.66Bi, 14.24Sn	5–50	.0345	Mazotto
manganin	0	.097	Jaeger, Diesselhorst
	100	.095	" "
platinum iridium, 90Pt, 10Ir..	20–100	.0323	Pionchon
Rose alloy, 27.5Pb, 48.9Bi,.. 23.6 Sn	20–89	.0552	Schüz
solder, *see* lead tin			
steel, ordinary (.004C)......	20	0.107	Regnault
	100	.117	"
Wood's alloy, 25.85Pb, 6.99Cd 52.43Bi, 14.73Sn	5–50	.0352	Mazotto
Amalgams			
50.8Pb, 49.2Hg..............	23–99	.0383	Regnault
78.3Pb, 37.1Sn, 62.9Hg.......	22–99	.0729	"
54.1Sn, 45.9Hg.............	25–99	.0659	Schüz
Asbestos..................	20–98	.195	Ulrich
Basalt......................	20–100	.20	Mean
Calcspar....................	0–100	.2005	Lindner
Carborundum................	3–44	.162	
Cellulose, dry..............	....	.37	Mean
Cement, powder..............	200–10	.20	
Chalk......................	20–99	.214	Regnault
Charcoal...................	10	.16	Weber, 1875
Clay, dry..................	20–100	.22	Mean
Ebonite....................	20–100	.40	Louguinine, 1882
Glass, normal thermometer.....	19–100	.1988	Wachsmuth
crown.....................	10–50	.161	KH. Meyer
flint.....................	10–50	.117	H. Meyer

SPECIFIC HEAT OF ALLOYS AND VARIOUS SOLIDS (Continued)

Values given in calories per gram

Substance.	Temp. ° C.	Sp. heat.	Observer.
Granite	12–100	.192	Joly
Ice	−200	.168	Nernst, 1910
	−180	.199	" "
	−160	.230	" "
	−140	.262	" "
	−100	.325	" "
	− 60	.392	" "
	− 20	.480	" "
	− 10	.530	" "
India rubber (Para)	?–100	.481	Gee and Terry
Leather, dry	....	.36	
Marble	0–100	.21	
Mica (Mg)	20–98	.2061	Ulrich
Paraffin	0–20	.6939	R. W. Weber
Porcelain	15–950	.26	Harker, 1905
Quartz	12–100	.188	Joly
Rock-salt	13–45	.219	Kopp
Sugar	20	.274	Hess, 1888
Vulcanite	20–100	.3312	A. M. Mayer
Wood	....	.42	

SPECIFIC HEAT

Variation with Temperature

The table gives the true specific heat at the temperatures named. From data of Wüst, Meuthen, and Durrer, 1918.

°C	Pb	Zn	Al	Ag	Au	Cu	Ni	Fe	Co	Quartz
0°C	0.0359	0.0878	0.2220	0.0573	0.0317	0.1008	0.1095	0.1055	0.0912	......
100	0.0336	0.0965	0.2297	0.0583	0.0320	0.1014	0.1200	0.1168	0.0993	0.2372
200	0.0313	0.1052	0.2374	0.0594	0.0322	0.1020	0.1305	0.1282	0.1073	0.2416
300	0.0290	0.1139	0.2451	0.0605	0.0325	0.1026	0.1409	0.1396	0.1154	0.2460
400	0.0266	0.1226	0.2529	0.0616	0.0328	0.1032	0.1294	0.1509	0.1235	0.2504
500	0.0259	0.1173	0.2606	0.0627	0.0330	0.1038	0.1294	0.1623	0.1316	0.2548
600	0.0252	0.1141	0.2683	0.0638	0.0333	0.1045	0.1294	0.1737	0.1396	0.2592
700	0.0246	0.1109	0.2523	0.0649	0.0335	0.1051	0.1295	0.1850	0.1477	0.2636
800	0.0239	0.1076	0.2571	0.0660	0.0338	0.1057	0.1295	0.1592	0.1558	0.2680
900	0.0233	0.1044	0.2619	0.0671	0.0341	0.1063	0.1295	0.1592	0.1639	0.2724
1000	0.0226	0.1012	0.2667	0.0637	0.0343	0.1069	0.1295	0.1448	......	0.2768
1100	......	......	......	0.0694	0.0329	0.1028	0.1296	0.1448	0.1424	0.2812
1200	......	......	......	0.0750	0.0346	0.1159	0.1296	0.1448	0.1454	0.2856
1300	......	......	......	0.0807	0.0364	0.1291	0.1296	0.1449	0.1483	0.2900
1400	......	......	......	......	......	......	0.1296	0.1449	0.1512	0.2944
1500	......	......	......	......	......	......	0.1338	0.2142	0.1472	0.2988
1600	......	......	......	......	......	......	......	0.1501	0.1472	......

SPECIFIC HEAT OF VARIOUS LIQUIDS

Liquid.	Temp. ° C.	Sp. heat.	Observer.
Acetic acid	20	0.472	Schiff, 1886
Acetone	0	.506	Regnault, 1862
Alcohol, ethyl	0	.548	Regnault
ethyl	40	.648	Regnault
methyl	5–10	.590	Regnault
methyl	15–20	.601	Regnault
Amyl acetate	20	.459	Schiff, 1880
Benzol, C_6H_6	10	.340	de Heen & Deruyts
Benzol	40	.423	de Heen & Deruyts
Carbon bisulphide	30	.240	Regnault
Chloroform	0	.232	Regnault
Ethyl ether	0	.529	Regnault
Glycerine	15–50	.576	Emo
Oils, olive	6.6	.471	
turpentine	0	.411	Regnault
Petroleum	21–58	.511	Pagliani

SPECIFIC HEAT FOR AQUEOUS SOLUTIONS

Giving the specific heat referred to that of water at the same temperatures. Concentration of the solutions is stated as the number of molecules of water to each molecule of the solutes (anhydrous.)

Values from Marignac, Thomsen and others.

Substance	Temp. °C.	Concentration		
		25	50	100
Acetic acid	21–52	0.957	0.977	0.987
Aluminum sulphate	21–53	.....	.....	0.870
Ammonium acetate	17.5	0.911	0.951	0.976
chloride	18	0.881	0.937	0.966
hydroxide	18	.....	0.999	.....
nitrate	18	0.880	0.929	0.962
sulphate	19–51	0.803	0.879	0.933
Barium chloride	22–27	.....	0.780	0.875
Cadmium sulphate	12	0.696	0.813	0.893
Calcium acetate	22–52	.....	0.896	0.939
chloride	21–51	0.754	0.851	0.917
nitrate	21–51	0.760	0.846	0.911
Chromic acid	21–53	0.825	0.896	0.942
Copper chloride	19–51	0.779	0.864	0.920
nitrate	18–50	.....	0.826	0.899
sulphate	18–23	.....	0.841	0.908
Ferric chloride	0–98	0.666	0.750	0.854

SPECIFIC HEAT OF AQUEOUS SOLUTIONS (Continued)

Giving the specific heat referred to that of water at the same temperatures. Concentration of the solutions is stated as the number of molecules of water to each molecule of the solutes (anhydrous).

Values from Marignac, Thomsen and others.

Substance.	Temp. °C.	Concentration. 25	50	100
Hydrochloric acid	18	.....	0.932	0.964
Lactic acid	16.5	0.947	0.970	0.982
Lead acetate	18–51	0.682	0.794	0.881
nitrate	18–51	.....	0.750	0.851
Lithium chloride	11	.....	0.941	0.973
hydroxide	13	.....	0.958	0.978
Magnesium chloride	22–52	0.772	0.866	0.923
nitrate	19–51	.....	0.832	0.903
Sulphate	18	.....	0.857	0.917
Manganese chloride	0–98	0.787	0.861	0.914
nitrate	19–51	.....	0.832	0.903
sulphate	19–51	.....	0.844	0.912
Nickel chloride	24–55	0.735	0.831	0.902
nitrate	24–55	0.717	0.823	0.895
sulphate	25–56	.....	0.837	0.910
Nitric acid	18	.....	0.930	0.963
Oxalic acid	20–52	.....	0.942	0.965
Potassium bromide	20–51	0.769	0.864	0.925
carbonate	21–52	0.760	0.851	0.916
chloride	18	0.828	0.904	0.948
chromate	20–51	.....	0.810	0.890
hydroxide	18	.....	0.916	0.954
iodide	20–51	0.715	0.830	0.906
nitrate	18–23	0.832	0.900	0.943
oxalate	21–52	.....	0.839	0.908
sulphate	19–52	.....	.....	0.902
Silver nitrate	25–52	0.750	0.849	0.913
Sodium acetate	18	.....	0.938	0.965
bromide	20–52	0.809	0.886	0.939
carbonate	21–52	0.865	0.907	0.943
chloride	18	0.880	0.931	0.962
chromate	21–52	0.781	0.856	0.913
hydroxide	18	0.908	0.942	0.968
iodide	20–51	0.749	0.850	0.917
nitrate	18	0.863	0.918	0.950
sulphate	21–52	0.819	0.878	0.960
Strontium chloride	21–26	.....	0.814	0.894
nitrate	19–51	.....	0.817	0.890
Sulphuric acid	21	0.854	0.915	0.956
Zinc chloride	19–51	0.796	0.884	0.933
nitrate	20–52	0.718	0.823	0.899
sulphate	20–52	.....	0.842	0.911

SPECIFIC HEAT OF GASES

Giving the specific heat of gases at constant pressure in calories per gram and the ratio of the specific heat at constant pressure to that at constant volume.

Values are for atmospheric pressure.
(Selected from Smithsonian Tables.)

Gas or vapor.	Specific heat at constant pressure.			Ratio of specific heats.		
	Temp. ° C.	Sp. ht.	Obs.*	Temp. ° C.	Ratio Cp/Cv	Obs.*
Acetone	26–110	0.3468	W			
Air	0–100	0.2374	R			
Air	0–200	0.2375	R			
Air	20–630	0.2429	A			
Alcohol	108–220	0.4534	R	53	1.133	J
Ammonia	23–100	0.5202	W	0	1.3172	Wr
Argon	20–90	0.1233	D	0	1.667	N
Benzol	34–115	0.2990	W	20	1.403	P
Bromine	83–228	0.0555	R	20–388	1.293	S
Carbon dioxide	15–100	0.2025	R			
Carbon monoxide	23–99	0.2425	W	0	1.403	Wr
Carbon disluphide	86–190	0.1596	R	3.67	1.205	B
Chlorine	13–202	0.1241	R	20–340	1.323	S
Chloroform	27–118	0.1441	W	22–78	1.102	B
Ether	25–111	0.4280	W	12–20	1.024	L
Hydrochloric acid	13–100	0.1940	S	20	1.389	S
Hydrogen	12–198	3.4090	R			
Hydrogen sulphide	20–206	0.2451	R	10–40	1.276	Mr
Methane	18–208	0.5929	R	11–30	1.316	Mr
Nitrogen	0–200	0.2438	R	....	1.41	C
Nitric oxide	13–172	0.2317	R			
Nitrous oxide	16–207	0.2262	R	0	1.311	Wr
Oxygen	13–207	0.2175	R	5–14	1.3977	L–P
Sulphur dioxide	16–202	0.1544	R	16–34	1.256	Mr
Water vapor	0	0.4655	T	78	1.274	B
Water vapor	100	0.421	T	94	1.33	J
Water vapor	180	0.51	T			

*A Austin
B Beyme
C Cazin
D Dittenberger
J Jaeger
L Low
L–P Lummer & Pringsheim
Mr Muller
N Niemeyer
P Pagliani
R Regnault
S Strecker
T Thiesen
W Wiedemann
Wr Wüllner

BOILING-POINT OF WATER*

(Hydrogen Scale)

Pressure mm.	Tenths of millimeters .0	.1	.2	.3	.4	.5	.6	.7	.8	.9
700	97.714	718	722	725	729	733	737	741	745	749
701	753	757	761	765	769	773	777	781	785	789
702	792	796	800	804	808	812	816	820	824	828
703	832	836	840	844	847	851	855	859	863	867
704	871	875	879	883	887	891	895	899	902	906
705	97.910	914	918	922	926	930	934	938	942	946
706	949	953	957	961	965	969	973	977	981	985
707	989	993	996	*000	*004	*008	*012	*016	*020	*024
708	98.028	032	036	040	043	047	051	055	059	063
709	067	071	075	079	082	086	090	094	098	102
710	98.106	110	114	118	121	125	129	133	137	141
711	145	149	153	157	160	164	168	172	176	180
712	184	188	192	195	199	203	207	211	215	219
713	223	227	230	234	238	242	246	250	254	258
714	261	265	269	273	277	281	285	289	292	296
715	98.300	304	308	312	316	320	323	327	331	335
716	339	343	347	351	355	358	362	366	370	374
717	378	382	385	389	393	397	401	405	409	412
718	416	420	424	428	432	436	440	443	447	451
719	455	459	463	467	470	474	478	482	486	490
720	98.493	497	501	505	509	513	517	520	524	528
721	532	536	540	544	547	551	555	559	563	567
722	570	574	578	582	586	590	593	597	601	605
723	609	613	617	620	624	628	632	636	640	643
724	647	651	655	659	662	666	670	674	678	682
725	98.686	689	693	697	701	705	709	712	716	720
726	724	728	732	735	739	743	747	751	755	758
727	762	766	770	774	777	781	785	789	793	797
728	800	804	808	812	816	819	823	827	831	835
729	838	842	846	850	854	858	861	865	869	873
730	98.877	880	884	888	892	896	899	903	907	911
731	915	918	922	926	930	934	937	941	945	949
732	953	956	960	964	968	972	975	979	983	987
733	991	994	998	*002	*006	*010	*013	*017	*021	*025
734	99.029	032	036	040	044	048	051	055	059	063
735	99.067	070	074	078	082	085	089	093	097	101
736	104	108	112	116	119	123	127	131	135	138
737	142	146	150	153	157	161	165	169	172	176
738	180	184	187	191	195	199	203	206	210	214
739	218	221	225	229	233	236	240	244	248	252
740	99.255	259	263	267	270	274	278	282	285	289
741	293	297	300	304	308	312	316	319	323	327
742	331	334	338	342	346	349	353	357	361	364
743	368	372	376	379	383	387	391	394	398	402
744	406	409	413	417	421	424	428	432	436	439
745	99.443	447	451	454	458	462	466	469	473	477
746	481	484	488	492	495	499	503	507	510	514
747	518	522	525	529	533	537	540	544	548	551
748	555	559	563	566	570	574	578	581	585	589
749	592	596	600	604	607	611	615	619	622	626

* See also under Vapor Tension.

BOILING–POINT OF WATER (Continued)

(Hydrogen Scale)

Pressure mm.	Tenths of millimeters .0	.1	.2	.3	.4	.5	.6	.7	.8	.9
750	99.630	633	637	641	645	648	652	656	659	663
751	667	671	674	678	682	686	689	693	697	700
752	704	708	712	715	719	723	726	730	734	738
753	741	745	749	752	756	760	764	767	771	775
754	778	782	786	790	793	797	801	804	808	812
755	99.815	819	823	827	830	834	838	841	845	849
756	852	856	860	863	867	871	875	878	882	886
757	889	893	897	900	904	908	911	915	919	923
758	926	930	934	937	941	945	948	952	956	959
759	963	967	970	974	978	982	985	989	993	996
760	100.000	004	007	011	015	018	022	026	029	033
761	037	040	044	048	052	055	059	063	066	070
762	074	077	081	085	088	092	096	099	103	107
763	110	114	118	121	125	129	132	136	140	143
764	147	151	154	158	162	165	169	173	176	180
765	100.184	187	191	195	198	202	206	209	213	216
766	220	224	227	231	235	238	242	246	249	253
767	257	260	264	268	271	275	279	283	286	290
768	293	297	300	304	308	311	315	319	322	326
769	330	333	337	341	344	348	352	355	359	363
770	100.366	370	373	377	381	384	388	392	395	399
771	403	406	410	414	417	421	424	428	432	435
772	439	442	446	450	453	457	461	464	468	472
773	475	479	483	486	490	493	497	501	504	508
774	511	515	519	522	526	530	533	537	540	544
775	100.548	551	555	559	562	566	569	573	577	580
776	584	588	591	595	598	602	606	609	613	616
777	620	624	627	631	634	638	642	645	649	653
778	656	660	663	667	671	674	678	681	685	689
779	692	696	689	703	707	710	714	718	721	725
780	100.728	732	735	739	743	746	750	753	757	761
781	764	768	772	775	779	782	786	789	793	797
782	800	804	807	811	815	818	822	825	829	833
783	836	840	843	847	851	854	858	861	865	869
784	872	876	879	883	886	890	894	897	901	904
785	100.908	912	915	919	922	926	929	933	937	940
786	944	947	951	954	958	962	965	969	972	976
787	979	983	987	990	994	997	*001	*005	*008	*012
788	101.015	019	022	026	029	033	037	040	044	047
789	051	054	058	062	065	069	072	076	079	083
790	101.087	090	094	097	101	104	108	112	115	119
791	122	126	129	133	136	140	144	147	151	154
792	158	161	165	168	172	176	179	183	186	190
793	193	197	200	204	207	211	215	218	222	225
794	229	232	236	239	243	246	250	254	257	261
795	101.264	268	271	275	278	282	286	289	293	296
796	300	303	307	310	314	317	321	324	328	332
797	335	339	342	346	349	353	356	360	363	367
798	370	374	377	381	385	388	392	395	399	402
799	406	409	413	416	420	423	427	430	434	437
800	101.441	...	...	...	.....	...	...	...	...	...

MELTING AND BOILING POINTS OF THE ELEMENTS

The following table gives the melting and boiling temperatures of the Elements. Boiling points are at atmospheric pressure.

Element	Melting Point, °C.	Observer	Boiling Point, °C.	Observer
Aluminum . . .	658.7	Burgess	1800	Greenwood, 1909
Antimony . . .	630.0	. . . .	1440	"
Argon.	−188	Ramsay-Travers	−186.1	Ramsay-Travers
Arsenic	850	Sublimes		. . . .
	500	Gluntz, Broniewski, 1907	Black 360	Conechy
Barium	850	Gluntz	. . . . . .	. . . .
Beryllium . . .	1280	. . . .	. . . . . .	. . . .
Bismuth	271	Adjusted	1430	Barus, 1894
Boron.	2200–2500?	. . . .	. . . . . .	. . . .
	2400	Gertler, Pirani	. . . . . .	. . . .
Bromine	−7.3	. . . .	61.1	Thorpe, 1880
Cadmium. . . .	320.9	. . . .	778	Berthelot, 1902 . . . . . .
Caesium	26	. . . .	670	Ruff-Johannsen.
Calcium.	810	Adjusted	. . . . . .	. . . .
Carbon	(>3500)	Sublimes	3600	Violle, 1895
	3600	Gertler, Pirani, 1919	. . . . . .	. . . .
Cerium	640	. . . .	. . . . . .	. . . .
	700	Pirani, 1919	. . . . . .	. . . .
Chlorine	−101.5	Olszewski	−33.6	Regnault, 1863
Chromium . .	1615	Burgess-Waltenberg	2200	Greenwood, 1909
	1520	Gertler, Pirani	. . . . . .	. . . .
Cobalt	1480	Burgess-Waltenberg	. . . . . .	. . . .
Copper	1083 ± 3	Mean, Holborn Day, Day-Clement	2310	Greenwood
Erbium.	. . . .	. . . .	. . . . . .	. . . .
Fluorine.	−223	Moissan-Dewar	−187	Moisson-Dewar, 1903
Gallium	30.1	. . . .	. . . . . .	. . . .
Germanium .	958	. . . .	. . . . . .	. . . .
Glucinum . . .	1300	Guertler, Pirani	. . . . . .	. . . .
Gold.	1063.0	Adjusted	. . . . . .	. . . .
Helium	< −271	. . . .	−267	Computed

MELTING AND BOILING POINTS OF THE ELEMENTS (Continued)

Element	Melting Point, °C.	Observer	Boiling Point, °C.	Observer
Hydrogen	−259	…	−252.6	Mean
Indium	155	Thiel	…	…
Iodine	113.5	…	>200	…
Iridium	2350?	…	…	…
Iron	1530	Burgess-Waltenberg	2450	Greenwood
Krypton	−169	Ramsay	−151.7	Ramsay
Lanthanum	810?	Muthmann-Weiss	…	…
Lead	327 ± 0.5	…	1525	Greenwood
Lithium	186	Kahlbaum	1400	Ruff-Johannsen, 1905
Magnesium	651	Grube	1120	Greenwood
Manganese	1230	Burgess-Waltenberg	1900	"
	1210	Guertler, Pirani	…	…
Mercury	−38.87	…	357	Crafts, Regnault
	−39.7	Guertler, Pirani	…	…
Molybdenum	2535	Mendenhall-Forsythe	3620	Langmuir, Mackay
	2410	Guertler, Pirani	…	…
Neodymium	840?	Muthmann-Weiss	…	…
Neon	−253?	…	−239	Dewar, 1901
Nickel	1452	Day, Sosman, Burgess, Waltenberg	…	…
Niobium	1700?	…	…	…
Nitrogen	−211	Fisher-Alt	−195	Mean
Osmium	About 2700	Waidner, Burgess	…	…
Oxygen	−218	…	−182.7	Mean
Ozone	−250	Reisenfeld, Schwab, 1922	−119	Troost
Palladium	1549 ± 5	Waidner-Burgess, Nernst-Wartenburg, Day & Sosman.	…	…
Phosphorous	44.2	…	288	…
Platinum	1755 ± 5	…	3910	Langmuir, Mackay
Potassium	62.3	…	712	Perman, Ruff-Johannsen
Praesodymium	940	Muthmann-Weiss	…	…
Radium	700	…	…	…
Rhodium	1950	Mendenhall-Ingersoll	…	…

MELTING AND BOILING POINTS OF THE ELEMENTS (Concluded)

Element	Melting Point, °C.	Observer	Boiling Point, °C.	Observer
Rubidium	38	...	696	Ruff-Johannsen
Ruthenium	2450?	...	...	...
Samarium	1300–1400	Muthmann-Weiss	...	...
Scandium	?	...	...	...
Selenium	217–220	...	690	...
Silicon	1420	Adjusted	...	...
Silver	960.5	"	1955	Greenwood, Perman,
Sodium	97.5	...	750	Ruff-Johannsen
Strontium	900 (?)	...	...	...
Sulphur	S_I 112.8 S_{II} 119.2 S_{III} 106.8	Various forms	444.7	Mean
Tantalum	2900	Adjusted	...	...
Tellurium	452	Adjusted	1390	Deville-Troost
Thallium	302	...	1280	v. Wartenburg
Thorium	1842 ± 30	Rentschler, Marden, 1925	...	...
Tin	231.9 ± 2	...	2270	Greenwood
Titanium	1795	Burgess-Waltenberg	...	...
	2000	Guertler, Pirani	...	...
Tungsten	3400	Adjusted	5830	Langmuir, 1913
	3395	Worthing, 1917	...	...
Uranium	<1850	Moissan	...	...
Vanadium	1720	Burgess-Waltenberg, Guertler, Pirani	...	...
	1800		...	...
Xenon	−140	Ramsay	−109.1	Ramsay, 1903
Ytterbium				
Yttrium	1490	...	...	...
Zinc	419.4	...	930	...
Zirconium	1700?	Troost	...	...

MELTING POINTS OF MIXTURES OF METALS

(*Smithsonian Physical Tables*)

Melting-points, °C.

Metals	Percentage of metal in second column.										
	0%*	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Pb. Sn.	326	295	276	262	240	220	190	185	200	216	232
Bi.	322	290	...	...	179	145	126	168	205	...	268
Te.	322	710	790	880	917	760	600	480	410	425	446
Ag.	328	460	545	590	620	650	705	775	840	905	959
Na.	...	360	420	400	370	330	290	250	200	130	96
Cu.	326	870	920	925	945	950	955	985	1005	1020	1084
Sb.	326	250	275	330	395	440	490	525	560	600	632
Al. Sb.	650	750	840	925	945	950	970	1000	1040	1010	632
Cu.	650	630	600	560	540	580	610	755	930	1055	1084
Au.	655	675	740	800	855	915	970	1025	1055	675	1062
Ag.	650	625	615	600	590	580	575	570	650	750	954
Zn.	654	640	620	600	580	560	530	510	475	425	419
Fe.	653	860	1015	1110	1145	1145	1220	1315	1425	1500	1515
Sn.	650	645	635	625	620	605	590	570	560	540	232
Sb. Bi.	632	610	590	575	555	540	520	470	405	330	268
Ag.	630	595	570	545	520	500	505	545	680	850	959
Sn.	622	600	570	525	480	430	395	350	310	255	232
Zn.	632	555	510	540	570	565	540	525	510	470	419
Ni. Sn.	1455	1380	1290	1200	1235	1290	1305	1230	1060	800	232
Na. Bi.	96	425	520	590	645	690	720	730	715	570	268
Cd.	96	125	185	245	285	325	330	340	360	390	322
Cd. Ag.	322	420	520	610	700	760	805	850	895	940	954
Tl.	321	300	285	270	262	258	245	230	210	235	302
Zn.	322	280	270	295	313	327	340	355	370	390	419
Au. Cu.	1063	910	890	895	905	925	975	1000	1025	1060	1084
Ag.	1064	1062	1061	1058	1054	1049	1039	1025	1006	982	963
Pt.	1075	1125	1190	1250	1320	1380	1455	1530	1610	1685	1775
K. Na.	62	17.5	−10	−3.5	5	11	26	41	58	77	97.5
Hg.	...	...	...	...	...	90	110	135	162	265	...
Tl.	62.5	133	165	188	205	215	220	240	280	305	301
Cu. Ni.	1080	1180	1240	1290	1320	1355	1380	1410	1430	1440	1455
Ag.	1082	1035	990	945	910	870	830	788	814	875	960
Sn.	1084	1005	890	755	725	680	630	580	530	440	232
Zn.	1084	1040	995	930	900	880	820	780	700	580	419
Ag. Zn.	959	850	755	705	690	660	630	610	570	505	419
Sn.	959	870	750	630	550	495	450	420	375	300	232
Na. Hg.	96.5	90	80	70	60	45	22	55	95	215	...

* The data in this table are compiled from various sources,— hence the variations in the melting point of the metals as shown in this column.

MELTING AND BOILING TEMPERATURES

Temperature of Fusion for Various Substances for Atmospheric Pressure

For the melting- and boiling-points of the chemical elements and of inorganic compounds see under Physical Constants of the Elements, and Physical Constants of Inorganic Compounds.

Substance.	Temp. of fusion ° C.	Substance.	Temp. of fusion ° C.
Acetylene	−81	German silver	1000.
Alcohol, ethyl	−130.	Glass	1100.
Brass	900.	Glycerine	17.
Butter	31–31.5	Olive oil	2–6
Camphor	177.7	Paraffin	55.
Caoutchouc, pure gum	120.	Resin	135.
Chloroform	−63.2	Sea water	−2.5
Ether	−117.6	Sugar (cane)	160.

Boiling-point for Various Substances

Giving the boiling-point at atmospheric pressure and the variation per cm. pressure near 76 cm.

Substance.	Temp. ° C.	Variation.
Acetone	57.	0.39
Acetylene	−72.2	
Alcohol, ethyl	78.3	0.34
methyl	64.7	0.35
Amyl acetate	148.	
Benzene	80.	0.43
Camphor	205.	0.56
Chloroform	61.2	0.41
Ether	34.6	0.40
Gasoline	70–90.	
Glycerine	291.	
Turpentine	159.	

MELTING POINT OF ICE—VARIATION WITH PRESSURE

(From Tamann, 1900, by permission.)

Pressure in kg. per sq.cm.	Temp. ° C.	Pressure in kg. per sq.cm.	Temp. ° C.
1	0.0	1410	−12.5
336	− 2.5	1625	−15.0
615	− 5.0	1835	−17.5
890	− 7.5	2042	−20.0
1155	−10.0	2200	−22.1

BOILING POINTS OF WATER-ALCOHOL MIXTURES

(P. N. Evans, Journal of Industrial and Engineering Chemistry.)

Boiling point, °C.	Weight per cent alcohol in		Boiling point, °C.	Weight per cent alcohol in	
	Liquid.	Vapor.		Liquid.	Vapor.
78.2	91	92	86.5	18	71
78.4	85	89	87.0	17	70
78.6	82	88	87.5	16	69
78.8	80	87	88.0	15	68
79.0	78	86	88.5	13	67
79.2	76	85	89.0	12	65
79.4	74	85	89.5	11	63
79.6	72	84	90.0	10	61
79.8	69	84	90.5	10	59
80.0	67	83	91.0	9	57
80.2	64	83	91.5	8	55
80.4	62	82	92.0	8	53
80.6	59	82	92.5	7	51
80.8	56	81	93.0	6	49
81.0	53	81	93.5	6	46
81.2	50	80	94.0	5	44
81.4	47	80	94.5	5	42
81.6	45	80	95.0	4	39
81.8	43	79	95.5	4	36
82.0	41	79	96.0	3	33
82.5	36	78	96.5	3	30
83.0	33	78	97.0	2	27
83.5	30	77	97.5	2	23
84.0	27	76	98.0	1	19
84.5	25	75	98.5	1	15
85.0	23	74	99.0	0	10
85.5	21	73	99.5	0	5
86.0	20	72	100.0	0	0

MOLECULAR ELEVATION OF THE BOILING POINT

Showing the elevation of the boiling point due to the addition of one gram molecular weight of the dissolved substance, for various solvents.

Solvent	Constant for one gram molecular weight dissolved in 100 gms. ° C.	Constant for one gram molecular weight dissolved in 100 c.c. at the boiling point. ° C.
Acetic acid	25.4–30.7	....
Acetone	16.7	22.2
Aniline	32.2–34.1	....
Benzene	26.7	32.0
Chloroform	36.6	26.0
Ether	21.1	30.3
Ethyl acetate	27.9	....
Ethyl alcohol	11.5	15.6
Methyl acetate	20.6	....
Methyl alcohol	8.4–9.3	....
Nitrobenzene	50.1–50.4	....
Phenol	30.4	....
Water	5.2	5.4

MOLECULAR DEPRESSION OF THE FREEZING POINT

Showing the depression of the freezing point due to the addition of one gram molecular weight of dissolved substance, for various solvents.

Solvent	Depression for one gram molecular weight dissolved in 100 gms. ° C.
Acetic acid	39.0
Benzene	49.0
Benzophenone	98.0
Diphenyl	80.0
Diphenylamine	86.0
Ethylene dibromide	118.0
Formic acid	27.7
Naphthalene	68–69
Nitrobenzene	70.0
Phenol	74.0
Stearic acid	45.0
Triphenyl methane	124.5
Urethane	51.4
Water	18.5–18.7

CRITICAL AND VAN DER WAALS' CONSTANTS FOR GASES

Name.	Critical.			Van der Waals'.	
	Temp., ° C.	Pressure, atm.	Density, gms. per cm.^{3}	*a*	*b*
Acetylene	36 5	61 6	0.2315	0.00880	0 00230
Air	−140	39	....	0.00257	0.00156
Ammonia	130	115.0	....	0.00798	0 00161
Aniline	425.6	52 3	....	0.05282	0 00611
Argon	−117.4	52.9	....	0.00259	0 00135
Benzene	288 5	47.9	0 3045	0 03726	0.00537
Bromine	302	131	....	0 01434	0 00202
Carbon bisulphide	273	72 9	0 4408	0 02316	0.00343
Carbon dioxide	31 1	73	0.464	0 00717	0 00191
Carbon monoxide	−141 1	35 9	0.328	0 00275	0 00168
Chlorine	146	93 5	0.547	0 01063	0 00205
Chloroform	260	54 9	....	0 0293	0.00445
Ethane	34	50.2	....	0.01060	0.0028
Ether	197	35.8	0.2622	0.03496	0 00602
Ethyl alcohol	243	62.7	0.2755	0.02407	0 00377
Ethylene	10	51.7	0.210	0 00877	0 00251
Helium	−268	2 3	....	0 0000615	0.0000995
Hydrochloric acid	52 3	86	....	0 00697	0.00173
Hydrogen	−234 5	20	0.03346	0 00042	0 00088
Hydrogen sulphide	100	88 7	....	0 00888	0 00193
Krypton	− 62 5	54.3	....	0 00462	0 00178
Methane	− 95 5	50	....	0 00357	0 00162
Neon	−228.7	29	....	....	....
Nitric oxide, NO	− 93.5	71.2	0.524	0 00257	0.00116
Nitrogen	−146	33	0.3269	0 00259	0 00165
Nitrogen tetroxide, NO_2	171 2	147	....	0.00756	0.00138
Nitrous oxide, N_2O	38.8	77.5	0.454	0 00710	0.00184
Oxygen	−118	50	0.4292	0.00273	0.00142
Sulphur dioxide	155.4	78.9	0.520	0.01316	0.00249
Water	365	194.6	0.329	0.0118	0.00150
Xenon	14.7	57.2	....	0.00818	0.00230

FREEZING MIXTURES

A is the proportion of the substance named in the first column to be added to the proportion of the substance given in column *B*. The table gives the temperature of the separate ingredients and the temperature attained by the mixture.

(From Smithsonian Tables.)

Substance.	*A*	*B*	Initial Temp. ° C.	Temp. ° C. attained by mixt.
$NaC_2H_3O_2$ (cryst.)	85	H_2O 100	10.7	− 4.7
NH_4Cl	30	H_2O 100	13.3	− 5.1
$NaNO_3$	75	H_2O 100	13.2	− 5.3
$Na_2S_2O_3$ (cryst.)	110	H_2O 100	10.7	− 8.0
KI	140	H_2O 100	10.8	−11.7
$CaCl_2$ (cryst.)	250	H_2O 100	10.8	−12.4
NH_4NO_3	60	H_2O 100	13.6	−13.6
$CaCl_2$	30	* Snow 100	− 1	−10.9
NH_4Cl	25	Snow 100	− 1	−15.4
NH_4NO_3	45	Snow 100	− 1	−16.75
$NaNO_3$	50	Snow 100	− 1	−17.75
NaCl	33	Snow 100	− 1	−21.3
$H_2SO_4+H_2O$ (66.1% H_2SO_4)	1	Snow 1.097	− 1	−37.0
	1	Snow 2.52	− 1	−30.0
	1	Snow 4.32	− 1	−25.0
	1	Snow 7 92	− 1	−20.0
	1	Snow 13.08	− 1	−16.0
$CaCl_2+6H_2O$	1	Snow .49	0	−19.7
	1	Snow .61	0	−39.0
	1	Snow .70	0	−54.9
	1	Snow .81	0	−40.3
	1	Snow 1.23	0	−21.5
	1	Snow 2.46	0	− 9.0
	1	Snow 4.92	0	− 4.0
Alcohol at 4°	77	Snow 73.	0	−30.0
	..	CO_2 solid	......	−72.0
Chloroform	....	CO_2 solid	......	−77.0
Ether	....	CO_2 solid	......	−77.0
Liquid SO_2	....	CO_2 solid	......	−82.0
NH_4NO_3	1	H_2O .94	20	− 4.0
	1	Snow .94	0	− 4.0
	1	H_2O 1.20	10	−14.0
	1	Snow 1.20	0	−14.0
	1	H_2O 1.31	10	−17.5
	1	Snow 1.31	0	−17.5

* Or finely pulverized ice.

HEAT EQUIVALENT OF FUSION

The table gives the heat equivalent in calories per gram at the temperature of fusion.

(From Smithsonian Tables.)

Substance.	Temp. ° C.	Heat cal/g.	Observer.
Aluminum	658.	76.8	Glaser
Ammonia	−75.	108.	Massol
Benzole	5.4	30.6	Mean
Bromine	−7.3	16.2	Regnault
Bismuth	268.	12.64	Person
Cadmium	320.7	13.66	Person
Calcium chloride	28.5	40.7	Person
Copper	1083	42.	Mean
Iron, gray cast	....	23.	Grumer
white cast	....	33.	Grumer
slag	....	50.	Grumer
Iodine	....	11.71	Favre & Silbermann
Ice	0	79.24	Regnault
Ice	0	80.02	Bunsen
Ice from sea water	−8.7	54.0	Petterson
Lead	327	5.86	Rudberg
Mercury	−39	2.82	Person
Naphthalene	79.87	35.62	Pickering
Nickel	1435	4.64	Pionchon
Palladium	1545	36.3	Violle
Phosphorus	44.2	4.97	Petterson
Platinum	1755	27.2	Violle
Potassium	62	15.7	Joannis
Potassium nitrate	333.5	48.9	Person
Phenol	25.37	24.93	Petterson
Paraffin	52.40	35.10	Batelli
Silver	961	21.07	Person
Sodium	97	31.7	Joannis
Sodium nitrate	305.8	64.87	Joannis
phosphate	36.1	66.8	Joannis
Spermaceti	43.9	36.98	Batelli
Sulphur	115	9.37	Person
Tin	232	14.0	Mean
Wax (Bees')	61.8	42.3	Mean
Zinc	419	28.13	Mean

HEAT EQUIVALENT OF VAPORIZATION

The table gives the heat equivalent (or latent heat) of vaporization in calories per gram, at the temperature of ebullition, and at the pressure of the vapor for that temperature.

(Principally from the Smithsonian Tables.)

Substance.	Temp. °C.	Heat Cal/g.	Observer.
Acetic acid	118*	84.9	Ogier
Air	....	50.97	Fenner-Richtmyer
Alcohol: amyl	131*	120	Schall
ethyl	78.1*	205	Wirtz
ethyl	0	236	Regnault
methyl	64.5*	2.67	Wirtz
methyl	0	289	Ramsay & Young
Ammonia	7.8	294.2	Regnault
Ammonia	11	291.3	Regnault
Ammonia	16	297.4	Regnault
Ammonia	17	296.5	Regnault
Benzene	80.1*	92.9	Wirtz
Bromine	61*	45.6	Andrews
Carbon dioxide, liq	− 25	72.23	Cailletet & Mathias
Carbon dioxide, liq	0	57.48	Cailletet & Mathias
Carbon dioxide, liq	12.35	44.97	Mathias
Carbon dioxide, liq	22.04	31.8	Mathias
Carbon dioxide, liq	29.85	14.4	Mathias
Carbon dioxide, liq	30.82	3.72	Mathias
Carbon disulphide	46.1*	83.8	Wirtz
Carbon disulphide	0	90	Regnault
Chloroform	60.9*	58.5	Wirtz
Ether	34.5*	88.4	Wirtz
Ether	34.9	90.5	Andrews
Ether	0	94	Regnault
Iodine	184*	23.95	Favre & Silbermann
Mercury	357*	65	Mean
Nitrogen	−195.6*	47.65	Alt
Oxygen	−182.9*	50.97	Alt
Sulphur dioxide	0	91.2	Cailletet & Mathias
Sulphur dioxide	30	80.5	Cailletet & Mathias
Sulphur dioxide	65	68.4	Cailletet & Mathias
Turpentine	159.3	74.04	Brix
Water	100	535.9	Andrews
Water	0	596.8	Dieterici, 1889
Water	20	585.3	Smith, 1908
Water	40	574.0	Henning, 1909
Water	60	562.9	Henning, 1909
Water	80	551.1	Henning, 1909
Water	100*	538.7	Henning, 1909
Water	120	525.3	Henning, 1909
Water	140	510.9	Henning, 1909
Water	160	496.6	Henning, 1909
Water	180	482.2	Henning, 1909

Temperature values marked * are those of normal ebullition, at 76 cm. pressure.

CHANGE IN VOLUME DUE TO FUSION

The table gives the variation in volume expressed in c.cm. for one gram of the substance.

Substance.	Variation, cm.	Observer.
Aluminum.....	+0.019	Toepler, 1894
Bismuth.......	−0.0034	Toepler, 1894
Cadmium.....	+0.0064	Toepler, 1894
Iron..........	−0.0085	Wrightson, Roberts, 1881
Lead..........	+0.0034	Toepler, 1894
Tin...........	+0.0039	Toepler, 1894
Water.........	−0.083*	Toepler, 1894
Zinc..........	+0.0105	Toepler, 1894

*For one cubic centimeter.

FIXED POINTS FOR THERMOMETER CALIBRATION

Substance	Point	Temperature Thermo. Scale. °C	Conditions
Hydrogen....	Boils	—252.7	
Oxygen......	Boils	—182.9	
Carbon dioxide	Sublimes	—78.5	
Mercury.....	Solidifies	—37.7	
Water.......	Melts	0.	
Ethyl alcohol	Boils	78.26	76 cm. variation 0.34° per cm.
Benzene.....	Boils	80.0	76 cm. variation 0.43° per cm.
Water......	Boils	100.	76 cm. variation
Chlorobenzene	Boils	132.	76 cm. variation 0.50° per cm.
Xylene (m.)	Boils	138.8	76 cm. variation 0.50° per cm.
Aniline.....	Boils	184.51	76 cm. variation 0.51° per cm.
Toluidine (o.)	Boils	199.7	76 cm. variation 0.58° per cm.
Naphthalene.	Boils	218.	76 cm. variation 0.59° per cm.
Tin.........	Melts	231.9 ± 0.2	
Diphenylamine	Boils	302	
Benzophenone	Boils	305.9 ± 0.1	76 cm.
Cadmium....	Melts	320.9 ± 0.2	Graphite crucible in air.
Lead........	Melts	327. ± 0.5	
Mercury....	Boils	357.25	
Zinc........	Melts	419.4 ± 0.3	Graphite crucible in air.
Sulfur......	Boils	444.55	76 cm.
Antimony....	Melts	630.0 ± 0.5	Graphite crucible in CO_2.
Aluminum....	Solidifies	658.7 ± 0.6	Graphite crucible in CO_2.
Silver......	Melts	960.5	Graphite crucible in CO_2.
Gold........	Melts	1063.0	Graphite crucible in CO_2.
Copper......	Melts	1083. ± 3	Graphite crucible in CO_2.
Li_2SiO_3......	Melts	1201.0	Platinum crucible in air.
Nickel......	Melts	1452	Magnesia crucible in H and N.
Cobalt......	Melts	1480	Magnesia crucible in air.
Palladium....	Melts	1549.2 ± 2	Magnesia crucible in air.
Anorthite, pure	Melts	1549.5 ± 2	Platinum crucible in air.
Platinum....	Melts	1755. ± 5	
Alumina.....	Melts	2000.	
Tungsten....	Melts	3400.	

VAPOR TENSION OF WATER

Tension of Aqueous Vapor, −30 to 0° C., Over Water

The tension is given in millimeters of mercury at 0° C.

(From International Bureau of Weights and Measures.)

Temp. ° C.	0.0	0.2	0.4	0.6	0.8
−30	0.3805				
−29	0.4185	0.4106	0.4028	0.3952	0.3878
−28	0.4598	0.4512	0.4428	0.4346	0.4265
−27	0.5047	0.4954	0.4862	0.4772	0.4684
−26	0.5535	0.5433	0.5333	0.5236	0.5141
−25	0.6064	0.5955	0.5847	0.5741	0.5637
−24	0.6637	0.6518	0.6402	0.6288	0.6175
−23	0.7258	0.7130	0.7003	0.6879	0.6757
−22	0.7930	0.7792	0.7655	0.7520	0.7388
−21	0.8656	0.8506	0.8359	0.8214	0.8071
−20	0.9441	0.9279	0.9120	0.8963	0.8808
−19	1.0288	1.0114	0.9941	0.9772	0.9605
−18	1.1202	1.1013	1.0828	1.0646	1.0465
−17	1.2187	1.1985	1.1785	1.1588	1.1394
−16	1.3248	1.3030	1.2814	1.2602	1.2393
−15	1.4390	1.4155	1.3924	1.3695	1.3470
−14	1.5618	1.5366	1.5117	1.4872	1.4629
−13	1.6939	1.6667	1.6399	1.6135	1.5874
−12	1.8357	1.8065	1.7776	1.7493	1.7214
−11	1.9880	1.9567	1.9258	1.8953	1.8653
−10	2.1514	2.1178	2.0847	2.0520	2.0198
− 9	2.3266	2.2905	2.2550	2.2199	2.1854
− 8	2.5143	2.4758	2.4378	2.4002	2.3632
− 7	2.7153	2.6740	2.6332	2.5930	2.5534
− 6	2.9304	2.8863	2.8427	2.7997	2.7572
− 5	3.1605	3.1132	3.0665	3.0205	2.9751
− 4	3.4065	3.3560	3.3062	3.2570	3.2084
− 3	3.6693	3.6153	3.5620	3.5095	3.4576
− 2	3.9499	3.8923	3.8355	3.7794	3.7240
− 1	4.2493	4.1878	4.1271	4.0672	4.0082
− 0	4.5687	4.5032	4.4385	4.3747	4.3116

VAPOR TENSION OF WATER

Tension of Aqueous Vapor. 40 to 0° C., Over Ice

The tension is given in millimeters of mercury.
(Juhlin and Marvin.)

Temp. ° C.	0.	1.	2.	3.	4.
−40	0.105	0.095	0.085	0.076	0.068
−30	0.292	0.264	0.238	0.215	0.193
−20	0.787	0.714	0.648	0.589	0.534
−10	1.974	1.806	1.650	1.506	1.375

Temp. ° C.	5.	6.	7.	8.	9.
−40	0.061	0.054	0.048	0.043	0.038
−30	0.173	0.156	0.141	0.127	0.115
−20	0.484	0.438	0.397	0.358	0.324
−10	1.257	1.148	1.048	0.955	0.868

Temp. ° C.	.0	.1	.2	3	.4
−10	1.974	1.956	1.939	1.922	1.905
− 9	2.154	2.136	2.118	2.100	2.082
− 8	2.347	2.327	2.307	2.287	2.268
− 7	2.557	2.535	2.514	2.492	2.470
− 6	2.785	2.761	2.738	2.715	2.692
− 5	3.032	3.006	2.981	2.956	2.931
− 4	3.299	3.271	3.244	3.217	3.190
− 3	3.586	3.556	3.527	3.498	3.469
− 2	3.894	3.862	3.831	3.799	3.768
− 1	4.223	4.189	4.155	4.122	4.089
− 0	4.579	4.543	4.507	4.470	4.434

Temp. ° C.	.5	.6	.7	.8	.9
−10	1.888	1.872	1.855	1.838	1.822
− 9	2.064	2.046	2.028	2.010	1.992
− 8	2.249	2.230	2.211	2.192	2.173
− 7	2.449	2.428	2.407	2.387	2.367
− 6	2.669	2.646	2.624	2.601	2.579
− 5	2.906	2.882	2.857	2.833	2.809
− 4	3.163	3.136	3.110	3.084	3.058
− 3	3.440	3.411	3.382	3.354	3.326
− 2	3.737	3.706	3.676	3.646	3.616
− 1	4.056	4.023	3.990	3.958	3.926
− 0	4.398	4.362	4.327	4.292	4.257

VAPOR TENSION OF WATER

Tension of Aqueous Vapor, 0 to 100° C.

The tension is given in millimeters of mercury at 0° C.

(International Bureau of Weights and Measures.)

Temp. °C.	0.0	0.2	0.4	0.6	0.8
0	4.5687	4.6350	4.7022	4.7703	4.8393
1	4.9091	4.9798	5.0515	5.1240	5.1975
2	5.2719	5.3472	5.4235	5.5008	5.5790
3	5.6582	5.7383	5.8195	5.9017	5.9850
4	6.0693	6.1546	6.2410	6.3285	6.4171
5	6.5067	6.5974	6.6893	6.7824	6.8765
6	6.9718	7.0682	7.1658	7.2646	7.3647
7	7.4660	7.5685	7.6722	7.7772	7.8834
8	7.9909	8.0998	8.2099	8.3214	8.4342
9	8.5484	8.6641	8.7810	8.8993	9.0189
10	9.1398	9.2623	9.3863	9.5117	9.6387
11	9.7671	9.8969	10.028	10.161	10.296
12	10.432	10.570	10.709	10.850	10.993
13	11.137	11.283	11.430	11.580	11.731
14	11.884	12.038	12.194	12.352	12.512
15	12.674	12.837	13.003	13.170	13.339
16	13.510	13.683	13.858	14.035	14.214
17	14.395	14.578	14.763	14.950	15.139
18	15.330	15.524	15.719	15.917	16.117
19	16.319	16.523	16.730	16.939	17.150
20	17.363	17.579	17.997	18.018	18.241
21	18.466	18.694	18.924	19.157	19.392
22	19.630	19.870	20.113	20.359	20.607
23	20.858	21.111	21.367	21.626	21.888
24	22.152	22.420	22.690	22.963	23.239
25	23.517	23.799	24.084	24.371	24.662
26	24.956	25.252	25.552	25.855	26.161
27	26.471	26.783	27.099	27.418	27.740
28	28.065	28.394	28.727	29.062	29.401
29	29.744	30.090	30.440	30.793	31.149
30	31.510	31.873	32.341	32.612	32.988
31	33.366	33.749	34.136	34.526	34.920
32	35.318	35.720	36.126	36.536	36.951
33	37.369	37.791	38.218	38.649	39.084
34	39.523	39.966	40.414	40.866	41.323

VAPOR TENSION OF WATER (Continued)

Tension of Aqueous Vapor, 0 to 100° C.

In millimeters of mercury.

Temp. ° C.	0.0	0.2	0.4	0.6	0.8
35	41.784	42.250	42.720	43.195	43.674
36	44.158	44.646	45.139	45.637	46.140
37	46.648	47.160	47.677	48.200	48.727
38	49.259	49.796	50.339	50.886	51.439
39	51.997	52.560	53.128	53.702	54.281
40	54.865	55.455	56.051	56.652	57.258
41	57.870	58.488	59.111	59.741	60.376
42	61.017	61.664	62.316	62.975	63.640
43	64.310	64.987	65.670	56.359	67.055
44	67.757	68.465	69.180	69.901	70.628
45	71.362	72.102	72.850	73.603	74.364
46	75.131	75.906	76.687	77.475	78.270
47	79.071	79.880	80.696	81.520	82.350
48	83.188	84.034	84.886	85.746	86.614
49	87.488	88.371	89.261	90.159	91.064
50	91.978	92.900	93.829	94.766	95.711
51	96.664	97.626	98.595	99.573	100.56
52	101.55	102.56	103.57	104.59	105.62
53	106.65	107.70	108.76	109.82	110.89
54	111.97	113.06	114.16	115.27	116.39
55	117.52	118.65	119.80	120.95	122.12
56	123.29	124.48	125.67	126.87	128.09
57	129.31	130.54	131.79	133.04	134.30
58	135.58	136.86	138.15	139.46	140.77
59	142.10	143.43	144.78	146.14	147.51
60	148.88	150.27	151.68	153.09	154.51
61	155.95	157.39	158.85	160.32	161.80
62	163.29	164.79	166.31	167.83	169.37
63	170.92	172.49	174.06	175.65	177.25
64	178.86	180.48	182.12	183.77	185.43
65	187.10	188.79	190.49	192.20	193.93
66	195.67	197.42	199.18	200.96	202.75
67	204.56	206.38	208.21	210.06	211.92
68	213.79	215.68	217.58	219.50	221.43
69	223.37	225.33	227.30	229.29	231.29

VAPOR TENSION OF WATER (Continued)

Tension of Aqueous Vapor, 0 to 100° C.

In millimeters of mercury.

Temp. ° C.	0.0	0.2	0.4	0.6	0.8
70	233.31	235.34	237.39	239.45	241.52
71	243.62	245.72	247.85	249.98	252.14
72	254.30	256.49	258.69	260.91	263.14
73	265.38	267.65	269.93	272.23	274.54
74	276.87	279.21	281.58	283.96	286.35
75	288.76	291.19	293.64	296.11	298.59
76	301.09	303.60	306.14	308.69	311.26
77	313.85	316.45	319.07	321.72	324.38
78	327.05	329.75	332.47	335.20	337.95
79	340.73	343.52	346.33	349.16	352.01
80	354.87	357.76	360.67	363.59	366.54
81	369.51	372.49	375.50	378.53	381.58
82	384.64	387.73	390.84	393.97	397.12
83	400.29	403.49	406.70	409.94	413.19
84	416.47	419.77	423.09	426.44	429.81
85	433.19	436.60	440.04	443.49	446.97
86	450.47	454.00	457.54	461.11	464.71
87	468.32	471.96	475.63	479.32	483.03
88	486.76	490.52	494.31	498.12	501.95
89	505.81	509.69	513.60	517.53	521.48
90	525.47	529.48	533.51	537.57	541.65
91	545.77	549.90	554.07	558.26	562.47
92	566.71	570.98	575.28	579.61	583.96
93	588.33	592.74	597.17	601.64	606.13
94	610.64	615.19	619.76	624.37	629.00
95	633.66	638.35	643.06	647.81	652.59
96	657.40	662.23	667.10	672.00	676.92
97	681.88	686.87	691.89	696.93	702.02
98	707.13	712.27	717.44	722.65	727.89
99	733.16	738.46	743.80	749.17	754.57
100	760.00	765.47	770.97	776.50	782.07

VAPOR TENSION OF WATER

TENSION OF AQUEOUS VAPOR, 100–230° C.

Giving the vapor tension in millimeters of mercury, in pounds per square inch and the corresponding temperature Fahrenheit.

(From Regnault—Smithsonian Tables.)

Temp.* ° C.	Pressure.		Temp.* ° F.	Temp.* ° C.	Pressure.		Temp.* ° F.
	mm.	Pounds per sq.in.			mm.	Pounds per sq.in.	
100	760.00	14.70	212.0	145	3125.55	60.44	293.0
101	787.59	15.23	213.8	146	3212.74	62.13	294.8
102	816.01	15.79	215.6	147	3301.87	63.86	296.6
103	845.28	16.35	217.4	148	3392.98	65.62	298.4
104	875.41	16.94	219.2	149	3486.09	67.41	300.2
105	906.41	17.53	221.0	150	3581.2	69.26	302.0
106	938.31	18.15	222.8	151	3678.4	71.14	303.8
107	971.14	18.78	224.6	152	3777.7	73.06	305.6
108	1004.91	19.44	226.4	153	3879.2	75.02	307.4
109	1039.65	20.11	228.2	154	3982.8	77.03	309.2
110	1075.37	20.80	230.0	155	4088.6	79.07	311.0
111	1112.09	21.51	231.8	156	4196.6	81.22	312.8
112	1149.83	22.24	233.6	157	4306.9	83.29	314.6
113	1188.61	22.99	235.4	158	4419.5	85.47	316.4
114	1228.47	23.76	237.2	159	4534.4	87.69	318.2
115	1269.41	24.55	239.0	160	4651.6	89.96	320.0
116	1311.47	25.37	240.8	161	4771.3	92.27	321.8
117	1354.66	26.20	242.6	162	4893.4	94.63	323.6
118	1399.02	27.06	244.4	163	5017.9	97.04	325.4
119	1444.55	27.94	246.2	164	5145.0	99.50	327.2
120	1491.28	28.85	248.0	165	5274.5	102.01	329.0
121	1539.25	29.78	249.8	166	5406.7	104.56	330.8
122	1588.47	30.73	251.6	167	5541.4	107.18	332.6
123	1638.96	31.70	253.4	168	5678.8	109.84	334.4
124	1690.76	32.70	255.2	169	5818.9	112.53	336.2
125	1743.88	33.72	257.0	170	5961.7	115.29	338.0
126	1798.35	34.78	258.8	171	6107.2	118.11	339.8
127	1854.20	35.86	260.6	172	6255.5	120.98	341.6
128	1911.47	36.97	262.4	173	6406.6	123.90	343.4
129	1970.15	38.11	264.2	174	6560.6	126.87	345.2
130	2030.28	39.26	266.0	175	6717.4	129.91	347.0
131	2091.94	40.47	267.8	176	6877.2	133.00	348.8
132	2155.03	41.68	269.6	177	7040.0	136.15	350.6
133	2219.69	42.93	271.4	178	7205.7	139.35	352.4
134	2285.92	44.21	273.2	179	7374.5	142.62	354.2
135	2353.73	45.52	275.0	180	7546.4	145.93	356.0
136	2423.16	46.87	276.8	181	7721.4	149.32	357.8
137	2494.23	48.24	278.6	182	7899.5	152.77	359.6
138	2567.00	49.65	280.4	183	8080.8	156.32	361.4
139	2641.44	51.06	282.2	184	8265.4	159.84	363.2
140	2717.63	52.55	284.0	185	8453.2	163.47	365.0
141	2795.57	54.07	285.8	186	8644.4	167.17	366.8
142	2875.30	55.60	287.6	187	8838.8	170.94	368.6
143	2956.86	57.16	289.4	188	9036.7	174.76	370.4
144	3040.26	58.79	291.2	189	9238.0	178.65	372.2

* These are the temperatures at which water boils under pressures shown.

VAPOR TENSION OF WATER (Continued)

Tension of Aqueous Vapor, 100–230° C.

Giving the vapor tension in millimeters of mercury, in pounds per square inch and the corresponding temperature Fahrenheit.)

(From Regnault—Smithsonian Tables.)

Temp. ° C.	Pressure. mm.	Pressure. Pounds per sq.in.	Temp. ° F.	Temp. ° C.	Pressure. mm.	Pressure. Pounds. per sq.in.	Temp. ° F.
190	9442.7	182.61	374.0	210	14324.8	277.01	410.0
191	9650.9	186.63	375.8	211	14611.3	282.58	411.8
192	9862.7	190.72	377.6	212	14902.2	288.21	413.6
193	10078.0	194.88	379.4	213	15197.5	293.92	415.4
194	10297.0	199.13	381.2	214	15497.2	299.72	417.2
195	10519.6	203.43	383.0	215	15801.3	305.57	419.0
196	10746.0	207.81	384.8	216	16109.9	311.57	420.8
197	10975.0	212.25	386.6	217	16423.2	317.62	422.6
198	11209.8	216.77	388.4	218	16740.9	323.78	424.4
199	11147.5	221.37	390.2	219	17063.3	330.01	426.2
200	11689.0	226.04	392.0	220	17390.4	336.30	428.0
201	11934.4	230.79	393.8	221	17722.1	342.70	429.8
202	12183.7	235.61	395.6	222	18058.6	349.21	431.6
203	12437.0	240.54	397.4	223	18399.9	355.81	433.4
204	12694.3	245.49	399.2	224	18746.1	362.50	435.2
205	12955.7	250.53	401.0	225	19097.0	369.29	437.0
206	13221.1	255.67	402.8	226	19452.9	376.17	438.8
207	13490.8	260.88	404.6	227	19813.8	383.15	440.6
208	13764.5	266.18	406.4	228	20179.6	390.22	442.4
209	14042.5	271.55	408.2	229	20550.5	397.40	444.2

VAPOR TENSION OF MERCURY

(From Gebhardt, Hertz, Regnault, Van der Plaats, and others.)

Temp. ° C.	Pressure, mm.	Temp. ° C.	Pressure, mm.
0	0.0004	200	18.3
20	0.0013	220	33.7
40	0.006	240	59.
60	0.03	260	98
80	0.09	280	156.
100	0.28	300	246.
120	0.8	320	371.
140	1.85	340	548.
160	4.4	360	790.
180	9.2		

LOWERING OF VAPOR PRESSURE BY SALTS IN AQUEOUS SOLUTIONS

The table gives the reduction of the vapor pressure in millimeters due to the presence of the number of grammolecules of salt per liter of water given at the head of the columns, at the temperature 100° C., at which temperature the vapor pressure of pure water is 76.0 centimeters.

(From Smithsonian Tables.)

Substance	0.5	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0
Ammonium chloride	12.0	23.7	45.1	69.3	94.2	118.5	138.2	179.0	213.8
Barium chloride	16.4	36.7	77.6						
Calcium chloride	17.0	39.8	95.3	166.6	241.5	319.5			
Ferrous sulphate	5.8	10.7	24.0	42.4					
Potassium hydroxide	15.0	29.5	64.0	99.2	140.0	181.8	223.0	309.5	387.8
Potassium iodide	12.5	25.3	52.2	82.6	112.2	141.5	171.8	225.5	278.5
Sodium chloride	12.3	25.2	52.1	80.0	111.0	143.0	176.5		
Sodium hydroxide	11.8	22.8	48.2	77.3	107.5	139.1	172.5	243.3	314.0
Sulphuric acid	12.9	26.5	62.8	104.0	148.0	198.4	247.0	343.2	
Zinc sulphate	4.9	10.4	21.5	42.1	66.2				

CONSTANTS OF THE KINETIC THEORY OF GASES

Giving the velocity, mean free path and diameter of molecules for various gases and vapors at 0° C. and 760 mm. pressure.

Gas.	Mean vel. cm./s.	Mean free path, cm.	Diam. cm.	Observer.
Ammonia	5.8×10^{4}	6.2×10^{-6}	3.9×10^{-8}	Graham, 1846
Argon	3.81	8.84	3.23	Schultze, 1901
Benzene	2.7	21	6.6	
Carbon dioxide	3.6	5.6	4.1	Breitenbach 1899
Chlorine	2.86	4.07	4.76	Graham, 1846
Chloroform	2.2	2.3	6.3	Puluj, 1878
Ether	2.8	2.1	6.6	Puluj, 1878
Ethyl alcohol	3.5	3.2	5.3	Puluj, 1878
Helium	12.02	25.1	1.9	Schultze, 1901
Hydrogen	16.94	16.3	2.38	Puluj, 1878
Nitrogen	4.53	8.61	3.27	Markowski, 1904
Oxygen	4.25	9.06	3.19	Markowski, 1904
Water vapor	5.7	5.7	4.0	Puluj, 1878

NUMBER OF MOLECULES IN A MOLECULE-GRAM

Perrin, 1909–11 . . . . 6.2×10^{23}
Perrin (Brownian movement) . . . . 6.85 "
Millikan, 1910 . . . . 6.2

MASS OF THE HYDROGEN ATOM

1.66×10^{-24} grams.

VAPOR PRESSURES OF

In centimeters

(Principally from

Temp. ° C.	Carbon bisulphide, CS_2.	Carbon dioxide, CO_2.	Carbon tetrachloride, CCl_4.	Chloroform, $CHCl_3$.	Ethyl Alcohol, C_2H_6O.	Ethyl Ether, $C_4H_{10}O$.	Acetic acid.	Acetone, C_3H_6O.	Ammonia, NH_3.
−30	....	.....	....	....	....	....	....	....	86.61
−25	....	1300.70	....	....	....	....	....	....	110.43
−20	4.73	1514.24	.98	....	.33	6.89	....	....	139.21
−15	6.16	1758.25	1.35	....	.51	8.93	....	....	173.65
−10	7.94	2034.02	1.85	....	.65	11.47	....	....	214.46
− 5	10.13	2344.13	2.48	....	.91	14.61	....	....	264.42
0	12.79	2690.66	3.29	5.97	1.27	18.44	0.35	....	318.33
5	16.00	3075.38	4.32	....	1.76	23.09	....	....	383.03
10	19.85	3499.86	5.60	10.05	2.42	28.68	0.64	....	457.40
15	24.41	3964.69	7.17	....	3.30	35.36	....	....	543.34
20	29.80	4471.66	9.10	16.05	4.45	43.28	1.18	17.96	638.78
25	36.11	5020.73	11.43	20.02	5.94	52.59	....	22.63	747.70
30	43.46	5611.90	14.23	24.75	7.85	63.43	2.01	28.10	870.10
35	51.97	6244.73	17.55	30.35	10.29	76.12	....	34.52	1007.02
40	61.75	6918.44	21.48	36.93	13.37	90.70	3.42	42.01	1159.53
45	72.95	7631.46	26.08	44.60	17.22	107.42	....	50.75	1328.73
50	85.71	.....	31.44	53.50	21.99	126.48	5.63	62.29	1515.83
55	100.16	.....	37.63	63.77	27.86	148.11	....	72.59	1721.98
60	116.45	.....	44.74	75.54	35.02	172.50	8.83	86.05	1948.21
65	134.75	.....	52.87	88.97	43.69	199.89	....	101.43	2196.51
70	155.21	.....	62.11	104.21	54.11	230.49	13.70	118.94	2467.55
75	177.99	.....	72.57	121.42	66.55	264.54	....	138.76	2763.00
80	203.25	.....	84.33	140.76	81.29	302.28	20.23	161.10	3084.31
85	231.17	.....	97.51	162.41	98.64	343.95	....	186.18	3433.09
90	261.91	.....	112.23	186.52	118.93	389.83	29.27	214.17	3810.92
95	296.63	.....	128.69	213.28	142.51	440.18	....	245.28	4219.57
100	332.51	.....	146.71	242.85	169.75	495.33	41.7	279.73	4660.82
105	372.72	.....	166.72	275.40	201.04	555.62	....	317.70	.....
110	416.41	.....	188.74	311.10	236.76	621.46	....	359.40	.....
115	463.74	.....	212.91	350.10	277.34	693.33	58.2	405.00	.....
120	514.88	.....	239.37	392.57	323.17	771.92	79.4	454.69	.....
125	569.97	.....	268.24	438.66	374.69	....	....	508.62	.....
130	629.16	.....	299.69	488.51	432.30	....	106.7	566.97	.....
135	692.59	.....	333.86	542.25	496.42	....	....	629.87	.....
140	760.40	.....	370.90	600.02	567.46	....	140.4	697.44	.....
145	832.69	.....	411.00	661.92	645.80	....	....	....	.....
150	909.59	.....	454.31	728.06	731.84	....	184.7	....	.....
155	....	.....	501.02	798.53	825.92	....	....	....	.....
160	....	.....	551.31	873.42	....	....	....	....	.....
165	....	.....	605.38	952.78	....	....	....	....	.....

VARIOUS SUBSTANCES

of mercury.

Regnault.)

Temp. ° C.	Benzol, C_6H_6.	Camphor.	Methyl alcohol, CH_4O.	Naphthalene.	Nitrous oxide, N_2O.	Pictet's fluid, $64SO_2+44CO_2$ by weight.	Sulphur dioxide, SO_2.	Hydrogen sulphide, H_2S.	Turpentine, $C_{10}H_{16}$.
−30	....	....	....	....	.....	58.52	28.75		
−25	....	....	.41	....	1569.49	67.64	37.38	374.93	
−20	.58	....	.63	....	1758.66	74.48	47.95	443.85	
−15	.88	....	.93	....	1968.43	89.68	60.79	519.65	
−10	1.29	....	1.35	....	2200.80	101.84	76.25	608.46	
− 5	1.83	....	1.92	....	2457.92	121.60	94.69	706.60	
0	2.53	0.006	2.68	0.002	2742.10	139.08	116.51	820.63	.21
5	3.42	....	3.69	....	3055.86	167.20	142.11	949.08	
10	4.52	0.010	5.01	0.005	3401.91	193.80	171.95	1089.63	.29
15	5.89	....	6.71	0.005	3783.17	226.48	206.49	1244.79	
20	7.56	0.015	8.87	0.008	4202.79	258.40	246.20	1415.15	.44
25	9.59	....	11.60	....	4664.14	297.92	291.60	1601.24	
30	12.02	0.026	15.00	0.013	5170.85	338.20	343.18	1803.53	.69
35	14.93	....	19.20	....	6335.98	383.80	401.48	2002.43	
40	18.36	0.060	24.35	0.032	.....	434.72	467.02	2258.25	1.08
45	22.41	....	30.61	....	.....	478.80	540.35	2495.43	
50	27.14	0.130	38.17	0.081	.....	521.36	622.00	2781.48	1.70
55	32.64	....	47.22	....	.....	....	712.50	3069.07	
60	39.01	0.255	57.99	0.183	.....	....	812.38	3374.02	2.65
65	46.34	....	70.73	....	.....	....	922.14	3696.15	
70	54.74	0.460	85.71	0.395	.....	....	....	4035.32	4.06
75	64.32	....	103.21						
80	75.19	0.915	123.85	0.74	.....	....	....	.....	6.13
85	87.46	....	147.09						
90	101.27	....	174.17	1.26	.....	....	....	.....	9.06
95	116.75	....	205.17						
100	134.01	....	240.51	1.85	.....	....	....	.....	13.11
105	153.18	....	280.63						
110	174.44	....	325.96	2.73	.....	....	....	.....	18.60
115	197.82	....	376.98						
120	223.54	....	434.18	4.02	.....	....	....	.....	25.70
125	251.71	....	498.05						
130	282.43	....	569.13	6.19	.....	....	....	.....	34.90
135	315.85	....	647.93						
140	352.07	....	733.71	....	.....	....	....	.....	46.40
145	391.21	....	830.89	....					
150	433.37	....	936.13						
155	478.65	....	....	....	.....	....	....	.....	60.50
160	527.14	....	....	....	.....	....	....	.....	68.60
165	568.30	....	....	....	.....	....	....	.....	77.50

HEAT CONDUCTIVITY

Giving the quantity of heat in calories which is transmitted per second through a plate one centimeter thick across an area of one square centimeter when the temperature difference is one degree Centigrade.

Metals

Substance	Temp. ° C.	Conductivity	Observer
Aluminum	−160	0.514	Lees, 1908
	18	0.480	Jaeger & Diesselhorst, 1900
	18	0.504	Lees, 1908
	100	0.492	Jaeger & Diesselhorst, 1900
	100	0.49	Angell, 1911
	200	0.55	"
	300	0.64	"
	400	0.76	"
	600	1.01	"
Antimony	0	0.0442	Lorenz, 1881
	100	0.040	"
	0–30	0.042	Berget, 1890
Bismuth	−186	0.025	Macchia, 1907
	0	0.0177	Lorenz
	18	0.0194	Jaeger & Diesselhorst, 1900
	100	0.0161	Jaeger & Diesselhorst, 1900
Brass (70Cu+30Zn)	−160	0.181	Lees, 1908
(70Cu+30Zn)	17	0.260	" "
yellow	0	0.204	Lorenz
red	0	0.246	"
Bronze, aluminum (90Cu, 10Al)	....	0.18	Van Aubel
Cadmium	−160	0.239	Lees, 1908
	0	0.220	Lorenz
	18	0.222	Jaeger & Diesselhorst, 1900
	100	0.216	Jaeger & Diesselhorst, 1900
Constantan	18	0.054	Jaeger & Diesselhorst, 1900
(60Cu, 40Ni)	100	0.064	Jaeger & Diesselhorst, 1900
Copper, pure	−160	1.097	Lees, 1908
	13	1.00	Angström, 1863
	18	0.918	Jaeger & Diesselhorst, 1900

HEAT CONDUCTIVITY (Continued)

Metals

Substance	Temp. ° C.	Conductivity	Observer
Copper, pure........	100	0.908	Jaeger & Diesselhorst, 1900
	100–197	1.043	Hering, 1910
	100–268	0.969	"
	100–370	0.931	"
	100–541	0.902	"
	100–837	0.858	"
German silver.......	0	0.070	Lorenz, 1881
	100	0.089	"
(52Cu, 26Zn, 22Ni)	....	0.10	Glage, 1905
Gold...............	17	0.705	Barratt, 1914
	18	0.700	Jaeger & Diesselhorst, 1900
	100	0.703	Jaeger & Diesselhorst, 1900
Iridium............	17	0.141	Barratt, 1914
Iron, pure..........	18	0.161	Jaeger & Diesselhorst
	100	0.151	" "
	100–727	0.202	Hering, 1910
	100–1245	0.191	"
wrought..........	–160	0.152	Lees, 1908
	18	0.144	Jaeger & Diesselhorst
	100	0.143	" "
cast.............	18	0.109	" "
	100	0.108	" "
	54	0.114	Callendar
	102	0.111	"
Steel...............	–160	0.113	Lees, 1908
	18	0.115	" "
	18	0.108	Jaeger & Diesselhorst
	100	0.107	" "
Lead...............	–160	0.092	Lees, 1908
	18	0.083	Jaeger & Diesselhorst
	100	0.082	" "
Magnesium.........	0–100	0.376	Lorenz, 1881
Manganin..........	18	0.15186	Jaeger & Diesselhorst
(84Cu, 4Ni, 12Mn)	100	0.06310	" "
	–160	0.035	Lees, 1908
Mercury...........	0	0.0148	H. F. Weber, 1880
	50	0.0189	" "
	17	0.0197	R. Weber, 1902
Molybdenum.......	17	0.346	Barratt, 1914
Nickel.............	–160	0.129	Lees, 1908

HEAT CONDUCTIVITY (Continued)

Metals

Substance	Temp. °C.	Conductivity	Observer
Nickel	18	0.142	Jaeger & Diesselhorst, 1900
	100	0.138	Jaeger & Diesselhorst, 1900
	300	0.126	Angell, 1911
	600	0.088	"
	800	0.068	"
	1200	0.058	"
Palladium	18	0.1683	Jaeger & Diesselhorst, 1900
	100	0.182	
Platinum	18	0.1664	Jaeger & Diesselhorst, 1900
	100	0.1733	Jaeger & Diesselhorst, 1900
Platinum-iridium 10 % Ir	17	0.074	Barratt, 1914
Platinum-rhodium 10 % Rh	17	0.072	Barratt, 1914
Platinoid	18	0.060	Lees, 1908
Rhodium	17	0.210	Barratt, 1914
Silver, pure	−160	0.998	Lees, 1908
	18	0.974	"
	18	1.006	Jaeger & Diesselhorst, 1900
	100	0.992	Jaeger & Diesselhorst, 1900
Tin	−160	0.192	Lees, 1908
	0	0.1528	Lorenz, 1881
	18	0.155	Jaeger & Diesselhorst, 1900
	100	0.145	Jaeger & Diesselhorst, 1900
	100	0.1423	Lorenz, 1881
Tantalum	17	0.130	Barratt, 1914
Tungsten	17	0.476	"
	18	0.35	Coolidge
Wood's alloy	....	0.0319	H. F. Weber
Zinc	−160	0.278	Lees, 1908
	18	0.2653	Jaeger & Diesselhorst
	100	0.2619	" "

HEAT CONDUCTIVITY (Continued)

Various Solids

Approximate values at ordinary temperatures.

Substance	Conductivity	Observer
Asbestos fiber, 500° C. .	0.00019	Randolph, 1912
paper	0.0006	. . . .
	0.0004	Lees-Chorlton, 1896
Basalt	0.0052	Hecht, 1903
Brick, common red	0.0015	Herschel-Lebour & Dunn, 1879
Blotting paper	0.00015	Lees-Charlton, 1896
Carbon	0.01	
Carborundum	0.0005	Lorenz
brick, 150°–1200° . . .	0.0032–0.0027	Wologdine
Cardboard	0.0005	. . . .
Cement, Portland	0.00071	Lees-Chorlton, 1896
Chalk	0.0020	Herschel-Lebour & Dunn, 1879
Concrete, cinder	0.00081	. . . .
stone	0.0022	Norton
Cork	0.00072	G. Forbes, 1875
	0.00013	Lees, 1892–8
Cotton wool	0.000043	G. Forbes
felted	0.000033	"
Diatomic earth	0.00013	Hutton-Blard
Earth's crust, ave	0.004	. . . .
Ebonite	0.00042	Lees
	0.00014	Barratt, 1914
Eiderdown	0.000011	Peclet, 1878
Felt	0.000087	. . . .
Fiber, red	0.0011	Barratt, 1914
Fire brick	0.00028	Hutton-Blard
	0.0011	Barratt, 1914
Flannel	0.00023	
Gas carbon, 20°	0.0085	Barratt, 1914
100°	0.0095	"
Glass		
crown (window)	0.0025	Lees, 1892–8
flint	0.002	"
Jena	0.001–0.002	"
soda, 20°	0.0017	Barratt, 1914
100°	0.0018	"
Granite, 100°	0.0045–0.0050	Poole, 1912
500°	0.0040	"
Graphite	0.012	. . . .
Graphite brick, 300° to 700°	0.24	Wologdine, 1909

HEAT CONDUCTIVITY (Continued)

Various Solids (Continued)

Approximate values at ordinary temperatures.

Substance	Conductivity	Observer
Gutta percha	0.00048	Péclet, 1878
Gypsum	0.0031	R. Weber, 1878
Haircloth, felt	0.000042	G. Forbes
Ice	0.005	....
	0.0039	....
	0.0022	Forbes, 1875
Infusorial earth, 100°	0.00034	Skinner
300°	0.00040	"
pressed bricks, 100°	0.00030	"
Lamp black, 100	0.00007	Randolph, 1912
Leather, cowhide	0.00042	Lees-Chorlton, 1896
chamois	0.00015	" "
Lime	0.00029	Hutton-Blard
Linen	0.00021	Lees-Chorlton, 1896
Magnesia, MgO	0.00016–0.00045	Hutton-Blard
brick, 50°–1130°	0.0027–0.0072	Wologdine, 1909
Magnesium carbonate, 100°	0.00023	Skinner
300°	0.00025	"
Marble	0.0071	Lees, 1892–8
Mica, perpendicular to cleavage plane	0.0018	Lees
Paper	0.0003	"
Paraffine	0.0006	"
0°	0.00023	R. Weber, 1878
Plaster of Paris	0.00070	Lees-Chorlton, 1896
Porcelain	0.0025	Lees, 1892–8
165°–1055°	0.0039–0.0047	Wologdine, 1909
Quartz, parallel to axis	0.030	Lees, 1892–8
perpendicular to axis	0.16	"
Rubber, para	0.00045	"
Sand, dry	0.00093	Herschel-Lebour & Dunn, 1879
Sandstone	0.0055	Herschel-Lebour & Dunn, 1879
Sawdust	0.00012	G. Forbes, 1875
Silica, fused, 20°	0.00237	Barratt, 1914
100°	0.00255	"
Silica brick, 100° to 1000° C	0.002–0.003	Wologdine, 1909
Silk	0.000095	Lees-Chorlton, 1896
Slate	0.004700	Lees, 1892–8

HEAT CONDUCTIVITY (Continued)

Various Solids (Continued)

Approximate values at ordinary temperatures.

Substance	Conductivity	Observer
Snow, compact	0.00051	Hjeltström
Soil, dry	0.00033	Lees-Chorlton, 1896
Wax, bees'	0.00009	G. Forbes
Wood, fir ‖ to axis	0.00030	....
perpendicular to axis	0.00009	....

Liquids

Substance	Conductivity	Observer
Acetic acid	0.00047	H. F. Weber
Amyl alcohol	0.000328	"
Aniline, 12°	0.00041	....
Benzole, 5°	0.000333	H. F. Weber
Carbon disulphide, 9° to 15°	0.000343	"
Chloroform, 9°–15°	0.000288	"
Ether, 9°–15°	0.000303	"
Ethyl alcohol	0.000423	"
Glycerine, 9°–15°	0.000637	Graetz
Methyl alcohol	0.000495	H. F. Weber
Oils: olive	0.000395	Wachsmuth
castor	0.000425	"
petroleum, 13°	0.000355	Graetz
turpentine	0.000325	"
Vaseline, 25°	0.00044	Lees
Water, 4°	0.00138	H. F. Weber
0°	0.00120	"
17°	0.00131	R. Weber
20°	0.00143	Milner & Chattock

Gases

Substance	Conductivity	Observer
Air, 0°	0.0000568	Winklemann
Argon, 0°	0.0000389	Schwarze
Ammonia gas, 0°	0.0000458	Winklemann
Carbon dioxide, 0°	0.0000307	"
monoxide	0.0000499	"
Ethylene	0.0000395	"
Helium, 0°	0.000339	Schwarze
Hydrogen, 0°	0.000327	Winklemann
100°	0.000369	Graetz
Methane, 7°–8°	0.0000647	Winklemann
Nitric oxide, NO, 8°	0.0000460	"
Nitrogen, 7°–8°	0.0000524	"
Nitrous oxide, N_2O	0.0000350	
Oxygen, 7°–8°	0.0000563	

PROPERTIES OF

METRIC AND

The heat units used are the large calorie, 15° to 16° C. and the B.T.U., 62° to 63° F. The heat of the liquid, q, is the heat required to raise unit mass of water from 0° C. (32° F.) to the temperature indicated. The heat of vaporization, r, is the heat required to vaporize unit mass of water at the indicated temperature and pressure. Total heat involved, $H = r + q$.

The heat of vaporization overcomes external pressure and changes the state from liquid to vapor at constant temperature and pressure. If u is the change

Temperature degrees Centigrade.	Pressure.			Heat of the liquid.		Heat of vaporization.		Heat equivalent of internal work.		Temperature, degrees Fahrenheit.
	Millimeters of mercury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	
t	p	p	p	q	q	r	r	ρ	ρ	t
0	4.579	0.00623	0.0886	0.00	0.0	595.4	1071.7	565.3	1017.5	**32**
1	4.924	0.00670	0.0952	1.01	1.8	594.9	1070.8	564.7	1016.4	**33.8**
2	5.290	0.00719	0.1023	2.02	3.6	594.4	1069.9	564.0	1015.3	**35.6**
3	5.681	0.00772	0.1099	3.03	5.5	593.9	1069.0	563.4	1014.2	**37.4**
4	6.097	0.00829	0.1179	4.03	7.3	593.3	1068.0	562.8	1013.1	**39.2**
5	6.541	0.00889	0.1265	5.04	9.1	592.8	1067.1	562.2	1011.9	**41**
6	7.011	0.00953	0.1356	6.04	10.9	592.3	1066.1	561.5	1010.7	**42.8**
7	7.511	0.01021	0.1453	7.05	12.7	591.8	1065.2	560.9	1009.6	**44.6**
8	8.042	0.01093	0.1555	8.05	14.5	591.2	1064.2	560.2	1008.5	**46.4**
9	8.606	0.01170	0.1664	9.05	16.3	590.7	1063.3	559.6	1007.4	**48.2**
10	9.205	0.01252	0.1780	10.06	18.1	590.2	1062.3	559.0	1006.2	**50**
11	9.840	0.01338	0.1903	11.06	19.9	589.6	1061.3	558.3	1005.0	**51.8**
12	10.513	0.01429	0.2033	12.06	21.7	589.1	1060.4	557.7	1003.9	**53.6**
13	11.226	0.01526	0.2171	13.06	23.5	588.6	1059.4	557.1	1002.7	**55.4**
14	11.980	0.01629	0.2317	14.06	25.3	588.1	1058.5	556.5	1001.6	**57.2**
15	12.779	0.01737	0.2471	15.06	27.1	587.6	1057.6	555.9	1000.5	**59**
16	13.624	0.01852	0.2635	16.06	28.9	587.0	1056.6	555.2	999.4	**60.8**
17	14.517	0.01974	0.2807	17.06	30.7	586.5	1055.7	554.6	998.3	**62.6**
18	15.460	0.02102	0.2990	18.06	32.5	585.9	1054.7	553.9	997.1	**64.4**
19	16.456	0.02237	0.3182	19.06	34.3	585.4	1053.8	553.3	996.0	**66.2**
20	17.51	0.02381	0.3386	20.06	36.1	584.9	1052.8	552.7	994.8	**68**
21	18.62	0.02532	0.3601	21.06	37.9	584.4	1051.9	552.1	993.7	**69.8**
22	19.79	0.02691	0.3827	22.06	39.7	583.9	1051.0	551.5	992.6	**71.6**
23	21.02	0.02858	0.4065	23.06	41.5	583.3	1050.0	550.8	991.4	**73.4**
24	22.32	0.03035	0.4316	24.06	43.3	582.8	1049.1	550.2	990.3	**75.2**
25	23.69	0.03221	0.4581	25.05	45.1	582.3	1048.1	549.5	989.1	**77**
26	25.13	0.03417	0.4860	26.05	46.9	581.8	1047.2	548.9	988.0	**78.8**
27	26.65	0.03623	0.5154	27.05	48.7	581.2	1046.2	548.2	986.9	**80.6**
28	28.25	0.03841	0.5463	28.05	50.5	580.7	1045.2	547.6	985.7	**82.4**
29	29.94	0.04071	0.5790	29.04	52.3	580.2	1044.3	547.0	984.6	**84.2**
30	31.71	0.04311	0.6132	30.04	54.1	579.6	1043.3	546.3	983.4	**86**

SATURATED STEAM

English Units

in volume the external work is pu and the corresponding amount of heat is Apu where A is the reciprocal of the mechanical equivalent of heat. The part of the heat of vaporization not used in external work is considered used in changing the state from liquid to vapor. The heat required for this work may be represented by $\rho = r - Apu$.

(From Peabody, Steam and Entropy Tables, John Wiley and Sons, Inc., publishers, by permission.)

Temperature, degrees Centigrade.	Heat equivalent of external work.		Entropy of the liquid.	Entropy of vaporization.	Specific volume.		Density.		Temperature, degrees Fahrenheit.
	Calories per kilogram.	B.T.U. per pound.			Cubic meters per kilo.	Cubic feet per pound.	Kilos per cubic meter.	Pounds per cubic foot.	
t	Apu	Apu	θ	$\frac{r}{T}$	s	s	$\frac{1}{s}$	$\frac{1}{s}$	t
0	30.1	54.2	0.0000	2.1804	206.3	3304	0.00485	0.000303	**32**
1	30.2	54.4	0.0037	2.1706	192.7	3087	0.00519	0.000324	**33.8**
2	30.4	54.6	0.0074	2.1609	180.0	2884	0.00556	0.000347	**35.6**
3	30.5	54.8	0.0110	2.1513	168.2	2694	0.00595	0.000371	**37.4**
4	30.5	54.9	0.0146	2.1416	157.2	2518	0.00636	0.000397	**39.2**
5	30.6	55.2	0.0183	2.1320	147.1	2356	0.00680	0.000424	**41**
6	30.8	55.4	0.0219	2.1225	137.7	2206	0.00726	0.000453	**42.8**
7	30.9	55.6	0.0256	2.1130	129.0	2067	0.00775	0.000484	**44.6**
8	31.0	55.7	0.0290	2.1036	120.9	1937	0.00827	0.000516	**46.4**
9	31.1	55.9	0.0326	2.0943	113.4	1816	0.00882	0.000551	**48.2**
10	31.2	56.1	0.0361	2.0850	106.3	1703	0.00941	0.000587	**50**
11	31.3	56.3	0.0397	2.0758	99.8	1599	0.01002	0.000625	**51.8**
12	31.4	56.5	0.0433	2.0667	93.7	1502	0.01067	0.000666	**53.6**
13	31.5	56.7	0.0467	2.0576	88.1	1411	0.01135	0.000709	**55.4**
14	31.6	56.9	0.0502	2.0486	82.9	1327	0.01206	0.000754	**57.2**
15	31.7	57.1	0.0537	2.0396	77.9	1248	0.01283	0.000801	**59**
16	31.8	57.3	0.0571	2.0308	73.3	1174	0.01364	0.000852	**60.8**
17	31.9	57.4	0.0607	2.0220	69.1	1105	0.01447	0.000905	**62.6**
18	32.0	57.6	0.0641	2.0132	65.1	1041	0.01536	0.000961	**64.4**
19	32.1	57.8	0.0675	2.0045	61.3	982	0.01631	0.001018	**66.2**
20	32.2	58.0	0.0709	1.9959	57.8	926	0.01730	0.001080	**68**
21	32.3	58.2	0.0743	1.9873	54.5	873	0.01835	0.001145	**69.8**
22	32.4	58.4	0.0776	1.9788	51.5	824	0.01942	0.001214	**71.6**
23	32.5	58.6	0.0811	1.9703	48.60	778	0.02058	0.001286	**73.4**
24	32.6	58.8	0.0845	1.9620	45.92	735	0.02178	0.001361	**75.2**
25	32.8	59.0	0.0878	1.9536	43.40	695	0.02304	0.001439	**77**
26	32.9	59.2	0.0911	1.9453	41.05	657	0.02436	0.001522	**78.8**
27	33.0	59.3	0.0945	1.9370	38.83	622	0.02575	0.001608	**80.6**
28	33.1	59.5	0.0978	1.9288	36.74	589	0.02722	0.001698	**82.4**
29	33.2	59.7	0.1011	1.9207	34.78	557	0.02875	0.001795	**84.2**
30	33.3	59.9	0.1044	1.9126	32.95	528	0.03035	0.001894	**86**

PROPERTIES OF

Temperature, degrees Centigrade.	Pressure.			Heat of the liquid.		Heat of vaporization.		Heat equivalent of internal work.		Temperature, degrees Fahrenheit.
	Millimeters of mercury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	
t	p	p	p	q	q	r	r	ρ	ρ	t
31	33.57	0.04564	0.64[illegible]2	31.04	55.9	579.1	1042.4	545.7	982.2	**87.8**
32	35.5[illegible]	0.0483[illegible]	0.6871	32.04	57.7	578.6	1041.4	545.1	981.0	**89.6**
33	37.5[illegible]	0.05111	0.7269	33.04	59.5	578.0	1040.4	544.4	979.9	**91.4**
34	3[illegible].75	0.05404	0.7687	34.03	61.3	577.4	1039.4	543.7	978.7	**93.2**
35	4[illegible].02	0.05713	0.8126	35.03	6[illegible].1	576.9	1038.5	543.1	977.6	**95**
36	44.40	0.06037	0.8586	36.03	64.9	576.4	1037.5	542.5	976.4	**96.8**
37	46.90	0.06376	0.9068	37.02	66.6	575.8	1036.5	541.8	975.2	**98.6**
38	49.51	0.06731	0.9574	38.02	68.4	575.3	1035.5	541.2	974.0	**100.4**
39	52.2[illegible]	0.07105	1.0105	39.02	70.2	574.7	1034.5	540.5	972.8	**102.2**
40	55.13	0.07495	1.0661	40.02	72.0	574.2	1033.5	539.9	971.7	**104**
41	58.14	0.07[illegible]5	1.1243	41.01	73.8	573.6	1032.5	539.2	970.5	**105.8**
42	61.30	0.08334	1.1854	42.01	75.6	573.1	1031.5	538.6	969.3	**107.6**
43	64.5[illegible]	0.08782	1.2492	43.01	77.4	572.5	1030.5	537.9	968.2	**109.4**
44	68.0[illegible]	0.09252	1.3159	44.01	79.2	571.9	1029.4	537.2	966.9	**111.2**
45	71.66	0.09713	1.3858	45.00	81.0	571.3	1028.4	536.5	965.7	**113**
46	75.43	0.10256	1.4587	46.00	82.8	570.8	1027.4	535.8	964.5	**114.8**
47	79.3[illegible]	0.10792	1.5350	47.00	84.6	570.2	1026.4	535.1	963.3	**116.6**
48	83.5[illegible]	0.11353	1.6147	48.00	86.4	569.6	1025.3	534.4	962.0	**118.4**
49	87.8[illegible]	0.11937	1.6979	48.99	88.2	569.0	1024.3	533.7	960.8	**120.2**
50	92.3[illegible]	0.12549	1.7849	49.99	90.0	568.4	1023.2	533.0	959.6	**122**
51	96.99	0.13187	1.8756	50.99	91.8	567.8	1022.2	532.3	958.4	**123.8**
52	101.8[illegible]	0.13852	1.9701	51.99	93.6	567.3	1021.2	531.7	957.2	**125.6**
53	106.90	0.14546	2.0680	52.99	95.4	566.8	1020.2	531.1	956.0	**127.4**
54	112.30	0.15268	2.172	53.98	97.2	566.2	1019.1	530.4	954.7	**129.2**
55	117.85	0.16023	2.279	54.98	99.0	565.6	1018.1	529.7	953.5	**131**
56	123.61	0.16806	2.390	55.98	100.8	565.1	1017.1	529.1	952.3	**132.8**
57	129.63	0.17624	2.506	56.98	102.6	564.5	1016.1	528.4	951.1	**134.6**
58	135.8[illegible]	0.18475	2.627	57.98	104.4	563.9	1015.1	527.7	949.9	**136.4**
59	142.41	0.1[illegible]362	2.754	58.97	106.2	563.4	1014.1	527.1	948.7	**138.2**
60	149.1[illegible]	0.20284	2.885	59.97	108.0	562.8	1013.1	526.4	947.5	**140**
61	156.24	0.21242	3.021	60.97	109.8	562.2	1012.0	525.7	946.3	**141.8**
62	163.58	0.2224	3.163	61.97	111.6	561.7	1011.0	525.1	945.1	**143.6**
63	171.20	0.2328	3.310	62.97	113.4	561.1	1009.9	524.4	943.8	**145.4**
64	179.13	0.2435	3.464	63.98	115.2	560.5	1008.9	523.7	942.6	**147.2**
65	187.36	0.2547	3.623	64.98	117.0	559.9	1007.8	523.0	941.3	**149**
66	195.92	0.2664	3.789	65.98	118.8	559.3	1006.8	522.3	940.1	**150.8**
67	204.80	0.2784	3.960	66.98	120.6	558.8	1005.8	521.7	938.9	**152.6**
68	214.02	0.2910	4.139	67.98	122.4	558.2	1004.7	521.0	937.6	**154.4**
69	223.58	0.3040	4.324	68.98	124.2	557.6	1003.6	520.3	936.3	**156.2**
70	233.53	0.3175	4.516	69.98	126.0	556.9	1002.5	519.5	935.0	**158**

SATURATED STEAM (Continued)

Temperature, degrees Centigrade.	Heat equivalent of external work. Calories per kilogram.	Heat equivalent of external work. B.T.U. per pound.	Entropy of the liquid.	Entropy of vaporization.	Specific volume. Cubic meters per kilo.	Specific volume. Cubic feet per pound.	Density. Kilos per cubic meter.	Density. Pounds per cubic foot.	Temperature, degrees Fahrenheit.
t	Apu	Apu	θ	$\frac{r}{T}$	s	s	$\frac{1}{s}$	$\frac{1}{s}$	t
31	33.4	60.2	0.1077	1.9046	31.24	501	0.03201	0.00199[illegible]	87.8
32	33.5	60.4	0.1110	1.8966	29.62	474.7	0.03376	0.002107	89.6
33	33.6	60.5	0.1142	1.8886	28.08	449.7	0.03561	0.002224	91.4
34	33.7	60.7	0.1175	1.8806	26.62	426.5	0.03757	0.002345	93.2
35	33.8	60.9	0.1207	1.8728	25.25	4[illegible]4.7	0.03[illegible]	0.0[illegible]2471	95
36	33.9	61.1	0.1239	1.8650	23.08	384.2	0.0417[illegible]	0.002[illegible]3	96.8
37	34.0	61.3	0.1272	1.8572	22.78	364.9	0.043[illegible]	0.00274[illegible]	98.6
38	34.1	61.5	0.1304	1.8494	21.65	346.8	0.04619	0.002[illegible]	100.4
39	34.2	61.7	0.1336	1.8417	20.58	329.7	0.0485[illegible]	0.00303[illegible]	102.2
40	34.3	61.8	0.1368	1.8341	19.57	313.5	0.0[illegible]11	0.00319[illegible]	104
41	34.4	62.0	0.13[illegible]	1.8265	18.61	2[illegible]8.0	0.0[illegible]37	0.00335[illegible]	105.8
42	34.5	62.2	0.1431	1.818[illegible]	17.69	283.3	0.0565	0.00353[illegible]	107.6
43	34.6	62.3	0.1463	1.8113	16.82	269.5	0.0595	0.00[illegible]711	109.4
44	34.7	62.5	0.1494	1.8038	16.01	256.5	0.0625	0.0[illegible]	111.2
45	34.8	62.7	0.1526	1.76[illegible]3	15.25	244.4	0.0656	0.00409[illegible]	113
46	35.0	62.9	0.1557	1.7889	14.54	233.0	0.0688	0.004[illegible]	114.8
47	35.1	63.1	0.15[illegible]	1.7815	13.86	222.1	0.07[illegible]2	0.004502	116.6
48	35.2	63.3	0.1619	1.7742	13.21	211.7	0.0757	0.004724	118.4
49	35.3	63.5	0.1650	1.7669	12.60	201.9	0.0794	0.004[illegible]5	120.2
50	35.4	63.6	0.1682	1.7[illegible]7	12.02	1[illegible]2.6	0.0[illegible]32	0.00519	122
51	35.5	63.8	0.1713	1.7525	11.47	183.8	0.0872	0.00544	123.8
52	35.6	64.0	0.1743	1.7454	10.96	175.5	0.0[illegible]12	0.00570	125.6
53	35.7	64.2	0.1774	1.7383	10.47	167.7	0.0955	0.005[illegible]6	127.4
54	35.8	64.4	0.1804	1.7312	10.00	160.3	0.1000	0.00624	129.2
55	35.9	64.6	0.1835	1.7242	9.56	153.2	0.1046	0.00653	131
56	36.0	64.8	0.1865	1.7173	9.14	146.5	0.1094	0.00683	132.8
57	36.1	65.0	0.1895	1.7104	8.74	140.1	0.1144	0.00713	134.6
58	36.2	65.2	0.1925	1.7035	8.36	134.0	0.1196	0.00746	136.4
59	36.3	65.4	0.1955	1.6967	8.00	128.3	0.1250	0.00779	138.2
60	36.4	65.6	0.1986	1.6899	7.66	122.8	0.1305	0.00814	140
61	36.5	65.7	0.2016	1.6831	7.34	117.6	0.1362	0.00850	141.8
62	36.6	65.9	0.2046	1.6764	7.03	112.7	0.1422	0.00887	143.6
63	36.7	66.1	0.2075	1.6696	6.74	108.0	0.1484	0.00926	145.4
64	36.8	66.3	0.2105	1.6629	6.46	103.5	0.1548	0.00966	147.2
65	36.9	66.5	0.2135	1.6563	6.19	99.2	0.1615	0.01008	149
66	37.0	66.7	0.2164	1.6497	5.94	95.1	0.1684	0.01051	150.8
67	37.1	66.9	0.2194	1.6431	5.70	91.3	0.1754	0.01095	152.6
68	37.2	67.1	0.2223	1.6366	5.47	87.6	0.1828	0.01142	154.4
69	37.3	67.3	0.2253	1.6300	5.25	84.1	0.1905	0.01189	156.2
70	37.4	67.4	0.2282	1.6235	5.04	80.7	0.1984	0.01239	158

PROPERTIES OF

Temperature, degrees Centigrade.	Pressure.			Heat of the liquid.		Heat of vaporization.		Heat equivalent of internal work.		Temperature, degrees Fahrenheit.
	Millimeters of mercury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	
t	p	p	p	q	q	r	r	ρ	ρ	t
71	243.8	0.3315	4.715	70.98	127.8	556.4	1001.5	518.8	933.9	**159.8**
72	254.5	0.3460	4.921	71.99	129.6	555.8	1000.4	518.1	932.6	**161.6**
73	265.6	0.3611	5.136	72.99	131.4	555.2	999.4	517.4	931.4	**163.4**
74	277.1	0.3767	5.358	73.99	133.2	554.6	998.3	516.7	930.1	**165.2**
75	289.0	0.3929	5.589	74.99	135.0	554.0	997.3	516.0	928.8	**167**
76	301.3	0.4096	5.826	76.00	136.8	553.4	996.2	515.3	927.6	**168.8**
77	314.0	0.4269	6.072	77.00	138.6	552.9	995.2	514.7	926.4	**170.6**
78	327.2	0.4449	6.327	78.00	140.4	552.3	994.1	514.0	925.2	**172.4**
79	340.9	0.4635	6.592	79.01	142.2	551.7	993.0	513.3	923.9	**174.2**
80	355.1	0.4828	6.867	80.01	144.0	551.1	991.9	512.6	922.6	**176**
81	369.7	0.5026	7.150	81.02	145.8	550.5	990.8	511.9	921.3	**177.8**
82	384.9	0.5233	7.443	82.02	147.6	549.9	989.8	511.2	920.1	**179.6**
83	400.5	0.5445	7.745	83.03	149.4	549.3	988.7	510.5	918.8	**181.4**
84	416.7	0.5665	8.058	84.03	151.2	548.7	987.6	509.8	917.6	**183.2**
85	433.5	0.5894	8.383	85.04	153.1	548.1	986.5	509.1	916.3	**185**
86	450.8	0.6129	8.717	86.04	154.9	547.4	985.4	508.3	915.0	**186.8**
87	468.6	0.6371	9.062	87.05	156.7	546.8	984.3	507.6	913.7	**188.6**
88	487.1	0.6623	9.419	88.06	158.5	546.2	983.2	506.9	912.5	**190.4**
89	506.1	0.6881	9.787	89.06	160.3	545.6	982.1	506.2	911.2	**192.2**
90	525.8	0.7149	10.167	90.07	162.1	544.9	980.9	505.4	909.9	**194**
91	546.1	0.7425	10.560	91.08	163.9	544.3	979.8	504.7	908.5	**195.8**
92	567.1	0.7710	10.966	92.08	165.7	543.7	978.7	504.0	907.2	**197.6**
93	588.7	0.8004	11.384	93.09	167.5	543.1	977.6	503.3	906.0	**199.4**
94	611.0	0.8307	11.815	94.10	169.3	542.5	976.5	502.6	904.7	**201.2**
95	634.0	0.8620	12.260	95.11	171.2	541.9	975.4	501.9	903.4	**203**
96	657.7	0.8942	12.718	96.12	173.0	541.2	974.2	501.1	902.1	**204.8**
97	682.1	0.9274	13.190	97.12	174.8	540.6	973.1	500.4	900.8	**206.6**
98	707.3	0.9616	13.678	98.13	176.6	539.9	971.9	499.6	899.4	**208.4**
99	733.3	0.9970	14.180	99.14	178.5	539.3	970.8	498.9	898.2	**210.2**
100	760.0	1.0333	14.697	100.2	180.3	538.7	969.7	498.2	896.9	**212**
101	787.5	1.0707	15.229	101.2	182.1	538.1	968.5	497.5	895.5	**213.8**
102	815.9	1.1093	15.778	102.2	183.9	537.4	967.3	496.8	894.1	**215.6**
103	845.1	1.1490	16.342	103.2	185.7	536.8	966.2	496.1	892.9	**217.4**
104	875.1	1.1898	16.923	104.2	187.6	536.2	965.1	495.4	891.6	**219.2**
105	906.1	1.2319	17.522	105.2	189.4	535.6	964.0	494.7	890.3	**221**
106	937.9	1.2752	18.137	106.2	191.2	534.9	962.8	493.9	889.0	**222.8**
107	970.6	1.3196	18.769	107.2	193.0	531.2	961.6	493.1	887.6	**224.6**
108	1004.3	1.3653	19.420	108.2	194.8	533.6	960.5	492.4	886.3	**226.4**
109	1038.8	1.4123	20.089	109.3	196.7	532.9	959.3	491.6	885.0	**228.2**
110	1074.5	1.4608	20.777	110.3	198.5	532.3	958.1	490.9	883.6	**230**

SATURATED STEAM (Continued)

Temperature, degrees, Centigrade.	Heat equivalent of external work.		Entropy of the liquid.	Entropy of vaporization.	Specific volume.		Density.		Temperature, degrees Fahrenheit.
	Calories per kilogram.	B.T.U. per pound.			Cubic meters per kilo.	Cubic feet per pound.	Kilos per cubic meter.	Pounds per cubic foot.	
t	Apu	Apu	θ	$\frac{r}{T}$	s	s	$\frac{1}{s}$	$\frac{1}{s}$	t
71	37.6	67.6	0.2311	1.6171	4.838	77.5	0.2067	0.01290	**159.8**
72	37.7	67.8	0.2340	1.6107	4.647	74.4	0.2152	0.01344	**161.6**
73	37.8	68.0	0.2639	1.6044	4.466	71.5	0.2239	0.01398	**163.4**
74	37.9	68.2	0.2398	1.5981	4.294	68.8	0.2329	0.01453	**165.2**
75	38.0	68.5	0.2427	1.5918	4.130	66.2	0.2421	0.01510	**167**
76	38.1	68.6	0.2456	1.5856	3.973	63.7	0.2517	0.01570	**168.8**
77	38.2	68.8	0.2484	1.5793	3.822	61.2	0.2616	0.01634	**170.6**
78	38.3	68.9	0.2513	1.5731	3.676	58.8	0.2720	0.01700	**172.4**
79	38.4	69.1	0.2541	1.5670	3.537	56.6	0.2827	0.01767	**174.2**
80	38.5	69.3	0.2570	1.5609	3.404	54.5	0.2938	0.01835	**176**
81	38.6	69.5	0.2598	1.5548	3.277	52.5	0.3052	0.01905	**177.8**
82	38.7	69.7	0.2626	1.5487	3.156	50.6	0.3168	0.01976	**179.6**
83	38.8	69.9	0.2654	1.5426	3.040	48.71	0.3289	0.02053	**181.4**
84	38.9	70.0	0.2682	1.5366	2.929	46.92	0.3414	0.02131	**183.2**
85	39.0	70.2	0.2711	1.5307	2.824	45.23	0.3541	0.02211	**185**
86	39.1	70.4	0.2739	1.5247	2.723	43.62	0.3672	0.02293	**186.8**
87	39.2	70.6	0.2767	1.5187	2.627	42.08	0.3807	0.02376	**188.6**
88	39.3	70.7	0.2795	1.5128	2.534	40.59	0.3946	0.02463	**190.4**
89	39.4	70.9	0.2823	1.5069	2.444	39.15	0.4091	0.02554	**192.2**
90	39.5	71.0	0.2851	1.5010	2.358	37.77	0.4241	0.02648	**194**
91	39.6	71.3	0.2879	1.4952	2.275	36.45	0.4395	0.02743	**195.8**
92	39.7	71.5	0.2906	1.4894	2.197	35.19	0.4552	0.02842	**197.6**
93	39.8	71.6	0.2934	1.4836	2.122	34.00	0.4713	0.02941	**199.4**
94	39.9	71.8	0.2961	1.4779	2.050	32.86	0.4878	0.03043	**201.2**
95	40.0	72.0	0.2989	1.4723	1.980	31.75	0.505	0.03149	**203**
96	40.1	72.1	0.3016	1.4666	1.913	30.67	0.523	0.03260	**204.8**
97	40.2	72.3	0.3043	1.4609	1.849	29.63	0.541	0.03375	**206.6**
98	40.3	72.5	0.3070	1.4552	1.787	28.64	0.560	0.03492	**208.4**
99	40.4	72.6	0.3097	1.4496	1.728	27.69	0.579	0.03611	**210.2**
100	40.5	72.8	0.3125	1.4441	1.671	26.78	0.598	0.03734	**212**
101	40.6	73.0	0.3152	1.4386	1.617	25.90	0.618	0.03861	**213.8**
102	40.6	73.2	0.3179	1.4330	1.564	25.06	0.639	0.03990	**215.6**
103	40.7	73.3	0.3205	1.4275	1.514	24.25	0.661	0.04124	**217.4**
104	40.8	73.5	0.3232	1.4220	1.465	23.47	0.683	0.04261	**219.2**
105	40.9	73.7	0.3259	1.4165	1.419	22.73	0.705	0.04400	**221**
106	41.0	73.8	0.3286	1.4111	1.374	22.01	0.728	0.04543	**222.8**
107	41.1	74.0	0.3312	1.4057	1.331	21.31	0.751	0.04692	**224.6**
108	41.2	74.2	0.3339	1.4003	1.289	20.64	0.776	0.04845	**226.4**
109	41.3	74.3	0.3365	1.3949	1.248	19.99	0.801	0.0500	**228.2**
110	41.4	74.5	0.3392	1.3895	1.209	19.37	0.827	0.0516	**230**

PROPERTIES OF

Temperature, degrees Centigrade.	Pressure.			Heat of the liquid.		Heat of vaporization.		Heat equivalent of internal work.		Temperature, degrees Fahrenheit.
	Millimeters of mercury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	
t	p	p	p	q	q	r	r	ρ	ρ	t
111	1111.1	1.5106	21.486	111.3	200.3	531.6	956.9	490.2	882.3	**231.8**
112	1148.7	1.5617	22.214	112.3	202.1	530.9	955.7	489.4	880.9	**233.6**
113	1187.4	1.6144	22.962	113.3	203.9	530.3	954.5	488.7	879.5	**235.4**
114	1227.1	1.6684	23.729	114.3	205.8	529.6	953.3	487.9	878.2	**237.2**
115	1267.9	1.7238	24.518	115.3	207.6	528.9	952.1	487.1	876.8	**239**
116	1309.8	1.7808	25.328	116.4	209.4	528.2	950.8	486.3	875.4	**240.8**
117	1352.8	1.8393	26.160	117.4	211.2	527.5	949.5	485.5	873.9	**242.6**
118	1397.0	1.8993	27.015	118.4	213.0	526.9	948.4	484.8	872.6	**244.4**
119	1442.4	1.9611	27.893	119.4	214.9	526.2	947.2	484.0	871.3	**246.2**
120	1488.9	2.0243	28.792	120.4	216.7	525.6	946.0	483.4	870.0	**248**
121	1536.6	2.0891	29.715	121.4	218.5	524.9	944.8	482.6	868.6	**249.8**
122	1585.7	2.1556	30.661	122.5	220.4	524.2	943.5	481.8	867.1	**251.6**
123	1636.0	2.2241	31.637	123.5	222.2	523.5	942.3	481.0	865.8	**253.4**
124	1687.5	2.2943	32.64	124.5	224.1	522.8	941.0	480.2	864.3	**255.2**
125	1740.5	2.3663	33.66	125.5	225.9	522.1	939.8	479.4	863.0	**257**
126	1794.7	2.4401	34.71	126.5	227.7	521.4	938.6	478.6	861.6	**258.8**
127	1850.3	2.5156	35.78	127.5	229.5	520.7	937.3	477.8	860.2	**260.6**
128	1907.3	2.5931	36.88	128.6	231.4	520.0	936.1	477.0	858.8	**262.4**
129	1965.8	2.6726	38.01	129.6	233.3	519.3	934.8	476.3	857.4	**264.2**
130	2025.6	2.7540	39.17	130.6	235.1	518.6	933.6	475.5	856.0	**266**
131	2086.9	2.8373	40.36	131.6	236.9	517.9	932.3	474.7	854.6	**267.8**
132	2149.8	2.9227	41.57	132.6	238.7	517.3	931.1	474.0	853.2	**269.6**
133	2214.0	3.0101	42.81	133.7	240.6	516.6	929.8	473.3	851.8	**271.4**
134	2280.0	3.0999	44.09	134.7	242.4	515.9	928.5	472.5	850.4	**273.2**
135	2347.5	3.1916	45.39	135.7	244.2	515.1	927.2	471.6	848.9	**275**
136	2416.5	3.2854	46.73	136.7	246.0	514.4	925.9	470.8	847.5	**276.8**
137	2487.3	3.3816	48.10	137.7	247.9	513.7	924.6	470.1	846.1	**278.6**
138	2559.7	3.4801	49.50	138.8	249.7	513.0	923.3	469.3	844.6	**280.4**
139	2633.8	3.581	50.93	139.8	251.6	512.3	922.1	468.5	843.3	**282.2**
140	2709.5	3.684	52.39	140.8	253.4	511.5	920.7	467.6	841.8	**284**
141	2787.1	3.789	53.89	141.8	255.3	510.7	919.3	466.8	840.2	**285.8**
142	2866.4	3.897	55.43	142.8	257.1	510.1	918.1	466.1	838.9	**287.6**
143	2947.7	4.008	57.00	143.9	259.0	509.3	916.7	465.3	837.4	**289.4**
144	3030.5	4.121	58.60	144.9	260.8	508.6	915.4	464.4	835.9	**291.2**
145	3115.3	4.236	60.24	145.9	262.7	507.8	914.1	463.6	834.5	**293**
146	3202.1	4.354	61.92	146.9	264.5	507.1	912.8	462.8	833.1	**294.8**
147	3290.8	4.474	63.64	148.0	266.4	506.4	911.5	462.0	831.6	**296.6**
148	3381.3	4.597	65.39	149.0	268.2	505.6	910.1	461.2	830.1	**298.4**
149	3474.0	4.723	67.18	150.0	270.1	504.9	908.8	460.4	828.7	**300.2**
150	3568.7	4.852	69.01	151.0	271.9	504.1	907.4	459.5	827.2	**302**

SATURATED STEAM (Continued)

Temperature, degrees Centigrade.	Heat equivalent of external work.		Entropy of the liquid.	Entropy of vaporization.	Specific volume.		Density.		Temperature, degrees Fahrenheit.
	Calories per kilogram.	B.T.U. per pound.			Cubic meters per kilo.	Cubic feet per pound.	Kilos per cubic meter.	Pounds per cubic foot.	
t	Apu	Apu	θ	$\frac{r}{T}$	s	s	$\frac{1}{s}$	$\frac{1}{s}$	t
111	41.4	74.6	0.3418	1.3842	1.172	18.77	0.853	0.0533	**231.8**
112	41.5	74.8	0.3445	1.3789	1.136	18.20	0.880	0.0550	**233.6**
113	41.6	75.0	0.3471	1.3736	1.101	17.64	0.908	0.0567	**235.4**
114	41.7	75.1	0.3498	1.3683	1.068	17.10	0.936	0.0585	**237.2**
115	41.8	75.3	0.3524	1.3631	1.036	16.59	0.965	0.0603	**239**
116	41.9	75.4	0.3550	1.3579	1.005	16.09	0.995	0.0622	**240.8**
117	42.0	75.6	0.3576	1.3527	0.9746	15.61	1.026	0.0641	**242.6**
118	42.1	75.8	0.3602	1.3475	0.9460	15.16	1.057	0.0659	**244.4**
119	42.2	75.9	0.3628	1.3423	0.9183	14.72	1.089	0.0679	**246.2**
120	42.2	76.0	0.3654	1.3372	0.8914	14.28	1.122	0.0700	**248**
121	42.3	76.2	0.3680	1.3321	0.8653	13.86	1.156	0.0721	**249.8**
122	42.4	76.4	0.3705	1.3269	0.8401	13.46	1.190	0.0743	**251.6**
123	42.5	76.5	0.3731	1.3218	0.8158	13.07	1.226	0.0765	**253.4**
124	42.6	76.7	0.3756	1.3167	0.7924	12.69	1.262	0.0788	**255.2**
125	42.7	76.8	0.3782	1.3117	0.7698	12.33	1.299	0.0811	**257**
126	42.8	77.0	0.3807	1.3067	0.7479	11.98	1.337	0.0835	**258.8**
127	42.9	77.1	0.3833	1.3017	0.7267	11.64	1.376	0.0859	**260.6**
128	43.0	77.3	0.3858	1.2967	0.7063	11.32	1.416	0.0883	**262.4**
129	43.0	77.4	0.3884	1.2917	0.6867	11.00	1.456	0.0909	**264.2**
130	43.1	77.6	0.3909	1.2868	0.6677	10.70	1.498	0.0935	**266**
131	43.2	77.7	0.3934	1.2818	0.6493	10.40	1.540	0.0961	**267.8**
132	43.3	77.9	0.3959	1.2769	0.6315	10.12	1.583	0.0988	**269.6**
133	43.3	78.0	0.3985	1.2720	0.6142	9.839	1.628	0.1016	**271.4**
134	43.4	78.1	0.4010	1.2672	0.5974	9.569	1.674	0.1045	**273.2**
135	43.5	78.3	0.4035	1.2623	0.5812	9.309	1.721	0.1074	**275**
136	43.6	78.4	0.4060	1.2574	0.5656	9.060	1.768	0.1104	**276.8**
137	43.6	78.5	0.4085	1.2526	0.5506	8.820	1.816	0.1134	**278.6**
138	43.7	78.7	0.4110	1.2479	0.5361	8.587	1.865	0.1165	**280.4**
139	43.8	78.8	0.4135	1.2431	0.5219	8.360	1.916	0.1196	**282.2**
140	43.9	78.9	0.4160	1.2383	0.5081	8.140	1.968	0.1229	**284**
141	43.9	79.1	0.4185	1.2335	0.4948	7.926	2.021	0.1262	**285.8**
142	44.0	79.2	0.4209	1.2288	0.4819	7.719	2.075	0.1296	**287.6**
143	44.0	79.3	0.4234	1.2241	0.4694	7.519	2.130	0.1330	**289.4**
144	44.2	79.5	0.4259	1.2194	0.4574	7.326	2.186	0.1365	**291.2**
145	44.2	79.6	0.4283	1.2147	0.4457	7.139	2.244	0.1401	**293**
146	44.3	79.7	0.4307	1.2100	0.4343	6.957	2.303	0.1437	**294.8**
147	44.4	79.9	0.4332	1.2054	0.4232	6.780	2.363	0.1475	**296.6**
148	44.4	80.0	0.4356	1.2008	0.4125	6.60[illegible]	2.424	0.1513	**298.4**
149	44.5	80.1	0.4380	1.1962	0.4022	6.443	2.486	0.1552	**300.2**
150	44.6	80.2	0.4405	1.1916	0.3921	6.282	2.550	0.1592	**302**

Temperature, degrees Centigrade.	Pressure.			Heat of the liquid.		Heat of vaporization.		Heat equivalent of internal work.		Temperature, degrees Fahrenheit.
	Millimeters of mercury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	
t	p	p	p	q	q	r	r	ρ	ρ	t
151	3665.3	4.984	70.88	152.1	273.8	503.4	906.1	458.7	825.7	**303.8**
152	3761.1	5.118	72.79	153.1	275.6	502.6	904.7	457.9	824.2	**305.6**
153	3861.9	5.255	74.74	154.1	277.4	501.9	903.3	457.1	822.7	**307.4**
154	3968	5.395	76.73	155.1	279.2	501.1	901.9	456.3	821.2	**309.2**
155	4073	5.538	78.76	156.2	281.1	500.3	900.5	455.4	819.6	**311**
156	4181	5.681	80.81	157.2	283.0	499.6	899.2	454.6	818.2	**312.8**
157	4290	5.833	82.96	158.2	284.8	498.8	897.8	453.8	816.7	**314.6**
158	4402	5.985	85.12	159.3	286.7	498.1	896.5	453.0	815.3	**316.4**
159	4517	6.141	87.33	160.3	288.5	497.3	895.1	452.1	813.7	**318.2**
160	4633	6.300	89.59	161.3	290.4	496.5	893.7	451.2	812.2	**320**
161	4752	6.462	91.89	162.3	292.2	495.7	892.3	450.4	810.7	**321.8**
162	4874	6.628	94.25	163.4	294.1	494.9	890.9	449.5	809.2	**323.6**
163	4998	6.796	96.65	164.4	295.9	494.2	889.5	448.7	807.7	**325.4**
164	5124	6.967	99.09	165.4	297.7	493.4	888.1	447.9	806.2	**327.2**
165	5253	7.142	101.58	166.5	299.6	492.6	886.7	447.0	804.7	**329**
166	5384	7.329	104.11	167.5	301.5	491.9	885.4	446.3	803.3	**330.8**
167	5518	7.502	106.71	168.5	303.3	491.1	883.9	445.4	801.7	**332.6**
168	5655	7.688	109.35	169.5	305.1	490.3	882.5	444.6	800.1	**334.4**
159	5794	7.877	112.04	170.6	307.0	489.5	881.0	443.7	798.5	**336.2**
170	5937	8.071	114.79	171.6	308.9	488.7	879.6	442.8	797.0	**333**
171	6081	8.268	117.59	172.6	310.7	487.9	878.3	441.9	795.6	**339.8**
172	6229	8.469	120.45	173.7	312.6	487.1	876.9	441.1	794.1	**341.6**
173	6379	8.673	123.36	174.7	314.5	486.3	875.4	440.2	792.5	**343.4**
174	6533	8.882	126.33	175.7	316.3	485.5	873.9	439.4	790.9	**345.2**
175	6689	9.094	129.35	176.8	318.2	484.7	872.4	438.5	789.3	**347**
176	6848	9.310	132.43	177.8	320.0	483.9	871.0	437.7	787.8	**348.8**
177	7010	9.531	135.56	178.8	321.8	483.1	869.5	436.8	786.2	**350.6**
178	7175	9.755	138.75	179.9	323.7	482.3	868.1	436.0	784.7	**352.4**
179	7343	9.983	142.00	180.9	325.6	481.4	866.6	435.0	783.1	**354.2**
180	7514	10.216	145.30	181.9	327.5	480.6	865.1	434.2	781.5	**356**
181	7688	10.453	148.67	183.0	329.3	479.8	863.6	433.3	779.9	**357.8**
182	7866	10.695	152.11	184.0	331.2	479.0	862.2	432.5	778.4	**359.6**
183	8046	10.940	155.60	185.0	333.0	478.2	860.7	431.6	776.9	**361.4**
184	8230	11.189	159.15	186.1	334.9	477.4	859.2	430.8	775.3	**363.2**
185	8417	11.444	162.77	187.1	336.8	476.6	857.7	429.9	773.7	**365**
186	8608	11.703	166.46	188.1	338.6	475.7	856.3	429.0	772.2	**366.8**
187	8802	11.967	170.21	189.2	340.5	474.8	854.7	428.0	770.5	**368.6**
188	8999	12.235	174.02	190.2	342.4	474.0	853.2	427.2	768.9	**370.4**
189	9200	12.508	177.90	191.2	344.2	473.2	851.7	426.3	767.4	**372.2**
190	9404	12.786	181.85	192.3	346.1	472.3	850.2	425.4	765.8	**374**

SATURATED STEAM (Continued)

Temperature, degrees Centigrade.	Heat equivalent of external work. Calories per kilogram.	Heat equivalent of external work. B.T.U. per pound.	Entropy of the liquid.	Entropy of vaporization.	Specific volume. Cubic meters per kilo.	Specific volume. Cubic feet per pound.	Density. Kilos per cubic meter.	Density. Pounds per cubic foot.	Temperature, degrees Fahrenheit.
t	Apu	Apu	θ	$\frac{r}{T}$	s	s	$\frac{1}{s}$	$\frac{1}{s}$	t
151	44.6	80.4	0.4429	1.1870	0.3824	6.126	2.615	0.1632	**303.8**
152	44.7	80.5	0.4453	1.1824	0.3729	5.974	2.682	0.1674	**305.6**
153	44.8	80.6	0.4477	1.1778	0.3637	5.826	2.750	0.1716	**307.4**
154	44.8	80.7	0.4501	1.1733	0.3548	5.683	2.818	0.1759	**309.2**
155	44.9	80.9	0.4525	1.1688	0.3463	5.546	2.888	0.1803	**311**
156	45.0	81.0	0.4549	1.1644	0.3380	5.413	2.959	0.1847	**312.8**
157	45.0	81.1	0.4573	1.1599	0.3298	5.282	3.032	0.1893	**314.6**
158	45.1	81.2	0.4596	1.1554	0.3218	5.154	3.108	0.1940	**316.4**
159	45.2	81.4	0.4620	1.1509	0.3140	5.029	3.185	0.1988	**318.2**
160	45.3	81.5	0.4644	1.1465	0.3063	4.906	3.265	0.2038	**320**
161	45.3	81.6	0.4668	1.1421	0.2989	4.789	3.345	0.2088	**321.8**
162	45.4	81.7	0.4692	1.1377	0.2920	4.677	3.425	0.2138	**323.6**
163	45.5	81.8	0.4715	1.1333	0.2855	4.571	3.503	0.2188	**325.4**
164	45.5	81.9	0.4739	1.1289	0.2792	4.469	3.582	0.2238	**327.2**
165	45.6	82.0	0.4763	1.1245	0.2729	4.368	3.664	0.2289	**329**
166	45.6	82.1	0.4786	1.1202	0.2666	4.268	3.751	0.2343	**330.8**
167	45.7	82.2	0.4810	1.1159	0.2603	4.168	3.842	0.2399	**332.6**
168	45.7	82.4	0.4833	1.1115	0.2540	4.070	3.937	0.2457	**334.4**
169	45.8	82.5	0.4857	1.1072	0.2480	3.975	4.032	0.2516	**336.2**
170	45.9	82.6	0.4880	1.1029	0.2423	3.883	4.127	0.2575	**338**
171	46.0	82.7	0.4903	1.0987	0.2368	3.794	4.223	0.2636	**339.8**
172	46.0	82.8	0.4926	1.0944	0.2314	3.709	4.322	0.2696	**341.6**
173	46.1	82.9	0.4949	1.0901	0.2262	3.626	4.421	0.2758	**343.4**
174	46.1	83.0	0.4972	1.0859	0.2212	3.545	4.521	0.2821	**345.2**
175	46.2	83.1	0.4995	1.0817	0.2164	3.467	4.621	0.2884	**347**
176	46.2	83.2	0.5018	1.0775	0.2117	3.391	4.724	0.2949	**348.8**
177	46.3	83.3	0.5041	1.0733	0.2072	3.318	4.826	0.3014	**350.6**
178	46.3	83.4	0.5064	1.0691	0.2027	3.247	4.933	0.3080	**352.4**
179	46.4	83.5	0.5087	1.0649	0.1983	3.177	5.04	0.3148	**354.2**
180	46.4	83.6	0.5110	1.0608	0.1941	3.109	5.15	0.3217	**356**
181	46.5	83.7	0.5133	1.0567	0.1899	3.041	5.27	0.3288	**357.8**
182	46.5	83.8	0.5156	1.0525	0.1857	2.974	5.38	0.3362	**359.6**
183	46.6	83.8	0.5178	1.0484	0.1817	2.911	5.50	0.3435	**361.4**
184	46.6	83.9	0.5201	1.0443	0.1778	2.849	5.62	0.3510	**363.2**
185	46.7	84.0	0.5224	1.0403	0.1740	2.787	5.75	0.3588	**365**
186	46.7	84.1	0.5246	1.0362	0.1702	2.727	5.88	0.3667	**366.8**
187	46.8	84.2	0.5269	1.0321	0.1666	2.669	6.00	0.3746	**368.6**
188	46.8	84.3	0.5291	1.0280	0.1632	2.614	6.13	0.3826	**370.4**
189	46.9	84.3	0.5314	1.0240	0.1598	2.560	6.26	0.3906	**372.2**
190	46.9	84.4	0.5336	1.0200	0.1565	2.507	6.39	0.3989	**374**

PROPERTIES OF

Temperature, degrees Centigrade.	Pressure.			Heat of the liquid.		Heat of vaporization.		Heat equivalent of internal work.		Temperature, degrees Fahrenheit.
	Millimeters of mercury.	Kilograms per square centimeter.	Pounds per square inch.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	Calories per kilogram.	B.T.U. per pound.	
t	*p*	*p*	*p*	*q*	*q*	*r*	*r*	*ρ*	*ρ*	*t*
191	9612	13.066	185.87	193.3	347.9	471.5	848.7	424.5	764.2	375.8
192	9822	13.353	189.96	194.4	349.8	470.6	847.1	423.6	762.5	377.6
193	10038	13.647	194.11	195.4	351.7	469.8	845.6	422.8	761.0	379.4
194	10256	13.944	198.33	196.4	353.5	468.9	844.1	421.9	759.4	381.2
195	10479	14.247	202.64	197.5	355.4	468.1	842.5	421.0	757.7	383
196	10705	14.554	207.01	198.5	357.3	467.2	841.0	420.1	756.1	384.8
197	10934	14.866	211.45	199.5	359.2	466.4	839.5	419.2	754.6	386.6
198	11168	15.184	215.96	200.6	361.1	465.6	838.0	418.4	753.0	388.4
199	11406	15.507	220.56	201.6	362.9	464.7	836.4	417.5	751.3	390.2
200	11647	15.835	225.23	202.7	364.8	463.8	834.8	416.6	749.7	392
201	11893	16.169	229.98	203.7	366.7	462.9	833.3	415.6	748.1	393.8
202	12142	16.508	234.80	204.7	368.5	462.1	831.8	414.8	746.6	395.6
203	12396	16.852	239.71	205.8	370.4	461.2	830.2	413.8	744.9	397.4
204	12654	17.202	244.68	206.8	372.3	460.3	828.6	412.9	743.3	399.2
205	12915	17.558	249.75	207.9	374.1	459.4	827.0	412.0	741.6	401
206	13181	17.921	254.89	208.9	376.0	458.6	825.4	411.1	740.0	402.8
207	13452	18.289	260.13	210.0	377.9	457.7	823.8	410.2	738.3	404.6
208	13727	18.663	265.45	211.0	379.8	456.8	822.2	409.3	736.7	406.4
209	14006	19.042	270.85	212.0	381.6	455.9	820.6	408.4	735.1	408.2
210	14290	19.428	276.34	213.1	383.5	455.0	819.1	407.5	733.6	410
211	14578	19.820	281.91	214.1	385.4	454.1	817.4	406.6	731.9	411.8
212	14871	20.218	287.57	215.2	387.3	453.2	815.8	405.7	730.2	413.6
213	15168	20.622	293.31	216.2	389.2	452.4	814.3	404.9	728.7	415.4
214	15470	21.033	299.16	217.3	391.1	451.5	812.7	404.0	727.1	417.2
215	15778	21.452	305.10	218.3	392.9	450.6	811.0	403.1	725.4	419
216	16090	21.876	311.14	219.3	394.8	449.6	809.3	402.1	723.7	420.8
217	16406	22.306	317.26	220.4	396.7	448.7	807.7	401.2	722.1	422.6
218	16728	22.743	323.48	221.4	398.5	447.8	806.1	400.3	720.5	424.4
219	17055	23.188	329.81	222.5	400.4	446.9	804.5	399.4	718.9	426.2
220	17387	23.639	336.24	223.5	402.3	446.0	802.9	398.5	717.3	428

SATURATED STEAM (Concluded)

Temperature, degrees Centigrade.	Heat equivalent of external work.		Entropy of the liquid.	Entropy of vaporization.	Specific volume.		Density.		Temperature, degrees Fahrenheit.
	Calories per kilogram.	B.T.U. per pound.			Cubic meters per kilo.	Cubic feet per pound.	Kilos per cubic meter.	Pounds per cubic foot.	
t	Apu	Apu	θ	$\frac{r}{T}$	s	s	$\frac{1}{s}$	$\frac{1}{s}$	t
191	47.0	84.5	0.5358	1.0160	0.1533	2.456	6.52	0.4072	**375.8**
192	47.0	84.6	0.5381	1.0120	0.1501	2.405	6.66	0.4158	**377.6**
193	47.0	84.6	0.5403	1.0080	0.1470	2.355	6.80	0.4246	**379.4**
194	47.0	84.7	0.5426	1.0040	0.1440	2.306	6.94	0.4336	**381.2**
195	47.1	84.8	0.5448	1.0000	0.1411	2.259	7.09	0.4426	**383**
196	47.1	84.9	0.5470	0.9961	0.1382	2.214	7.23	0.4516	**384.8**
197	47.2	84.9	0.5492	0.9922	0.1354	2.169	7.38	0.4610	**386.6**
198	47.2	85.0	0.5514	0.9882	0.1327	2.126	7.53	0.4704	**388.4**
199	47.3	85.1	0.5536	0.9843	0.1300	2.083	7.69	0.4801	**390.2**
200	47.3	85.1	0.5558	0.9804	0.1274	2.041	7.84	0.4900	**392**
201	47.3	85.2	0.5580	0.9765	0.1249	2.001	8.00	0.4998	**393.8**
202	47.3	85.2	0.5602	0.9727	0.1225	1.962	8.16	0.510	**395.6**
203	47.4	85.3	0.5624	0.9688	0.1201	1.923	8.33	0.520	**397.4**
204	47.4	85.3	0.5646	0.9650	0.1177	1.885	8.50	0.531	**399.2**
205	47.4	85.4	0.5668	0.9611	0.1153	1.847	8.67	0.541	**401**
206	47.5	85.4	0.5690	0.9572	0.1130	1.810	8.85	0.552	**402.8**
207	47.5	85.5	0.5712	0.9534	0.1108	1.774	9.03	0.564	**404.6**
208	47.5	85.5	0.5733	0.9496	0.1086	1.739	9.21	0.575	**406.4**
209	47.5	85.5	0.5755	0.9458	0.1065	1.705	9.39	0.587	**408.2**
210	47.5	85.5	0.5777	0.9420	0.1044	1.673	9.58	0.598	**410**
211	47.5	85.5	0.5799	0.9382	0.1024	1.640	9.77	0.610	**411.8**
212	47.5	85.6	0.5820	0.9344	0.1004	1.608	9.96	0.622	**413.6**
213	47.5	85.6	0.5842	0.9307	0.0984	1.577	10.16	0.634	**415.4**
214	47.5	85.6	0.5863	0.9269	0.0965	1.546	10.36	0.647	**417.2**
215	47.5	85.6	0.5885	0.9232	0.0947	1.516	10.56	0.660	**419**
216	47.5	85.6	0.5906	0.9195	0.0928	1.486	10.78	0.673	**420.8**
217	47.5	85.6	0.5927	0.9157	0.0910	1.458	10.99	0.686	**422.6**
218	47.5	85.6	0.5948	0.9120	0.0893	1.430	11.20	0.699	**424.4**
219	47.5	85.6	0.5969	0.9084	0.0876	1.403	11.41	0.713	**426.2**
220	47.5	85.6	0.5991	0.9047	0.0860	1.376	11.62	0.727	**428**

HIGH AND LOW TEMPERATURES OBTAINED BY VARIOUS MEANS

Absolute zero, −273° C.

Freezing-point of helium	−272° C.
Freezing-point of hydrogen	−259
Boiling-point of hydrogen	−252
Boiling-point of liquid air at atmospheric pressure	−192
Freezing-point of carbon dioxide	− 57

Industrial furnaces	+1700 to 1800°
Bunsen burner	1870
Oxy-coal gas flame	2000
Oxy-hydrogen flame	2800
Oxy-acetylene flame	3500
Electric arc (furnace)	3500

(Sun's Temperature, 5000° C.)

HEAT VALUES OF FUEL

(From Smithsonian Tables.)

Fuel.	Calories per gm.	B.T.U. per lb.
Coal:		
Lignite		
low grade	3247	5845
high grade	6764	12175
Sub-bituminous		
low grade	5115	9207
high grade	5865	10557
Bituminous		
low grade	6088	10958
high grade	7852	14134
Semi-bituminous		
Low grade	7845	14121
high grade	8166	14699
Semi-anthracite	7612	13702
Anthracite		
low grade	6987	12577
high grade	7417	13351
Peats (air dried):		
From Franklin Co., N. Y.	5726	10307
From Sawyer Co., Wis.	4867	8761
Liquid fuel:		
Petroleum ether	12215	21987
Gasoline	11250	20250
Kerosene	11100	19980
Fuel oils, heavy petroelum or refinery residue	10350	18630
Alcohol, fuel or denatured with 7–9 per cent water and denaturing material	6455	11619

HYGROMETRIC AND BAROMETRIC TABLES

CONVERSION TABLE FOR BAROMETRIC READINGS

U. S. inches to cm.

Inches.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
27.0	68.580	.606	.631	.656	.682	.707	.733	.758	.783	.809
27.1	.834	.860	.885	.910	.936	.961	.987	*.012	*.037	*.063
27.2	69.088	.114	.139	.164	.190	.215	.241	.266	.291	.317
27.3	.342	.368	.393	.418	.444	.469	.495	.520	.545	.571
27.4	.596	.622	.647	.672	.698	.723	.749	.774	.799	.825
27.5	.850	.876	.901	.926	.952	.977	*.002	*.028	*.053	*.079
27.6	70.104	.130	.155	.180	.206	.231	.257	.282	.307	.333
27.7	.358	.384	.409	.434	.460	.485	.511	.536	.561	.587
27.8	.612	.638	.663	.688	.714	.739	.765	.790	.815	.841
27.9	.866	.892	.917	.942	.968	.993	*.018	*.044	*.069	*.095
28.0	71.120	.146	.171	.196	.222	.247	.273	.298	.323	.349
28.1	.374	.400	.425	.450	.476	.501	.527	.552	.577	.603
28.2	.628	.654	.679	.704	.730	.755	.781	.806	.831	.857
28.3	.882	.908	.933	.958	.984	*.009	*.035	*.060	*.085	*.111
28.4	72.136	.162	.187	.212	.238	.263	.289	.314	.339	.365
28.5	.390	.416	.441	.466	.492	.517	.543	.568	.593	.619
28.6	.644	.670	.695	.720	.746	.771	.797	.822	.847	.873
28.7	.898	.924	.949	.974	*.000	*.025	*.051	*.076	*.101	*.127
28.8	73.152	.178	.203	.228	.254	.279	.305	.330	.355	.381
28.9	.406	.432	.457	.482	.508	.533	.559	.584	.609	.635
29.0	.660	.686	.711	.736	.762	.787	.813	.838	.863	.889
29.1	.914	.940	.965	.990	*.016	*.041	*.067	*.092	*.117	*.143
29.2	74.168	.194	.219	.244	.270	.295	.321	.346	.371	.397
29.3	.422	.448	.473	.498	.524	.549	.575	.600	.625	.651
29.4	.676	.702	.727	.752	.778	.803	.829	.854	.879	.905
29.5	.930	.956	.981	*.006	*.032	*.057	*.083	*.108	*.133	*.159
29.6	75.184	.210	.235	.260	.286	.311	.337	.362	.387	.413
29.7	.438	.464	.489	.514	.540	.565	.591	.616	.341	.667
29.8	.692	.718	.743	.768	.794	.819	.845	.870	.895	.921
29.9	.946	.972	.997	*.022	*.048	*.073	*.099	*.124	*.149	*.175
30.0	76.200	.226	.251	.277	.302	.327	.353	.378	.404	.429
30.1	.454	.480	.505	.531	.556	.581	.607	.632	.658	.683
30.2	.708	.734	.759	.785	.810	.835	.861	.886	.912	.937
30.3	.962	.988	*.013	*.039	*.064	*.089	*.115	*.140	*.166	*.191
30.4	77.216	.242	.267	.293	.318	.343	.369	.394	.420	.445
30.5	.470	.496	.521	.547	.572	.597	.623	.648	.674	.699
30.6	.724	.750	.775	.801	.826	.851	.877	.902	.928	.953
30.7	.978	*.004	*.029	*.055	*.080	*.105	*.131	*.156	*.182	*.207
30.8	78.232	.258	.283	.309	.334	.359	.385	.410	.436	.461
30.9	.486	.512	.537	.563	.588	.613	.639	.664	.690	.715

TEMPERATURE CORRECTION, BRASS SCALE

Metric

To reduce readings of a mercurial barometer with a brass scale to 0° C subtract the appropriate quantity as found in the table.

Temp. ° C.	Observed height in centimeters.								
	70 cm.	71 cm.	72 cm.	73 cm.	74 cm.	75 cm.	76 cm.	77 cm.	78 cm.
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	.011	.011	.012	.012	.012	.012	.012	.012	.013
2	.023	.023	.023	.024	.024	.024	.024	.025	.025
3	.034	.034	.035	.035	.036	.036	.037	.037	.038
4	.045	.046	.046	.047	.048	.048	.049	.050	.050
5	0.056	0.057	0.058	0.059	0.060	0.060	0.061	0.062	0.063
6	.068	.069	.069	.071	.072	.072	.073	.074	.075
7	.079	.080	.081	.082	.083	.085	.086	.087	.088
8	.090	.092	.093	.094	.095	.097	.098	.099	.101
9	.102	.103	.104	.106	.107	.109	.110	.112	.113
10	0.113	0.114	0.116	0.118	0.119	0.121	0.122	0.124	0.126
11	.124	.126	.128	.129	.131	.133	.135	.137	.138
12	.135	.137	.139	.141	.143	.145	.147	.149	.151
13	.147	.149	.151	.153	.155	.157	.159	.161	.164
14	.158	.160	.163	.165	.167	.169	.172	.174	.176
15	0.169	0.172	0.174	0.177	0.179	0.181	0.184	0.186	0.189
16	.181	.183	.186	.188	.191	.194	.196	.199	.201
17	.192	.195	.197	.200	.203	.206	.208	.211	.214
18	.203	.206	.209	.212	.215	.218	.221	.224	.227
19	.215	.218	.221	.224	.227	.230	.233	.236	.239
20	0.226	0.229	0.232	0.236	0.239	0.242	0.245	0.248	0.252
21	.237	.241	.244	.247	.251	.254	.258	.261	.264
22	.249	.252	.256	.259	.263	.266	.270	.273	.277
23	.260	.264	.267	.271	.275	.278	.282	.286	.290
24	.271	.275	.279	.283	.287	.291	.294	.298	.302
25	0.283	0.287	0.291	0.295	0.299	0.303	0.307	0.311	0.315
26	.294	.298	.302	.306	.311	.315	.319	.323	.327
27	.305	.310	.314	.318	.323	.327	.331	.336	.340
28	.317	.321	.326	.330	.335	.339	.344	.348	.353
29	.328	.333	.337	.342	.347	.351	.356	.361	.365
30	0.339	0.344	0.349	0.354	0.359	0.363	0.368	0.373	0.378

CONVERSION TABLE FOR PRESSURE UNITS

Correct for mercury at 0° C.

Cms. of Hg.	Grams per sq.cm.	Dynes per sq.cm. ($g = 980$).	Lbs. per sq.in.
1	13.5956	13,323.7	0.193376
2	27.1912	26,647.4	0.386752
3	40.7868	39,971.1	0.580123
4	54.3824	53,294.8	0.773504
5	67.9780	66,618.4	0.966880
6	81.5736	79,942.1	1.160256
7	95.1692	93,265.8	1.353632
8	108.7648	106,589.5	1.547008
9	122.3604	119,913.2	1.740384

TEMPERATURE CORRECTION, GLASS SCALE

METRIC

To reduce readings of a mercurial barometer with a glass scale to 0° C. subtract the appropriate quantity as found in table.

Temp. ° C.	Observed height in centimeters.								
	70 cm.	71 cm.	72 cm.	73 cm.	74 cm.	75 cm.	76 cm.	77 cm.	78 cm.
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	.012	.012	.013	.013	.013	.013	.013	.013	.014
2	.025	.025	.025	.026	.026	.026	.026	.027	.027
3	.036	.036	.037	.037	.038	.038	.039	.039	.040
4	.048	.049	.049	.050	.051	.051	.052	.053	.053
5	0.060	0.061	0.062	0.063	0.064	0.064	0.065	0.066	0.067
6	.073	.074	.074	.076	.077	.077	.078	.079	.080
7	.085	.086	.087	.088	.089	.091	.092	.093	.094
8	.096	.098	.099	.100	.101	.103	.104	.105	.107
9	.109	.110	.111	.113	.114	.116	.117	.119	.120
10	0.121	0.122	0.124	0.126	0.127	0.129	0.130	0.132	0.134
11	.133	.135	.137	.138	.140	.142	.144	.146	.147
12	.144	.146	.148	.150	.152	.154	.156	.158	.160
13	.157	.159	.161	.163	.165	.167	.169	.171	.174
14	.169	.171	.174	.176	.178	.180	.183	.185	.187
15	0.181	0.184	0.186	0.189	0.191	0.193	0.196	0.198	0.201
16	.194	.196	.199	.201	.204	.207	.209	.212	.214
17	.205	.208	.210	.213	.216	.219	.221	.224	.227
18	.217	.220	.223	.226	.229	.232	.235	.238	.241
19	.230	.233	.236	.239	.242	.245	.248	.251	.254
20	0.242	0.245	0.248	0.252	0.255	0.258	0.261	0.264	0.268
21	.254	.258	.261	.264	.268	.271	.275	.278	.281
22	.266	.269	.273	.276	.280	.283	.287	.290	.294
23	.278	.282	.285	.289	.293	.296	.300	.304	.308
24	.290	.294	.298	.302	.306	.310	.313	.317	.321
25	0.303	0.307	0.311	0.315	0.319	0.323	0.327	0.331	0.335
26	.315	.319	.323	.327	.332	.336	.340	.344	.348
27	.326	.331	.335	.339	.344	.348	.352	.357	.361
28	.339	.343	.348	.352	.357	.361	.366	.370	.375
29	.351	.356	.360	.365	.370	.374	.379	.384	.388
30	0.363	0.368	0.373	0.378	0.383	0.387	0.392	0.397	0.402

MASS OF WATER VAPOR IN SATURATED AIR

Mass in grams per cubic meter.

(From Smithsonian Tables.)

Temp. ° C.	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
−20	0.892	0.810	0.737	0.673	0.613	0.557	0.505	0.457	0.413	0.373
−10	2.154	1.978	1.811	1.658	1.519	1.395	1.282	1.177	1.079	0.982
− 0	4.835	4.468	4.130	3.813	3.518	3.244	2.988	2.752	2.537	2.340
+ 0	4.835	5.176	5.538	5.922	6.330	6.761	7.219	7.703	8.215	8.757
10	9.330	9.935	10.574	11.249	11.961	12.712	13.505	14.339	15.218	16.144
20	17.118	18.143	19.222	20.355	21.546	22.796	24.109	25.487	26.933	28.450
30	30.039	31.704	33.449	35.275	37.187	39.187	41.279	43.465	45.751	48.138

REDUCTION OF BAROMETER READINGS TO STANDARD TEMPERATURE

BRASS SCALE, BRITISH UNITS.

The table gives the corrections for the barometer reading in inches and the temperature in degrees Fahrenheit for a brass scale graduated to be correct at 62° F. The correction is to be subtracted.

Temp. °F.	Observed height in inches.								
	27.0	27.5	28.0	28.5	29.0	29.5	30.0	30.5	31.0
32	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.010
34	.013	.014	.014	.014	.014	.015	.015	.015	.015
36	.018	.019	.019	.019	.020	.020	.020	.021	.021
38	.023	.024	.024	.025	.025	.025	.026	.026	.027
40	.028	.029	.029	.030	.030	.031	.031	.032	.032
42	.033	.034	.034	.035	.036	.036	.038	.037	.038
44	.038	.039	.039	.040	.041	.041	.042	.043	.044
46	.043	.044	.044	.045	.046	.047	.048	.048	.049
48	.048	.049	.050	.050	.051	.052	.053	.054	.055
50	.053	.054	.055	.055	.057	.058	.058	.059	.060
52	.058	.059	.060	.060	.062	.063	.064	.065	.066
54	.062	.063	.065	.066	.067	.068	.069	.071	.072
56	.067	.068	.070	.071	.072	.074	.075	.076	.077
58	.072	.073	.075	.076	.078	.079	.080	.082	.083
60	.077	.078	.080	.081	.083	.084	.086	.087	.089
62	.082	.083	.085	.086	.088	.090	.091	.093	.094
64	.087	.088	.090	.092	.093	.095	.097	.098	.100
66	.092	.093	.095	.097	.099	.100	.102	.104	.105
68	.097	.098	.100	.102	.104	.106	.107	.109	.111
70	.102	.103	.105	.107	.109	.111	.113	.115	.117
72	.107	.108	.110	.112	.114	.116	.118	.120	.122
74	.111	.113	.116	.117	.120	.122	.124	.126	.128
76	.116	.118	.121	.123	.125	.127	.129	.131	.133
78	.121	.123	.126	.128	.130	.132	.135	.137	.139
80	.126	.128	.131	.133	.135	.138	.140	.142	.145
82	.131	.133	.136	.138	.141	.143	.146	.148	.150
84	.136	.138	.141	.143	.146	.148	.151	.153	.156
86	.141	.143	.146	.148	.151	.154	.156	.159	.162
88	.146	.148	.151	.154	.156	.159	.162	.165	.167
90	.151	.153	.156	.159	.162	.165	.167	.170	.173
92	.156	.158	.161	.164	.167	.170	.173	.176	.178
94	.160	.163	.166	.170	.172	.175	.178	.181	.184
96	.165	.168	.171	.174	.178	.181	.184	.187	.190
98	.170	.173	.177	.179	.183	.186	.189	.192	.195

CORRECTION FOR CAPILLARY DEPRESSION OF MERCURY IN A GLASS TUBE

Correction to be added.

Diam. of tube.	Height of meniscus in centimeters.							
	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18
cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
0.4	0.083	0.122	0.154	0.198	0.257			
0.5	.047	.065	.086	.119	.145	0.180		
0.6	.027	.041	.056	.078	.098	.121	0.143	
0.7	.018	.028	.040	.053	.067	.082	.097	.113
0.8	....	.020	.029	.038	.046	.056	.065	0.077
0.9	....	0.015	0.021	0.028	0.033	0.040	0.046	0.052
1.0	....	.....	.015	.020	.025	.029	.033	.037
1.1	....	.....	.010	.014	.018	.021	.024	.027
1.2	....	.....	.007	.010	.013	.015	.018	.019
1.3	....	.....	.004	.007	.010	.012	.013	.014

REDUCTION OF BAROMETER TO SEA LEVEL

Metric Units

Correction to be subtracted given in millimeters

(From Smithsonian Physical Tables)

Height above sea level in meters	Observed Height of Barometer in Millimeters						
	500	550	600	650	700	750	800
100	.....	.....	.....	.....	.02	.02	.02
200	.....	.....	.....	.....	.04	.05	.05
300	.....	.....	.....	.....	.07	.07	.07
400	.....	.....	.....	.....	.09	.10	.10
500	.....	.....	.....	.....	.11	.12	.13
600	.....	.....	.....	.12	.13	.14	
700	.....	.....	.....	.14	.15	.16	
800	.....	.....	.....	.16	.18	.19	
900	.....	.....	.....	.18	.20	.22	
1000	.....	.18	.19	.20	22	.24	
1100	.....	.19	.21	.22	.24		
1200	.....	.21	.23	.24	.26		
1300	.....	.22	.24	.26	.29		
1400	.....	.24	.26	.28	.31		
1500	24	.26	.28	.30	.33		
1600	.25	.28	.30	.32			
1700	.27	.30	.32	.34			
1800	.28	.31	.34	.36			
1900	.30	.33	.36	.39			
2000	.31	34	.38	.41			
2100	.33	.36	.40				
2200	.35	.38	.41				
2300	.36	.40	.43				
2400	.38	.42	.45				
2500	.39	.43	.47				

English Units

Height above sea level in feet	Observed Height in Inches						
	18	20	22	24	26	28	30
1000	.....	.....	.....	.....	.003	.003	.003
2000	.....	.....	.....	.004	.005	.005	.006
3000	.....	.....	.007	.007	.008	.008	
4000	.....	.....	.009	.009	.010		
4500	.....	.....	.010	.010	.011		
5000	.....	.010	.011	.011	.012		
5500	.....	.011	.012	.013			
6000	.....	.011	.013	.014			
6500	.011	.012	.014	.015			
7000	.012	.013	.015	.016			
7500	.013	.014	.016	.017			
8000	.014	.015	.017				
8500	.015	.016	.018				
9000	.016	.017	.019				
9500	.016	.018	.020				

REDUCTION OF BAROMETER TO LATITUDE 45°

Metric Scale

For latitudes below 45°, subtract the correction; for latitudes greater than 45° it is to be added. Corrections in cm.

(From Smithsonian Meteorological Tables.)

Latitude.		Observed Height of Barometer in Centimeters.					
		68	70	72	74	76	78
25°	65°	0.116	0.120	0.123	0.127	0.130	0.133
26	64	.111	.115	.118	.121	.125	.128
27	63	.106	.110	.113	.116	.119	.122
28	62	.101	.104	.107	.110	.113	.116
29	61	.096	.099	.102	.104	.107	.110
30	60	0.091	0.094	0.096	0.098	0.101	0.104
31	59	.085	.087	.090	.092	.095	.097
32	58	.079	.082	.084	.086	.089	.091
33	57	.074	.076	.078	.080	.082	.084
34	56	.068	.070	.072	.074	.076	.078
35	55	0.062	0.064	0.066	0.067	0.069	0.071
36	54	.056	.058	.059	.061	.063	.064
37	53	.050	.051	.053	.054	.056	.057
38	52	.044	.045	.046	.048	.049	.050
39	51	.038	.039	.040	.041	.042	.043
40	50	0.031	0.032	0.033	0.034	0.035	0.036
41	49	.025	.026	.027	.027	.028	.029
42	48	.019	.019	.020	.021	.021	.022
43	47	.013	.013	.013	.014	.014	.014
44	46	.006	.007	.007	.007	.007	.007

English Scale

Corrections in inches.

Latitude.		Observed Height in Inches.					
		25	26	27	28	29	30
25°	65°	0.043	0.044	0.046	0.048	0.050	0.051
26	64	.041	.043	.044	.046	.048	.049
27	63	.039	.041	.042	.044	.045	.047
28	62	.037	.039	.040	.042	.043	.045
29	61	.035	.037	.038	.039	.041	.042
30	60	0.033	0.035	0.036	0.037	0.039	0.040
31	59	.031	.032	.034	.035	.036	.037
32	58	.029	.030	.032	.033	.034	.035
33	57	.027	.028	.029	.030	.031	.032
34	56	.025	.026	.027	.028	.029	.030
35	55	0.023	0.024	0.025	0.025	0.026	0.027
36	54	.021	.021	.022	.023	.024	.025
37	53	.018	.019	.020	.021	.021	.022
38	52	.016	.017	.017	.018	.019	.019
39	51	.014	.014	.015	.015	.016	.017
40	50	0.012	0.012	0.012	0.013	0.013	0.014
41	49	.009	.010	.010	.010	.011	.011
42	48	.007	.007	.008	.008	.008	.008
43	47	.005	.005	.005	.005	.005	.006
44	46	.002	.002	.003	.003	.003	.003

RELATIVE HUMIDITY—DEW-POINT

The table gives the relative humidity of the air for temperature *t* and dew-point *d*.

(From Smithsonian Meteorological Tables.)

Depression of dew-point *t–d* ° C.	Dew-point (*d*).				
	−10	0	+10	+20	+30
0.0	100%	100%	100%	100%	100%
0.2	98	99	99	99	99
0.4	97	97	97	98	98
0.6	95	96	96	96	97
0.8	94	94	95	95	96
1.0	92	93	94	94	94
1.2	91	92	92	93	93
1.4	90	90	91	92	92
1.6	88	89	90	91	91
1.8	87	88	89	90	90
2.0	86	87	88	88	89
2.2	84	85	86	87	88
2.4	83	84	85	86	87
2.6	82	83	84	85	86
2.8	80	82	83	84	85
3.0	79	81	82	83	84
3.2	78	80	81	82	83
3.4	77	79	80	81	82
3.6	76	77	79	80	82
3.8	75	76	78	79	81
4.0	73	75	77	78	80
4.2	72	74	76	77	79
4.4	71	73	75	77	78
4.6	70	72	74	76	77
4.8	69	71	73	75	76
5.0	68	70	72	74	75
5.2	67	69	71	73	75
5.4	66	68	70	72	74
5.6	65	67	69	71	73
5.8	64	66	69	70	72
6.0	63	66	68	70	71
6.2	62	65	67	69	71
6.4	61	64	66	68	70
6.6	60	63	65	67	69
6.8	60	62	64	66	68
7.0	59	61	63	66	68
7.2	58	60	63	65	67
7.4	57	60	62	64	66
7.6	56	59	61	63	65
7.8	55	58	60	63	65

RELATIVE HUMIDITY—DEW-POINT (Continued)

Depression of dew-point $t-d$ °C.	Dew-point (d).				
	−10	0	+10	+20	+30
8.0	54	57	60	62	64
8.2	54	56	59	61	63
8.4	53	56	58	60	63
8.6	52	55	57	60	62
8.8	51	54	57	59	61
9.0	51	53	56	58	61
9.2	50	53	55	58	60
9.4	49	52	55	57	59
9.6	48	51	54	56	59
9.8	48	51	53	56	58
10.0	47	50	53	55	57
10.5	45	48	51	54	
11.0	44	47	49	52	
11.5	42	45	48	51	
12.0	41	44	47	49	
12.5	39	42	45	48	
13.0	38	41	44	46	
13.5	37	40	43	45	
14.0	35	38	41	44	
14.5	34	37	40	43	
15.0	33	36	39	42	
15.5	32	35	38	40	
16.0	31	34	37	39	
16.5	30	33	36	38	
17.0	29	32	35	37	
17.5	28	31	34	36	
18.0	27	30	33	35	
18.5	26	29	32	34	
19.0	25	28	31	33	
19.5	24	27	30	33	
20.0	24	26	29	32	
21.0	22	25	27		
22.0	21	23	26		
23.0	19	22	24		
24.0	18	21	23		
25.0	17	19	22		
26.0	16	18	21		
27.0	15	17	20		
28.0	14	16	19		
29.0	13	15	18		
30.0	12	14	17		

REDUCTION OF PSYCHROMETRIC OBSERVATION

For the reduction of observations with the wet and dry bulb thermometer. Assuming the relative velocity of the air to the thermometer bulbs is at least three meters per second; if t is the temperature of the air as indicated by the dry bulb, t_w, the temperature of the wet bulb, B, the barometric pressure, and E_w, the vapor tension of water corresponding to t_w, then the actual vapor tension is

$$E = E_w - 0.00066B(t - t_w)[1 + 0.00115(t - t_w)].$$

The value of the term

$$0.00066B(t - t_w)[1 + 0.00115(t - t_w)]$$

is given in the following table.

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission.)

$t - t_w$	Barometric Pressure B in Centimeters.							
	70.0	71.0	72.0	73.0	74.0	75.0	76.0	77.0
°	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
1	0.047	0.048	0.048	0.049	0.050	0.050	0.051	0.052
2	.093	.094	.096	.097	.098	.100	.101	.103
3	.139	.141	.143	.145	.147	.149	.152	.154
4	.186	.189	.191	.194	.197	.199	.202	.204
5	0.232	0.236	0.239	0.243	0.246	0.249	0.252	0.256
6	.279	.283	.287	.291	.295	.299	.303	.307
7	.326	.331	.336	.340	.345	.350	.354	.359
8	.373	.379	.384	.389	.395	.400	.405	.411
9	.421	.427	.432	.438	.444	.450	.456	.462
10	0.468	0.474	0.481	0.488	0.494	0.501	0.508	0.515
11	.515	.522	.530	.537	.544	.551	.559	.566
12	.562	.570	.578	.586	.594	.602	.611	.619
13	.610	.618	.627	.636	.645	.653	.662	.671
14	.658	.667	.676	.686	.695	.705	.714	.723
15	0.706	0.716	0.726	0.736	0.746	0.756	0.766	0.776
16	.754	.764	.775	.786	.796	.807	.818	.829
17	.802	.813	.824	.836	.847	.859	.870	.882
18	.850	.862	.874	.886	.898	.910	.922	.935
19	.898	.911	.923	.936	.949	.962	.975	.987
20	0.946	0.960	0.973	0.987	1.000	1.014	1.027	1.041

VELOCITY OF SOUND

Solids

Approximate values.
(From Smithsonian Tables.)

Substance.	Temp. ° C.	Veloc., meters per sec.	Veloc., feet per sec.	Observer.
Metals:				
Aluminum	....	5104	16740	Masson
Brass	....	3500	11480	Various
Cadmium	....	2307	7570	Masson
Cobalt	....	4724	15500	Masson
Copper	20	3560	11670	Wertheim
Copper	100	3290	10800	Wertheim
Copper	200	2950	9690	Wertheim
Gold, soft	20	1743	5717	Wertheim
Gold, hard	....	2100	6890	Various
Iron and soft steel	....	5000	16410	Various
Iron	20	5130	16820	Wertheim
Iron	100	5300	17390	Wertheim
Iron	200	4720	15480	Wertheim
Iron cast steel	20	4990	16360	Wertheim
Iron cast steel	200	4790	15710	Wertheim
Lead	20	1227	4026	Wertheim
Magnesium	....	4602	15100	Melde
Nickel	....	4973	16320	Masson
Palladium	....	3150	10340	Various
Platinum	20	2690	8815	Wertheim
Platinum	100	2570	8437	Wertheim
Platinum	200	2460	8079	Wertheim
Silver	20	2610	8553	Wertheim
Silver	100	2640	8658	Wertheim
Tin	....	2500	8200	Various
Zinc	....	3700	12140	Various
Various:				
Brick	....	3652	11980	Chladni
Clay rock	....	3480	11420	Gray and Milne
Cork	....	500	1640	Stefan
Granite	....	3950	12960	Gray and Milne
Marble	....	3810	12500	Gray and Milne
Paraffin	15	1304	4280	Warburg
Slate	....	4510	14800	Gray and Milne
Tallow	16	390	1280	Warburg
Glass, from	....	5000	16410	Various
Glass, to	....	6000	19690	Various
Ivory	....	3013	9886	Ciccone & Campanile
Vulcanized rubber	0	54	177	Exner
Wax	17	880	2890	Stefan
Woods:				
Ash, along the fiber	....	4670	15310	Wertheim
Ash, across the rings	....	1390	4570	Wertheim
Ash, along the rings	....	1260	4140	Wertheim
Beech, along the fiber	....	3340	10960	Wertheim
Elm, along the fiber	....	4120	13516	Wertheim
Fir, along the fiber	....	4640	15220	Wertheim
Maple, along the fiber	....	4110	13470	Wertheim
Oak, along the fiber	....	3850	12620	Wertheim
Pine, along the fiber	....	3320	10900	Wertheim
Poplar, along the fiber	....	4280	14050	Wertheim
Sycamore, along fiber	....	4460	14640	Wertheim

VELOCITY OF SOUND (Continued)

Liquids and Gases

(From Smithsonian Tables.)

Substance.	Temp. ° C.	Veloc., meters per sec.	Veloc., feet per sec.	Observer.
Liquids:				
Alcohol, 95%	12.5	1241.	4072.	Dorsing, 1908
Alcohol	20.5	1213.	3890.	Dorsing, 1908
Ammonia, conc.	16.	1663.	5456.	Dorsing, 1908
Benzine	17.	1166.	3826.	Dorsing, 1908
Carbon bisulphide	15.	1161.	3809.	Dorsing, 1908
Chloroform	15.	983.	3225.	Dorsing, 1908
Ether	15.	1032.	3386.	Dorsing, 1908
NaCl, 10% sol	15.	1470.	4823.	Dorsing, 1908
NaCl, 15% sol	15.	1530.	5020.	Dorsing, 1908
NaCl, 20% sol	15.	1650.	5414.	Dorsing, 1908
Turpentine oil	15.	1326.	4351.	Dorsing, 1908
Water, air-free	13.	1441.	4728.	Dorsing, 1908
Water, air-free	19.	1461.	4794.	Dorsing, 1908
Water, air-free	31.	1505.	4938.	Dorsing, 1908
Water, Lake Geneva	9.	1435.	4708.	Colladon-Sturm
Water, Seine River	15.	1437.	4714.	Wertheim
Water, Seine River	30.	1528.	5013.	Wertheim
Water, Seine River	60.	1724.	5657.	Wertheim
Gases:				
Air, dry, CO_2-free	0.	331.78	1088.5	Rowland
Air, dry,	0.	331.36	1087.1	Violle, 1900
Air, dry, CO_2-free	0.	331.92	1089.0	Thiesen, 1908
Air 1 atmosphere	0.	331.7	1088.	Mean
Air 25 atmospheres	0.	332.0	1089.	Mean (Witkowski)
Air 50 atmospheres	0.	334.7	1098.	Mean (Witkowski)
Air 100 atmospheres	0.	350.6	1150.	Mean (Witkowski)
Air	20.	344.	1129.	
Air	100.	386.	1266.	Stevens
Air	500.	553.	1814.	Stevens
Air	1000.	700.	2297.	Stevens
Ammonia	0.	415.	1361.	Masson
Carbon monoxide	0.	337.1	1106.	Wullner
Carbon dioxide	0.	258.0	846.	Bückendahl, 1906
Carbon disulphide	0.	189.	606.	Masson
Chlorine	0.	205.3	674.	Strecker
Ethylene	0.	314.	1030.	Dulong
Hydrogen	0.	1269.5	4165.	Dulong
Illuminating gas	0.	490.4	1609.	Zoch
Methane	0.	432.	1417.	Masson
Nitric oxide	0.	325.	1066.	Masson
Nitrous oxide	0.	261.8	859.	Dulong
Oxygen	0.	317.2	1041.	Dulong
Vapors:				
Alcohol	0.	230.6	756.	Masson
Ether	0.	179.2	588.	Masson
Water	0.	401.	1315.	Masson
Water	100.	404.8	1328.	Treitz, 1903
Water	130.	424.4	1392.	Treitz, 1903

MUSICAL SCALES

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission

VIBRATION FREQUENCY OF TONES IN THE MUSICAL SCALE FOR HIGHER OR LOWER OCTAVES ARE OBTAINED BY MULTIPLYING BY SOME POWER OF 2

Scientific diatonic scale. $C_3 = 256$.		Musical equal-tempered chromatic scale. $A_3 = 435$.			
C_3	256.	C_3	258.65	G_3	387.54
D_3	288.	$C\sharp_3$	274.03	$G\sharp_3$	410.58
E_3	320.	D_3	290.33	A_3	435.
F_3	341.33	$D\sharp_3$	307.59	$A\sharp_3$	460.87
G_3	384.	E_3	325.88	B_3	488.27
A_3	426.66	F_3	345.26	C_4	517.30
B_3	480.	$F\sharp_3$	365.79		
C_4	512.				

ELECTRICITY AND MAGNETISM

SPARKING POTENTIAL OR DIELECTRIC STRENGTH

Air

Potential in volts necessary to produce a spark in air at atmospheric pressure and ordinary temperatures, the potential required depends on the shape and size of the electrodes and increases with the pressure of the air.

(From Smithsonian Tables.)

Spark length. cm.	Point electrodes, steady potential.	Ball electrodes, 1 cm. diam.	
		Steady potential.	Alternating potential.
.02	....	1530	
.04	....	2430	
.06	....	3240	
.08	....	3990	3770
.10	3720	4560	4400
.2	4680	8490	7510
.3	5310	11340	10480
.4	5970	14340	13360
.5	6300	17220	16140
.6	6840	20070	18700
.8	8070	24780	23820
1.0	8670	27810	28380
2.0	10140	45480	42950
3.0	11250	46710	
4.0	12210	49100	
5.0	13050	50310	
6.0			
8.0	....	52400	
10.0	....	74300	

SPECIFIC INDUCTIVE CAPACITY

Solids

Atmospheric temperatures except where noted.

(From Smithsonian Tables.)

Substance.	Wave length.	Specific inductive capacity.	Observer.
Asphalt	∞	2.68	v. Pirani, 1903
Caoutchouc	∞	2.22	Gordon, 1879
Calcspar:			
⊥ to axis	∞	8.49	Fallinger, 1902
‖ to axis	∞	7.56	Fallinger, 1902
Diamond	∞	16.5	v. Pirani, 1903
Ebonite	∞	2.72	Winklemann, 1889
Glass flint, extra heavy	∞	9.90	Hopkinson, 1891
hard crown	∞	6.96	Hopkinson, 1891
lead (Powell)	∞	5.4–8.0	Gray-Dobbie, 1898
Jena, barium	∞	7.8–8.5	Löwe, 1898
Gutta percha	.....	3.3–4.9	(submarine-data)
Ice −5° C	1200	2.85	Thwing, 1894
−18°	5000	3.16	Abegg, 1897
−190°	75	1.76–1.88	Behn-Kiebitz, 1904
Iodine, cryst	75	4.00	Schmidt, 1903
Marble, Carrara	75	8.3	Schmidt, 1903
Mica	∞	5.66–5.97	Elsas, 1891
Mica, Canadian amber	∞	3.0	E. Wilson
Paraffin	∞	2.10	Zietkowski, 1900
Phosphorus, yellow	75	3.60	Schmidt, 1903
Porcelain, hard (Royal Berlin)	∞	5.73	Starke, 1897
Quartz:			
⊥ to axis	∞	4.69	Fallinger, 1902
‖ to axis	∞	5.06	Fallinger, 1902
Selenium	∞	6.13	Vonwiller-Mason, 1907
Shellac	∞	3.10	Winkelmann, 1889
Sulphur, amorphous	∞	3.98	v. Pirani, 1903
Sulphur, cast, fresh	∞	4.22	v. Pirani, 1903
Wood, dry:			
red beech	∞	4.83–2.51	
red beech	∞	7.73–3.63	
oak	∞	4.22–2.46	
oak	∞	6.84–3.64	

SPECIFIC INDUCTIVE CAPACITY (Continued)

Gases

The specific inductive capacity of a vacuum is taken as unity. Wave-lengths of the measuring current greater than 10,000 cm.

(Dielectric constant.)

Gas.	Temp. ° C.	Pressure in atmospheres.	Specific inductive capacity.	Observer.
Air	0	1	1.000590	Boltzmann, 1875
Air	19	20	1.0108	Tangl, 1907
Air	....	40	1.0218	Tangl, 1907
Air	....	60	1.0330	Tangl, 1907
Air	....	80	1.0439	Tangl, 1907
Air	....	100	1.0548	Tangl, 1907
Ammonia	20	1	1.00718	Bädeker, 1901
Carbon bisulphide	0	1	1.00290	Klemenčič
Carbon bisulphide	100	1	1.00239	Bädeker
Carbon dioxide	0	1	1.000985	Klemenčič
Carbon dioxide	15	10	1.008	Linde, 1895
Carbon dioxide	....	20	1.020	Linde, 1895
Carbon dioxide	....	40	1.060	Linde, 1895
Carbon monoxide	0	1	1.000690	Boltzmann
Ethylene	0	1	1.00131	Boltzmann
Hydrochloric acid	100	1	1.00258	Bädeker
Hydrogen	0	1	1.000264	Boltzmann
Methane	0	1	1.000944	Boltzmann
Nitrous oxide (N_2O)	0	1	1.00116	Boltzmann
Nitrous oxide (N_2O)	15	10	1.010	Linde, 1895
Nitrous oxide (N_2O)	....	20	1.025	Linde, 1895
Nitrous oxide (N_2O)	....	40	1.070	Linde, 1895
Sulphur dioxide	0	1	1.00993	Bädeker
Sulphur dioxide	0	1	1.00905	Klemenčič
Water vapor	145	4	1.00705	Bädeker

Liquids

Where the wave-length is not specified it is greater than 10,000 cm.

Liquid.	Temp. ° C.	Wave length.	Specific inductive capacity.	Observer.
Acetic acid	18	∞	9.7	Francke, 1893
Acetone	0	∞	26.6	Abegg, 1897
Air	−191	∞	1.43	v. Pirani, 1903
Alcohol:				
amyl	0	∞	17.4	Abegg-Seitz, 1899
amyl	+20	∞	16.0	Abegg-Seitz, 1899
ethyl	frozen	∞	2.7	Abegg-Seitz, 1899
ethyl	−120	∞	54.6	Abegg-Seitz, 1899

SPECIFIC INDUCTIVE CAPACITY (Continued)

Liquids (Continued)

Liquid.	Temp. ° C.	Wave length.	Specific inductive capacity.	Observer.
Alcohol:				
ethyl	−80	∞	44.3	Abegg-Seitz, 1899
ethyl	−40	∞	35.3	Abegg-Seitz, 1899
ethyl	0	∞	28.4	Abegg-Seitz, 1899
ethyl	+20	∞	25.8	Abegg-Seitz, 1899
ethyl	17	200	24.4	Drude, 1896
ethyl	17	75	23.0	Drude, 1896
ethyl	17	53	20.6	Marx, 1898
ethyl	17	4	8.8	Marx, 1898
ethyl	17	0.4	5.0	Lampa, 1896
methyl	0	∞	35.0	Abegg-Seitz, 1899
methyl	+20	∞	31.2	Abegg-Seitz, 1899
propyl	0	∞	24.8	Abegg-Seitz, 1899
propyl	+20	∞	22.2	Abegg-Seitz, 1899
Ammonia	−34	75	21–23	Goodwin-Thompson, 1899
Amyl acetate	19	∞	4.81	Löwe, 1898
Anilin	18	∞	7.316	Turner, 1900
Benzol (Benzene)	18	∞	2.288	Turner, 1900
Bromine	23	84	3.18	Schlundt
Carbon bisulphide	20	∞	2.626	Tangl, 1903
Carbon dioxide	−5	∞	1.60	Linde, 1895
Chlorine	−60	∞	2.15	Linde, 1895
Chloroform	18	∞	5.2	Turner, 1900
Ethyl ether	0	∞	4.68	Abegg, 1897
Ethyl ether	20	∞	4.30	Tangl, 1903
Glycerine	15	1200	56.2	Thwing, 1894
Hydrogen peroxide 46% in H_2O	18	75	84.7	Calvert, 1900
Hydrogen sulphide	10	∞	5.93	Eversheim, 1904
Nitrous oxide, N_2O	−88	∞	1.93	Hasenhörl, 1900
Oils:				
castor	11	∞	4.67	Arons-Rubens, 1892
cottonseed	14	∞	3.10	Salvioni, 1888
linseed	13	∞	3.35	Salvioni, 1888
olive	20	∞	3.11	Heinke, 1896
petroleum	....	2000	2.13	Marx
sperm	20	∞	3.17	Hopkinson, 1881
turpentine	20	∞	2.23	Hopkinson, 1881
Oxygen	−182	∞	1.49	Fleming-Dewar, 1896
Phenol	48	73	9.68	Drude, 1896
Sulphur dioxide	20	∞	14.0	Eversheim, 1904
Water	18	∞	81.07	Turner, 1900

SPARKING POTENTIAL OR DIELECTRIC STRENGTH

Various Insulators.

Potential to puncture in kilovolts per centimeter. 1 kilovolt = 1000 volts.

Substance.	Thickness used mm.	Kilovolts per cm.
Air, liquid	....	40–90
Ebonite	....	300–1100
Fiber	....	20
Glass	....	300–1500
Guttapercha	....	80–200
Kerosene	1.0	164
Linen, varnished	....	100–200
Mica	0.1	1500–2200
Mica	1.0	300–700
Oils:		
castor	0.2	190
castor	1.0	130
cottonseed	....	70
lard	0.2	140
lard	1.0	40
linseed, raw	0.2	185
raw	1.0	90
boiled	0.2	190
boiled	1.0	80
lubricating	....	50
olive	0.2	170
olive	1.0	75
paraffin	0.2	215
paraffin	1.0	160
sperm, mineral	0.2	180
mineral	1.0	85
natural	0.2	195
natural	1.0	90
turpentine	0.2	160
turpentine	1.0	110
Papers:		
beeswaxed	....	770
blotting	....	150
Manilla	....	25
paraffined	....	500
varnished	....	100–250
Paraffin:		
melted	....	75
solid, melt. point 43°	....	350
solid, melt. point 70°	....	450
Rubber	....	160–500
Vaseline	....	90–130
Xylol	0.2	140
Xylol	1.0	80

ELECTROMOTIVE FORCE AND COMPOSITION OF VOLTAIC CELLS

Standard Cells

(From Smithsonian Tables.)

Name of cell.	Negative pole.	Solution.	Positive pole.	Depolarizer.	E.M.F. in volts.
Weston normal..	Cadmium amalgam...	Saturated solution of $CdSO_4$.....	Mercury..	Paste of Hg_2SO_4 and $CdSO_4$	1.0183 at 20° C.
Clark standard..	Zinc amalgam.......	Saturated solution of $ZnSO_4$.....	Mercury..	Paste of Hg_2SO_4 and $ZnSO_4$.	1.4328 at 15° C.

Temperature equations:

Clark cell: $E_t = 1.4328[1 - 0.00119(t-15) - 0.000007(t-15)^2]$ volt

Weston cell: $E_t = 1.0183[1 - 0.0000406(t-20) - 0.00000095(t-20)^2 + 0.00000001(t-20)^3]$ volt

Double Fluid Cells

Name of cell.	Negative pole.	Solution.	Positive pole.	Solution.	E.M.F. in volts.
Bunsen.........	Amal. zinc.........	1 part H_2SO_4 to 12 parts H_2O....	Carbon...	Fuming nitric acid........	1.94
Bunsen.........	Amal. zinc.........	1 part H_2SO_4 to 12 parts H_2O....	Carbon...	HNO_3, density, 1.38.......	1.86
Bichromate.....	Amal. zinc..........	12 parts $K_2Cr_2O_7$ to 25 parts H_2SO_4 and 100 parts H_2O.	Carbon...	1 part H_2SO_4 to 12 parts H_2O	2.00
Bichromate.....	Amal. zinc..........	1 part H_2SO_4 to 12 parts H_2O....	Carbon...	12 parts $K_2Cr_2O_7$ to 100 parts H_2O..............	2.03
Daniell.........	Amal. zinc..........	1 part H_2SO_4 to 4 parts H_2O.....	Copper...	Saturated solution of $CuSO_4 + 5H_2O$...........	1.06
Daniell.........	Amal. zinc..........	5% solution of $ZnSO_4 + 6H_2O$....	Copper...	Saturated solution of $CuSO_4 + 5H_2O$...........	1.08
Daniell	Amal. zinc..........	1 part NaCl to 4 parts H_2O.....	Copper...	Saturated solution of $CuSO_4 + 5H_2O$...........	1.05
Grove..........	Amal. zinc..........	1 part H_2SO_4 to 12 parts H_2O....	Platinum .	Fuming nitric acid........	1.93
Grove..........	Amal. zinc..........	Solution of $ZnSO_4$..............	Platinum .	HNO_3 density 1.38........	1.66

ELECTROMOTIVE FORCE AND COMPOSITION OF VOLTAIC CELLS (Continued)

Double Fluid Cells (Continued)

Name of cell.	Negative pole.	Solution.	Positive pole.	Solution.	E.M.F. in volts.
Grove	Amal. zinc	H_2SO_4 solution, density 1.136	Platinum	HNO_3 density 1.33	1.79
Grove	Amal. zinc	H_2SO_4 solution, density 1.14	Platinum	HNO_3 density 1.19	1.66
Grove	Amal. zinc	NaCl solution	Platinum	HNO_3 density, 1.33	1.88

Single Fluid Cells

Name of cell.	Negative pole.	Solution.	Positive pole.	E.M.F.
Leclanché	Amal. zinc	Solution of sal-ammoniac	Carbon, depolarizer: manganese peroxide with powd. carbon	1.46
Edison-Lalande	Amal. zinc	Solution of caustic potash	Copper, depolarizer, CuO	0.70
Chloride of silver	Zinc	23% sol. of sal-ammoniac	Silver, depolarizer: silver chloride	1.02

Storage Cells

Name of cell.	Negative pole.	Solution.	Positive pole.	E.M.F.
Lead accumulator	Lead	H_2SO_4 solution of density 1.1	PbO_2	2.2
Regnier (1)	Copper	$CuSO_4 + H_2SO_4$	PbO_2	1.68 to 0.85, average, 1.3
Regnier (2)	Amal. zinc	$ZnSO_4$ solution	PbO_2 in H_2SO_4	2.36
Main	Amal. zinc	H_2SO_4, density about 1.1	PbO_2	2.50
Edison	Iron	KOH, 20% solution	A nickel oxide	1.1, mean of full discharge

CONTACT DIFFERENCE OF POTENTIAL

Metals

The values in the table give the potential in volts of the metal at the top of the column with respect to the metal named at the left.

(Tabulated from results by Pellat, 1881.)

	Antimony.	Bismuth.	Brass.	Copper.	Gold.	Iron.
Antimony	0	−.08	−.06	−.30	−.48	−.15
Bismuth	+.08	0	−.07	−.22	−.40	−.07
Brass	+.06	+.07	0	+.15	−.33	0
Copper	+.30	+.22	−.15	0	−.18	+.15
Gold	+.48	+.40	+.33	+.18	0	+.33
Iron	+.15	+.07	0	−.15	−.33	0
Lead	−.26	−.34	−.41	−.56	−.74	−.41
Nickel	+.06	−.02	−.09	−.24	−.42	−.09
Platinum	+.46	+.39	+.32	+.17	−.01	+.32
Silver	+.50	+.42	+.35	+.20	+.02	+.35
Tin	−.16	−.24	−.31	−.46	−.64	−.31
Zinc	−.41	−.49	−.56	−.71	−.89	−.56
Carbon*	.....	.....	+.41	+.37	.....	+.48
Mercury	.....	....	.....	+.31	.....	+.50

	Lead.	Nickel.	Platinum.	Silver.	Tin.	Zinc.	Carbon.
Antimony	+.26	−.06	−.46	−.50	+.16	+.41	
Bismuth	+.34	+.02	−.39	−.42	+.24	+.49	
Brass	+.41	+.09	−.32	−.35	+.31	+.56	−.41
Copper	+.56	+.24	−.17	−.20	+.46	+.71	−.37
Gold	+.74	+.42	+.01	−.02	+.64	+.89	
Iron	+.41	+.09	−.32	−.35	+.31	+.56	−.48
Lead	0	−.32	−.73	−.76	−.10	+.15	−.85
Nickel	+.32	0	−.41	−.44	+.22	+.47	
Platinum	+.73	+.41	0	−.03	+.63	+.88	−.11
Silver	+.76	+.44	+.03	0	+.66	+.91	
Tin	+.10	−.22	−.63	−.66	0	+.25	−.79
Zinc	−.15	−.47	−.88	−.91	−.25	0	−1.10
Carbon*	+.85	.....	+.11	.....	+.79	+1.10	0
Mercury	....	.....	+.16	....	....	....	+.09

* Ayrton and Perry.

DIFFERENCE OF POTENTIAL BETWEEN METALS IN SOLUTIONS OF SALTS

The table gives the difference in potential in hundredths of a volt between zinc in a normal solution of sulphuric acid and the metal named at the head of the columns in the solution named at the side. The signs given refer to the external difference of potential.

(Magnanini.)

Strength of the solution in gramme molecules per liter.	Difference of potential in centivolts.					
	Zinc	Cadmium	Lead.	Tin.	Copper.	Silver.
0.5 Sulphuric acid	0.0	36.6	51.3	51.3	100.7	121.3
1.0 Sodium hydroxide	−32.1	19.5	31.8	0.2	80.2	95.8
1.0 Potassium hydroxide	−42.5	15.5	32.0	−1.2	77.0	104.0
0.5 Sodium sulphate	1.4	35.6	50.8	51.4	101.3	120.9
1.0 Potassium nitrate	11.8	31.9	42.6	31.1	81.2	105.7
1.0 Sodium nitrate	11.5	32.3	51.0	40.9	95.7	114.8
0.5 Potassium bichromate	72.8	61.1	78.4	68.1	123.6	132.4
0.5 Potassium sulphate	1.8	34.7	51.0	40.9	95.7	114.8
0.2 Potassium chlorate	15.−10.	39.9	53.8	57.7	105.3	120.9
1.0 Ammonium chloride	2.9	32.4	51.3	50.9	81.2	101.7
1.0 Sodium chloride	......	31.9	51.2	50.3	80.9	101.3
1.0 Potassium chloride	......	32.1	51.6	52.6	81.6	107.6

PROPERTIES OF METALS AS CONDUCTORS

Metal	Resistivity microhm-centimeters 20° C.	Temp. coefficient 20° C.	Specific gravity.	Tensile strength, lbs./in.	Melting point ° C.
Advance. See *constantan*					
Aluminum	2.824	0.0039	2.70	30,000	659
Antimony	41.7	.0036	6.6	....	630
Arsenic	33.3	.0042	5.73	....	....
Bismuth	120	.004	9.8	....	271
Brass	7	.002	8.6	70,000	900
Cadmium	7.6	.0038	8.6	....	321
Calido. See *nichrome*					
Climax	87	.0007	8.1	150,000	1250
Cobalt	9.8	.0033	8.71	....	1480
Constantan	49	.00001	8.9	120,000	1190
Copper: annealed	1.7241	.00393	8.89	30,000	1083
hard-drawn	1.771	.00382	8.89	60,000	....
Eureka. See *constantan*					
Excello	92	.00016	8.9	95,000	1500
Gas Carbon	5000	—.0005	......	....	3500
German silver, 18%Ni	33	.0004	8.4	150,000	1100
Gold	2.44	.0034	19.3	20,000	1063
Ideal. See *constantan*					
Iron, 99.98% pure	10	.005	7.8	....	1530
Lead	22	.0039	11.4	3,000	327
Magnesium	4.6	.004	1.74	33,000	651
Manganin	44	.00001	8.4	150,000	910
Mercury	95.783	.00089	13.546	0	—38.9
Molybdenum, drawn	5.7	.004	9.0	....	2500
Monel metal	42	.0020	8.9	160,000	1300
Nichrome	100	.0004	8.2	150,000	1500
Nickel	7.8	.006	8.9	120,000	1452
Palladium	11	.0033	12.2	39,000	1550
Phosphor bronze	7.8	.0018	8.9	25,000	750
Platinum	10	.003	21.4	50,000	1755
Silver	1.59	.0038	10.5	42,000	960
Steel, E. B. B.	10.4	.005	7.7	53,000	1510
Steel, B. B.	11.9	.004	7.7	58,000	1510
Steel, Siemens-Martin	18	.003	7.7	100,000	1510
Steel, manganese	70	.001	7.5	230,000	1260
Tantalum	15.5	.0031	16.6	....	2850
Therlo	47	.00001	8.2	....	....
Tin	11.5	.0042	7.3	4,000	232
Tungsten, drawn	5.6	.0045	19	500,000	3400
Zinc	5.8	.0037	7.1	10,000	419

RESISTIVITY

Giving the resistivity ρ for metals, including alloys and carbon. Temperature coefficients of resistance are given in a succeeding table.

Material	Temp. °C.	Resistivity ohm-cm	Authority
Advance, see constantan			
Aluminum, commercial	20	2.828×10^{-6}	Bureau of Standards
Al 99.57, Si 0.29, Fe 0.14			
pure	−189	.64	Niccolai, 1907
	−100	1.53	"
	0	2.63	"
	+100	3.86	"
	400	8.0	"
Aluminum bronze	0	12.—13.	Various
Cu 97, Al 3	0	8.26	Pecheux, 1909
Cu 90, Al 10	0	12.6	"
Cu 6, Al 94	0	3.1	"
Antimony	20	41.7	Bureau of Standards
	−190	10.5	Eucken, Gelhoff
liquid	+860	120.	de la Rive
Argentan			
Cu 56, Ni 26	15	42.	Matthiessen
Arsenic	0	35.	"
Bismuth	18	119.0	Jäger, Diesselhorst
	100	160.2	" "
	−200	34.8	Various
	−100	75.6	"
	+100	156.5	Northrup, 1914
	200	214.5	"
liquid	300	128.9	"
"	500	139.9	"
"	700	150.8	"
Brass			
various	0	6.4—8.4	Various
hard drawn Cu 70.2, Zn 29.8	0	8.2	Siemens
annealed	0	7.0	"
Bronze			
Cu 88, Sn 12	20	18	
Cu 89, Sn 6, Zn 4	15	13.5	
Cadmium, drawn	18	7.54	Jäger, Diesselhorst
	100	9.82	" "
	−252.9	0.17	Euchen, Gehlhoff, 1912
	−200	1.66	" "
	−100	4.80	" "
	+300	16.50	Northrup, 1913
liquid	400	33.70	"
	500	35.12	"
	700	35.78	"
Caesium	0	19	Various
	−187	5.25	Guntz, Broniewski
	27	22.2	Hackspill
liquid	30	36.6	"
Calcium, Ca 99.57%	20	4.6	Swisher, 1917
Calido, (*See constantan*)			
Carbon	0	3500	
	500	2700	
	1000	2100	
	2000	1100	
	2500	900	

RESISTIVITY (Continued)

Material	Temp. °C.	Resistivity ohm-cm	Authority
Chromel, (*See nichrome*)			
Chromium	0	2.6×10^{-6}	Shukow
Climax,	20	87	Bureau of Standards
Cobalt, Co 99.8%	20	9.7	Reichardt, 1901
Constantan,	20	49	Bureau of Standards
Cu 60, Ni 40	−200	42.4	Niccolai
	−150	43.0	"
	−100	43.5	"
	−50	43.9	"
	0	44.1	"
	+100	44.6	"
	400	44.8	"
Copper, commercial annealed	20	1.724	Bureau of Standards
hard drawn	20	1.77	"
pure, annealed	20	1.692	Wolff, Dellinger 1910
	−258.6	.014	Niccolai
	−206.6	.163	"
	−150	.567	"
	−100	904	"
	+100	2.28	Northrup, 1914
	200	2.96	"
	500	5.08	"
	1000	9.42	"
liquid	1500	24.62	"
Copper-manganese			
Cu 96.5, Mn 3.5		15	Feussner, Lindeck 1895
Cu 92, Mn 8		28.4	" "
Cu 70, Mn 30	0	101	
Copper-manganese-iron			
Cu 91, Mn 7.1, Fe 1.9	0	20	Blood
Cu 70.6, Mn 23.2, Fe 6.2	0	77	"
Copper-manganese-nickel			
Cu 73, Mn 24, Ni 3	0	48	Feussner, Lindeck
Eureka	0	47	Drysdale, 1907
Excello	20	92	Bureau of Standards
Gallium	0	53	Guntz, Broniewski
German silver, Ni 18%	20	33	Bureau of Standards
Cu 60.16, Zn 25.37, Ni 14.03, Fe 0.3, Co and Mn trace	−200	27.9	Dewar, Fleming
	−100	29.3	
	+100	33.1	
Gold, pure, drawn	20	2.44	Jäger, Diesselhorst
	−252.8	.018	Niccolai
	−200	.601	"
99.9 pure	−183	.68	Dewar, Fleming
	−150	.997	Niccolai, 1907
	−100	1.400	"
	+100	2.97	Northrup, 1914

RESISTIVITY (Continued)

Material	Temp. °C	Resistivity ohm-cm	Authority
Gold, 99.9 pure	200	3.83×10^{-6}	Northrop, 1914
	500	6.62	"
	1000	12.52	"
	1500	3.70	"
Gold-copper-silver			
Au 58.3, Cu 26.5, Ag 15.2	0	13.2	Matthiessen
Au 66.5, Cu 15.4, Ag 18.1	0	14.6	"
Au 7.4, Cu 78.3, Ag 14.3	0	3.6	"
Gold-silver			
Au 90, Ag 10	0	6.3	
Au 67, Ag 33	0	10.8	
Graphite	0	800	
	500	830	
	1000	870	
	2000	1000	
	2500	1100	
Ia — Ia			
Cu 60, Ni 40	0	50	Drysdale, 1907
Ideal, (*See constantan*)			
Illium		91.61	Knipp, Hall 1922
Indium	0	8.37	Erhardt, 1881
Invar (*See steel*)			
Iridium	−186	1.92	Broniewski, Hackspill
	0	6.10	" "
	100	8.30	" "
Iron 99.98% pure	20	10	Bureau of Standards
	−252.7	0.011	Niccolai
	−205.3	.652	Dawar, Fleming
	−200.	2.27	Niccolai
	−192.5	.844	"
	−100	5.92	"
	+100	16.61	"
	200	24.50	"
	400	43.29	"
(*See also under steel*)			
Lead	20	22.	Bureau of Standards
	−252.9	.59	Schimank, Nernst
	−203	4.42	" "
	−192.8	5.22	" "
	−103	11.8	
	+100	27.8	Northrup
	200	38	"
	319	50	"
liquid	333	95.0	"
"	400	98.3	"
"	600	107.2	"
"	800	116.2	"
cold pressed	−183	6.02	Dewar, Fleming
" "	−78	14.1	
" "	0	20.4	
" "	90.4	28.0	
" "	196.1	36.9	
Lithium	−187	1.34	Guntz, Broniewski
	0	8.55	" "
	99.3	12.7	" "

RESISTIVITY (Continued)

Material	Temp. °C.	Resistivity ohm-cm	Authority
Lithium liquid	230	45.2×10^{-6}	Bernini, 1905
Magnesium	20	4.6	Bureau of Standards
Zn free	−183	1.00	Dewar, Fleming
" "	−78	2.97	" "
" "	0	4.35	" "
" "	98.5	5.99	" "
pure	400	11.9	Niccolai, 1907
Manganese		5.0	Shukow
Manganese-copper Mn 30, Cu 70	0	100	Feussner, Lindeck
Manganin, Cu 84, Mn 12, Ni 4	20	44	Bureau of Standards
	22.5	45	Kimura, Sakamaki
	−200	37.8	Niccolai
	−100	38.5	"
	−50	38.7	"
	0	38.8	"
	100	38.9	"
	400	38.3	"
Mercury	20	95.783	Bureau of Standards
solid	−183.5	6.97	Dewar, Fleming
"	−102.9	15.04	" "
"	−50.3	12.3	" "
"	−39.2	25.5	" "
liquid	−36.1	80.6	" "
"	0	94.07	" "
"	50	98.50	Grimaldi
"	100	103.25	Vincentini, Omodei
"	200	114.27	" "
"	350	135.5	" "
"	100	103.1	Northrup
"	200	114.0	"
"	300	127.0	"
Molybdenum, drawn	20	5.7	Bureau of Standards
Monel metal	20	42	Bureau of Standards
Nichrome	20	100	Bureau of Standards
Nickel	20	7.8	Bureau of Standards
pure	−182.5	1.44	Fleming, 1900
"	−78.2	4.31	"
"	0	6.93	"
"	94.9	11.1	"
"	400	60.2	Niccolai, 1907
Nickel-copper-zinc Ni 12.84, Cu 30.59 Zn 6.57 by vol.	0	20.3	Matthiessen
Nickelin Ni 18.46, Cu 61.63 Zn 19.67, Fe 0.24 Co 0.19, Mn 0.18	0	33	Feussner, Lindeck
Osmium	20	60.2	Niccolai
Palladium	20	11	Bureau of Standards
	−183	2.78	Dewar, Fleming
	−78	7.17	" "
	0	10.21	" "
	98.5	13.79	" "
Patent nickel Ni 25.1, Cu 74.41 Fe 0.42, Zn 0.23 Mn 0.13, Co trace	0	34	Feussner, Lindeck
Phosphor bronze	0	5–10	Various

RESISTIVITY (Continued)

Material	Temp. °C.	Resistivity ohm-cm	Authority
Platinoid, Cu 62,	−160	32.5×10^{-6}	Lees, 1908
Ni 15, Zn 22	18	34.4	"
Platinum	20	10	Bureau of Standards
	−203.1	2.44	Dewar, Fleming
	−97.5	6.87	" "
	0	10.96	" "
	+100	14.85	" "
	400	26	Niccolai
	−265	.10	Nernst
	−253	.15	"
	−233	.54	"
	−153	4.18	"
	−73	7.82	"
	0	11.05	"
	+100	14.1	Pirrani
	200	17.9	"
	400	25.4	"
	800	40.3	"
	1000	47.0	"
	1200	52.7	"
	1400	58.0	"
	1600	63.0	"
Platinum-iridium			
P 90, Ir 10	0	24	Barnes, 1888
P 80, Ir 20	0	31	"
Platinum-rhodium	−200	14.49	Dewar, Fleming
Pt 90, Rh 10	−100	18.05	" "
	0	21.14	" "
	+100	24.20	" "
Platinum-silver	0	24.2	
Pt 67, Ag 33			
Platinite, nickel steel	0	45	
Ni 46–48%			
Potassium	−200	1.72	Guntz, Broniewski
	−100	3.72	" "
	−75	4.0	Hackspill
	0	6.1	"
	+55	8.4	"
liquid	100	15.31	Northrup
Rheotan	0	53	Feussner, Lindeck
Cu 53.28, Ni 25.31			
Zn 16.80, Fe 4.46			
Mn 0.37			
Rhodium	−186	0.7	Broniewski, Hackspill
	−78.3	3.09	" "
	0	4.69	" "
	+100	6.60	" "
Rose metal	0	64	
Bi 49, Pb 28,			
Sm 23			
Rubidium	−190	2.5	Hackspill
	0	11.6	
	+35	13.4	
liquid	40	19.6	
Silicium (silicon)	20	58.	
Silicium bronze	0	2.4	
Silver 99.98%	18	1.629	Jäger, Diesselhorst
electrolytic	−183	0.390	Dewar, Fleming
"	−78	1.021	" "

RESISTIVITY (Continued)

Material	Temp. °C.	Resistivity ohm-cm	Authority
Silver, 99.98%	0	1.468×10^{-6}	Dewar, Fleming
electrolytic	+98.15	2.062	" "
"	192.1	2.608	" "
	−258.6	.009	Niccolai
	−200	.357	"
	−100	.916	"
	0	1.506	"
	+100	2.15	Northrup
	200	2.80	"
	400	3.46	"
	750	6.65	"
liquid	1000	11.3	"
"	1500	15.3	"
Sodium	−180	1.0	Hackspill
	−75	2.8	"
	0	4.3	"
	55	5.4	"
liquid	116	10.2	"
"	−200	0.605	Various
	140	10.34	Northrup
Sodium-amalgam Hg 98, Na 2	0	95	
Steel			
aluminum	20	64	Portevin, 1909
Al 5, C 0.2			
Al 15, C 09	20	88	"
chromium	20	60	"
Cr 13, C oz			
Cr 40, C 08	20	71	
invar			
35% Ni	20	81	Bureau of Standards
manganese	20	70	" "
nickel			
Ni 10, C 0.1	20	29	
Ni 25, C 0.1	20	39	
Ni 80, C 0.1	20	82	Portevin, 1909
piano wire	0	11.8	Stronhal, Barnes
Siemens-martin	20	18	Bureau of Standards
silicon, Si 2.5%	20	45	
Si 4%	20	62	
tempered glass			
hard		45.7	Stronhal, Barnes
tempered yellow		27	" "
" blue		20.5	" "
" soft		15.9	" "
titanium			
Ti 2.5, C 0.15,	20	16	Portevin, 1909
tungsten			
W 5, C 0.2	20	20	"
W 20, C 0.2	20	24	"
vanadium			
V 5, C 1.1	20	121	"
Strontium	20	24.8	Matthiessen
Tantalium	20	15.5	Bureau of Standards
Tellurium	19.6	200,000.	Matthiessen
Thallium, pure	−183	4.08	Dewar, Fleming
	−78	11.8	" "
	0	17.60	" "
	+98.5	24.7	" "

RESISTIVITY (Concluded)

Material	Temp. °C.	Resistivity ohm-cm	Authority
Therlo	20	47×10^{-6}	Bolton, 1909
Thorium	15	40.1	Rentschler, Marden, 1925
	20	18	Bureau of Standards
Tin	20	11.5	Bureau of Standards
	−184	3.40	Dewar, Fleming
	−78	8.8	" "
	0	13.0	" "
	+91.45	18.2	" "
	200	20.30	Northrup
	225	22.00	"
liquid	235	47.60	"
	750	61.22	"
Tin-bismuth			
Sn 90.5, Bi 9.5,	12	16	
Sn 2., Bi 98	0	244	
Tin-lead			
Sn 90, Pb 10	15	13.5	
Sn 33.3, Pb 66.7	15	16	Laport, 1897
Titanium		3.2	Shukow
Tungsten	20	5.51	Langmuir, 1916
	727	25.3	"
	1227	59.4	"
	1727	59.4	"
	2727	98.9	"
	3237	118	"
Wood's metal			
Bi 56, Pb 14, Sn 14	0	52	
Zinc	−183	1.62	Dewar, Fleming
	−78	3.34	" "
	0	5.75	" "
	+92.5	8.00	
	191.5	10.37	
liquid	440	37.2	de la Rive
	100	7.95	Northrup
	300	13.25	"
	415	17.00	"
liquid	427	37.30	"
"	500	36.60	"
"	600	35.90	"
"	700	35.60	"
"	800	35.60	"
"	850	35.74	"

TEMPERATURE COEFFICIENT OF RESISTIVITY

Giving the temperature coefficient of resistivity for degrees centigrade for various metals including alloys.

Material	T °C.	α	Authority
Advance (*See constantan*)			
Aluminum	18	0.0039	Jäger, Diesselhorst, 1900
	25	.0034	Somerville, 1910
	100	.0040	"
	500	.0050	"
annealed, highest purity	0–100	.00445	Holborn, 1921
Aluminum-bronze			
Cu 97, Al 3		.00102	
Cu 90, Al 10		.00320	
Cu 6, Al 94		.00380	
Antimony	20	.0036	
Arsenic		.0042	
Bismuth	20	.004	Bureau of Standards
	0–100	.00446	Holborn, 1921
Brass	20	.002	Bureau of Standards
Cu 66, Zn 34	15	.0020	
Cu 60, Zn 40	15	.0010	
Bronze			
Cu 88, Sn 12	20	.0005	
Cadmium	20	.0038	Bureau of Standards
drawn			
annealed, pure	0–100	.00424	Holborn, 1921
	0	.0042	
Carbon		−.0005	
Climax	20	+.0007	Bureau of Standards
Cobalt	0	.0033	
	0–100	.00658	Holborn, 1921
Constantan	12	.000008	Somerville, 1911
	25	.000002	"
	100	.000033	"
	200	.000020	"
	500	.000027	"
Copper, annealed	20	.00393	Bureau of Standards
hard drawn	20	.00382	" "
	100	.0038	Somerville, 1911
	400	.0042	"
	1000	.0062	"
electrolytic	0	.0041	
pure, annealed	0–100	.00433	Holborn, 1921
Copper-manganese			
Cu 96.5, Mn 3.5		.00022	Feussner, Lindeck
Cu 95, Mn 5		.000026	" "
Cu 70, Mn 30		.00004	" "
Copper-manganese-iron			
Cu 91, Mn 7.1, Fe 1.9	0	.000120	Blood
Cu 70.6, Mn 23.2, Fe 6.2	0	.000022	"
Copper-manganese-nickel			
Cu 73, Mn 24, Ni 3	0	−.00003	Feussner, Lindeck
Eureka	0	+.00005	Drysdale, 1907
Excello	20	.00016	Bureau of Standards
German-silver			
Ni 18%	20	.0004	Bureau of Standards
Cu 60, Zn 25, Ni 15	0	.00036	Feussner, Lindeck
Gold	20	.0034	Bureau of Standards
	100	.0025	Somerville, 1910
	500	.0035	"
	1000	.0049	"
	0–100	.00400	Holborn, 1921

TEMPERATURE COEFFICIENT OF RESISTIVITY
(Continued)

Material	T °C.	α	Authority
Gold-copper-silver			
Au 58.3, Cu 26.5, Ag 15.2	0	.000574	Matthiessen
Au 66.5, Cu 15.4, Ag 18.1	0	.000529	"
Au 7.4, Cu 78.3, Ag 14.3	0	.001830	"
Gold-silver			
Au 90, Ag 10	0	.0012	
Au 67, Ag 33	0	.00065	
Ia Ia			
Cu 60, Ni 40	0	−.00003	Drysdale, 1907
Illium		+.000479	Knipp-Hall, 1922
Indium	0	.0047	
Iridium	0–100	.00411	Holborn, 1921
Iron	20	.0050	Bureau of Standards
	0	.0062	Dewar, Fleming
	25	.0052	Somerville, 1910
	100	.0068	"
	500	.0147	"
	1000	.0050	"
	0–100	.00657	Holborn, 1912
Lead	18	.0043	Jäger, Diesselhorst
pure	0–100	.00422	Holborn, 1921
Lithium	0	.0047	
	230	.0027	
Magnesium	20	.004	Bureau of Standards
	0	.0038	Vincentini, Omodei
	25	.0050	Somerville, 1910
	100	.0045	"
	500	.0036	"
	600	.0100	"
Manganese-copper	0	.000040	Feussner-Lindeck
Mn 30, Cu 70			
Manganin			
Cu 84, Mn 12, Ni 4	12	.000006	Somerville, 1910
	25	.000000	"
	100	−.000042	"
	250	−.000052	"
	475	.000000	"
	500	+.00011	"
Mercury	20	.00089	Bureau of Standards
	0	.00088	Glazebrook
Molybdenum	25	.0033	Somerville
	100	.0034	"
	1000	.0048	"
	0–100	.00435	Holborn, 1921
Monel-metal	20	.0020	Bureau of Standards
Nichrome	20	.0004	Bureau of Standards
Nickel	20	.006	Bureau of Standards
	0	.006	Vincentini
	25	.0043	Somerville
	100	.0043	"
	500	.0030	"
	1000	.0037	"
pure, annealed	0–100	.00675	Holborn, 1912
Palladium	20	.0033	Bureau of Standards
pure	0–100	.00377	Holborn
"	0	.0035	Dewar, Fleming
Phosphor-bronze	0	.0040 – .0030	

TEMPERATURE COEFFICIENT OF RESISTIVITY
(Concluded)

Material	T °C.	α	Authority
Platinite, nickel steel, Ni 46–48%	0	.003	
Platinum	20	.003	Bureau of Standards
	0	.0037	Dewar, Fleming
	0–100	.00392	Holborn, 1921
Platinum-iridium			
Pt 90, Ir 18	0	.0012	Barnes, 1888
Pt 80, Ir 20	0	.0008	"
Platinum-rhodium			
Pt 90, Rh 10	0	.0013	Le Chatelier, 1900
Platinum-silver			
Pt 33, Ag 67	0	.00024	
Potassium	0	.0055	
liquid	100	.0042	
Rheotan	0	.0004	
Rhodium	0–100	.00443	Holborn
Rose metal	0	.0020	
Rubidium	0	.0060	
Silicium bronze	0	.0038–.0023	
Silver	20	.0038	Bureau of Standards
	25	.0030	Somerville, 1910
	100	.0036	"
	500	.0044	"
pure, annealed	0–100	.00410	Holborn, 1921
Sodium	0	.0044	
liquid	120	.0033	
Steel			
invar	0	.0020	
Ni 36, C 0.2			
piano wire	0	.0032	Strouhal, Barnes
Siemens-Martin	20	.003	Bureau of Standards
Silicon			
Si 4%	20	.0008	
tempered glass hard	0	.0016	Strouhal, Barnes
tempered blue	0	.0033	" "
Tantalum	20	.0031	Bureau of Standards
	0–100	.00347	Holborn, 1921
Thallium	0	.0040	
liquid	295	.00035	
Therlo	20	.00001	Bureau of Standards
Thorium	20-1800	.0021	Rentschler, Marden, 1925
Tin	20	.0042	Bureau of Standards
Tungsten	18	.0045	Jäger, Diesselhorst
	500	.0057	Somerville
	1000	.0089	"
pure, annealed	0–100	.00465	Holborn, 1921
Wood's metal	0	.0020	
Zinc	20	.0037	Bureau of Standards
	0	.0040	
	0–100	.00415	Holborn, 1921

RESISTANCE OF ELECTROLYTES

Resistance of aqueous solutions of various salts and acids in ohms per centimeter cube for a temperature of 18° C.

(From observations by Kohlrausch.)

Salt.	Number of grams of salt in 100 grams solution.							
	5	10	15	20	25	30	40	50
Acetic acid	....	654.	616.	622.5	658.	714.	925.	1351.
Ammonium chloride	10.89	5.63	3.86	2.97	2.48			
Copper nitrate	27.4	15.7	11.7	9.82	9.17			
sulphate	52.9	31.2	23.7					
Hydrochloric acid	2.54	1.59	1.34	1.31	1.38	1.51	1.94	
Potassium iodide	29.5	14.7	....	6.88	....	4.34	3.16	2.55
Silver nitrate	39.0	21.0	14.64	11.46	9.45	8.07	6.39	5.39
Sodium carbonate	22.2	14.2	12.0					
chloride	14.94	8.33	6.10	5.11	4.69			
hydroxide	5.08	3.20	2.89	3.06	3.68	4.95	8.61	
Sulphuric acid	4.79	2.55	1.81	1.53	1.39	1.3[illegible]	1.47	1.85
Zinc chloride	20.7[illegible]	13.75	..	10.96	...	10.[illegible]	11.83	15.87
sulphate	52.3	31.2	24.1	21.4	20.8	22.5		
(Concentration)	6.2	12.4	18.6	24.8	31.	37.2	43.4	
Nitric acid	3.2	1.84	1.45	1.30	1.28	1.32	1.43	
(Concentration)	8.4	12.6	16.8	21.	25.2	29.4	33.6	
Potassium hydroxide	3.67	2.66	2.1[illegible]	1.96	1.[illegible]	1.84	1.91	

SAFE CARRYING CAPACITY OF COPPER WIRE

(From Collins' Design and Construction of Induction Coils, by permission.)

Brown & Sharpe gauge.	Diameter in mils.	Area in circular mils.	Number of amperes, exposed work.	Number of amperes, confined spaces.
18	40	1.624	5	3
17	45	2.048	6	4
16	51	2.583	8	6
15	57	3.257	10	8
14	64	4.106	16	12
13	72	5.178	19	14
12	81	6.530	23	17
11	91	8.234	27	21
10	102	10.380	32	25
9	114	13.090	39	29
8	128	16.510	46	33
7	144	20.820	56	39
6	162	26.250	65	45
5	182	33.100	77	53
4	204	41.740	92	63
3	229	52.630	110	75
2	258	66.370	131	88
1	289	83.690	156	105
0	325	105.500	185	125
00	365	133.100	220	150

CONDUCTIVITY OF STANDARD SOLUTIONS

Giving the conductivity in reciprocal ohms (mho) per cm. for NaCl, KCl, H_2SO_4 and $MgSO_4$ for various temperatures. Solutions are as follows: —

H_2SO_4, — maximum conductivity (18° C.); dissolve 378 g. of 97% acid in pure water and dilute to 1 liter. Density at 18° C., 1.223.

$MgSO_4$, — maximum conductivity (18° C.); dissolve in 1 liter of distilled water 552 g. of $MgSO_4 7H_2O$. Density at 18° C., 1.190.

NaCl, — solution saturated at all temperatures given. An excess of NaCl in distilled water, about 450 g. per liter. D = 1.2014 (18° C.).

KCl, — normal solution, 74.59 grams per liter of solution at 18° C. Dissolve 74.555 grams (weighed in air) of KCl and dilute to 1 liter. Density, 1.04492.

Solution.	0° C.	5°	10°	15°
H_2SO_4	0.5184	0.7952	0.6408	0.7028
$MgSO_4$	0.02877	0.03402	0.03963	0.04555
NaCl	0.1345	0.1555	0.1779	0.2014
KCl, normal	0.06541	0.07414	0.08319	0.09252
KCl, 1/10 normal	0.00715	0.00822	0.00933	0.01048
KCl, 1/100 normal	0.000776	0.000896	0.001020	0.001147

	16°	17°	18°	19°	20°
H_2SO_4	0.7151	0.7275	0.7398	0.7522	0.7645
$MgSO_4$	0.04676	0.04799	0.04922	0.05046	0.05171
NaCl	0.2062	0.2111	0.2160	0.2209	0.2259
KCl, n.	0.09441	0.09631	0.09822	0.10014	0.10207
KCl, 1/10 n.	0.01072	0.01095	0.01119	0.01143	0.01167
KCl, 1/100 n.	0.001173	0.001199	0.001225	0.001251	0.001278

	21°	22°	23°	24°	25°
H_2SO_4	0.7768	0.7890	0.8013	0.8135	0.8257
$MgSO_4$	0.05297	0.05424	0.05551	0.05679	0.05808
NaCl	0.2309	0.2360	0.2411	0.2462	0.2513
KCl, n.	0.10400	0.10594	0.10789	0.10984	0.11180
KCl, 1/10, n.	0.01191	0.01215	0.01239	0.01264	0.01288
KCl, 1/100 n.	0.001305	0.001332	0.001359	0.001386	0.001413

	26°	27°	28°	29°	30°
H_2SO_4	0.8378	0.8499	0.8620	0.8740	0.8860
$MgSO_4$	0.05937	0.06067	0.06197	0.06328	0.06459
NaCl	0.2565	0.2616	0.2669	0.2721	0.2774
KCl, n.	0.11377	0.11574	....	....	....
KCl, 1/10 n.	0.01313	0.01337	0.01362	0.01387	0.01412
KCl, 1/100 n.	0.002819	0.002873	0.002927	0.002981	0.003036

EQUIVALENT CONDUCTIVITY OF AQUEOUS SOLUTIONS

The conductivity is given in reciprocal ohms per centimeter cube. Concentration is given in milli-equivalents of solute per liter of solution. Corrected for conductance of water except in case of the strong acids.

Substance.	Concentration milli-equivalents per liter.	18° C.	100° C.
Acetic acid	0.	347.	773.
	10.	14.50	25.1
	30.	8.50	14.7
	80.	5.22	9.05
	100.	4.67	8.10
*Ammonium acetate	0.	99.8	338.
	10.	91.7	300.
	25.	88.2	286.
*Ammonium chloride	0.	131.1	415.
	2.	126.5	399.
	10.	122.5	382.
	30.	118.1	......
Ammonium hydroxide	0.	238.	647.
	10.	9.66	23.2
	30.	5.66	13.6
	100.	3.10	7.47
Barium ferrocyanide	0.	91.	521.
	2.	46.9	202.3
	12.5	30.4	129.8
Barium hydroxide	0.	222.	645.
	2.	215.	591.
	10.	207.	548.
	50.	191.1	478.
	100.	180.1	443.
Barium nitrate	0.	116.9	385.
	2.	109.7	352.
	10.	101.	322.
	40.	88.7	280.
	80.	81.6	258.
	100.	79.1	249.
Calcium ferrocyanide	0.	88.	512.
	100.	21.9	84.3
	200.	20.6	77.5
	400.	202.	76.2
Calcium nitrate	0.	70.4	369.
	2.	66.5	346.5
	50.	55.6	276.8
	100.	51.9	255.5
	200.	48.3	234.4

* Values have been corrected for hydrolysis.

EQUIVALENT CONDUCTIVITY OF AQUEOUS SOLUTIONS (Continued)

Substance.	Concentration milli-equivalents per liter.	18° C.	100° C.
Hydrochloric acid	0.	379.	850.
	2.	373.6	826.
	10.	368.1	807.
	80.	353.	762.
	100.	350.6	754.
Lanthanum nitrate	0.	75.4	413.
	2.	68.9	363.5
	12.5	61.4	311.2
	50.	54.	261.4
	100.	49.9	236.7
	200.	46.	210.8
Magnesium sulphate	0.	114.1	426.
	2.	94.3	302.
	10.	76.1	234.
	20.	67.5	190.
	40.	59.3	160.
	80.	52.	136.
	100.	49.8	130.
	200.	43.1	110.
Nitric acid	0.	377.	826.
	2.	371.2	806.
	10.	365.	786.
	50.	353.7	750.
	100.	346.4	728.
Phosphoric acid	0.	338.3	730.
	2.	283.1	498.
	10.	203.	308.
	50.	122.7	168.
	100.	95.7	128.
Potassium chloride	0.	130.1	414.
	2.	126.3	393.
	10.	122.4	377.
	80.	113.5	342.
	100.	112.	336.
Potassium citrate	0.	76.4	420.
	2.	71.	381.2
	5.	67.6	357.2
	50.	54.4	273.
	100.	50.2	247.5
	300.	43.5	209.5
Potassium nitrate	0.	80.8	384.
	2.	78.6	370.3
	12.5	75.3	351.5

EQUIVALENT CONDUCTIVITY OF AQUEOUS SOLUTIONS (Continued)

Substance.	Concentration milli-equivalents per liter.	18° C.	100° C.
Potassium nitrate	50.	70.7	326.1
	100.	67.2	308.5
Potassium ferrocyanide	0.	98.4	527.
	2.	84.8	427.6
	50.	58.2	272.4
	100.	53.	245.
	206.	48.8	222.3
	400.	45.4	203.1
Potassium oxalate	0.	79.4	419.
	2.	74.9	389.3
	50.	63.	312.2
	100.	59.3	288.9
	200.	55.8	265.1
Potassium sulphate	0.	132.8	455.
	2.	124.8	402.
	10.	115.7	365.
	40.	104.2	320.
	80.	97.2	294.
	100	95.	286.
Silver nitrate	0.	115.8	367.
	2.	112.2	353.
	10.	108.	337.
	20.	105.1	326.
	40.	101.3	312.
	80.	96.5	294.
	100.	94.6	289.
Sodium acetate	0.	78.1	285.
	2.	74.5	268.
	10.	71.2	253.
	80.	63.4	221.
Sodium chloride	0.	109.	362.
	2.	105.6	349.
	10.	102.	336.
	80.	93.5	301.
	100.	92.0	296.
Sodium hydroxide	0.	216.5	594.
	2.	212.1	582.
	20.	205.8	559.
	50.	200.6	540.
Sulphuric acid	0.	383.	891.
	2.	353.9	571.
	10.	309.	446.
	50.	253.5	384.
	100.	233.3	369.

THE EQUIVALENT CONDUCTANCE OF THE SEPARATE IONS

(From Smithsonian Physical Tables.)

Ion.	0°	18°	25°	50°	75°	100°	128°	156°
K	40.4	64.6	74.5	115	159	206	263	317
Na	26.	43.5	50.9	82	116	155	203	249
NH_4	40.2	64.5	74.5	115	159	207	264	319
Ag	32.9	54.3	63.5	101	143	188	245	299
$\frac{1}{2}$Ba	33.	55	65.	104	149	200	262	322
$\frac{1}{2}$Ca	30.	51	60.	98	142	191	252	312
$\frac{1}{3}$La	35.	61.	72.	119	173	235	312	388
Cl	41.1	65.5	75.5	116	160	207	264	318
NO_3	40.4	61.7	70.6	104	140	178	222	263
$C_2H_3O_2$	20.3	34.6	40.8	67	96	130	171	211
$\frac{1}{2}SO_4$	41.	68	79.	125	177	234	303	370
$\frac{1}{2}C_2O_4$	39.	63	73.	115	163	213	275	336
$\frac{1}{3}C_6H_5O_7$	36.	60.	70.	113	161	214		
$\frac{1}{4}Fe(CN)_6$	58.	95.	111.	173	244	321		
H	240.	314.	350.	465	565	644	722	777
OH	105.	172.	192.	284	360	439	525	592

RESISTIVITY OF DIELECTRICS

Giving the volume resistivity ρ, the variation of the volume resistivity with temperature, given as the ratio of the value at 20° C. to that at 30° C., and the surface resistivity for various dielectrics. The surface resistivity is the resistance between the opposite edges of a centimeter square. A large part of the data are from Curtis, Bulletin of the Bureau of Standards 1915. Temperatures, unless otherwise stated, are 22° C. The numbers in parentheses refer to the source of information.

Material	Volume resistivity			Surface resistivity, ohm-cm	
	Temp. °C.*	ρ ohm-cm	ρ^{20}/ρ^{30}	Humidity 50%	Humidity 90%
Amberite	22	5×10^{16}		2×10^{15}	3×10^{12}
Amber		5×10^{16}		6×10^{14}	1×10^{11}
Bakelite†					
No. 1		2×10^{11}		3×10^{11}	2×10^{8}
140		2×10^{7}	2.4	3×10^{8}	2×10^{5}
150		4×10^{12}	3.6	3×10^{12}	4×10^{9}
190		1×10^{11}	3.6	1×10^{11}	5×10^{8}
L 558		2×10^{16}	2.6	8×10^{15}	8×10^{14}
G5074		4×10^{10}		3×10^{11}	5×10^{5}
5199RGRB		5×10^{12}		6×10^{12}	1×10^{10}
5200		4×10^{11}	5.3	1×10^{12}	5×10^{9}
Bakelite micarta		5×10^{10}	2.4	2×10^{10}	1×10^{8}
Beeswax					
yellow, unrefined		20×10^{14}	16.0	$^{**}6 \times 10^{14}$	$^{**}5 \times 10^{16}$
	20	8×10^{14} (1)			
white		6×10^{14}			
	22	5×10^{14} (1)			
Celluloid		2×10^{10}	1.8	5×10^{10}	2×10^{9}
	16	4×10^{10} (2)			
Ceresin		$> 5 \times 10^{18}$		$> {}^{**}1 \times 10^{17}$	$> {}^{**}1 \times 10^{17}$
Condensite					
black		4×10^{10}	2.9	6×10^{10}	8×10^{8}
yellow		4×10^{10}	2.9	3×10^{11}	6×10^{9}
Dielectrite		5×10^{12}	3.0	5×10^{11}	4×10^{7}
Duranoid		3×10^{16}		6×10^{12}	3×10^{6}
Electrose, No. 8		2×10^{16}		1×10^{15}	2×10^{12}
black		1×10^{14}	2.0	1×10^{12}	6×10^{9}
yellow		5×10^{16}	2.3	3×10^{14}	5×10^{8}
Fibre, hard		2×10^{10}	3.2	5×10^{9}	3×10^{7}
red		5×10^{9}	2.6	2×10^{10}	2×10^{9}
	20	1×10^{8} (3)			
Galalith,					
black		2×10^{10}		8×10^{10}	3×10^{9}
white		1×10^{10}		4×10^{10}	6×10^{8}
Glass, German		5×10^{13}	2.5	4×10^{11}	6×10^{8}
	18	5×10^{11} (4)			
Kavalier		8×10^{15}	4.5	4×10^{12}	1×10^{9}
	17	1×10^{16} (5)			
opal		1×10^{12}	2.8		
plate, commercial		2×10^{13}	3.2	5×10^{10}	2×10^{8}
ordinary	20	9×10^{13}			
Bohemian	20	6×10^{12}			
Glyptol		1×10^{16}	3.0		
Gummon		3×10^{12}	1.4	2×10^{12}	3×10^{8}
Halowax 1001		2×10^{13}	2.5	$^{*}6 \times 10^{15}$	$^{*}5 \times 10^{11}$
5055 B		2×10^{16}			

* Temperature is .22°C. except where otherwise stated.
† For composition of bakelite samples see table following.
** Leakage resistivity.

RESISTIVITY OF DIELECTRICS (Continued)

Material	Volume resistivity			Surface resistivity, ohm-cm	
	Temp. °C.	ρ ohm-cm	ρ^{20}/ρ^{30}	Humidity 50%	Humidity 90%
Hard Rubber		1×10^{18}		3×10^{15}	2×10^{9}
		2×10^{15} (6)			
		3×10^{16} (?)			
Hemit		1×10^{10}	1.2	1×10^{10}	3×10^{8}
Insulate		8×10^{15}	1.0	3×10^{14}	3×10^{11}
Ivory		2×10^{8}	1.5	5×10^{9}	1×10^{9}
Khotinsky Cement		2×10^{15}	11.0	*7×10^{14}	*5×10^{11}
Lavite		2×10^{10}		1×10^{11}	1×10^{8}
Marble					
Italian		1×10^{11}		3×10^{9}	2×10^{7}
		1×10^{10} (?)			
Pink Tennessee		5×10^{9}		5×10^{9}	3×10^{7}
Blue Vermont		1×10^{9}		8×10^{9}	1×10^{7}
Mica	20	9×10^{15} (6)			
black African		4×10^{13}		3×10^{12}	3×10^{9}
brown African		2×10^{15}	1.2	3×10^{11}	1×10^{9}
colorless		2×10^{17}	2.0	2×10^{13}	8×10^{9}
India ruby		5×10^{13}	2.7	1×10^{10}	9×10^{7}
stained		2×10^{13} (7)			
Indian ruby		5×10^{16}	1.0		
slightly stained		4×10^{13} (7)			
Moulded mica		1×10^{16}	1.2	5×10^{13}	3×10^{9}
Paraffin (special)		$>5\times10^{18}$		*9×10^{15}	*6×10^{15}
parowax		1×10^{16}	2.0		
		3×10^{18} (8)			
	17	5×10^{16} (5)			
Porcelain, unglazed		3×10^{14}	1.6	6×10^{11}	5×10^{6}
glazed				2×10^{12}	5×10^{8}
Quartz crystal					
‖ to axis	17	2×10^{14} (5)			
	20	1×10^{14} (6)			
⊥ to axis	17	2×10^{16} (5)			
	20	3×10^{16} (6)			
fused		$>5\times10^{18}$		3×10^{12}	2×10^{8}
cleaned with chromic acid				3×10^{14}	2×10^{12}
Redmonite		2×10^{14}	2.0	5×10^{13}	3×10^{10}
Rosin		5×10^{16}	3.6	5×10^{14}	2×10^{14}
	17	7×10^{15} (5)			
Sealing wax		8×10^{16}	0.9	2×10^{15}	9×10^{13}
	19	1×10^{16} (1)			
Shellac		1×10^{16}	1.5	5×10^{13}	6×10^{9}
		9×10^{16} (?)			
Slate		1×10^{8}		9×10^{6}	1×10^{6}
		2×10^{8} (?)			
Stabalite		3×10^{13}	1.6	2×10^{13}	4×10^{7}
Sulfur		1×10^{17}	4.9	7×10^{15}	1×10^{14}
	17	8×10^{15} (5)			
Tegit		2×10^{12}	1.4		
Tetrachlornaphthalene		5×10^{13}	2.9	*1×10^{14}	*1×10^{14}
Wood, paraffined					
mahogany		4×10^{13}		3×10^{12}	5×10^{9}
maple		3×10^{10}	3.6	8×10^{11}	2×10^{8}
poplar		5×10^{11}	3.6	1×10^{12}	1×10^{9}

* Leakage resistivity.

RESISTIVITY OF DIELECTRICS (Continued)

Description of Materials

Amberite is made by compressing scrap amber.

Bakelite. A phenol condensation product, with various fillers. The various samples were made as follows:

Number	Percent pure Bakelite	Filler	Phenolic Body	Condensing Agent
1		Paper	Cresols	Ammonia
140	50	Vegetable	Phenol	Caustic soda
150	50	Fiber	"	Ammonia
190	50	"	Cresols	"
5199	50	"	Phenol	"
5200	50	Fiber & clay	"	"
5074	35	Talc	"	Caustic soda
588	100	None	"	
1 Regular	100	None	Cresols	Ammonia

Ceresin is a waxy material refined from the mineral ozokerite. Condensite is a phenol condensation product.

Hard fiber, soft cotton paper, treated with zinc chloride, dried and pressed.

Galalith is made from the casein of milk.

Kavalier glass is hard combustion tubing having a large potassium and calcium content.

Glyptol is an artificial resin resembling amber.

Gummon, hemit, and tegit are coal tar products.

Halowax, chlorinated naphthalenes.

Moulded mica is ground mica and asbestos with shellac.

Stabalite is a rubber compound.

References

1. Dietrich, 1909
2. Addenbrooke, 1911
3. Rayner, 1905
4. Campbell, 1913
5. Thornton, 1910
6. Curie, 1889
7. Wilson-Mitchell, 1905
8. Braum, 1887

Liquids

Resistance in ohms per centimeter cube.

Substance.	Temp. °C.	Resistance, ohms.
Alcohol, ethyl	15	$.3 \times 10^6$
methyl	....	$.14 \times 10^6$
Oils, olive	....	5×10^{12}
paraffin	....	1×10^{16}
Petroleum	....	2×10^{16}
Water distilled	18	0.5×10^6

Fused Salts

(Poincaré)

Substance.	Temp. °C.	Resistance, ohms.
Calcium chloride	750	.862
Potassium bromide	750	.714
chlorate fused	355	2.20
Silver nitrate	350	.820
Sodium chloride fused	750	.294

THERMOELECTRIC POWER

The table gives the electromotive force in microvolts per degree difference in temperature between the two junctions, for various metals with lead. The temperature given is the mean temperature of the two junctions. A is the thermo-electric power at 0 °C. and B the coefficient in the equation for the thermoelectric power at any temperature,

$$Q = A + Bt,$$

where t is the mean temperature of the two junctions. The thermoelectric power of any two metals in the table may be found by subtracting the value for the first from that of the second, a positive difference indicating that the current will flow from the cold to the hot junction in the second metal.

The sign of the values given is so chosen that if A is positive the current flows in the metal listed from the cold to the hot junction. When B is positive Q increases with the temperature.

(Principally from the Smithsonian Physical Tables.)

Metal.	A microvolts.	B microvolts per °C.	Temp. °C.	Thermoelectric power, microvolts.	Neutral point.
Aluminum[1]	0.76	−0.0039	20	0.68	195
Antimony comm'l.-pressed wire[2]	.....	......	20	−6.0	
pure[3]	.....	−0.018	−100–+100	−1.49	
Argentan[1]	11.94	0.0506	20	12.95	−236
Arsenic[2]	.....	......	20	13.56	
Bismuth comm'l.-pressed wire[2]	.....	......	20	97.0	
pure pressed wire[2]	.....	......	20	89.0	
commercial[4]	.....	......	50	39.9	
Brass[6]	.....	−0.0026	0.260	−0.65	
Cadmium[1]	−2.63	−0.0424	20	−3.48	−62
Cobalt[4]	.....	......	20	22.	
Constantin	.....	......	50	+19.3	
Copper[1]	−1.34	−0.0094	20	−1.52	−143
commercial[2]	.....	......	20	−0.10	
German silver[3]	.....	+0.019	−100–+100	+10.7	
Gold[1]	−2.80	−0.0101	20	−3.0	−277
Iron[1]	−17.15	0.0482	20	−16.2	356
pianoforte wire[2]	.....	......	20	−17.5	
Magnesium[1]	−2.22	0.0094	20	−2.03	236
Manganin[3]	.....	0.003	−100–+100	1.12	
Mercury[2]	.....	......	20	0.413	
Nickel[4]	.....	......	50	15.50	
Paladium[1]	6.18	0.0355	20	6.9	−174
Platinum, pure[6]	.....	+0.011	0–200	+3.04	
Platinum-iridium alloys:					
85%Pt+15%Ir[1]	−7.90	−0.0062	20	−8.03	−1274
90%Pt+10%Ir[1]	−5.90	0.0133	20	−5.63	444
Selenium[2]	.....	......	20	−807.	
Silver[1]	−2.12	−0.0147	20	−2.41	−144
pure hard[2]	.....	......	20	−3.00	
Steel[1]	−11.27	0.0325	20	−10.62	347
Tellurium[2]	.....	......	20	−502.	
Tin, commercial[4]	.....	......	50	−0.33	
Tin[1]	0.43	−0.0055	20	0.33	78
Zinc[1]	−2.32	−0.0238	20	−2.79	−98

OBSERVERS: [1] Tait. [2] Matthiesen. [3] Dewar & Fleming. 1895. [4] Ed. Becquerel. [5] Steinmann. [6] Noll, 1894.

THERMOELECTRIC POWER

Metal	A micro volts	B micro volts per °C.	Temp. °C.	Thermo. electric power	Neutral point
Calcium	....	....	50	+8.9	....
Gallium	....	....	20	−0.2	....
Germanium	....	....	−192	+160.	300
	....	....	+125	425.	....
	....	....	550	−175.	....
	....	....	675	−125.	....
Molybdenum	....	....	20	+5.9	....
Thallium	....	....	20	+0.8	....
Tungsten	....	....	20	−2.0	....

HYSTERESIS

The dissipation of energy due to hysteresis in metals is expressed by Steinmetz by the following equation:

$$E = \eta B^{1.6}$$

Values of η as found by Steinmetz appear below. C. G. S. units.

Material	
Iron	
Norway iron	.00227
Wrought bar	.00326
Commercial ferrotype plate	.00548
Annealed " "	.00458
Thin tin plate	.00286
Medium thickness tin plate	.00425
Steel	
Soft galvanized wire	.00349
Annealed cast steel	.00848
Soft annealed cast steel	.00457
Very soft annealed cast steel	.00318
Same above tempered in cold water	.02792
Tool steel glass hard tempered in water	.07476
" " tempered in oil	.02670
" " annealed	.01899
Cast iron	
Gray cast iron	.01300
" " " ½% aluminium	.01365
" " " 1% "	.01459
Nickel	
Soft wire	.0122
Annealed wire	.0156
Hardened	.0385
Cobalt	
2% of iron	.0210
Iron Filings	
180 cycles per second	.0457
114 " " "	.0396
79–91 " " "	.0373

MAGNETIC CONSTANTS OF IRON

Permeability of Transformer Iron

Giving M, the total magneto motive force applied. M/l, the magneto motive force per unit length of iron circuit. B the total induction, B/a the induction per unit cross-section of iron, M/B, the magnetic reluctance of the iron circuit and Bl/Ma, the permeability; showing the typical relations of the magnetic constants for varying field.

(From Smithsonian Tables.)

M.	M/l.	B.	B/a.	Reluctance $M/B=K$.	Permeability $Bl/Ma = \mu$.
20	0.597	218×10^3	1406	0.917×10^{-4}	2360
40	1.194	587	3790	0.681	3120
60	1.791	878	5660	0.683	3180
80	2.338	1091	7040	0.734	2960
100	2.985	1219	7860	0.819	2640
120	3.582	1330	8580	0.903	2410
140	4.179	1405	9060	0.994	2186
160	4.776	1475	9510	1.090	2000
180	5.373	1532	9880	1.180	1850
200	5.970	1581	10200	1.270	1720
220	6.567	1618	10430	1.360	1590
260	7.761	1692	10910	1.540	1410

MAGNETIC PROPERTIES OF IRON AND STEEL

(From Gumlich, 1909.)

Sample.	Coercive force.	Residual B.	Maximum permeability.	B for H = 150.	$4\pi I$ for saturation.
Electrolytic iron	2.83	11400	1850	19200	21620
The same annealed	0.36	10800	14400	18900	21630
Cast steel	1.51	10600	3550	18800	21420
The same annealed	0.37	11000	14800	19100	21420
Steel hardened	52.4	7500	110	11700	18000
Cast iron	11.4	5100	240	10400	16400
The same annealed	4.6	5350	600	11000	16800
Electrical iron in sheets annealed	1.30	9400	3270	18200	20500

SATURATION CONSTANTS FOR MAGNETIC SUBSTANCES

Substance.	Field intensity. (For saturation.)	Induced magnetization. (For saturation.)	Substance.	Field intensity. (For saturation.)	Induced magnetization. (For saturation.)
Cobalt	9000	1300	Nickel, hard	8000	400
Iron, wrought	2000	1700	annealed	7000	515
cast	4000	1200	Vicker's steel	15000	1600
Manganese steel	7000	200			

MAGNETIC SUSCEPTIBILITY OF VARIOUS SUBSTANCES

Metals

Magnetic susceptibility or the ratio of the magnetic moment per unit volume to the magnetizing field is given for various substances. The value is negative for diamagnetic bodies, positive for paramagnetic bodies.

(C. G. S. Electromagnetic units.)

Substance.	Temp ° C.	Susceptibility (vacuum =0).	Observer.
Aluminum	.....	-1.8×10^{-6}	
Antimony	.....	-4.6	Curie, 1895
Bismuth	.....	-13.3	Curie, 1895
Copper	.....	-1.33	Becquerel, 1855
Gold	.....	-4.5	Hanriot & Raoult, 1911
Lead	.....	-1.21	Becquerel
Mercury	15	-2.1	St. Mayer
Platinum	.....	$+29.0$	J. Königsberger, 1898
Selenium	20	-1.54	Curie, 1895
Silver	.....	-1.8	Becquerel, 1855
Tellurium	20	-1.94	Curie, 1895
Zinc	.....	-1.16	Owen, 1912
Iron annealed	.....	$+37.4 \times 10^{1}$	For weak fields
Nickel	.....	$+4. \times 10^{1}$	For H = 100 C. G. S.
Steel tempered	.....	$+3.4 \times 10^{1}$	For weak fields

Inorganic Compounds

Substance.	Temp. ° C.	Susceptibility (vacuum =0)	Observer.
Boric acid	.....	-0.88×10^{-6}	Meslin, 1906
Cobalt sulphate ($7H_2O$)	.....	$+76.3$	Meslin, 1906
Copper sulphate ($5H_2O$)	.....	$+13.4$	Mlle. Feytis, 1911
Ferric chloride	.....	$+287.$	Meslin, 1906
Ferrous sulphate ($7H_2O$)	.....	$+95.3$	Meslin, 1906
Glass	.....	-0.15	Faraday, 1853
Nickel sulphate ($7H_2O$)	.....	$+37.$	Meslin, 1906
Potassium bichromate	.....	$+0.36$	Meslin, 1906
Potassium chloride	18	-1.09	Curie, 1895
Potassium ferrocyanide	.....	$+16.0$	Meslin, 1906
Quartz	20	-1.20	J. Königsberger
Sodium chloride	22	-1.02	Meslin, 1906

Liquids

Substance.	Temp. ° C.	Susceptibility (vacuum =0).	Observer.
Acetic acid	.....	-0.61	Meslin, 1906
Alcohol, ethyl	.....	-0.65	Meslin, 1906
Benzene	.....	-0.69	Meslin, 1906
Chloroform	.....	-0.86	Meslin, 1906
Ether	.....	-0.61	Meslin, 1906
Glycerine	.....	-0.81	Meslin, 1906
Sulphuric acid	.....	-0.77	Quincke, 1885
Water	20	-0.72	Piccard, 1912

VARIATION OF RESISTANCE DUE TO A MAGNETIC FIELD

Bismuth

The table shows the proportional values of the resistance for values of the magnetic field from 0 to 35,000 and for different temperatures. The resistance at 0° C. and H = 0 is taken as 1.

Proportional values of resistance.

(From Smithsonian Tables.)

H. Gauss.	−192°	−135°	−100°	−37°	0°	+18°	+60°	+100°	+183°
0	0.40	0.60	0.70	0.88	1.00	1.08	1.25	1.42	1.79
2000	1.16	0.87	0.86	0.96	1.08	1.11	1.26	1.43	1.80
4000	2.32	1.35	1.20	1.10	1.18	1.21	1.31	1.46	1.82
6000	4.00	2.06	1.60	1.29	1.30	1.32	1.39	1.51	1.85
8000	5.90	2.88	2.00	1.50	1.43	1.42	1.46	1.57	1.87
10000	8.60	3.80	2.43	1.72	1.57	1.54	1.54	1.62	1.89
12000	10.8	4.76	2.93	1.94	1.71	1.67	1.62	1.67	1.92
14000	12.9	5.82	3.50	2.16	1.87	1.80	1.70	1.73	1.94
16000	15.2	6.95	4.11	2.38	2.02	1.93	1.79	1.80	1.96
18000	17.5	8.15	4.76	2.60	2.18	2.06	1.88	1.87	1.99
20000	19.8	9.50	5.40	2.81	2.33	2.20	1.97	1.95	2.03
25000	25.5	13.3	7.30	3.50	2.73	2.52	2.22	2.10	2.09
30000	30.7	18.2	9.8	4.20	3.17	2.86	2.46	2.28	2.17
35000	35.5	20.35	12.2	4.95	3.62	3.25	2.69	2.45	2.25

Various Metals

The table gives the per cent. change in the resistance due to a field of 10,000 gauss with respect to the value at 0° C. and H = 0.

(Grumach.)

Metal.	Per cent. change.	Metal	Per cent. change.
Cadmium	+0.03	Palladium	+0.001
Cobalt	−0.53	Platinum	+0.0005
Copper	+0.004	Silver	+0.004
Gold	+0.003	Tantalum	+0.0003
Lead	+0.0004	Tin	+0.002
Nickel	−1.4	Zinc	+0.01

INTERNAL RESISTANCE OF VARIOUS VOLTAIC CELLS

The internal resistance is subject to large variations: the values given can be considered only approximate.

Cell.	Resistance, ohms.	Cell.	Resistance, ohms.
Edison-Lalande	0.03	Grove	0.1–0.2
Daniell	0.85	Bunsen	0.1–0.2
Gravity	1–5	Bichromate	0.08–0.40
Silver chloride	4.	Storage	0.004–0.02
Dry cell	0.2–1.0	Clark standard	20–50
Leclanché	0.4–0.2	Weston standard	20–50

HALL EFFECT

If a strip of metal of thickness t, in which a current i is flowing (longitudinally) is subjected to a transverse magnetic field H, a difference of potential E is produced at opposite points at the side of the strip. $E = R \times Hi/t$ where R is a constant specific with different metals and E, H, i and t in C. G. S. units. The table gives values obtained at ordinary room temperatures, 18–24° C. If the value of R is independent of the field, or nearly so, the field intensity is not given. The positive sign indicates that if a strip of metal were considered to be in the plane of this page with its long axis horizontal, the primary current flowing from left to right and the magnetic field directed away from the observer, normal to the plane of the strip, the upper edge of the strip would be at a higher potential than the lower.

Substance.	Field strength, gausses.	*R*.	Observer.
Aluminum	......	−.00038	Von Ettinghausen & Nernst, 1886
Antimony	1750	+0.219	Barlow, 1903
Bismuth	1650	−10.27	Von Ettinghausen & Nernst, 1886
Bismuth	11100	−4.95	Von Ettinghausen & Nernst, 1886
Cadmium	......	+.00055	Von Ettinghausen & Nernst, 1886
Carbon	......	−.17	Von Ettinghausen & Nernst, 1886
Cobalt	3463	+.24	Hall, 1885
Copper	......	−.00052	Hall, 1885
Gold	......	−.00066	Hall, 1885
Iron	6290	+.0108	Zahn, 1904
Lead	......	.00009	Von Ettinghausen & Nernst, 1886
Magnesium	......	−.00094	Von Ettinghausen & Nernst, 1886
Nickel	10620	−.0047	Zahn, 1904
Platinum	......	−.00024	Von Ettinghausen & Nernst, 1886
Silver	......	−.00083	Von Ettinghausen & Nernst, 1886
Tellurium	......	+530.	Von Ettinghausen & Nernst, 1886
Tin	......	−.00004	Von Ettinghausen & Nernst, 1886
Zinc	......	+.00033	Barlow, 1903

ELECTROCHEMICAL EQUIVALENTS

Grams per coulomb.

Element.	Valence.	Equiv.	Element.	Valence.	Equiv.
Aluminum	3	$.0936 \times 10^{-3}$	Iron	3	$.1929 \times 10^{-3}$
Antimony	3	.4153	Lead	2	1.0731
Antimony	5	.2492	Magnesium	2	.1260
Bismuth	3	.7185	Mercury	1	2.0788
Cadmium	2	.5824	Mercury	2	1.0394
Chromium	3	.1796	Nickel	2	.3040
Cobalt	2	.3055	Oxygen	2	.0829
Copper	1	.6588	Platinum	2	1.0104
Copper	2	.3294	Silver	1	1.1180
Gold	3	.6812	Tin	2	.6166
Hydrogen	1	.0105	Tin	4	.3083
Iron	2	.2893	Zinc	2	.3387

MAGNETIC INCLINATION OR DIP AND HORIZONTAL INTENSITY

The mean or limiting values are given for the territory covered by the State named. The horizontal intensity is given in gausses. The table is compiled from the results of the U. S. Coast and Geodetic Survey for 1911 and 1912.

State.	Dip, degrees.			Horizontal intensity.		
Alabama	62.	to	66.	.23	to	.26
Alaska	67.		74.	.16		.21
Arizona	59.			.27		
Arkansas	63.		65.	.24		.25
California	58.		62.	.25		.27
Colorado	67.		68.	.22		.23
Connecticut	72.		73.	17		.18
Delaware	70.		71.5	19		.20
Florida	57.		58.	27		.29
Georgia	62.		66.	.23		.26
Hawaii	39.			.29		
Idaho	69.			.21		
Indiana	69.		72.	.18		.21
Iowa	71.		73.	.18		20
Kansas	67.		69.	.21		.23
Kentucky	68.		70.	.20		.22
Maine	74.		76.	.14		.16
Maryland	70.5			.20		
Massachusetts	73.			.17		
Michigan	73.		76.	.15		.18
Mississippi	61.		66.	.24		.26
Missouri	67.		71.	.20		.22
Montana	70.		72.	.18		.20
Nebraska	70.		71.	.20		
New Hampshire	73.		74.	.16		.17
New Jersey	71.			.19		
New Mexico	63.		65.	.24		.25
New York	74.			.16		.17
North Carolina	66.		68.	.21		.23
North Dakota	74.		77.	.15		.16
Ohio	71.		73.	.18		20
Oklahoma	63.		67.	.23		.25
Oregon	68.		69.	.21		
Pennsylvania	71.		72.	.18		.19
Philippines	0.		23.	.37		.39
Porto Rico	49.		50.	.29		.30
South Carolina	66.		67.	.23		
South Dakota	71.		74.	.17		.19
Tennessee	66.		68.	.22		.23
Texas	57.		63.	.25		.29
Utah	66.		67.	.22		.23
Vermont	73.		75.	.16		.17
Virginia	68.		70.	.20		.21
Washington	71.			.19		
West Virginia	70.5			.20		
Wisconsin	74.		76.	.15		.17
Wyoming	68.		72.	.19		.22

MAGNETIC DECLINATION

An annual decrease in declination is indicated by the negative sign an increase by the positive.

(From U. S. Coast and Geodetic Survey)

State.	Station.	Magnetic declination in degrees and tenths.					Ann. Chge. (1910).
		1870	1880	1890	1900	1910	
Ala.	Montgomery	4.5 E	3.9 E	3.2 E	2.8 E	2.9 E	−.012
Alaska	Sitka	29.0 E	29.3 E	29.5 E	29.7 E	30.2 E	
	Kodiak	25.6 E	25.1 E	24.7 E	24.4 E	24.1 E	
	Unalaska	20.1 E	19.6 E	19.0 E	18.3 E	17.5 E	
	St. Michael	....	24.7 E	23.1 E	22.1 E	21.4 E	
Ariz.	Holbrook	13.8 E	13.7 E	13.4 E	13.5 E	13.9 E	+.072
	Prescott	13.7 E	13.6 E	13.5 E	13.7 E	14.3 E	+.077
Ark.	Little Rock	8.2 E	7.6 E	7.0 E	6.6 E	6.9 E	+.023
Cal.	Los Angeles	14.4 E	14.6 E	14.6 E	14.9 E	15.5 E	+.083
	San José	17.3 E	17.5 E	17.5 E	17.8 E	18.5 E	+.075
Cal.	Redding	18.1 E	18.2 E	18.3 E	18.6 E	19.3 E	+.075
Colo.	Pueblo	13.8 E	13.5 E	13.0 E	12.9 E	13.3 E	+.050
	Glenwood Sp.	16.3 E	16.1 E	15.7 E	15.6 E	16.1 E	+.062
Conn.	Hartford	8.7 W	9.4 W	9.8 W	10.4 W	11.0 W	+.097
Del.	Dover	4.7 W	5.3 W	5.9 W	6.4 W	7.0 W	+.080
D. C.	Washington	2.4 W	3.0 W	3.6 W	4.2 W	4.7 W	+.075
Fla.	Jacksonville	3.1 E	2.4 E	1.8 E	1.3 E	1.2 E	−.033
	Tampa	3.9 E	3.3 E	2.8 E	2.3 E	2.0 E	−.013
Ga.	Macon	3.9 E	3.2 E	2.6 E	2.1 E	2.0 E	−.033
Hawaii	Honolulu	9.5 E	9.8 E	10.1 E	10.4 E	10.6 E	
Idaho	Pocatello	17.8 E	17.9 E	17.7 E	17.8 E	18.4 E	+.067
	Boise	18.6 E	18.7 E	18.6 E	18.8 E	19.4 E	+.075
Ill.	Bloomington	5.4 E	4.7 E	4.1 E	3.6 E	3.4 E	−.013
Ind.	Indianapolis	3.2 E	2.6 E	2.0 E	1.4 E	1.1 E	−.030
Ia.	Des Moines	9.7 E	9.1 E	8.4 E	7.9 E	8.1 E	+.017
Kans.	Emporia	11.2 E	10.7 E	10.1 E	9.8 E	10.1 E	+.030
	Ness City	12.2 E	11.9 E	11.4 E	11.1 E	11.4 E	+.040
Ky.	Lexington	2.5 E	1.9 E	1.2 E	0.7 E	0.5 E	−.033
	Princeton	5.6 E	5.0 E	4.3 E	3.8 E	3.7 E	−.017
La.	Alexandria	8.0 E	7.4 E	6.9 E	6.6 E	6.8 E	+.030
Me.	Eastport	18.2 W	18.6 W	18.7 W	19.0 W	19.4 W	+.100
	Portland	12.8 W	13.4 W	13.9 W	14.4 W	14.8 W	+.100
Md.	Baltimore	3.8 W	4.4 W	5.0 W	5.6 W	6.1 W	+.075
Mass.	Boston	11.0 W	11.5 W	12.0 W	12.6 W	13.1 W	+.100
	Pittsfield	9.3 W	10.0 W	10.4 W	11.0 W	11.5 W	+.097
Mich.	Marquette	4.6 E	3.8 E	3.0 E	2.3 E	2.0 E	−.027
	Lansing	2.1 E	1.3 E	0.5 E	0.0 E	0.4 E	+.040
Minn.	Northome	10.0 E	9.3 E	8.6 E	8.0 E	8.1 E	+.017
	Mankato	10.9 E	10.4 E	9.5 E	9.0 E	9.1 E	+.020
Miss.	Jackson	7.5 E	6.9 E	6.4 E	6.0 E	6.2 E	+.017
Mo.	Sedalia	9.4 E	8.7 E	8.0 E	7.6 E	7.9 E	+.020
Mont.	Forsyth	18.6 E	18.4 E	17.9 E	17.8 E	18.3 E	+.050
	Helena	19.8 E	19.6 E	19.4 E	19.5 E	20.0 E	+.062
Nebr.	Hastings	11.7 E	11.2 E	10.5 E	10.2 E	10.5 E	+.033
	Alliance	15.3 E	14.8 E	14.3 E	14.2 E	14.5 E	+.043

MAGNETIC DECLINATION (Continued)

An annual decrease in declination is indicated by the negative sign and an increase by the positive.

(From U. S. Coast and Geodetic Survey.)

State.	Station.	Magnetic declination in degrees and tenths. 1870	1880	1890	1900	1910	Ann. Chge. (1910)
Nevada	Elko	17.7 E	17.7 E	17.6 E	17.8 E	18.3 E	+.077
	Hawthorne	16.9 E	17.0 E	17.0 E	17.3 E	17.8 E	+.083
N. H.	Hanover	11.1 W	11.6 W	12.0 W	12.5 W	13.0 W	+.100
N. J.	Trenton	6.0 W	6.7 W	7.2 W	7.8 W	8.4 W	+.082
N. Mex.	Santa Rosa	12.7 E	12.5 E	12.1 E	12.0 E	12.4 E	+.060
N. Mex.	Laguna	13.6 E	13.4 E	13.0 E	13.0 E	13.5 E	+.062
N. Y.	Albany	9.1 W	9.8 W	10.2 W	10.8 W	11.4 W	+.093
	Elmira	5.4 W	6.3 W	7.0 W	7.6 W	8.1 W	+.075
N. C.	Newbern	1.0 W	1.6 W	2.2 W	2.8 W	3.3 W	+.057
	Salisbury	1.5 E	0.8 E	0.2 E	0.4 W	0.7 W	+.047
N. Dak.	Jamestown	14.0 E	13.5 E	12.7 E	12.4 E	12.8 E	+.030
	Dickinson	17.4 E	17.0 E	16.4 E	16.2 E	16.6 E	+.040
Ohio	Columbus	1.2 E	0.6 E	0.0 E	0.7 W	1.1 W	+.047
Okla.	Okmulgee	9.8 E	9.4 E	8.8 E	8.5 E	8.9 E	+.033
	Enid	10.9 E	10.5 E	9.9 E	9.7 E	10.1 E	+.043
Oregon	Sumpter	20.0 E	20.2 E	20.2 E	20.4 E	21.0 E	+.077
	Detroit	20.1 E	20.4 E	20.5 E	20.8 E	21.5 E	+.080
Penn.	Philadelphia	5.5 W	6.3 W	6.8 W	7.4 W	8.0 W	+.083
	Altoona	3.1 W	3.8 W	4.5 W	5.1 W	5.6 W	+.067
P. R.	San Juan	....	....	....	1.0 W	2.0 W	
R. I.	Newport	10.3 W	10.8 W	11.3 W	11.9 W	12.4 W	+.100
S. C.	Columbia	2.1 E	1.4 E	0.8 E	0.2 E	0.1 W	+.043
S. D.	Huron	12.6 E	12.1 E	11.4 E	11.1 E	11.4 E	+.030
	Rapid City	16.3 E	15.8 E	15.3 E	15.1 E	15.4 E	+.042
Tenn.	Chattanooga	3.3 E	2.6 E	2.0 E	1.5 E	1.3 E	−.033
Tenn.	Huntington	6.1 E	5.5 E	4.9 E	4.4 E	4.3 E	−.008
Texas	Houston	8.9 E	8.5 E	7.9 E	7.7 E	8.1 E	+.042
	San Antonio	9.6 E	9.3 E	8.9 E	8.7 E	9.1 E	+.050
	Pecos	11.0 E	10.8 E	10.4 E	10.3 E	10.7 E	+.060
	Floydada	11.2 E	10.9 E	10.4 E	10.3 E	10.7 E	+.052
Utah	Salt Lake City	16.7 E	16.5 E	16.3 E	16.5 E	17.0 E	+.070
Vermont	Rutland	10.6 W	11.2 W	11.6 W	12.1 W	12.7 W	+.100
Va.	Richmond	1.8 W	2.5 W	3.1 W	3.7 W	4.2 W	+.067
	Lynchburg	0.5 W	1.2 W	1.8 W	2.4 W	2.8 W	+.057
Wash.	Wilson Creek	21.9 E	21.9 E	22.1 E	22.4 E	22.9 E	+.075
Wash.	Seattle	22.1 E	22.3 E	22.6 E	23.0 E	23.5 E	+.083
W. Va.	Charleston	0.2 W	0.9 W	1.5 W	2.1 W	2.6 W	+.057
Wis.	Madison	7.2 E	6.4 E	5.6 E	5.0 E	4.9 E	−.017
Wyo.	Douglas	16.0 E	15.8 E	15.4 E	15.3 E	15.7 E	+.053
	Green River	17.0 E	16.9 E	16.6 E	16.6 E	17.0 E	+.060

LIGHT

PHOTOMETRIC STANDARDS

Value of Various Standards in International Candles

Standard Pentane Lamp, burning pentane......	10.0	candles
Standard Hefner Lamp, burning amyl acetate....	0.9	"
Standard Carcel Lamp, burning colza oil.........	9.6	"
Standard English Sperm Candle, about..........	1.0	"

The *Carcel unit* is the horizontal intensity of the carcel lamp, burning 42 grams of colza oil per hour. For a consumption between 38 and 46 grams per hour the intensity may be considered proportional to the consumption.

The *Hefner unit* is the horizontal intensity of the Hefner lamp burning amyl acetate, with a flame 4 cm. high. If the flame is l mm. high, the intensity $I = 1 + 0.027(l - 40)$.

STANDARD CANDLES

The horizontal intensity may be considered proportional to the rate of consumption of material if the variation is small.

	French.	English.	German.
Material.......	2 pts. stearic acid 1 pt. palmitic acid	Spermaceti	Paraffin
Temp. of fusion.	54° C.	44.4–46°.1 C.	55° C.
Wick (cotton)...	81 threads	54 to 63 threads	24 to 25 threads
Height of flame..	5.24 cm.	4.5 cm.	5 cm.
Rate of consumption of material	10 g. per hr.	7.78 g. per hr.	7.7 g. per hr.
Horizontal intensity in Internat. candles	1.34	1.05	1.11

MECHANICAL EQUIVALENT OF LIGHT

The luminous equivalent of radiation of maximum visibility,

One lumen = 0.001496 watts

One watt, radiation of maximum visibility ($\lambda = 0.556\mu$) = 668 lumens

MEAN HORIZONTAL CANDLE POWER OF VARIOUS LIGHT SOURCES

GIVEN IN INTERNATIONAL CANDLES.

(Lux, 1907.)

Source.	Total power consumed in watts.	Mean horizontal candle power.	Efficiency in watts per candle (spherical)
Acetylene flame	96	6.9	17.7
Electric arcs:			
Carbon, open air, continuous current	435	171	0.92
alternating current	181	98	2.27
Flaming arc, yellow	350	816	0.34
Mercury arc, uviol tube	199	393	0.64
quartz tube	691	3060	0.25
Incandescent electric, carbon filament	98	28.3	4.54
tantalum filament	44	31.1	1.83
tungsten filament	38	32.7	1.59
tungsten filament, gas filled	1000	1670	0.66
Incandescent gas mantle, vertical	717	96.3	8.9
inverted	571	96.3	7.7
Nernst lamp	181	108	2.12

PRIMARY COLOR SENSATIONS PRODUCED BY VARIOUS LIGHT SOURCES

The relative values of the excitation of the three primary sensations are given.

(Ives, 1911.)

Source.	Red.	Green.	Blue.
Black body at 5000° absolute	33	33	33
Blue sky	29	30	41
Clouded sky	35	34	31
Sun	38	37	25
Hefner lamp	54	40	6
Acetylene flame	49	40	11
Incandescent carbon filament	51	41	8
Tungsten filament	48	41	11
Nernst filament	49	40	11
Electric arc, carbon	41	36	23
Mercury arc	29	30	41
Flaming arc	52	37.5	10.5
Incandescent gas mantle, thorium with 0.25 part in 100 of cerium	42	41	17

INTRINSIC BRILLIANCY OF SURFACE INTENSITY OF LIGHT SOURCES

GIVEN IN INTERNATIONAL CANDLES PER SQUARE CENTIMETER.

Sources.	Surface intensity.	Observer.
Electric arc:		
current of 10 amperes	16000	Blondel, 1897
current of 25 amperes	19500	Blondel, 1897
current of 250 amperes	30000	Rey & Blondel, 1902
Flaming arc	4000	
Flames, candle	0.4–0.6	
petroleum lamp, round wick	3.3	Stockhausen, 1910
petroleum lamp, flat wick	.67	Stockhausen, 1910
gas, argand burner	1.14	Stockhausen, 1910
acetylene, flat flame	5.6	Stockhausen, 1910
Incandescent electric:		
filament of carbon (3.3 watts per candle)	75.	Blondel, 1911
filament of tungsten (1.2 watts per candle)	150.	Blondel, 1911
Nernst	350–470	Ives & Luckiesch, '11
Gas mantle	4.8–6.7	Ives & Luckiesch
Mercury arc	2.5	Ives & Luckiesch
Moon	0.4	Pickering, 1908
Star (Algol)	840000	Nordmann, 1910
Sun at zenith	160000	Palaz, 1893

WAVE LENGTHS OF VARIOUS RADIATIONS

	Microns
Röntgen (X) rays	0.0001
Shortest ultra-violet radiation	0.051
Shortest ultra-violet radiation in the solar spectrum (limited by atmospheric absorption)	0.292
Limit of the visible spectrum	0.390
Violet, wave length best representing the color	0.410
Wave lengths included	0.390–0.422
Blue, representative	0.470
Includes	0.422–0.492
Green, representative	0.520
Includes	0.492–0.535
Maximum visual intensity, about	0.535
Yellow, representative	0.580
Includes	0.535–0.586
Orange, representative	0.600
Includes	0.586–0.647
Red, representative	0.650
Includes	0.647–0.810
Limit of the visible spectrum	0.810
Limit of the solar spectrum	5.300
Infra-red (heat waves)	
Includes	0.810–314.00
Shortest measured Hertzian wave	4000.
Used for wireless telegraphy	100–5000 meters

BRIGHTNESS OF TUNGSTEN

(Forsythe 1922)

Temperature° K	Brightness, candles per square centimeter	Per cent. change in candle-power for one per cent. change in temperature
1000	.000098	27.0
1200	.00585	21.6
1400	.1075	18.1
1600	.925	15.6
1800	5.21	13.7
2000	20.1	12.3
2200	61.7	11.2
2400	155.5	10.3
2600	343	9.5
2800	679	8.9
3000	1235	8.4
3200	2105	8.1
3400	3380	7.9
3600	5200	7.8

RELATIVE VISIBILITY

The visibility at wave length .556μ is taken as unity.

(Hyde, Forsythe and Cady)

Wave-length	Relative visibility	Wave-length	Relative visibility	Wave-length	Relative visibility
0.40μ	0.00009	0.52μ	0.698	0.64μ	0.154
.41	.0006$_2$	.53	.847	.65	.094
.42	.004$_1$	.54	.968	.66	.051
.43	.011$_5$	.55	.996	.67	.026
.44	.022	.56	.995	.68	.012$_5$
.45	.036	.57	.944	.69	.006$_2$
.46	.055	.58	.855	.70	.003$_1$
.47	.0087	.59	.735	.71	.0015
.48	.138	.60	.600	.72	.0007$_4$
.49	.216	.61	.464	.73	.0003$_6$
.50	.328	.62	.341	.74	.0001$_8$
.51	.515	.63	.238	.75	.00009
				.76	.00005

VARIATION IN THE SENSITIVENESS OF THE EYE WITH THE WAVE LENGTH

For Low Intensities

(König.)

Wave length...	.410	.430	.450	.470	.490	.510	.530	.550	.570	.590	.610
Mean sensitiveness........	0.02	0.06	0.23	0.49	0.81	1.00	0.81	0.49	0.22	0.077	0.026

WAVE LENGTHS OF THE FRAUNHOFER LINES

Sun's Spectrum

At 15° C. and 76 cm. pressure. Wave length in Ångström units (Fabry and Buisson system).

Line.	Due to	Wave length	Line.	Due to	Wave length
U	Fe	2947.9	*h*	H	4101.9
t	Fe	2994.4	*g*	Ca	4226.7
T	Fe	3020.7	*G*	Ca	4307.7
s	Fe	3047.6		Fe	4307.9
S	Fe	3099.9	*G*	H	4340.5
	Fe	3100.0	*F*	H	4861.4
	Fe, Mn	3100.3	b_4	Mg	5167.3
	Fe, Ti	3100.7	b_2	Mg	5172.7
R	Ca	3179.3	b_1	Mg	5183.6
Q	Fe	3286.8	*E*	Fe	5269.6
P	Ti	3361.2	D_2	Na	5890.0
O	Fe	3440.6	D_1	Na	5895.9
	Fe	3441.0	*C*	H	6562.8
N	Fe	3581.2	*B*	O	6867.2
M	Fe	3719.9	*A*	O	7593.8
L	Fe, C	3820.4	*Z*	.....	8228.5
K	Ca	3933.7	*Y*	.....	8990.0
H	Ca	3968.5			

WAVE LENGTHS FOR SPECTROSCOPE CALIBRATION

Source.	Wave length.	Source.	Wave length.
Potassium flame..........	0.7699μ	*E*, solar..................	0.5270μ
Potassium flame..........	0.7666	b_1, solar or magnesium flame	0.5184
B, solar................	0.6867	b_2, solar or magnesium flame	0.5173
Lithium flame............	0.6708	*F*, solar or hydrogen tube...	0.4867
C, solar or hydrogen tube..	0.6563	Strontium flame...........	0.4608
D_1, solar or sodium flame..	0.5896	*G*, solar or hydrogen tube...	0.4308
D_2 solar or sodium flame..	0.5893	H_1, solar................	0.3969
Thallium flame...........	0.5351	H_2, solar................	0.3934

WAVE LENGTH OF PRINCIPAL LINES OF VARIOUS ELEMENTS

Solids

Wave lengths of the most prominent lines in microns. The letters a, s and f after a wave length indicate its occurrence as a strong line in the arc, spark or flame spectrum respectively.

Aluminum	.3082	a, s
	.3092	a, s
	.3587	s
	.3944	a, s
	.3961	a, s
	.5697	s
	.5723	s
Antimony	.3268	s
	.6005	s
	.6079	s
	.6130	s
Arsenic	.2745	s
	.2861	s
	.3923	s
	.4037	s
Barium	.3891	s
	.4131	s
	.4554	a, s
	.4934	a, s
	.5535	a, s, f
	.5853	a, s
	.6141	a, s
	.6497	a, s
Barium chloride in the Bunsen flame gives other lines not due to barium	.5136	
	.5242	
	.5313	
Bismuth	.3596	s
	.4723	a, s
	.4994	s
Cadmium	.3611	a, s
	.4678	a, s
	.4800	a, s
	.5086	a, s
	.5338	s
	.5378	s
	.6439	a, s
Caesium	.4555	a, f
	.4593	a, f
	.6723	a
	.6974	a
Calcium	.3934	a, s
	.3969	a, s
	.4227	a, s, f
Calcium chloride in the Bunsen flame also gives lines not due to calcium	.5517	
	.5543	
	.6181	
	.6202	
	.6265	
Cerium	.4012	s
	.4134	s
	.4150	s
	.4165	s
	.4187	s
	.4297	s
	.4527	s
	.4628	s
	.5274	s
	.5353	s
Chromium*	.4255	a, s
	.4275	a, s
	.4290	a, s
	.4559	s
	.4588	s
	.5205	a, s
	.5206	a, s
	.5209	a, s
	.5410	a
Cobalt†	.3846	a, s
	.3873	a, s
	.3894	a, s
	.4531	a

* More than twenty fairly prominent lines occur in the spark spectrum of chromium having wave lengths from .2763 to .3606μ.

† A large number of lines occur in the arc and spark spectrum of cobalt having wave lengths less than .3600 (ultraviolet).

WAVE LENGTH OF PRINCIPAL LINES OF VARIOUS ELEMENTS (Continued)

Solids (Continued)

Cobalt (Cont.)...	.4581	a	Iron*...........	.4046	a, s
	.4780	a, s		.4064	a, s
	.4793	a, s		.4071	a, s
	.4814	a, s		.4118	a
	.4840	a, s		.4132	a, s
	.4868	a, s		.4134	a
				.4143	a
Copper..........	.3248	a		.4144	a, s
	.3274	a		.4187	a, s
	.4023	a		.4188	a, s
	.4063	a		.4191	a
	.5106	a, s		.4198	a, s
	.5153	a, s		.4199	a, s
	.5218	a, s		.4202	a, s
	.5700	a		.4227	a, s
	.5782	a, s		.4234	a, s
Gold...........	.2428	a, s		.4236	a, s
	.2676	a, s		.4250	a, s
	.2802	s		.4251	a, s
	.3898	s		.4261	a, s
	.4065	s		.4272	a, s
	.4315	s		.4282	a, s
	.6278	s		.4294	a, s
				.4299	a, s
Iodine (spark) ...	.5159			.4308	a, s
	.5244			.4315	a
	.5339			.4326	a, s
	.5349			.4337	a
	.5408			.4384	a, s
	.5448			.4405	a, s
	.5471			.4415	a, s
	.5631			.4476	a
	.5686			.4528	a, s
	.5716			.4655	a, s
	.5741			.4736	a
	.5766			.4892	a
	.5781			.4921	a, s
	.5961			.4957	a, s
				.5139	a, s
Iridium.........	.3606	s		.5167	a, s
	.3653	s		.5192	a, s
	.3675	s		.5227	a, s
	.3800	s		.5233	a, s
	.3903	s		.5267	a, s
	.4400	a, s		.5270	a, s

* The ultraviolet spectrum of iron shows over 100 lines of intensity comparable with those listed above.

WAVE LENGTH OF PRINCIPAL LINES OF VARIOUS ELEMENTS (Continued)

Solids (Continued)

Iron (Cont.)	.5284	a, s
	.5302	a, s
	.5324	a
	.5328	a
	.5372	a
	.5397	a
	.5406	a
	.5447	a
	.5455	a
	.5570	a
	.5573	a
	.5587	a
	.5616	a
	.5659	a
	.5763	a
	.5862	a
	.5930	a
	.6065	a
	.6137	a
	.6138	a
	.6192	a
	.6231	a
	.6253	a
	.6302	a
	.6318	a
	.6337	a
	.6400	a
	.6495	a
	.6546	a
	.6593	a
Lead*	.3640	a, s
	.3684	a, s
	.3740	a, s
	.3786	s
	.3854	s
	.4058	a, s
	.4245	s
	.4387	s
	.5374	s
	.5547	s
	.5608	s
	.6657	s
Lithium	.4132	a
Lithium (Cont.)	.4602	a, s
	.6104	a
	.6708	a, s, f
Mercury	.2537	a
	.2967	a, s
	.3022	a
	.3023	s
	.3126	a, s
	.3132	a, s
	.3341	a, s
	.3650	a, s
	.3654	a, s
	.3663	a, s
	.3984	s
	.4046	a, s
	.4078	a, s
	.4358	a, s
	.5426	s
	.5461	a, s
	.5770	a, s
	.5791	a, s
	.5804	s
Magnesium	.2796	a, s
	.2803	a, s
	.2852	a, s, f
	.3097	a, f
	.3829	a, s, f
	.3832	a, s, f
	.3838	a, s, f
	.4481	s
	.5173	a, s
	.5183	a, s
Manganese	.3807	a, s
	.4031	a, s
	.4033	a
	.4035	a
	.4042	a
	.4754	a
	.4784	a
	.4824	a, s
	.6014	a, s
	.6017	a, s
	.6022	a, s

* The arc and spark spectra of lead include a large number of lines in the ultraviolet not given above.

WAVE LENGTH OF PRINCIPAL LINES OF VARIOUS ELEMENTS (Continued)

Solids (Continued)

Molybdenum....	.3635	s
	.3688	s
	.3798	a, s
	.3864	a, s
	.3903	a, s
	.3961	s
	.5506	a, s
	.5533	a, s
	.5570	a, s
	.6030	s
Nickel..........	.4714	a, s
	.4855	a, s
	.4866	a, s
	.4873	s
	.5035	a, s
	.5081	a
	.5477	a
	.5893	s
Osmium.........	.3753	s
	.4067	s
	.4136	s
	.4212	s
	.4261	s
	.4294	s
	.4421	s
Platinum........	.3687	s
	.3923	s
	.4552	s
	.5228	a, s
	.5301	s
	.5369	s
Potassium.......	.3447	a, s, f
	.4044	a, s, f
	.6911	a
	.6939	a
	.7665	a, s, f
	.7699	a, s, f
Radium.........	.3650	s
	.3815	s
	.4341	s
	.4436	s
	.4533	s
	.4683	s
Radium (Cont.)..	.4826	s, f
	.5661	s
	.5814	s
band .6130–	.6330	f
	.6349	f
band .6530–	.6700	f
Rubidium.......	.4202	a, s, f
	.4215	a, s, f
	.6207	a, f
	.6298	a, s, f
	.7806	a, f
	.7811	a
	.7950	a, f
Selenium........	.4606	s
	.4840	s
	.4842	s
	.4972	s
	.4993	s
	.5094	s
	.5142	s
	.5176	s
	.5225	s
	.5270	s
	.5305	s
Silicon..........	.2516	a, s
	.2881	a, s
Silver...........	.3281	a, s
	.3383	a, s
	.4055	a
	.4212	a
	.5209	a, s
	.5466	a, s
Sodium.........	.3302	a, s, f
	.3303	a, s, f
	.5683	a
	.5688	a
	.5890	a, s, f
	.5896	a, s, f
	.6154	a
	.6161	a
Strontium......	.4078	a, s
	.4216	a, s
	.4607	a, s, f

WAVE LENGTH OF PRINCIPAL LINES OF VARIOUS ELEMENTS (Continued)

Solids (Continued)

Strontium compounds, chloride, nitrate, etc., give other bands not due to strontium	.6032	
	.6060	
	.6351	
	.6464	
	.6597	
	.6664	
	.6694	
Sulphur	.4465	s
	.4486	s
	.4525	s
	.4552	s
	.5021	s
	.5033	s
	.5201	s
	.5215	s
	.5320	s
	.5343	s
	.5605	s
	.5640	s
	.6290	s
Tantalum	.3906	s
	.4059	s
	.4080	s
	.4101	s
	.4124	s
Thallium	.2918	a
	.3230	a
	.3519	a, s
	.3529	a
	.3776	a, s, f
	.4737	s
	.5351	a, s, f
Thorium	.3221	s
	.3272	s
	.3291	s
	.3301	s
	.3314	s
	.3508	s
	.3539	s
	.4019	s
	.4382	s
	.4391	s
	.4555	s
Tin	.3801	s
	.4525	a, s
	.5564	s
	.5589	s
	.5632	a, s
	.5799	s
	.6453	s
Tungsten	.4843	s
	.5059	s
	.5224	s
	.5514	s
Uranium	.5478	s
	.5480	s
	.5482	s
	.5494	s
	.5528	s
Zinc	.3345	a, s
	.4680	a, s
	.4722	a, s
	.4811	a, s
	.4912	s
	.4925	s
	.6103	s
	.6362	a, s
Zirconium	.3958	a, s
	.3982	a
	.3991	a, s
	.3999	s
	.4049	a, s
	.4073	a
	.4081	a
	.4149	a, s
	.4156	a, s
	.4161	a, s
	.4360	a, s
	.4371	a, s
	.4380	a, s
	.4443	s
	.4494	s
	.4497	a, s
	.4688	s
	.4710	s
	.4739	s
	.4772	s
	.4816	s
	.6128	s
	.6142	s

WAVE LENGTH OF PRINCIPAL LINES OF VARIOUS ELEMENTS (Continued)

Gases

Air (spark) line due to	N	.3995
	N	.4447
	N	.4631
	O	.4642
	N	.4643
		.5001
	N	.5005
	N	.5679
Argon, Plücker tube (blue spectrum)...		.3491
		.3560
		.3589
		.3638
		.3729
		.3850
		.4072
		.4104
		.4228
		.4331
		.4348
		.4426
		.4430
		.4806
(red spectrum)...		.4158
		.4191
		.4198
		.4200
		.4259
		.4511
		.6965
		.7067
Bromine..........		.4785
		.5332
		6150
		.6351
Chlorine, Plücker tube............		.3851
		.3861
		.4133
		.4253
		.4344
		.4794
		.4810
		.4819
		.5423
Helium...........		.3188
		.3888
		.4026
		.4471
		.5016
		.5876
		.6678
Hydrogen.........		.4102
		.4341
		.4861
		.6563
Nitrogen..........		See air
Oxygen...........		See air

RELATIVE STIMULATION OF THE THREE PRIMARY COLOR SENSATIONS BY DIFFERENT WAVE LENGTHS

Wave length...	0.36μ	0.38	0.40	0.42	0.44	0.46	0.48	0.50	0.52	0.54
Red......	0.0	0.0	2.0	1.0	1.0	1.0	3.0	9.0	23.0	39.0
Green.....	0.0	0.0	0.0	0.0	0.0	2.0	7.0	23.0	61.0	87.0
Blue......	0.0	10.5	29.0	52.0	76.0	78.0	68.0	46.0	16.0	7.0

Wave length...	0.56μ	0.58	0.60	0.62	0.64	0.66	0.68	0.70	0.72	0.74
Red......	56.0	69.0	71.5	59.0	30.0	12.0	5.0	2.0	1.0	0.0
Green.....	86.0	67.0	37.0	10.0	2.5	1.0	0.0	0.0	0.0	0.0
Blue......	4.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

STANDARD WAVE LENGTHS

Primary Standard

Wave length of the red cadmium line in air, 760 mm. pressure. 15°C., measures of Benoit, Fabry and Perot 1907,

6438.4696 Ångström units

SECONDARY STANDARDS. Lines of the Iron Arc

Means of measures by Fabry-Buisson, Pfund, Evershein and Burns adopted 1910 and 1913. Wave lengths in Ångstrom units.

Wave-length	Wave-length	Wave-length	Wave-length	Wave-length
3370.789	3935.818	4592.658	5232.957	6065.492
3399.337	3977.746	4602.947	5266.569	6137.701
3485.345	4021.872	4647.439	5371.495	6191.568
3513.821	4076.642	4691.417	5405.780	6230.734
3556.881	4118.552	4707.288	5434.527	6265.145
3606.682	4134.685	4736.786	5455.614	6318.028
3640.392	4147.676	4789.657	5497.522	6335.341
3676.313	4191.443	4878.225	5506.784	6393.612
3677.629	4233.615	4903.325	5569.633	6430.859
3724.380	4282.408	4919.007	5586.772	6494.993
3753.615	4315.089	5001.881	5615.661	6546.250
3805.346	4375.934	5012.073	5658.836	6592.928
3843.261	4427.314	5049.827	5709.396	6678.004
3850.820	4466.556	5083.344	5763.013	6750.250
3865.527	4494.572	5110.415	5857.759 Ni	
3906.482	4531.155	5167.492	5892.882 Ni	
3907.937	4547.853	5192.363	6027.059	

SECONDARY STANDARDS

Spectra of helium, neon, argon, krypton and xenon. Comparison with the primary standard made by interferometer methods. Wave lengths in Ångström units.

Helium

Merrill, Bulletin 14, Bulletin of Standards 1917.

2945.104	3888.646	4387.928	5047.736
3187.743	3964.727	4471.477	5875.618
3613.641	4026.189	4713.143	6678.149
3705.003	4120.812	4921.929	7065.188
3819.606	4143.759	5015.675	7281.349

STANDARD WAVE LENGTHS (Continued)

Neon

Burns, Meggers, Merrill, Bulletin 14, Bureau of Standards, 1918
Meissner, Annalen der Physik, 1919

Bureau of Standards	Meissner	Bureau of Standards	Meissner
3369.904	.....	6402.245	.2460
3417.906	.....	6506.528	.527
3447.705	.....	6532.883	.881
3454.197	.....	6598.953	.953
3460.526	.....	6678.276	.275
3464.340	.....	6717.043	.042
3466.581	.....	6929.468	.455
3472.578	.....	7024.049	....
3498.067	.....	7032.413	.410
3501.218	.....	....	....
3515.192	.....	7051.292	7051.314
3520.474	.....	7059.109	7059.119
3593.526	.....	7173.938	7173.938
3593.634	.....	7245.166	7245.165
3600.170	.....	7438.899	7438.885
3633.664	.....	7488.872	....
5330.779	.....	7535.784	7535.786
5341.096	.....	7544.050	7544.061
5400.562	.564	....	7937.010
5764.419	.....	7943.182	7943.193
5820.155	.....	....	8082.460
5852.488	.4875	....	8118.554
5881.895	.896	8136.408	8136.423
5944.834	.834	....	8259.392
5974.534	.534	....	8266.092
6029.997	.999	8300.369	8300.338
6074.338	.337	8377.606	8377.630
6096.163	.163	....	8418.447
6143.062	.061	8495.358	8495.359
6163.594	.594	....	8591.266
6217.280	.279	....	8634.668
6266.495	.495	....	8654.380
6304.789	.788	....	....
6334.428	.428	....	....
6382.991	.991	....	....

STANDARD WAVE LENGTHS (Continued)

Argon

Meggers, Journal Optical Society of America, 1921

Bureau of Standards	Meissner	Bureau of Standards	Meissner
3948.980	4300.101	6871.290	7514.651
4044.419	4333.561	6937.666	7635.106
4158.591	4345.168	6965.429	7723.758
4164.180	4510.733	7030.250	7724.210
4181.884	4522.325	7067.217	7948.175
4190.714	4596.096	7147.042	8006.156
4191.027	4628.445	7206.986	8014.784
4198.316	4702.317	7272.935	8103.693
4200.676	6032.127	7353.316	8115.307
4251.184	6416.307	7372.119	8264.522
4259.362	6677.282	7383.979	8408.210
4266.286	6752.831	7503.867	8424.646
4272.169	....	....	8521.443

Krypton

Meggers, Journal Optical Society of America, 1921

Bureau of Standards	Meissner	Bureau of Standards	Meissner
4273.9696	4362.6422	4502.354	6456.290
4282.967	4376.122	4807.065	7587.414
4318.552	4399.969	5562.224	7601.544
4319.580	4453.9174	5570.2872	....
4355.478	4463.690	5870.9137	....

Xenon

Meggers, Journal Optical Society of America, 1921

4500.978	4624.275	4807.019
4524.680	4671.225	4829.705
4582.746	4697.020	4844.333
4603.028	4734.154	4923.246

INDEX OF REFRACTION OF OPTICALLY ISOTROPIC SOLIDS

The following table gives the index of refraction with reference to air for optically isotropic solids including minerals. Data for glass and certain other substances of special optical importance will be found in succeeding tables.

Substance.	Spectrum line or wave length.	Index of refraction.	Observer.
Agate	red	1.537	De Senarmont
		1.540	Kohlrausch
Alabandite, MnS	*Li*	2.700	
Albite glass	*D*	1.4890	Larsen, 1909
Almandite, $3FeO \cdot Al_2O_3 \cdot 3SiO_2$	*D*	1.81	Lacroix, 1893
	D	1.778	
Alum, aluminum ammonium	*D*	1.45939	Soret
aluminum caesium	*D*	1.45856	Soret
aluminum potassium	*D*	1.45645	Soret
aluminum rubidium	*D*	1.45660	Soret
aluminum sodium	*D*	1.43884	Soret
aluminum thallium	*D*	1.49748	Soret
chromium ammonium	*D*	1.48418	Soret
chromium caesium	*D*	1.48100	Soret
chromium potassium	*D*	1.48137	Soret
chromium rubidium	*D*	1.48151	Soret
chromium thallium	*D*	1.52280	Soret
iron ammonium	*D*	1.48482	Soret
iron caesium	*D*	1.48378	Soret
iron potassium	*D*	1.48169	Soret
iron rubidium	*D*	1.48234	Soret
iron thallium	*D*	1.52365	Soret
Amber	*D*	1.546	Mulheim
Ammonium chloride	*D*	1.6422	Grailich, 1858
iodide	*D*	1.7031	Topsoe, Christiansen
Ammonium and iron chloride	*D*	1.6439	Grailich
Amphigen, $K_2Al_2Si_4O_{12}$	*D*	1.5086	Zymanyi
Analcite, $Na_2O \cdot Al_2O_3 \cdot 4SiO_2 \cdot 2H_2O$	*D*	1.487	
Andradite, $3CaO \cdot Fe_2O_3 \cdot 3SiO_2$	*D*	1.857	
Anorthite glass	*D*	1.5755	Larsen, 1909
Arsenic disulfide, realgar, As_2S_2		2.454	Jamin
Arsenolite, arsenic trioxide, As_2O_3	*D*	1.755	Des Cloizeaux
Asphalt	.670	1.621	Nichols
	D	1.635	Nichols
Barium calcium propionate, $BaCa_2(C_3H_5O_2)_6$	*D*	1.4442	Fritz, Sassoni
Barium nitrate	*D*	1.5711	Topsoe, Christiansen
Bauxite, $Al_2O_3 \cdot nH_2O$	*D*	1.570	
Berseliite, $3(Ca, Mg, Mn)O \cdot As_2O_5$	*D*	1.727	
Borax, amorphous fused	*C*	1.4624	Bedson, Williams
	D	1.4630	Bedson, Williams
	F	1.4702	Bedson, Williams
Boric acid, amorphous	*C*	1.4623	Bedson, Williams
	D	1.4637	Bedson, Williams
	F	1.4694	Bedson, Williams
Boric oxide, B_2O_3	*D*	1.4637	Bedson, Williams
Bromyrite, AgBr	*D*	2.253	
Bunsenite, NiO	*Li*	2.18	
Camphor	*D*	1.532	Kohlrausch
	D	1.5462	Mulheim
Canada balsam	*D*	1.530	

INDEX OF REFRACTION OF OPTICALLY ISOTROPIC SOLIDS (Continued)

Substance.	Spectrum line or wave length.	Index of refraction.	Observer.
Cerargyrite, AgCl	*D*	2.061	
Chromite, FeO, Cr_2O_3	*D*	2.070	
Cristobalite, SiO_2	*D*	1.486	
Cryolithionite, $3NaF \cdot 3LiF \cdot 2AlF_3$	*D*	1.339	
Cupric oxide, CuO	white	2.84	Kundt
Cuprite, Cu_2O	*D*	2.849	
Cuprous oxide, Cu_2O	*D*	2.705	Wernicke
Cyanine	*D*	1.71	Wood
Diamond	*D*	2.4173	Sella
Dysanlite, CaO, FeO, TiO_2, etc.	*D*	2.330	
Ebonite	red	1.66	Ayrton, Perry
	white	1.611	Jellet
Egglestonite, $HgO \cdot 2HgCl$	*Li*	2.490	
Embolite, Ag(Br, Cl)	*D*	2.150	
Eulytite, $2Bi_2O_3 \cdot 3SiO_2$	*D*	2.050	
Fluorite, CaF_2	*D*	1.434	
Franklinite, (Zn, Fe, Mn)O. $(Fe, Mn)_2O_3$	*Li*	2.360	
Fuchsin	*C*	2.33	Mean
	D	2.70	Coblentz
	G	1.97	Mean
	H	1.32	Mean
Gahnite, $ZnO \cdot Al_2O_3$	*D*	1.800	
Garnet	*D*	1.74	Mean
Gelatine, Nelson's No. 1	*D*	1.530	Jones, 1911
Grossularite, $3CaO \cdot Al_2O_3 \cdot 3SiO_2$	*D*	1.736	
Gum Arabic	red	1.480	Jamin
	red	1.514	Wollaston
Halite, NaCl	*D*	1.544	
Hauerite, MnS_2	*Li*	2.690	
Hauynite, $1Na_2O \cdot 3Al_2O_3 \cdot 6SiO_2 \cdot 2SO_2$ CaO	*D*	1.496	
Helvite, 3(Mn, Fe)O·3BeO·$3SiO_2 \cdot MnS$	*D*	1.739	
Hercynite, $FeO \cdot Al_2O_3$	*D*	1.800	
Hessonite, 3CaO.(Al, Fe)$_2$O$_3$·$3SiO_2$	*D*	1.763	
Hoffman's violet	.671	2.53	Pflüger
	.589	2.20	Pflüger
	.535	1.27	Pflüger
	.486	0.86	Pflüger
	.434	1.32	Pflüger
Lazurite, $4Na_2O \cdot 3Al_2O_3 \cdot 6SiO_2 \cdot Na_2S$	*D*	1.500	
Lead nitrate, $Pb(NO_3)_2$	*D*	1.5716	Fock
Lead oxide, PbO	,	2.076	Jamin
Leucite, $K_2O \cdot Al_2O_3 \cdot 4SiO_2$	*D*	1.509	
Lewisite, $5CaO \cdot 2TiO_2 \cdot 3Sb_2O_5$	*D*	2.200	
Lime, CaO	*D*	1.830	
Magdala red	.671	2.06	Pflüger
	.589	1.90	Pflüger
	.535	1.56	Pflüger
Magnesium bromate, $Mg(BrO_3)_2$ M + $6H_2O$	*D*	1.5139	Ortloff
Malachite green	.671	2.50	Pflüger
	.589	1.33	Pflüger
	.535	1.16	Pflüger

INDEX OF REFRACTION OF OPTICALLY ISOTROPIC SOLIDS (Continued)

Substance.	Spectrum line or wave length.	Index refraction.	Observer.
Manganioste, MnO	*D*	2.160	
Marshite, CuI	*D*	2.346	
Microlite, $6CaO \cdot 3Ta_2O_5 \cdot CbOF_3$	*D*	1.925	
Miersite, $CuI \cdot 4AgI$	*D*	2.200	
Mosesite, Hg, NH_4, Cl etc.	*D*	2.065	
Nantokite, CuCl	*D*	1.930	
Nickel oxide, NiO	white	2.23	Kundt
Noselite, $5Na_2O \cdot 3Al_2O_3 \cdot 6SiO_2 \cdot 2SO_2$	*D*	1.495	
Obsidian	*D*	1.4953	Kohlrausch
	D	1.4964	Mülheims
	D	1.4841	Corning
Opal, $SiO_2 \cdot nH_2O$	*D*	1.44807	Baille
	D	1.4536	Zymanyi
	D	1.45883	Brun
Periclasite, MgO	*D*	1.736	
Percylite, $PbO \cdot CuCl_2 \cdot H_2O$	*D*	2.050	
Perovskite, $CaO \cdot TiO_2$	*D*	2.380	
Pharmacosiderite, $3Fe_2O_3 \cdot 2As_2O_5 \cdot 3K_2O \cdot 5H_2O$	*D*	1.676	
Phosphorous	*D*	2.1442	Gladstone, Dale
Picotite, $(Mg, Fe)O \cdot (AlCr)_2O_3$	*D*	2.950	
Pitch	red	1.531	Wollaston
Pleonaste, $(Mg, Fe)O \cdot Al_2O_3$	*D*	1.770	
Pollucite, $2Cs_2O \cdot 2Al_2O_3 \cdot 9SiO_2 \cdot H_2O$	*D*	1.525	
Potassium bromide	*D*	1.5593	Topsoe, Christiansen
chloride	*D*	1.49038	Martens
chlorstannate	*D*	1.6574	Topsoe, Christiansen
iodide	*D*	1.6666	Topsoe, Christiansen
zinc cyanide, $2KCN \cdot Zn(CN)_2$	yellow	1.4115	Grailich
Pyrochlor, CaO, Ce_2O_3, TiO_2 etc.	*D*	1.960–2.000	
Quartz, fused	.656	1.45640	Giffard, Shenstone
	.589	1.45843	Giffard, Shenstone
	.509	1.46190	Giffard, Shenstone
	.361	1.47503	Giffard, Shenstone
	.275	1.49634	Giffard, Shenstone
	.214	1.53386	Giffard, Shenstone
	.185	1.57464	Giffard, Shenstone
Resin, aloes	red	1.619	Jamin
colophony	red	1.548	Jamin
copal	red	1.528	Jamin
mastic	red	1.535	Jamin
Rubidium bromide	*D*	1.5533	Craw
chloride	*D*	1.4928	Craw
iodide	*D*	1.6262	Leblanc, Erdmann
Schorlomite, $2CaO \cdot (Fe, Ti)_2O_3 \cdot 3(Si, Ti)O_2$	*D*	1.980	
Selenium	.760	2.612	Wood
	.656	2.729	
	.589	2.93	Wood
	.500	3.13	Wood
	.408	2.95	Wood
Senarmontite, Sb_2O_3	*D*	2.087	
Silver bromide	*D*	2.2536	Wernicke
chloride	*D*	2.0622	Wernicke
iodide	*D*	2.1816	Wernicke

INDEX OF REFRACTION OF OPTICALLY ISOTROPIC SOLIDS (Continued)

Substance.	Spectrum line or wave length.	Index of refraction.	Observer.
Sodalite, $3Na_2O \cdot 3Al_2O_3 \cdot 6SiO_2 \cdot 2NaCl$	*D*	1.483	
Sodium bromate	*D*	1.5943	Craw
chlorate	*D*	1.51523	Borel
chloride	*D*	1.5433	Borel
Spessartite, $3MnO \cdot Al_2O_3 \cdot 3SiO_2$	*D*	1.811	
Sphalerite, (Zn, Fe)S	*D*	2.37–2.47	
Spinel, $MgO \cdot Al_2O_3$	*D*	1.723	
Strontium nitrate	*D*	1.5667	Fock
Sylvite, KCl	*D*	1.490	
Uvarovite, $3CaO \cdot Cr_2O_3 \cdot 3SiO_2$	*D*	1.838	
Villiaumite, NaF	*D*	1.328	
Zinc blende, ZnS	*D*	2.3695	Baille
bromate, $Zn(BrO_3)_2 \cdot 6H_2O$	*D*	1.5452	Ortloff

INDEX OF REFRACTION OF UNIAXIAL CRYSTALS

The following table gives the index of refraction with reference to air for uniaxial crystals including minerals. More complete data for certain substances of optical importance will be found in succeeding tables.

Substance.	Spectrum line or wave length.	Index of refraction. Ordinary.	Index of refraction. Extraordinary.	Observer.
Alunite, $K_2O \cdot 3Al_2O_3 \cdot 4SO_3 \cdot 6H_2O$	*D*	1.572	1.592	
Ammonium arseniate, $NH_4H_2AsO_4$	*D*	1.5766	1.5217	Topsoe, Christiansen
monophosphate, $NH_4H_2PO_4$	*D*	1.5246	1.4792	Topsoe, Christiansen
uranyl acetate	*D*	1.4808	1.4933	Schrauf
Ammonium and cadmium chloride, $2NH_4Cl \cdot CdCl_2$	*D*	1.6038	1.6042	Schrauf
Ammonium and copper chloride, $2NH_4Cl \cdot CuCl_2 \cdot 2H_2O$	*D*	1.744	1.724	DeSenarmont
Anatase, TiO_2	*D*	2.53536	2.49585	Schrauf
Apatite, $Ca_5P_3O_{12}(ClF)$	*D*	1.6391	1.6355	Zymanyi
Apophyllite, $K_2O \cdot 8CaO \cdot 6SiO_2 \cdot 16H_2O$	*D*	1.535	1.537	
Argyrithrose, Ag_3SbS_3	*D*	3.084	2.881	Fizeau
Barysilite, $CPbO \cdot 2SiO_2$	*D*	2.070	2.050	
Benitoite, $BaO \cdot TiO_2 \cdot 3SiO_2$	*D*	1.757	1.804	
Benzil, $(C_6H_5CO)_2$	*D*	1.6588	1.6784	
Beryl, $3BeO \cdot Al_2O_3 \cdot 6SiO_2$	*D*	1.581	1.575	
Brucite, $MgO \cdot H_2O$	*D*	1.559	1.580	
Cacoxenite, $2Fe_2O_3 \cdot P_2O_5 \cdot 12H_2O$	*D*	1.582	1.645	
Cadmium potassium chloride, $2KCl \cdot CdCl_2$	*D*	1.5906	1.5907	Schrauf
Caesium thallium chloride, $Cs_3Tl_2Cl_9$	*D*	1.784	1.774	Pratt
Calcite, $CaO \cdot CO_2$	*D*	1.658	1.486	

INDEX OF REFRACTION OF UNIAXIAL CRYSTALS (Continued)

Substance.	Spectrum line or wave length.	Index of refraction. Ordinary.	Index of refraction. Extraordinary.	Observer.
Calcium chloride, $CaCl_2 \cdot 6H_2O$	yellow	1.417	1.393	Groth
Calcium copper acetate, $Ca(C_2H_3O_2)_2 \cdot Cu(C_2H_3O_2)_2$	*D*	1.436	1.478	Kohlrausch
Calcium hyposulfate, $CaS_2O_6 \cdot 4H_2O$	*D*	1.5496	......	Topsoe, Christiansen
Calcium strontium propionate, $SrCa_2(C_3H_5O_2)_6$	*D*	1.4871	1.4956	Fritz, Sassoni
Calomel, HgCl	*D*	1.97325	2.6559	Dufet
Cancrinite, $4Na_2O \cdot CaO \cdot 4Al_2O_3 \cdot 2CO_2 \cdot 9SiO_2 \cdot 3H_2O$	*D*	1.524	1.496	
Cassiterite, SnO_2	*D*	1.997	2.093	
Chabazite, $(Ca, Na_2)O \cdot Al_2O_3 \cdot 4SiO_2 \cdot 6H_2O$	*D*	1.480	1.482	
Chiolite, $2NaF \cdot AlF_3$	*D*	1.349	1.342	
Chrysocolla, $CuO \cdot SiO_2 \cdot 2H_2O$	*D*	1.460	1.570	
Cinnabarite, HgS	*D*	2.854	3.201	
Connellite, $20CuO \cdot SO_3 \cdot 2CuCl_2 \cdot 20H_2O$	*D*	1.724	1.746	
Coquimbite, $Fe_2O_3 \cdot 3SO_3 \cdot 9H_2O$	*D*	1.550	1.556	
Corundum, Al_2O_3, sapphire, ruby	*D*	1.769	1.760	Osann
Derbylite, $6FeO \cdot Sb_2O_3 \cdot 5TiO_2$	*Li*	2.450	2.510	
Dioptasite, $CuO \cdot SiO_2 \cdot H_2O$	*D*	1.654	1.707	
Dolomite, $CaO \cdot MgO \cdot 2CO_2$	*D*	1.682	1.503	
Douglasite, $2KCl \cdot FeCl_2 \cdot 2H_2O$	*D*	1.488	1.500	
Emerald, *see* beryl.				
Eudialite, $6Na_2O \cdot 6(Ca, Fe)O \cdot 20(Si, Zr)O_2 \cdot NaCl$	*D*	1.606	1.611	
Ganomalite, $6PbO \cdot 4(Ca, Mn)O \cdot 6SiO_2 \cdot H_2O$	*D*	1.910	1.945	
Gehlenite, $2CaO \cdot Al_2O_3 \cdot SiO_2$	*D*	.669	1.658	
Geikielite, $(Mg, Fe)O \cdot TiO_2$	*D*	2.310	1.950	

INDEX OF REFRACTION OF UNIAXIAL CRYSTALS (Continued)

Substance.	Spectrum line or wave length.	Index of refraction. Ordinary.	Extraordinary.	Observer.
Glucinum oxide, GlO	*D*	1.719	1.733	Mallard
sulfate, $GlSO_4 \cdot 4H_2O$	*D*	1.4714	1.4322	Wulff
	D	1.4720	1.4395	Topsoe, Christiansen
Hanksite, $11Na_2O \cdot 9SO_3 \cdot 2CO_2 \cdot KCl$	*D*	1.481	1.461	
Hematite, Fe_2O_3	*Li*	3.220	2.940	
Hydronephelite, $2Na_2O \cdot 3Al_2O_3 \cdot 6SiO_2 \cdot 7H_2O$	*D*	1.490	1.502	
Hydrotalcite, $6MgO \cdot Al_2O_3 \cdot CO_2 \cdot 15H_2O$	*D*	1.512	1.498	
Ice	*A*	1.3049	1.3062	Pulfrich
	D	1.3091	1.3104	Pulfrich
	F	1.3133	1.3147	Pulfrich
Iodyrite, AgI	*D*	2.210	2.220	
Ivory	*D*	1.539	1.541	Kohlrausch
Jarosite, $K_2O \cdot 3Fe_2O_3 \cdot 4SO_3 \cdot 6H_2O$	*D*	1.820	1.715	
Kaliophilite, $K_2O \cdot Al_2O_3 \cdot 2SiO_2$	*D*	1.537	1.533	
Lanthanum sulfate, $LaSO_4 \cdot 4H_2O$(?)	red	1.564	1.569	Des Cloizeaux
Laubanite, $2CaO \cdot Al_2O_3 \cdot 5SiO_2 \cdot 6H_2O$	*D*	1.475	1.486	
Magnesite, $MgO \cdot CO_2$	*D*	1.700	1.509	
Magnesium chlorostannate, $MgCl_2 \cdot SnCl_4 \cdot 6H_2O$	*D*	1.5885	1.597	Topsoe, Christiansen
fluosilicate, $MgF_2 \cdot SiF_4 \cdot 6H_2O$	*D*	1.3439	1.3602	Topsoe, Christiansen
platinocyanide, $Mg(CN)_2 \cdot Pt(CN)_2 \cdot 7H_2O$	*D*	1.5532		Grailich

INDEX OF REFRACTION OF UNIAXIAL CRYSTALS (Continued)

Substance.	Spectrum line or wave length.	Index of refraction. Ordinary.	Index of refraction. Extraordinary.	Observer.
Marialite, $3NaO_2 \cdot 3Al_2O_3 \cdot 18SiO_2 \cdot 2NaCl$	*D*	1.539	1.537	
Massicotite, PbO	*Li*	2.665	2.535	
Matlockite, $PbO \cdot PbCl_2$	*D*	2.150	1.040	
Meionite, $4CaO \cdot 3Al_2O_3 \cdot 6SiO_2$	*D*	1.597	1.560	
Melilite, Na_2O, CaO, Al_2O_3, SiO_2, etc.	*D*	1.634	1.629	
Mellite, $Al_2O_3 \cdot C_{12}O_9 \cdot 18H_2O$	*D*	1.539	1.511	
Milarite, $K_2O \cdot 4CaO \cdot 2Al_2O_3 \cdot 24SiO_2 \cdot H_2O$	*D*	1.532	1.529	
Mimetite, $9PbO \cdot 3As_2O_5 \cdot PbCl_2$	*D*	2.135	2.118	
Moissanite, CSi	*D*	2.654	2.697	
Nephelite, $Na_2O \cdot Al_2O_3 \cdot 2SiO_2$	*D*	1.542	1.538	
Nickel fluosilicate, $NiF_2 \cdot SiF_4 \cdot 6H_2O$	*D*	1.3910	1.4066	
selenate, $NiSeO_4 \cdot 6H_2O$	*D*	1.5393	1.5125	Topsoe, Christiansen
sulfate, $NiSO_4 \cdot 6H_2O$	*D*	1.5109	1.4873	Topsoe, Christiansen
Octahedrite, TiO_2	*D*	2.554	2.493	
Parisite, $2CeOF \cdot CaO \cdot 3CO_2$	*D*	1.676	1.757	
Penfieldite, $PbO \cdot 2PbCl_2$	*D*	2.130	2.210	
Penninnite, $5(Mg, Fe)O \cdot Al_2O_3 \cdot 3SiO_2 \cdot 4H_2O$	*D*	1.576	1.579	
Phenacite, $2BeO \cdot SiO_2$	*D*	1.654	1.670	
Phosgenite, $PbO \cdot PbCl_2 \cdot CO_2$	*D*	2.114	2.140	
Potassium arsenate, monobasic, KH_2AsO_4	*D*	1.5674	1.5179	Topsoe, Christiansen

INDEX OF REFRACTION OF UNIAXIAL CRYSTALS (Continued)

Substance.	Spectrum line or wave length.	Index of refraction. Ordinary.	Index of refraction. Extraordinary.	Observer.
copper chloride, $2KCl \cdot CuCl_2 \cdot 2H_2O$	*D*	1.6365	1.6148	Grailich
copper cyanide, $2KCN \cdot Cu(CN)_2$	*D*	1.5215	1.5215	Grailich
hyposulfate, $K_2S_2O_6$	*D*	1.4550	1.5153	Topsoe, Christiansen
lithium sulfate, $LiKSO_4$	*D*	1.4715	1.4721	Wulff
phosphate, acid, KH_2PO_4	*D*	1.5095	1.4684	Topsoe, Christiansen
Powellite, $CaO \cdot MoO_3$	*D*	1.967	1.978	
Proustite, $3Ag_2S, As_2S_3$	*Li*	2.979	2.711	
Pyragyrite, $3Ag_2S \cdot Sb_2S_3$	*Li*	3.084	2.881	
Pyrochroite, $MnO \cdot H_2O$	*D*	1.723	1.681	
Pyromorphite, $9PbO \cdot 3P_2O_5 \cdot PbCl_2$	*D*	2.050	2.042	
Quartz, SiO_2	*D*	1.54424	1.55335	Mean
Rhodochrosite, $MnO \cdot CO_2$	*D*	1.818	1.505	
Rubidium hyposulfate, $Rb_2S_2O_6$	*D*	1.4574	1.5078	Topsoe, Christiansen
Ruby, *see* corundum.				
Rutile, TiO_2	*D*	2.661	2.903	
Sapphire, *see* corundum.				
Scheelite, $CaO \cdot WO_3$	*D*	1.918	1.934	
Sellaite, MgF_2	*D*	1.378	1.390	
Siderite, $FeO \cdot CO_2$	*D*	1.875	1.635	

INDEX OF REFRACTION OF UNIAXIAL CRYSTALS (Continued)

Substance.	Spectrum line or wave length.	Index of refraction.		Observer.
		Ordinary.	Extraordinary.	
Silicon carbide, carborundum	*D*	2.786	2.832	Becke
Silver phosphate, Ag_2HPO_4	*D*	1.8036	1.7983	Dufet
Smithsonite, $ZnO \cdot CO_2$	*D*	1.818	1.618	
Sodium arsenate, $Na_3AsO_4 \cdot 12H_2O$	*D*	1.4567	1.4662	Dufet
nitrate, $NaNO_3$	*D*	1.5874	1.3361	Schrauf
phosphate, $Na_3PO_4 \cdot 12H_2O$	*D*	1.4458	1.4524	Dufet
vanadate, $Na_3VO_4 \cdot 12H_2O$	*D*	1.5095	1.5232	Baker
vanadate, $Na_3VO_4 \cdot 10H_2O$	*D*	1.5398	1.5475	Baker
Stolzite, $PbO \cdot WO_3$	*D*	2.269	2.182	
Strychnine sulfate	*D*	1.6137	1.5988	Martin
Tapiolite, $FeO \cdot (TaCb)_2O_5$	*Li*	2.270	2.420	
Thaumasite, $3CaO \cdot CO_2 \cdot SiO_2 \cdot 15H_2O$	*D*	1.507	1.468	
Torbernite, $CUO \cdot 2UO_3 \cdot P_2O_5 \cdot 8H_2O$	*D*	1.592	1.582	
Tourmaline, Na_2O, FeO, Al_2O_3, B_2O_3, SiO_2, etc.	*D*	1.669	1.638	
Vanadinite, $9PbO \cdot 3V_2O_5 \cdot PbCl_2$	*D*	2.354	2.299	
Vesuvianite, $2(Ca, Mn, Fe)O \cdot (Al, Fe)(OH, F)O \cdot 2SiO_2$	*D*	1.716	1.718	
Wernerite	*D*	1.578	1.551	
Willemite, $2ZnO \cdot SiO_2$	*D*	1.694	1.723	
Wulfenite, $PbO \cdot MoO_3$	*Li*	2.402	2.304	
Xanotime, $Y_2O_3 \cdot P_2O_5$	*D*	1.721	1.816	
Zincite, ZnO	*D*	2.008	2.029	
Zircon, $ZrO_2 \cdot SiO_2$	*D*	1.923	1.968	

INDEX OF REFRACTION OF BIAXIAL CRYSTALS

The following table gives the indices of refraction and the angle between the optic axes for biaxial crystals. The index is relative to air and the wave length that of the D (Na) line except where noted.

Substance.	Index of refraction. n	n	n	Angle of the optic axes.		Observer.
Actinolite, $CaO \cdot 3(Mg, Fe)O \cdot 4SiO_2$	1.611	1.627	1.636	80°	0′	1
Aegirine, $Na_2Fe_2Si_4O_{12}$	1.763	1.799	1.812	62	13	2
Albite, $Na_2O \cdot Al_2O_3 \cdot 6Si_3O_2$	1.529	1.533	1.539	—	—	3
Aluminite, $Al_2O_3 \cdot SO_3 \cdot 9H_2O$	1.459	1.464	1.470	—	—	—
Alunogenite, $Al_2O_3 \cdot 3SO_3 \cdot 16H_2O$	1.474	1.476	1.483	—	—	—
Amblygonite, $Al_2O_3 \cdot P_2O_5 \cdot 2LiF$	1.578	1.593	1.597	50		1
Ammonium antimonyl tartrate, $2(NH_4 \cdot SbO \cdot C_4H_4O_6) \cdot H_2O$	(C line)	1.6229	....	68	8	4
carbonate, monobasic, $(NH_4)HCO_3$	1.4227	1.5358	1.5545	—	—	5
cobalt selenate, $(NH_4)_2Co(SeO_4)_2 \cdot 6H_2O$	1.524	1.531	1.540	82	1	4
cobalt sulfate, $(NH_4)_2 \cdot Co \cdot (SO_4)_2 \cdot 6H_2O$	1.490	1.496	1.5024	—	—	6
copper selenate, $(NH_4)_2SeO_4 \cdot CuSeO_4 \cdot 6H_2O$	1.5213	1.5355	1.5395	55	24	4
copper sulfate, $(NH_4)_2SO_4 \cdot CuSO_4 \cdot 6H_2O$	(yellow)	1.497	....	71	21	7
iron selenate, $(NH_4)_2Fe(SeO_4)_2 \cdot 6H_2O$	1.5201	1.5260	1.5356	76	48	4
iron sulfate, $(NH_4)_2Fe(SO_4)_2 \cdot 6H_2O$	(yellow)	1.490	....	76	52	7
lithium racemate, $(NH_4)Li(C_4H_4O_6) \cdot H_2O$	(red)	1.5287	....	81	42	8
lithium sulfate, $(NH_4)LiSO_4$	(red)	1.437	....	36	32	8
lithium tartrate, $(NH_4)Li(C_4H_4O_6) \cdot H_2O$	(red)	(red)	1.5673	87	6	8
magnesium selenate, $(NH_4)_2SeO_4 \cdot MgSeO_4 \cdot 6H_2O$	1.5056	1.5075	1.5150	53	44	4
magnesium sulfate, $(NH_4)_2 \cdot Mg(SO_4)_2 \cdot 6H_2O$	1.4717	1.4728	1.4791	50	40	4
malate	(red)	1.503	....	47	34	8

INDEX OF REFRACTION OF BIAXIAL CRYSTALS (Continued)

Substance.	Index of refraction. n	n	n	Angle of the optic axes.	Observer.
manganese sulfate, $(NH_4)_2 \cdot Mn(SO_4)_2 \cdot 6H_2O$	(yellow)	1.484	....	69 9	6
nickel selenate, $(NH_4)_2 \cdot Ni(SeO_4)_2 \cdot 6H_2O$	1.5291	1.5372	1.5466	86 14	4
nickel sulfate, $(NH_4)_2 \cdot Ni(SO_4)_2 \cdot 6H_2O$	yellow 1.489	1.498	1.508	86 26	7
oxalate, $(NH_4)_2C_2O_4 \cdot H_2O$	1.4381	1.5475	1.5950	63 58	10
racemate, $(NH_4)_2C_4H_4O_6 \cdot 2H_2O$	(red)	1.564	....	60 54	8
sodium racemate, $(NH_4)Na(C_4H_4O_6) \cdot H_2O$	(red)	1.473	....	44 20	8
sodium tartrate, $(NH_4)Na(C_4H_4O_6) \cdot 4H_2O$	1.4950	1.4980	1.4990	96 30	8
sulfate, $(NH_4)_2SO_4$	1.5208	1.5232	1.5332	52 58	11
tartrate, acid, $(NH_4)H(C_4H_4O_6)$	1.5188	1.5614	1.5910	79 54	4
tartrate, neutral, $(NH_4)_2C_4H_4O_6$	(yellow)	1.581	....	30 36	12
zinc selenate, $(NH_4)_2Zn(SeO_4)_2 \cdot 6 \cdot H_2O$	1.5233	1.5292	1.5372	81 22	4
zinc sulfate, $(NH_4)_2Zn(SO_4)_2 \cdot 6H_2O$	1.4890	1.4934	1.4996	79 43	13
Andalusite, $Al_2O_3 \cdot SiO_2$	red 1.632	1.638	1.643	84 30	12
Andesine, $(CaO, Na_2O)Al_2O_3 \cdot 4SiO_2$	1.549	1.553	1.556	88	1
Anglesite, PbO, SO_3	1.8771	1.8822	1.8936	75 24	14
Anhydrite, CaO, SO_3	1.5693	1.5751	1.6130	43 41	15
Anorthite, $CaO \cdot Al_2O_3 \cdot 2SiO_2$	1.574	1.581	1.586	77	1
Anorthoclase, $(Na, K)_2O \cdot Al_2O_36SiO_2$	1.523	1.529	1.531		
Anthophyllite, $MgO \cdot SiO_2$	1.633	1.642	1.657	83 54	1
Antigorite, $(MgO)_3(SiO_2)_2 \cdot 3H_2O$, serpentine	1.560	1.570	1.571	....	1
Antipyrin, $C_{11}H_{12}NO_2$	1.5697	1.6935	1.7324	54 20	16

INDEX OF REFRACTION OF BIAXIAL CRYSTALS (Continued)

Substance.	Index of refraction.			Angle of the optic axes.		Observer.
	n	n	n			
Aragonite, $CaO \cdot CO_2$	1.52999	1.68116	1.68567	18	117	17, 18
Arcanite, $K_2O \cdot SO_3$	1.494	1.495	1.497			
Asparagine, $C_4H_8O_3N_2$	1.5476	1.5800	1.6190	86	28	19
Atacamite, $3CuO \cdot CuCl_2 \cdot 3H_2O$	1.831	1.861	1.880			
Augelite, $2Al_2O_3P_2O_5 \cdot 3H_2O$	1.5736	1.5759	1.5877	50	49	20
Augite, $Ca(Fe, Mg)Si_2O_6 \cdot MgAl_2SiO_6$	1.688–1.712	1.701–1.717	1.713–1.733	60		3, 1
Autunite, $CaO \cdot 2UO_3 \cdot P_2O_5 \cdot 8H_2O$	1.553	1.575	1.577	30		1
Axinite, $6(Ca, Mn)O \cdot 2Al_2O_3 \cdot B_2O_3 \cdot 8SiO_2 \cdot H_2O$	1.678	1.685	1.688	72		12
Azurite, $3CuO \cdot 2CO_2 \cdot H_2O$	1.730	1.758	1.838			
Baddeleyite, ZrO_2	2.130	2.190	2.200			
Barite, $BaO \cdot SO_3$	1.63609	1.63726	1.64814	36	48	17, 15
Barium cadmium bromide, $BaBr_2 \cdot CdBr_2 \cdot 4H_2O$	(yellow)	1.702	....	....	....	7
cadmium chloride, $BaCl_2 \cdot CdCl_2 \cdot 4H_2O$	....	1.651	....	61	1	7
chlorate, $Ba(ClO_3)_2 \cdot H_2O$	1.5622	1.577	1.635	55	30	21
chloride, $BaCl_2 \cdot 2H_2O$	yellow 1.635	1.644	1.664	84	20	12
formate, $Ba(HCO_2)_2$	1.5729	1.5970	1.6361	76	42	12
hyposulfate, $BaS_2O_6 \cdot 2H_2O$	1.5860	1.5951	1.6072	84	33	10
platinocyanide, $Ba(CN)_2 \cdot Pt(CN) \cdot 4H_2O$	(red)	1.662	....	20	51	7
propionate, $Ba(C_3H_5O_2)_2 \cdot H_2O$	....	1.5175	....	81	36	22
Beccarite, $ZrO_2 \cdot SiO_2$	1.9272	1.9277	1.9820	....	....	23
Bertrandite, $Be_4Si_2O_8$	1.588	1.593	1.611	74	51	1, 24
Beryllonite, $Na_2O \cdot 2BeO \cdot P_2O_5$	1.5520	1.5579	1.5608	67	56	25

INDEX OF REFRACTION OF BIAXIAL CRYSTALS (Continued)

Substance.	Index of refraction. n	n	n	Angle of the optic axes.		Observer.
Biotite, $K_2O \cdot 4(Mg, Fe)O \cdot 2Al_2O_3 \cdot 6SiO_2 \cdot H_2O$	1.541	1.574	1.574			
Boracite, $4(MgB_4O_7) \cdot MgCl_2 \cdot 2MgO$	yellow 1.662	1.667	1.673	83	33	26
Borax, $Na_2B_4O_7 \cdot 10H_2O$	1.4467	1.4694	1.4724	39	21	27
Bloedite, $Na_2O \cdot MgO \cdot 2SO_3 \cdot 4H_2O$	1.486	1.488	1.489			
Brookite, TiO_2	2.5832	2.5856	2.7414	17	7	2
Cadmium caesium sulfate, $CdSO_4 \cdot Cs_2SO_4 \cdot 6H_2O$	1.4975	1.5000	1.5062	67	53	28
magnesium chloride, $(CdCl_2)_2 \cdot MgCl_2 \cdot 12H_2O$	(yellow)	1.5331	1.5769	.....	.....	9
rubidium sulfate, $CdSO_4 \cdot Rb_2SO_4 \cdot 6H_2O$	1.4798	1.4848	1.4948	72	26	28
sulfate, $3CdSO_4 \cdot 8H_2O$	(yellow)	1.565	.....	88	9	12
Caesium cobalt sulfate, $Cs_2SO_4 \cdot CoSO_4 \cdot 6H_2O$	1.5057	1.5085	1.5132	81	34	28
copper sulfate, $Cs_2SO_4 \cdot CuSO_4 \cdot 6H_2O$	1.5048	1.5061	1.5153	43	24	28
iron sulfate, $Cs_2SO_4 \cdot FeSO_4 \cdot 6H_2O$	1.5003	1.5035	1.5094	74	51	28
magnesium sulfate, $Cs_2SO_4 \cdot MgSO_4 \cdot 6H_2O$	1.4857	1.4858	1.4916	16	25	28
manganese sulfate, $Cs_2SO_4 \cdot MnSO_4 \cdot 6H_2O$	1.4946	1.4966	1.5025	50	57	28
nickel sulfate, $Cs_2SO_4 \cdot NiSO_4 \cdot 6H_2O$	1.5087	1.5129	1.5162	87	21	28
selenate, Cs_2SeO_4	1.5989	1.5999	1.6003	71	49	28
sulfate, Cs_2SO_4	1.5598	1.5644	1.5662	65	20	28
zinc sulfate, $Cs_2SO_4 \cdot ZnSO_4 \cdot 6H_2O$	1.5022	1.5048	1.5093	74	11	28
Calamine, $2ZnO \cdot SiO_2 \cdot H_2O$	1.614	1.617	1.636	46	10	5
Calcium borate, CaB_2O_7	1.540	1.656	1.682	.....	.....	26
formate, $Ca(HCO_2)_2$	1.5101	1.5135	1.5775	.....	.....	19
malate, $Ca(C_4H_5O_5)_2 \cdot 6H_2O$	1.4933	1.5073	1.5449	.....	.....	19
Caledonite, $2(Pb, Cu)O \cdot SO_3 \cdot H_2O$	1.818	1.866	1.909			

INDEX OF REFRACTION OF BIAXIAL CRYSTALS (Continued)

Substance.	Index of refraction. n	n	n	Angle of the optic axes.		Observer.
Carnallite, $KCl \cdot MgCl_2 \cdot 6H_2O$	1.466	1.475	1.494			
Celestite, $SrO \cdot SO_3$	1.622	1.624	1.631	51	12	29
Cerium hyposulfate, $CeS_2O_6 \cdot 5H_2O$	....	1.507	....	88	52	8
Cerussite, $PbO \cdot CO_2$	1.8037	2.0763	2.0780	....	....	19
Chalcanthite, $CuO \cdot SO_3 \cdot 5H_2O$	1.516	1.539	1.546			
Chloral hydrate, $CCl_3 \cdot CH(OH)_2$	1.5383	1.5995	1.6017	20	48	27
Chondrodite, $4MgO \cdot 2SiO_2 \cdot Mg(F, OH)_2$	1.609	1.619	1.639	80		12
Chrysoberyl, $BeO \cdot Al_2O_3$	1.747	1.748	1.757			
Citric acid, $C_6H_8O_7 \cdot H_2O$	1.4932	1.4977	1.5089	....	....	19
Claudetite, As_2O_3	1.871	1.920	2.010			
Cobalt acetate, $Co(C_2H_3O_2)_2 \cdot 4H_2O$	(yellow)	1.542	....	30	43	7
rubidium sulfate, $CoSO_4 \cdot Rb_2SO_4 \cdot 6H_2O$	1.4859	1.4916	1.5014	75	11	28
selenate, $CoSeO_4 \cdot 6H_2O$	....	1.5225	1.5227	7	13	4
Copper formate, $Cu(HCO_2)_2 \cdot 4H_2O$	1.4133	1.5423	1.5571	....	....	27
strontium formate, $Cu(HCO_2)_2 \cdot 2(Sr(HCO_2))$ $8H_2O$	1.4995	1.5199	1.5801	72	4	10
sulfate, $CuSO_4 \cdot 5H_2O$	1.5161	1.5394	1.5460	55	45	29
Codein, $C_{18}H_{21}NO_3 \cdot H_2O$	1.5390	1.5435	....	....	....	9
Colemanite, $2CaO \cdot 3Be_2O_3 \cdot 5H_2O$	1.58626	1.59202	1.61398	55	20	15, 20
Copiapite, $2Fe_2O_3 \cdot 5SO_3 \cdot 18H_2O$	1.530	1.543	1.595			
Cordierite, $4(Mg, Fe)O \cdot 4Al_2O_3 \cdot 10SiO_2 \cdot H_2O$ (Ceylon)	1.5384	1.5401	1.5438	85	50	31, 32
	1.59172	1.59700	1.59919	....	....	17
Cotunnite, $PbCl_2$	2.200	2.217	2.260			

INDEX OF REFRACTION OF BIAXIAL CRYSTALS (Continued)

Substance.	Index of refraction. *n*	*n*	*n*	Angle of the optic axes.	Observer.
Crocoite, $PbO \cdot CrO_3$	*Li* 2.310	2.370	2.660		
Cyanite, $Al_2O_3 \cdot SiO_2$	1.712	1.720	1.728		
Danburite, $CaO \cdot B_2O_3 \cdot 2SiO_2$	1.632	1.634	1.636		
Datolite, $2CaO \cdot 2SiO_2 \cdot B_2O_3 \cdot H_2O$	1.625	1.653	1.669		
Diasporite, $Al_2O_3 \cdot H_2O$	1.702	1.722	1.750		
Diopside, $CaO \cdot MgO \cdot 2SiO_2$	1.664	1.671	1.694		
Enstatite, $MgO \cdot SiO_2$	1.650	1.653	1.658		
Epidote, $4CaO \cdot 3(AlFe)_2O_3 \cdot 6SiO_2 \cdot H_2O$	1.729	1.754	1.768		
Epsomite, $MgO \cdot SO_3 \cdot 7H_2O$	1.433	1.455	1.461		
Erythrite, $3CoO \cdot As_2O_5 \cdot 8H_2O$	1.626	1.661	1.699		
Euclasite, $2BeO \cdot Al_2O_3 \cdot 2SiO_2 \cdot H_2O$	1.652	1.655	1.671		
Fayalite, $2FeO \cdot SiO_2$	1.824	1.864	1.874		
Ferrous sulfate, $FeSO_4 \cdot 7H_2O$	1.4713	1.4782	1.4856	85 27	11
Forsterite, $2MgO \cdot SiO_2$	1.635	1.651	1.670		
Gaylussite, $Na_2O \cdot CaO \cdot 2CO_2 \cdot 5H_2O$	1.444	1.516	1.523	33 46	
Gibbsite, $Al_2O_3 \cdot 3H_2O$	1.566	1.566	1.587		
Glauberite, $Na_2O \cdot CaO \cdot 2SO_3$	1.515	1.532	1.536		
Glaucophanite, $Na_2O \cdot 2FeO \cdot Al_2O_3 \cdot 6SiO_2$	1.621	1.638	1.638	43 58	
Glucinum selenate, $GlSeO_4 \cdot 4H_2O$	1.4664	1.5007	1.5027	26 48	4
Goethite, $Fe_2O_3 \cdot H_2O$	*Li* 2.210	2.350	2.350		
Goslarite, $ZnO \cdot SO_3 \cdot 7H_2O$	1.457	1.480	1.484		
Gypsum, $CaO \cdot SO_3 \cdot 2H_2O$	1.52046	1.52260	1.52962	58 5	27

INDEX OF REFRACTION OF BIAXIAL CRYSTALS (Continued)

Substance.	Index of refraction. n	n	n	Angle of the optic axes.		Observer.
Hambergite, Be_2HBO_4	1.5595	1.5908	1.6311	87	7	33
Harmotomite, $(K_2, Ba)O \cdot Al_2O_3 \cdot 5SiO_2 \cdot 5H_2O$	1.503	1.505	1.508			
Herderite, $CaPO_4 \cdot BeFOH$	1.592	1.612	1.621	68	2	12, 34
Heulandite, $CaO \cdot Al_2O_3 \cdot 6SiO_2 \cdot 3H_2O$	1.498	1.499	1.505	....	....	1
Hopeite, $3ZnO \cdot P_2O_5 \cdot 4H_2O$	1.527	1.590	1.590	54	44	12
Hornblende, Na_2O, MgO, FeO, SiO_2, etc.	1.629	1.642	1.653	84		1
Huebnerite, $MnO \cdot WO_3$	2.170	2.220	2.320			
Hutchinsonite, $(Tl, Ag)_2S \cdot PbS \cdot 2As_2S_3$	3.078	3.176	3.188			
Hydrocarbostyril, C_9H_9ON	1.47917	1.70947	1.81020	60		35
Hydromagnesite, $4MgO \cdot 3CO_2 \cdot 4H_2O$	1.527	1.530	1.540			
Kainite, $MgO \cdot SO_3 \cdot KCl \cdot 3H_2O$	1.494	1.505	1.516			
Kieserite, $MgO \cdot SO_3 \cdot H_2O$	1.523	1.535	1.586			
Labradorite	1.559	1.563	1.568			
Lanarkite, $2PbO \cdot SO_3$	1.930	1.990	2.020			
Lanthanite, $La_2O_3 \cdot 3CO_2 \cdot 9H_2O$	1.520	1.587	1.613			
Laumontite, $CaO \cdot Al_2O_3 \cdot 4SiO_2 \cdot 4H_2O$	1.513	1.524	1.525			
Laurionite, $PbCl_2 \cdot PbO \cdot H_2O$	2.077	2.116	2.158			
Lazulite, $(Fe, Mg)O \cdot Al_2O_3 \cdot P_2O_5 \cdot H_2O$	1.603	1.632	1.639			
Lead acetate, $Pb(C_2H_3O_2)_2 \cdot 3H_2O$	....	1.576	....	83	55	12
carbonate, *see* cerussite.						
chloride, $PbCl_2$	2.19924	2.21723	2.25965	66	12	36
Leadhillite, $4PbO \cdot SO_3 \cdot 2CO_2 \cdot H_2O$	1.870	2.000	2.010			
Lepidocrocite, $Fe_2O_3 \cdot H_2O$	1.930	2.210	2.510			
Lepidolite, $Al_2O_3 \cdot 3SiO_2 \cdot 2(K, Li)F$	1.560	1.598	1.605			

INDEX OF REFRACTION OF BIAXIAL CRYSTALS (Continued)

Substance.	Index of refraction. n	n	n	Angle of the optic axes.		Observer.
Limonite	2.170	2.290	2.310			
Lithargite, PbO	2.510	2.610	2.710			
Lithium carbonate, Li_2CO_3	1.428	1.567	1.572	....	....	26
hyposulfate, $Li_2S_2O_6 \cdot 2H_2O$	1.5487	1.5602	1.5788	78	16	4
rubidium tartrate, $LiRb(C_4H_4O_6) \cdot H_2O$	(red)	1.552	....	57	10	8
sodium racemate, $LiNa(C_4H_4O_6) \cdot H_2O$	(red)	1.4904	....	68	57	8
sulfate, $LiSO_4$	....	1.465	....	72	58	8
Magnesium acetate, $Mg(C_2H_3O_2)_2 \cdot H_2O$	....	1.491	....	56	34	7
borate, MgB_2O_6	1.6527	1.6537	1.6748	....	....	26
carbonate, $MgCO_3 \cdot 3H_2O$	1.495	1.501	1.526	53	5	34
chromate, $MgCrO_4 \cdot 7H_2O$	1.5211	1.5500	1.5680	75	28	4
rubidium sulfate, $MgSO_4 \cdot Rb_2SO_4 \cdot 6H_2O$	1.4672	1.4689	1.4779	48	46	28
selenate, $MgSeO_4 \cdot 6H_2O$	1.4856	1.4892	1.4911	28	12	4
sulfate, $MgSO_4 \cdot 7H_2O$	1.4328	1.4555	1.4610	51	25	37
Malachite, $2CuO \cdot CO_2 \cdot H_2O$	1.655	1.875	1.909			
Manganese borate, MnB_2O_5	1.617	1.738	1.776	55	47	26
rubidium sulfate, $MnSO_4 \cdot Rb_2SO_4 \cdot 6H_2O$	1.4764	1.4809	1.4910	67	38	13
Manganite, $Mn_2O_3 \cdot H_2O$	2.240	2.240	2.530			
Mascagnite, $(NH_4)_2O \cdot SO_3$	1.521	1.523	1.533			
Matlockite, $PbO \cdot PbCl_2$	2.040	2.150	2.150			
Melanterite, $FeO \cdot SO_3 \cdot 7H_2O$	1.471	1.478	1.486			
Mendipite, $2PbO \cdot PbCl_2$	2.240	2.270	2.310			
Microcline, $K_2O \cdot Al_2O_3 \cdot 6SiO_2$	1.522	1.526	1.530			

INDEX OF REFRACTION OF BIAXIAL CRYSTALS (Continued)

Substance.	Index of refraction. n	n	n	Angle of the optic axes.		Observer.
Mirabilite, $Na_2O \cdot SO_3 \cdot 10H_2O$	1.394	1.396	1.398			
Monetite, $2CaO \cdot P_2O_5 \cdot H_2O$	1.515	1.518	1.525			
Monticellite, $CaO \cdot MgO \cdot SiO_2$	1.651	1.662	1.668			
Montroydite, HgO	2.370	2.500	2.650			
Muscovite, $K_2O \cdot 3Al_2O_3 \cdot 6SiO_2 \cdot 2H_2O$	1.561	1.590	1.594			
Natrolite, $Na_2O \cdot Al_2O_3 \cdot 3SiO_2 \cdot 2H_2O$	1.480	1.482	1.493			
Natron, $Na_2O \cdot CO_2 \cdot 10H_2O$	1.405	1.425	1.440			
Newberyite, $2MgO \cdot P_2O_5 7H_2O$	1.514	1.519	1.533			
Nickel rubidium sulfate, $NiSO_4 \cdot Rb_2SO_4 \cdot 6H_2O$	1.4895	1.4961	1.5052	82		28
sulfate, $NiSO_4 \cdot 7H_2O$	1.4669	1.4888	1.4921	41	56	4
Niter, $K_2O \cdot N_2O_5$	1.334	1.505	1.506			
Oligoclase	1.539	1.543	1.547			
Olivenite, $4CuO \cdot As_2O_5 \cdot H_2O$	1.772	1.810	1.863			
Olivine, Mg_2SiO_4	1.653	1.670	1.689	88	54	3
Orthoclase, $K_2O \cdot Al_2O_3 \cdot 6SiO_2$	1.518	1.524	1.526			
Pectolite, $Na_2O \cdot 4CaO \cdot 6SiO_2 \cdot H_2O$	1.595	1.606	1.634			
Petalite, $Li_2O \cdot Al_2O_3 \cdot 8SiO_2$	1.504	1.510	1.516	83	34	1, 12
Phlogopite, $K_2O \cdot 6MgO \cdot Al_2O_3 \cdot 6SiO_2 \cdot 2H_2O$	1.562	1.606	1.606			
Potassium bichromate, $K_2Cr_2O_7$	1.7202	1.7380	1.8197	51	53	27
chromate, K_2CrO_4	......	1.7254	......	51	40	4
cobalt selenate, $K_2SeO_4 \cdot CoSeO_4 \cdot 6H_2O$	1.5135	1.5195	1.5358	63	52	4
cobalt sulfate, $K_2SO_4 \cdot CoSO_4 \cdot 6H_2O$	1.4807	1.4865	1.5004	68	41	28
copper selenate, $K_2SeO_4 \cdot CuSeO_4 \cdot 6H_2O$	1.5096	1.5235	1.5385	88	12	4

INDEX OF REFRACTION OF BIAXIAL CRYSTALS (Continued)

Substance.	Index of refraction. n	n	n	Angle of the optic axes.	Observer.
Potassium copper sulfate, $K_2SO_4 \cdot CuSO_4 \cdot 6H_2O$	1.4836	1.4864	1.5020	46 32	28
ferricyanide, $K_3Fe(CN)_6$	1.5660	1.5689	1.5831	....	19
ferrocyanide, $K_4Fe(CN)_6 \cdot 3H_2O$	....	1.5772	....	78 10	27
hypophosphate, $K_2H_2P_2O_6 \cdot 2H_2O$	1.4893	1.5314	1.5363	36 12	27
hypophosphate, $K_2H_2P_2O_6 \cdot 3H_2O$	1.4768	1.4843	1.4870	61 48	27
lithium ferrocyanide, $K_2Li_2Fe(CN)_6 \cdot 3H_2O$	1.5883	1.6007	1.6316	65 56.5	8
lithium tartrate, $LiK(C_4H_4O_6) \cdot H_2O$	(red)	1.5226	....	75 58	8
magnesium selenate, $K_2SeO_4 \cdot MgSeO_4 \cdot 6H_2O$	1.4950	1.4970	1.5120	40 22	4
magnesium sulfate, $K_2SO_4 \cdot MgSO_4 \cdot 6H_2O$	1.4607	1.4629	1.4755	47 54	28
nickel selenate, $K_2SeO_4 \cdot NiSeO_4 \cdot 6H_2O$	1.5199	1.5248	1.5339	72 56	4
nickel sulfate, $K_2SO_4 \cdot NiSO_4 \cdot 6H_2O$	1.4836	1.4916	1.5051	75 16	28
nitrate, KNO_3	1.3346	1.5056	1.5064	....	19
osmium cyanide, $K_4Os(CN)_6 \cdot 3H_2O$	....	1.6071	....	47	27
platinum dibrom-nitrite, $K_2Br_2Pt(NO_2)_2 \cdot H_2O$	1.626	1.6684	1.757	72 21	27
ruthenium cyanide, $KRu(CN)_6 3H_2O$	....	1.5837	....	54 0	27
selenate, K_2SeO_4	1.5352	1.5390	1.5446	76 50	28
sulfate, K_2SO_4	1.4935	1.4947	1.4973	67 20	28
zinc selenate, $K_2SeO_4 \cdot ZnSeO_4 \cdot 6H_2O$	1.5115	1.5177	1.5327	66 8	4
zinc sulfate, $K_2SO_4 \cdot ZnSO_4 \cdot 6H_2O$	1.4775	1.4833	1.4969	68 14	28
Prehnite, $2CaO \cdot Al_2O_3 \cdot 3SiO_2 \cdot H_2O$	1.616	1.626	1.649	67	12
Pseudobrookite, $2Fe_2O_3 \cdot 3TiO_2$	*Li* 2.380	2.390	2.420		
Pyrophyllite, $Al_2O_3 \cdot 4SiO_2 \cdot H_2O$	1.552	1.588	1.600		

INDEX OF REFRACTION OF BIAXIAL CRYSTALS (Continued)

Substance.	Index of refraction. *n*	*n*	*n*	Angle of the optic axes.	Observer.
Racemic acid, $C_4H_6O_6\cdot H_2O$	(yellow)	1.526	......	....	38
Raspite, $PbO\cdot WO_3$	2.270	2.270	2.300		
Realgar, AsS	*Li* 2.460	2.590	2.610		
Resorcin, $C_6H_6O_2$	....	1.555	......	46 14	38
Rubidium selenate, Rb_2SeO_4	1.5515	1.5537	1.5582	68 53	28
sulfate, Rb_2SO_4	1.5131	1.5133	1.5144	....	13
zinc sulfate, $Rb_2SO_4\cdot ZnSO_4\cdot 6H_2O$	1.4833	1.4882	1.4976	72 30	13
Sassolite, $B_2O_3\cdot H_2O$	1.340	1.456	1.495		
Sillimanite, $Al_2O_3SiO_2$	1.659	1.661	1.680	26 —	1
Scolecite, $CaO\cdot Al_2O_3\cdot SiO_2\cdot 3H_2O$	1.512	1.519	1.519		
Scorodite, $Fe_2O_3\cdot As_2O_5\cdot 4H_2O$	1.765	1.774	1.797		
Sodium arsenate, $Na_2HAsO_4\cdot 12H_2O$	1.4453	1.44955	1.4513	65 13	27
$Na_2HAsO_4\cdot 7H_2O$	1.4622	1.4658	1.4782	57 7	27
$NaH_2AsO_4\cdot 2H_2O$	1.4794	1.5021	1.5265	88 57	27
$NaH_2AsO_4\cdot H_2O$	1.5382	1.5535	1.5607	67 57	27
bichromate, $Na_2Cr_2O_7\cdot 2H_2O$	1.6610	1.6994	1.7510	83 42	27
ferrocyanide, $Na_4Fe(CN)_6\cdot 12H_2O$	(yellow)	1.529	....	81 25	12
hypophosphate, $Na_4P_2O_6\cdot 10H_2O$	1.4777	1.4822	1.5036	48 50	27
$Na_3HP_2O_6\cdot 9H_2O$	1.4653	1.4738	1.4804	82 0	27
$Na_2H_2P_2O_6\cdot 6H_2O$	1.4855	1.4897	1.5041	57 20	27
hypophosphite, $Na_2HPO_3\cdot 5H_2O$	....	1.4434	....	44 7	27
$NaH_2PO_3\cdot 5H_2O$	1.4193	1.4309	1.4493	77 38	27

INDEX OF REFRACTION OF BIAXIAL CRYSTALS (Continued)

Substance.	Index of refraction. n	n	n	Angle of the optic axes.	Observer.
hyposulfate, $Na_2S_2O_3 \cdot 2H_2O$	yellow 1.4820	1.4954	1.5185	75 14	5
molybdate, $Na_6Mo_7O_{24} \cdot 22H_2O$	(yellow)	1.627	......	84 6	12
phosphate, $Na_2HPO_4 \cdot 12H_2O$	1.4321	1.4361	1.4373	56 43	27
$Na_2HPO_4 \cdot 7H_2O$	1.44115	1.4424	1.4526	38 50	27
$NaH_2PO_4 \cdot 2H_2O$	1.44005	1.4629	1.48145	82 35	27
$NaH_2PO_4 \cdot H_2O$	1.4557	1.4852	1.4873	29 22	27
pyrophosphate, $Na_4P_2O_7 \cdot 10H_2O$	1.4499	1.4525	1.4604	60 29	27
$Na_2H_2P_2O_7 \cdot 6H_2O$	1.4599	1.4645	1.4649	31 56	27
tartrate, acid, $NaH(C_4H_4O_6) \cdot H_2O$	(red)	1.5332	....	51 31	10
Sodium thiosulfate (hypo), $Na_2S_2O_3 \cdot 5H_2O$	1.4886	1.5079	1.5360	80 40	27
ruthenium nitrate, $(RuNO)_2O_3 \cdot (N_2O_3)_2 \cdot 4NaNO_2 \cdot 4H_2O$	1.5888	1.5943	1.7162	25 14	27
Spodumenite, $Li_2O \cdot Al_2O_3 \cdot 4SiO_2$	1.660	1.666	1.676		
Staurolite, $2FeO \cdot 5Al_2O_3 \cdot 4SiO_2 \cdot H_2O$	1.736	1.741	1.746	88	1
Sterocite, $Na_2O \cdot (NH_4)_2O \cdot P_2O_5 \cdot 9H_2O$	1.439	1.441	1.469		
Stibiotantalite, $Sb_2O_3 \cdot Ta_2O_5$	2.374	2.404	2.457		
Stibnite, Sb_2S_3	3.194	4.303	4.460		
Stilbite, $(Ca, Na_2)O \cdot Al_2O_3 \cdot 6SiO_2 \cdot 5H_2O$	1.494	1.498	1.500		
Strengite, $Fe_2O_3 \cdot P_2O_5 \cdot 4H_2O$	1.710	1.710	1.745		
Strontianite, $SrO \cdot CO_2$	1.518	1.664	1.665	......	26
Strontium bichromate, $SrCr_2O_7 \cdot 3H_2O$	1.7146	1.7174	1.812	20 28	8
formate, $Sr(HCO_2)_2 \cdot 2H_2O$	1.4838	1.5210	1.5382	......	19

INDEX OF REFRACTION OF BIAXIAL CRYSTALS (Continued)

Substance.	Index of refraction. n	n	n	Angle of the optic axes.		Observer.
Struvite, $(NH_4)_2O \cdot 2MgO \cdot P_2O_5 \cdot 12H_2O$	...	1.502	...	...	...	12
Sugar, cane, $C_{12}H_{22}O_{11}$	1.537	1.565	1.570	47	48	39
Sulfur	1.95047	2.03832	2.24052	69	5	19, 12
Talc, $3MgO \cdot 4SiO_2 \cdot H_2O$	1.539	1.589	1.589	...	...	3
Tantalite, $(Fe, Mn)O \cdot Ta_2O_5$	Li 2.260	2.320	2.430			
Tartaric acid, (d), $C_4H_6O_6$	1.495	1.535	1.604	78	40	40
Terlinguaite, Hg_2OCl	Li 2.350	2.640	2.670			
Thenardite, $Na_2O \cdot SO_3$	1.464	1.474	1.485			
Thermonatrite, $Na_2O \cdot CO_2 \cdot H_2O$	1.420	1.495	1.518			
Thomsenolite, $NaF \cdot CaF_2 \cdot AlF_3 \cdot H_2O$	1.407	1.414	1.415			
Thomsonite, $(Na_2Ca)O \cdot Al_2O_3 \cdot 2SiO_2 \cdot 3H_2O$	1.497	1.503	1.525	53	50	12
Titanite, $CaO \cdot TiO_2 \cdot SiO_2$	1.9133	1.9206	2.0536	23	9	41
	1.900	1.907	2.034			
Topaz, $2AlOF \cdot SiO_2$, colorless	1.6114	1.6141	1.6213	65		17
Topaz, yellow, Brazil	1.6306	1.6313	1.6379	50		17
Tremolite, $CaO \cdot 3MgO \cdot 4SiO_2$	1.609	1.623	1.635			
Tridymite, SiO_2	1.469	1.470	1.473			
Triphylite, $Li_2O \cdot 2(Fe, Mn)O \cdot P_2O_5$	1.688	1.688	1.692			
Trona, $3Na_2O \cdot CO_2 \cdot H_2O$	1.410	1.492	1.542			
Turgite, $2Fe_2O_3 \cdot H_2O$, etc.	Li 2.450	2.550	2.550			

INDEX OF REFRACTION OF BIAXIAL CRYSTALS (Continued)

Substance.	Index of refraction.			Angle of the optic axes.	Observer.
	n	*n*	*n*		
Turquois, $CuO \cdot 3Al_2O_3 \cdot 2P_2O_5 \cdot 9H_2O$	1.610	1.620	1.650		
Uranite, *see* autunite.					
Valentenite, Sb_2O_3	2.180	2.350	2.350		
Variscite, $Al_2O_3 \cdot P_2O_5 \cdot 4H_2O$	1.551	1.558	1.582		
Vivianite, $3FeO \cdot P_2O_5 \cdot 8H_2O$	1.579	1.603	1.633	73 10	
Wagnerite, $3MgO \cdot P_2O_5 \cdot MgF_2$	1.569	1.570	1.582	37 49	1, 33
Wavellite, $3Al_2O_3 \cdot 2P_2O_5 \cdot 12(H_2O, 2HF)$	1.525	1.534	1.552	71 48	
Whewellite, $CaO \cdot C_2O_3 \cdot H_2O$	1.491	1.555	1.650		
Witherite, $BaO \cdot CO_2$	1.529	1.676	1.677	....	26
Wolframite, $(Fe, Mn)O \cdot WO_3$	2.310	2.360	2.460		
Wollastonite, $CaO \cdot SiO_2$	1.6177	1.6307	1.6325	40	3
Zinc sulfate, $ZnSO_4 \cdot 7H_2O$	1.45683	1.48010	1.48445	46 14	27

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INDEX OF REFRACTION FOR LIQUIDS

The following table gives the index of refraction with respect to air for various liquids. The index is for sodium light (=.589) except where noted. Values for oils, fats and waxes will be found in a general table of constants for such substances. See index.

Substance.	Temp. °C.	Index.	Observer.
Acetal	20	1.382	1
Acetaldehyde	20	1.3316	2
Acetic acid	20	1.372	3
anhydride	20	1.390	2
Acetone	20	1.359	4
Acetyl-acetone	15.5	1.449	5
Acetyl chloride	20	1.38976	1
Acetylene dibromide	20	1.5428	6
tetrabromide	0	1.64788	7
Acrolein	20	1.39975	1
Alcohol. *See under* ethyl, methyl, etc.			
Allyl alcohol	20	1.41345	1
amine	21.8	1.41943	1
bromide	20	1.46545	1
chloride	20	1.41538	1
mustard oil	20	1.52660	8
sulfide	26.8	1.48770	9
Aluminum ethyl	6.5	1.480	10
methyl	12	1.432	10
Ammonia, liquid (d = 615)	16.5	1.325	10
Amyl acetate	20	(C) 1.402	2
Amyl alcohol, primary, normal	17.8	1.408	2
alcohol, iso-, primary	20	1.407	1
chloride	18.2	1.4097	11
iodide	14	1.4960	6
Aniline	20	1.586	1
Anethol	11.5	1.5624	12
Anisol	21.8	1.515	9
Antimony pentachloride	17.5	1.587	6
Benzene	20	1.501	1
Benzonitrile	25.5	1.526	1
Benzoyl chloride	20	1.55369	1
Benzyl alcohol	20	1.539	1
amine	19.5	1.54406	1
chloride	15.4	1.5415	11
Boron tribromide	6.3	1.536	13
trichloride	5.7	1.419	13
Bromine	20	1.654	14
Brom-aniline, meta	20.4	1.62604	1
benzene	20	1.560	1
ethylene, di-	0	1.556	7
ethylene, tri- (bromoform)	20	1.589	15
naphthalene	20	1.658	1
Butyl aldehyde, normal	20	1.38433	1
aldehyde, iso-	20	1.37302	1
alcohol, normal	20	1.39909	1
alcohol, iso-	19.6	1.396	1
nitrate	23.2	1.40130	1
Carbon dioxide, liquid	15	1.195	10
disulfide	18	1.629	1
tetrachloride	20	1.4607	17
Chloral	20	1.456	1
Chlorine, liquid	14	1.367	10

INDEX OF REFRACTION FOR LIQUIDS (Continued)

Substance.	Temp. ° C.	Index.	Observer.
Chlorobenzene	15	1.526	11
Chloroform	20	1.446	18
Cyanogen, liquid	18	1.327	10
Decane	14.9	1.4108	2
Diethylamine	17.6	1.38730	1
Dimethylamine	17.	1.350	10
Dimethylaniline	8	1.56489	5
Ether, ethyl	22	1.351	16
Ethyl benzene	20	1.496	1
acetate	16.4	1.374	19
alcohol	20.	1.361	21
benzoate	20	1.5057	20
benzol	14.5	1.4994	2
bromide	8	1.4320	6
carbonate	20	1.38523	1
carbylamine	24	1.3659	6
formate	20	(C) 1.35800	2
iodide	20	1.51203	18
mercaptan	20	1.43055	9
nitrate	21.5	(F) 1.38484	1
oxalate	20	1.41043	1
sulfate	16.1	(C) 1.40210	22
sulfite	11	1.4198	23
thiocyanate	22.9	1.46533	9
Ethylene, liquid	−100	1.363	24
bromide	10.5	1.5446	6
chloride	17	1.4466	11
formate	20	(C) 1.35800	2
glycol	22.5	1.4306	6
Ethylidene bromide	0	1.52455	7
chloride	0	1.42881	7
Eugenol, normal	14.5	1.5439	12
iso-	18	1.5680	12
Formamide	22.7	1.445	1
Formic acid	20	1.371	26
Furfurol	20	1.526	1
Glycerine	20	1.474	27
Glycol	20	(C) 1.425	2
Hexane	20	1.3754	1
Hexylene	23.3	1.3945	1
Hydrazine	22.3	1.470	1
Hydrobromic acid	10	1.325	10
Hydrochloric acid	10	1.254	10
Hydrogen	−200	1.12	28
Hydrogen sulfide	18.5	1.384	10
Hydroiodic acid	16.5	1.466	10
Hydroxylamine	23.5	1.440	1
Iodobenzene	8	1.627	5
Iodomethane, di-	25	1.737	5
Isoprene	18	1.4041	6
Lactic acid	20	1.441	2
Menthol	22	1.460	29
Methyl acetate	14.8	1.3632	30
alcohol	20	1.329	2
amine	17.5	1.432	10
benzoate	20	(C) 1.51158	2
chloride	0	1.353	31
iodide, *see* iodomethane.			
Naphthalene	98.4	1.582	32
Naphthol, (α)	98.7	1.62067	32
Nicotine	18.8	1.529	1

INDEX OF REFRACTION FOR LIQUIDS (Continued)

Substance.	Temp. °C.	Index.	Observer.
Nitric oxide	−90	1.330	24
Nitrobenzene	20	1.553	1
Nitrogen	−190	1.205	24
Nitroglycerine	18.6	1.482	6
Nitrous oxide, N_2O	15	1.194	10
Oenanthylic acid	20	1.426	1
Oleic acid	17.8	1.460	12
Oxygen	−181	1.222	33
Paraffin	38.3	(C) 1.43295	12
Paraldehyde	20	1.405	1
Pentane	15.7	1.358	2
Phenol	20	1.550	2
Phenylhydrazine	20.3	1.608	1
Phosphorous trichloride	15.4	1.520	22
Piperidine	18.7	1.453	1
Propionic acid	0	1.395	34
Propyl alcohol, primary	18.1	1.386	25
alcohol, iso-	20	1.377	1
Pyridine	21	1.509	1
Salicylic acid	20	1.565	2
Silicon tetrabromide	23.5	1.563	35
tetrachloride	22.9	1.412	35
Sulfur	130	1.890	36
Sulfur dioxide	15	1.350	10
Sulfuric acid	15	1.420	37
Thiophene	18.5	1.530	1
Thymol	24.4	1.519	32
Toluene	20	1.495	1
Toluidine, ortho-	20	1.573	1
meta	20	1.571	1
para	20	1.553	1
Triphenylamine	16	1.353	10
Triphenylmethane	99	1.578	5
Water	20	1.33299	—
Xylene, ortho	21.6	1.505	1
meta	20	1.496	1
para	14.7	1.498	2

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INDEX OF REFRACTION OF WATER

Alcohol and Carbon Bisulfide

For sodium light, λ = .5893

Temp. °C	Water, pure relative to air	Ethyl Alcohol 99.8 relative to air	Carbon Bisulfide relative to air
14	1.36290	....	....
15	1.33341	....	1.62935
16	1.33333	1.36210	1.62858
18	1.33317	1.36129	1.62704
20	1.33299	1.36048	1.62546
22	1.33281	1.35967	1.62387
24	1.33262	1.35885	1.62226
26	1.33241	1.35803	1.62064
28	1.33219	1.35721	1.61902
30	1.33192	1.35639	1.61740
32	1.33164	1.35557	1.61577
34	1.33136	1.35474	1.61413
36	1.33107	1.35390	1.61247
38	1.33079	1.35306	1.61080
40	1.33051	1.35222	1.60914
42	1.33023	1.35138	1.60748
44	1.32992	1.35054	1.60582
46	1.32959	1.34969	....
48	1.32927	1.34885	....
50	1.32894	1.34800	....
52	1.32860	1.34715	....
54	1.32827	1.34629	....
56	1.32792	1.34543	....
58	1.32755	1.34456	....
60	1.32718	1.34368	....
62	1.32678	1.34279	....
64	1.32636	1.34189	....
66	1.32596	1.34096	....
68	1.32555	1.34004	....
70	1.32511	1.33912	....
72	1.32466	1.33820	....
74	1.32421	1.33728	....
76	1.32376	1.33626	....
78	1.32332	....	....
80	1.32287	....	....
82	1.32241	....	....
84	1.32195	....	....
86	1.32148	....	....
88	1.32100	....	....
90	1.32050	....	....
92	1.32000	....	....
94	1.31949	....	....
96	1.31897	....	....
98	1.31842	....	....
100	1.31783	....	....

ABSOLUTE INDEX FOR PURE WATER FOR SODIUM LIGHT

Temperature	Index	Temperature	Index
15° C.	1.33377	60° C.	1.32754
20	1.33335	65	1.32652
25	1.33287	70	1.32547
30	1.33228	75	1.32434
35	1.33157	80	1.32323
40	1.33087	85	1.32208
45	1.33011	90	1.32086
50	1.32930	95	1.31959
55	1.32846	100	1.31819

INDEX OF REFRACTION OF GLASS

RELATIVE TO AIR

Variety.	Wave length in microns.							
	.361	.434	.486	.589 (Na)	.656	.768	1.20	2.00
Zinc crown	1.539	1.528	1.523	1.517	1.514	1.511	1.505	1.497
Higher dispersion crown	1.546	1.533	1.527	1.520	1.517	1.514	1.507	1.497
Light flint	1.614	1.594	1.585	1.575	1.571	1.567	1.559	1.549
Heavy flint	1.705	1.675	1.664	1.650	1.644	1.638	1.628	1.617
Heaviest flint	...	1.945	1.919	1.890	1.879	1.867	1.848	1.832

INDEX OF REFRACTION OF ROCK SALT, SILVINE, CALCITE, FLUORITE AND QUARTZ

(Compiled from data of Martens, Paschen, and others.)

Wave length.	Rock salt.	Silvine, KCl.	Fluorite.	Calcspar, ordinary ray.	Calcspar, extraordinary ray.	Quartz, ordinary ray.	Quartz, extraordinary ray.
0.185	1.893	1.827	......	......	......	1.676	1.690
0.198	.....	......	1.496	......	1.578	1.651	1.664
0.340	.....	......	......	1.701	1.506	1.567	1.577
0.589	1.544	1.490	1.434	1.658	1.486	1.544	1.553
0.760	.....	......	1.431	1.650	1.483	1.539	1.548
0.884	1.534	1.481	1.430				
1.179	1.530	1.478	1.428				
1.229	.....	......	......	1.639	1.479		
2.324	.....	......	......	......	1.474	1.516	
2.357	1.526	1.475	1.421				
3.536	1.523	1.473	1.414				
5.893	1.516	1.469	1.387				
8.840	1.502	1.461	1.331				

INDEX OF REFRACTION OF GLASS

Index of refraction of optical glass made at the Bureau of Standards.
Composition refers to the raw material combined, not to the finished glass.

Composition	Ordinary Crown	Borosilicate Crown	Barium flint	Light Barium flint	Light flint	Dense barium flint	Medium flint	Dense flint
				(Composition percentage)				
SiO_2	67.0	64.2	53.7	48.0	53.9	37.0	45.6	39.0
Na_2O	12.0	9.4	1.7	2.0	1.0	....	3.4	3.0
K_2O	5.0	8.3	8.3	6.1	7.6	2.7	4.1	4.0
B_2O_3	3.5	11.0	2.7	4.0	....	5.0	....	....
BaO	10.6	6.1	14.3	29.5	....	47.0	....	....
ZnO	1.5	....	2.5	10.0	....	7.7	....	....
As_2O_3	0.4	0.4	....	1.4	0.3	....	....	....
CaO	....	1.0	....	....	2.0	....	3.0	4.0
PbO	....	....	16.7	....	35.2	....	41.0	49.0
Sb_2O_3	....	....	....	....	....	....	....	1.0
Wave length, Å				(Index of Refraction)				
Hg 4046.8	1.53189	1.53817	1.58851	1.59137	1.60507	1.63675	1.65788	1.69005
Hg 4047.1	1.53147	1.53775	1.58791	1.59084	1.60430	1.63619	1.65692	1.68894
H 4340.7	1.52818	1.53468	1.58327	1.58698	1.59860	1.63189	1.64973	1.68079
Hg 4358.6	1.52798	1.53450	1.58299	1.58674	1.59826	1.63163	1.64931	1.68030
H 4861.5	1.52326	1.53008	1.57646	1.58121	1.59029	1.62548	1.63941	1.66911
Hg 4916.4	1.52283	1.52967	1.57587	1.58071	1.58958	1.62492	1.63854	1.66814
Hg 5461.0	1.51929	1.52633	1.57105	1.57657	1.58380	1.62033	1.63143	1.66016
Hg 5769.6	1.51771	1.52484	1.56894	1.57473	1.58128	1.61829	1.62831	1.65671
Hg 5790.5	1.51760	1.52175	1.56881	1.57460	1.58112	1.61817	1.62815	1.65650

INDEX OF REFRACTION OF GLASS (Continued)

Index of refraction of optical glass made at the Bureau of Standards.
Composition refers to the raw material combined, not to the finished glass

(Index of Refraction) Continued

Wave Length, Å	Ordinary Crown	Borosilicate Crown	Barium flint	Light Barium flint	Light flint	Dense barium flint	Medium flint	Dense flint
Na 5893.2	1.51714	1.52430	1.56819	1.57406	1.58038	1.61756	1.62725	1.65548
Hg 6234.6	1.51573	1.52297	1.56631	1.57242	1.57818	1.61576	1.62458	1.65250
H 6563.0	1.51458	1.52188	1.56482	1.57107	1.57638	1.61427	1.62211	1.65007
Li 6708.2	1.51412	1.52145	1.56423	1.57054	1.57567	1.61369	1.62157	1.64913
K 7682.0	1.51160	1.51908	1.56100	1.56762	1.57183	1.61047	1.61701	1.64405

Dispersion

	Ordinary Crown	Borosilicate Crown	Barium flint	Light Barium flint	Light flint	Dense barium flint	Medium flint	Dense flint
N_d	1.51714	1.52430	1.56819	1.57406	1.58038	1.61756	1.62725	1.65548
$n_f - n_c$	0.00868	0.00820	0.01164	0.01014	0.01391	0.01121	0.01700	0.01904
$\frac{n_d - 1}{n_f - n_c} = \gamma$	59.6	63.9	48.8	56.6	41.7	55.1	36.9	34.4
$n_d - n_f$	0.00612	0.00578	0.00827	0.00715	0.00991	0.00792	0.01216	0.01363
$n_f - n_{g'}$	0.00492	0.00460	0.00681	0.00577	0.00831	0.00641	0.01032	0.01168
$n_d - n_c$	0.00256	0.00242	0.00337	0.00299	0.00400	0.00329	0.00484	0.00541

OPTICAL CONSTANTS OF METALS

The following table gives the refractive index n, the absorption index k, the angle of principle incidence $\bar{\phi}$, the angle of principle azimuth $\bar{\psi}$ and the percent of light reflected R.

The reduction of amplitude of the wave of the wave length λ after traveling any distance d in the medium is given by the ratio $1 : e^{\frac{2\pi dk}{\lambda}}$. $\bar{\phi}$ is the angle of incidence for which the phase change between the two rectangular components vibrating in and normal to the plane of incidence is 90°. $\bar{\psi}$ is the azimuth at which circularly polarized light results. These quantities are connected by the following relations

$$k = \tan 2\bar{\psi}(1 - \cot^2 \bar{\phi}), \qquad n = \frac{\sin \bar{\phi} \tan \bar{\phi}}{(1+k^2)^{\frac{1}{2}}} (1 + \tfrac{1}{2} \cot^2 \bar{\phi})$$

Metal	λ	$\bar{\phi}$	$\bar{\psi}$	Computed n	Computed k	Computed nk	Computed R	Authority
	μ	° ′	° ′					
Aluminum	0.589	....	....	1.44	5.32		83.	Drude
Antimony	.589	....	....	3.04	4.94		70.	"
Bismuth (prism)	white	....	....	2.26	....	....	....	Kundt, 1889
Bronze	.527	....	....	1.18	....	....	....	Jamin
	.589	....	....	1.12				"
Cadmium	.589	....	....	1.13	5.01	....	85.	Drude
Chromium	.579	....	....	2.97	4.85	....	70.	Wartenburg, 1910
Cobalt	0.231	64 31	29 39	1.10	1.30	1.43	32	Minor
	.275	70 22	29 59	1.41	1.52	2.14	46	"
	.500	77 5	31 53	1.93	1.93	3.72	66	"
	.650	79 0	31 25	2.35.	1.87	4.40	69.	Ingersoll
	1.00	81 45	29 6	3.63.	1.58	5.73	73.	"
	1.50	83 21	26 18	5.22	1.29	6.73	75	"
	2.25	83 48	26 5	5.65	1.27	7.18	76.	"
Columbium	.579	....	....	1.80	2.11	....	41.	Wartenburg, 1910
Copper	.231	65 57	26 14	1.39	1.05	1.45	29	Minor
	.317	65 6	28 16	1.19	1.23	1.47	32	"
	.500	70 44	33 46	1.10	2.13	2.34	56.	"
	.650	74 16	41 30	0.44	7.4	3.26	86.	Ingersoll
	.870	78 40	42 30	0.35	11.0	3.85	91.	"
	1.75	84 4	42 30	0.83	11.4	9.46	96	"
	2.25	85 13	42 30	1.03	11.4	11.7	97.	"
	4.00	87 20	42 30	1.87	11.4	21.3	....	Först-Fréed
	5.50	88 00	41 50	3.16	9.0	28.4	....	" "
Gold	.257	....	....	0.92	1.14	....	28	Meier, 1903
Electrolytic	.441	....	....	1.18	1.85	....	42.	"
	.589	....	....	0.47	2.83	....	82.	"
	1.00	81 45	44 00	0.24	28.0	6.7	....	Först-Fréed
	2.00	85 30	43 56	0.47	26.7	12.5	....	" "
	3.00	87 05	43 50	0.80	24.5	19.6	....	" "
	5.00	88 15	43 25	1.81	18.1	33.	....	" "
Iodine	.589	....	....	3.34	0.57	....	30.	Meier, 1903
Iridium	.579	....	....	2.13	4.87	....	75.	Wartenburg, 1916
	1.00	82 10	29 15	3.85	1.60	6.2	....	Först-Fréed
	2.00	83 10	29 40	4.30	1.66	7.1	....	" "
	3.00	81 40	30 40	3.33	1.79	6.0	....	" "
	5.00	79 00	32 20	2.27	2.03	4.6	....	" "
Iron	.257	....	....	1.01	0.88	....	16.	Meier, 1903
	.441	....	....	1.28	1.37	....	28	"
	.589	....	....	1.51	1.63	....	33	"

OPTICAL CONSTANTS OF METALS

(Continued)

Metal	λ	$\bar{\phi}$	$\bar{\psi}$	Computed				Authority
				n	*k*	*nk*	*R*	
	μ	° ′	° ′					
Lead	.589	.....	.....	2.01	3.48	.....	62.	Drude
Magnesium	5.89	.....	.....	0.37	4.42	.....	93.	"
Manganese	5.79	.....	.....	2.49	3.89	.....	64.	Wartenburg, 1910
Mercury (liq.)	.326	.....	.....	0.68	2.26	.....	66	Meier, 1903
	.441	.....	.....	1.01	3.42	.....	74.	"
	.589	.....	.....	1.62	4.41	.....	75.	"
	.668	.....	.....	1.72	4.70	.....	77.	"
Nickel	0.420	72 20	31 42	1.41	1.79	2.53	54.	Tool
	0.589	76 1	31 41	1.79	1.86	3.33	62.	Drude
	0.750	78 45	32 6	2.19	1.99	4.36	70.	Ingersoll
	1.00	80 33	32 2	2.63	2.00	5.26	74.	"
	2.25	84 21	33 30	3.95	2.33	9.20	85.	"
	.275	.....	.....	1.09	1.16	.....	24.	Meier, 1903
	.441	.....	.....	1.16	1.23	.....	25.	"
	.589	.....	.....	1.30	1.97	.....	43.	"
Platinum	1.00	75 30	37 00	1.14	3.25	3.7	....	Först-Fréed
	2.00	74 30	39 50	0.70	5.06	3.5	....	" "
	3.00	73 50	41 00	0.52	6.52	3.4	....	" "
	5.00	72 00	42 10	0.34	9.01	3.1	....	" "
Electrolytic	.257	.....	.....	1.17	1.65	.....	37.	Meier, 1903
	.441	.....	.....	1.84	3.16	.....	58.	"
	.589	.....	.....	2.63	3.54	.....	59.	"
	.668	.....	.....	2.91	3.66	.....	59.	"
Potassium	.665	65 27	43 56	.066	26.8	.....	93.8	Duncan, 1913
	.589	62 58	43 42	.068	22.1	.....	92.	"
	.472	57 9	43 0	.070	14.3	.....	86.9	"
	.546	.....	.....	1.09	1.16	.....	24.	Morgan, 1922
Rhodium	.579	.....	.....	1.54	4.67	.....	78.	Wartenburg, 1910
Selenium	.400	.....	.....	2.94	2.31	.....	44.	Wood
	.490	.....	.....	3.12	1.49	.....	35.	"
	.589	.....	.....	2.93	0.45	.....	25.	"
	.760	.....	.....	2.60	0.06	.....	20.	"
Silicon, 95% pure	.579	75 38	.....	3.87	0.116	.....	35.7	Wartenburg, 1910
	.589	.....	.....	4.18	0.09	.....	38.	Ingersoll
	1.25	.....	.....	3.67	0.08	.....	33.	"
	2.25	.....	.....	3.53	0.08	.....	31.	"
99.75% pure	0.589	76 45	.....	4.24	0.118	.....	37.8	Littleton, 1912
Silver	0.226	62 41	22 16	1.41	0.75	1.11	18.	Minor
	.293	63 14	18 56	1.57	0.62	0.97	17.	"
	.316	52 28	15 38	1.13	0.38	0.43	4.	"
	.332	52 1	37 2	0.41	1.61	0.65	32.	"
	.395	66 36	43 6	0.16	12.32	1.91	87.	"
	.500	72 31	43 29	0.17	17.1	2.94	93.	"
	.589	75 35	43 47	0.18	20.6	3.64	95.	"
	.750	79 26	44 6	0.17	30.7	5.16	97.	Ingersoll
	1.00	82 0	44 2	0.24	29.0	6.96	98.	"
	1.50	84 42	43 48	0.45	23.7	10.7	98.	"
	2.25	86 18	43 34	0.77	19.9	15.4	99.	"
	3.00	87 10	42 40	1.65	12.2	20.1	....	Först-Fréed
	4.50	88 20	41 10	4.49	7.42	33.3	...	" "
Sodium	.665	72 11	44 29	0.051	55.0	.....	97.7	Duncan, 1913
	.589	68 51	44 29	.044	55.0	.....	97.1	"
	.546	68 48	44 20	.052	42.6	.....	96.5	"

OPTICAL CONSTANTS OF METALS

(Continued)

Metal	λ	$\bar{\phi}$	$\bar{\psi}$	Computed				Authority
				n	k	nk	R	
	μ	° ′	° ′					
Sodium	.472	66 29	44 9	.057	33.3	.....	95.2	Duncan, 1913
	.435	66 0	44 6	.058	31.7	.....	94.8	"
(liq.)	.589	.....	.....	.004	2.61	.....	99.	Drude
(solid)	.546	.....	.....	.047	47.3	.....	96.9	Morgan, 1922
Sodium-Potassium								
17.3% K	.546	.....	.....	.081	27.2	.....	94.6	"
45. % K	.546	.....	.....	1.08	16.8	.....	90.4	"
66. % K	.546	.....	.....	.137	12.5	.....	87.0	"
74.2% K	.546	.....	.....	.124	12.8	.....	86.9	"
84.3% K	.546	.....	.....	.088	17.6	.....	90.2	"
Steel								
0.44% C	.589	77 15	.....	2.50	1.30	.....	57.4	Littleton, 1912
1.28% C	.589	77 22	.....	2.66	1.28	.....	57.5	"
3.5 % C	.589	77 35	.....	2.77	1.23	.....	57.0	"
	0.226	66 51	28 17	1.30	1.26	1.64	35	Minor
	.257	68 35	28 45	1.38	1.35	1.86	40.	"
	.325	69 57	30 9	1.37	1.53	2.09	45.	"
	.500	75 47	29 2	2.09	1.50	3.14	57.	"
	.650	77 48	27 9	2.70	1.33	3.59	59.	Ingersoll
	1.50	81 48	28 51	3.71	1.55	5.75	73.	"
	2.25	83 22	30 36	4.14	1.79	7.41	80.	"
Tantalum	.579	.....	.....	2.05	2.31	.....	44.	Wartenburg
Tellurium								
axis horizontal	.590	.....	.....	3.07	.563	.....	34.	Van Dyke, 1922
axis vertical	.590	.....	.....	2.68	.632	.....	30.	Van Dyke, 1922
Tin	.589	.....	.....	1.48	5.25	.....	82.	Drude
Tungsten	.579	76 0	.....	2.76	0.98	.....	48.6	Wartenburg
	.589	78 31	.....	3.46	0.94	.....	54.5	Littleton, 1912
Vanadium	.579	.....	.....	3.03	3.51	.....	58.	"
Zinc	.257	.....	.....	0.55	0.61	.....	20.	Meier, 1903
	.441	.....	.....	0.93	3.19	.....	73.	"
	.589	....	.....	1.93	4.66	.....	74.	"
	.668	.....	.....	2.62	5.08	.....	73.	"

DISPERSION

The dispersion for various types of optical glass is shown in the following table. n_D = index of refraction for the D line (of the solar spectrum) and n_F and n_C the index for the F and C lines respectively $(n_F - n_D)$ shows the dispersion for these two wave lengths.

Glass.	n_D	$(n_F - n_C)$
Light phosphate crown	1.5159	.00737
Barium-silicate crown	1.5399	.00909
High-dispersion crown	1.5262	.01026
Borate flint	1.5686	.01102
Extra light flint	1.5398	.01142
Heavy flint	1.7174	.02434
Heaviest flint	1.9626	.04882

INDEX OF REFRACTION, AQUEOUS SOLUTIONS

Substance.	Density.	Temp. °C.	Index for $\lambda = .5893$ (Na)	Observer.
Ammonium chloride	1.067	27.05	1.379	Willigen
Ammonium chloride	1.025	29.75	1.351	Willigen
Calcium chloride	1.398	25.65	1.443	Willigen
Calcium chloride	1.215	22.9	1.397	Willigen
Calcium chloride	1.143	25.8	1.374	Willigen
Hydrochloric acid	1.166	20.75	1.411	Willigen
Nitric acid	1.359	18.75	1.402	Willigen
Potash (caustic)	1.416	11.0	1.403	Frauenhofer
Potassium chloride	Normal	solution	1.343	Bender
Potassium chloride	Double	normal	1.352	Bender
Potassium chloride	Triple	normal	1.360	Bender
Soda (caustic)	1.376	21.6	1.413	Willigen
Sodium chloride	1.189	18.07	1.378	Schutt
Sodium chloride	1.109	18.07	1.360	Schutt
Sodium chloride	1.035	18.07	1.342	Schutt
Sodium nitrate	1.358	22.8	1.385	Willigen
Sulphuric acid	1.811	18.3	1.437	Willigen
Sulphuric acid	1.632	18.3	1.425	Willigen
Sulphuric acid	1.221	18.3	1.370	Willigen
Sulphuric acid	1.028	18.3	1.339	Willigen
Zinc chloride	1.359	26.6	1.402	Willigen
Zinc chloride	1.209	26.4	1.375	Willigen

INDEX OF REFRACTION OF METALS

For Sodium Light

(Drude.)

Metal.	Index of refraction.	Metal.	Index of refraction.
Aluminum	1.44	Mercury	1.73
Antimony	3.04	Nickel	1.79
Bismuth	1.90	Platinum	2.06
Cadmium	1.13	Silver	0.181
Copper	0.641	Steel	2.41
Gold	0.366	Tin, solid	1.48
Iron	2.36	Tin, fluid	2.10
Lead	2.01	Zinc	2.12
Magnesium	0.37		

INDEX OF REFRACTION, GASES

Values are relative to a vacuum and for a temp. of 0° C. and 760 mm. pressure.

(From Smithsonian Tables.)

Substance.	Kind of light.	Indices of refraction.	Observer.
Acetone	*D*	1.001079–1.001100	
Air	*D*	1.0002926	Perreau
Ammonia	white	1.000381–1.000385	
Ammonia	*D*	1.000373–1.000379	
Argon	*D*	1.000281	Rayleigh
Benzene	*D*	1.001700–1.001823	
Bromine	*D*	1.001132	Mascart
Carbon dioxide	white	1.000449–1.000450	
dioxide	*D*	1.000448–1.000454	
disulphide	white	1.001500	Dulong
disulphide	*D*	1.001478–1.001485	
monoxide	white	1.000340	Dulong
monoxide	white	1.000335	Mascart
Chlorine	white	1.000772	Dulong
Chlorine	*D*	1.000773	Mascart
Chloroform	*D*	1.001436–1.001464	
Cyanogen	white	1.000834	Dulong
Cyanogen	*D*	1.000784–1.000825	
Ethyl alcohol	*D*	1.000871–1.000885	
ether	*D*	1.001521–1.001544	
Helium	*D*	1.000036	Ramsay
Hydrochloric acid	white	1.000449	Mascart
Hydrochloric acid	*D*	1.000447	Mascart
Hydrogen	white	1.000138–1.000143	
Hydrogen	*D*	1.000132	Burton
sulphide	*D*	1.000644	Dulong
sulphide	*D*	1.000623	Mascart
Methane	white	1.000443	Dulong
Methane	*D*	1.000444	Mascart
Methyl alcohol	*D*	1.000549–1.000623	
Methyl ether	*D*	1.000891	Mascart
Nitric oxide	white	1.000303	Dulong
Nitric oxide	*D*	1.000297	Mascart
Nitrogen	white	1.000295–1.000300	
Nitrogen	*D*	1.000296–1.000298	
Nitrous oxide	white	1.000503–1.000507	
Nitrous oxide	*D*	1.000516	Mascart
Oxygen	white	1.000272–1.000280	
Oxygen	*D*	1.000271–1.000272	
Pentane	*D*	1.001711	Mascart
Sulphur dioxide	white	1.000665	Dulong
Sulphur dioxide	*D*	1.000686	Ketteler
Water	white	1.000261	Jamin
Water	*D*	1.000249–1.000259	

COEFFICIENT OF TRANSPARENCY OF UVIOL GLASS FOR THE ULTRA-VIOLET

For a thickness of 1 mm.

Wave length, microns	0.280	0.309	0.325	0.346	0.361	0.383	0.397
Uviol crown	0.56	0.95	0.990	0.996	0.999	1.000	1.000

REFLECTION OF LIGHT BY GLASS IN AIR

The table gives the per cent of the incident light which is reflected from the surface of glass in air assuming an index of refraction of 1.55; *i* represents the angle of incidence and *R* the per cent of light reflected.

(Computed according to Fresnel's formula.)

i	*R*	*i*	*R*	*i*	*R*
0°	4.65				
5	4.65	35°	4.98	65°	12.91
10	4.66	40	5.26	70	18.00
15	4.66	45	5.73	75	26.19
20	4.68	50	6.50	80	39.54
25	4.73	55	7.74	85	61.77
30	4.82	60	9.73	90	100.

REFLECTION BY TRANSPARENT MEDIA IN AIR

For Normal Incidence

The table gives the per cent of the normally incident light which is reflected by transparent media of various indices of refraction. *n* = index of refraction, *R* = reflected light, *i* = angle of incidence = 0.

(Computed from Fresnel's formula.)

n	*R*	*n*	*R*	*n*	*R*
1.0	0.00	1.7	6.72	2.4	17.0
1.1	0.23	1.8	8.16	2.5	18.4
1.2	0.83	1.9	9.63	2.6	19.8
1.3	1.70	2.0	11.11	2.7	21.1
1.4	2.78	2.1	12.6	2.8	22.5
1.5	4.00	2.2	14.1	2.9	23.8
1.6	5.33	2.3	15.5	3.0	25.0

COEFFICIENT OF TRANSPARENCY OF GLASS FOR THE INFRA-RED

Normal incidence. thickness 1 cm.

Wave length, microns....	0.7	1.1	1.7	2.3	2.7	3.1
Crown, borate..........	1.00	.55	.21	.025	.04	
borosilicate...........	...	.74	.61	.33	.034	.021
Flint, light.............	1.00	.91	.82	.45	.083	.019
heavy	1.00	1.00	1.00	1.00	.45	.019

REFLECTION OF LIGHT BY METALS

The table gives the per cent of normally incident light which is reflected by the polished surface of various metals.

Wave length.	Antimony.	Bronze (68Cu, 68Sn).	Copper, commercial.	Gold, electrolytic.	Iron.	Magnalium, Mach's.	Magnesium.	Mercury, backed glass.
.251	....	.30	25.9	38.8	....	67.0		
.288	....	....	24.3	34.0	....	70.6		
.305	....	....	25.3	31.8	....	72.2		
.326	....	....	24.9	28.6	....	75.5		
.357	....	....	27.3	27.9	....	81.2		
.385	....	.53	28.6	27.1	....	83.9		
.420	....	....	32.7	29.3	....	83.3		
.450	....	....	37.0	33.1	....	83.4	....	72.8
.500	....	.63	43.7	47.0	.55	83.3	.72	70.9
.550	....	....	47.7	74.0	....	82.7	....	71.2
.600	.53	.64	71.8	84.4	.57	83.0	.73	69.9
.650	....	....	80.0	88.9	....	82.7	....	71.5
.700	....	....	83.1	92.3	.59	83.3	....	72.8
.800	....	....	88.6	94.9	....	84.3		
1.00	.55	.70	90.1	......	.65	84.1	.74	
2.0	.60	.80	95.5	96.8	.78	86.7	.77	
3.0	.65	.86	97.1	......	.84	87.4	.80	
4.0	.68	.88	97.3	96.9	.89	88.7	.83	
9.0	.72	.93	98.4	98.0	.94	90.6	.93	

Wave length.	Nickel, electrolytic.	Platinum, electrolytic.	Silver, chemically deposited.	Silver-backed glass.	Speculum metal.	Steel.	Tungsten.
.251	37.8	33.8	34.1	......	29.9	32.9	
.288	42.7	38.8	21.2	......	37.7	35.0	
.305	44.2	39.8	9.1	......	41.7	37.2	
.326	45.2	41.4	14.6	......	......	40.3	
.357	48.8	43.4	74.5	......	51.0	45.0	
.385	49.6	45.4	81.4	......	53.1	47.8	
.420	56.6	51.8	86.6	......	56.4	51.9	
.450	59.4	54.7	90.5	85.7	60.0	54.4	
.500	60.8	58.4	91.3	86.6	63.2	54.8	.49
.550	62.6	61.1	92.7	88.2	64.0	54.9	
.600	64.9	64.2	92.6	88.1	64.3	55.4	.51
.650	66.6	66.5	94.7	89.1	65.4	56.4	
.700	68.8	69.0	95.4	89.6	66.8	57.6	.54
.800	69.6	70.3	96.8	......	......	58.0	
1.00	72.0	72.9	97.0	......	70.5	63.1	.62
2.0	83.5	80.6	97.8	......	80.4	76.7	.85
3.0	88.7	88.8	98.1	......	86.2	83.0	.90
4.0	91.1	91.5	98.5	......	88.5	87.8	.93
9.0	95.6	95.4	98.7	......	92.2	92.9	.95

REFLECTION OF LIGHT BY METALS

The table gives the percent of normally incident light which is reflected by the polished surface of various metals.

Coblentz, 1906, 1911.

Wave length	Aluminum	Cadmium	Cobalt	Graphite	Iridium	Molybdenum	Palladium	Rhodium	Silicon
.5	..	..	..	22	..	46	..	76	34
.6	..	..	..	24	..	48	..	77	32
.8	..	..	..	25	..	52	..	81	29
1.0	71	72	67	27	78	58	72	84	28
2.0	82	87	72	35	87	82	81	91	28
4.0	92	96	81	48	94	90	88	92	28
7.0	96	98	93	54	95	93	94	94	28
10.0	98	98	97	59	96	94	97	95	28
12.0	98	99	97	..	96	95	97	..	..

Wave length	Tantalum	Telurium	Tin	Vanadium	Zinc	Wave length	Tungsten*	Stellite*
.5	38	..	..	57	..	.15	....	.32
.6	45	49	..	58	..	.20	....	.42
.8	64	48	..	60	..	.30	....	.50
1.0	78	50	54	61	80	.50	.50	.64
2.0	90	52	61	69	92	.75	.52	.67
4.0	93	57	72	79	97	1.00	.576	.689
7.0	94	68	81	88	98	2.00	.900	.747
10.0	..	..	84	..	98	3.00	.943	.792
12.0	95	..	85	..	99	4.00	.948	.825
						5.00	.953	.848
						9.00	...	.880

* Coblentz, Emerson, 1917

REFLECTION OF LIGHT BY METALS (Continued)

Coblentz, Bulletin 379, Bureau of Standards 1920

Wave-length in μ – 0.001mm.	Silver	Monel metal	Stellite	Zinc
0.45	88.0	56.5	63.5	54.0
0.50	90.0	57.8	65.8	55.0
0.55	91.5	59.0	68.3	56.0
0.60	92.7	60.2	70.1	57.5
0.65	93.5	61.8	71.0	60.0
0.70	94.1	63.7	71.8	61.0
0.75	94.7	65.6	72.4	61.5
0.80	95.1	67.2	73.0	61.5
0.90	96.0	70.0	73.5	55.5
0.95	96.3	71.1	....	51.0
1.00	96.5	72.3	74.0	49.0
1.05	96.7	73.0	....	53.5
1.10	96.9	73.6	....	62.5
1.20	97.2	74.8	74.5	74.7
1.40	97.4	77.0	75.0	85.8
1.50	97.6	78.2	75.3	88.4
1.75	97.8	81.2	76.0	92.0
2.00	97.9	83.8	76.8	94.0
2.50	98.0	87.0	78.6	95.3
3.00	98.0	88.7	80.0	95.5
3.50	98.0	89.5	81.4	95.8
4.00	98.0	91.0	82.8	96.2

TRANSMISSION FACTORS FOR "GROUND" GLASS

Luckiesch

	Side toward light	Transmission Factor	
		Narrow beam	Diffuse
Sand blasted	Rough	0.783	0.702
	Smooth	.739	.695
Etched, fine	Rough	.794	.709
	Smooth	.758	.704

DIFFUSE REFLECTING POWER

The diffuse reflecting power, or ratio of total luminous flux reflected to that received, measured for the various regions of the spectrum. The wave lengths given are those of maximum energy. — Coblentz, Bulletin, 196, Bureau of Standards 1912.

Material	Reflecting power %					
	0.54 μ	0.60	0.95	4.4	8.8	24.0
Lampblacks						
paint	....	3.2	3.4	3.2	3.8	4.4
paraffin-candle	....	....	0.97	....	....	....
rosin	....	....	1.3	1.3	....	3.0
sperm candle	....	....	1.1	.9	1.3	4.0
camphor	....	....	1.3	1.2	1.6	5.7
acetylene	....	....	0.6	.8	1.2	2.1
Platinum black						
electrolytic	....	....	1.1	1.4	2.1	4.2
Pigments						
cobalt oxide, Co_2O_3	....	3.02	3.92	13.9	14.6	5.9
	....	....	4.04	....	11.8	....
	....	....	2.49	....	....	....
copper oxide, CuO	....	....	23.5	15.2	....	4.4
chromium oxide, Cr_2O_3	24.1	27.0	44.6	32.9	5.0	8.2
lead oxide, PbO	....	51.8	....	50.6	25.6	9.5
red iron oxide, Fe_2O_3	....	26.3	41.0	29.9	3.7	9.1
yttrium oxide, Y_2O_3	....	73.8	....	34.4	11.1	10.0
lead chromate, $PbCrO_4$	61.2	70.2	....	41.2	4.74	7.4
aluminum oxide, Al_2O_3	....	84.1	87.7	20.8	2.34	6.5
					1.64	....
thorium oxide, ThO_2	....	86.0	....	46.9	7.11	10.0
zinc oxide, ZnO	....	82.2	86.4	8.5	3.2	5.1
					2.1	
magnesium oxide, MgO	....	86.3	....	16.0	2.5	9.1
calcium oxide, CaO	....	85.4	....	22.3	3.6	6.2
zirconium oxide, ZrO_2	82.2	85.8	84.1	23.2	5.1	5.4
lead carbonate, $PbCO_3$	....	86.8	90.8	29.2	9.3	6.9
		89.9	92.8	....	.....	....
		.....	94.5	....	13.2	....
magnesium carbonate, $MgCO_3$	....	85.2	89.4	10.8	4.1	8.8
Paints						
white lead No. 103	....	76.2	79.3	....	....	....
" " " 102	....	74.3	....	....	....	....
zinc lead white No. 107	....	69.6	....	....	....	....
" oxide No. 104	....	68.1	72.1	....	....	....
white lead 50% / zinc oxide 50% No. 209	....	70.8	....	....	....	....
Miscellaneous						
asphalt (pavement)	....	14.8	....	....	....	....
black felt	....	13.9	21.2	....	....	....
		22.5	25.6	....	....	....
black velvet	....	1.75	....	3.66	2.7	....
bluestone (sandstone) SiO_2	....	18.4	8.1	17.6	11.0	....
blue flannel	....	17.5	....	....	....	....
Brick:						
light buff	....	48.4	....	....	....	....
darker	....	40.0	....	....	....	....
red brick	...	30.1	....	....	12.4	....
darker & glazed	....	23.4	....	....	....	....
Cotton cloth:						
diamine fast red 8 B L	....	43.8	....	....	....	....
diamine fast black C B —	....	33.1	....	....	....	....
columbia fast black R	....	28.7	....	....	....	....
diamine aldehyde black	....	29.5	....	....	....	....
sulphur black A W L —	....	2.43	2.57	....	....	....

DIFFUSE REFLECTING POWER (Continued)

The diffuse reflecting power, or ratio of total luminous flux reflected to that received, measured for the various regions of the spectrum. The wave lengths given are those of maximum energy. — Coblentz, Bulletin, 196, Bureau of Standards 1912.

Material	Reflecting power %					
	0.54 μ	0.60	0.95	4.4	8.8	24.0
Woolen Cloth:						
lanacyl blue B N —	....	25.1	....	....	....	....
salacine blue black A E —	....	14.6	17.8	....	....	....
" black PB —	....	11.8	15.1	....	....	....
Linen:						
starched, dull finish	....	81.2	....	....	....	....
deep blue cloth (Navy Dept.)	....	17.0	....	....	....	....
lighter shade	....	18.2	....	....	....	....
Feldspar, $KAlSi_3O_8$	....	....	86.7	38.2	10.3	9.7
cleavage surface	....	39.4	....	....	14.6	....
Granolith (pavement)	....	16.9	....	....	....	....
Green Leaf (tulip tree)	....	21.9	38.0	5.6	....	....
Indiana limestone, $CaCO_3$	....	42.9	....	20.3	5.0	....
Quartz (powder, French Flint) SiO_2	....	81.0	41.5	7.9	9.0	....
Slate (dark clay)	....	6.7	....	13.4	20.0	....
White marble $CaCO_3$ ground, unpolished	....	53.5	....	6.4	5.1	....
cleavage, surface	....	40.8	....	....	....	....
White paper	....	71.7	74.7	18.2	5.0	....
two thicknesses	....	73.4	....	....	....	....
White paper, (Bond)	....	75.2	....	....	....	....

DIFFUSED REFLECTION

Albedo

Giving the percent of diffused reflection of "white light" for various surfaces. *Sumpner*, *Zöllner* and others.

Material	Reflections	Material	Reflections
Wood, pine	40	Parchment	
Cardboard		1 sheet	22
yellow	30	2 sheets	35
white	60–70	Cloth	
Painted surface,		black	1
yellow	40	tracing	35
white washed	50	white	60–70
Paper		Velvet	
tracing	22	black	0.4
ordinary white	60–70		
blotting	70–80	Loam, sandy	24
chocolate color	4		
brown	13	Earth, moist	8
blue	25		
yellow	25	Marl, argillaceous	16

PIGMENTS AND DYES

The tables which follow give the percent of incident light reflected by pigments or transmitted by dyes. The pigments were in dry powdered form and the dye solutions, except where indicated, in distilled water. Wave lengths are given in microns.

(*Luckiesch, 1917*)

Pigment	0.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70
American vermilion	0.08	0.06	0.05	0.05	0.06	0.06	0.09	0.11	0.24	0.39	0.53	0.61	0.66	0.65
Venetian red	.05	.05	.05	.05	.05	.06	.07	.12	.19	.24	.28	.30	.32	.32
Tuscan red	.07	.07	.07	.08	.08	.08	.08	.12	.16	.18	.20	.22	.23	.24
Indian red	.08	.07	.07	.07	.07	.07	.07	.11	.15	.18	.20	.22	.23	.24
Burnt sienna	.04	.04	.04	.04	.05	.06	.09	.14	.18	.20	.21	.23	.24	.25
Raw sienne	.12	.13	.13	.13	.18	.26	.35	.43	.46	.46	.45	.44	.45	.43
Golden ochre	.22	.22	.23	.27	.40	.53	.63	.71	.75	.74	.73	.73	.73	.72
Chrome yellow, ochre	.08	.09	.07	.07	.10	.19	.30	.46	.60	.62	.66	.82	.81	.80
Yellow ochre	.20	.20	.21	.24	.32	.42	.53	.63	.64	.61	.60	.59	.59	.59
Chrome yellow (medium)	.05	.05	.06	.08	.18	.48	.66	.75	.78	.79	.81	.81	.81	.81
Chrome yellow (light)	.13	.13	.18	.30	.56	.82	.88	.89	.90	.89	.88	.87	.85	.84
Chrome green (light)	.10	.10	.14	.23	.26	.23	.20	.17	.14	.11	.09	.08	.07	.06
Chrome green (medium)	.07	.07	.10	.21	.21	.17	.13	.11	.09	.07	.06	.06	.06	.05
Cobalt blue	.59	.58	.49	.35	.23	.15	.11	.10	.10	.10	.11	.15	.20	.25
Ultramarine blue	.67	.54	.38	.21	.10	.06	.04	.03	.03	.04	.05	.07	.10	.17

PIGMENTS AND DYES (Continued)

Red Dyes

Dye-Solution	0.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	70
Carmen ruby opt.	....	....	....	....	....	....	....	....	....	0.04	0.18	0.37	0.49	0.60
Amido naphthol red	....	....	....	....	....	....	....	....	0.04	.38	.75	.92	.96	.96
Coccinine	....	....	....	....	....	....	....	0.04	.56	.96	.98	.98	.98	.98
Erythrosine	0.06	....	....	....	....	....	0.10	.53	.90	.95	.96	.96	.96	.96
Hematoxyline	.01	0.03	0.07	0.13	0.14	0.12	.13	.25	.44	.54	.63	.73	.78	.82
"	....	....	....	....	....	....	....	.01	.02	.04	.09	.15	.21	.25
Alizarine red	.01	.01	.02	.03	.04	.06	.11	.22	.39	.54	.65	.72	.77	.79
Acid rosolic (pure)	.04	.03	.01	....	....	....	.02	.38	.78	.88	.90	.91	.92	.92
Rapid filter red	....	....	....	....	....	.01	.10	.47	.86	.95	.96	.96	.96	.96
Aniline red fast extra A	....	....	....	....	....	.02	.12	.34	.55	.72	.81	.88	.90	.92
Pinatype red fast	....	....	....	....	....	....	....	....	.11	.35	.55	.65	.68	.69
Eosine (yellowish)	....	....	....	....	....	....	....	....	.06	.40	.63	.74	.82	.85
Eosine	....	....	....	....	....	....	.01	.54	.87	.93	.92	.92	.92	.92
Naphthalinrot in absolute alcohol	....	....	....	....	....	....	....	....	.06	.28	.43	.50	.57	.61
Rose bengal	.80	.70	.34	.06	.01	....	.14	.82	.96	.97	.98	.98	.98	.98
Rose bengal	.01	....	....	....	....	....	....	.09	.57	.83	.89	.92	.94	.96
Cobalt ammonium sulphate	.60	.56	.48	.37	.38	.53	.70	.82	.86	.90	.90	.90	.90	.89
Cobalt nitrate	.69	.51	.40	.31	.32	.48	.67	.82	.87	.90	.90	.90	.90	.90

PIGMENTS AND DYES (Continued)

Yellow Dyes

Dye-Solution	0.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70
Tartrazine	....	....	....	....	0.07	0.52	0.75	0.86	0.91	0.95	0.96	0.97	0.98	0.98
Chrysoidin	....	....	....	....	....	....	....	....	.02	.23	.50	.71	.79	.79
Aurantia	....	....	....	....	....	.03	.23	.53	.82	.92	.96	.96	.96	.96
Aniline yellow phosphine	....	....	....	....	.02	.20	.43	.60	.67	.75	.81	.85	.86	.87
Fluorescein	0.15	0.01	....	....	.48	.91	.97	.98	.98	.98	.98	.98	.98	.98
Aniline yellow fast, S	....	....	0.01	0.07	.43	.84	.96	.96	.96	.96	.96	.96	.96	.96
Methyl orange, indicator	....	....	....	....	....	....	.01	.31	.70	.79	.80	.81	.81	.81
Auramin	....	....	.01	.39	.77	.83	.84	.86	.87	.88	.90	.92	.93	.93
Uranine	.15	.01	....	.01	.58	.96	.97	.97	.97	.97	.97	.97	.97	.97
Uranine naphthaline	....	....	....	.04	.53	.77	.82	.83	.84	.85	.86	.86	.87	.87
Orange B Naphthol	....	....	....	....	....	.01	.43	.88	.95	.96	.97	.97	.97	.97
Safranine	....	....	....	....	....	....	....	....	.03	.27	.64	.85	.93	.93
Martius gelb	....	....	....	.01	.43	.84	.91	.94	.95	.95	.95	.95	.95	.95
Naphthol yellow	....	....	.01	.18	.74	.91	.96	.97	.98	.98	.98	.98	.98	.98
Potassium bechromate, sat. sol.	....	....	....	....	....	.10	.60	.84	.88	.89	.89	.89	.89	.88
Cobalt chromate	.17	.36	.62	.82	.88	.90	.92	.93	.95	.96	.96	.96	.96	.95

PIGMENTS AND DYES (Continued)

Green Dyes

Dye-Solution	0.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70
Naphthol green	0.02	0.04	0.07	0.21	0.30	0.36	0.29	0.16	0.07	0.02	0.01	....	....	....
Brilliant green	.04	.39	.69	.52	.23	.04	....	....	....	....	....	0.02	0.23	0.64
Filter blue green	.35	.49	.64	.70	.60	.37	.13	.02	....	....	....	....	....	....
Filter blue green	.06	.14	.23	.40	.26	.08	.01	....	....	....	....	....	....	....
Malachite green	....	.12	.20	.08	.01	....	....	....	....	....	....	....	.12	.50
Malachite green	....	.01	.04	.01	....	....	....	....	....	....	....	....	.02	.23
Malachite green	....	....	.01	....	....	....	....	....	....	....	....	....	....	.10
Saurgrun	.03	.29	.57	.57	.39	.19	.04	.01	....	....	....	....	.04	.30
Methylengrun	.28	.31	.32	.26	.17	.07	.02	.01	....	....	....	....	.03	.28
Methylengrun	.14	.16	.17	.13	.06	.01	....	....	....	....	....	....	.02	.14
Aniline green naphthol B	.02	.06	.14	.24	.34	.40	.32	.14	.04	.01	....	....	....	....
Aniline green naphthol B	....	....	.02	.06	.10	.15	.09	.02	....	....	....	....	....	....
Neptune green	....	.40	.63	.41	.13	.01	....	....	....	....	....	....	....	.05
Neptune green	....	.19	.36	.18	.02	....	....	....	....	....	....	....	....	.02
Cupric chloride	.77	.84	.89	.92	.92	.89	.80	.67	.52	.36	.19	.06	.02	....

PIGMENTS AND DYES (Continued)

Blue Dyes

Dye-Solution	0.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70
Trunbulls' blue	0.58	0.60	0.56	0.51	0.38	0.28	0.18	0.09	0.05	0.03	0.01	....	....	....
Victoria blau	.52	.23	.09	.01	....	....	....	....	....	.01	.04	0.21	0.49	0.73
Prussian blue (soluble)	.66	.71	.76	.69	.60	.46	.32	.20	.12	.07	.05	.03	.03	....
" " "	.06	.09	.09	.05	.02	.01	....	....	....	....	....	....	....	....
Wasser blau	.89	.75	.51	.26	.07	.01	....	....	.01	.02	.06	.18	.37	.60
" "	.85	.66	.42	.17	.03	.01	....	....	....	.01	.03	.10	.26	.48
Resorcine blue	.25	.18	.06	.02	.01	....	....	....	.01	.02	.14	.41	.64	.72
Toluidin blau	.66	.31	.13	.03	.01	....	....	....	....	....	.01	.04	.16	.40
Patent blue	.83	.91	.84	.76	.65	.46	.24	.08	.02	....	....	.06	.42	.78
" "	.15	.25	.17	.05	....	....	....	....	....	....	....	....	....	.12
Dianil "	.77	.69	.59	.48	.35	.24	.15	.09	.05	.05	.07	.14	.29	.53
" "	.38	.30	.18	.10	.04	.01	....	....	....	....	....	....	.02	.12
Filter "	.84	.79	.66	.44	.27	.17	.14	.19	.36	.56	.74	.81	.88	.92
" "	.35	.29	.18	.04	....	....	....	....	.02	.08	.23	.44	.62	.71
Aniline blue, methyl	.92	.88	.78	.52	.27	.09	.03	.02	.02	.04	.08	.16	.25	.45
" " "	.41	.31	.13	....	....	....	....	....	....	....	....	....	....	....

PIGMENTS AND DYES (Continued)

Purple Dyes

Dye-Solution	0.44	.46	.48	.50	52	.54	.56	.58	.60	.62	.64	.66	.68	.70
Ethyl violet in gelatine (dry)	0.97	0.87	0.67	0.28	0.04	....	....	....	....	0.05	0.33	0.73	0.88	.91
Ethyl violet in gelatine (wet)	.83	.79	.45	.07	.01	....	0.01	0.03	0.05	.15	.42	.76	.91	.93
Magenta	.21	.08	.02	.01	....	....	.01	.22	.73	.93	.97	.97	.97	.97
"	....	....	....	....	....	....	....	....	.07	.48	.81	.92	.95	.95
Gentian violet	.89	.83	.64	.44	.26	0.19	.15	.10	.13	.42	.75	.92	.93	.94
" "	.11	.01	....	....	....	....	....	....	....	....	.01	.15	.48	.66
Rosazeine	.50	.28	.02	....	....	....	....	.06	.55	.90	.98	.98	.98	.98
"	....	....	....	....	....	....	....	....	....	.07	.54	.90	.95	.95
Iodine (dense)	....	....	....	....	....	....	....	....	....	....	.01	.03	.11	.23
Rhodamine B	.81	.71	.45	.13	.02	....	....	.23	.83	.96	.96	.96	.95	.94
Acid violet	.84	.76	.68	.50	.33	.26	.27	.34	.49	.70	.84	.96	.96	.96
" "	.29	.08	.01	....	....	....	....	.01	.09	.32	.63	.84	.94	.94
Cyanine in alcohol	.07	.01	....	....	....	....	....	....	....	....	....	.01	.13	.23
Xylene red	.39	.23	.01	....	....	....	....	.01	.27	.79	.97	.97	.97	.96
" "	....	....	....	....	....	....	....	....	.01	.31	.79	.96	.96	.95
Methyl violet B	.25	.04	....	....	....	....	....	....	....	....	.03	.26	.63	.89

TRANSMISSIBILITY FOR RADIATIONS

Ratio of the transmitted light to the incident light for a definite thickness of the substance, usually 1 cm.

GLASS.

Glass in general is opaque to the ultra-violet and infra-red. Uviol glass is transparent to the longer radiations of the ultra-violet.
Coefficient of transparency of glass for visible and ultra-violet radiations.

Wave length microns	Normal incidence, thickness 1 cm.								
	0.309	0.330	0.347	0.357	0.361	0.375	0.384	0.388	0.396
Crown, ordinary	...	...	...	...	...	.947			
Crown, borosilicate	0.08	0.65	0.88	...	0.95	...	0.972	0.975	0.986
Flint, ordinary	...	...	...	0.72	...	...	...	0.904	
Flint, heavy	...	...	0.01	...	0.16	...	0.58		

Wave length, microns	Normal incidence, thickness 1 cm.								
	0.400	0.415	0.419	0.425	0.434	0.455	0.500	0.580	0.677
Crown, ordinary	0.964	...	0.952	...	0.960	0.981	...	0.986	0.990
Crown, borosilicate	...	0.985	...	0.993	...	...	0.993		
Flint, ordinary	...	0.959	...	...	...	...	1.00		
Flint, heavy	...	...	...	0.905					

See also pp. 175 and 176.

QUARTZ

Quartz is very transparent to the ultra-violet and to the visible spectrum, but opaque for the infra-red beyond 7.0μ.

(Pflüger.)

Wave length, microns	0.19	0.20	0.21	0.22
Transmission for 1 mm	.67	.84	.92	.94

FLUORITE

Fluorite is very transparent to the ultra-violet, nearly to 0.10μ. Coefficient of transparency at $\lambda = 186$ is found by Pflüger to be 0.80.
For the infra-red the values are given in a table below.

TRANSMISSIBILITY FOR RADIATIONS (Continued)

Rock Salt and Sylvine and Fluorite

Transparency for the Infra-red.

Thickness 1 cm.

Wave length, microns.	Rock salt.	Sylvine KCl.	Fluorite.
8.	....	....	.844
9.	0.995	1.000	.543
10.	.995	.988	.164
12.	.993	.995	.010
14.	.931	.975	.000
16.	.661	.936	
18.	.275	.862	
19.	.096	.758	
20.7	.006	.585	
23.7	.000	.155	

PHOSPHORESENCE BY CATHODE RAYS

Substances Luminous under Excitation by Cathode Rays.

Substance (with calcium oxide).	Wave lengths of principal bands in microns. (Urbain, 1909.)
Dysprosium oxide........	0.480, 0.489, 0.585, 0.675
Europium oxide.........	0.416–0.426, 0.469
Europium oxide..........	0.589–0.593, 0.613, 0.625
Neodymium oxide........	0.392, 0.419–0.429, 0.458
Praesodymium oxide.....	0.488, 0.604, 0.606, 0.626, 0.634

One part.	100 parts.	Wave length.	Color.	Observer.
Antimony oxide..	calcium oxide	0.560	yellow	Bruninghaus, 1910
Antimony trisulphide.........	calcium sulphide	0.569	yellow	Bruninghaus, 1910
Bismuth oxide...	calcium oxide	0.522	blue	Bruninghaus, 1910
Bismuth sulphate.	calcium sulphate	0.640	red	Bruninghaus, 1910
Manganous carbonate........	magnesium carbonate	0.620	red	Bruninghaus, 1910
oxide.........	calcium oxide	0.589	yellow	Lecoq & Boisbaudran, 1886
phosphate.....	calcium phosphate $Ca_3(PO_4)_2$	0.633	red	Bruninghaus, 1910
sulphate.......	calcium sulphate	0.540	green	Lecoq & Boisbaudran, 1886
sulphide.......	calcium sulphide	0.589	yellow	Bruninghaus, 1910

FLUORESCENCE OF ORGANIC SUBSTANCES IN SOLUTION

Excitation by White Light.

Substance.	Solvent.	Wave length microns.	Observer.
Anthracene......	alcohol	0.400 0.430 0.436	Stark & Meyer, 1907
Eosine..........	alcohol or water	0.589	Nichols & Merritt, 1907
Esculine.	alcohol	0.460	Nichols & Merritt, 1907
Fluorescein......	water (alkaline)	0.542	Nichols & Merritt, 1907
Naphthalin, red..	alcohol	0.632	Nichols & Merritt, 1907
Quinine sulphate.	water	0.437	Nichols & Merritt, 1907
Resorcin blue....	water	0.65	Nichols & Merritt, 1907
Rhodamin.......	water	0.554	Nichols & Merritt, 1907

FLUORESCENCE

Gases and Vapors.

Gas or vapor.	Condition.	Excitation.	Color or wave length of emitted light.	Observer.
Iodine...	Vapor at ordinary temperature.	Mercury arc $\lambda = .546\mu$	Strongest bands $\lambda = .5460\mu, .5774\mu$ .5730, .5796	Wood, 1911
Mercury .	Vapor at ordinary temperature	Spark between aluminum electrodes	Broad band $\lambda = .5900–.3000$	Wood, 1909
Oxygen ..	....	Mercury arc in quartz tube	Strongest lines $\lambda = .1849, .1851$ (ultra-violet)	Streubing, 1910
Potassium	Vapor, 300°–400° C.	White light	Many strong lines from .6416–.6768, strongest .6544 and .6584	Wood & Carter, 1908
Rubidium	Vapor, at 270° C.	White light (elec. arc)	Strong red band $\lambda = .6900–.6620$.	Dunoyer, 1912
Sodium ..	Vapor at 350° C.	White light (elec. arc)	D, $\lambda = .5893$ (mean)	Dunoyer, 1912

SPECIFIC ROTATION

The tables give the specific rotation in degrees for one decimeter: + signifies right-handed rotation, − left. Rotation is for sodium light.

LIQUIDS

Liquid.	Temp. ° C.	Specific Rotation. Degrees.	Observer.
Amyl alcohol.....	....	−5.7	Le Bel
Camphor.........	204	+70.33	Gernez
Cedar oil.........	15	−30 to −40	
Citron oil.........	15	+62	
Menthol..........	35.2	−49.7	Paterson & Taylor
Nicotine..........	22.7	+150.0	Molby
Oil of turpentine...	15	−20 to −40	

SOLUTIONS

Giving the rotation for one decimeter, for one gram of active substance in one cubic centimeter of solution.

Active substance.	Solvent.	Temp. ° C.	Spec. rot.	Observer.
Albumen, egg...	water	....	−25 to −38	
Camphor.......	ether	....	+57.	Darmois, 1910
Dextrose (β)....	water	15	+52.5	Tanret, 1896
Glucose (β).....	water	20	+51.4	
Lactose........	water	15	56.	
Maltose........	water	20	+136.9	
Quinine sulphate	alcohol	17	−57.5	Oudemans, 1876
Sugar cane.....	water	20	66.5	
Tartaric acid....	water	20	+13.44	Wendel, 1898

SOLIDS

(Rotation per millimeter.)

Substance.	Rotation.	Substance.	Rotation.
Cinnabar (HgS)....	32.5	Quartz...........	21.7
Lead hyposulphate.	5.5	Sodium bromate...	2.8
Potassium " .	8.4	Sodium chlorate...	3.13

MAGNETO OPTIC ROTATION

$$\text{Verdet's Constant: } \rho = \frac{\alpha}{tH \cos \theta}$$

The specific power of magnetic rotation ρ, is expressed in the above formula, where α is the total angle of rotation in minutes, t the thickness of the substance in centimeters, H the magnetic field intensity in gausses and θ the angle between the direction of the magnetic field and the path of light.

Solids

For sodium light.
(Values from the Smithsonian Tables.)

Substance.	Temp. ° C.	Verdet's Constant, Minutes.	Observer.
Amber	18–20	0.0095	Quincke
Blende	15	0.2234	Becquerel
Diamond	15	0.0127	Becquerel
Fluorspar	15	0.0087	Becquerel
Glass, crown	15	0.0203	Becquerel
flint	18–20	0.0420	Quincke
flint, dense	15	0.0647	Becquerel
Quartz (⊥ to axis)	18–20	0.0172	Quincke
Rock salt	15	0.0355	Becquerel
Selenium	15	0.4625	Becquerel
Sylvine	15	0.0283	Becquerel

Liquids

For sodium light.

Substance.	Density g/cm.³	Temp. ° C.	Verdet's Constant, minutes.	Observer.
Acetone	0.7947	20	0.0113	Jahn
Acids: (see also solutions				
in water) acetic	1.0561	21	0.0105	Perkin
hydrochloric	1.2072	15	0.0224	Perkin
hydrobromic	1.7859	15	0.0343	Perkin
nitric	1.5190	13	0.0070	Perkin
sulphuric	......	15	0.0121	Becquerel
sulphurous	......	15	0.0153	Becquerel
Alcohols: amyl	......	15	0.0131	Becquerel
ethyl	0.7929	18–20	0.0107	Quincke
methyl	0.7915	18–20	0.0094	Quincke
Benzine	0.8796	20	0.0297	Jahn
Carbon disulphide	1.2644	18–20	0.0441	Quincke
Chloroform	1.4	20	0.0164	Jahn
Phosphorus (melted)	....	33	0.1316	Becquerel
Sulphur (melted)	....	114	0.0803	Becquerel
Toluene	....	28.4	0.0269	Becquerel
Water	....	18–20	0.0130	Schönrock
Xylene	....	15	0.0221	Becquerel
Zinc bichloride	....	15	0.0437	Becquerel

MAGNETO OPTIC ROTATION (Continued)

Aqueous Solutions

For sodium light.

Salt.	Density, g/cm³.	Temp. °C.	Verdet's constant, minutes.	Observer.
Acids: hydrochloric	1.1856	15	0.0219	Perkin
hydrochloric	1.1279	15	0.0193	Perkin
hydrochloric	1.0323	20	0.0150	Jahn
nitric	1.3560	20	0.0105	Perkin
Ammonia	0.8918	15	0.0153	Perkin
Bromides: barium	1.5399	20	0.0215	Jahn
potassium	1.1424	20	0.0163	Jahn
sodium	1.1351	20	0.0165	Jahn
Carbonate of potassium	1.1960	20	0.0140	Jahn
Carbonate of sodium	1.1006	20	0.0140	Jahn
Chlorides: barium	1.2897	20	0.0168	Jahn
cadmium	1.3179	20	0.0185	Jahn
calcium	1.1504	20	0.0165	Jahn
iron (ferrous)	1.4331	15	0.0025	Becquerel
iron (ferric)	1.6933	15	−0.2026	Becquerel
lithium	1.0619	20	0.0145	Jahn
mercury	1.0381	16	0.0137	Schönrock
potassium	1.6000	15	0.0163	Becquerel
sodium	1.2051	15	0.0180	Becquerel
zinc	1.2851	15	0.0196	Verdet
Bichromate of potassium	1.0786	15	0.0126	Verdet
Iodides: potassium	1.6743	15	0.0338	Becquerel
Sulphates: barium	1.1788	20	0.0134	Jahn
potassium	1.0475	20	0.0133	Jahn
sodium	1.0661	20	0.0135	Jahn

Gases

For sodium light.

Substance.	Pressure.	Temp. °C	Verdet's constant, minutes.	Observer.
Atmospheric air	atmos.	ordinary	6.83×10^{-6}	Becquerel
Carbon dioxide	atmos.	ordinary	13.00	Becquerel
Carbon disulphide	74 cms.	70°	23.49	Bichat
Ethylene	atmos.	ordinary	34.48	Becquerel
Nitrogen	atmos.	ordinary	6.92	Becquerel
Nitrous oxide	atmos.	ordinary	16.90	Becquerel
Oxygen	atmos.	ordinary	6.28	Becquerel
Sulphur dioxide	atmos.	ordinary	31.39	Becquerel
Sulphur dioxide	246 cms	20°	38.40	Bichat

MISCELLANEOUS TABLES

α RAYS

The α rays are thought to be positively charged particles, moving with a high velocity. They are only slightly deviable by a strong magnetic or electric field and have small penetrating power. The initial velocity has been found to be about 2×10^9 cms./s. The mass of each particle is 6.2×10^{-24} g. (Rutherford and Geiger, 1910.) The charge carried by each, as measured by the same authors, is 9.3×10^{-10} electro static units.

β RAYS

The β rays are similar to the cathode rays produced by an electric discharge in a vacuum tube. They are judged to be negatively charged particles moving with high velocity. They are much more penetrating than the α rays, and are strongly deviated by a magnetic or electric field. The velocity of the moving particle is in the neighborhood of that of light, about 2×10^{10} cm./s. The charge on each particle is approximately 4.7×10^{-10} electro static units.

γ RAYS

The γ rays are similar to the X rays and are not deviable by magnetic or electric fields. They are more penetrating than either the α or β rays, and are considered to be of the nature of wave pulses in the ether.

RÖNTGEN RAYS

Scale of Hardness

The "radiochrometer" of Benoist consists of a disk of silver 0.11 mm. thick, which is surrounded by 12 sectors of aluminum ranging in thickness from 1 to 12 millimeters. The sector which shows the same absorption as the central disk gives the degree of hardness according to Benoist. The relation of this to other scales is shown below.

Benoist	2	3	4	5	6	7	8
Wehnelt	1.8–2	5	6.5	7.5	8	9	10–11
Walter	2.0–3	4–5	5–6	6	6–7	7	7–8

The absorption of rays is very nearly proportional to the mass of substance penetrated.

IONIZATION DUE TO RÖNTGEN RAYS IN VARIOUS GASES

From Smithsonian Physical Tables

Gas	Relative ionization		Density
	Soft rays, Strutt	Hard rays, Eve	
Hydrogen	0.11	0.42	0.069
Air	1.00	1.00	1.00
Oxygen	1.39	......	1.11
Carbon dioxide	1.60	......	1.53
Cyanogen	1.05	......	1.86
Sulphur dioxide	7.97	2.3	2.19
Chloroform	31.9	4.6	4.32
Methyl iodide	72.0	13.5	5.05
Carbon tetrachloride	45.3	4.9	5.31
Hydrogen sulphide	......	0.9	1.18

GRATING SPACE IN CRYSTALS

Calcite	3.02904×10^{-8}cm.	Millikan
Potassium ferrocyanide	8.408	Siegbahn
Rock salt, plane parallel to face	2.81	Bragg
Calcium fluoride	5.455 (Cu radiation)	Gerlach
	5.478 (Ni radiation)	"
Mica	9.845 (1st order)	Davis, Terrill
	9.958 (7th order)	" "
Silicon	5.415 (Cu radiation)	Gerlach
	5.410 (Ni radiation)	"
Zinc blende	5.90 (Cu radiation)	"

MEAN ABSORPTION COEFFICIENTS

(From Smithsonian Physical Tables)

If I_0 be the intensity of a parallel beam of homogeneous radiation incident normally on a plate of absorbing material of thickness t, then $I = I_0 e^{-\lambda x}$ gives the intensity I at the depth x. Because of the great homogeneity of the secondary X-rays they were used in the determination of the following coefficients. The coefficients λ have been divided by the density d.

	Absorber										
Radiator	C.	Mg.	Al.	Fe.	Ni.	Cu.	Zn.	Ag.	Sn.	Pt.	Au.
Cr.	15.3	126.	136.	104.	129.	143.	170.	580.	714.	(517.)	(507.)
Fe.	10.1	80.	88.	66.	84.	95.	112.	381.	472.	340.	367.
Co.	80.0	64.	72.	67.	67.	75.	92.	314.	392.	281.	306.
Ni.	6.6	52.	59.	314.	56.	62.	74.	262.	328.	236.	253.
Cu.	5.2	41.	48.	268.	63.	53.	61.	214.	272.	194.	210.
Zn.	4.3	35.	39.	221.	265.	56.	50.	175.	225.	162.	178.
As.	2.5	19.	22.	134.	166.	176.	204.	105.	132.	106.	106.
Se.	2.0	16.	19.	116.	141.	150.	175.	88.	112.	93.	100.
Ag.	.4	2.2	2.5	17.	23.	24.	27.	13.	16.	56.	61.

THE ABSORPTION OF X-RAYS

If radiation in traversing a thin layer of substance is reduced in intensity by a constant fraction μ per centimeter of the substance traversed, the intensity of the radiation, after penetrating to a depth x, is

$$I = I_0 e^{-\mu x}$$

where I_0 is the intensity at the surface. The quantity μ is called the "absorption coefficient." Similarly μ/ρ, the "mass absorption coefficient," is the fraction of a beam 1 cm² cross section absorbed per gram of substance traversed; and μ/ν, the "atomic absorption coefficient," where ν is the number of atoms per cm³, is the fraction of such a beam absorbed by each atom of the substance.

Values due principally to Hewlett and Richtmyer, compiled by Compton, 1922.

MASS ABSORPTION COEFFICIENTS

μ/ρ

Å.U.	Li 3	C 6	N 7	O 8	Al 13 (H)	Al 13 (R)	Fe 26	Cu 29	Mo 42	Ag 47	Pb 82	H_2O (H)	H_2O (R)
.025	....	....	....	.....		.071	.068	.....	.....	.....	.076	.....	....
.100	....	.144	....	.....	.162	← Duane →		.32	.....	.....	.....	.....	.168
.125	....	.154	....	.146	.174	.181	.399	.46	1.35	.....	Hull { 3.0	.161	.176
.150	....	.163	.163	.163	.200	.198	.585	.79	1.96	.....	1.57	.180	.185
.175	....	.166	.171	.174	.236	.221	.820	1.13	2.83	3.69	2.55	.195	.195
.20	....	.173	.177	.183	.273	.259	1.06	1.56	4.02	6.00	4.60	.199	.204
.25	....	.187	.193	.207	.358	.370	1.88	2.77	7.42	11.4	8.48	.219	.229
.30	.172	.202	.224	.243	.517	.532	3.09	4.50	12.7	18.2	14.2	.246	.261
.35	.188	.219	.251	.289	.719	.764	4.77	6.95	19.1	27.2	22.6	.283	.301
.40	.208	.240	....	.336	.982	1.06	7.02	10.1	26.7	28.6	33.6	.334	.354
.50	.245	.304	....	.488	1.86	1.92	13.86	18.8	48.6	11.5	60.6	.491	....
.60	.306	.394	....	.730	3.05	3.23	22.6	31.6	80.7	19.6	.....	.711	....
.70	.403	.532	....	1.08	4.84	5.05	35.3	48.8	18.8	.....	.....	1.023	....
.80	....	.706	....	1.53	7.26	.....	50.7	.....	27.2	.....	.....	1.475	....
1.00	....	1.27	....	.....	13.80	.....	90.2	.....	53	87. ← Bragg		2.70	....

X-RAY SPECTRA

From data by Siegbahn and his associates except as noted, compiled by Duane, Bulletin of the National Research Council, 1920.

Emission Wave-Lengths in the K Series

$\lambda \times 10^{-8}$ cm.

For Rock salt d = 2.814 $\times 10^{-8}$ cm., for calcite d = 3.028 $\times 10^{-8}$ cm.

Chemical Element	Atomic Number	α_2	α_1	α_3	α_4	β_1	γ
Sodium	11	......	11.8836	11.8024	11.7814	11.591	.....
Magnesium	12	......	9.8675	9.79940	9.78620	9.53450	...
Aluminium	13	......	8.31940	8.26460	8.25300	7.94050	....
Silicon	14	......	7.10917	7.06382	7.05372	6.73933	....
Phosphorus	15	......	6.14171	6.10219	6.09500	5.78513	....
Sulphur	16	......	5.36066	5.32833	5.32175	5.01913	....
Chlorine	17	......	4.71870	4.692		4.39450	....
Potassium	19	3.738	3.73386	3.724		3.44638	....
Calcium	20	3.359	3.35186	3.328		3.08297	3.06740
Scandium	21	3.032	3.02526	3.011		2.77366	2.755(5)
Titanium	22	2.746	2.742	2.729		2.50874	2.49367
Vanadium	23	2.502	2.498	....	....	2.27968	2.26537
Chromium	24	2.288	2.28517	....	....	2.08144	2.069
Manganese	25	2.097	2.093	....	....	1.902	1.892
Iron	26	1.932	1.93239	....	....	1.75397	1.736
Cobalt	27	1.785	1.78524	....	....	1.61715	1.606
Nickel	28	1.657	1.65467	....	....	1.49669	1.48403
Copper	29	1.543	1.53736	....	....	1.38887	1.382
Zinc	30	1.437	1.433	....	....	1.294	1.281
Gallium	31	1.34161	1.33785	....	....	1.20591	....
Germanium	32	1.261	1.257	....	....	1.131	1.121
Arsenic	33	1.174	1.170	....	....	1.052	1.038
Selenium	34	1.109	1.104	....	....	0.993	....
Bromine	35	1.040	1.035	....	....	0.929	0.914
Rubidium	37	0.926	0.922	....	....	0.825	0.813
Strontium	38	0.876	0.871	....	....	0.779	0.767
Yttrium	39	0.840	0.835	....	....	0.746	0.733
Zirconium	40	0.793	0.788	....	....	0.705	....
Niobium	41	0.754	0.749	....	....	0.669	0.657
Molybdenum[1]	42	0.71212	0.70783	....	....	0.63110	0.6197
Ruthenium	44	....	0.645	....	....	0.574	....
Rhodium[1]	45	0.6164	0.6121	....	....	0.5453	0.5342
Palladium	46	0.590	0.586	....	....	0.521	....
Silver	47	0.567	0.562	....	....	0.501	0.491
Cadmium	48	0.543	0.538	....	....	0.479	....
Indium	49	0.515	0.510	....	....	0.453	0.440
Tin	50	0.490	0.487	....	....	0.432	....
Antimony	51	0.472	0.468	....	....	0.416	0.408
Tellurium	52	....	0.456	....	....	0.404	....
Iodine	53	....	0.437	....	....	0.388	....
Caesium	55	0.402	0.398	....	....	0.352	....
Barium	56	0.393	0.388	....	....	0.343	....
Lanthanum	57	0.376	0.372	....	....	0.329	....
Cerium	58	0.360	0.355	....	....	0.314	....
Praseodymium	59	0.347	0.342	....	....	0.301	....
Neodymium	60	0.335	0.330	....	....	0.292	....
Tungsten[1]	74	0.21341	0.20860	....	....	0.18420	0.17901

[1] Duane

X-RAY SPECTRA (Continued)

Emission–Wave Lengths in the L Series

$\lambda \times 10^{-8}$ cm.
For Rock salt d = 2.814×10^{-8} cm., for calcite d = 3.028×10^{-8} cm.

Chemical Element	At. no.	l	α_2	α_1	α_3	η	β_4	β_1	β_2	β_3	β_5	γ_1	γ_2	γ_3	γ_4
Zinc	30			12.346											
Arsenic	33			9.701				9.449							
Bromine	35			8.391	8.360			8.141							
Rubidium	37			7.335	7.305			7.091							
Strontium	38			6.879				6.639							
Yttrium	39			6.464	6.440			6.227							
Zirconium	40			6.083	6.057			5.851							
Niobium	41		5.731	5.724	5.709			5.493	5.317			5.386			
Molybdenum	42		5.410	5.403	5.381			5.175							
Ruthenium	44		4.853	4.83567	4.823			4.61100				4.17282			
Rhodium	45			4.587	4.577			4.364				3.935			
Palladium	46		4.374	4.358	4.352		4.071	4.137	3.904	4.030		3.716			
Silver	47		4.155	4.154	4.133		3.861	3.926	3.698	3.823		3.514	3.597		
Cadmium	48		3.959	3.947			3.676	3.730	3.514	3.639		3.328			
Indium	49		3.774	3.763				3.547	3.354			3.155			
Tin	50		3.604	3.591			3.337	3.377	3.172	3.300		2.994	2.903	2.889	2.831
Antimony	51		3.443	3.431			3.184	3.218	3.021	3.149		2.845	2.782		
Tellurium	52		3.299	3.281			3.044	3.069	2.881	3.007		2.706			
Iodine	53		3.155	3.141			2.911	2.930	2.750	2.873		2.577			
Caesium	55		2.899	2.885			2.668	2.677	2.514	2.629		2.359			
Barium	56		2.786	2.769			2.558	2.562	2.407	2.520		2.236	2.234		
Lanthanum	57		2.674	2.659			2.453	2.452	2.307	2.414		2.136			
Cerium	58		2.573	2.555			2.357	2.350	2.212	2.307		2.044	2.003		

X-RAY SPECTRA (Continued)

Emission Wave-Lengths in the Series L (*Continued*)

Chemical Element	At. no.	l	α_2	α_1	α_3	η	β_4	β_1	β_2	β_3	β_5	γ_1	γ_2	γ_3	γ_4
Praseodymium	59	.....	2.472	2.457	.....	.....	.....	2.253	2.120	2.217	.....	1.956	1.937	1.933	.....
Neodymium	60	.....	2.379	2.364	.....	.....	2.167	2.167	2.036	2.128	.....	1.873	1.803	1.775	.....
Samarium	62	.....	2.210	2.200	.....	.....	.....	1.993	1.884	1.965	.....	1.725	1.659		.....
Europium	63	.....	2.131	2.121	.....	.....	1.923	1.918	1.810	1.888	.....	1.662	1.599	1.590	.....
Gadolinium	64	.....	2.054	2.043	.....	.....	1.851	1.844	1.744	1.811	.....	1.597	(1.562)	(1.558)	.....
Terbium	65	.....	1.983	1.973	.....	1.935	1.784	1.775	1.682	1.745	1.659	1.531	1.477	1.470	1.437
Dysprosium	66	.....	1.916	1.907	.....	.....	1.721	1.709	1.622	1.683	.....	1.470	1.422	1.418	.....
Holmium	67	.....	1.854	1.843	.....	.....	1.657	1.646	1.568	1.620	.....	1.415	1.369	1.365	.....
Erbium	68	.....	1.794	1.783	.....	1.725	1.599	1.586	1.514	1.560	.....	1.367	1.323	1.316	.....
Aldebaranium	70	1.892	1.681	1.670	.....	1.618	1.490	1.474	1.414	1.451	1.422	1.267	1.228	1.223	.....
Cassiopeium	71	1.834	1.629	1.619	.....	.....	1.437	1.421	1.368	1.399	.....	1.188	1.183	.....	.....
Tantalum	73	.....	1.528	1.518	.....	1.435	1.343	1.323	1.280	1.303	.....	1.135	1.101	1.097	.....
Tungsten	74	1.675	1.484	1.473	.....	1.4177	1.298	1.279	1.23191	1.260	1.2031	1.095	1.06584	1.059	1.026
Osmium	76	.....	1.398	1.388	.....	.....	1.214	1.194	1.167	1.176	.....	1.021	.....	.....	.....
Iridium	77	1.840	1.360	1.350	.....	.....	1.176	1.154	1.133	1.138	1.101	0.989	0.962	0.956	0.917
Platinum	78	1.499	1.323	1.313	.....	1.242	1.142	1.120	1.101	1.098	1.072	0.958	0.933	0.929	0.900
Gold	79	1.457	1.283	1.271	.....	1.197	1.102	1.080	1.065	1.059	1.035	0.922	0.898	0.894	0.869
Mercury	80	.....	1.251	1.240	.....	.....	.....	1.049	1.042	.....	.....	0.896	.....	.....	.....
Thallium	81	1.385	1.215	1.205	.....	1.124	1.036	1.012	1.006	0.998	0.977	0.864	0.844	0.840	0.808
Lead	82	1.348	1.186	1.175	.....	1.091	1.008	0.983	0.983	0.968	.....	0.842	0.820	0.816	0.792
Bismuth	83	1.317	1.153	1.144	.....	1.059	0.977	0.950	0.954	0.937	0.923	0.810	0.794	0.790	0.762
Pollonium	84	.....	.....	1.101	.....	.....	.....	0.920	.....	.....	.....	.....	.....	.....	.....
Radium	88	.....	.....	1.010	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Thorium	90	1.117	0.969	0.957	.....	.....	.....	0.766	0.797	0.758	.....	0.654	0.635		.....
Uranium	92	1.066	0.922	0.911	.....	.....	.....	0.720	0.756	0.710	.....	0.615	0.596		.....

X-RAY SPECTRA (Continued)

Emission Wave-Length in the M Series

$\lambda \times 10^8$ cm.

For rock salt d = 2.814 × 10^{-8} cm.

Chemical Element	Atomic Number	α	β	γ	δ	ϵ
Uranium	92	3.9014	3.7083	3.4714	2.943	2.813
Thorium	90	4.1292	3.9333	3.6565	3.127	3.006
Bismuth	83	5.1072	4.8993	4.5238	.....	.....
Lead	82	5.2751	5.0648	4.6637	.....	.....
Thallium	81	5.4499	5.2384	4.802	.....	.....
Gold	79	5.819	5.601	5.115	.....	.....
Platinum	78	6.035	5.818	5.295	.....	.....
Iridium	77	6.245	6.029	......	.....	.....
Osmium	76	6.477	6.250	......	.....	.....
Tungsten	74	6.976	6.749	6.091	.....	.....
Tantalum	73	7.237	7.012	......	.....	.....
Lutecium	71	7.818	7.593	......	.....	.....
Ytterbium	70	8.130	7.898	......	.....	.....
Erbium	68	8.770	8.561	......	.....	.....
Holmium	67	9.123	8.930	......	.....	.....
Dysprosium	66	9.509	9.313	......	.....	.....

ATOMIC ABSORPTION COEFFICIENTS

$$\frac{\mu}{\nu} = \frac{\mu}{\rho} \times \frac{W}{N}$$

The values are multiplied by 10^{23}

A.U.	H 1	Li 3	C 6	N 7	O 8	Al 13	Fe 26	Cu 29	Mo 42	Ag 47	Pb 82	H_2O (H)
.025	..	....	....	....	.....	.317	.625	...	......	......	2.60	.....
.100	.	....	.285	....	.....	.724	.....	3.3	.....	.....	.....	.....
.125	.04	....	.305	....	.385	.792	3.67	4.8	21.3	.....	103.	.478
.150	.05	....	.323	.376	.430	.889	5.38	8.3	31.0	......	53.6	.534
.175	.06	....	.329	.395	.459	1.04	7.55	11.8	44.7	66.5	86.1	.578
.20	.05	....	.343	.409	.482	1.19	9.75	16.4	63.5	107.	157.	.591
.25	.05	....	.370	.446	.546	1.62	17.3	29.0	117.	203.	290.	.650
.30	.04	.197	.400	.518	.641	2.34	28.4	47.2	201.	323.	485.	.730
.35	.04	.215	.433	.580	.763	3.31	43.9	72.9	302.	483.	772.	.840
.40	.05	.238	.475	....	.886	4.56	64.5	106.	422.	686.	1150.	.992
.50	.08	.280	.602	....	1.29	8.44	127.	197.	769.	204.	2070.	1.458
.60	.09	.350	.780	....	1.92	14.0	208.	332.	1277.	348.	......	2.11
.70	.10	.462	1.052	....	2.85	22.1	325.	512.	297.	......	......	3.04
.80	.17	....	1.40	....	4.03	32.4	466.	.....	430	......	......	4.38
1.00	..	....	2.51	....	.....	61.6	830.	.....	838.	2000.	......	8.01

X-RAY SPECTRA AND ATOMIC NUMBERS

(From Smithsonian Physical Tables)

Kaye has shown that an element excited by sufficiently rapid cathode rays emits characteristic Rontgen radiations. These have been analyzed and the wave lengths obtained by Moseley (Phil. Mag. 27, p. 703, 1914) using a crystal of potassium ferrocyanide as a grating. The "K" series of elements shows 2 lines α and β, the "L" series several. The wave lengths of the α and β lines of each series are given in the following table. $Q_K = (v/\frac{3}{4}\, v_0)^{\frac{1}{2}}$; $Q_L = (v/\frac{5}{36}\, v_0)^{\frac{1}{2}}$ where v is the frequency of the α line and v_0 the fundamental Rydberg frequency. The atomic number for the K series = $Q_K + 1$; for the L series = $Q_L + 7.4$ approximately. $v_0 = 3.29 \times 10^{15}$.

Element	α line $\lambda \times 10^8$ cm.	Q_K	Atomic number N	β line $\lambda \times 10^8$ cm.	Element	α line $\lambda \times 10^8$ cm.	Q_L	Atomic number N	β line $\lambda \times 10^8$ cm.
Al.	8.364	12.0	13	7.912	Zr.	6.091	32.8	40	
Si.	7.142	13.0	14	6.729	Cb.	5.749	33.8	41	5.507
Cl.	4.750	16.0	17		Mo.	5.423	34.8	42	5.187
K.	3.759	18.0	19	3.463	Ru.	4.861	36.7	44	4.660
Ca.	3.368	19.0	20	3.094	Rh.	4.622	37.7	45	
Ti.	2.758	21.0	22	2.524	Pd.	4.385	38.7	46	4.168
V.	2.519	22.0	23	2.297	Ag.	4.170	39.6	47	
Cr.	2.301	23.0	24	2.093	Sn.	3.619	42.6	50	
Mn.	2.111	24.0	25	1.818	Sb.	3.458	43.6	51	3.245
Fe.	1.946	25.0	26	1.765	La.	2.676	49.5	57	2.471
Co.	1.798	26.0	27	1.629	Ce.	2.567	50.6	58	2.360
Ni.	1.662	27.0	28	1.506	Pr.	(2.471)	51.5	59	2.265
Cu.	1.549	28.0	29	1.402	Md.	2.382	52.5	60	2.175
Zn.	1.445	29.0	30	1.306	Sa.	2.208	54.5	62	2.008
Yt.	0.838	38.1	39		Eu.	2.130	55.5	63	1.925

X-RAY SPECTRA AND ATOMIC NUMBERS

(From Smithsonian Physical Tables)

Element	α line $\lambda \times 10^8$ cm.	Q_K	Atomic number N	β line $\lambda \times 10^8$ cm.	Element	α line $\lambda \times 10^8$ cm.	Q_L	Atomic number N	β line $\lambda \times 10^8$ cm.
Zr.	0.794	39.1	40		Gd.	2.057	56.5	64	1.853
Cb.	0.750	40.2	41		Ho.	1.914	58.6	66	1.711
Mo.	0.721	41.2	42		Er.	1.790	60.6	68	1.591
Ru.	0.638	43.6	44		Ta.	1.525	65.6	73	1.330
Pd.	0.584	45.6	46		W.	1.486	66.5	74	
Ag.	0.560	46.6	47		Os.	1.397	68.5	76	1.201
					Ir.	1.354	69.6	77	1.155
					Pt.	1.316	70.6	78	1.121
					Au.	1.287	71.4	79	1.092

Moseley's summary condensed is as follows: Every element from Al to Au is characterized by an integer N which determines its X-ray spectrum; N is identified with the number of positive units of electricity in its atomic nucleus. The order of these atomic numbers (N) is that of the atomic weights except where the latter disagrees with the order of the chemical properties. Known elements correspond with all the numbers between 13 and 79 except 3. There are here 3 possible elements still undiscovered. The frequency of any line in the X-ray spectrum is approximately proportional to $A(N-b)^2$, where A and b are constants. All X-ray spectra of each series are similar in structure differing only in wave lengths.

RADIOACTIVITY

RADIOACTIVE SUBSTANCES

A list of the fully recognized radioactive substances and transformation products. In each series, each product is obtained from the substance preceding. The table gives also (1) the rays emitted, (2) the transformation period, that is, the time taken for half the active product to undergo change and (3) the radioactive constant, λ, the proportion of active matter which undergoes change each second.

Substance	Properties, etc.	Atomic wt.	Rays	Transformation period Γ	Transformation constant λ
Uranium I	Soluble in excess $(NH_4)_2CO_3$. One gram emits 2.37×10^4 α particles per second	238.5	α	5×10^9 yrs.	1.4×10^{-10} yrs.
Uranium 2	Inseparable from Ur 1	234.5	α	2×10^6 yrs.?	7×10^{-7} yrs.
Uranium X	Less volatile than Ur 1. Insoluble in excess of $(NH_4)_2CO_3$. Soluble in water and ether. Chemically allied to Th	230.5	β, γ	24.6 days (21.5)	0.0282 days
Uranium Y	Probably branch product exists in small quantity	230.5?	β	1.5 days	0.46 days
Ionium	Nonseparable from Th. Soluble in excess of ammon. oxalate. Carried down by H_2O_2 in presence of U salts	230.5	α	2×10^5 yrs. (3×10^4)	3.5×10^{-6} yrs.
Radium	Chemical properties of Ba. Characteristic spect. Spontaneously luminous. RBr_2 and RCl_2 less soluble than $BaBr_2$ and $BaCl_2$. One gr. in equilibrium emits 13.6×10^{10} α particles per sec.	226.4	α, β	2000 yrs. (1750)	3.5×10^{-6} yrs.
Radium emanation (Niton)	Inert gas, density 111 H. Boiling point −65° C., density of solid 5–6	222	α	3.85 days	0.180 days
Radium A	Acts as solid. Has + charge, deposits on cathode in electric field. Volatile at 800–900° C. Soluble in strong acids	218	α	3 min.	0.231 min.

Substance	Properties, etc.	Atomic wt.	Rays	Transformation period T	Transformation constant λ
Radium B	Like Ra A. Volatile 600–700° C. Precipitated by $BaSO_4$. Separated pure by recoil from Ra A.	214	β, γ	26.8 min.	0.0258 min.
Radium C	Physically like Ra A, chemically like Ra B. Volatile 800–1300° C. Deposited on Cu and Ni. Perhaps a mixture	214	a, β, γ	19.5 min.	0.0355 min.
Radium C_2	Probably branch product. Separated by recoil from Ra C	210?	β	1.4 min.	0.495 min.
Radium D	Radio lead. Separated with Pb. Not separable. Volatile below 1000° C. Soluble in strong acids.	210	Slow β	16.5 yrs.	0.042 yrs.
Radium E	Reactions analogous to Pb. Volatile at red heat. Soluble in cold acetic acid	210	β	6.2 days (5 days)	1.3×10^{-6} sec. (.139 day)
Radium E_1	Not volatile at red heat. Reactions analogous to Bi	....	β	4.8 days	1.7×10^{-6} sec.
Radium F (Polonium)	Separated with Bi. Probably changes to Pb. Volatile about 1000° C.	210	a	136 days (140)	0.00510 day
Actinium	Probably branch product Ur series. Chemically allied to lanthanum. Precipitated by oxalic acid in acid solutions. With thorium and rare earths.	....	None	....	....
Radio-actinium	Slightly volatile at high temperature. Insoluble in NH_4OH	....	a, β	19.5 days	0.0355 day
Actinium X	Not precipitated by NH_4OH. Chemical properties analogous to Ra	....	a	10.2 days	0.068 day
Actinium emanation	Inert gas, condenses −120 to −150	....	a	3.9 sec.	0.178 sec.
Actinium A	Analogous to Ra A. Volatile above 400° C. Soluble in NH_4OH and strong acids	....	a	0.002 sec.	350 sec.
Actinium B	Analogous to Ra B. Volatile below 700° C. Soluble in NH_4OH and strong acids	....	Slow β	36 min.	0.0193 min.
Actinium C	Analogous to Ra C	....	a	2.1 min.	0.33 min.
Actinium D	Analogous to Ra D	....	$\beta+\gamma$	4.7 min.	0.147 min.

RADIOACTIVITY (Continued)

RADIOACTIVE SUBSTANCES

A list of the fully recognized radioactive substances and transformation products. In each series, each product is obtained from the substance preceding. The table gives also (1) the rays emitted, (2) the transformation period, that is, the time taken for half the active product to undergo change and (3) the radioactive constant, λ, the proportion of active matter which undergoes change each second.

Substance	Properties, etc.	Atomic wt.	Rays	Transformation period Γ	Transformation constant λ
Thorium	Volatile in arc. Colorless salts not spontaneous by phosphorescent salts precipitated by NH_4OH and oxalic acid	232	α	1.3×10^{10} yrs. (3×10[illegible])	5.3×10^{-11} yr.
Mesothorium 1	Chemical properties analogous to Ra, from which it is inseparable	228	None	5.5 yrs.	0.126 yr.
Mesothorium 2	....	228	β, γ	6.2 yrs.	0.112 yr.
Radiothorium	Chemically allied to thorium, from which it is non-separable	228	α	2 yrs.	0.347 yr.
Thorium X	Chemically analogous to Ra. Soluble in NH_4OH	224	α, β	3.65 days	0.190 day
Thorium emanation	Inert gas. Condenses just above −120° C	220	α	54 sec.	0.0128 sec.
Thorium A	Volatile under 630° C. Positively charged. Soluble in strong acids	216	α	0.14 sec.	4.95 sec.
Thorium B	Chemically analogous to Ra B. Volatile above 630° C. and below 730° C	212	β, γ	10.6 hours	0.0654 hour
Thorium C	Chemically analogous to Ra C. Volatile above 730	212	α, β	60 min.	0.0118 min.
Thorium C_2	Th C_2 and Th D are probably β and λ ray products respectively from Th C	212	α	Short	....
Thorium D	By recoil from Th C. Probably transforms to Bi	208	$\beta+\gamma$	3.1 min.	0.224 min.
Potassium	Activity 1/1000 that of U	39.1	β	....	....
Rubidium	Activity 1/500 that of U	85.5	β	....	....

RADIOACTIVITY, PROPERTIES OF RAYS

Range of the α particle at 76.0 cm. and 15° C. Initial velocity is deduced from formula $V^3 = aR$, where R is range. Velocity for RaC of range 7.06 at 20° is assumed 2.06×10^9 cm. per sec. or $v = 1.077r^{1/3}$.

If μ is the coefficient of absorption, d the thickness of absorbing medium, I_0 the intensity before passage, — the intensity after passage $I = I_0e^{-d\mu}$. μ for β rays is in terms of cms. of Al; for γ rays, cms. of lead.

Substance	α Rays				β Rays		γ Rays
	Range cm.	Initial velocity cm. per sec.	Kinetic energy ergs.	Total number of ions produced by α part.	Absorption coefficient (Al)	Velocity, vel. of light taken as 1	Absorption coefficient (Pb)
Uranium 1	2.50	1.45×10^9	0.65×10^{-5}	1.26×10^5	....	....	....
Uranium 2	2.90	1.53	0.72	137	....	....	....
Uranium X	....	....	....	....	15510	Wide range	0.72
Uranium Y	....	....	....	....	....	....	....
Ionium	3.00	1.56×10^9	0.75×10^{-5}	1.40×10^5	....	....	....
Radium	3.30	1.61	0.79	1.50	312	0.52–0.65	....
Radium emanation	4.16	1.73	0.92	1.74	....	....	....
Radium A	4.75	1.82	1.01	1.88	....	....	....
Radium B	....	....	....	....	13, 80, 890	0.36–0.74	4 to 6
Radium C_1	6.94	2.06	1.31	2.37	13, 53	0.80–0.98	0.50
Radium C_2	....	....	....	....	13	....	....
Radium D	....	....	....	....	0.33, 0.39	....	....
Radium E	....	....	....	....	43	Wide range	....
Radium F (Polonium)	3.77	1.68	0.87	1.63	....	....	....

RADIOACTIVITY, PROPERTIES OF RAYS (Continued)

Substance	α Rays				β Rays		γ Rays
	Range cm.	Initial velocity cm. per sec.	Kinetic energy ergs.	Total number of ions produced by α part.	Absorption coefficient (Al)	Velocity, vel. of light taken as 1	Absorption coefficient (Pb)
Actinium	....	....	....	....	....	....	....
Radio-actinium	4.80	1.83×10^9	1.02×10^{-5}	1.89×10^5	140	....	....
Actinium X	4.40	1.76	0.94	1.79	....	....	....
Actinium emanation	5.70	1.94×10^9	1.15×10^{-5}	2.10×10^5	....	....	....
Actinium A	6.50	2.02	1.25	2.27	....	....	....
Actinium B	....	....	....	....	Very soft	....	....
Actinium C	5.40	1.89	1.10	2.02	....	....	....
Actinium D	....	....	....	....	28.5	....	0.217 (Al)
Thorium	2.72	1.50×10^9	0.69×10^{-5}	1.32×10^5	....	....	....
Mesothorium 1	....	....	....	....	....	0.37–0.66	....
Mesothorium 2	....	....	....	....	20–385	....	0.53
Radiothorium	3.87	1.70	0.89	1.66	....	....	....
Thorium X	5.7	1.94	1.15	2.1	330.	.47–.51	....
Thorium emanation	5.5	1.90	1.10	2.0	....	....	....
Thorium A	5.9	1.97	1.19	2.2	....	....	....
Thorium B	....	....	....	....	110.	0.63–0.72	....
Thorium C_1	5.0	1.85	1.05	1.9	15.6	....	Weak
Thorium C_2	8.6	2.22	1.53	2.0	....	....	....
Thorium D	....	....	....	....	24.8	.3, .4, .93–5	0.46
Potassium	....	....	....	....	38, 102	....	....
Rubidium	....	....	....	....	380, 1020	....	....

INTERNATIONAL TABLE OF THE RADIOACTIVE ELEMENTS AND THEIR CONSTANTS (1923)

T	Uranium and Radium Series		Atomic		Isotope	Radiation	α_o
	Name	Symbol	WT.	NO.			
4.67×10^9 years	Uranium I	UI	238	92	U	α	2.37
24.6 days	Uranium X_1	UX^2	234	90	Th	β	.....
1.15 minutes	Uranium X_2	UX^2	234	91	Pa	$\beta(\gamma)$	.....
2×10^6 years	Uranium II	UII	234	92	U	α	2.75
6.9×10^4 years	Ionium	Io	230	90	Th	α	2.85
1690 years	Radium	Ra	226	88	Ra	$\alpha(\beta + \gamma)$	3.13
3.85 days	Radon	Rn	222	86	Rn	α	3.94
3.0 minutes	Radium A	RaA	218	84	Po	α	4.50
26.8 minutes	Radium B	RaB	214	82	Pb	$\beta(\gamma)$	.....
19.5 minutes	Radium C	RaC	214	83	Bi	99.97% β & γ	.....
10^{-6} second	Radium C′	RaC′	214	84	Po	α	6.57
16.5 years	Radium D	RaD	210	82	Pb	(β and γ)	.....
5.0 days	Radium E	RaE	210	83	Bi	β	.....
136 days	Radium F (Polonium)	RaF (Po)	210	84	Po	$\alpha(\gamma)$	3.58
.....	Radium Ω′ (Lead)	RaΩ′ Pb^{206}	206	82	Pb	.....	.....
.....	Radium C	RaC	214	83	Bi	0.03% α	?
1.4 minutes	Radium C″	RaC″	210	81	Tl	β	.....
.....	Radium Ω″ (hypothetical)	RaΩ″	210	82	Pb	.....	.....

Actinium Series

T	Name	Symbol	WT.	NO.	Isotope	Radiation	α_o
.....	Uranium ?	.....	?	92	U	α	.....
1.04 days	Uranium Y	UY	?	90	Th	β	.....
1.2×10^4 years	Protoactinium	Pa	?	91	Pa	α	3.314
20 years	Actinium	Ac	?	89	Ac	—	.....
19.5 days	Radioactinium	RdAc	?	90	Th	$\alpha(\beta)$	4.36
11.4 days	Actinium X	AcX	?	88	Ra	α	4.17
3.9 seconds	Actinon	An	?	86	Rn	α	5.40

INTERNATIONAL TABLE OF THE RADIOACTIVE ELEMENTS AND THEIR CONSTANTS (1923)

Actinium Series (Continued)

T	Uranium and Radium Series		Atomic		Isotope	Radiation	α_0
	Name	Symbol	WT.	NO			
2.0×10^{-3} second	Actinium A	AcA	?	84	Po	α	6.16
36.1 minutes	Actinium B	AcB	?	82	Pb	(β and γ)	....
2.15 minutes	Actinium C	AcC	?	83	Bi	α	5.12
4.71 minutes	Actinium C″	AcC″	?	81	Tl	β and γ	....
....	Actinium Ω″ (hypothetical)	AcΩ″	?	82	Pb	....	....
Thorium Series							
1.31×10^{10} years	Thorium	Th	232	90	Th	α	2.58
6.7 years	Mesothorium 1	MsTh1	228	88	Ra	—	....
6.2 hours	Mesothorium 2	MsTh2	228	89	Ac	β and γ	....
2.02 years	Radiothorium	RdTh	228	90	Th	$\alpha(\beta)$	3.67
3.64 days	Thorium X	ThX	224	88	Ra	α	4.08
54 seconds	Thoron	Tn	220	86	Rn	α	4.74
0.14 second	Thorium A	ThA	216	84	Po	α	5.40
10.6 hours	Thorium B	ThB	212	82	Pb	β and γ	....
60 minutes	Thorium C	ThC	212	83	Bi	65% β	....
10^{-11} second	Thorium C′	ThC′	212	84	Po	α	8.16
....	Thorium Ω′ (Lead)	ThΩ′ Pb^{208}	208	82	Pb	....	....
....	Thorium C	ThC	212	83	Bi	35% α	24.69
3.1 minutes	Thorium C″	ThC″	208	81	Tl	β and γ	....
....	Thorium Ω″ (Lead)	ThΩ″ Pb^{208}	208	82	Pb	....	....
....	Potassium	K	39.1	19	K	β	....
....	Rubidium	Rb	85.5	37	Rb	β	....

In the table above, T is the time in which the quantity of radio-element is diminished to one-half, α_0 is the range in cm. of the α-rays in the air at 0° C. and a pressure of 760 mm. of mercury and, under the heading "Radiation," the parentheses ( ) indicate that the radiation is relatively feeble.

INTERNATIONAL TABLE OF ISOTOPES (1923)

Jour. Soc. Chem. Ind., *42*, *8* (1923)

Element	Atomic No.	Atomic Weight (1)	Masses of Isotopes (2)	Accuracy %
H	1	1.008	1.008	0.02
He	2	4.00	4	0.2
Li	3	6.94	7; 6	
Gl	4	9.1	9	
B	5	10.9	11; 10	0.1
C	6	12.005	12	
N	7	14.008	14	0.2
O	8	16.000	16	
F	9	19.0	19	0.1
Ne	10	20.2	20; 22	0.1
Na	11	23.00	23	
Mg	12	24.32	24; 25; 26	
Al	13	27.0	27	
Si	14	28.1	28; 29; (30)	0.1
P	15	31.04	31	0.2
S	16	32.06	32	0.2
Cl	17	35.46	35; 37	0.1
A	18	39.9	40; 36	0.1
K	19	39.10	39; 41	
Ca	20	40.07	40; (44)	
Fe	26	55.84	56; (54)?	
Ni	28	58.68	58; 60	0.1
Zn	30	65.37	64; 66; 68; 70	
As	33	74.96	75	0.1
Se	34	79.2	80; 78; 76; 82; 77; 74	0.1
Br	35	79.92	79; 81	0.1
Kr	36	82.92	84; 86; 82; 83; 80; 78	0.1
Rb	37	85.45	85; 87	
Sn	50	118.7	120; 118; 116; 124; 119; 117; 122; (121)	
I	53	126.92	127	0.2
Xe	54	130.2	129; 132; 131; 134; 136; 128; 130; (126); (124)	0.1
Cs	55	132.81	133	
Hg	80	200.6	(197–200); 202; 204	0.1

(1) International values for 1922. (2) In order of intensity of spectral bands. (3) Of the observations Aston is responsible for all save those of glucinium, magnesium, calcium and zinc, Dempster for those of lithium, magnesium, calcium, and zinc, and Thomson for those of lithium and glucinium.

DECLINATION OF THE SUN AND EQUATION OF TIME

Date.		Declination.	Diff. 1 day.	Equation of time		Date.		Declination.	Diff. 1 day.	Equation of time	
		°	°	m	s			°	°	m	s
Jan.	0	−23.1	0.11	+ 3	15	July	9	+22.4	0.15	+ 4	49
	10	−22.0	0.18	+ 7	42		19	+20.9	0.21	+ 5	58
	20	−20.2	0.25	+11	13		29	+18.8	0.26	+ 6	13
	30	−17.7	0.30	+13	32	Aug.	8	+16.2	0.30	+ 5	27
Feb.	9	−14.7	0.34	+14	27		18	+13.2	0.34	+ 3	44
	19	−11.3	0.37	+14	5		28	+ 9.8	0.36	+ 1	11
Mar.	1	− 7.6	0.38	+12	36	Sept.	7	+ 6.2	0.39	− 1	59
	11	− 3.8	0.40	+10	15		17	+ 2.3	0.39	− 5	26
	21	+ 0.2	0.39	+ 7	23		27	− 1.5	0.38	− 8	55
	31	+ 4.1	0.38	+ 4	19	Oct.	7	− 5.4	0.38	−12	4
Apr.	10	+ 7.9	0.35	+ 1	23		17	− 9.2	0.35	−14	31
	20	+11.4	0.33	− 1	5		27	−12.7	0.32	−16	0
	30	+14.7	0.29	− 2	52	Nov.	6	−15.9	0.26	−16	16
May	10	+17.6	0.23	− 3	48		16	−18.7	0.22	−15	7
	20	+19.9	0.18	− 3	45		26	−20.9	0.16	−12	36
	30	+21.7	0.12	− 2	49	Dec.	6	−22.5	0.08	− 8	54
June	9	+22.9	0.05	− 1	11		16	−23.3	0.01	− 4	17
	19	+23.4	0.01	+ 0	55		26	−23.4	0.08	+ 0	41
	29	+23.3	0.09	+ 3	2	Jan.	5	−22.6	....	+ 5	34

MEAN PLACES OF STARS

Jan. 0, 1925

Name of star	Right ascen.			Annual var.	Declination			Annual var.
	h.	m.	s.	s.	°	′	″	″
α Andromedæ (Alpheratz).	0	4	30.34	+ 3.10	+28	40	35.13	+19.88
α Ursæ Minoris (Polaris) . .	1	34	14.51	+31.14	+88	54	10.94	+18.37
α Arietis	2	2	56.40	+ 3.38	+23	6	30.80	+17.09
α Persei	3	18	57.46	+ 4.27	+49	35	44.29	+12.93
α Tauri (Aldebaran)	4	31	36.84	+ 3.44	+16	21	35.31	+ 7.36
β Orionis (Rigel)	5	10	55.92	+ 2.88	− 8	17	13.65	+ 4.26
α Aurigæ (Capella)	5	11	8.70	+ 4.43	+45	55	24.70	+ 3.82
ε Orionis	5	32	24.37	+ 3.04	− 1	14	54.86	+ 2.41
β Aurigæ	5	54	1.55	+ 4.40	+44	56	29.65	+ 0.52
β Canis Majoris	6	19	23.74	+ 2.64	−17	55	3.46	− 1.69
α Canis Majoris (Sirius) . . .	6	41	50.66	+ 2.64	−16	36	43.81	− 4.85
ε Canis Majoris	6	55	40.62	+ 2.36	−28	52	8.60	− 4.82
α Canis Minoris (Procyon)	7	35	22.57	+ 3.14	+ 5	25	5.98	− 9.14
α Hydræ	9	23	54.09	+ 2.95	− 8	19	57.91	−15.54
α Leonis (Regulus)	10	4	22.75	+ 3.20	+12	20	3.97	−17.54
α Ursæ Majoris	10	59	6.80	+ 3.72	+62	9	22.60	−19.41
β Leonis (Denebola)	11	45	14.09	+ 3.06	+14	59	28.86	−20.12
ε Ursæ Majoris (Alioth) . . .	12	50	44.06	+ 2.64	+56	22	0.43	−19.56
α Virginis (Spica)	13	21	14.32	+ 3.16	−10	46	13.05	−18.83
α Boötis (Arcturus)	14	12	14.35	+ 2.73	+19	34	20.21	−18.79
β Ursæ Minoris	14	50	54.30	− 0.20	+74	27	43.34	−14.72
α Scorpii (Antares)	16	24	48.29	+ 3.67	−26	16	0.53	− 8.11
λ Scorpii	17	28	30.79	+ 4.07	−37	3	1.91	− 2.77
α Ophiuchi	17	31	27.08	+ 2.78	+12	36	48.64	− 2.71
δ Ursæ Minoris	17	56	25.17	−19.50	+86	36	50.00	− 0.26
α Lyræ (Vega)	18	34	23.88	+ 2.03	+38	42	46.73	+ 3.28
α Aquilæ (Altair)	19	47	7.42	+ 2.93	+ 8	40	9.31	+ 9.42
α Cygni (Deneb)	20	38	52.41	+ 2.04	+45	0	41.97	+12.81
α Pisc. Austr. (Formalhaut)	22	53	30.60	+ 3.32	−30	1	12.16	+19.05
α Pegasi (Markab)	23	1	1.36	+ 2.99	+14	48	5.21	+19.35

APPROXIMATE CORRECTION FOR REFRACTION

For Astronomical Observations

Corresponding to temperature of 50° F., and to a barometric pressure of 29.6 inches.

(From Young's General Astronomy, by permission.)

Altitude.	Refraction.		Altitude.	Refraction.		Altitude.	Refraction.	
°	′	″	°	′	″	°	′	″
0	34	50	11	4	47.7	30	1	39.5
1	24	22	12	4	24.5	35	1	22.1
2	18	06	13	4	04.4	40	1	08.6
3	14	13	14	3	47.0	45		57.6
4	11	37	16	3	18.2	50		48.3
5	9	45	18	2	55.5	55		40.3
6	8	23	20	2	37.0	60		33.2
7	7	19	22	2	21.6	65		26.8
8	6	29	24	2	08.6	70		20.9
9	5	49	26	1	57.6	80		10.2
10	5	16	28	1	48.0	90		0.0

For every 5° F. by which the temperature is less than 50° F., add one per cent to the tabular refraction, and decrease it in the same ratio for temperatures above 50° F.

Increase the tabular refraction by three and a half per cent for every inch of barometric pressure above 29.6 inches, and decrease it in the same ratio below that point. These corrections for temperature and pressure, though only approximate, will give a result correct within 2″ except in extreme cases.

DATA IN REGARD TO THE EARTH

(Radius, U. S. C. & G. Survey.)

Equatorial radius, 6,378,388 meters, 3,963.399 miles.
Polar radius, 6,365,909 meters, 3,949.992 miles.
1° latitude at the equator = 68.70 miles.
1° latitude at the pole = 69.41 miles.
Mean density of the earth, 5.52 g. per cu.cm.
Mean distance from the earth to the sun
149,500,000 kilometers,
92,900,000 miles.
Mean distance from the earth to the moon
384,393 kilometers,
238,854 miles.

DATA CONCERNING THE SOLAR SYSTEM

(Values from Young's General Astronomy, by permission.)

Name.	Mean dis. from sun, millions of miles.	Period in years.	Mean dia. in miles.	Mass, the earth = 1.	Mean density, water = 1.
Mercury	36.0	0.24	3030	0.047	4.70
Venus	67.2	0.62	7700	0.82	4.94
The earth	92.9	1.00	7917.6	1.000	5.55
Mars	141.5	1.88	4230	0.107	3.92
Jupiter	483.3	11.86	86500	317.7	1.32
Saturn	886.0	29.46	73000	94.8	0.72
Uranus	1781.9	84.02	31900	14.6	1.22
Neptune	2791.6	164.78	34800	17.0	1.11
Sun	....	....	866400	332000.	1.39
Moon	....	....	2163	0.0123	3.39

METEOROLOGICAL DATA

The Atmosphere

Total mass, estimated by Elkholm:
5.2×10^{21} grams.
11.4×10^{18} pounds.
Composition:
The total volume = 1.

Substance.	Elevation.		
	Sea level.	10000 meters.	50000 meters.
Argon	0.009	0.006	0.0003
Carbon dioxide	0.0003	0.00015	0.0000
Helium	0.0000015	0.0000	0.00126
Hydrogen	0.0001	0.00035	0.136
Neon	0.000015	0.00002	0.0000
Nitrogen	0.780	0.812	0.792
Oxygen	0.210	0.182	0.070

Atmospheric Potential

The potential of the atmosphere increases with the elevation 130 to 200 volts per meter.

Velocity of Seismic Waves in the Earth's Crust

Longitudinal	4 to 14 kilometers per sec.
Transverse	3 to 10 kilometers per sec.

Angular Radius of Halos and Rainbows

Coronæ due to small water drops	1° to 10°
Small halo, due to 60° angles of ice crystals	22°
Large halo, due to 90° angles of ice crystals	46°
Rainbow, primary	41° 20′
Rainbow, secondary	52° 15′

Solar Constant

The energy falling on one sq.cm. area at normal incidence equals 1.92 small calories per minute.

ACCELERATION DUE TO GRAVITY, LATITUDE, LONGITUDE AND ELEVATION

UNITED STATES

Station.	Latitude. °	′	″	Longitude (Greenwich). °	′	″	Elevation, meters.	g cm/sec²
Atlanta, Ga.	33	44	58	84	23	18	324	979.523
Austin, Tex. (University)	30	17	11	97	44	14	189	979.282
Austin, Tex. (Capitol)	30	16	30	97	44	16	170	979.287
Baltimore, Md.	39	17	50	76	37	30	30	980.096
Boston, Mass.	42	21	33	71	03	50	22	980.395
Calias, Me.	45	11	11	67	16	54	38	980.630
Cambridge, Mass.	42	22	48	71	07	45	14	980.397
Charleston, S. C.	32	47	14	79	56	03	6	979.545
Charlottesville, Va.	38	02	01	78	30	16	166	979.937
Chicago, Ill.	41	47	25	87	36	03	182	980.277
Cincinnati, Ohio	39	08	20	84	25	20	245	980.003
Cleveland, Ohio	41	30	22	81	36	38	210	980.240
Colorado Springs, Colo.	38	50	44	104	49	02	1841	979.489
Deer Park, Md.	39	25	02	79	19	50	770	979.934
Denver, Colo.	39	40	36	104	56	55	1638	979.608
Ellsworth, Kansas	38	43	43	98	13	32	469	979.925
Ft. Egbert, Eagle, Alaska	64	47	22	141	12	24	174	982.182
Galveston, Texas	29	18	12	94	47	29	3	979.271
Grand Canyon, Wyo.	44	43	16	110	29	44	2386	979.898
Grand Junction, Colo.	39	04	09	108	33	56	1398	979.632
Green River, Utah	38	59	23	110	09	56	1243	979.635
Gunnison, Colo.	38	32	33	106	56	02	2340	979.341
Ithaca, N. Y.	42	27	04	76	29	00	247	980.299
Kansas City, Mo.	39	05	50	94	35	21	278	979.989
Key West, Fla.	24	33	33	81	48	25	1	978.969
Laredo, Texas	27	30	29	99	31	12	129	979.081
Little Rock, Ark.	34	44	57	92	16	24	89	979.720
Lower Geyser Basin, Wyo.	44	33	21	110	48	08	2200	979.931
Madison, Wis. (Univ. of Wis.)	43	04	35	89	24	00	270	980.364
New Orleans, La.	29	56	58	90	04	14	2	979.323
New York, N. Y.	40	48	27	73	57	43	38	980.266
Norris Geyser Basin, Wyo.	44	44	09	110	42	02	2276	979.949

ACCELERATION DUE TO GRAVITY, LATITUDE, LONGITUDE AND ELEVATION (Continued)

UNITED STATES (Continued)

Station.	Latitude.			Longitude (Greenwich).			Elevation, meters.	g cm/sec².
	°	′	″	°	′	″		
Philadelphia, Pa.	39	57	06	75	11	40	16	980.195
Pike's Peak, Colo.	38	50	20	105	02	02	4293	978.953
Pleasant Valley Junction, Utah	39	50	47	111	00	46	2191	979.511
Princeton, N. J.	40	20	57	74	39	28	64	980.177
Salt Lake City, Utah	40	46	04	111	53	46	1322	979.802
San Francisco, Cal.	37	47	00	124	46	00	114	979.965
St. Louis, Mo.	38	38	03	90	12	13	154	980.000
Terre Haute, Ind.	39	28	42	87	23	49	151	980.071
Wallace, Kans.	38	54	44	101	35	26	1005	979.754
Washington, C. & G. S.	38	53	13	77	00	32	14	980.111
Washington, Smithsonian	38	53	20	77	01	32	10	980.113
Worcester, Mass.	42	16	29	71	48	28	170	980.323

FOREIGN CITIES

Station.	Latitude.		Longitute (Paris).		Elevation, meters.	g cm/sec².
	°	′	°	′		
Berlin	+52	30	+ 11	4	38	981.287
Calcutta, India	+22	33	+ 86	1	6	978.822
Cape of Good Hope, Africa	−33	56	+ 16	9	11	979.659
Honolulu, Hawaii	+21	18	−160	12	3	978.966
London (Greenwich)	+51	17	− 2	12	48	981.188
Madrid	+40	24	− 6	1	656	979.981
Melbourne, Australia	−37	50	+142	38	27	979.985
Paris	+48	50	0	0	60	980.943
Rio de Janeiro, Brazil	−22	54	− 45	30	45	978.801
Rome	+41	54	+ 10	9	59	980.350
St. Petersburg	+59	56	+ 27	59	2	981.938
Shanghai, China	+31	12	+119	6	8	979.413
Stockholm	+59	21	+ 15	43	45	981.843
Tokio, Japan	+35	43	+137	26	18	979.801
Valparaiso, Chili	−33	2	− 73	58	0	979.630

MOMENT OF INERTIA FOR VARIOUS BODIES

The mass of the body is indicated by m.

Body.	Axis.	Moment of inertia.
Uniform thin rod	Normal to the length, at one end	$m\frac{l^2}{3}$
Uniform thin rod	Normal to the length, at the center	$m\frac{l^2}{12}$
Thin rectangular sheet, sides a and b	Through the center parallel to b	$m\frac{a^2}{12}$
Thin rectangular sheet, sides a and b	Through the center perpendicular to the sheet	$m\frac{a^2+b^2}{12}$
Thin circular sheet of radius r	Normal to the plate through the center	$m\frac{r^2}{2}$
Thin circular sheet of radius r	Along any diameter	$m\frac{r^2}{4}$
Thin circular ring. Plane figure formed by two concentric circles of radius r_1 and r_2	Through center normal to plane of ring	$m\frac{r_1^2+r_2^2}{2}$
Thin circular ring. Plane figure formed by two concentric circles of radius, r_1 and r_2	Any diameter	$m\frac{r_1^2+r_2^2}{4}$
Rectangular parallelopiped, edges a, b, and c	Through center perpendicular to face ab, (parallel to edge c)	$m\frac{a^2+b^2}{12}$
Sphere, radius r	Any diameter	$m\frac{2}{5}r^2$
Spherical shell, external radius, r_1 internal, radius r_2	Any diameter	$m\frac{2}{5}\frac{(r_1^5-r_2^5)}{(r_1^3-r_2^3)}$

MOMENT OF INERTIA FOR VARIOUS BODIES (Continued)

The mass of the body is indicated by m.

Body.	Axis.	Moment of inertia.
Spherical shell, very thin, mean radius, r	Any diameter	$m\frac{2r^2}{3}$
Right circular cylinder of radius r, length l	The longitudinal axis of the solid	$m\frac{r^2}{2}$
Right circular cylinder of radius r, length l	Through center perpendicular to the axis of the figure, (transverse diameter)	$m\left(\frac{r^2}{4}+\frac{l^2}{12}\right)$
Hollow circular cylinder, length l, external radius r_1 internal radius r_2	The longitudinal axis of the figure	$m\frac{(r_1^2+r_2^2)}{2}$
Thin cylindrical shell, length l, mean radius, r	The longitudinal axis of the figure	mr^2
Hollow circular cylinder, length l, external radius r_1 internal radius r_2	Transverse diameter	$m\left[\frac{r_1^2+r_2^2}{4}+\frac{l^2}{12}\right]$
Hollow circular cylinder, length l, very thin, mean radius r	Transverse diameter	$m\left(\frac{r^2}{2}+\frac{l^2}{12}\right)$
Elliptic cylinder, length l, transverse semiaxes a and b	Longitudinal axis	$m\left(\frac{a^2+b^2}{4}\right)$
Right cone, altitude h, radius of base r	Axis of the figure	$m\frac{3}{10}r^2$
Spheroid of revolution, equatorial radius r	Polar axis	$m\frac{2r^2}{5}$
Ellipsoid, axes $2a$, $2b$, $2c$	Axis $2a$	$m\frac{(b^2+c^2)}{5}$

ACCELERATION DUE TO GRAVITY AND LENGTH OF THE SECONDS PENDULUM

For Sea Level at Different Latitudes

Latitude.	g cm./sec.^{2}	g ft./sec.^{2}	Length in cm.	Length in ins.
0°	977.989	32.0862	99.0910	39.0121
5	8.029	.0875	.0950	.0137
10	.147	.0916	.1079	.0184
15	.339	.0977	.1265	.0261
20	.600	.1062	.1529	.0365
25	978.922	32.1168	99.1855	39.0493
30	9.295	.1290	.2234	.0642
31	.374	.1316		
32	.456	.1343		
33	.538	.1370		
34	979.622	32.1398		
35	.707	.1425	.2651	.0806
36	.793	.1454		
37	.880	.1490		
38	.963	.1511		
39	980.057	32.1540		
40	.147	.1570	.3096	.0982
41	.237	.1607		
42	.327	.1630		
43	.418	.1659		
44	980.509	32.1688		
45	.600	.1719	.3555	.1163
46	.691	.1748		
47	.782	.1778		
48	.873	.1808		
49	980.963	32.1838		
50	1.053	.1867	99.4014	39.1344
51	.143	.1896		
52	.231	.1924		
53	.318	.1954		
54	981.407	32.1983		
55	.493	.2011	.4459	.1520
56	.578	.2039		
57	.662	.2067		
58	.744	.2094		
59	981.825	32.2121		
60	.905	.2147	.4876	.1683
65	2.278	.2276	.5255	.1832
70	.600	.2375	.5581	.1960
75	.861	.2460	99.5845	39.2065
80	983.053	32.2523	.6040	.2141
85	.171	.2562	.6160	.2188
90	.210	.2575	.6200	.2204

ATOMIC AND MOLECULAR CONSTANTS

(From Smithsonian Physical Tables)

Elementary electrical charge, charge on electron, ½ charge on α particle,	e	$= 4.774 \times 10^{-10}$ e.s.u.
		$= 1.591 \times 10^{-20}$ e.m.u.
		$= 1.591 \times 10^{-19}$ coulombs
Mass of an electron,	m	= about 9.01×10^{-28} grams
Ratio e/m, small velocities,	e/m	$= 1.766 \times 10^{7}$ e.m.u.gm^{-1}
Radius of an electron,	l	= about 2×10^{-13} cm.
Number of molecules per gram molecule,	N	$= 6.06 \times 10^{23}$ gr^{-1}
Number of gas molecules per cc., 760^{mm}, 0° C.,	n	$= 2.70 \times 10^{19}$
Kinetic energy of a molecule at 0 °C.,	E_0	$= 5.62 \times 10^{-14}$ ergs
Constant of molecular energy, E_0/T,	ϵ	$= 2.06 \times 10^{-16}$ ergs/degrees
Constant of entropy equation (Boltzmann), $= R/N = p_0V_0/TN = (2/3)\ \epsilon$,	k	$= 1.37 \times 10^{-16}$ " "
Elementary "Wirkungsquantum,"	h	$= 6.547 \times 10^{-27}$ erg. sec.
Mass of hydrogen atom,		$= 1.662 \times 10^{-24}$ gram
Radius of an atom,		= about 10^{-8} cm.
Rydberg's fundamental frequency	V_0	$= 3.28880 \times 10^{15}$
Rydberg's constant $= \dfrac{V_0}{C}$		= 109675.
Mol (e) of gas, 76^{cm} pressure, 0° C.,		= 22.4 liters
$PV_m = RT$, V_m = vol. of molec. wt. in grams,		
when P in grams per cm², V_m in cm³,	R	= 84.780 gram. cm.
when P in atmospheres, V_m in liter,	R	= 0.08204 l. atm.
when P in dynes, V_m in cm³,	R	$= 8.31 \times 10^{5}$ ergs

	H_2	He	N_2	O_2	Xe	CO_2	H_2O
Sq. rt. of mean sq. molec. veloc., cm./sec. at 0°C. $\times 10^{-4}$	18.4	13.1	4.93	4.61	2.28	3.92	7.08
Mean free path cm. $\times 10^{6}$	18.	28.	9.4	9.9	5.6	6.4	7.2
Molecular diameter cm. $\times 10^{8}$	2.2	2.2	3.3	3.0	3.4	4.2	3.8

MISCELLANEOUS CONSTANTS

Mean radius of the earth, 6.371×10^8 cm. = 6371 kilometers.
1 degree of latitude at 40° = 69 miles.
1 knot or nautical mile = 1′ of arc on the earth's surface at the equator.
Mean density of the earth, 5.52 grams per cu.cm.
Constant of gravitation, $K = 6.667 \times 10^{-8}$ = the attraction in dynes between two gram masses one centimeter apart.
Acceleration due to gravity at sea level, lat. 45° = 980.60 cm. per sec. per sec. = 32.172 feet per sec. per sec.
Length of seconds pendulum at sea level, lat. 45° = 99.356 cm. = 39.116 in.

Density of mercury at 0° C. = 13.5955 g. per c.c.
Density of water, maximum at 3.98° C. = 0.999973 g. per c.c.
Density of dry air at 0° C. and 760 mm. = .001293 g. per c.c.

Velocity of sound in dry air at 0° C., 33,136 cm. per sec. = 1089 feet per sec.
Velocity of light in a vacuum = 2.9989×10^{10} cm. per sec. = 984×10^6 feet per sec.

Heat equivalent of fusion of water 79.24 cal. per gram.
Heat equivalent of vaporization of water, 535.9 cal. per gram.
Coefficient of expansion of gases, .003665.
Specific heat of air, at constant pressure, 0.238.

Electrochemical equivalent of silver, 0.001118 g. per sec. per ampere.
Mean wave length of sodium light, .00005893 cm. or 5893. ångström units.
Absolute wave length of red cadmium line in air, 760 mm. pressure, 15° C., ångström units: 6438.4722 (Michelson); 6438.4696 (Fabry and Perot).

GREEK ALPHABET

Greek letter	Greek name	English equivalent	Greek letter	Greek name	English equivalent
Α α	Alpha	a	Ν ν	Nu	n
Β β	Beta	b	Ξ ξ	Xi	x
Γ γ	Gamma	g	Ο ο	Omicron	ŏ
Δ δ	Delta	d	Π π	Pi	p
Ε ε	Epsilon	ĕ	Ρ ρ	Rho	r
Ζ ζ	Zeta	z	Σ σ	Sigma	s
Η η	Eta	ē	Τ τ	Tau	t
Θ θ	Theta	th	Υ υ	Upsilon	u
Ι ι	Iota	i	Φ φ	Phi	ph
Κ κ	Kappa	k	Χ χ	Chi	ch
Λ λ	Lambda	l	Ψ ψ	Psi	ps
Μ μ	Mu	m	Ω ω	Omega	ō

DEFINITIONS AND FORMULÆ

FUNDAMENTAL CHEMICAL LAWS

Scientific laws are statements of facts which have been established by direct experiment.

Boyle's Law for Gases. — At a constant temperature the volume of a given quantity of any gas varies inversely as the pressure to which the gas is subjected. This idea is expressed in the following formulæ:

PV = a constant, or $P = 1/V$, or $V = 1/P$, or $PV = P_1V_1$

The Law of Combining Weights. — If the weights of elements which combine with each other be called their "combining weights," then elements always combine either in the ratio of their combining weights or of simple multiples of these weights.

Law of Definite Proportions. — In every sample of each compound substance the proportions by weight of the constituent elements are always the same.

Dalton's Law of Partial Pressures. — The pressure exerted by a mixture of gases is equal to the sum of the separate pressures which each gas would exert if it alone occupied the whole volume. This fact is expressed in the following formula:

$$PV = V(p_1 + p_2 + p_3, \text{etc.})$$

Faraday's Law. — The amounts of decomposition effected by the passage of equal quantities of electricity through them are, for the same electrolyte, equal, and for different electrolytes are proportional to the combining weights of the elements or radicles which are deposited.

Gay-Lussac's Law for Gases (or Charles' Law). — At a constant pressure, the volume of a given quantity of any gas increases about 1/273 of its volume at 0° C. for each rise of 1° C. and at constant volume the pressure of a given quantity of any gas increases about 1/273 of the pressure at 0° C. for each rise of 1° C. in temperature.

Gay-Lussac's Law of Combining Volumes. — If gases interact and form a gaseous product, the volumes of the reacting gases and the volumes of the gaseous products are to each other in very simple proportions, which can be expressed by small whole numbers.

Gibbs' Phase Rule. — $F = C + 2 - P$ F, the number of degrees of freedom of a system, is the number of variable factors (temperature, pressure and concentration) of the components, which must be arbitrarily fixed in order that the condition of the system may be perfectly defined. C, the number of the components of the system, is chosen equal to the smallest number of independently variable constituents by means of which the composition of each phase participating in the state of equilibrium can be expressed in the form of a chemical equation; the components must be chosen from among the constituents which are present when the system is in a state of true equilibrium and which take part in that equilibrium; as components are chosen the smallest number of such constituents necessary to express the composition of each phase participating in the equilibrium, zero and negative quantities of components being permissible; in any system the number of components is definite, but may alter with changes in conditions of experiment; a qualitative but not quantitative freedom of selection of components is allowed, the choice being influenced by suitability and simplicity of application. *P*, the number of phases of the system, are the homogeneous mechanically separable and physically distinct portions of a heterogeneous system; the number of phases capable of existence varies greatly in different systems; there can never be more than one gas or vapor phase since all gases are miscible in all proportions; a heterogeneous mixture of solid substances forms as many phases as there are substances present.

Hess' Law of Constant Heat Summation. — The amount of heat generated by a chemical reaction is the same whether reaction takes place in one step or in several steps, or all chemical reactions which start with the same original substances, and end with the same final substances, liberate the same amounts of heat, irrespective of the process by which the final state is reached.

Henry's Law. — The amount of gas which a liquid will dissolve is directly proportional to the pressure of the gas. This holds for all gases which do not unite chemically with the solvent.

The Law of Mass Action. — At a constant temperature the product of the active masses on one side of a chemical equation when divided by the product of the active masses on the other side of the chemical equation is a constant, regardless of the amounts of each substance present at the beginning of the action.

Law of Multiple Proportions. — Two elements may combine in more than one proportion by weight, but if so, the weights of one element which combine with a fixed weight of the other element, are always in a simple ratio to each other.

The Periodic Law. — The physical and chemical properties of the elements are functions of their atomic weights, and most of these properties are periodic functions of the atomic weights.

FUNDAMENTAL CHEMICAL THEORIES

A scientific hypothesis is an endeavor to form a rational mental picture of the causes which lead to a group of observed facts even though these causes may not be subject to direct proof.

A scientific theory is an hypothesis whose consequences have been so thoroughly tested by experiment that it has become generally accepted as the correct explanation for a group of facts.

The Atomic Theory. — All elementary forms of matter are composed of very small unit quantities called atoms. The atoms of a given element all have the same size and weight. The atoms of different elements have different size and weight. Atoms of the same or different elements unite with each other to form very small unit quantities of compound substances called molecules.

Avogadro's Theory. — Equal volumes of all gases under the same conditions of temperature and pressure contain equal numbers of molecules.

The Electrolytic Dissociation or Ionization Theory. — When an acid, base or salt is dissolved in water or any other dissociating solvent, a part or all of the molecules of the dissolved substance are broken up into parts called ions, some of which are charged with positive electricity and are called cations, and an equivalent number of which are charged with negative electricity and are called anions.

Electrolytic Solution Tension Theory (or the Helmholtz Double Layer Theory). — When a metal, or any other substance capable of existing in solution as ion is placed in water or any other dissociating solvent, a part of the metal or other substances passes into solution in the form of ions, thus leaving the remainder of the metal or substances charged with an equivalent amount of electricity of opposite sign from that carried by the ions. This establishes a difference in potential between the metal and the solvent in which it is immersed.

The Electron Theory. — An atom of any element consists of a definite number of unit negative charges of electricity moving in orbits inside the atom with velocities which approach the velocity of light.

DEFINITION OF CHEMICAL TERMS

An Acid is any substance which yields hydrogen ions.

The Active Mass of a substance is the number of gram-molecular-weights per liter in solution, or in gaseous form.

Adsorption. The ability of a solid to condense gases, liquids, or dissolved substances on their surfaces is called adsorption. It is a manifestation of the force of adhesion.

An Atom is the smallest unit quantity of an element that is capable of entering into chemical combination.

A Base is any substance which yields hydroxyl ions.

A Balanced or Reversible Action is one which can be caused to proceed in either direction by suitable variation in the conditions of temperature, volume, pressure or of the quantities of reacting substances.

A Catalytic Agent is a substance which by its mere presence alters the velocity of a reaction, and may be recovered unaltered in nature or amount at the end of the reaction.

A Colligative Property is a property numerically the same for a group of substances, independent of their chemical nature.

A Constitutive Property is a property which depends on the constitution or structure of the molecule.

A Cryohydrate is the solid which separates when a saturated solution freezes. It contains the solvent and the solute in the same proportions as they were in the saturated solution.

The Combining Weight of an element or radicle is its atomic weight divided by its valence.

Eutectic, a term applied to the mixture of two or more substances which has the lowest melting point.

The Hydrogen Equivalent of a substance is the number of replaceable hydrogen atoms in 1 molecule or the number of atoms of hydrogen with which 1 molecule could react.

Hydrogen Ion Concentration or pH value is the logarithm of the reciprocal of the gram ionic hydrogen equivalents per liter; i.e., $pH = \log \frac{1}{(H^+)}$ per liter. Water has a concentration of H^+ ion of 10^{-7} and of OH^- ion of 10^{-7} moles per liter or a pH value of 7. Due to hydrolysis the composition of a weak acid solution titrated against a strong base is basic and of a weak base against a strong acid is acid. A truly neutral titrated solution of a strong acid or base has the same concentration of H^+ and OH^- ions as water.

The Heat of Combustion of a substance is the amount of heat evolved by the combustion of 1 gram molecular weight of the substance.

An Ion is a charged atom or group of atoms in solution. Solutions always contain equivalent numbers of positive and negative ions.

A Molecule is the smallest unit quantity of matter which can exist by itself and retain all the properties of the original substance.

A Molar Solution contains 1 gram molecular weight of dissolved substance per liter of solution.

A Normal Solution contains 1 gram molecular weight of dissolved substance devided by the hydrogen equivalent of the substance per liter of solution.

Oxidation is any process which increases the proportion of oxygen or acid-forming element or radicle in a compound.

Reduction is any process which increases the proportion of hydrogen or base-forming elements or radicle in a compound.

A Salt is any substance which yields ions, other than hydrogen or hydroxyl ions.

The Solubility Product or precipitation value is the product of the concentrations of the ions of a substance in a saturated solution of the substance.

A METHOD OF BALANCING EQUATIONS FOR OXIDATION-REDUCTION REACTIONS

On the left-hand side of the equation write the formulæ for all the compounds entering into the reaction. On the right-hand side write the formulæ for all the compounds formed in the reaction.

Determine the L. C. M. (least common multiple) of the numbers representing the changes in valence per molecule of the oxidizing and reducing agents.

The quotient obtained in dividing the L. C. M. by the number representing the valence change per molecule is the number of molecules of that compound required, or formed.

The reaction between $FeSO_4$, $KMnO_4$, and H_2SO_4 serves to illustrate. Following the rule as given above we write, $KMnO_4 + FeSO_4 + H_2SO_4 \rightarrow K_2SO_4 + MnSO_4 + Fe_2(SO_4)_3 + H_2O$.

The valence change of manganese is five, that of iron is two per molecule of $Fe_2(SO_4)_3$. The L. C. M. of these two numbers is ten.

The quotient obtained by dividing the L. C. M. by the valence change of manganese is two. Therefore two molecules of $KMnO_4$ are required. The quotient obtained by dividing the L. C. M. by the valence change of iron per molecule of $Fe_2(SO_4)_3$ is five. Five molecules of $Fe_2(SO_4)_3$ are formed. Ten molecules of $FeSO_4$ are needed. From the two molecules of $KMnO_4$ used one molecule of K_2SO_4 is formed, as well as two molecules of $MnSO_4$.

Eighteen sulfate radicals are used in forming the salts; ten of these radicals are supplied by the $FeSO_4$ used, the other eight must be supplied by the free acid. The sixteen hydrogens form eight molecules of water.

The complete equation is, therefore,

$$2KMnO_4 + 10FeSO_4 + 8H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 5Fe_2(SO_4)_3 + 8H_2O.$$

ONE HUNDRED COMPLETED CHEMICAL EQUATIONS

1. $H_2 PtCl_6 + 2KCl = 2HCl + K_2PtCl_6$
2. K_2PtCl_6 + heat = $2KCl + Pt + 2Cl_2$
3. $KHC_4H_4O_6 + NaOH = KNaC_4H_4O_6 + H_2O$
4. $Na_2O_2 + 2H_2O = 2NaOH + H_2O_2$
5. $2KMnO_4 + 3H_2SO_4 + 5H_2O_2 = K_2SO_4 + 2MnSO_4 + 8H_2O + 5O_2$
6. $2KI + H_2O_2 = 2KOH + I_2$
7. $2AuCl_3 + 3H_2O_2 + 6NaOH = 6NaCl + 6H_2O + 3O_2 + 2Au$
8. $MnCl_2 + 2KOH + H_2O_2 = 2KCl + H_2O + MnO\,.\,(OH)_2$ (brown)
9. $2NiCl_2 + 4KOH + H_2O_2 = 4KCl + 2Ni\,(OH)_3$ (black)
10. $2CoCl_2 + 4KOH + H_2O_2 = 4KCl + 2Co\,(OH)_3$ (black)
11. $MgCl_2 + Na_2HPO_4 + NH_3 = 2NaCl + MgNH_4PO_4$
12. $2BaCl_2 + K_2Cr_2O_7 + H_2O = 2BaCrO_4 + 2HCl + 2KCl$
13. $AlCl_3 + 3KOH = 3KCl + Al(OH)_3$
14. $Al\,(OH)_3 + 3KOH = 3H_2O + Al(OK)_3$
15. $2AlCl_3 + 3Na_2S_2O_3 + 3H_2O = 6NaCl + 3S + 3SO_2 + 2Al\,(OH)_3$
16. $2CrCl_3 + 3(NH_4)_2S + 6H_2O = 6NH_4Cl + 3H_2S + 2Cr(OH)_3$
17. $CrCl_3 + 8NaC_2H_3O_2 + 4H_2O + 3Cl = 6NaCl + 8HC_2H_3O_2 + Na_2CrO_4$
18. $2CrCl_3 + 3MnO_2 + 2H_2O = 3MnCl_2 + 2H_2CrO_4$
19. $K_2Cr_2O_7 + 2KOH = H_2O + 2K_2CrO_4$
20. $K_2Cr_2O_7 + 6FeSO_4 + 7H_2SO_4 = 7H_2O + K_2SO_4 + 3Fe_2\,(SO_4)_3 + Cr_2(SO_4)_3$
21. $K_2Cr_2O_7 + 6HI + 4H_2SO_4 = K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O + 6I$
22. $K_2Cr_2O_7 + 14HCl = 2KCl + 2CrCl_3 + 7H_2O + 3Cl_2$
23. $FeCl_2 + 2KCN = 2KCl + Fe(CN)_2$
24. $FeCN_2 + 4KCN = K_4[Fe(CN)_6]$
25. $FeCl_3 + 3NaC_2H_3O_2 = 3NaCl + Fe(C_2H_3O_2)_3$
26. $Fe(C_2H_3O_2)_3 + 2H_2O = 2HC_2H_3O_2 + Fe(OH)_2(C_2H_3O_2)$
27. $K_4[Fe(CN)_6] + 6H_2SO_4 + 6H_2O = 2K_2SO_4 + FeSO_4 + 3(NH_4)_2SO_4 + 6CO$
28. $2MnO_2 + 8HCl = 4H_2O + 2MnCl_2 + 2Cl_2$
29. $2MnSO_4 + 5PbO_2 + 6HNO_3 = 2PbSO_4 + 3Pb(NO_3)_2 + 2H_2O + 2HMnO_4$
30. $2HMnO_4 + 14HCl = 8H_2O + 2MnCl_2 + 5Cl_2$
31. $MnSO_4 + 2Na_2CO_3 + O_2 = 2CO_2 + Na_2SO_4 + Na_2MnO_4$
32. $2KMnO_4 + 10FeSO_4 + 8H_2SO_4 = K_2SO_4 + 2MnSO_4 + 5Fe_2\,(SO_4)_3 + 8H_2O$
33. $2KMnO_4 + 3MnSO_4 + 2H_2O = K_2SO_4 + 5MnO_2 + 2H_2SO_4$
34. $NiCl_2 + 6NH_3 = Ni(NH_3)_6Cl_2$
35. $NiCl_2 + 2KCN = 2KCl + Ni(CN)_2$
36. $Ni(CN)_2 + 2KCN = K_2Ni(CN)_4$
37. $CoCl_2 + 2KNO_2 = Co(NO_2)_2 + 2KCl$
38. $Co(NO_2)_2 + 2HNO_2 = H_2O + NO + Co(NO_2)_3$
39. $Co(NO_2)_3 + 3KNO_2 = K_3Co(NO_2)_6$
40. $3Zn + 8HNO_3 = 3Zn(NO_3)_2 + 4H_2O + 2NO$
41. $Zn + 2KOH = K_2ZnO_2 + H_2$
42. $Zn(OH)_2 + 2NH_4Cl + 4NH_3 = Zn(NH_3)_6Cl_2 + 2H_2O$
43. $ZnCl_2 + 2KCN = 2KCl + Zn(CN)_2$

44. $Zn(CN)_2 + 2KCN = K_2Zn(CN)_4$
45. $3Hg + 8HNO_3 = 3Hg(NO_3)_2 + 4H_2O + 2NO$
46. $HgCl_2 + 2NH_3 = NH_4Cl + HgNH_2Cl$
47. $3HgCl_2 + 2H_2S = 4HCl + Hg_3Cl_2S_2$ (white)
48. $Hg_3Cl_2S_2 + H_2S = 2HCl + 3HgS$
49. $3Hg(NO_3)_2 + 6FeSO_4 = 2Fe(NO_3)_3 + 2Fe_2(SO_4)_3 + 3Hg$
50. $2HgCl + 2NH_3 = NH_4Cl + HgNH_2Cl + Hg$
51. $Hg_2(NO_3)_2 + H_2S = 2HNO_3 + HgS + Hg$
52. $Hg_2(NO_3)_2 + 2KCN = 2KNO_3 + Hg(CN)_2 + Hg$
53. $Pb(NO_3)_2 + 2KOH = Pb(OH)_2 + 2KNO_3$
54. $Pb(OH)_2 + 2KOH = K_2PbO_2 + 2H_2O$
55. $2PbCl_2 + H_2S = 2HCl + PbCl_2.PbS$ (orange)
56. $PbCl_2.PbS + H_2S = 2PbS + 2HCl$
57. $3PbS + 8HNO_3 = 3Pb(NO_3)_2 + 4H_2O + 2NO + 3S$
58. $BiCl_3 + H_2O = 2HCl + BiOCl$
59. $SnCl_2 + 2KOH = 2KCl + Sn(OH)_2$ (white ppt.)
60. $Sn(OH)_2 + 2KOH = K_2SnO_2 + 2H_2O$ (soluble)
61. $2BiCl_3 + 6KOH = 2Bi(OH)_3 + 6KCl$
62. $2Bi(OH)_3 + 3K_2SnO_2 = 3H_2O + 3K_2SnO_3 + Bi_2$ (black)
63. $3Cu + 8HNO_3 = 4H_2O + 3Cu(NO_3)_2 + 2NO$
64. $Cu + H_2SO_4 = H_2O + SO_2 + CuO$
65. $CuO + H_2SO_4 = CuSO_4 + H_2O$
66. $2CuSO_4 + 2NH_4OH = (NH_4)_2SO_4 + Cu_2SO_4 \cdot (OH)_2$
67. $Cu_2SO_4(OH)_2 + (NH_4)_2SO_4 + 6NH_3 = 2[Cu(NH_3)_4]$ (SO_4) . H_2O (soluble, blue)
68. $2Cu(NH_3)_4SO_4$. $H_2O + 9KCN = Cu_2(CN)_8NH_4$. $K_5 + 2K_2SO_4 + 6NH_3 + NH_4CNO$
69. $Cd(NO_3)_2 + 2KCN = 2KNO_3 + Cd(CN)_2$
70. $Cd(CN)_2 + 2KCN = K_2Cd(CN)_4$
71. $K_2Cd(CN)_4 + H_2S = 2KCN + 2HCN + CdS$
72. $H_3AsO_4 + H_2S = H_2O + S + H_3AsO_3$
73. $2H_3AsO_3 + 3H_2S = 6H_2O + As_2S_3$
74. $As_2S_3 + 3(NH_4)_2S = 2(NH_4)_3AsS_3$
75. $2(NH_4)_3AsS_3 + 6HCl = 6NH_4Cl + As_2S_3 + 3H_2S$
76. $As_2S_5 + 3(NH_4)_2S = 2(NH_4)_3AsS_4$.
77. $2(NH_4)_3AsS_4 + 6HCl = As_2S_5 + 3H_2S + 4NH_4Cl$. Antimony reactions same as arsenic
78. $3Sn + 4HNO_3 + H_2O = 3H_2SnO_3 + 4NO$
79. $SnCl_2 + H_2S = SnS + 2HCl$
80. $SnS + (NH_4)_2S_2 = (NH_4)_2SnS_3$
81. $(NH_4)_2SnS_3 + 2HCl = 2NH_4Cl + H_2S + SnS_2$
82. $SnCl_4 + 2H_2S = SnS_2 + 4HCl$
83. $SnS_2 + (NH_4)_2S = (NH_4)_2SnS_3$
84. $SnO_2 + 2KCN = 2KCNO + Sn$ (fusion)
85. $2Au + 2HNO_3 + 6HCl = 4H_2O + 2NO + 2AuCl_3$
86. $2AgNO_3 + 2KOH = 2KNO_3 + H_2O + Ag_2O$
87. $Ag_2O + 2NH_4OH = 2(AgNH_3)OH + H_2O$
88. $AgCl + 2NH_4OH = Ag(NH_3)_2Cl + 2H_2O$
89. $AgCl + 2KCN = KAg(CN)_2 + KCl$
90. $6NH_4OH + 2NH_3 + 3Cl_2 = 6H_2O + 6NH_4Cl + N_2$
91. $6NaOH + 3Cl_2 = 5NaCl + NaClO_3 + 3H_2O$
92. $H_2SO_4 + 2HI = H_2O + H_2SO_3 + I_2$

93. $H_2SO_4+8HI=4H_2O+H_2S+4I_2$

94. $2Na_2S_2O_3+I_2=2NaI+Na_2S_4O_6$

95. $H_3PO_4+12(NH_4)_2MoO_4+21HNO_3=(NH_4)_3PO_4.12MoO_3+21(NH_4)NO_3+12H_2O$

96. $(NH_4)_3PO_4.12MoO_4+24NH_4OH=(NH_4)_3PO_4+12(NH_4)_2MoO_4+12H_2O$

97. $6FeSO_4+3H_2SO_4+2HNO_3=3Fe_2(SO_4)_3+4H_2O+2NO$

98. $Fe(NO_3)_2+NO=Fe(NO_3)_2NO$

99. $KClO_3+3H_2SO_4+6FeSO_4=3Fe_2(SO_4)_3+3H_2O+KCl$

100. $Na_2SiO_3+2NH_4Cl+2H_2O=2NaCl+2NH_4OH+H_2SiO_3$

PHYSICAL TERMS, QUANTITIES AND UNITS

The following pages give general statements, definitions, C. G. S. units and definitions of units for the more important physical terms and quantities.

Mechanics

Unit of Time. — The second, 1/86400 of a mean solar day. One of the three fundamental units of the C. G. S. system.

Unit of Length. — The centimeter, 1/100 the length of the International Prototype Meter, at Paris, at zero degrees centigrade. One of the three fundamental units of the C. G. S. system. The standard in the British system is the yard, the prototype of which is kept by the British government. The United States standard yard is defined as 3600/3937 meter.

Unit of Area. — The square centimeter. The area of a square whose sides are one centimeter in length. Other units of area are similarly derived.

Unit of Volume. — The cubic centimeter, the volume of a cube whose edges are one centimeter in length. Other units of volume are derived in a similar manner.

Mass. — Quantity of matter.

Units of Mass. — The gram is 1/1000 the quantity of matter in the International Prototype Kilogram; one of the three fundamental units of the C. G. S. system. The British standard of mass is the pound, of which a standard is preserved by the government. The United States standard mass is the avoirdupois pound defined as 1/2.20462 kilogram.

Inertia. — The resistance offered by a body to a change of its state of rest or motion. A particular aspect of a mass.

Density. — Concentration of matter, measured by the mass per unit volume, expressed as grams per cubic centimeter.

Specific Gravity. — The ratio of the mass of a body to the mass of an equal volume of water at 4° C.

Angle. — The ratio between the arc and the radius of the arc.

Units of Angle. — The radian, the angle subtended by an arc equal to the radius; the degree, 1/360 part of a circumference.

Solid Angle. — Measured by the ratio of the surface of the portion of a sphere enclosed by the conical surface forming the angle, to the square of the radius of the sphere.

Unit of Solid Angle. — The steradian, the solid angle which encloses a surface on the sphere equivalent to the square of the radius.

Speed. — Time rate of motion measured by the distance moved over in unit time. Unit — one centimeter per second.

Velocity. — Time rate of motion in a fixed direction. Unit — one centimeter per second.

Angular Velocity. — Time rate of angular motion about a center. Unit — one radian per second.

Acceleration. — The time rate of change of velocity either in speed or direction measured by the change in unit time. Unit — one centimeter per second per second.

Angular Acceleration. — The time rate of change of angular velocity. Unit — one radian per second per second.

Momentum. — Quantity of motion measured by the product of mass and velocity. Unit — one gram-centimeter per second.

Angular Momentum or Moment of Momentum. — Quantity of angular motion measured by the product of the angular velocity and the moment of inertia. Unit — unnamed, its nature is expressed by $g.cm^2/sec.$

Force. — That which changes the state of rest or motion in matter, measured by the rate of change of momentum. Unit — the dyne, the force which will produce the change of velocity of one centimeter per second in a gram mass in one second.

Moment of Force or Torque. — The effectiveness of a force to produce rotation about a center, measured by the product of the force and the perpendicular distance from the line of action of the force to the center. Unit — the dyne-centimeter.

Gravitation. — The universal attraction existing between all material bodies.

Acceleration Due to Gravity. — The acceleration of a body freely falling in a vacuum. Unit — one centimeter per second per second.

Weight. — The force with which a body is attracted toward the center of the earth. The weight of any fixed mass varies according to its geographical position.

Unit of Weight. — The dyne.

Moment of Inertia. — A measure of the effectiveness of mass in rotation. In the rotation of a rigid body not only the body's mass, but the distribution of the mass about the axis of rotation determines the change in the angular velocity resulting from the action of a given torque for a given time. Moment of inertia in rotation is analogous to mass (inertia) in simple translation. The unit is $g.cm.^2$

Radius of Gyration may be defined as the distance from the axis of rotation at which the total mass of a body might be concentrated without changing its moment of inertia. The product of total mass and the square of the radius of gyration will give moment of inertia.

Period in uniform circular motion is the time of one complete revolution.

Frequency in uniform circular motion or in any periodic motion is the number of revolutions or cycles completed in unit time.

Centripetal Force. — The force required to keep a moving mass in a circular path. Centrifugal force is the name given to the outward force of a mass in rotation.

Simple Harmonic Motion. — If a point move uniformly in a circle, the motion of its projection on the diameter (or any straight line in the same plane) is simple harmonic motion.

Displacement at any instant. The distance of a vibrating or oscillating particle from its position of equilibrium or the center of the circle of reference.

Amplitude. — The maximum value of the displacement.

Phase. — The fraction of a whole period which has elapsed since the moving particle last passed through its middle position in a positive direction.

Work. — When a force acts against resistance to produce motion in a body the force is said to do work. Work is measured by the product of the force acting and the distance moved through against the resistance.

Units of Work. — The erg, a force of one dyne acting through one centimeter. The joule is 10^7 ergs.

Power. — The time rate at which work is done.

Units of Power. — The watt, one joule (ten million ergs) per second; the kilowatt is equal to 1000 watts; the horse-power, 33,000 foot-pounds per minute, is equal to 746 watts.

Energy. — The capability of doing work. Units of energy the same as of work.

Potential Energy. — Energy due to position of one body with respect to another or to the relative parts of the same body.

Kinetic Energy. — Energy due to motion.

Coefficient of Friction. — The coefficient of friction between two surfaces is the ratio of the force required to move one over the other to the total force pressing the two together.

Simple Machine. — A contrivance for the transfer of energy and for increased convenience in the performance of work.

Mechanical advantage of a machine is the ratio of the distance through which force is applied to the distance through which resistance is overcome, also called the velocity ratio.

Efficiency is the ratio of the work done by a machine to the work done upon it.

Elasticity. — The property by virtue of which a body recovers from deformation produced by force.

Stress. — The force producing or tending to produce deformation in the body measured by the force applied per unit area. Unit — one dyne per square centimeter.

Strain. — The deformation resulting from a stress measured by the ratio of the change to the total value of the dimension in which the change occurred.

Modulus of Elasticity. — The stress required to produce unit strain, which may be a change of length (Young's modulus); a twist or shear (modulus of rigidity), or a change of volume (bulk modulus), expressed in dynes per square centimeter.

Limit of Elasticity. — The smallest value of the stress producing permanent alteration.

Coefficient of Restitution of two bodies on impact, the ratio of the difference in velocity before impact to the difference after impact.

Viscosity. — All liquids possess a definite resistance to change of form and many solids show a gradual yielding to forces tending to change their form. This property is called viscosity; it is expressed in dyne-seconds per cm^2 or poises.

Pressure. — Force applied to, or distributed, over a surface; measured as force per unit area. Unit — the barye, one dyne per square centimeter. The megabarye is equal to 10^6 dynes per square centimeter. Pressure is also measured by the height of the column of mercury or water which it supports.

Surface Tension. — The tension exhibited by the free surface of liquids measured in dynes per centimeter.

Heat

Temperature may be defined as the condition of a body which determines the transfer of heat to or from other bodies. The customary unit of temperature is the Centigrade degree, 1/100 the difference between the temperature of melting ice and that of water boiling under standard atmospheric pressure. The degree Fahrenheit is 1/180, and the degree Reaumur 1/80 the same difference of temperature.

The fundamental temperature scale is the absolute, thermodynamic or Kelvin scale in which the temperature measure is based on the average kinetic energy per molecule of a perfect gas. The zero of the Kelvin scale is −273.13° C. The temperature scale adopted by the International Bureau of Weights and Measures is that of the constant volume hydrogen gas thermometer. The magnitude of the degree in both these scales is defined as 1/100 the difference between the temperature of melting ice and that of boiling water at 760 mm pressure.

Heat Quantity is measured by the change of temperature produced. The unit of heat is the calorie, the quantity of heat necessary to change the temperature of one gram of water from 3.5° C. to 4.5° C. (called a small calorie). If the temperature changed involved is from 14.5 to 15.5° C., the unit is the normal calorie. The mean calorie is 1/100 the quantity of heat necessary to raise one gram of water from 0° C to 100° C. The large calorie is equal to 1000 small calories. The British thermal unit is the heat required to raise the temperature of one pound of water at its maximum density, 1° F. It is equal to 252 calories.

Coefficient of Thermal Expansion. — The coefficient of linear expansion is the ratio of the change in length per degree to the length at 0° C. The coefficient of surface expansion is two times the linear coefficient. The coefficient of volume expansion (for solids) is three times the linear coefficient. The coefficient of volume expansion for liquids is the ratio of the change in volume per degree to the volume at 0° C. The value of the coefficient varies with temperature. The coefficient of volume expansion for a gas under constant pressure is nearly the same for all gases and temperatures and is equal to 0.00367 for 1° C.

Absolute Zero. — The temperature at which a gas would show no pressure if the general law for gases should hold for all temperatures. It is equal to – 273.13° C. or – 459.4° F.

Thermal Capacity of a Substance is the quantity of heat necessary to produce unit change of temperature in unit mass. It is ordinarily expressed as calories per gram per degree Centigrade.

Specific Heat of a substance is the ratio of its thermal capacity to that of water at 15° C.

Thermal Capacity or Water Equivalent. — The total quantity of heat necessary to raise any body or system unit temperature, measured as calories per degree centigrade in the C. G. S. system.

Heat Equivalent, or Latent Heat, of Fusion. — The quantity of heat necessary to change one gram of solid to a liquid with no temperature change.

Latent Heat of Vaporization. — The quantity of heat necessary to change one gram of liquid to vapor without change of temperature. Both the above quantities are measured as calories per gram.

Thermal Conductivity. — Time rate of transfer of heat by conduction, through unit thickness, across unit area for unit difference of temperature. It is measured as calories per second per square centimeter for a thickness of one centimeter and a difference of temperature of 1° C.

Emissive Power or emissivity is measured by the energy radiated from unit area of a surface in unit time for unit difference of temperature between the surface in question and surrounding bodies. For the C. G. S. system the emissive power is given in ergs per second per square centimeter with the radiating surface at 1° absolute and the surroundings at absolute zero.

Monochromatic Emissive Power is the ratio of the energy of certain defined wave lengths radiated at definite temperatures to the energy of the same wave lengths radiated by a black body at the same temperature and under the same conditions.

Absorptive Power for any body is measured by the fraction of the radiant energy falling upon the body which is absorbed or transformed into heat. This ratio varies with the character of the surface and the wave length of the incident energy.

Black Body. — If, for all values of the wave length of the incident energy, all of the energy is absorbed the body is called a black body

Mechanical Equivalent of Heat is the quantity of energy which, when transformed into heat, is equivalent to unit quantity of heat; 4.18×10^7 ergs = 1 calorie (20° C.).

Isothermal. — When a gas passes through a series of pressure and volume variations without change of temperature the changes are called isothermal. A line on a pressure-volume diagram representing these changes is called an isothermal line

Adiabatic. — A body is said to undergo an adiabatic change when its condition is altered without gain or loss of heat. The line on the pressure volume diagram representing the above change is called an adiabatic line.

Critical Temperature is that temperature above which a gas cannot be liquefied by pressure alone. The pressure under which a substance may exist as a gas in equilibrium with the liquid at the critical temperature is the critical pressure.

Entropy. — A quantity depending on the quantity of heat in a body and on its temperature, which, when multiplied by any lower temperature (minimum available), gives the unavailable energy, or unavoidable waste when mechanical work is derived from the heat energy of the body.

Absolute Humidity. — Mass of water vapor present in the atmosphere measured as grams per cubic meter.

Relative Humidity. — The ratio of the quantity of water vapor present in the atmosphere to the quantity which would saturate at the existing temperature.

Wave Motion and Sound

Wave Motion. — A progressive disturbance propagated in a medium by the periodic vibration of the particles of the medium. Transverse wave motion is that in which the vibration of the particles is perpendicular to the direction of propagation. Longitudinal wave motion is that in which the vibration of the particles is parallel to the direction of propagation.

Pitch of sound is determined by the frequency or number of vibrations per second.

Intensity or loudness of a sound depends upon the energy of the wave motion. The term intensity as used in physics is measured by the energy transmitted per second through one square centimeter of surface.

Quality or timbre of a sound depends on the coexistence with the fundamental of other vibrations of various frequencies and amplitudes.

Lissajou's Figures. — The path described by a particle which is sumultaneously displaced by two simple harmonic motions at right angles, when the periods of the two motions are in the ratio of two small whole numbers, shows a variety of characteristic curves called Lissajou's figures.

Beats. — Two tones of slightly different frequencies sounded together interfere to give a sound of regularly varying intensity. The number of beats per second is the difference in frequency of the two tones.

Static Electricity

Unit Quantity of electricity or charge is the quantity which, when concentrated at a point and placed at unit distance from an equal and similarly concentrated quantity, is repelled with unit force. If the distance is one centimeter and the force of repulsion one dyne and the surrounding medium a vacuum, we have the electrostatic unit of quantity. The coulomb = 3×10^9 electrostatic units.

Line of Force. — A line such that its direction at every point is the same as the direction of the force which would act on a small positive charge placed at that point. A line of force is defined as starting from a positive charge and ending on a negative charge.

Conductors. — A class of bodies which are incapable of supporting electric strain. A charge given to a conductor spreads to all parts of the body.

Dielectrics or Insulators or Non-Conductors. — A class of bodies supporting an electric strain. A charge on one part of a non-conductor is not communicated to any other part.

Electric Surface Density. — Quantity of electricity per unit area.

Intensity of Electric Field is measured by the force exerted on unit charge. Unit field intensity is the field which exerts the force of one dyne on unit positive charge.

Electric Potential at any point is measured by the work necessary to bring unit positive charge from an infinite distance. Difference of potential between two points is measured by the work necessary to carry unit positive charge from one to the other. If the work involved is one erg we have the electrostatic unit of potential.

Capacity is measured by the charge which must be communicated to a body to raise its potential one unit. Electrostatic unit capacity is that which requires one electrostatic unit of charge to raise its potential one electrostatic unit. The farad = 9×10^{11} electrostatic units.

Specific Inductive Capacity. — The ratio of the capacity of a condenser with a given substance as dielectric to the capacity of the same condenser with air or a vacuum as dielectric is called the specific inductive capacity.

Magnetism

Unit Magnetic Pole or Quantity of Magnetism. — Two unit quantities of magnetism concentrated at points unit distance apart in a vacuum repel each other with unit force. If the distance involved is one centimeter and the force one dyne, the quantity of magnetism at each point is one C. G. S. unit of magnetism.

Surface Density of Magnetism. — Quantity of magnetism per unit area.

Magnetic Moment of a magnet is measured by the torque experienced when it is at right angles to a uniform field of unit intensity. The value of the magnetic moment is given by the product of the magnetic pole strength by the distance between the poles. Unit magnetic moment is that possessed by a magnet formed by two poles of opposite sign and of unit strength, one centimeter apart.

Intensity of Magnetization is given by the quotient of the magnetic moment of a magnet by its volume. Unit intensity of magnetization is the intensity of a magnet which has unit magnetic moment per cubic centimeter.

Magnetic Line of Force is a line which at every point has the direction of the magnetic force at that point.

Magnetic Field Intensity or Magnetizing Force is measured by the force acting on unit pole. Unit field intensity, the gauss, is that field which exerts a force of one dyne on unit magnetic pole. The field intensity is also specified by the number of lines of force intersecting unit area normal to the field, equal numerically to the field strength in gauss. Magnetizing force is measured by the space rate of variation of magnetic potential and as such its unit may be the gilbert per centimeter.

Magnetic Potential or Magnetomotive Force at a point is measured by the work required to bring unit positive pole from an infinite distance (zero potential) to the point. The unit is the gilbert, that magnetic potential against which an erg of work is done when unit magnetic pole is transferred.

Magnetic Flux through any area perpendicular to a magnetic field is measured as the product of the area by the field strength. The unit of magnetic flux, the maxwell, is the flux through a square centimeter normal to a field of one gauss.

Magnetic Induction resulting when any substance is subjected to a magnetic field is measured as the magnetic flux per unit area taken perpendicular to the direction of the flux. The unit is the maxwell per square centimeter or its equivalent, the gauss.

Magnetic Permeability is a property of materials modifying the action of magnetic poles placed therein and modifying the magnetic induction resulting when the material is subjected to a magnetic field or magnetizing force. The permeability of a substance may be defined as the ratio of the magnetic induction in the substance to the magnetizing field to which it is subjected. The permeability of a vacuum is unity.

Magnetic Susceptibility is measured by the ratio of the intensity of magnetization produced in a substance to the magnetizing force or intensity of field to which it is subjected. The susceptibility of a substance will be unity when unit magnetic intensity is produced by a field of one gauss.

Magnetic Reluctance for any magnetic circuit is measured by the ratio of the magnetomotive force or magnetic potential to the flux produced in the circuit. The unit of reluctance, the oersted, is the reluctance of a cylinder of one square centimeter cross section and one centimeter length taken in a vacuum.

Permeance, the reciprocal of reluctance. Unit permeance is the permeance of a cylinder one square centimeter cross section and one centimeter length taken in a vacuum.

Reluctivity or specific reluctance is the reciprocal of permeability. The reluctivity of empty space is taken as unity.

Paramagnetic bodies are those which tend to set the longest dimension parallel to the magnetic field. The permeability of a paramagnetic substance is greater than unity. Iron is paramagnetic.

Diamagnetic bodies tend to set the longest dimension across the magnetic field. The permeability of a diamagnetic substance is less than unity.

Hysteresis. — The magnetization of a sample of iron or steel due to a magnetic field which is made to vary through a cycle of values, lags behind the field. This phenomenon is called hysteresis.

Declination. — The angle between the vertical plane containing the direction of the earth's field at any point and a plane containing the geographic north and south meridian.

Dip. — The angle measured in a vertical plane between the direction of the earth's magnetic field and the horizontal.

Current Electricity

Electric Current. — The rate of transfer of electricity. The transfer at the rate of one electrostatic unit of electricity in one second is the electrostatic unit of current. The electromagnetic unit of current is a current of such strength that one centimeter of the wire in which it flows is pushed sideways with a force of one dyne when the wire is at right angles to a magnetic field of unit intensity. The practical unit of current is the ampere, a transfer of one coulomb per second, which is one tenth the electromagnetic unit. The international ampere is the unvarying electric current which when passed through a solution of silver nitrate in accordance with certain specifications, deposits silver at the rate of 0.00111800 gram per second. The international ampere is equivalent to 0.99991 absolute ampere.

Quantity. — The electromagnetic unit of quantity may be defined as that transferred by unit current in unit time. The quantity transferred by one ampere in one second is the coulomb, the practical unit.

Electromotive Force is defined as that which causes a flow of current. The electromotive force of a cell is measured by the maximum difference of potential between its plates. The electromagnetic unit of potential difference is that against which one erg of work is done in the transfer of electromagnetic unit quantity. The volt is that potential difference against which one joule of work is done in the transfer of one coulomb. One volt is equivalent to 10^8 electromagnetic units of potential. The international volt is the electrical pressure which when steadily applied to a conductor whose resistance is one international ohm will cause a current of one international ampere to flow. The international volt = 1.00043 absolute volts. The electromotive force of a Weston standard cell is 1.0183 at 20° C.

Resistance is property of conductors depending on their dimensions material and temperature which determines the current produced by a given difference of potential. The practical unit of resistance, the ohm, is that resistance through which a difference of potentia of one volt will produce a current of one ampere. The international ohm is the resistance offered to an unvarying current by a column of mercury at 0° C., 14.4521 grams in mass, of constant cross sectional area and 106.300 centimeters in length.

Conductance, the reciprocal of resistance, is measured by the ratio of the current flowing through a conductor to the difference of potential between its ends. The practical unit of conductance, the mho, is the conductance of a body through which one ampere of current flows when the potential difference is one volt. The conductance of a body in mho is the reciprocal of the value of its resistance in ohms.

Conductivity is measured by the quantity of electricity transferred across unit area, per unit potential gradient per unit time.

Resistivity or Specific Resistance, the reciprocal of conductivity, is measured by the resistance of a body of the substance of unit cross section and of unit length at 0° C.

Temperature Resistance Coefficient. — The ratio of the change of resistance in a wire due to a change of temperature of 1° C. to its resistance at 0° C.

Induction. — Any change in the intensity or direction of a magnetic field causes an electromotive force in any conductor in the field. The induced electromotive force generates an induced current if the conductor forms a closed circuit.

Self-Inductance. — The change in magnetic field due to the variation of a current in a conducting circuit causes an induced electromotive force in the circuit itself. This phenomenon is known as self-induction. It is measured as electromotive force produced in a conductor by unit rate of variation of the current through it. Units of self-inductance are the centimeter (electro static) and the henry, which is equal to 10^9 centimeters of inductance.

Mutual Inductance. — A change of current in a conductor is accompanied by a change of magnetic field which induces an electromotive force in a neighboring circuit. The mutual induction is measured by the electromotive force induced in one circuit by unit rate of variation of current in the other. Units, as of self-inductance.

Thermoelectric Power is measured by the electromotive force produced by a thermocouple for unit difference of temperature between the two junctions. It varies with the average temperature and is usually expressed in microvolts per degree C. It is customary to list the thermoelectric power of the various metals with respect to lead.

Light

Luminous Flux. — The total visible energy emitted by a source per unit time is called the total luminous flux from the source. The unit of flux, the lumen, is the flux emitted in unit solid angle (steradian) by a point source of one candle luminous intensity. A uniform point source of one candle intensity thus emits 4π lumens.

Visibility is measured by the ratio of the luminous flux in lumens to the total radiant energy in ergs per second or in watts.

Luminous Intensity or candle-power is the property of a source of emitting luminous flux and may be measured by the luminous flux emitted per unit solid angle. The accepted unit of luminous intensity is the international candle. The hefner unit, which is equivalent to 0.9 international candles, is the intensity of a lamp of specified design burning amyl acetate, called the Hefner lamp.

The mean horizontal candle-power is the average intensity measured in a horizontal plane passing through the source. The mean spherical candle-power is the average candle-power measured in all directions and is equal to the total luminous flux in lumens divided by 4π.

Illumination on any surface is measured by the luminous flux incident on unit area. The units in use are: the lux, one lumen per square meter; the phot, one lumen per square centimeter and the lumen per square foot. Since at unit distance from a point source of unit intensity the illumination is unity, unit illumination may be defined as that produced by unit source at unit distance, hence the meter-candle or candle-meter which is equal to the lux and the foot-candle equivalent to one lumen per square foot.

Brightness is measured by the flux emitted per unit emissive area as projected on a plane normal to the line of sight. The unit of brightness is that of a perfectly diffusing surface giving out one lumen per square centimeter of projected surface and is called the lambert. The millilambert (0.001 lambert) is a more convenient unit.

Reflection Coefficient is the ratio of the light reflected from a surface to the total incident light. The coefficient may refer to diffuse or to specular reflection. In general it varies with the angle of incidence and with the wave length of the light.

Index of Refraction for any substance is the ratio of the velocity of light in a vacuum to its velocity in the substance. It is also the ratio of the sine of the angle of incidence to the sine of the angle of refraction. In general, the index of refraction for any substance varies with the wave length of the refracted light.

Minimum Deviation. — The deviation or change of direction of light passing through a prism is a minimum when the angle of incidence is equal to the angle of emergence.

Principal Focus of a lens or spherical mirror is the point of convergence of light coming from a source at an infinite distance.

Conjugate Foci. — Under proper conditions light divergent from a point on or near the axis of a lens or spherical mirror is focused at another point. The point of convergence and the position of the source are conjugate foci.

Nodal Points. — Two points on the axis of a lens such that a ray entering the lens in the direction of one, leaves as if from the other and parallel to the original direction.

Spherical Aberration. — When large surfaces of spherical mirrors or lenses are used the light divergent from a point source is not exactly focused at a point. The phenomenon is known as spherical aberration. For axial pencils the error is known as axial spherical aberration; for oblique pencils, coma.

Chromatic Aberration. — Due to the difference in the index of refraction for different wave lengths, light of various wave lengths from the same source cannot be focused in a point by a simple lens. This is called chromatic aberration.

Achromatic. — A term applied to lenses signifying their more or less complete correction for chromatic aberration.

Astigmatism is an error of spherical lenses peculiar to the formation of images by oblique pencils. The image of a point when astigmatism is present will consist of two focal lines at right angles to each other and separated by a measurable distance along the axis of the pencil. The error is not eliminated by reduction of aperture as is spherical aberration.

Magnifying Power of an optical instrument is the ratio of the angle subtended by the image of the object seen through the instrument to the angle subtended by the object when seen by the unaided eye. In the case of the microscope or simple magnifier the object as viewed by the unaided eye is supposed to be at a distance of 25 cms. (10 ins.)

Resolving Power of a telescope or microscope is indicated by the minimum separation of two objects for which they appear distinct and separate when viewed through the instrument.

Angular Aperture of an objective is the largest angular extent of wave surface which it can transmit.

Numerical Aperture is the sine of half the angular aperture, used as a measure of the optical power of the objective.

Dispersion. — The difference between the index of refraction of any substance for any two wave lengths is a measure of the dispersion for these wave lengths, called the coefficient of dispersion.

Diffraction. — If the light source were a point, the shadow of any object would have its maximum sharpness; a certain amount of illumination, however, would be found within the geometrical shadow due to the diffraction of the light at the edge of the object.

Polarized Light. — Light which exhibits different properties in different directions at right angles to the line of propagation is said to be polarized. Specific rotation is the power of liquids to rotate the plane of polarization. It is stated in terms of specific rotation or the rotation in degrees per decimeter per unit density.

PHYSICAL LAWS AND FORMULÆ

On the following pages will be found a collection of the more important laws and equations of physics. Definitions and units will be found in the preceding table.

Unless otherwise specified, the symbol g in the following formulæ refers to the acceleration due to gravity.

Formulæ for capacity, inductance and high frequency resistance as used in radio work are given in a separate collection immediately following.

Mechanics

Composition of Vectors. — If the angle between two vectors is A, and their magnitudes a and b, their resultant,

$$c = \sqrt{a^2 + b^2 + 2ab \cos A}.$$

Triangle or Polygon of Forces. — If three or more forces acting on the same point are in equilibrium, the vectors representing them form, when added, a closed figure.

Velocity. — If s is space passed over in time t, the velocity,

$$v = \frac{s}{t}.$$

Uniformly Accelerated Motion. — If v_0 is the initial velocity, v_t the velocity after time t, the acceleration,

$$a = \frac{v_t - v_0}{t}.$$

The velocity after time t,

$$v_t = v_0 + at.$$

Space passed over in time t,

$$s = v_0t + \tfrac{1}{2}at^2.$$

Velocity after passing over space s,

$$v_s = \sqrt{v_0^2 + 2as}.$$

Space passed over in the nth second,

$$s = v_0 + \tfrac{1}{2}a(2n - 1).$$

In the above and following similar equations the values of the space, velocity, and acceleration must be substituted in the same system. For space in *cm*, velocity will be in *cm* per sec. and acceleration in *cm* per sec.

Falling Bodies. — Symbols as for uniformly accelerated motion except that $v_0 = 0$ and g is the acceleration due to gravity. The above formulæ become, — air resistance neglected,

$$v_t = gt, \quad s = \tfrac{1}{2}gt^2, \quad v_s = \sqrt{2gs}.$$

Bodies Projected Vertically Upward. — If v is the velocity of projection, the time to reach greatest height, neglecting the resistance of the air,

$$t = \frac{v}{g}.$$

Greatest height,

$$h = \frac{v^2}{2g}.$$

Projectiles. — For bodies projected with velocity v at an angle α with the horizontal, the time to highest point of flight,

$$t = \frac{v \sin \alpha}{g}.$$

Total time of flight,

$$T = \frac{2v \sin \alpha}{g}.$$

Maximum height,

$$h = \frac{v^2 \sin^2 \alpha}{2g}.$$

Horizontal range,

$$R = \frac{v^2 \sin 2\alpha}{g}.$$

In the above equations the resistance of the air is neglected.

Angular Velocity. — If the angle described in time t is θ, the angular velocity,

$$\omega = \frac{\theta}{t}.$$

θ in radians and t in seconds gives ω in radians per second.

Angular Acceleration. — If the initial angular velocity is ω_0, and the velocity after time t is $= \omega_t$, the angular acceleration,

$$A = \frac{\omega_t - \omega_0}{t}.$$

The angular velocity after time t,

$$\omega_t = \omega_0 + At.$$

The angle swept out in time t,

$$\theta = \omega_0 t + \tfrac{1}{2}At^2.$$

The angular velocity after movement through the arc θ,

$$\omega = \sqrt{\omega_0^2 + 2A\theta}.$$

In the above equations, for angular displacement in radians, angular velocity will be in radians per second and angular acceleration in radians per second per second.

Newton's Laws of Motion.

I. Every body continues in its state of rest or of uniform motion in a straight line except in so far as it may be compelled to change that state by the action of some outside force.

II. Change of motion is proportional to force applied and takes place in the direction of the line of action of the force.

III. To every action there is always an equal and opposite reaction.

Momentum. — A mass m moving with velocity v has a momentum,

$$M = mv.$$

Angular momentum of a mass whose moment of inertia is I, rotating with angular velocity ω, is

$$I\omega.$$

Change in Momentum. — If a mass m has its velocity changed from v_1 to v_2 by the action of a force F for a time t,

$$mv_2 - mv_1 = Ft.$$

Conservation of Momentum. — If two bodies of masses m_1 and m_2 before impact have velocities v_1 and v_2 and after impact velocities u_1 and u_2,

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2.$$

Force. — For a mass m and an acceleration a,

$$F = ma.$$

If m is substituted in grams and a in cm per sec^2, F will be given in dynes.

Pressure. — The pressure due to a force F distributed over an area A,

$$P = \frac{F}{A}.$$

Moment of Force or Torque. — If a force F acts to produce rotation about a center at a distance d from the line in which the force acts, the force has a torque,

$$L = Fd.$$

Moment of Inertia. — If m_1, m_2, m_3 etc. represent the masses of infinitely small particles of a body; r_1, r_2, r_3 etc. their respective distances from an axis of rotation, the moment of inertia about this axis will be,

$$I = (m_1r_1^2 + m_2r_2^2 + m_3r_3^2 + \cdot\ \cdot\ \cdot)$$

or

$$I = \Sigma(mr^2).$$

Gravitation. — The force of attraction between two masses, m and m', separated by a distance r, k being the constant of gravitation,

$$F = k\frac{mm'}{r^2}.$$

(If m and m' are given in grams, and r in centimeters, F will be in dynes if $k = 6.658 \times 10^{-8}$.)

Weight of mass m, where g is the acceleration due to gravity,

$$W = mg.$$

The weight will be given in dynes when m is in grams and g in cm per sec².

Acceleration Due to Gravity at any Latitude and Elevation. If ϕ is the latitude and H the elevation in centimeters the acceleration in C.G.S. units is,

$$g = 980.616 - 2.5928 \cos 2\phi + 0.0069 \cos^2 2\phi - 3.086 \times 10^{-6} H.$$

(Helmert's equation.)

Uniform Circular Motion. — If r is the radius of a circle, s the linear speed in the arc, ω the angular velocity and T the period or time of one revolution,

$$\omega = \frac{s}{r} = \frac{2\pi}{T}.$$

The acceleration toward the center is

$$a = \frac{s^2}{r} = \omega^2 r = \frac{4\pi^2 r}{T^2}.$$

The centrifugal force for a mass m,

$$F = \frac{ms^2}{r} = m\omega^2 r = \frac{4\pi^2 mr}{T^2}.$$

In the above equations ω will be in radians per second and a in cm per sec.² if r is in cm, s in cm per sec. and T in sec. F will will be in dynes if mass is in grams and other units as above.

Application to the Solar System. — If M is the mass of the sun, G the constant of gravitation, P the period of the planet, and r the distance of the planet from the sun, then the mass of the sun

$$M = \frac{4\pi^2 r^3}{GP^2} \quad (G = 6.657 \text{ for C.G.S. units.})$$

If P is the period and r the distance of a satellite revolving around the planet, the above expression for M gives the mass of the planet. The formula is written on the assumption that the orbit of the planet or satellite is circular, which is only approximately true.

Kepler's Laws.

I. The planets move about the sun in ellipses, at one focus of which the sun is situated.

II. The radius vector joining each planet with the sun describes equal areas in equal times.

III. The cubes of the mean distances of the planets from the sun are proportional to the squares of their times of revolution about the sun.

Simple Harmonic Motion. — If r is the radius of the reference circle, ω the angular velocity of the point in the circle, θ the angular displacement at the time t after the particle passes the mid-point of its path, the linear displacement,

$$x = r \sin \theta = r \sin \omega t.$$

The velocity at the same instant,

$$v = r\omega \cos \theta = \omega\sqrt{r^2 - x^2}.$$

The acceleration,

$$a = -\omega^2 x.$$

The force for a mass m,

$$F = -m\omega^2 x = -\frac{4\pi^2 mx}{T^2}.$$

The period

$$T = 2\pi\sqrt{\frac{x}{a}}.$$

In the above equations the C. G. S. system calls for x and r in cm, v in cm per sec., a in cm per sec.^{2}, T in sec., m in grams, θ in radians, and ω in radians per sec.

The Pendulum. — For a simple pendulum of length l, for a small amplitude, the period,

$$T = 2\pi\sqrt{\frac{l}{g}}, \text{ or } g = 4\pi^2\frac{l}{T^2}.$$

T will be given in seconds if l is in cm and g in cm per sec^2.

For a sphere suspended by a wire of negligible mass where d is the distance from the knife edge to the center of the sphere whose radius is r, the length of the equivalent simple pendulum,

$$l = d + \frac{2r^2}{5d}.$$

If the period is P for an arc θ, the time of vibration in an infinitely small arc is approximately,

$$T = \frac{P}{1 + \frac{1}{4}\sin^2\frac{\theta}{4}}.$$

For a compound pendulum, if a body of mass m be suspended from a point about which its moment of inertia is I with its center of gravity a distance h below the point of suspension, the period,

$$T = 2\pi\sqrt{\frac{I}{mgh}}.$$

Foucault's Pendulum. — The rate of rotation in degrees per hour of a line on the surface of the earth relative to the plane of a Foucault's pendulum at latitude ϕ is,

$$\omega = 15 \sin \phi.$$

Work. — If a force F act through a space s, the work done is

$$W = Fs.$$

Work will be given in ergs if F is in dynes and s in cm.

Work done in rotation. If a torque L dyne-cm acts through an angle θ radians, the work done in ergs is,

$$W = L\theta.$$

Power. — If an amount of work W is done in time t the power or rate of doing work is,

$$P = \frac{W}{t} = \frac{Fs}{t}.$$

Power will be obtained in watts if W is expressed in joules (10^7 ergs) and t in sec.

Energy. — The potential energy of a mass m, raised through a distance h, where g is the acceleration due to gravity, is

$$E = mgh.$$

The kinetic energy of mass m, moving with a velocity v, is

$$E = \tfrac{1}{2}mv^2.$$

Energy will be given in ergs if m is in grams, g in cm per sec.^{2}, h in cm and v in cm per sec.

Kinetic Energy of Rotation. — If a mass whose moment of inertia about an axis is I, rotates with angular velocity ω about this axis, the kinetic energy of rotation will be,

$$E = \tfrac{1}{2}I\omega^2.$$

Energy will be given in ergs if I is in g.cm^2 and ω in radians per sec.

Conservation of Energy. — In every modification of a material system not affected by forces foreign to the system the sum of its potential and kinetic energies remains constant.

Friction. — If F is the force required to move one surface over another and W, the force pressing the surfaces together, the coefficient of friction,

$$k = \frac{F}{W}.$$

Simple Machines. — If a force f applied to a machine through a distance S results in a force F exerted by the machine through a distance s, neglecting friction,

$$fS = Fs.$$

The theoretical mechanical advantage or velocity ratio in the above case is

$$\frac{S}{s}.$$

Actually the force obtained from the machine will have a smaller value than will satisfy the equation above. If F' be the actual force obtained, the practical mechanical advantage will be

$$\frac{F'}{f}.$$

The efficiency of the machine,

$$E = \frac{Fs'}{fS}.$$

Mass by Weighing on a Balance with Unequal Arms. — If W_1 is the value for one side, W_2 the value for the other, the true mass,

$$W = \sqrt{W_1 W_2}.$$

Sensitiveness of a Balance. — If w is the weight of the beam, h the distance of the center of gravity below the knife edge, a the length of the balance arms and x a small mass added to one pan, the deflection θ produced is given by

$$\tan\theta = \frac{ax}{wh}.$$

Hooke's Law. — Within the elastic limit of any body the ratio of the stress to the strain produced is constant.

Elastic Coefficients

Young's modulus by stretching. — If an elongation s is produced by the weight of the mass m, in a wire of length l, and radius r, the modulus,

$$M = \frac{mgl}{\pi r^2 s}.$$

Young's modulus by bending, bar supported at both ends. If a flexure s is produced by the weight of mass m, added midway between the supports separated by a distance l, for a rectangular bar with vertical dimensions of cross-section a and horizontal dimension b, the modulus is,

$$M = \frac{mgl^3}{4sa^3b}.$$

For a cylindrical bar of radius r,

$$M = \frac{mgl^3}{12\pi r^4 s}.$$

For a bar supported at one end. In the case of a rectangular bar as described above,

$$M = \frac{4mgl^3}{sa^3b}.$$

For a round bar supported at one end,

$$M = \frac{4mgl^3}{3\pi r^4 s}.$$

Modulus of Rigidity. — If a couple C $(= mgx)$ produces a twist of θ radians in a bar of length l and radius r, the modulus is

$$M = \frac{2Cl}{\pi r^4 \theta}.$$

The substitution in the above formulæ for the elastic coefficients of m in grams, g in cm per sec., l, a, b, and r in cm, s in cm², and C in dyne-cm will give moduli in dynes per cm².

Coefficient of Restitution. — Two bodies moving in the same straight line, with velocities v_1 and v_2 respectively, collide and after impact move with velocities v_3 and v_4. The coefficient of restitution is

$$C = \frac{v_4 - v_3}{v_2 - v_1}.$$

Viscosity. — Flow of liquids through a tube; where l is the length of the tube, r its radius, the difference of pressure at the ends, η the coefficient of viscosity, the volume escaping per second,

$$v = \frac{\pi p r^4}{8l\eta}. \qquad \text{(Poiseuille.)}$$

The volume will be given in cm³ per second if l and r are in cm, p in dynes per cm² and η in poises or dyne-seconds per cm².

Stokes' Law gives the rate of fall of a small sphere in a viscous fluid. When a small sphere falls under the action of gravity through a viscous medium it ultimately acquires a constant velocity,

$$V = \frac{2ga^2(d_1 - d_2)}{9\eta}.$$

where a is the radius of the sphere, d_1 and d_2 the densities of the sphere and the medium respectively, and η the coefficient of viscosity. V will be in cm³ per sec. if g is in cm per sec.², a in cm, d_1 and d_2 in g per cm³ and η in dyne-sec. per cm² or poises.

Diffusion. — If the concentration (mass of solid per unit volume of solution) at one surface of a layer of liquid is d_1, and at the other surface d_2, the thickness of the layer h and the area under consideration A, then the mass of the substance which diffuses through the cross-section A in time t is,

$$m = KA\frac{(d_2 - d_1)t}{h}.$$

where K is the coefficient of diffusion. *See table Diffusion.*

Surface Tension. — The total force along a line of length l on the surface of a liquid whose surface tension is T,

$$F = lT.$$

Capillary Tubes. — If a liquid of density d rises a height h in a tube of internal radius r the surface tension is,

$$T = \frac{rhdg}{2}.$$

The tension will be in dynes per cm if r and h are in cm, d in g per cm³ and g in cm per sec².

Pressure in dynes per cm² due to surface tension on a drop of radius r cm for a liquid whose surface tension is T dynes per cm,

$$P = \frac{2T}{r}.$$

For a bubble of mean radius r cm, $P = \frac{4T}{r}$.

Values of T will be found in tables in another part of this volume.

Hydrostatic pressure at a distance h from the surface of a fluid of density d,

$$P = hdg.$$

The total force on an area A due to hydrostatic pressure,

$$F = PA = Ahdg.$$

Force in dynes and pressure in dynes per cm² will be given if h is in cm, d in g per cm³ and g in cm per sec².

Pascal's Law. — Pressure exerted at any point upon the mass of a liquid is transmitted undiminished in all directions.

Archimedes Principle. — A body wholly or partly immersed in a fluid is buoyed up by a force equal to the weight of the fluid displaced. A body of volume V cm³ immersed in a fluid of density d grams per cm³ is buoyed up by a force in dynes,

$$F = dgV.$$

A floating body displaces its own weight of liquid.

Velocity of Efflux of a Liquid. — If h is the distance from the opening to the free surface of the liquid, the velocity of efflux is

$$V = \sqrt{2gh}.$$

The above is the theoretical discharge velocity disregarding friction and the shape of orifice. For water issuing through a circular opening with sharp edges of area, A, the volume discharged per second is given approximately by,

$$Q = 0.62A\sqrt{2gh}.$$

Bernoulli's Theorem. At any point in a tube through which a liquid is flowing the sum of the pressure energy, potential energy, and kinetic energy is a constant. If p is pressure; h, height above a reference plane; d, density of the liquid, and v, velocity of flow,

$$p + hdg + \tfrac{1}{2}dv^2 = \text{a constant}.$$

Diminution of Pressure at the Side of a Moving Stream. — If a fluid of density d moves with a velocity v the diminution of pressure due to the motion is (neglecting viscosity),

$$p = \tfrac{1}{2}dv^2.$$

Boyle's Law. — For a perfect gas, changing from pressure p and volume v to pressure p' and volume v' without change of temperature,

$$pv = p'v'.$$

Altitudes with the Barometer. — If b_1 and b_2 denote the corrected barometer readings at two stations, t the mean of the temperatures t_1 and t_2 of the air at the two stations, e_1 and e_2, the tension of water vapor at the two stations, h the mean height above sea level, ϕ the latitude, then the difference in elevation in centimeters is

$$H = 1{,}843{,}000\,(\log b_1 - \log b_2)(1 + 0.00367t)(1 + 0.0026 \cos 2\phi + 0.00002h + \tfrac{3}{8}k),$$

where $$k = \tfrac{1}{2}\left(\frac{e_1}{b_1} + \frac{e_2}{b_2}\right).$$

An approximate formula, sufficient for differences not over 1000 meters is

$$H = 1{,}600{,}000\,\frac{b_1 - b_2}{b_1 + b_2}(1 + 0.004t).$$

Heat

Thermal Expansion. — If l_0 is the length at 0° C., α the coefficient of linear expansion, the length at t_0 C. is,

$$l_t = l_0(1 + \alpha t).$$

General Formula for Thermal Expansion. — The rate of thermal expansion varies with the temperature. The general equation giving the magnitude m_t (length or volume) at a temperature t, where m_0 is the magnitude at 0° C., is

$$m_t = m_0(1 + \alpha t + \beta t^2 + \gamma t^3 \ldots)$$

where α, β, γ, etc., are empirically determined coefficients.

Volume expansion. If V represents volume and β the coefficient of expansion,

$$V_t = V_0(1 + \beta t).$$

For solids, $\beta = 3\alpha$ (approximately).

Expansion of Gases, Charles' Law or Gay-Lussac's Law. The volume of a gas at constant pressure increases proportionally to the absolute temperature. If V_1 and V_2 are volumes of the same mass of gas at absolute temperatures T_1 and T_2,

$$\frac{V_1}{V_2} = \frac{T_1}{T_2}.$$

For an original volume V_0 at 0° C. the volume at $t°$ C. (at constant pressure) is

$$V_t = V_0(1 + 0.00367t).$$

General Law for Gases.

$$p_t v_t = p_0 v_0\left(1 + \frac{t}{273}\right),$$

where p_0, v_0, p_t, v_t represent the pressure and volume at 0° and t° C.

The law may also be expressed,

$$pv = RT$$

where T is the absolute temperature and R a constant depending only on the units of pressure, volume and temperature. For volume in cm³, pressure in dynes per cm² and temperature in Centigrade degrees on the absolute scale $R = 8.3156 \times 10^7$.

Reduction of a Gas Volume to 0° C., 760 mm. Pressure. — If V is the original volume of a gas at temperature t and pressure H the volume at 0° C. and 760 mm. pressure will be,

$$V_0 = \frac{V}{(1 + \alpha t)} \frac{H}{760}.$$

If d is the original density the density at 0° C. and 760 mm. pressure will be,

$$d_0 = d(1 + \alpha t)\frac{760}{H},$$

$$\alpha = 0.00367 \text{ approximately.}$$

Avogadro's Law. — Equal volumes of different gases at the same pressure and temperature contain the same number of molecules.

Dalton's Law. The pressure of a mixture of several gases in a given space is equal to the sum of the pressures which each gas would exert if confined by itself in that space.

Van der Waal's Variation of Boyle's Law.

$$(p + \frac{a}{v^2})\ (v - b) = RT$$

where p and v are the pressure and volume at any constant temperature and a and b are constants. R is the gas constant and T the absolute temperature. For values of R, a and b see tables.

Kinetic Theory, Expression for Pressure.

$$P = \tfrac{1}{3} Nmv^2$$

where N is the number of molecules in unit volume, m the mass of each molecule and v^2 the mean square of the velocity of the molecules.

Gas Thermometer. — Where P_o, P_s, and P_x represent the total pressures with the bulb at 0° C., at the boiling-point of water and at the unknown temperature respectively, t_s the temperature of steam and t_x the unknown temperature,

$$t_x = t_s\frac{P_x - P_0}{P_s - P_0}$$

(approximately). The total pressure on the gas in the bulb is the sum of barometric pressure at the time and that measured by the manometer.

Dulong and Petit's Law of Thermal Capacity. — For simple substances the atoms all have approximately the same thermal capacity. The product of the specific heat by the atomic weight is a constant, — about 6.38.

Specific Heat. — If a quantity of heat H calories is necessary to raise the temperature of m grams of a substance from t_1 to $t_2°$ C., the specific heat,

$$s = \frac{H}{m(t_2 - t_1)}.$$

Specific Heat by the Method of Mixtures. — Where a mass m_1 of the substance is heated to a temperature t_1, then placed in a mass of water m_2 at a temperature t_2 contained in a calorimeter with stirrer (of same material) of mass m_3, specific heat of the calorimeter c, v the volume of the immersed portion of the thermometer, t_3 the final temperature, the specific heat.

Black's Ice Calorimeter. — If a body of mass m and temperature t melts a mass m' of ice, its temperature being reduced to 0° C., the specific heat of the substance is,

$$s = \frac{80.1m'}{mt}.$$

Bunsen's Ice Calorimeter.—A body of mass m at temperature t causes a motion of the mercury column of l centimeters in a tube whose volume per unit length is v. The specific heat is

$$s = \frac{884lv}{mt}.$$

Conduction of Heat.—If the two opposite faces of a cube of a substance are maintained at temperatures t_1 and t_2, the heat conducted across the cube of section a and thickness d in a time T will be,

$$Q = K\frac{(t_2 - t_1)aT}{d}.$$

K is a constant depending on the nature of the substance, designated as the specific heat conductivity. K is usually given for Q in calories, t_1 and t_2 in °C, a in cm², T in sec., and d in cm. *See table Heat Conductivity.*

First Law of Thermodynamics. — When mechanical work is transformed into heat or heat into work the amount of work is always equivalent to the quantity of heat.

Second Law of Thermodynamics. — It is impossible by any continuous self-sustaining process for heat to be transferred from a colder to a hotter body.

Stefan-Boltzman Law of Radiation. — The energy radiated in unit time by a black body is given by, $E = K(T^4 - T_0^4)$, where T is the absolute temperature of the body, T_0 the absolute temperature of the surroundings, and K a constant. *See table Atomic and Molecular Constants.*

Wien Displacement Law.—When the temperature of a radiating black body increases, the wave length of every monochromatic radiation decreases in such a way that the product of the temperature and wave length is constant.

$$\lambda T = \lambda_0 T_0$$

where λ and λ_0 are wave lengths and T and T_0 the corresponding absolute temperatures.

For the wave length of maximum energy,

$$\lambda_{max} T = \text{a constant.}$$

Wave Motion and Sound

Velocity of a Wave.—The velocity of propagation in terms of wave length λ and period T or frequency n is,

$$V = \frac{\lambda}{T} = n\lambda.$$

Velocity of Water Waves.—If the depth h is small compared with the wave length, the velocity,

$$V = \sqrt{gh}.$$

In deep water for a wave length λ,

$$V = \sqrt{\frac{g\lambda}{2\pi}}.$$

If the wave length is very small, less than about 1.6 cm, the velocity increases as the wave length decreases and is expressed by the following,

$$V = \sqrt{\frac{2\pi T}{\lambda d} + \frac{g\lambda}{2\pi}}$$

where T is the surface tension and d the density of the liquid. V will be given in cm per sec. if h and λ are in cm, g in cm per sec.^{2}, T in dynes per cm and d in g per cm^3.

Newton's Formula.—The velocity of a compressional wave in an elastic medium, in terms of elasticity E (bulk modulus) and density d,

$$V = \sqrt{\frac{E}{d}}.$$

For the velocity of sound in air, where p is the pressure and d the density,

$$V = \sqrt{\frac{p}{d} 1.4.}$$

Velocity of Sound, Variation with Temperature.—The velocity in meters per sec. at any temperature T in °C. is given by,

$$V_T = V_0\sqrt{1 + \frac{T}{273}}$$

or

$$V_T = 331.7 + 6.07T.$$

Doppler's Principle.—The apparent frequency of a sound as affected by motion of the hearer, the source and the medium is given by the following expression,

$$n = n_0\frac{V + w - v_0}{V + w - v_s}$$

where n_s is the original frequency of the source, V the velocity of sound, w that of the medium, v_0 that of the observer and v_s that of the source. Only the components of motion parallel to the line connecting the source and observer are to be considered. All velocities are taken in the direction from source to observer; if the motion is in the opposite direction the sign of the velocity substituted in the formula should be changed.

Velocity of a Transverse Wave in a stretched cord. If T is the tension of the cord and m the mass per unit length,

$$V = \sqrt{\frac{T}{m}}.$$

Frequency of Vibrating Strings.—For a string of circular section of length l, tension T, density d, and radius r, the frequency of the fundamental is,

$$n = \frac{1}{2rl}\sqrt{\frac{T}{\pi d}}.$$

The frequency in vibrations per second will be given if T is in dynes, r and l in cm and d in g per cm³.

Organ Pipes.—The frequency of vibration of a closed pipe of length l, where V is the velocity of sound in air, for the fundamental and first three overtones respectively is,

$$n_0 = \frac{V}{4l}, \quad n_1 = \frac{3V}{4l}, \quad n_2 = \frac{5V}{4l}, \quad n_3 = \frac{7V}{4l}.$$

For an open pipe,

$$n_0 = \frac{V}{2l}, \quad n_1 = \frac{2V}{2l}, \quad n_2 = \frac{3V}{2l}, \quad n_3 = \frac{4V}{2l}.$$

Intensity of Sound.—The energy in ergs per cm³ in a sound wave is given by

$$E = 2\pi^2\, dn^2a^2$$

where d is density in g per cm³, n is frequency in vib. per sec. and a is amplitude in cm. The energy reaching the ear in unit time will also be proportional to the velocity of propagation.

Static Electricity

Force between Two Charges.—If two charges q and q' are at a distance r in a vacuum, the force between them is,

$$F = \frac{qq'}{r^2}.$$

The force will be given in dynes if q and q' are in electrostatic units and r in cm.

Field Intensity, or force exerted on unit charge at a point distant r from a charge q in a vacuum.

$$H = \frac{q}{r^2}.$$

If the dielectric in the above cases is not a vacuum the dielectric constant K must be introduced. The formulæ become.

$$F = \frac{qq'}{Kr^2}. \qquad H = \frac{q}{Kr^2}.$$

The value of K is frequently considered unity for air. If the dielectric constant of a vacuum is considered unity the value for air at 0° C. and 760 mm. pressure is 1.000576.

Potential at a point due to a charge q at a distance r,

$$V = \frac{q}{Kr}.$$

Energy of the Electric Field.—If H is the electric field intensity in electrostatic units and K the specific inductive capacity, the energy of the field in ergs per cm³ is,

$$E = \frac{KH^2}{8\pi}.$$

Capacity in terms of charge and potential. A conductor charged with a quantity q to a potential V has a capacity,

$$C = \frac{q}{V}.$$

Capacity of a spherical conductor of radius r,

$$C = Kr.$$

Capacity of two concentric spheres of radii r and r',

$$C = K\frac{rr'}{r - r'}.$$

Capacity of a parallel plate condenser, the area of whose plates is A and the distance between them d,

$$C = \frac{KA}{4\pi d}.$$

Capacities will be given in electrostatic units if the dimensions of condensers are substituted in cm. *See tables for values of K.*

Energy of a charged conductor in ergs where Q is the charge and V the potential in electrostatic units,

$$E = \tfrac{1}{2}QV.$$

Condensers in Parallel and Series. — If c_1, c_2, c_3, etc., represent the capacities of a series of conductors and C their combined capacity, —

when in parallel, $C = c_1 + c_2 + c_3 + \ldots,$

when in series, $\frac{1}{C} = \frac{1}{c_1} + \frac{1}{c_2} + \frac{1}{c_3} \ldots.$

Magnetism

Force between Two Magnetic Poles. — If two poles of strength m and m' are separated by a distance r in a medium whose permeability is μ (unity for a vacuum), the force between them is

$$F = \frac{mm'}{\mu r^2}.$$

Force will be given in dynes if r is in cm and m and m' are in C. G. S. units of pole strength.

The strength of a magnetic field at a point distant r from an isolated pole of strength m is,

$$H = \frac{m}{\mu r^2}.$$

The field will be given in gauss if m and r are in C. G. S. units.

Values of the permeability μ will be found in tables elsewhere in the volume.

Magnetic Moment.—If the poles are separated by a distance which is great compared with the dimensions of the magnet, the magnetic moment of a magnet of length l whose poles have values of $+m$ and $-m$ is,

$$M = ml.$$

Couple acting on a magnet of magnetic moment ml in a field of strength H. If the magnet is perpendicular to the direction of the field,

$$C = Hml = HM.$$

If the angle between the magnet and the field is θ,

$$C = Hml \sin \theta.$$

The couple will be in dyne-cm for C. G. S. units of H, m and l.

Action of One Magnet on Another.—The turning moment experienced by a magnet of pole strength m' and length $2l'$ placed at a distance r from another magnet of length $2l$ and pole strength m, where the center of the first magnet is on the axis (extended) of the second and the axis of the first is perpendicular to the axis of the second,

$$C = 8\frac{mm'll'}{r^3} = \frac{2MM'}{r^3}.$$

If the first magnet is deflected through an angle θ, the expression becomes,

$$C = \frac{2MM'}{r^3}\cos\,\theta.$$

Magnetic Field due to a magnet.

At a point on the magnetic axis prolonged, at a distance r cm from the center of the magnet of length $2l$ whose poles are $+m$ and $-m$ and magnetic moment M, the field strength in gauss is,

$$H = \frac{4mlr}{(r^2 - l^2)^2}.$$

If r is large compared with l,

$$H = \frac{2M}{r^3}.$$

At a point on a line bisecting the magnet at right angles, with corresponding symbols,

$$H = \frac{2ml}{(r^2 + l^2)^{\frac{3}{2}}}.$$

For large values of r,

$$H = \frac{M}{r^3}.$$

Period of vibration of a magnet of magnetic moment M and moment of inertia I vibrating in a field of strength H,

$$T = 2\pi\sqrt{\frac{I}{MH}}.$$

Magnetic Induction.—If a substance of permeability μ is placed in a magnetic field H the magnetic induction in the substance,

$$B = \mu H.$$

If I is the magnetic moment for unit volume, or intensity of magnetization,

$$B = H + 4\pi I.$$

The susceptibility,

$$K = \frac{I}{H}, \qquad \mu = 1 + 4\pi K.$$

Hysteresis.—Steinmetz' equation for hysteresis gives the loss of energy in ergs per cycle per cm³,

$$W = \eta B^{1.6}$$

where B is the maximum induction in maxwells per cm² and η the coefficient of hysteresis. *See table Hysteresis.*

Tractive Force of a Magnet.—If a magnet with induction B has a pole face of area A the force is,

$$F = \frac{B^2 A}{8\pi}.$$

If B and A are in C. G. S. units, A will be in dynes.

Current Electricity

Ohm's Law. — Current in terms of electromotive force E and resistance R,

$$i = \frac{E}{R}.$$

The current is given in amperes when E is in volts and R in ohms.

Current in a Simple Circuit. The current in a circuit including an external resistance R and a cell of electromotive force E, and internal resistance r,

$$i = \frac{E}{R + r}.$$

If E is in volts and r and R in ohms the current will be in amperes.

For two cells in parallel,

$$i = \frac{E}{R + \frac{r}{2}}.$$

For two cells in series,

$$i = \frac{2E}{R + 2r}.$$

Resistance of a conductor at 0° C., of length l, cross-section s and specific resistance ρ,

$$R_0 = \rho\frac{l}{s}.$$

The resistivity may be expressed as ohm-cm when R is in ohms, l in cm and s in cm². *See table Resistivity.*

Resistance of a conductor at a temperature t whose resistance at 0° C. is R_0 and whose temperature resistance coefficient is α,

$$R_t = R_0(1 + \alpha t).$$

Resistance of Conductors in Series and Parallel. — The total resistance of any number of resistances joined in series is the sum of the separate resistances. The total resistance of conductors in parallel whose separate resistances are r_1, r_2, r_3, . . . r_n is given by the formula

$$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} \ldots + \frac{1}{r_n}.$$

R is the total resistance.

For two terms this becomes,

$$R = \frac{r_1 r_2}{r_1 + r_2}.$$

Kirchoff's Laws.

I. The algebraic sum of the currents which meet at any point is zero.

II. In any closed circuit the algebraic sum of the products of the current and the resistance in each conductor in the circuit is equal to the electromotive force in the circuit.

Wheatstone's Bridge. — If the resistances r_1, r_2, r_3, and r_4 form the arms of a Wheatstone's bridge in order as the circuit (omitting cell and galvanometer connections) is traced, when the bridge is balanced,

$$\frac{r_1}{r_2} = \frac{r_4}{r_3} \text{ or } \frac{r_1}{r_4} = \frac{r_2}{r_3}.$$

Electrical Energy. — The power in watts developed by an electric current flowing in a conductor, where E is the difference of potential at its terminals in volts, r its resistance in ohms, and i the current in amperes,

$$P = Ei = ri^2.$$

The work done in joules in a time t sec. is,

$$W = Eit = ri^2t.$$

Heat Effect. — The heat in calories developed in a circuit by an electric current of i amperes flowing through a resistance of r ohms, with a difference of potential E volts for a time t seconds,

$$H = \frac{ri^2t}{4.18} = \frac{Eit}{4.18}.$$

Electromagnetic Field. — The intensity of the magnetic field in gauss at the center of a circular conductor of radius r in which a current i in electromagnetic units is flowing,

$$H = \frac{2\pi i}{r}.$$

If the circular coil has n turns the magnetic intensity at the center is,

$$H = \frac{2\pi n i}{r}.$$

If i is given in amperes the above formulae become, —

$$H = \frac{2\pi i}{10r}, \quad H = \frac{2\pi n i}{10r}.$$

Magnetic Field in a Solenoid. — The magnetic field in a long solenoid of n turns carrying a current i in electromagnetic units,

$$H = 4\pi n i.$$

Tangent Galvanometer. — A tangent galvanometer with n turns, of radius r, in the earth's field H, has a deflection θ. The current flowing is,

$$i = \frac{Hr}{2\pi n} \tan \theta.$$

If $\frac{2\pi n}{r} = G$ (the galvanometer constant),

$$i = \frac{H}{G} \tan \theta.$$

Electrolysis. — If a current i flows for a time t and deposits a metal whose electrochemical equivalent is e, the mass deposited is

$$m = eit.$$

The value of e is usually given for mass in grams, i in amperes and t in seconds.

Lenz' Law. — When an electromotive force is induced in a conductor by any change in the relation between the conductor and the magnetic field, the direction of the electromotive force is such as to produce a current whose magnetic field will oppose the change.

Alternating current in circuits including resistance and inductance,

$$I = \frac{E}{\sqrt{R^2 + (2\pi nL)^2}}$$

where n is the frequency in cycles per second, L the inductance in henry. I will be given in virtual amperes if R is in ohms and E in virtual volts. The denominator is known as the impedance of the circuit.

For circuits also involving a capacity C in farads, the impedance becomes,

$$\sqrt{R^2 + \left(2\pi nL - \frac{1}{2\pi nC}\right)^2}.$$

Average Power in watts for alternating current in a circuit,

$$P = EI \cos \phi$$

where E and I are the effective values of the electromotive force and current in volts and amperes respectively and ϕ the phase angle between the current and the impressed electromotive force.

The ratio,

$$\frac{P}{EI} = \cos \phi$$

is called the power factor.

Light

Intensity of illumination in candle meters of a screen illuminated by a source of illuminating power P candles at a distance r meters, for normal incidence,

$$I = \frac{P}{r^2}.$$

If two sources of illuminating power P_1 and P_2 produce equal illumination on a screen when at distances r_1 and r_2 respectively,

$$\frac{P_1}{r_1^2} = \frac{P_2}{r_2^2} \quad \text{or} \quad \frac{P_1}{P_2} = \frac{r_1^2}{r_2^2}.$$

Spherical Mirrors. — If R is the radius of curvature, F principal focus, and f_1 and f_2 any two conjugate focal distances,

$$\frac{1}{f_1} + \frac{1}{f_2} = \frac{1}{F} = \frac{2}{R}.$$

If the linear dimensions of the object and image be O and I respectively and u and v their distances from the mirror,

$$\frac{O}{I} = \frac{u}{v}.$$

Index of Refraction, Snell's Law. — If i is the angle of incidence, r the angle of refraction, v the velocity of light in the first medium, v' the velocity in the second medium, the index of refraction n,

$$n = \frac{\sin i}{\sin r} = \frac{v}{v'}.$$

For a prism of angle A where light passes at the angle of minimum deviation D, the index of refraction,

$$n = \frac{\sin \frac{1}{2}(A + D)}{\sin \frac{1}{2}A}.$$

Total Reflection. — When light passes from any medium to one in which the velocity is greater, refraction ceases and total reflection begins at a certain critical angle of incidence θ such that

$$\sin \theta = \frac{1}{n}$$

where n is the index of the first medium with respect to the second. If the second medium is air n has the ordinary value for the first medium. For any other second medium,

$$n = \frac{n_1}{n_2}$$

where n_1 and n_2 are the ordinary indices of refraction for the first and second medium respectively.

Refraction at a Spherical Surface. — If u be the distance of a point source, v the distance of the point image or the intersection of the refracted ray with the axis, n_1 and n_2 the indices of refraction of the first and second medium, and r the radius of curvature of the separating surface,

$$\frac{n_2}{v} + \frac{n_1}{u} = \frac{n_2 - n_1}{r}.$$

If the first medium is air the equation becomes,

$$\frac{n}{v} + \frac{1}{u} = \frac{n - 1}{r}.$$

Lenses. — For a single thin lens whose surfaces have radii of curvature r_1 and r_2, whose principal focus is F, the index of the fraction n, and conjugate focal distances f_1 and f_2,

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} = (n - 1)\left(\frac{1}{r_1} + \frac{1}{r_2}\right).$$

For a thick lens, of thickness t,

$$F = \frac{nr_1r_2}{(n - 1)\,[n(r_1 + r_2) - t(n - 1)]}.$$

Combinations of Lenses. — If f_1 and f_2 are the focal lengths of two thin lenses separated by a distance d the focal length of the system,

$$F = \frac{f_1f_2}{f_1 + f_2 - d}.$$

Radius of Curvature from Spherometer Readings. — If l is the mean length of the sides of the triangle formed by the points of the three legs, d the spherometer reading, the radius of curvature of the surface is

$$R = \frac{l_2}{6d} + \frac{d}{2}.$$

Dispersive Power. — If n_1 and n_2 are the indices of refraction for wave lengths λ_1 and λ_2 and n the mean index or that for sodium light, the dispersive power for the specified wave lengths is,

$$\omega = \frac{n_2 - n_1}{n - 1}.$$

Lambert's Law. — When light is normally incident on a perfectly diffusing surface the intensity of the reflected light is proportional to the cosine of the angle made with the normal.

Reflection of Light by a Transparent Medium in Air. (Fresnel's Formulæ). — If i is the angle of incidence, r the angle of refraction, n_1 the index of refraction for air (nearly equal to unity),

n_2 index of refraction for a medium, then the ratio of the reflected light to the incident light is,

$$R = \frac{1}{2}\left[\frac{\sin^2(i-r)}{\sin^2(i+r)} + \frac{\tan^2(i-r)}{\tan^2(i+r)}\right].$$

If $i = 0$ (normal incidence), and $n_1 = 1$ (approximate for air),

$$R = \left(\frac{n_2 - 1}{n_2 + 1}\right)^2$$

Diffraction Grating. — If s is the distance between the rulings, d the angle of diffraction, then the wave length where the angle of incidence is 90° is (for the nth order spectrum),

$$\lambda = \frac{s \sin d}{n}.$$

If i is the angle of incidence, d the angle of diffraction, s the distance between the rulings, n the order of the spectrum, the wave length is,

$$\lambda = \frac{s}{n}(\sin i + \sin d).$$

Brewster's Law. — The tangent of the polarizing angle for a substance is equal to the index of refraction. The polarizing angle is that angle of incidence for which the reflected polarized ray is at right angles to the refracted ray.

Specific Rotation. — If there are n grams of active substance in v cubic centimeters of solution and the light passes through l centimeters, r being the observed rotation in degrees, the specific rotation (for 1 centimeter),

$$[\alpha] = \frac{rv}{nl}.$$

RADIO FORMULÆ

A collection of formulae useful in the computation of inductance, capacity, and other constants of oscillating circuits. From Radio Instruments and Measurements, Bureau of Standards.

Capacity

Units. — In the following formulæ all lengths are expressed in centimeters, areas in square centimeters; the dielectric constant K, is taken as unity for air. Capacities will be given in micromicrofarads = 10^{-12} farads. The electrostatic unit of capacity, sometimes called the centimeter = 1.1124 micromicrofarads.

Parallel plate condenser. — If s be the area of one plate: t, the thickness of the dielectric; K, the dielectric constant; and N, the number of plates, — the capacity

$$C = 0.0885\,K\,\frac{(N-1)s}{t}.$$

Variable condenser, semicircular plates. — Where N is the total number of parallel plates; r_1 the outer, and r_2 the inner radius of the plates; t, the thickness of the dielectric, and K the dielectric constant, — the maximum capacity is given by

$$C = 0.1390K\,\frac{(N-1)(r_1^2 - r_2^2)}{t}.$$

Isolated thin circular disk. — If d is the diameter of the disk

$$C = 0.354d.$$

Isolated sphere. — If d is the diameter of the sphere

$$C = 0.556d.$$

Two concentric spheres. — If r_1 is the radius of the outer sphere; r_2, that of the inner sphere; K, the dielectric constant of the material between the spheres,

$$C = 1.112K\,\frac{r_1 r_2}{r_1 - r_2}.$$

Two coaxial cylinders. — If r_1 is the radius of the outer cylinder; r_2, that of the inner; l, the length of the cylinders; K, the dielectric constant,

$$C = K\,\frac{0.2416\,l}{\log_{10}\dfrac{r_1}{r_2}}.$$

Single long wire parallel to the ground. — For a wire of length l; diameter, d; suspended at a height h above the ground, where the diameter is small compared with the length, For $\frac{4h}{l} = \text{or} < l$ $\qquad C = \dfrac{0.2416\ l}{\log_{10}\dfrac{4h}{d} - k_1}$

For $\frac{l}{4h} = \text{or} < l$ $\qquad C = \dfrac{0.2416\ l}{\log_{10}\dfrac{2\,l}{d} - k_2}$

In which,

$$k_1 = \log_{10}\left[\frac{1 + \sqrt{1 + \left(\frac{4h}{l}\right)^2}}{2}\right] \qquad k_2 = \log_{10}\left[\frac{l}{4h} + \sqrt{1 + \left(\frac{l}{4h}\right)^2}\right]$$

the values of which may be found in a table at the end of this section.

Vertical wire. — For a wire of length l, relatively high above the ground; of diameter d, the approximate capacity is as follows,

$$C = \frac{0.2416\,l}{\log_{10}\dfrac{2l}{d}}.$$

Two horizontal parallel wires at the same height. — If d is the diameter of each wire; l, the length of each; h, the height above the ground; D, the distance between wires, — where d and D are small compared to l,

$$C = \frac{0.1208\,l}{\log_{10}\dfrac{2D}{d} - \dfrac{D^2}{8h^2}}.$$

Two parallel horizontal wires, one above the other. — Use the preceding formula for parallel wires at the same height, substituting the mean height for h.

Two parallel wires joined together, both at the same height. — Let l be the length of each wire; D, the distance between centers; h, the height above the ground; d_2 the diameter of cross section of the wire. If d^2 and D^2 are small compared with l^2 and $4h^2$ respectively

For $\frac{4h}{l} = \text{or} < l$ $\qquad C = \dfrac{0.4831\,l}{\log_{10}\dfrac{4h}{d} + \log_{10}\dfrac{2h}{D} - 2k_1}.$

For $\frac{l}{4h} = \text{or} < l$ $\qquad C = \dfrac{0.4831l}{\log_{10}\dfrac{2l}{d} + \log_{10}\dfrac{l}{D} - 2k_2}.$

k_1 and k_2 have the same significance as above and may be found from the tables at the end of the section.

Several wires in parallel. — If n parallel wires are joined together; D, the spacing between the wires; d, the diameter of the wire; h, the height above the ground; l, the length of the group, — the approximate capacity is,

$$C = \frac{1.112\, l}{\frac{p_{11} + (n-1)p_{12}}{n} - k}.$$

p_{11} and p_{12} may be computed from the following:

For $\frac{4h}{l}$ = or $< l$

$$p_{11} = 4.605\left[\log_{10}\frac{4h}{d} - k_1\right]$$

$$p_{12} = 4.605\left[\log_{10}\frac{2h}{D} - k_1\right]$$

For $\frac{l}{4h}$ = or $< l$

$$p_{11} = 4.605\left[\log_{10}\frac{2l}{d} - k_2\right]$$

$$p_{12} = 4.605\left[\log_{10}\frac{l}{D} - k_2\right]$$

Values of k, k_1, k_2 may be found in the following table.

TABLE 1

$\frac{4h}{l}$	k_1	$\frac{l}{4h}$	k_2	n	k	n	k
0	0	0	0	2	0	11	2.22
0.1	0.001	0.1	0.043	3	0.308	12	2.37
.2	.004	.2	.086	4	.621	13	2.51
.3	.009	.3	.128	5	.906	14	2.63
.4	.016	.4	.169	6	1.18	15	2.74
.5	.025	.5	.209	7	1.43	16	2.85
.6	.035	.6	.247	8	1.66	17	2.95
.7	.045	.7	.283	9	1.86	18	3.04
.8	.057	.8	.318	10	2.05	19	3.14
.9	.069	.9	.351			20	3.24
1.0	.082	1.0	.383				

Inductance

Units. — In the following formulæ all lengths are expressed in centimeters. The inductance calculated will be in micro-henries = 10^{-6} henry.

Long straight round wire. — If l is the length; d, the diameter of cross section; μ the permeability of the material, — the inductance at zero or low frequency is,

$$L = 0.002\, l\left[2.303 \log_{10}\frac{4l}{d} - l + \frac{\mu}{4}\right]$$

For all except iron wire $\mu = 1$ and the last term becomes 0.25. For wires whose length is less than about 1000 times the diameter the term $+\frac{d}{2l}$ should be added inside the brackets.

For any frequency:

$$L = 0.002\,l\left[2.303 \log_{10}\frac{4l}{d} - 1 + \mu\delta\right]$$

where δ is a quantity given in Table 2 below as a function of x. x is to be computed from the relation

$$x = 0.1405d\sqrt{\frac{\mu f}{\rho}}$$

where d and μ are as above; f, the frequency and ρ the resistivity of the material of the wire expressed in microhm-centimeters. (See Properties of Metallic Conductors.)

For copper at 20° C.

$$x = 0.1071\,d\sqrt{f}.$$

For wires other than iron, whose length is 100,000 times the diameter the inductance at infinite frequency is about 2% less than at zero frequency.

TABLE 2

Values of δ for computing inductance at any frequency.

x	δ	x	δ
0	0.250	12	0.059
0.5	.250	14	.050
1.0	.249	16	.044
1.5	.247	18	.039
2.0	.240	20	.035
2.5	.228	25	.028
3.0	.211	30	.024
3.5	.191	40	.0175
4.0	.1715	50	.014
4.5	.154	60	.012
5.0	.139	70	.010
6.0	.116	80	.009
7.0	.100	90	.008
8.0	.088	100	.007
9.0	.078	∞	.000
10.0	.070		

Two parallel round wires, return circuit. — If l is the length of each wire; d, the diameter; D, the distance between centers of wires; μ the permeability, — the inductance for any frequency is

$$L = 0.004\,l\left[2.303 \log_{10} \frac{2D}{d} - \frac{D}{l} + \mu\delta\right]$$

where δ is a quantity to be obtained from the table above as a function of x which is to be computed as explained for the previous formula.

For copper and at low frequency the term δ becomes 0.25.

Square of round wire. — If a is the length of the side of the square; d, the diameter of the wire; μ the permeability, the inductance for any frequency is,

$$L = 0.008\,a\left[2.303 \log_{10} \frac{2a}{d} + \frac{d}{2a} - 0.774 + \mu\delta\right]$$

where δ is obtained as above. For low frequency and for wires other than iron δ becomes 0.25; for infinite frequency the value is zero.

Grounded horizontal wire, the Earth acting as return circuit. If l is the length of wire; h, the height above the ground; d, the diameter of the wire; μ the permeability and δ the frequency constant (see table 2), the inductance, — where d is small compared with l, — is given as follows:

For $\frac{2h}{l} = \text{or} < l$ $\qquad L = 0.002\,l\left[2.3026 \log_{10} \frac{4h}{d} - P + \mu\delta\right]$

For $\frac{l}{2h} = \text{or} < l$ $\qquad L = 0.002\,l\left[2.3026 \log_{10} \frac{4l}{d} - Q + \mu\delta\right]$

P and Q may be found in the following table.

TABLE 3

$\frac{2h}{l}$	P	$\frac{2h}{l}$	Q	$\frac{2h}{l}$	P	$\frac{2h}{l}$	Q
0	0	0	1.0000	0.6	0.5136	0.6	1.2918
0.1	0.0975	0.1	0.0499	.7	.5840	.7	1.3373
.2	.1900	.2	1.0997	.8	.6507	.8	1.3819
.3	.2778	.3	1.1489	.9	.7139	.9	1.4251
.4	.3608	.4	1.1975	1.0	.7740	1.0	1.4672
.5	.4393	.5	1.2452	...	......	...	......

The mutual inductance of the case above may be expressed, For $\frac{2h}{l}$ = or $<l$ $\qquad M = 0.002\,l\left[2.3026 \log_{10}\frac{2h}{D} - P + \frac{D}{l}\right]$

For $\frac{l}{2h}$ = or $<l$ $\qquad M = 0.002\,l\left[2.3026 \log_{10}\frac{2l}{D} - Q + \frac{D}{l}\right]$

The values of P and Q are found in the table above.

Grounded wires in parallel. — Compute by the above formulae the inductance L_1 per unit length of a single wire and the mutual inductance M_1 per unit length of two adjacent wires, using the actual length in determining the ratios $\frac{2h}{l}$, $\frac{2l}{d}$ etc. Then the inductance of n parallel wires will be,

$$L = l\left[\frac{L_1 + (n-1)M_1}{n} - 0.001k\right]$$

where k is a function of n found in Table 1 under capacity formulae.

Circular ring of round wire. — If a is the mean radius of the ring; d, the diameter of the wire, the inductance at any frequency is

$$L = 0.01257a\left[2.303 \log_{10}\frac{16a}{d} - 2 + \mu\delta\right]$$

where δ is determined from the table above.

Circular coil of circular cross section. — For a coil of n fine wires wound with mean radius of the turns a, the cross section of whose winding is a circle of diameter d, the inductance at low frequency, for wire other than iron, neglecting insulation space is,

$$L = 0.01257an^2\left[2.303 \log_{10}\frac{16a}{d} - 1.75\right]$$

Torus with a single layer transverse winding, — a circular solenoid of circular cross section. If r is the distance from the center of the torus to the center of the transverse section; a, the radius of the turns of the winding; n, the number of turns, the inductance at low frequency is

$$L = 0.01257n^2\left[r - \sqrt{r^2 - a^2}\right]$$

Solenoid, single layer. If n is the number of turns; a the radius of the coil; b, the length, the approximate inductance at any frequency is,

$$L = \frac{0.03948a^2n^2}{b}K$$

where K is a function of $\frac{2a}{b}$ given in the table below.

TABLE 4

$\frac{2a}{b}$	K	$\frac{2a}{b}$	K	$\frac{2a}{b}$	K
0.00	1.0000	2.00	0.5255	7.00	0.2584
.05	.9791	2.10	.5137	7.20	.2537
.10	.9588	2.20	.5025	7.40	.2491
.15	.9391	2.30	.4918	7.60	.2448
.20	.9210	2.40	.4816	7.80	.2406
.25	.9016	2.50	.4719	8.00	.2366
.30	.8838	2.60	.4626	8.50	.2272
.35	.8665	2.70	.4537	9.00	.2185
.40	.8499	2.80	.4452	9.50	.2106
.45	.8337	2.90	.4370	10.00	.2033
.50	.8181	3.00	.4292	......	......
.55	.8031	3.10	.4217	11.0	.1903
.60	.7885	3.20	.4145	12.0	.1790
.65	.7745	3.30	.4075	13.0	.1692
.70	.7609	3.40	.4008	14.0	.1605
.75	.7478	3.50	.3944	15.0	.1527
.80	.7351	3.60	.3882	16.0	.1457
.85	.7228	3.70	.3822	17.0	.1394
.90	.7110	3.80	.3764	18.0	.1336
.95	.6995	3.90	.3708	19.0	.1284
1.00	.6884	4.00	.3654	20.0	.1236
1.05	.6777	4.10	.3602	22.0	.1151
1.10	.6673	4.20	.3551	24.0	.1078
1.15	.6573	4.30	.3502	26.0	.1015
1.20	.6475	4.40	.3455	28.0	.0959
1.25	.6381	4.50	.3409	30.0	.0910
1.30	.6290	4.60	.3364	35.0	.0808
1.35	.6201	4.70	.3321	40.0	.0728
1.40	.6115	4.80	.3279	45.0	.0664
1.45	.6031	4.90	.3238	50.0	.0611
1.50	.5950	5.00	.3198	60.0	.0528
1.55	.5871	5.20	.3122	70.0	.0467
1.60	.5795	5.40	.3050	80.0	.0419
1.65	.5721	5.60	.2981	90.0	.0381
1.70	.5649	5.80	.2916	100.0	.0350
1.75	.5579	6.00	.2854	......	......
1.80	.5511	6.20	.2795	......	......
1.85	.5444	6.40	.2739	......	......
1.90	.5379	6.60	.2685	......	......
1.95	.5316	6.80	.2633	......	......

Long multiple layer solenoid. — The inductance is given approximately by,

$$L = L_1 - \frac{0.01257 n^2 a c}{b}(0.693 + B_s)$$

where L_1 is the inductance calculated from the formula for a single layer solenoid, n being the number of turns of the winding; a, the radius of the coil measured from the axis to the center of the cross section of the winding; b, the length of the coil; c, the radial depth of the winding; B_s a correction given in table below as a function of b/c.

TABLE 5

b/c	B_s	b/c	B_s
1	0.0000	16	0.3017
2	.1202	17	.3041
3	.1753	18	.3062
4	.2076	19	.3082
5	.2292	20	.3099
6	.2446	21	.3116
7	.2563	22	.3131
8	.2656	23	.3145
9	.2730	24	.3157
10	.2792	25	.3169
11	.2844	26	.3180
12	.2888	27	.3190
13	.2927	28	.3200
14	.2961	29	.3209
15	.2991	30	.3218

Square coil of rectangular cross section. — If a be the side of the square measured to the center of the rectangular section which has sides b and c and if n be the number of turns,

$$L = 0.008an^2\left[2.303 \log_{10} \frac{a}{b+c} + 0.2235 \frac{b+c}{a} + 0.726\right]$$

If the cross section is a square $b = c$ and the expression becomes

$$L = 0.008an^2\left[2.303 \log_{10} \frac{a}{b} + 0.447 \frac{b}{a} + 0.033\right]$$

MUTUAL INDUCTANCE

Two parallel wires. — If l be the length of each wire; D, the distance between, the inductance is

$$M = 0.002\,l\left[2.303 \log_{10} \frac{2l}{D} - 1 + \frac{D}{l}\right]$$

Coaxial solenoids, single layer coils, not concentric. If a is the radius of the smaller coil; A, the radius of the larger: n_1 and n_2 the number of turns on the smaller and larger coil respectively; $2l$ the length of the smaller coil; $2x$, the length of the larger; D, the distance between the centers of the coils measured along the common axis,

$$M = 0.009870\frac{a^2A^2n_1n_2}{2x\cdot 2l}\left[K_1k_1 + K_3k_3 + K_5k_5\right]$$

where

$$K_1 = \frac{2}{A^2}\left(\frac{x_2}{r_2} - \frac{x_1}{r_2}\right) \qquad k_1\ 2l$$

$$K_3 = \frac{1}{2}\left(\frac{x_1}{r_1^5} - \frac{x_2}{r_2^5}\right) \qquad k_3 = a^2l\left(3 - 4\frac{l^2}{a^2}\right)$$

$$K_5 = -\frac{A^2}{8}\left[\frac{x_1}{r_1}9\left(3 - 4\frac{x_1^2}{A^2}\right) - \frac{x_2}{r_2}9\left(3 - 4\frac{x_2^2}{A^2}\right)\right]$$

$$k_5 = a^4l\left(\frac{5}{2} - 10\frac{l^2}{a^2} + 4\frac{l^4}{a^4}\right)$$

where

$$x_1 = D - x \qquad r_1 = \sqrt{x_1^2 + A^2}$$

$$x_2 = D + x \qquad r_2 = \sqrt{x_2^2 + A^2}$$

The above is most accurate for short coils with relatively great distance between.

Coaxial, concentric solenoids, outer coil the longer. If a be the radius of the smaller coil; A, that of the larger; $2l$, the length of the inner coil; $2x$, the length of the outer; n_1 and n_2 the number of turns on the inner and outer coil respectively,

$$M = \frac{0.01974a^2n_1n_2}{g}\left[1 + \frac{A^2a^2}{8g^4}\left(3 - 4\frac{l^2}{a^2}\right)\right]$$

where $g = \sqrt{x^2 + A^2}$.

Coaxial, concentric solenoids, outer coil the shorter. Assuming the symbols as before except

$$g = \sqrt{l^2 + a^2}$$

$$M = 0.01974\frac{a^2n_1n_2}{g}\left[1 + \frac{A^2a^2}{8g^4}\left(3 - 4\frac{x^2}{a^2}\right)\right]$$

High Frequency Resistance

Cylindrical straight wires. — The ratio R/R_0 of the high frequency resistance to the resistance at low frequency may be found from the table below, by calculating first the value of x from the relation,

$$x = d\sqrt{\frac{2\mu f}{\rho}}$$

where d is the diameter of the wire in centimeters; μ, the magnetic permeability; f, the frequency; ρ, the resistivity in microhm-centimeters.

For copper wire $x = 10da$ where a has a value given by $a = 0.1071\sqrt{f}$. The value of a for various frequencies may be found in the second of the two tables below. The above method gives the high-frequency resistance of simple circuits of any shape where the length is great compared with the diameter of the wire and the different portions of the circuit are not close to each other.

TABLE 6

Ratio of High-Frequency Resistance to the Direct-Current Resistance.

x	R/R_0	x	R/R_0	x	R/R_0
0	1.0000	5.2	2.114	14.0	5.209
0.5	1.0003	5.4	2.184	14.5	5.386
.6	1.0007	5.6	2.254	15.0	5.562
.7	1.0012	5.8	2.324	16.0	5.915
.8	1.0021	6.0	2.394	17.0	6.268
.9	1.0034	6.2	2.463	18.0	6.621
1.0	1.005	6.4	2.533	19.0	6.974
1.1	1.008	6.6	2.603	20.0	7.328
1.2	1.011	6.8	2.673	21.0	7.681
1.3	1.015	7.0	2.743	22.0	8.034
1.4	1.020	7.2	2.813	23.0	8.387
1.5	1.026	7.4	2.884	24.0	8.741
1.6	1.033	7.6	2.954	25.0	9.094
1.7	1.042	7.8	3.024	26.0	9.447
1.8	1.052	8.0	3.094	28.0	10.15
1.9	1.064	8.2	3.165	30.0	10.86
2.0	1.078	8.4	3.235	32.0	11.57
2.2	1.111	8.6	3.306	34.0	12.27
2.4	1.152	8.8	3.376	36.0	12.98
2.6	1.201	9.0	3.446	38.0	13.69
2.8	1.256	9.2	3.517	40.0	14.40
3.0	1.318	9.4	3.587	42.0	15.10
3.2	1.385	9.6	3.658	44.0	15.81
3.4	1.456	9.8	3.728	46.0	16.52
3.6	1.529	10.0	3.799	48.0	17.22
3.8	1.603	10.5	3.975	50.0	17.93
4.0	1.678	11.0	4.151	60.0	21.47
4.2	1.752	11.5	4.327	80.0	28.54
4.4	1.826	12.0	4.504	90.0	32.07
4.6	1.899	12.5	4.780	100.0	35.61
4.8	1.971	13.0	4.856	.....	......
5.0	2.043	13.5	5.033	.....	......

TABLE 7

Values of a ($= 0.1071\sqrt{f}$) for various frequencies.

f	a	Wave-length meters	f	a	Wave-length meters
100	0.1071	......	50,000	2.395	6,000
200	.1514	......	60,000	2.624	5,000
300	.1855	......	70,000	2.834	4,286
400	.2142	......	80,000	3.029	3,750
500	.2395	......	90,000	3.213	3,333
600	.2624	......	100,000	3.387	3,000
700	.2834	......	150,000	4.148	2,000
800	.3029	......	200,000	4.790	1,500
900	.3213	......	250,000	3.355	1,200
1,000	.3387	......	300,000	5.866	1,000
2,000	.4790	......	333,333	6.184	900
3,000	.5866	......	375,000	6.564	800
4,000	.6774	......	428,570	7.012	700
5,000	.7573	......	500,000	7.573	600
6,000	.8296	......	600,000	8.296	500
7,000	.8960	......	700,000	8.960	429
8,000	.9579	......	750,000	9.275	400
9,000	1.0160	......	800,000	9.579	375
10,000	1.071	30,000	900,000	10.16	333
15,000	1.312	20,000	1,000,000	10.71	300
20,000	1.514	15,000	1,500,000	13.12	200
30,000	1.855	10,000	3,000,000	18.55	100
40,000	2.142	7,500	....	....	.....

Wave Length

The wave length in meters is given by the following expression when L, the inductance, is in microhenries and C, the capacity, is in microfarads. The resistance is assumed negligible.

$$\lambda = 1884\sqrt{LC}$$

ACID PROOF WOOD STAIN

Solution No. 1	Solution No. 2
125 grams of copper sulphate	150 grams of good fresh anilin oil
125 grams of potassium chlorate	180 grams of concentrated hydrochloric acid
1000 grams of water	1000 grams of water

Wood must be free from paint, varnish, grease or chemicals. Apply two coats of solution No. 1 boiling hot with a paint brush, allowing each coat to dry thoroughly before the next coat is applied. Then apply two coats of solution No. 2 in the same way. When the wood is completely dried wash off excess chemicals with hot soapsuds. Finish with raw linseed oil. Polish comes from rubbing the oil down well with a cloth or sponge. Whenever the tables get dingy again go over them with a coat of linseed oil and rub smooth.

BLUE PRINT PAPER, Formula for Sensitizing

Solution A:	Water	50. c.c.,	8.5 oz.
	Iron and ammonium citrate	10. grams,	1.7 oz.
Solution B:	Water	50. c.c.,	8.5 oz.
	Potassium ferricyanide	8. grams,	1.4 oz.

Filter separately. The solutions, which may be preserved separately for some time, are best kept in the dark. For use, mix, in a dark room or by an artificial light of low intensity, equal quantities of the two solutions.

Any non-absorbent paper may be sensitized by brushing the solution over it rapidly with a soft, wide, flat brush, going over the surface twice, the second coat being applied in a direction at right angles to the first. An alternative method is to lower the paper, beginning at one edge, on to the surface of the solution in a tray and allow it to float for a few seconds. Care must be taken to exclude air bubbles. After sensitizing by either method, the paper should be hung by one edge in a dark room to dry.

CEMENTS

Glues of all kinds are useful for wood, leather, paper and glass, where the joints are not required to be waterproof.

For waterproof joints of nearly all substances, including metals, shellac may be used. Flakes of solid shellac may be used with heat or it may be used as a solution in alcohol.

Kotinsky cement, Chatterton's compound and other resinous cements are used for similar purposes and in the same way as solid shellac. Glass cells made up with compounds of this nature may be made impervious to alcohol by painting over the joints with a rubber cement made by melting up small pieces of rubber tubing and adding carbon disulphide to make a thin syrup.

For celluloid a cement made by dissolving celluloid shavings in acetone is recommended.

Brass fittings are usually cemented on glass tubing with sealing wax. The glass tube should be wound with thread or twine to secure a close fit. The glass and the brass fitting should be warmed slightly above the melting-point of wax. (Thick, or pressed glass should be warmed slowly.) Wax may be applied to both parts and the thread well saturated with the melted wax. Enough should be used to insure filling the space completely. Join the parts while the wax is very soft and clamp in position until it is thoroughly cold.

For optical purposes, cementing glass, etc., Canada balsam is universally employed, and makes a permanent and nearly invisible joint.

CLEANING MERCURY

Mercury may be cleaned sufficiently for many laboratory purposes without distilling. Allow the mercury to fall in a fine spray into a quantity of dilute nitric acid, 25 parts of acid to 75 parts distilled water. After being passed through the acid one or more times it should be passed through distilled water and dried. Most of the water may be removed with a clean filter, and the mercury heated in a porcelain dish to about 110° C. To produce the spray the stem of a glass funnel may be drawn down so as to leave only a small opening for the escape of mercury or a glass tube with a capillary point attached to a funnel with a tightly fitting rubber tube.

A three- to four-foot length of one-inch glass tube closed at one end and supported in a vertical position may be used to contain the acid solution. If a small glass tube be fused into the lower closed end of the large tube, and bent so as to stand up for a distance a little greater than 1/13.6, the column of acid solution in the large tube, a U-tube is formed in which a short column of mercury supports the long column of acid solution.

The end of the small tube should be bent over at the top so as to facilitate the delivery of the mercury and a short piece of clean rubber tubing with a pinch-cock put on at the start; as soon as mercury enough has collected in the bottom of the tube the pinch-cock may be opened. The mercury will rise nearly or quite to the top of the small tube, and as the quantity increases will be delivered from the small tube as fast as it falls in the spray.

The reversed end of the small tube should be short to avoid forming a siphon, which would completely empty the apparatus.

An efficient procedure, especially if the mercury is greasy, consists in spraying the mercury by means of the above apparatus, first, through a dilute solution (10%) of potassium hydroxide, then through dilute nitric acid (10–15%) and finally through distilled water.

CLEANING OPTICAL SURFACES FOR SILVERING

(From Miller's Laboratory Physics, Ginn & Co., publishers by permission.)

Probably the most important part of the silvering process is the proper cleaning of the surface to be silvered.

The surface is thoroughly cleaned of grease or other organic matter by the usual methods, using alcohol or chromic acid. Then it should be carefully cleansed with strong nitric acid, the whole surface being firmly rubbed with clean cotton tied to a rod of wood or glass. Care should be taken not to injure the surface. Rinse with water, and then wash the surface thoroughly with a strong solution of caustic potash, rubbing with a cotton brush as before. Finally, rinse with distilled water, and keep the surface wet until it is placed in the silvering solution. If the distilled water wets the whole surface uniformly the cleaning may be sufficient; if it does not wet uniformly, the operations must be repeated. The fingers should not touch the edges of the glass during the latter cleaning operations, as a layer of organic matter is apt to spread over the surface and render the silvering uneven.

Dr. Brashear recommends that the surface, after the washings described above, be rubbed with prepared chalk on a cotton wad until it is thoroughly dry and clean. It may then be put into the silvering solution at one's convenience.

COLORED LIQUIDS

For rendering columns of water easily visible, add a few drops of one per cent alcoholic solution of fluorescein to a liter of water. The dilute solution of fluorescein is bright green by reason of its fluorescence, although colorless by transmitted light.

A small quantity of an aqueous (1%) solution of uranine (the sodium salt of fluorescein) may be used in place of the alcoholic solution mentioned above.

If solutions showing color by transmission are desired, dilute aqueous may be made with any of the following dyes:

Dye	Color
Erythrosine	Pink
Eosine	Pink (green fluorescence)
Rhodamine B	Pink (red fluorescence)
Ponceau 2R	Scarlet
Naphthol green	Green
Methylene green	Bluish green
Methylene blue	Blue
Methyl violet	Purple

CROSS HAIRS

The spider lines which serve as an index in reading telescopes may be quickly replaced in an emergency by single silk fibers (from ordinary sewing silk) attached by soft wax. Single fibers may easily be removed from an untwisted strand.

Spider web should be used in permanent work. The fibers of the egg nest of certain species are employed and may be obtained of most dealers in scientific apparatus. In mounting them the following suggestions may be useful: The cross hair diaphragm of the telescope should be removed and clamped in a horizontal position. A bow of brass wire, about No. 28, should be employed to stretch the fiber. A background of black velvet makes the fibers more easily visible. With soft wax or other convenient adhesive ready on both tips of the bow, a fiber of the required length is to be disentangled with tweezers and wrapped several times about the ends of the bow under tension sufficient to straighten the fiber. The fiber, now conveniently handled by the wire bow, should be cautiously lowered onto the diaphragm in the proper position, the wire left hanging.

A small drop of shellac varnish applied at each side will hold the fiber in position as soon as it is thoroughly dry, after which the ends of the fiber should be cut away.

FLUORESCENT SCREENS

For observations of the ultra-violet spectrum, moisten a small quantity of anthracene with water and brush a thin layer over a ground-glass surface. On drying most of the anthracene will adhere to the glass. The prepared surface should be placed so as to receive the radiation directly, glass being comparatively opaque to the shorter wave lengths.

GLASS-GRINDING FLUID

Turpentine	45	c.cm.
Ether (ethyl oxide)	22.5	c.cm.
Camphor gum	31	grams

To be used with powdered emery for grinding glass.

For smoothing edges a sheet of emery cloth moistened with the above solution may be used.

Plane surfaces should be ground on thick plate glass.

For grinding glass stoppers use coarse emery, turn in one direction, finish with fine emery.

LABELS FOR BOTTLES

Ordinary gummed labels written upon, preferably, with India ink, may be protected after being gummed to the bottle by a coat of lacquer or varnish. A more complete protection is obtained by painting the label, after it is in place, with melted paraffin.

MIRRORS FOR SPECTROMETER ADJUSTMENT

A small square of thick plate glass with edges ground smooth and silvered on one surface affords a means of accurate adjustment.

To avoid the necessity of frequently resilvering, which arises where the mirrors are in constant use, the following course is suggested:

From selected German plate mirror 2 to 3 mm. thick, cut two pieces of the same size, say 4×5 cm. Remove the protective layer of varnish or paint from both pieces by soaking in alcohol and rubbing with cotton, being careful not to injure the silver surface. From one piece remove every trace of varnish by repeated rinsing, dry and polish the silver surface thus exposed by stroking lightly with a chamois rouge pad. From the other piece remove the silver by nitric acid, wash thoroughly in distilled water and dry. Cement the clear piece on the silver face of the other with Canada balsam. This is accomplished by placing two or three drops of Canada balsam in xylol (obtained in collapsible tubes) on the center of the silver face, and evenly lowering upon it the clear glass. The balsam should spread rapidly to the edges of the plates. Minute bubbles of air in the balsam film are harmless; if large bubbles are present the plates should be slipped apart, cleaned with alcohol and the process repeated.

The balsam will be sufficiently hard in a few days to allow the excess to be scraped from the edges and the plates bound together with lantern slide binding strip. Gentle heat may be used to harden the balsam more rapidly.

POLARITY TEST PAPER

Dissolve one gram of phenolphthalein in a small quantity of alcohol. Add the solution of phenolphthalein to 100 c.cm. of a 10 per cent solution of potassium chloride in distilled water. Filter paper should be soaked in the solution and dried. A strip of paper moistened with water and placed in contact with the two terminals will show a bright red stain at the negative terminal.

SILVERING GLASS

Brashear's Process

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission.)

Two solutions are required, one, the reducing solution, should be prepared at least a week before it is used, and it may be made in large quantity and kept in stock with advantage; the other solution is to be prepared when used.

Reducing Solution

Distilled water	700 c.cm.
Pure sugar (loaf, granulated or rock candy)	80 g.

When dissolved add

Alcohol	175 c.cm.
Strong nitric acid (sp. gr. 1.42)	3 c.cm.
Add water to make	1000 c.cm.

For silvering, the mirror may rest face up on the bottom of a suitable dish; it may stand on edge, or be supported in any manner, face downward, dipping into the upper part of the solution. In the latter case, the mirror may be fastened with wax to a stick laid across the dish, or it may be supported on glass feet or on paraffined wood wedges. Dr. Brashear recommends that the mirror, if round, form the bottom of the silvering dish, which is completed by wrapping a strip of paraffined paper around the edge of the mirror, this being held in place by rubber bands or fastened with several wrappings of cord.

Having selected a dish and support for the mirror, measure with water the quantity of solution that will be required to make a layer a centimeter or two thick over the surface to be silvered. For each 150 c.cm. of final solution, 1 g. of silver nitrate and 0.5 g. of caustic potash (purified by alcohol) will be required. Dissolve the silver and potash separately, using quantities of water of the proportion of 100 c.cm. to 1 g of the solid. Ordinary graduates or flasks are the most convenient form of vessel in which to mix the solutions. Into the silver nitrate solution pour a few drops of dilute aqua ammonia. The solution will turn to a dark brown color; add ammonia little by little till the precipitate is nearly but not quite redissolved. Now add the potash solution, when a precipitate will again be formed. This is to be nearly, but not entirely, redissolved by the addition of more ammonia, a few drops being sufficient this time. After the ammonia has been added shake or stir the solution well and wait a minute or two to be certain that it does not entirely clear. If by chance too much ammonia has been used, a little silver nitrate is to be dissolved and added, a few drops at a time, till a permanent precipitate is formed. This excess of silver must be present, the solution showing a decided brown tint. The solution may be filtered, though usually this is not necessary.

A quantity of reducing solution equal to about a twenty-fifth part of the solution just prepared is measured out. The mirror, having been properly cleaned and rinsed with distilled water, is placed in position. The reducing solution is poured into the silver and potash solution, and mixed by a quick shaking of the graduate or stirring with a glass rod; the whole is then poured into the dish. If the mirror is immersed face down, care is necessary to remove air bubbles; the mirror may well be immersed after the solution is in, being dipped in at one side first. If the mirror is at the bottom of the dish, after cleaning it is covered with a thin layer of water, and the prepared solutions are poured into the dish without further trouble. In the latter case the dish must be rocked during the time of deposition.

The solution soon turns to a black color, which in a few minutes will turn to a brown; and when it becomes a light gray and the precipitate is flocculent, which may be in ten or fifteen minutes, the operation is at an end. If the mirror is allowed to remain in the solution too long, the surface will have a bleached appearance, which polishing will hardly remove. Remove the mirror, rinse with water, and carefully wipe off the sediment with a tuft of absorbent cotton. It is then set on edge to dry; a rinsing with alcohol will facilitate the drying, or all water may be safely taken up by pressing clean blotting paper over the surface.

When dry, the surface may be polished, if necessary, with a small pad of chamois leather stuffed with cotton, on which is spread a little rouge. Small, circular strokes of the pad, with light pressure, will soon bring out the deep luster of the silver.

A uniform temperature of the bath and the glass, of about 20° is essential to success.

Since fulminating silver is liable to be produced by the action of ammonia on silver oxide, especially in a warm room, all solutions should be thrown away as soon as the silvering operation is completed. The used solutions may be poured into a large jar, in which is thrown some common salt; this causes the silver to be precipitated as the chloride, and about 90 per cent of the original silver may be recovered.

Rochelle Salts Process

(From Miller's Laboratory Physics, Ginn & Co., publishers, by permission.)

For depositing the uniform thin film of silver required on the half-silvered glass of the interferometer, the following method is more suitable than the one described above, as the silver is deposited more slowly. If a thick film is desired, two or more successive deposits may be made, each of which may require an hour's time.

Dissolve 5 g. of silver nitrate in 300 c.cm. of distilled water, and add dilute aqua ammonia until the precipitate formed is nearly, *but not entirely*, redissolved in the manner explained in the preceding method. Filter the solution and add water to make 500 c.cm.

Dissolve one g. of silver nitrate in a small quantity of water and pour into about half a liter of boiling water; dissolve 0.83 g. of Rochelle salts in a small quantity of water, and add to the boiling solution. Continue the boiling for half an hour, till the gray precipitate collects as a powder in the bottom of the flask. Filter hot, and add water to make 500 c.cm.

These solutions may be kept in the dark for a month or two.

For silvering, equal volumes of the two solutions are mixed, and the glass is supported in the mixture in whatever fashion is convenient. Various methods are mentioned in the preceding article. The thickest possible deposit may require an hour's time. A second deposit may be made upon the first if necessary to secure the desired thickness. The drying and polishing may be carried out as described above.

A half-silvered film will be produced in about a minute; only experience can determine when the proper thickness has been secured. The glass appears as though it were very lightly smoked. A film that reflects a little more than half the light incident at 45° is desirable for interferometer use. A simple method of testing is to look at two similar gas flames, one seen through the film and the other seen reflected by it. It is well to silver at once all four surfaces of the two plane-parallel plates of the interferometer and to select for use that film which is of the proper and most uniform thickness.

SOAP SOLUTION FOR SOAP FILM EXPERIMENTS

Pure castile or palm-oil soap..........	1 oz.
Distilled water........................	8 oz.
Pure glycerine.........................	4 oz.

Cut the soap in thin shavings and dissolve in the water. When the solution is complete, add the glycerine and mix very thoroughly. On standing the liquid becomes clear at the bottom. The clear portion may conveniently be removed by a siphon and preserved indefinitely.

SODIUM LIGHT

Paper is to be soaked in a saturated solution of common salt, borax or other salt of sodium, and dried. When wrapped around a Bunsen burner, secured by a twist of wire and pushed up into the edge of the flame, a sodium flame of considerable intensity is obtained. As the ash of the paper breaks away it must be occasionally raised. Lithium chloride may be used in place of or with sodium salt to give the lithium line for spectrometric measurement. Sheet asbestos (thin) may replace the paper if convenient.

SOLDERS

Composition by weight.						Temperature of fusion.	Metals for which it is used.	Flux commonly used.
Lead.	Tin	Copper.	Zinc.	Silver	Gold.			
1	1	...	...	..	...	188° C.	Lead	Tallow
3	5	...	...	..	...	176	Zinc	Zinc chloride with 25% HCl
2	5	...	...	..	...	170	Copper brass	Zinc chloride (neutral) or resin
							Iron	Zinc chloride or ammonium chloride
		2	1	..	...	......	Iron or copper	Borax
		55	45	..	...	880	Iron, copper or brass	Borax
		4.5	0.5	15.0	...	1005	Iron, copper or gold	Borax
		6.5	2.0	11.0	...	983	Iron, copper or gold	Borax
		4	...	6	10	......	Gold	

STOPCOCK GREASE

Vaseline.......................... 16 parts
Pure gum rubber.................. 8 parts
Paraffin.......................... 1 part

Melt all together. More paraffin may be added if the compound is not stiff enough.

UNIVERSAL WAX

(1) A soft wax useful in the laboratory may be made by melting together paraffin, vaseline and paraffin oil in various proportions according to the pliability desired.

(2) Another authority recommends equal quantities of beeswax and turpentine (by weight). It is customary to color the wax by adding finely-powdered Venetian red.

(3) Melt together 1 part of Venice turpentine and 5 parts of beeswax. Color with vermilion.

PHOTOGRAPHIC FORMULÆ

Developers for Plates and Films

NOTE. — Pure water, preferably distilled, should be used in all solutions. Chemicals should be dissolved in the order given. The abbreviation "anhy." is used in connection with sodium sulphite and carbonate to indicate the anhydrous or dried salt. If crystals are used about twice the quantity is necessary.

AMIDOL (Diamidophenol)

1

Amidol	2–3 gr.	4.5–7 gm.
Sodium sulphite, anhy.	12 gr.	29 gm.
Water	1 oz.	1000 cc.

Solution mixed as above will keep about one week.

2

Stock solution of sodium sulphite:

Sodium sulphite, anhy.	2 oz.	100 gm.
Potassium metabisulphite	0.5 oz.	25 gm.
Water	20 oz.	1000 cc.

Boil after dissolving in warm water. Developer is made when needed by adding dry amidol to the stock solution of sulphite which keeps for a long period:

Stock solution of sodium sulphite	2 oz.	200 cc.
Water	10 oz.	1000 c.c.
Amidol	20–30 gr.	4.5–7 gm.

ELON. *See under Metol-Hydroquinone*

GLYCIN

Boiling water	4 oz.	1000 cc.
Sodium sulphite, anhy.	1.25 oz.	312 gm.

When dissolved add:

Glycin	1 oz.	250 gm.

Slowly add:

Potassium carbonate (dry)	5 oz.	1250 gm.

Forms thick cream; for use, shake and dilute with water. Normal, 1 oz. stock solution to 15 oz. water; for less contrast use more water up to 30 oz.

Keeps indefinitely in stock solution, — slow acting, free from stain.

PHOTOGRAPHIC FORMULÆ (Continued)

Hydroquinone

1

Normal developer: —

Water	20 oz.	1000 cc.
Hydroquinone	100 gr.	11.5 gm.
Sodium sulphite, anhy	0.75 oz.	38 gm.
Sodium carbonate, anhy	1.5 oz.	75 gm.

Becomes inert below 16° C. (60° F.). Is a rather slow developer.

2

Solution A: —

Water	20 oz.	1000 cc.
Hydroquinone	160 gr.	18 gm.
Sodium sulphite, anhy	1 oz.	50 gm.
Citric acid	60 gr.	7 gm.
Potassium bromide	40 gr.	4.5 gm.

Solution B: —

Sodium hydroxide (stick)	160 gr.	18 gm.
Water	20 oz.	1000 c.c.

For use take A, 1 oz.; B, 1 oz.; water, 2 oz.

A more rapid developer than No. 1 but tends to great density in high lights.

3

Developer for process work: —

Solution A: —

Water	40 oz.	1000 cc.
Hydroquinone	1 oz.	25 gm.
Potassium metabisulphite	1 oz.	25 gm.
Potassium bromide	1 oz.	25 gm.

Solution B: —

Water	40 oz.	1000 cc.
Potassium hydroxide (caustic potash)	2 oz.	50 gm.

To develop use equal parts A and B. Will develop in 3 minutes at 65° F. (18° C.). Inert below 55° F. Use developer once only; if yellow stain occurs reduce bromide to half quantity.

Metol

Water, warm	20 oz.	1000 cc.
Metol	150 gr.	17 gm.
Sodium sulphite, anhy	1.25 oz.	63 gm.
Sodium carbonate, anhy	1.75 oz.	88 gm.
Potassium bromide	16 gr.	1.8 gm.

Always dissolve metol first.

For use dilute with equal part water for portraiture; for landscape use two parts of water to one of stock solution. Gives detail without density except by prolonged development.

PHOTOGRAPHIC FORMULÆ (Continued)

Metol-Hydroquinone

Note: — Elon may be used with hydroquinone in place of metol, in equal quantity.

Solution A: —

Dissolve in the order given:

Water	64 oz.	1820 cc.
Metol	120 gr.	7.8 gm.
Hydroquinone	120 gr.	7.8 gm.
Sodium sulphite, anhy.	2 oz.	57 gm.

Solution B: —

Water	16 oz.	455 cc.
Sodium carbonate, anhy.	2 oz.	57 gm.

For use take A, 4 oz.; B, 1 oz.; water, 4 oz.

Factor 15

Monomet

Water	20 oz.	1000 cc.
Monomet	20 gr.	2.2 gm.
Sodium sulphite, anhy.	120 gr.	14 gm.
Sodium carbonate, anhy.	120 gr.	14 gm.
Potassium bromide, 10% sol.	20–40 drops	2–4 cc.

Use 1 part stock solution with 1 part water; gives soft negatives.

Monomet-Hydroquinone

Water	20 oz.	1000 cc.
Monomet	16 gr.	2 gm.
Hydroquinone	32 gr.	4 gm.
Sodium sulphite, anhy.	120 gr.	14 gm.
Sodium carbonate, anhy.	120 gr.	14 gm.
Potassium bromide, 10% sol.	20 drops	2–4 cc.

For use take one part stock solution with one part water.

Ortol

Solution A: —

Ortol	140 gr.	16 gm.
Potassium metabisulphite	70 gr.	8 gm.
Cold water	20 oz.	1000 cc.

Solution B: —

Sodium carbonate, anhy.	1.25 oz.	63 gm.
Sodium sulphite, anhy.	1.75 oz.	88 gm.
Potassium bromide	10–20 gr.	1.1–2.3 gm.
Water	20 oz.	1000 cc.

For rapid developer take A, 1 part; B, 1 part. For slower, softer development take A, 1 part; B, 1 part; water, 1 part.

PHOTOGRAPHIC FORMULÆ (Continued)

Paramidophenol

Water, boiling	20 oz.	1000 cc.
Potassium metabisulphite	6 oz.	300 gm.
Paramidophenol	2 oz.	100 gm.

Add sodium or potassium hydroxide in small quantities to dissolve the precipitate first formed.

For use take 1 part stock solution with 20 parts water.

Pyro

1

Solution A:—

Water	16 oz.	455 cc.
Oxalic acid	12 gr.	0.8 gm.
Pyrogallic acid	1 oz.	28 gm.

Solution B:—

Water	16 oz.	455 cc.
Sodium sulphite, anhy	2 oz.	57 gm.

Solution C:—

Water	16 oz.	455 cc.
Sodium carbonate, anhy	1 oz.	28 gm.

For immediate use mix 1 part each of A, B and C with 10 parts water.

Factor 12

2

Hurter and Driffield standard developer for plate testing:—

Pyro	8 parts
Sodium sulphite, crystal	40 "
Sodium carbonate, crystal	40 "
Water to make	1000 "

Factors

If the image first appears after immersion in the developer for a certain time, then this period of time multiplied by the "factor" for the particular developer used will give the total time required for full, normal development. The factor for the degree of development desired may well be determined by experiment; the following are suggested.

Amidol, 2 gr. per oz.	18
Glycin	8–12
Hydroquinone	$4\frac{1}{2}$–5
Metol	30
Metol-hydroquinone	14
Ortol	10

PHOTOGRAPHIC FORMULÆ (Continued)

Pyro, without bromide:—

1 gr. per oz.	18
2 " " "	12
3 " " "	10
4 " " "	8
5 " " "	6

With 1 part bromide to 4 parts pyro:—

1 gr. pyro per oz.	9
2 " " " "	5
3 " " " "	4½
4 " " " "	4

FORMULÆ FOR TANK DEVELOPMENT

1

Water	48 oz.	1360 cc.
Sodium sulphite, anhy.	115 gr.	7.5 gm.
Sodium carbonate, anhy.	90 gr.	5.8 gm.
Pyro	45 gr.	2.9 gm.

Dissolve immediately before use. Use full strength.
Develop 15 minutes at 65° F. (18° C.).

2

Solution A:—		
Water	16 oz.	455 cc.
Oxalic acid	10 gr.	0.65 gm.
Pyro	1 oz.	28 gm.
Solution B:—		
Water	16 oz.	455 cc.
Sodium sulphite, anhy.	3 oz.	85 gm.
Solution C:—		
Water	16 oz.	455 cc.
Sodium carbonate, anhy.	1 oz.	28 gm.

For use take A, 1 part; B, 1 part; C, 1 part; water, 61 parts. Develop 30 minutes at 65° F. (18° C.) for best results.

For temperature 60° F. develop 35 min.
" " 65° F. " 30 "
" " 70° F. " 25 "

3

Stock solution:		
Hot water (200° F.)	60 oz.	1700 cc.
Sodium carbonate, anhy.	2 oz.	57 gm.
Glycin	0.5 oz.	14 gm.
Sodium sulphite, anhy.	0.5 oz.	14 gm.

Dissolve in order. For use take stock solution, 6 parts; water, 58 parts.

For temperature 60° F. develop 30 minutes.
" " 65° F. " 25 "
" " 70° F. " 20 "

PHOTOGRAPHIC FORMULÆ (Continued)

DEVELOPER FOR LANTERN SLIDES

1

Water	20 oz.	568 cc.
Hydroquinone	60 gr.	3.9 gm.
Sodium sulphite, anhy.	120 gr.	7.8 gm.
Potassium bromide	6 gr.	0.4 gm.
Citric acid	6 gr.	0.4 gm.
Sodium carbonate, anhy	1 oz.	28 gm.

Use full strength.

2

Solution A:—

Water	24 oz.	682 cc.
Sodium sulphite, anhy.	3 oz.	85 gm.
Hydroquinone	150 gr.	9.7 gm.

Solution B:—

Water	16 oz.	455 cc.
Potassium carbonate, anhy	2 oz.	57 gm.
Potassium bromide	15 gr.	1 gm.

For use take A, 3 parts; B, 2 parts.

FIXING BATHS FOR PLATES OR FILMS

A.	Water (1 gallon)	128 oz.	3600 cc.
	Hypo (sodium thiosulphate)	32 oz.	850 gm.
B.	Water	32 oz.	852 cc.
	Sodium sulphite, anhy	3 oz.	85 gm.
	Sulphuric acid, C. P.	0.5 oz.	14 cc.
	Chrome alum, powd	2 oz.	56 gm.

NOTE:—Be sure to mix Solution B exactly in given proportions and rotation.

Always pour B into A while stirring well. If this is not done precipitation will take place.

During the cold season one half the quantity of Solution B is sufficient for full quantity of Solution A.

This bath remains clear after frequent use, does not discolor the negatives and hardens the film to such a degree that the negatives can be washed in warm water and dried by artificial heat if necessary. They should be left in the bath ten to twenty minutes after the bromide of silver appears to have been dissolved, to insure permanency, freedom from stain and perfect hardening.

If the bath becomes exhausted by continued use, replace it by a new one.

It is not advisable to use this bath, which contains sulphuric acid, in metal developing tanks.

PHOTOGRAPHIC FORMULÆ (Continued)

PLAIN FIXING BATH

Water	32 oz.	852 cc.
Hypo (sodium thiosulphate)	8 oz.	227 gm.

Do not use the bath when it is discolored; it must be made fresh each day.

INTENSIFICATION

Prepare the following solution, which will keep and work well until exhausted.

No. 1.	Water	16 oz.	455 cc.
	Mercuric chloride, $HgCl_2$	120 gr.	7.8 gm.
	Potassium bromide	120 gr.	7.8 gm.
No. 2.	Number 2 should be mixed fresh.		
	Water	8 oz.	227 cc.
	Sodium sulphite, anhy	1 oz.	28 gm.

· After the negative is well fixed and washed, immerse in No. 1 until it has become thoroughly whitened, and after rinsing carefully place it in No. 2, leaving it there until entirely cleared. In case sufficient intensification has not been gained, wash for ten minutes, repeat the operation and finally wash well. If after intensification the negative is too dense it may be reduced by placing it for a few seconds in water 16 oz., hypo 1 oz.

If the negative has not been thoroughly fixed and washed before intensification, stains will ensue.

REDUCTION

A.	Water	16 oz.	455 cc.
	Hypo (sodium thiosulphate)	1 oz.	28 gm.
B.	Water	16 oz.	455 cc.
	Potassium ferricyanide	1 oz.	28 gm.

As this solution is affected by light, the bottle containing it should be of amber color or wrapped in opaque paper and kept in the dark when not in use.

Mix for immediate use: —

A	8 parts
B	1 part

Use in subdued daylight.

The negative can be placed in this solution directly after fixing. If a dry negative is to be reduced, it must be soaked in water for at least half an hour before applying the solution. To avoid streaks, always rinse the negative before holding it up for examination. As soon as sufficiently reduced wash thoroughly.

IRON CLEARING SOLUTION

To remove yellow stain caused by pyro or hydroquinone developer, wash well to free from hypo and place in

Water	20 oz.	568 cc.
Ferrous sulphate, pure	3 oz.	85 gm.
Sulphuric acid, C. P.	1 oz.	28 gm.
Powdered alum	1 oz.	28 gm.

until stain is gone, then wash well.

DEVELOPERS FOR GASLIGHT PAPERS

Hydro-Metol

1

Water	16 oz.	455 cc.
Metol	18 gr.	1.2 gm.
Hydroquinone	18 gr.	1.2 gm.
Sodium sulphite, dry	204 gr.	13 gm.
Sodium carbonate, dry	408 gr.	26 gm.
Potassium bromide	10 gr.	0.6 gm.

If the whites fail to develop without fog, 10% potassium bromide solution may be added, a few drops at a time, until the desired results are obtained.

2

Water (soft or distilled)	40 oz.	1000 cc.
Metol	15 gr.	1 gm.
Sodium sulphite (dried powd.)	1 oz.	28 gm.
Hydroquinone	60 gr.	4 gm.
Sodium carbonate (dried powd.)	$\frac{3}{4}$ oz.	21 gm.
Potassium bromide (10% solution)	40 drops	40 drops

Fixing Bath

Water	64 oz.
Hypo	16 oz.

Dissolve, then add the following acid hardener:

Water	5 oz.
Sodium sulphite (dried powd.)	$\frac{1}{2}$ oz.
Acetic acid, 25%	3 oz.
Alum (powd.)	$\frac{1}{2}$ oz.

This fixing bath is also excellent for dry plates and films, and will keep indefinitely before using; therefore it can be made up some time in advance. One pint of the bath should fix at least fifty 4 × 5 prints. The acid fixing bath can be used repeatedly. It keeps with but little care. It will by degrees become alkaline by the gradual addition of developer adhering to the prints. It should be discarded entirely when it becomes frothy, and a fresh bath prepared.

DIAPHRAGM NUMBERS

U. S.	1	equals	F/4	U. S.	32	equals	F/22
"	4	"	F/8	"	64	"	F/32
"	8	"	F/11	"	128	"	F/45
"	16	"	F/16	"	256	"	F/64

MEASURES AND UNITS

FUNDAMENTAL STANDARDS

The primary standard of *length* is defined as the distance between two lines at 0° C on a platinum-iridium bar known as the International Prototype Meter deposited at the International Bureau of Weights and Measures. The International Prototype Meter is 1553164.13 times the wave length of the red cadmium line in air, 760 mm. pressure, 15° C.

The primary standard of *mass* is defined as the mass of the International Prototype Kilogram of platinum-iridium kept at the International Bureau of Weights and Measures at Sèvres. It is equal to the mass of 0.001000027 cubic meter of pure water at 4° C and 760 mm. pressure.

The primary standard of *time* is the mean solar second, one eighty six thousand four hundredth (1/86400) part of a mean solar day.

The standard scale of *temperature* adopted by the International Committee of Weights and Measures 1887 is based on the variations in pressure of hydrogen at constant volume. The hydrogen is taken at an initial pressure, at the temperature of melting ice, of one meter of mercury (0° C., sea level, latitude 45°). The scale is defined by taking the temperature of melting ice as 0° and that of condensing steam under 760 mm. pressure as 100°. This is known as the Centigrade (C) scale.

The *absolute* or *thermodynamic temperature scale* proposed by Lord Kelvin is based on the average kinetic energy per molecule of a perfect gas. The temperature of melting ice is 273.13° and that of the boiling point of water 373.13°. This is frequently referred to as the Kelvin (K) scale.

WEIGHTS AND MEASURES

Metric System

Lengths

Millimeters (mm)	Centimeters (cm)	Decimeters (dm)	Meters (m)	U. S. Equivalent	British Imperial Equivalent
1	0.1	0.01	0.001	0.0393700 inch	0.03937011 inch
10	1	.1	.01	0.393700 inch	0.3937011 inch
100	10	1	.1	3.93700 inches 0.3280833 foot	3.937011 inches 0.3280843 foot
1000	100	10	1	39.3700 inches 3.280833 feet	39.37011 inches 3.28084 feet

Meters (m)	Dekameters (dkm)	Hectometers (hm)	Kilometers (km)	U. S. Equivalent	British Imperial Equivalent
1	0.1	0.01	0.001	1.093611 yards 0.198838 rod	1.09361425 yards
10	1	.1	.01	10.93611 yards 1.98838 rods	10.9361425 yards
100	10	1	.1	19.8838 rods	109.361425 yards
1000	100	10	1	0.62137 mile	0.62137 mile

1 millionth micron ($\mu\mu$) = 10^{-12} meter = 10^{-10} centimeter = 0.01 Ångström units
1 Ångström unit or Ångström (Å U or A) = .0000000001 or 10^{-10} meter
1 milli-micron or micro millimeter ($m\mu$) = one one-thousandth micron = 10^{-7} centimeter = 10 Ångström units
1 micron (μ) .001 millimeter = 10^{-6} meter = 10^{-4} centimeter = 10,000 Ångström units = 0.00003937 inch
1 myriameter = 10,000 meters = 6.2137 miles

WEIGHTS AND MEASURES (Continued)

Metric System (Continued)

Area

Sq. Millimeters (mm^2)	Sq. Centimeters (cm^2)	Sq. Decimeters (dm^2)	Sq. Meters, Centares (m^2, ca.)	U. S. Equivalent	British Imperial Equivalents
1	0.01	0.0001	0.000001	0.00155 sq. in.	0.001550 sq. in.
100	1	.01	.0001	0.154999 sq. in.	0.155001 sq. in.
10,000	100	1	.01	15.4999 sq. in.	15.5001 sq. in.
1,000,000	10,000	100	1.	10.76387 sq. ft.	10.76390 sq. ft.

Sq. Meters, Centares (m^2, ca)	Sq. Dekameters Ares (dkm^2, a)	Sq. Hectometers Hectares (hm^2, ha)	Sq. Kilometers (km^2)	U. S. Equivalents	British Imperial Equivalents
1	0.01	0.0001	0.000001	0.039537 sq. rod	1.1960 sq. yds.
100	1	.01	.0001	0.02471 acre	119.60 sq. yds.
10,000	100	1	.01	2.471 acres	2.4711 acres
1,000,000	10,000	100	1	0.3861006 sq. mile	

WEIGHTS AND MEASURES (Continued)

Metric System (Continued)

Volume

Cu. Millimeters (mm^3)	Cu. Centimeters (cm^3, cc)	Cu. Decimeters (dm^3)	Cu. Meters (m^3)	U. S. and British Equivalents
1	0.001	0.000001	0.000000001	0.0000610 cu. inch
1000	1.	.001	.00001	0.0610 cu. inch
1,000,000	1.000	1	.001	61.024 cu. inches
1,000,000,000	1,000,000	1,000	1	35.315 cu. feet, 1.3080 cu. yards

1 stere = 1 cubic meter

Capacity

1 liter is the volume of pure water at 4° C. and 760 mm. pressure which weighs 1 kilogram. 1 liter = 1.000027 cubic decimeter = 1000.027 cubic centimeters.

Milliliter (ml)	Centiliters (cl)	Deciliter (dl)	Liter (l)	U. S. Equivalents	British Imperial Equivalents
1	0.1	0.01	0.001	16.231 minims 0.0610 cu. inch	0.0610 cu. inch
10	1	.1	.01	2.70518 fl. drams	0.070 gill
100	10	1	.1	3.38147 fl. ounces	0.176 pint
1000	100	10	1	270.518 fl. drams 33.8147 fl. ounces	1.75980 pints

WEIGHTS AND MEASURES (Continued)

Metric System (Continued)

Capacity (Continued)

Liters (l)	Dekaliters (dkl)	Hectoliters (hl)	Kiloliters (kl)	U. S. Equivalents	British Imperial Equivalents
1	0.1	0.01	0.001	1.05671 liq. quart 0.264178 gallon 1.1862 dry pints 0.9081 dry quart	.2200 gallon
10	1	.1	.01	18.162 dry pints 9.081 dry quarts 1.13513 pecks	2.200 gallons
100	10	1	.1	2.8378 bushels	
1000	100	10	1	....	3.437 quarters

Mass

Milligrams (mg)	Centigrams (cg)	Decigrams (dg)	Grams (g)	U. S. Equivalents	British Imperial Equivalents
1	0.1	0.01	0.001	0.015432356 grain	0.01543236 grain
10	1	.1	.01	0.15432356 grain	0.1543236 grain
100	10	1	.1	1.5432356 grains	1.543236 grains
1000	100	10	1	15.432356 grains 0.5643833 dram av. 0.03527396 ounce av.	15.43236 grains 0.564383 dram av. 0.0352739 ounce av.

WEIGHTS AND MEASURES (Continued)

Metric System (Continued)

Mass (Continued)

Grams (g)	Dekagrams (dkg)	Hectograms (hg)	Kilograms (kg)	U. S. Equivalents	British Imperial Equivalents
1	0.1	0.01	0.001	0.771618 scruple 0.2572059 dram apoth. 0.03215074 ounce apoth. 0.0022046 pound av.	0.77162 scruple 0.64301 pennyweight 0.03215 ounce troy
10	1	.1	.01	5.643833 drams av.	5.64383 drams av.
100	10	1	.1	3.527396 ounces av.	3.52739 ounces av.
1000	100	10	1	2.204622341 pounds av. 2.6792285 pounds Troy or apoth.	2.2046223 pounds av.

1 kilogram = 15432.35639 grains = 0.00110231 short ton = 0.00098421 long ton.
1 metric carat = 200 milligrams = 3.0864712 grains.
1 myriagram = 10000 g. = 10 kg. = 22.04622 pounds av.
1 quintal = 100 kg. = 220.46 pounds av.
1 millier or tonne = 1000 kg. = 220462. pounds av. = 2679.23 pounds troy = 0.98420640 long ton = 1.1023112 short tons.

Prefixes

The prefixes mega-, meaning one million, and micro-, one millionth, are used in connection with various simple and derived units of the metric system.

WEIGHTS AND MEASURES (Continued)

U. S. System

Miscellaneous Units and Equivalents

Lengths

The United States standard yard is defined as 3600/3937ths meter.

Inches (in.)	Feet (ft.)	Yards (yd.)	Rods (rd.)	Miles (mi.)	Metric Equivalent
1	0.08333	0.027778	0.00505051	0.000015783	2.54001 centimeters
12	1	.33333	.0606061	.000189394	0.304801 meter
36	3	1	.0181818	.000568182	0.914402 meter
198	16.5	5.5	1	.003125	5.029210 meters
63,360	5280.	1760.	320.	1	1.60935 kilometers

1 mil = 0.001 inch = 25.4001 microns = .0254001 millimeter
1 hand = 4 inches = 10.1600 centimeters
1 span = 9 inches = 22.86005 centimeters
1 fathom (fath.) = 6 feet = 1.828804 meters
1 link (li.) = 0.66 foot = 7.92 inches = 20.11684 centimeters
1 rod (rd.) = 25 links = 5.029210 meters
1 surveyor's or Gunter's chain (ch.) = 4 rods = 100 links = 66 feet = 20.11684 meters
1 engineer's or Ramsden's chain = 100 links of one foot each = 100 feet = 30.4801 meters
1 knot or nautical mile = 1.1516 statute miles = 6080.27 feet = 1.85325 kilometers = 1′ of arc on the Earth's surface at the equator

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

Lengths (Continued)

1 British yard = 3 feet = 36 inches = 0.914399 meter
1 British inch = 2.539998 centimeters
1 British mile = 1760 yards = 1.60934 kilometers
1 furlong (fur.) = 40 rods = 220 yards = 660 feet = 201.168 meters
1 pole (British) = 5.5 yards = 5.0292 meters = approximately 1 rod
1 British fathom = 608 feet
1 toise = 6 Paris feet = 1.94904 meters
1 Paris foot (pied) = 12 Paris inches = 0.324839 meter
1 Paris inch (pouce) = 12 Paris lines = 2.70700 centimeters
1 Paris line (ligne) = .225583 centimeter
1 light year = 5.9×10^{12} miles = 9.5×10^{12} kilometers
1 point (type sizes) = 1/72 or 0.01389 inch.
1 line = 1/12 or 0.08333 inch.
1 cubit = 18 inches

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

Area

Sq. Inches (sq. in.)	Sq. Feet (sq. ft.)	Sq. Yards (sq. yd.)	Sq. Rods (sq. rd.)	Acres (A.)	Sq. Miles (sq. mi.)	Metric Equivalent
1	0.0069444	....	....	....	....	6.452 sq. centimeters
144	1	0.111111	....	....	....	0.09290 sq. meter
1296	9	1	0.03305785	....	....	0.8361 sq. meter
	272.25	30.25	1	0.00625	....	25.29295 sq. meters or centares
	43560	4840	160	1	0.0015625	40.46873 ares
	27,878,400	3,097,600	102,400	640	1	2.589998 sq. kilometers

1 square mil = .000001 square inch = .000645 square millimeters
1 circular mil = area of a circle whose diameter is one mil = .000000785 square inches
1 square link = 62.7264 square inches = 404.6873 square centimeters
1 square rod (sq. rd.) = 625 square links = 25.29295 square meters
1 square chain (sq. ch.) = 16 square rods = 404.6873 square meters
1 acre (A) = 10 square chains = 4046.873 square meters

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1 British square yard = 9 square feet = 0.836126 square meter
1 British square foot = 144 square inches = 9.2903 square decimeters
1 British square inch = 6.4516 square centimeters
1 perch (British) = 30.25 square yards = 25.293 square meters
1 rood (British) = 40 perches = 10.117 ares or square dekameters
1 acre (British) = 4 roods

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

VOLUME

Cubic Inches (cu. in.)	Cubic Feet (cu. ft.)	Cubic Yards (cu. yd.)	Metric Equivalent
1	0.00057870	....	16.387 cubic centimeters
1728	1	0.037037	0.02832 cubic meter
46,656	27	1	0.765 cubic meter

1 board foot (bd. ft.) = 144 cubic inches = 2359.8 cubic centimeters
1 cord = 128 cubic feet = 3.625 cubic meters
1 British cubic foot = 1728 cubic inches = 0.028317 cubic meter
1 British cubic yard = 27 cubic feet = 0.76455 cubic meter
1 cubic foot = 6.229 British gallons
1 cubic yard = 168.17 British gallons

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

Capacity — Liquid Measure

Gills	Pints (pt.)	Quarts (qt.)	Gallons (gal.)	Cubic Inches	Metric Equivalent
1	0.25	0.125	0.03125	7.21875	118.292 milliliters
4	1	0.5	0.125	28.875	0.473167 liter
8	2	1	0.25	57.75	0.946333 liter
32	8	4	1	231.	3.785332 liters

1 gill = 4 fluid ounces = 1.18 deciliters
1 gallon (U. S.) of water at 15° weighs about 8.337 pounds av. or 3.782 kilograms = 0.83268 British gallon
1 hogshead = 63 gallons
1 firkin = 9 gallons = 34.06799 liters
1 tun = 252 gallons
1 British gill = 1.42 deciliters
1 British pint = 4 gills = 0.568 liter
1 British quart = 2 pints = 1.136 liters
1 British gallon = 4 quarts = 277.3 cubic inches = 0.160 cubic foot = 4.5459631 liters
1 British gallon of water at 15° C. weighs 10 pounds = 1.20094 U. S. gallons

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

Apothecaries' Fluid Measure

Minims (min. or ♏)	Fluid Drams (fl. dr. or ʒ)	Fluid Ounces (fl. oz. or ℥)	Pints (pt.)	Metric Equivalent
1	0.016667	0.0020833	.....	0.0616102 milliliter
60	1	0.125	.....	3.69661 milliliters
480	8	1	0.625	29.5729 milliliters
7680	128	16	1	0.473167 liter

1 fluid ounce = 1.80469 cubic inches
1 gallon = 128 fluid ounces = 8 pints
1 British Imperial gallon = 8 pints = 160 fluid ounces = 4.5459631 liters
1 British fluid ounce = 8 drachms = 28.4123 cubic centimeters
1 British fluid drachm = 60 minims = 3.5515 cubic centimeters
1 British minim = 0.05919 cubic centimeters

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

Dry Measure

Pints (pt.)	Quarts (qt.)	Pecks (pk.)	Bushels (bu.)	Cubic Inches	Metric Equivalents
1	0.5	0.0625	0.015625	33.6003125	0.550599 liters
2	1	0.125	0.03125	67.200625	1.101198 liters
16	8	1	0.25	537.605	8.80958 liters
64	32	4	1	2150.42	35.2383 liters

1 British peck = 2 British gallons = 554.6 cubic inches = 9.092 liters
1 British bushel = 8 British gallons = 2218.192 cubic inches = 36.37 liters = 1.03151 U. S. bushels
1 British quarter = 8 bushels = 2.909 hectoliters
1 U. S. bushel = 0.96945 British bushel

Mass

Note: Three systems are in use, — avoirdupois, troy, and apothecaries'. The grain is the same in all.

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

Avoirdupois — Commercial

The U. S. Standard pound avoirdupois is defined as 453.5924277 grams.

Grains (gr.)	Drams (dr. av.)	Ounces (oz. av.)	Pounds (lb. av.)	Tons (short) (tn.)	Metric Equivalents
1	0.03657	....	....	......	0.06479818 gram
27.34375	1	0.0625	....	......	1.771845 grams
437.5	16	1	0.0625	......	28.349527 grams
7000.	256	16	1	0.0005	453.5924 grams; 0.4535924 kilogram
....	....	32000	2000	1	907.18486 kilograms

1 pound avoirdupois is the mass of 27.692 cubic inches of water weighted in air at 4° C., 760 mm. pressure
1 short hundredweight (cwt.) = 100 pounds = 45.359243 kilograms
1 short ton = 20 short hundredweight = 2,430.56 troy pounds = 907.18486 kilograms
1 stone (British) = 14 pounds = 6.350 kilograms
1 quarter (British) = 28 pounds = 12.70 kilograms
1 long hundredweight (British) = 4 quarters = 112 pounds = 50.802352 kilograms
1 long ton (British) = 20 long hundredweight = 1016.04704 kilograms
1 long ton = 1.12000 short tons = 2722.22 troy pounds = 1.01605 metric tons
1 short ton = 0.89287 long ton = 29,166.66 troy or apothecaries' ounces = 0.90718 metric ton
1 avoirdupois pound = 1.21528 troy or apothecaries' pounds = 14.5833 troy ounces
1 avoirdupois ounce = 0.9115 troy or apothecaries' ounce = 0.00014643 long ton = 0.00015359 metric ton

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

Troy Weight

Grains (gr.)	Pennyweights (dwt.)	Ounces (oz. t.)	Pounds (lb. t.)	Metric Equivalents
1	0.0416667	0.0020833	....	64.798918 milligrams = 0.064798918 gram
24	1	0.05	0.0041667	1.555174 grams
480	20	1	0.08333	31.103481 grams
5760	240	12	1	373.24177 grams

1 troy pound = $\frac{5760}{7000}$ or 0.822857 avoirdupois pound = 13.1657 avoirdupois ounces
1 carat (1877) = 3.168 grains = 205.6 milligrams
1 troy ounce = 1.09712 avoirdupois ounces
1 troy pound = 0.00036735 long ton = 0.0041143 short ton = 0.00037324 metric ton

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

Apothecaries' Weight

Grains (gr.)	Scruples (℈ or s. ap.)	Drams (ʒ or dr. ap.)	Ounces (℥ or oz. ap.)	Pounds (lb. ap.)	Metric Equivalents
1	0.05000	0.016667	0.0020833	....	64.798918 milligrams
20	1	0.3333	0.041667	0.003472	1.2959784 grams
60	3	1	0.12500	0.010416	3.8879351 grams
480	24	8	1	0.08333	31.103481 grams
5760	288	96	12	1	373.24177 grams

Time

Seconds (sec.)	Minutes (min.)	Hours (hrs.)	Days	Years (yrs.)
1	0.016667	0.00027778		
60	1	0.016667	0.000490196	
3600	60	1	0.041667	
86400	2040	24	1	
.....	....	....	365.242218	1 (common)
.....	....	....	365.256	1 (sidereal)

1 lunar month (mo.) = 29 days 12 hr. 44 min.

1 sidereal second = 0.99727 mean solar second

WEIGHTS AND MEASURES (Continued)

U. S. System (Continued)

Angle

Seconds (″)	Minutes (′)	Degrees (°)	Circumference	
1	0.016667	0.0002778	....	2π radians = 360° = circumference
60	1	0.016667	....	π radians = 180°
3600	60	1	0.0027778	$\frac{\pi}{2}$ radians = 90°
1,296,000	12,600	360	1	$\frac{\pi}{4}$ radians = 45°

1 degree = 0.017453 radian

1 radian = 57° 17′ 44.8″ = 57.2958° = 3437.75′ = 206265″ = $\frac{1}{2\pi}$ of a circumference

1 grade = $\frac{1}{400}$ circumference = 100 centesimal minutes = 0.0157079 radian

1 centesimal minute = 100″ centesimal seconds

Solid Angle

1 steradian = $\frac{1}{4\pi}$ of the solid angle around a point.

CONVERSION OR REDUCTION FACTORS

Various Derived Units

Density

1 pound per cubic foot = 0.01602 gram per cubic centimeter
1 gram per cubic centimeter = 62.4 pounds per cubic foot

Velocity

1 foot per second = 0.6818 mile per hour = 1.0973 kilometers per hour
1 mile per hour = 44.70 centimeters per second = 1.4667 feet per second = 1.6093 kilometers per hour
1 kilometer per hour = 0.9113 foot per second = 0.6214 mile per hour
1 meter per second = 2.2369 miles per hour
1 centimeter per second = 0.02237 mile per hour

Acceleration

1 foot per second per second = 30.4796 centimeters per second per second

Force

1 pound weight = 32.2 poundals (g = 32.2)
1 poundal = 13,825 dynes
1 dyne = 7.2330×10^{-5} poundals = 2.247×10^{-6} pounds weight (g = 981) = 0.001019 gram weight = 0.01573 grain weight
1 gram weight = 981 dynes
1 grain weight = 63.57 dynes

NOTE: The relation between gravitational and absolute units of force is dependent on the value of g, the acceleration due to gravity. Thus the gravitational unit is g times the absolute unit, — g being substituted in cm. per sec.^{2} for the metric and in ft. per sec.^{2} for the English units.

Pressure

(See also table *Conversion of Pressure Units*)

1 ton (2000 lb.) per sq. inch = 1.3789×10^8 dynes per square centimeter = 1.4062 kilograms per square millimeters (g = 980.6)
1 ton (2240 lb.) per sq. inch = 1.545×10^8 dynes per square centimeter = 152.4 atmospheres = 1.575 kilograms per square millimeter (g = 981)
1 inch of mercury = 0.0333 atmosphere = 13.6 inches of water = 0.490 pound per sq. inch
1 inch of water = 0.03613 pound per sq. inch

1 pound per square foot = 0.016 foot of water = 4.882 kilograms per square meter

1 pound per square inch = 2.312 feet of water = 2.040 inches of mercury = 0.0703 kilogram per sq. centimeter

1 atmosphere = 34.0 feet of water = 760 millimeters of mercury = 14.7 pounds per sq. inch

1 kilogram per square centimeter = 14.22 pounds per square inch 76 cm. of mercury at 0° C. (g = 980) = 1,012,630 dynes per cm.^{2} or 14.697 pounds per square inch

Work or Energy

(See also table Factors for Conversion of Energy Units)

1 foot poundal = 421,403 ergs

1 joule = 10^7 ergs = 6

1 erg = 2.3730 × 10 foot-poundals

1 foot-pound = 1356.3 × 10^4 ergs = 0.138255 kilogram meters (g = 981)

1 megalerg = 10^6 ergs

1 lumen = 0.001496 watt

1 watt of max. visibility radiation = 668 lumens

1 calorie (20°) = 0.003965 B.T.U. = 1.162 × 10^{-6} = kilowatt hours = 4.183 joules = 4.183 × 10^7 ergs

1 large calorie or kilogram calorie = 1000 small calories = 3.965 B.T.U.

1 British thermal unit (B.T.U.) = 0.0002931 kilowatt-hour = 0.293 watt hours = 252.2 calories (20°) = 0.252 large calory

1 kilowatt hour = 3,600,000 joules = 2,655,000 foot pounds = 367,100 kilogram-meters = 860,300 calories (20°) = 3411 B.T.U.

Power

1 horse power = 33,000 foot pounds per minute = 550 foot pounds per second = 746 watts (g = 981) = 745.2 watts (g. = 980) = 0.7452 kilowatts (g = 980) = 1.101387 force de cheval

1 watt = 1 joule per second = 10^7 ergs per second = 44.2385 foot pounds per minute (g = 981) = .00134 horse power

1 force de cheval = 75 kilogram meters per second = 735.75 watts = 0.98632 horse power

1 kilowatt = 1000 watts = 738 foot pounds per second = 1.341 horse power = 0.949 B.T.U. per second = 0.239 large calory per second

1 British thermal unit (B.T.U.) per minute = 0.233 horse power

1 British thermal unit per second = 1052.6 watts

Thermal Capacity

1 large calorie per cubic meter = 0.1124 B.T.U. per cubic foot

1 large calorie per kilogram per degree centigrade = 1.800 B.T.U. per pound, per degree Fahrenheit

1 small calorie per gram per degree centigrade = 1.800 B.T.U. per pound per degree Fahrenheit

1 B.T.U. per pound per degree Fahrenheit = 0.5556 calory per gram per degree centigrade
1 B.T.U. per cubic foot = 8.90 large calories per cubic meter

Photometric Units

1 hefner unit = 0.9 international candle
1 lumen is emitted by .07958 spherical candle power
1 lumen emitted per ft.^{2} = 1.076 millilamberts (perfect diffusion)
1 spherical candle power emits 12.57 lumens
1 lux = 1 lumen incident per m.^{2} = .0001 phot = .1 milliphot
1 phot = 1 lumen incident per cm.^{2} 10,000 lux = 1000 milliphots
1 milliphot = .001 phot = .929 foot-candle
1 foot-candle = 1 lumen incident per ft.^{2} = 1.076 milliphots = 10.76 lux
1 lambert = 1 lumen emitted per cm.^{2} of a perfectly diffusing surface
1 millilambert = .929 lumen emitted per ft.^{2} (perfect diffusion)
1 lambert = .3183 candle per cm.^{2} = 2.054 candles per in.^{2}
1 candle per cm.^{2} = 3.1416 lamberts
1 candle per in.^{2} = .4968 lambert = 486.8 millilamberts

RELATIONS OF ELECTRICAL UNITS

1 ohm	= 10^9 electromagnetic	= $1/9 \times 10^{-11}$ electrostatic
1 volt	= 10^8 electromagnetic	= $1/3 \times 10^{-2}$ electrostatic
1 ampere	= 10^{-1} electromagnetic	= 3×10^9 electrostatic
1 coulomb	= 10^{-1} electromagnetic	= 3×10^9 electrostatic
1 farad	= 10^{-9} electromagnetic	= 9×10^{11} electrostatic
1 farad	= 1,000,000 microfarads	
1 henry	= 10^9 electromagnetic	= $1/9 \times 10^{-11}$ electrostatic

VALUE OF THE GAS CONSTANT *R* FOR VARIOUS UNITS

Units of pressure.	Units of Volume.	*R* per gram molecule.
Atmospheres	Volume at 0° C.	0.003662
Atmospheres	c. cm.	82.07
Atmospheres	liters	0.08207
Atmospheres	cubic meters	
Dynes per sq.cm. (barye)	c.cm.	8.3156×10^7
Kilograms per sq.m. (g. = 980.6)	c.cm.	8.48×10^5
		***R* per lb. molecule.**
Pounds per sq.in.	cu.in.	18510.
Pounds per sq.in.	cu.ft.	10.71
Atmospheres	cu.in.	1260.
Atmospheres	cu.ft.	0.729

FACTORS FOR CONVERSION OF ENERGY UNITS

(From Perkins' Introduction to General Thermodynamics, John Wiley & Sons, publishers, by permission.)

	Gram-Calories (4° C.).	B.T.U.*	Joules.	Foot-pounds.	Kilogm.-meters.	Liter-atmos.	Cu.ft.-atmos.	Foot-Poundals	Horse-power Hours.
Gram-calorie...	1.	3.968×10^{-3}	4.185	3.087	.4267	4.130×10^{-2}	1.459×10^{-3}	99.31	1.5591×10^{-6}
B.T.U.......	252.	1	1055.	777.9	107.5	10.41	.3676	25030.	3.929×10^{-4}
Joule..........	.2389	9.482×10^{-4}	1.	.73756	.1019	9.689×10^{-3}	3.485×10^{-4}	23.73	3.725×10^{-7}
Foot-pound....	.3240	1.286×10^{-3}	1.356	1.	.113826	1.3381×10^{-2}	4.7253×10^{-4}	32.174	5.0505×10^{-7}
Kilogr.-meter .	2.343	9.298×10^{-3}	9.806	7.2327	1.	9.678×10^{-2}	3.4177×10^{-3}	232.7	3.6529×10^{-6}
Liter-atmos....	24.21	9.607×10^{-2}	101.32	74.733	10.333	1.	3.5319×10^{-2}	2403.8	3.7734×10^{-5}

* At temp. of maximum density.

CONVERSION OF PRESSURE UNITS

(From Perkins' Introduction to General Thermodynamics, John Wiley & Sons, publishers, by permission.)

	Dynes per sq.cm.	Grams per sq.cm.	Kilo. per sq. meter.	Mm. of Mercury.	Atmospheres.	Lbs. per sq.in.	Lbs. per sq.ft.
Dynes per sq. centimeter..	1.	1.0198×10^{-3}	1.0198×10^{-2}	7.5010×10^{-4}	9.8697×10^{-7}	1.4504×10^{-5}	2.0887×10^{-3}
Gram per sq. centimeter...	980.6	1	10	7.3551×10^{-1}	9.6777×10^{-4}	1.4223×10^{-2}	2.0481
Kilogram per sq. meter....	98.06	10^{-1}	1	7.3551×10^{-2}	9.6777×10^{-6}	1.4223×10^{-3}	2.0481×10^{-1}
Millimeter of mercury.....	1332	1.3595	13.595	1	1.3158×10^{3}	1.9337×10^{-2}	2.7845
Atmosphere.............	1013200.	1033.3	10333	760	1	14.696	2116.32
Pound per square inch....	68944	70.308	703.12	51.715	6.8046×10^{-2}	1	144
Pound per square foot....	478.78	4.883×10^{-1}	4.883	3.5912×10^{-1}	4.7252×10^{-4}	6.9445×10^{-3}	1

In the two tables above the numbers show the value of the energy or pressure unit named at the left in the units named at the top. For example, 1 gram-calorie is equivalent to 3.968×10^{-3} B.T.U.

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10

Length

INCHES		MILLI-METERS	INCHES		CENTI-METERS	FEET		METERS	U. S. YARDS		METERS	U. S. MILES		KILO-METERS
0.03937	=	**1**	0.3937	=	**1**	**1**	=	0.304801	**1**	=	0.914402	0.62137	=	**1**
0.07874	=	**2**	0.7874	=	**2**	**2**	=	0.609601	1.093611	=	**1**	**1**	=	1.60935
0.11811	=	**3**	**1**	=	2.54001	**3**	=	0.914402	**2**	=	1.828804	1.24274	=	**2**
0.15748	=	**4**	1.1811	=	**3**	3.28083	=	**1**	2.187222	=	**2**	1.86411	=	**3**
0.19685	=	**5**	1.5748	=	**4**	**4**	=	1.219202	**3**	=	2.743205	**2**	=	3.21869
0.23622	=	**6**	1.9685	=	**5**	**5**	=	1.524003	3.280833	=	**3**	2.48548	=	**4**
0.27559	=	**7**	**2**	=	5.08001	**6**	=	1.828804	**4**	=	3.657607	**3**	=	4.82804
0.31496	=	**8**	2.3622	=	**6**	6.56167	=	**2**	4.374444	=	**4**	3.10685	=	**5**
0.35433	=	**9**	2.7559	=	**7**	**7**	=	2.133604	**5**	=	4.572009	3.72822	=	**6**
1	=	25.4001	**3**	=	7.62002	**8**	=	2.438405	5.468056	=	**5**	**4**	=	6.43739
2	=	50.8001	3.1496	=	**8**	**9**	=	2.743205	**6**	=	5.486411	4.34959	=	**7**
3	=	76.2002	3.5433	=	**9**	9.84250	=	**3**	6.561667	=	**6**	4.97096	=	**8**
4	=	101.6002	**4**	=	10.16002	13.12333	=	**4**	**7**	=	6.400813	**5**	=	8.04674
5	=	127.0003	**5**	=	12.70003	16.40417	=	**5**	7.655278	=	**7**	5.59233	=	**9**
6	=	152.4003	**6**	=	15.24003	19.68500	=	**6**	**8**	=	7.315215	**6**	=	9.65608
7	=	177.8004	**7**	=	17.78004	22.96583	=	**7**	8.748889	=	**8**	**7**	=	11.26543
8	=	203.2004	**8**	=	20.32004	26.24667	=	**8**	**9**	=	8.229616	**8**	=	12.87478
9	=	228.6005	**9**	=	22.86005	29.52750	=	**9**	9.842500	=	**9**	**9**	=	14.48412

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10—Continued

Area

Square inches		Square millimeters	Square inches		Square centimeters	Square feet		Square meters	Square yards		Square meters	Square miles		Square kilometers
0.00155	=	**1**	0.1550	=	**1**	**1**	=	0.09290	**1**	=	0.8361	0.3861	=	**1**
0.00310	=	**2**	0.3100	=	**2**	**2**	=	0.18581	1.1960	=	**1**	0.7722	=	**2**
0.00465	=	**3**	0.4650	=	**3**	**3**	=	0.27871	**2**	=	1.6723	**1**	=	2.5900
0.00620	=	**4**	0.6200	=	**4**	**4**	=	0.37161	2.3920	=	**2**	1.1583	=	**3**
0.0075	=	**5**	0.7750	=	**5**	**5**	=	0.46452	**3**	=	2.5084	1.5444	=	**4**
0.00930	=	**6**	0.9300	=	**6**	**6**	=	0.55742	3.5880	=	**3**	1.9305	=	**5**
0.01085	=	**7**	**1**	=	6.452	**7**	=	0.65032	**4**	=	3.3445	**2**	=	5.1800
0.01240	=	**8**	1.0850	=	**7**	**8**	=	0.74323	4.7839	=	**4**	2.3166	=	**6**
0.01395	=	**9**	1.2400	=	**8**	**9**	=	0.83613	**5**	=	4.1807	2.7027	=	**7**
1	=	645.16	1.3950	=	**9**	10.764	=	**1**	5.9799	=	**5**	**3**	=	7.7700
2	=	1,290.33	**2**	=	12.903	21.528	=	**2**	**6**	=	5.0168	3.0888	=	**8**
3	=	1,935.49	**3**	=	19.355	32.292	=	**3**	**7**	=	5.8529	3.4749	=	**9**
4	=	2,580.65	**4**	=	25.807	43.055	=	**4**	7.1759	=	**6**	**4**	=	10.3600
5	=	3,225.81	**5**	=	32.258	53.819	=	**5**	**8**	=	6.6890	**5**	=	12.9500
6	=	3,870.98	**6**	=	38.710	64.583	=	**6**	8.3719	=	**7**	**6**	=	15.5400
7	=	4,516.14	**7**	=	45.161	75.347	=	**7**	**9**	=	7.5252	**7**	=	18.1300
8	=	5,161.30	**8**	=	51.613	86.111	=	**8**	9.5679	=	**8**	**8**	=	20.7200
9	=	5,806.46	**9**	=	58.065	96.875	=	**9**	10.7639	=	**9**	**9**	=	23.3100

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10—Continued

Volume								AREA—Continued	
CUBIC INCHES	CUBIC MILLI-METERS	CUBIC INCHES	CUBIC CENTI-METERS	CUBIC FEET	CUBIC METERS	CUBIC YARDS	CUBIC METERS	ACRES	HECTARES
0.000061 =	1	0.0610 =	1	1	= 0.02832	1	= 0.7646	1	= 0.4047
0.000122 =	2	0.1220 =	2	2	= 0.05663	1.3079	= 1	2	= 0.8094
0.000183 =	3	0.1831 =	3	3	= 0.08495	2	= 1.5291	2.471	= 1
0.000244 =	4	0.2441 =	4	4	= 0.11327	2.6159	= 2	3	= 1.2141
0.000305 =	5	0.3051 =	5	5	= 0.14159	3	= 2.2937	4	= 1.6187
0.000366 =	6	0.3661 =	6	6	= 0.16990	3.9238	= 3	4.942	= 2
0.000427 =	7	0.4272 =	7	7	= 0.19822	4	= 3.0582	5	= 2.0234
0.000488 =	8	0.4882 =	8	8	= 0.22654	5	= 3.8228	6	= 2.4281
0.000549 =	9	0.5492 =	9	9	= 0.25485	5.2318	= 4	7	= 2.8328
1	= 16,387.2	1	= 16.3872	35.314	= 1	6	= 4.5874	7.413	= 3
2	= 32,774.3	2	= 32.7743	70.629	= 2	6.5397	= 5	8	= 3.2375
3	= 49,161.5	3	= 49.1615	105.943	= 3	7	= 5.3519	9	= 3.6422
4	= 65,548.6	4	= 65.5486	141.258	= 4	7.8477	= 6	9.884	= 4
5	= 81,935.8	5	= 81.9358	176.572	= 5	8	= 6.1165	12.355	= 5
6	= 98,323.0	6	= 98.3230	211.887	= 6	9	= 6.8810	14.826	= 6
7	= 114,710.1	7	= 114.7101	247.201	= 7	9.1556	= 7	17.297	= 7
8	= 131,097.3	8	= 131.0973	282.516	= 8	10.4635	= 8	19.768	= 8
9	= 147,484.5	9	= 147.4845	317.830	= 9	11.7715	= 9	22.239	= 9

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10—Continued

Capacity

Milliliters (cc.)	U. S. liquid ounces	Milliliters (cc.)	U. S. apothecaries' drams	U. S. apothecaries' scruples	Milliliters (cc.)	U. S. liquid quarts	Liters	U. S. liquid gallons	Liters
1	= 0.03381	1	= 0.2705	0.8115	= 1	1	= 0.94636	0.26417	= 1
2	= 0.06763	2	= 0.5410	1	= 1.2322	1.05668	= 1	0.52834	= 2
3	= 0.10144	3	= 0.8115	1.6231	= 2	2	= 1.89272	0.79251	= 3
4	= 0.13526	3.6967	= 1	2	= 2.4645	2.11336	= 2	1	= 3.78543
5	= 0.16907	4	= 1.0820	2.4346	= 3	3	= 2.83908	1.05668	= 4
6	= 0.20288	5	= 1.3525	3	= 3.6967	3.17005	= 3	1.32085	= 5
7	= 0.23670	6	= 1.6231	3.2461	= 4	4	= 3.78543	1.58502	= 6
8	= 0.27051	7	= 1.8936	4	= 4.9290	4.22673	= 4	1.84919	= 7
9	= 0.30432	7.3934	= 2	4.0577	= 5	5	= 4.73179	2	= 7.57087
29.574	= 1	8	= 2.1641	4.8692	= 6	5.28341	= 5	2.11336	= 8
59.147	= 2	9	= 2.4346	5	= 6.1612	6	= 5.67815	2.37753	= 9
88.721	= 3	11.0901	= 3	5.6807	= 7	6.34009	= 6	3	= 11.35630
118.295	= 4	14.7869	= 4	6	= 7.3934	7	= 6.62451	4	= 15.14174
147.869	= 5	18.4836	= 5	6.4923	= 8	7.39677	= 7	5	= 18.92717
177.442	= 6	22.1803	= 6	7	= 8.6257	8	= 7.57088	6	= 22.71261
207.016	= 7	25.8770	= 7	7.3038	= 9	8.45345	= 8	7	= 26.49804
236.590	= 8	29.5737	= 8	8	= 9.8579	9	= 8.51723	8	= 30.28348
266.163	= 9	33.2704	= 9	9	= 11.0901	9.51014	= 9	9	= 34.06891

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10—Continued

U. S. DRY QUARTS		LITERS	U. S. PECKS		LITERS	DEKA-LITERS		U. S. PECKS.	U. S. BUSHELS		HECTO-LITERS	U. S. BUSHELS PER ACRE		HECTO-LITERS PER HECTARE
0.9081	=	**1**	0.11351	=	**1**	0.8810	=	**1**	**1**	=	0.35239	**1**	=	0.87078
1	=	1.1012	0.22702	=	**2**	**1**	=	1.1351	**2**	=	0.70479	1.14840	=	**1**
1.8162	=	**2**	0.34053	=	**3**	1.7620	=	**2**	2.83774	=	**1**	**2**	=	1.74156
2	=	2.2025	0.45404	=	**4**	**2**	=	2.2702	**3**	=	1.05718	2.29680	=	**2**
2.7242	=	**3**	0.56755	=	**5**	2.6429	=	**3**	**4**	=	1.40957	**3**	=	2.61233
3	=	3.3037	0.68106	=	**6**	**3**	=	3.4053	**5**	=	1.76196	3.44519	=	**3**
3.6323	=	**4**	0.79457	=	**7**	3.5239	=	**4**	5.67548	=	**2**	**4**	=	3.48311
4	=	4.4049	0.90808	=	**8**	**4**	=	4.5404	**6**	=	2.11436	4.59359	=	**4**
4.5404	=	**5**	**1**	=	8.80982	4.4049	=	**5**	**7**	=	2.46675	**5**	=	4.35389
5	=	5.5061	1.02157	=	**9**	**5**	=	5.6755	**8**	=	2.81914	5.74199	=	**5**
5.4485	=	**6**	**2**	=	17.61964	5.2859	=	**6**	8.51323	=	**3**	**6**	=	5.22467
6	=	6.6074	**3**	=	26.42946	**6**	=	6.8106	**9**	=	3.17154	6.89039	=	**6**
6.3565	=	**7**	**4**	=	35.23928	6.1669	=	**7**	11.35097	=	**4**	**7**	=	6.09545
7	=	7.7086	**5**	=	44.04910	**7**	=	7.9457	14.18871	=	**5**	**8**	=	6.96622
7.2646	=	**8**	**6**	=	52.85892	7.0479	=	**8**	17.02645	=	**6**	8.03879	=	**7**
8	=	8.8098	**7**	=	61.66874	7.9288	=	**9**	19.86420	=	**7**	**9**	=	7.83700
8.1727	=	**9**	**8**	=	70.47856	**8**	=	9.0808	22.70194	=	**8**	9.18719	=	**8**
9	=	9.9110	**9**	=	79.28838	**9**	=	10.2159	25.53968	=	**9**	10.33558	=	**9**

COMPARISON OF METRIC AND CUSTOMARY UNITS FROM 1 TO 10—Continued

Weight (or Mass)

GRAINS		GRAMS	AVOIRDUPOIS OUNCES		GRAMS	TROY OUNCES		GRAMS	AVOIRDUPOIS POUNDS		KILOGRAMS	TROY POUNDS		KILOGRAMS
1	=	0.06480	0.03527	=	**1**	0.03215	=	**1**	**1**	=	0.45359	**1**	=	0.37324
2	=	0.12960	0.07055	=	**2**	0.06430	=	**2**	**2**	=	0.90718	**2**	=	0.74648
3	=	0.19440	0.10582	=	**3**	0.09645	=	**3**	2.20462	=	**1**	2.67923	=	**1**
4	=	0.25920	0.14110	=	**4**	0.12860	=	**4**	**3**	=	1.36078	**3**	=	1.11973
5	=	0.32399	0.17637	=	**5**	0.16075	=	**5**	**4**	=	1.81437	**4**	=	1.49297
6	=	0.38879	0.21164	=	**6**	0.19290	=	**6**	4.40924	=	**2**	**5**	=	1.86621
7	=	0.45359	0.24692	=	**7**	0.22506	=	**7**	**5**	=	2.26796	5.35846	=	**2**
8	=	0.51839	0.28219	=	**8**	0.25721	=	**8**	**6**	=	2.72155	**6**	=	2.23945
9	=	0.58319	0.31747	=	**9**	0.28936	=	**9**	6.61387	=	**3**	**7**	=	2.61269
15.4324	=	**1**	**1**	=	28.3495	**1**	=	31.10348	**7**	=	3.17515	**8**	=	2.98593
30.8647	=	**2**	**2**	=	56.6991	**2**	=	62.20696	**8**	=	3.62874	8.03769	=	**3**
46.2971	=	**3**	**3**	=	85.0486	**3**	=	93.31044	8.81849	=	**4**	**9**	=	3.35918
61.7294	=	**4**	**4**	=	113.3981	**4**	=	124.41392	**9**	=	4.08233	10.71691	=	**4**
77.1618	=	**5**	**5**	=	141.7476	**5**	=	155.51740	11.02311	=	**5**	13.39614	=	**5**
92.5941	=	**6**	**6**	=	170.0972	**6**	=	186.62088	13.22773	=	**6**	16.07537	=	**6**
108.0265	=	**7**	**7**	=	198.4467	**7**	=	217.72437	15.43236	=	**7**	18.75460	=	**7**
123.4589	=	**8**	**8**	=	226.7962	**8**	=	248.82785	17.63698	=	**8**	21.43383	=	8
138.8912	=	**9**	**9**	=	255.1457	**9**	=	279.93133	19.84160	=	**9**	24.11306	=	**9**

COMPARISON OF THE VARIOUS TONS AND POUNDS IN USE IN THE UNITED STATES

From 1 to 10 Units

Long tons	Short tons	Metric tons	Kilograms	Avoirdupois pounds	Troy pounds
0.00036735	0.00041143	0.00037324	0.37324	0.822857	1.
0.00044643	0.00050000	0.00045359	0.45359	1.	1.21528
0.00073469	0.00082286	0.00074648	0.74648	1.64571	2.
0.00089286	0.00100000	0.00090718	0.90718	2.	2.43056
0.00098421	0.00110231	0.00100000	1.	2.20462	2.67923
0.00110204	0.00123429	0.00111973	1.11973	2.46857	3.
0.00133929	0.00150000	0.00136078	1.36078	3.	3.64583
0.00146939	0.00164571	0.00149297	1.49297	3.29143	4.
0.00178571	0.00200000	0.00181437	1.81437	4.	4.86111
0.00183673	0.00205714	0.00186621	1.86621	4.11429	5.
0.00196841	0.00220462	0.00200000	2.	4.40924	5.35846
0.00220408	0.00246857	0.00223945	2.23945	4.93714	6.
0.00223214	0.00250000	0.00226796	2.26796	5.	6.07639
0.00257143	0.00288000	0.00261269	2.61269	5.76000	7.
0.00267857	0.00300000	0.00272155	2.72155	6.	7.29167
0.00293878	0.00329143	0.00298593	2.98593	6.58286	8.
0.00295262	0.00330693	0.00300000	3.	6.61387	8.03769
0.00312500	0.00350000	0.00317515	3.17515	7.	8.50694
0.00330612	0.00370286	0.00335918	3.35918	7.40571	9.
0.00357143	0.00400000	0.00362874	3.62874	8.	9.72222

COMPARISON OF THE VARIOUS TONS AND POUNDS IN USE IN THE UNITED STATES (Continued)

From 1 to 10 Units

Long tons	Short tons	Metric tons	Kilograms	Avoirdupois pounds	Troy pounds
0.00393683	0.00440924	0.00400000	4.	8.81849	10.71691
0.00401786	0.00450000	0.00408233	4.08233	9.	10.93750
0.00492103	0.00551156	0.00500000	5.	11.0231	13.39614
0.00590524	0.00661387	0.00600000	6.	13.2277	16.07537
0.00688944	0.00771618	0.00780000	7.	15.4324	18.75460
0.00787365	0.00881849	0.00800000	8.	17.6370	21.43383
0.00885786	0.00992080	0.00900000	9.	19.8416	24.11306
0.89287	1.	0.9718	907.18	2,000.	2,430.56
0.98421	1.10231	1.	1,000.	2,204.62	2,679.23
1.	1.12000	1.01605	1,016.05	2,240.00	2,722.22
1.78571	2.	1.81437	1,814.37	4,000.00	4,861.11
1.96841	2.20462	2.	2,000.00	4,409.24	5,358.46
2.	2.24000	2.03209	2,032.09	4,480.00	5,444.44
2.67857	3.	2.72155	2,721.55	6,000.00	7,291.67
2.95262	3.30693	3.	3,000.00	6,613.87	8,037.69
3.	3.36000	3.04814	3,048.14	6,720.00	8,166.67
3.57143	4.	3.62874	3,628.74	8,000.00	9,722.22
3.93683	4.40924	4.	4,000.00	8,818.49	10,716.91
4.	4.48000	4.06419	4,064.19	8,960.00	10,888.89
4.46429	5.	4.53592	4,535.92	10,000.00	12,152.78

COMPARISON OF THE VARIOUS TONS AND POUNDS IN USE IN THE UNITED STATES (Continued)

Long tons	Short tons	Metric tons	Kilograms	Avoirdupois pounds	Troy pounds
4.92103	5.51156	5.	5,000.00	11,023.11	13,396.14
5.	5.60000	5.08024	5,080.24	11,200.00	13,611.11
5.35714	6.	5.44311	5,443.11	12,000.00	14,583.33
5.90524	6.61387	6.	6,000.00	13,227.73	16,075.37
6.	6.72000	6.09628	6,096.28	13,440.00	16,333.33
6.25000	7.	6.35029	6,350.29	14,000.00	17,013.89
6.88944	7.71618	7.	7,000.00	15,432.36	18,754.60
7.	7.84000	7.11232	7,112.32	15,680.00	19,055.56
7.14286	8.	7.25748	7,257.48	16,000.00	19,444.44
7.87365	8.81849	8.	8,000.00	17,636.98	21,433.83
8.	8.96000	8.12838	8,128.38	17,920.00	21,777.78
8.03571	9.	8.16466	8,164.66	18,000.00	21,875.00
8.85786	9.92080	9.	9,000.00	19,841.60	24,113.06
9.	10.08000	9.14442	9,144.42	20,160.00	24,500.00

LENGTHS — CENTIMETERS TO INCHES

0.1 *to* 100 *Units*

1 centimeter = 0.393700 inches

The values found in the body of the table give, in inches, the lengths indicated in centimeters at the top and side.

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0		0.03937	0.07874	0.11811	0.15748	0.19685	0.23622	0.27559	0.31496	0.35433
1	0.39370	0.43307	0.47244	0.51181	0.55118	0.59055	0.62992	0.66929	0.70866	0.74803
2	0.78740	0.82677	0.86614	0.90551	0.94488	0.98425	1.0236	1.0630	1.1024	1.1417
3	1.1811	1.2205	1.2598	1.2992	1.3386	1.3780	1.4173	1.4567	1.4961	1.5354
4	1.5748	1.6142	1.6535	1.6929	1.7323	1.7717	1.8110	1.8504	1.8898	1.9291
5	1.9685	2.0079	2.0472	2.0866	2.1260	2.1654	2.2047	2.2441	2.2835	2.3228
6	2.3622	2.4016	2.4409	2.4803	2.5197	2.5591	2.5984	2.6378	2.6772	2.7165
7	2.7559	2.7953	2.8346	2.8740	2.9134	2.9528	2.9921	3.0315	3.0709	3.1102
8	3.1496	3.1890	3.2283	3.2677	3.3071	3.3465	3.3858	3.4252	3.4646	3.5039
9	3.5433	3.5827	3.6220	3.6614	3.7008	3.7402	3.7795	3.8189	3.8583	3.8976

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
10	3.9370	3.9764	4.0158	4.0551	4.0945	4.1339	4.1732	4.2126	4.2520	4.2913
11	4.3307	4.3701	4.4094	4.4488	4.4882	4.5276	4.5669	4.6063	4.6457	4.6850
12	4.7244	4.7638	4.8031	4.8425	4.8819	4.9213	4.9606	5.0000	5.0394	5.0787
13	5.1181	5.1575	5.1968	5.2362	5.2756	5.3150	5.3543	5.3937	5.4331	5.4724
14	5.5118	5.5512	5.5905	5.6299	5.6693	5.7087	5.7480	5.7874	5.8268	5.8661
15	5.9055	5.9449	5.9842	6.0236	6.0630	6.1024	6.1417	6.1811	6.2205	6.2598
16	6.2992	6.3386	6.3779	6.4173	6.4567	6.4961	6.5354	6.5748	6.6142	6.6535
17	6.6929	6.7323	6.7716	6.8110	6.8504	6.8898	6.9291	6.9685	7.0079	7.0472
18	7.0866	7.1260	7.1653	7.2047	7.2441	7.2835	7.3228	7.3622	7.4016	7.4409
19	7.4803	7.5197	7.5590	7.5984	7.6378	7.6772	7.7165	7.7559	7.7953	7.8346
20	7.8740	7.9134	7.9527	7.9921	8.0315	8.0709	8.1102	8.1496	8.1890	8.2283
21	8.2677	8.3071	8.3464	8.3858	8.4252	8.4646	8.5039	8.5433	8.5827	8.6220
22	8.6614	8.7008	8.7401	8.7795	8.8189	8.8583	8.8976	8.9370	8.9764	9.0157
23	9.0551	9.0945	9.1338	9.1732	9.2126	9.2520	9.2913	9.3307	9.3701	9.4094
24	9.4488	9.4882	9.5275	9.5669	9.6063	9.6457	9.6850	9.7244	9.7638	9.8031
25	9.8425	9.8819	9.9212	9.9606	10.000	10.039	10.079	10.118	10.157	10.197
26	10.236	10.276	10.315	10.354	10.394	10.433	10.472	10.512	10.551	10.591
27	10.630	10.669	10.709	10.748	10.787	10.827	10.866	10.905	10.945	10.984
28	11.024	11.063	11.102	11.142	11.181	11.220	11.260	11.299	11.339	11.378
29	11.417	11.457	11.496	11.535	11.575	11.614	11.654	11.693	11.732	11.772

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
30	11.811	11.850	11.890	11.929	11.968	12.008	12.047	12.087	12.126	12.165
31	12.205	12.244	12.283	12.323	12.362	12.402	12.441	12.480	12.520	12.559
32	12.598	12.638	12.677	12.717	12.756	12.795	12.835	12.874	12.914	12.953
33	12.992	13.031	13.071	13.110	13.150	13.189	13.228	13.268	13.307	13.346
34	13.386	13.425	13.465	13.504	13.543	13.583	13.622	13.661	13.701	13.740
35	13.780	13.819	13.858	13.898	13.937	13.976	14.016	14.055	14.094	14.134
36	14.173	14.213	14.252	14.291	14.331	14.370	14.409	14.449	14.488	14.528
37	14.567	14.606	14.646	14.685	14.724	14.764	14.803	14.842	14.882	14.921
38	14.961	15.000	15.039	15.079	15.118	15.157	15.197	15.236	15.276	15.315
39	15.354	15.394	15.433	15.472	15.512	15.551	15.591	15.630	15.669	15.709
40	15.748	15.787	15.827	15.866	15.905	15.945	15.984	16.024	16.063	16.102
41	16.142	16.181	16.220	16.260	16.299	16.339	16.378	16.417	16.457	16.496
42	16.535	16.575	16.614	16.654	16.693	16.732	16.772	16.811	16.850	16.890
43	16.929	16.968	17.008	17.047	17.087	17.126	17.165	17.205	17.244	17.283
44	17.323	17.362	17.402	17.441	17.480	17.520	17.559	17.598	17.638	17.677
45	17.717	17.756	17.795	17.835	17.874	17.913	17.953	17.992	18.031	18.071
46	18.110	18.150	18.189	18.228	18.268	18.307	18.346	18.386	18.425	18.465
47	18.504	18.543	18.583	18.622	18.661	18.701	18.740	18.779	18.819	18.858
48	18.898	18.987	18.976	19.016	19.055	19.094	19.134	19.173	19.213	19.252
49	19.291	19.331	19.370	19.409	19.449	19.488	19.526	19.567	19.606	19.646

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
50	19.685	19.724	19.764	19.803	19.842	19.882	19.921	19.961	20.000	20.039
51	20.079	20.118	20.157	20.197	20.236	20.276	20.315	20.354	20.394	20.433
52	20.472	20.512	20.551	20.591	20.630	20.669	20.709	20.748	20.787	20.827
53	20.866	20.905	20.945	20.984	21.024	21.063	21.102	21.142	21.181	21.220
54	21.260	21.299	21.339	21.378	21.417	21.457	21.496	21.535	21.575	21.614
55	21.654	21.693	21.732	21.772	21.811	21.850	21.890	21.929	21.968	22.008
56	22.047	22.087	22.126	22.165	22.205	22.244	22.283	22.323	22.362	22.402
57	22.441	22.480	22.520	22.559	22.598	22.638	22.677	22.716	22.756	22.795
58	22.835	22.874	22.913	22.953	22.992	23.031	23.071	23.110	23.150	23.189
59	23.228	23.268	23.307	23.346	23.386	23.425	23.465	23.504	23.543	23.583
60	23.622	23.661	23.701	23.740	23.779	23.819	23.858	23.898	23.937	23.976
61	24.016	24.055	24.094	24.134	24.173	24.213	24.252	24.291	24.331	24.370
62	24.409	24.449	24.488	24.528	24.567	24.606	24.646	24.685	24.724	24.764
63	24.803	24.842	24.882	24.921	24.961	25.000	25.039	25.079	25.118	25.157
64	25.197	25.236	25.276	25.315	25.354	25.394	25.433	25.472	25.512	25.551
65	25.591	25.630	25.669	25.709	25.748	25.787	25.827	25.866	25.905	25.945
66	25.984	26.024	26.063	26.102	26.142	26.181	26.220	26.260	26.299	26.339
67	26.378	26.417	26.457	26.496	26.535	26.575	26.614	26.653	26.693	26.732
68	26.772	26.811	26.850	26.890	26.929	26.968	27.008	27.047	27.087	27.126
69	27.165	27.205	27.244	27.283	27.323	27.362	27.402	27.441	27.480	27.520

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
70	27.559	27.598	27.638	27.677	27.716	27.756	27.795	27.835	27.874	27.913
71	27.953	27.992	28.031	28.071	28.110	28.150	28.189	28.228	28.268	28.307
72	28.346	28.386	28.425	28.465	28.504	28.543	28.583	28.622	28.661	28.701
73	28.740	28.779	28.819	28.859	28.898	28.937	28.976	29.016	29.055	29.094
74	29.134	29.173	29.213	29.252	29.291	29.331	29.370	29.409	29.449	29.488
75	29.528	29.567	29.606	29.646	29.685	29.724	29.764	29.803	29.842	29.882
76	29.921	29.961	30.000	30.039	30.079	30.118	30.157	30.197	30.236	30.276
77	30.315	30.354	30.394	30.433	30.472	30.512	30.551	30.590	30.630	30.669
78	30.709	30.748	30.787	30.827	30.866	30.905	30.945	30.984	31.024	31.063
79	31.102	31.142	31.181	31.220	31.260	31.299	31.339	31.378	31.417	31.457
80	31.496	31.535	31.575	31.614	31.653	31.693	31.732	31.772	31.811	31.850
81	31.890	31.929	31.968	32.008	32.047	32.087	32.126	32.165	32.205	32.244
82	32.283	32.323	32.362	32.402	32.441	32.480	32.520	32.559	32.598	32.638
83	32.677	32.716	32.756	32.795	32.835	32.874	32.913	32.953	32.992	33.031
84	33.071	33.110	33.150	33.189	33.228	33.268	33.307	33.346	33.386	33.425
85	33.465	33.504	33.543	33.583	33.622	33.661	33.701	33.740	33.779	33.819
86	23.858	33.898	33.937	33.976	33.016	34.055	34.094	34.134	34.173	34.213
87	34.252	34.291	34.331	34.370	34.409	34.449	34.488	34.527	34.567	34.606
88	34.646	34.685	34.724	34.764	34.803	34.842	34.882	34.921	34.961	35.000
89	35.039	35.079	35.118	35.157	35.197	35.236	35.276	35.315	35.354	35.394

LENGTHS — CENTIMETERS TO INCHES (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
90	35.433	35.472	35.512	35.551	35.590	35.630	35.669	35.709	35.748	35.787
91	35.827	35.866	35.905	35.945	35.984	36.024	36.063	36.102	36.142	36.181
92	36.220	36.260	36.299	36.339	36.378	36.417	36.457	36.496	36.535	36.575
93	36.614	36.653	36.693	36.732	36.772	36.811	36.850	36.890	36.929	36.968
94	37.008	37.047	37.087	37.126	37.165	37.205	37.244	37.283	37.323	37.362
95	37.402	37.441	37.480	37.520	37.559	37.598	37.638	27.677	37.716	37.756
96	37.795	37.835	37.874	37.913	37.953	37.992	38.031	38.071	38.110	38.150
97	38.189	38.228	38.268	38.307	38.346	38.386	38.425	38.464	38.504	38.543
98	38.583	38.622	38.661	38.701	38.740	38.779	38.819	38.858	38.898	38.937
99	38.976	39.016	39.055	39.094	39.034	39.173	39.213	39.252	39.291	39.331

LENGTHS — INCHES TO CENTIMETERS

From 0.1 *to* 100 *Units*

1 inch = 2.54001 centimeters

The values found in the body of the table give, in centimeters, the lengths indicated in inches at the top and side.

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	....	0.25400	0.50800	0.76200	1.0160	1.2700	1.5240	1.7780	2.0320	2.2860
1	2.5400	2.7940	3.0480	3.3020	3.5560	3.8100	4.0640	4.3180	4.5720	4.8260
2	5.0800	5.3340	5.5880	5.8420	6.0960	6.3500	6.6040	6.8580	7.1120	7.3660
3	7.6200	7.8740	8.1280	8.3820	8.6360	8.8900	9.1440	9.3980	9.6520	9.9060
4	10.160	10.414	10.668	10.922	11.176	11.430	11.684	11.938	12.192	12.446
5	12.700	12.954	13.208	13.462	13.716	13.970	14.224	14.478	14.732	14.986
6	15.240	15.494	15.748	16.002	16.256	16.510	16.764	17.018	17.272	17.526
7	17.780	18.034	18.288	18.542	18.796	19.050	19.304	19.558	19.812	20.066
8	20.320	20.574	20.828	21.082	21.336	21.590	21.844	22.098	22.352	22.606
9	22.860	23.114	23.368	23.622	23.876	24.130	24.384	24.638	24.892	25.146

LENGTHS — INCHES TO CENTIMETERS (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
10	25.400	25.654	25.908	26.162	26.416	26.670	26.924	27.178	27.432	27.686
11	27.940	28.194	28.448	28.702	28.956	29.210	29.464	29.718	29.972	30.226
12	30.480	30.734	30.988	31.242	31.496	31.750	32.004	32.258	32.512	32.766
13	33.020	33.274	33.528	33.782	34.036	34.290	34.544	34.798	35.052	35.306
14	35.560	35.814	36.068	36.322	36.576	36.830	37.084	37.338	37.592	37.846
15	38.100	38.354	38.608	38.862	39.116	39.370	39.624	39.878	40.132	40.386
16	40.640	40.894	41.148	41.402	41.656	41.910	42.164	42.418	42.672	42.926
17	43.180	43.434	43.688	43.942	44.196	44.450	44.704	44.958	45.212	45.466
18	45.720	45.974	46.228	46.482	46.736	46.990	47.244	47.498	47.752	48.006
19	48.260	48.514	48.768	49.022	49.276	49.530	49.784	50.038	50.292	50.546
20	50.800	51.054	51.308	51.562	51.816	52.070	52.324	52.578	52.832	53.086
21	53.340	53.594	53.848	54.102	54.356	54.610	54.864	55.118	55.372	55.626
22	55.880	56.134	56.388	56.642	56.896	57.150	57.404	57.658	57.912	58.166
23	58.420	58.674	58.928	59.182	59.436	59.690	59.944	60.198	60.452	60.706
24	60.960	61.214	61.468	61.722	61.976	62.230	62.484	62.738	62.992	63.246
25	63.500	63.754	64.008	64.262	64.516	64.770	65.024	65.278	65.532	65.786
26	66.040	66.294	66.548	66.802	67.056	67.310	67.564	67.818	68.072	68.326
27	68.580	68.834	69.088	69.342	69.596	69.850	70.104	70.358	70.612	70.866
28	71.120	71.374	71.628	71.882	72.136	72.390	72.644	72.898	73.152	73.406
29	73.660	73.914	74.168	74.422	74.676	74.930	75.184	75.438	75.692	75.946

LENGTHS — INCHES TO CENTIMETERS (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
30	76.200	76.454	76.708	76.962	77.216	77.470	77.724	77.978	78.232	78.486
31	78.740	78.994	79.248	79.502	79.756	80.010	80.264	80.518	80.772	81.026
32	81.280	81.534	81.788	82.042	82.296	82.550	82.804	83.058	83.312	83.566
33	83.820	84.074	84.328	84.582	84.836	85.090	85.344	85.598	85.852	86.106
34	86.360	86.614	86.868	87.122	87.376	87.630	87.884	88.138	88.392	88.646
35	88.900	89.154	89.408	89.662	89.916	90.170	90.424	90.678	90.932	91.186
36	91.440	91.694	91.948	92.202	92.456	92.710	92.964	93.218	93.472	93.726
37	93.980	94.234	94.488	94.742	94.996	95.250	95.504	95.758	96.012	96.266
38	96.520	96.774	97.028	97.282	97.536	97.790	98.044	98.298	98.552	98.806
39	99.060	99.314	99.568	99.822	100.08	100.33	100.58	100.84	101.09	101.35
40	101.60	101.85	102.11	102.36	102.62	102.87	103.12	103.38	103.63	103.89
41	104.14	104.39	104.65	104.90	105.16	105.41	105.66	105.92	106.17	106.43
42	106.68	106.93	107.19	107.44	107.70	107.95	108.20	108.46	108.71	108.97
43	109.22	109.47	109.73	109.98	110.24	110.49	110.74	111.00	111.25	111.51
44	111.76	112.01	112.27	112.52	112.78	113.03	113.28	113.54	113.79	114.05
45	114.30	114.55	114.81	115.06	115.32	115.57	115.82	116.08	116.33	116.59
46	116.84	117.09	117.35	117.60	117.86	118.11	118.36	118.62	118.87	119.13
47	119.38	119.63	119.89	120.14	120.40	120.65	120.90	121.16	121.41	121.67
48	121.92	122.17	122.43	122.68	122.94	123.19	123.44	123.70	123.95	124.21
49	124.46	124.71	124.97	125.22	125.48	125.73	125.98	126.24	126.49	126.75

LENGTHS — INCHES TO CENTIMETERS (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
50	127.00	127.25	127.51	127.76	128.02	128.27	128.52	128.78	129.03	129.29
51	129.54	129.79	130.05	130.30	130.56	130.81	131.06	131.32	131.57	131.83
52	132.08	132.33	132.59	132.84	133.10	133.35	133.60	133.86	134.11	134.37
53	134.62	134.87	135.13	135.38	135.64	135.89	136.14	136.40	136.65	136.91
54	137.16	137.41	137.67	137.92	138.18	138.43	138.68	138.94	139.19	139.45
55	139.70	139.95	140.21	140.46	140.72	140.97	141.22	141.48	141.73	141.99
56	142.24	142.49	142.75	143.00	143.26	143.51	143.76	144.02	144.27	144.53
57	144.78	145.03	145.29	145.54	145.80	146.05	146.30	146.56	146.81	147.07
58	147.32	147.57	147.83	148.08	148.34	148.59	148.84	149.10	149.35	149.61
59	149.86	150.11	150.37	150.62	150.88	151.13	151.38	151.64	151.89	152.15
60	152.40	152.65	152.91	153.16	153.42	153.67	153.92	154.18	154.43	154.69
61	154.94	155.19	155.45	155.70	155.96	156.21	156.46	156.72	156.97	157.23
62	157.48	157.73	157.99	158.24	158.50	158.75	159.00	159.26	159.51	159.77
63	160.02	160.27	160.53	160.78	161.04	161.29	161.54	161.80	162.05	162.31
64	162.56	162.81	163.07	163.32	163.58	163.83	164.08	164.34	164.59	164.85
65	165.10	165.35	165.61	165.86	166.12	166.37	166.62	166.88	167.13	167.39
66	167.64	167.89	168.15	168.40	168.66	168.91	169.16	169.42	169.67	169.93
67	170.18	170.43	170.69	170.94	171.20	171.45	171.70	171.96	172.21	172.47
68	172.72	172.97	173.23	173.48	173.74	173.99	174.24	174.50	174.75	175.01
69	175.26	175.51	175.77	176.02	176.28	176.53	176.78	177.04	177.29	177.55

LENGTHS — INCHES TO CENTIMETERS (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
70	177.80	178.05	178.31	178.56	178.82	179.07	179.32	179.58	179.83	180.09
71	180.34	180.59	180.85	181.10	181.36	181.61	181.86	182.12	182.37	182.63
72	182.88	183.13	183.39	183.64	183.90	184.15	184.40	184.66	184.91	185.17
73	185.42	185.67	185.93	186.18	186.44	186.69	186.94	187.20	187.45	187.71
74	187.96	188.21	188.47	188.72	188.98	189.23	189.48	189.74	189.99	190.25
75	190.50	190.75	191.01	191.26	191.52	191.77	192.02	192.28	192.53	192.79
76	193.04	193.29	193.55	193.80	194.06	194.31	194.56	194.82	195.07	195.33
77	195.58	195.83	196.09	196.34	196.60	196.85	197.10	197.36	197.61	197.87
78	198.12	198.37	198.63	198.88	199.14	199.39	199.64	199.90	200.15	200.41
79	200.66	200.91	201.17	201.42	201.68	201.93	202.18	202.44	202.69	202.95
80	203.20	203.45	203.71	203.96	204.22	204.47	204.72	204.98	205.23	205.49
81	205.74	205.99	206.25	206.50	206.76	207.01	207.26	207.52	207.77	208.03
82	208.28	208.53	208.79	209.04	209.30	209.55	209.80	210.06	210.31	210.57
83	210.82	211.07	211.33	211.58	211.84	212.09	212.34	212.60	212.85	213.11
84	213.36	213.61	213.87	214.12	214.38	214.63	214.88	215.14	215.39	215.65
85	215.90	216.15	216.41	216.66	216.92	217.17	217.42	217.68	217.93	218.19
86	218.44	218.69	218.95	219.20	219.46	219.71	219.96	220.22	220.47	220.73
87	220.98	221.23	221.49	221.74	222.00	222.25	222.50	222.76	223.01	223.27
88	223.52	223.77	224.03	224.28	224.54	224.79	225.04	225.30	225.55	225.81
89	226.06	226.31	226.57	226.82	227.08	227.33	227.58	227.84	228.09	228.35

LENGTHS — INCHES TO CENTIMETERS (Continued)

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
90	228.60	228.85	229.11	229.36	229.62	229.87	230.12	230.38	230.63	230.89
91	231.14	231.39	231.65	231.90	232.16	232.41	232.66	232.92	233.17	233.43
92	233.68	233.93	234.19	234.44	234.70	234.95	235.20	235.46	235.71	235.97
93	236.22	236.47	236.73	236.98	237.24	237.49	237.74	238.00	238.25	238.51
94	238.76	239.01	239.27	239.52	239.78	240.03	240.28	240.54	240.79	241.05
95	241.30	241.55	241.81	242.06	242.32	242.57	242.82	243.08	243.33	243.59
96	243.84	246.09	244.35	244.60	244.86	245.11	245.36	245.62	245.87	246.13
97	246.38	246.63	246.89	247.14	247.40	247.65	247.90	248.16	248.41	248.67
98	248.92	249.17	249.43	249.68	249.94	250.19	250.44	250.70	250.95	251.21
99	251.46	251.71	251.97	252.22	252.48	252.73	252.98	253.24	253.49	253.75

LENGTHS — METERS TO FEET

From 1 *to* 1,000 *Units*

Reduction factor: 1 meter = 3.280833333 feet

The values found in the body of the table give, in feet, the length indicated in meters at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	. . . .	3.2808	6.5617	9.8425	13.123	16.404	19.685	22.966	26.247	29.528
10	32.808	36.089	39.370	42.651	45.932	49.213	52.493	55.774	59.055	62.336
20	65.617	68.898	72.178	75.459	78.740	82.021	85.302	88.583	91.863	95.144
30	98.425	101.71	104.99	108.27	111.55	114.83	118.11	121.39	124.67	127.95
40	131.23	134.51	137.80	141.08	144.36	147.64	150.92	154.20	157.48	160.76
50	164.04	167.32	170.60	173.88	177.17	180.45	183.73	187.01	190.29	193.57
60	196.85	200.13	203.41	206.69	209.97	213.25	216.54	219.82	223.10	226.38
70	229.66	232.94	236.22	239.50	242.78	246.06	249.34	252.62	255.91	259.19
80	262.47	265.75	269.03	272.31	275.59	278.87	282.15	285.43	288.71	291.99
90	295.28	298.56	301.84	305.12	308.40	311.68	314.96	318.24	321.52	324.80

LENGTHS — METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
100	328.08	331.36	334.65	337.93	341.21	344.49	347.77	351.05	354.33	357.61
110	360.89	364.17	367.45	370.73	374.02	377.30	380.58	383.86	387.14	390.42
120	393.70	396.98	400.26	403.54	406.82	410.10	413.39	416.67	419.95	423.23
130	426.51	429.79	433.07	436.35	439.63	442.91	446.19	449.47	452.76	456.04
140	459.32	462.60	465.88	469.16	472.44	475.72	479.00	482.28	485.56	488.84
150	492.13	495.41	498.69	501.97	505.25	508.53	511.81	515.09	518.37	521.65
160	524.93	528.21	531.50	534.78	538.06	541.34	544.62	547.90	551.18	554.46
170	557.74	561.02	564.30	567.58	570.87	574.15	577.43	580.71	583.99	587.27
180	590.55	593.83	597.11	600.39	603.67	606.95	610.24	613.52	616.80	620.08
190	623.36	626.64	629.92	633.20	636.48	639.76	643.04	646.32	649.61	652.89
200	656.17	659.45	662.73	666.01	669.29	672.57	675.85	679.13	682.41	685.69
210	688.98	692.26	695.54	698.82	702.10	705.38	708.66	711.94	715.22	718.50
220	721.78	725.06	728.35	731.63	734.91	738.19	741.47	744.75	748.03	751.31
230	754.59	757.87	761.15	764.43	767.72	771.00	774.28	777.56	780.84	784.12
240	787.40	790.68	793.96	797.24	800.52	803.80	807.09	810.37	813.65	816.93
250	820.21	823.49	826.77	830.05	833.33	836.61	839.89	843.17	846.46	849.74
260	853.02	856.30	859.58	862.86	866.14	869.42	872.70	875.98	879.26	882.54
270	885.83	889.11	892.39	895.67	898.95	902.23	905.51	908.79	912.07	915.35
280	918.63	921.91	925.20	928.48	931.76	935.04	938.32	941.60	944.88	948.16
290	951.44	954.72	958.00	961.28	964.57	967.85	971.13	974.41	977.69	980.97

LENGTHS — METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
300	984.25	987.53	990.81	994.09	997.37	1,000.7	1,003.9	1,007.2	1,010.5	1,013.8
310	1,017.1	1,020.3	1,023.6	1,026.9	1,030.2	1,033.5	1,036.7	1,040.0	1,043.3	1,046.6
320	1,049.9	1,053.1	1,056.4	1,059.7	1,063.0	1,066.3	1,069.6	1,072.8	1,076.1	1,079.4
330	1,082.7	1,086.0	1,089.2	1,092.5	1,095.8	1,099.1	1,102.4	1,105.6	1,108.9	1,112.2
340	1,115.5	1,118.8	1,122.0	1,125.3	1,128.6	1,131.9	1,135.2	1,138.4	1,141.7	1,145.0
350	1,148.3	1,151.6	1,154.9	1,158.1	1,161.4	1,164.7	1,168.0	1,171.3	1,174.5	1,177.8
360	1,181.1	1,184.4	1,187.7	1,190.9	1,194.2	1,197.5	1,200.8	1,204.1	1,207.3	1,210.6
370	1,213.9	1,217.2	1,220.5	1,223.8	1,227.0	1,230.3	1,233.6	1,236.9	1,240.2	1,243.4
380	1,246.7	1,250.0	1,253.3	1,256.6	1,259.8	1,263.1	1,266.4	1,269.7	1,273.0	1,276.2
390	1,279.5	1,282.8	1,286.1	1,289.4	1,292.6	1,295.9	1,299.2	1,302.5	1,305.8	1,309.1
400	1,312.3	1,315.6	1,318.9	1,322.2	1,325.5	1,328.7	1,332.0	1,335.3	1,338.6	1,341.9
410	1,345.1	1,348.4	1,351.7	1,355.0	1,358.3	1,361.5	1,364.8	1,368.1	1,371.4	1,374.7
420	1,378.0	1,381.2	1,384.5	1,387.8	1,391.1	1,394.4	1,397.6	1,400.9	1,404.2	1,407.5
430	1,410.8	1,414.0	1,417.3	1,420.6	1,423.9	1,427.2	1,430.4	1,433.7	1,437.0	1,440.3
440	1,443.6	1,446.8	1,450.1	1,453.4	1,456.7	1,460.0	1,463.[illegible]	1,466.5	1,469.8	1,473.1
450	1,476.4	1,479.7	1,482.9	1,486.2	1,489.5	1,492.8	1,496.1	1,499.3	1,502.6	1,505.9
460	1,509.2	1,512.5	1,515.7	1,519.0	1,522.3	1,525.6	1,528.9	1,532.1	1,535.4	1,538.7
470	1,542.0	1,545.3	1,548.6	1,551.8	1,555.1	1,558.4	1,561.7	1,565.0	1,568.2	1,571.5
480	1,574.8	1,578.1	1,581.4	1,584.6	1,587.9	1,591.2	1,594.5	1,597.8	1,601.0	1,604.3
490	1,607.6	1,610.9	1,614.2	1,617.5	1,620.7	1,624.0	1,627.3	1,630.6	1,633.9	1,637.1

LENGTHS — METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
500	1,640.4	1,643.7	1,647.0	1,650.3	1,653.5	1,656.8	1,660.1	1,663.4	1,666.7	1,669.9
510	1,673.2	1,676.5	1,679.8	1,683.1	1,686.3	1,689.6	1,692.9	1,696.2	1,699.5	1,702.8
520	1,706.0	1,709.3	1,712.6	1,715.9	1,719.2	1,722.4	1,725.7	1,729.0	1,732.3	1,735.6
530	1,738.8	1,742.1	1,745.4	1,748.7	1,752.0	1,755.2	1,758.5	1,761.8	1,765.1	1,768.4
540	1,771.7	1,774.9	1,778.2	1,781.5	1,784.8	1,788.1	1,791.3	1,794.6	1,797.9	1,801.2
550	1,804.5	1,807.7	1,811.0	1,814.3	1,817.6	1,820.9	1,824.1	1,827.4	1,830.7	1,834.0
560	1,837.3	1,840.5	1,843.8	1,847.1	1,850.4	1,853.7	1,857.0	1,860.2	1,863.5	1,866.8
570	1,870.1	1,873.4	1,876.6	1,879.9	1,883.2	1,886.5	1,889.8	1,893.0	1,896.3	1,899.6
580	1,902.9	1,906.2	1,909.4	1,912.7	1,916.0	1,919.3	1,922.6	1,925.8	1,929.1	1,932.4
590	1,935.7	1,939.0	1,942.3	1,945.5	1,948.8	1,952.1	1,955.4	1,958.7	1,961.9	1,965.2
600	1,968.5	1,971.8	1,975.1	1,978.3	1,981.6	1,984.9	1,988.2	1,991.5	1,994.7	1,998.0
610	2,001.3	2,004.6	2,007.9	2,011.2	2,014.4	2,017.7	2,021.0	2,024.3	2,027.6	2,030.8
620	2,034.1	2,037.4	2,040.7	2,044.0	2,047.2	2,050.5	2,053.8	2,057.1	2,060.4	2,063.6
630	2,066.9	2,070.2	2,073.5	2,076.8	2,080.0	2,083.3	2,086.6	2,089.9	2,093.2	2,096.5
640	2,099.7	2,103.0	2,106.3	2,109.6	2,112.9	2,116.1	2,119.4	2,122.7	2,126.0	2,129.3
650	2,132.5	2,135.8	2,139.1	2,142.4	2,145.7	2,148.9	2,152.2	2,155.5	2,158.8	2,162.1
660	2,165.4	2,168.6	2,171.9	2,175.2	2,178.5	2,181.8	2,185.0	2,188.3	2,191.6	2,194.9
670	2,198.2	2,201.4	2,204.7	2,208.0	2,211.3	2,214.6	2,217.8	2,221.1	2,224.4	2,227.7
680	2,231.0	2,234.2	2,237.5	2,240.8	2,244.1	2,247.4	2,250.7	2,253.9	2,257.2	2,260.5
690	2,263.8	2,267.1	2,270.3	2,273.6	2,276.9	2,280.2	2,283.5	2,286.7	2,290.0	2,293.3

LENGTHS — METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
700	2,296.6	2,299.9	2,303.1	2,306.4	2,309.7	2,313.0	2,316.3	2,319.5	2,322.8	2,326.1
710	2,329.4	2,332.7	2,336.0	2,339.2	2,342.5	2,345.8	2,349.1	2,352.4	2,355.6	2,358.9
720	2,362.2	2,365.5	2,368.8	2,372.0	2,375.3	2,378.6	2,381.9	2,385.2	2,388.4	2,391.7
730	2,395.0	2,398.3	2,401.6	2,404.9	2,408.1	2,411.4	2,414.7	2,418.0	2,421.3	2,424.5
740	2,427.8	2,431.1	2,434.4	2,437.7	2,440.9	2,444.2	2,447.5	2,450.8	2,454.1	2,457.3
750	2,460.6	2,463.9	2,467.2	2,470.5	2,473.7	2,477.0	2,480.3	2,483.6	2,486.9	2,490.2
760	2,493.4	2,496.7	2,500.0	2,503.3	2,506.6	2,509.8	2,513.1	2,516.4	2,519.7	2,523.0
770	2,526.2	2,529.5	2,532.8	2,536.1	2,539.4	2,542.6	2,545.9	2,549.2	2,552.5	2,555.8
780	2,559.1	2,562.3	2,565.6	2,568.9	2,572.2	2,575.5	2,578.7	2,582.0	2,585.3	2,588.6
790	2,591.9	2,595.1	2,598.4	2,601.7	2,605.0	2,608.3	2,611.5	2,614.8	2,618.1	2,621.4
800	2,624.7	2,627.9	2,631.2	2,634.5	2,637.8	2,641.1	2,644.4	2,647.6	2,650.9	2,654.2
810	2,657.5	2,660.8	2,664.0	2,667.3	2,670.6	2,673.9	2,677.2	2,680.4	2,683.7	2,687.0
820	2,690.3	2,693.6	2,696.8	2,700.1	2,703.4	2,706.7	2,710.0	2,713.2	2,716.5	2,719.8
830	2,723.1	2,726.4	2,729.7	2,732.9	2,736.2	2,739.5	2,742.8	2,746.1	2,749.3	2,752.6
840	2,755.9	2,759.2	2,762.5	2,765.7	2,769.0	2,772.3	2,775,6	2,778.9	2,782.1	2,785.4
850	2,788.7	2,792.0	2,795.3	2,798.6	2,801.8	2,805.1	2,808.4	2,811.7	2,815.0	2,818.2
860	2,821.5	2,824.8	2,828.1	2,831.4	2,834.6	2,827.9	2,841.2	2,844.5	2,847.8	2,851.0
870	2,854.3	2,857.6	2,860.9	2,864.2	2,867.4	2,870.7	2,874.0	2,877.3	2,880.6	2,883.9
880	2,887.1	2,890.4	2,893.7	2,897.0	2,900.3	2,903.5	2,906.8	2,910.1	2,913.4	2,916.7
890	2,919.9	2,923.2	2,926.5	2,929.8	2,933.1	2,936.3	2,939.6	2,942.9	2,946.2	2,949.5

LENGTHS — METERS TO FEET (Continued)

	0	1	2	3	4	5	6	7	8	9
900	2,952.8	2,956.3	2,959.3	2,962.6	2,965.9	2,969.2	2,972.4	2,975.7	2,979.0	2,982.3
910	2,985.6	2,988.8	2,992.1	2,995.4	2,998.7	3,002.0	3,005.2	3,008.5	3,011.8	3,015.1
920	3,018.4	3,021.6	3,024.9	3,028.2	3,031.5	3,034.8	3,038.1	3,041.3	3,044.6	3,047.9
930	3,051.2	3,054.5	3,057.7	3,061.0	3,064.3	3,067.6	3,070.9	3,074.1	3,077.4	3,080.7
940	3,084.0	3,087.3	3,090.5	3,093.8	3,097.1	3,100.4	3,103.7	3,106.9	3,110.2	3,113.5
950	3,116.8	3,120.1	3,123.4	3,126.6	3,129.9	3,133.2	3,136.5	3,139.8	3,143.0	3,146.3
960	3,149.6	3,152.9	3,156.2	3,159.4	3,162.7	3,166.0	3,169.3	3,172.6	3,175.8	3,179.1
970	3,182.4	3,185.7	3,189.0	3,192.3	3,195.5	3,198.8	3,202.1	3,205.4	3,208.7	3,211.9
980	3,215.2	3,218.5	3,221.8	3,225.1	3,228.3	3,231.6	3,234.9	3,238.2	3,241.5	3,244.7
990	3,248.0	3,251.3	3,254.6	3,257.9	3,261.1	3,264.4	3,267.7	3,271.0	3,274.3	3,277.6

LENGTHS — FEET TO METERS

From 1 *to* 1,000 *Units*

Reduction factor: 1 foot = 0.3048006096 meter

The values found in the body of the table give, in meters, the lengths indicated in feet at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	0.30480	0.60960	0.91440	1.2192	1.5240	1.8288	2.1336	2.4384	2.7432
10	3.0480	3.3528	3.6576	3.9624	4.2672	4.5720	4.8768	5.1816	5.4864	5.7912
20	6.0960	6.4008	6.7056	7.0104	7.3152	7.6200	7.9248	8.2296	8.5344	8.8392
30	9.1440	9.4488	9.7536	10.058	10.363	10.668	10.973	11.278	11.582	11.887
40	12.192	12.497	12.802	13.106	13.411	13.716	14.021	14.326	14.630	14.935
50	15.240	15.545	15.850	16.154	16.459	16.764	17.069	17.374	17.678	17.983
60	18.288	18.593	18.898	19.202	19.507	19.812	20.117	20.422	20.726	21.031
70	21.336	21.641	21.946	22.250	22.555	22.860	23.165	23.470	23.774	24.079
80	24.384	24.689	24.994	24.298	25.603	25.908	26.213	26.518	26.822	27.127
90	27.432	27.737	28.042	28.346	28.651	28.956	29.261	29.566	29.870	30.175

LENGTHS — FEET TO METERS (Continued)

	0	1	2	3	4	5	6	7	8	9
100	30.480	30.785	31.090	31.394	31.699	32.004	32.309	32.614	32.918	33.223
110	33.528	33.833	34.138	34.442	34.747	35.052	35.357	35.662	35.966	36.271
120	36.576	36.881	37.186	37.490	37.795	38.100	38.406	38.710	39.014	39.319
130	39.624	39.929	40.234	40.538	40.843	41.148	41.453	41.758	42.062	42.367
140	42.672	42.977	43.282	43.586	43.891	44.196	44.501	44.806	45.110	45.415
150	45.720	46.025	46.330	46.634	46.939	47.244	47.549	47.854	48.169	48.463
160	48.768	49.073	49.378	49.683	49.987	50.292	50.697	50.902	51.207	51.511
170	51.816	52.121	52.426	52.731	53.035	53.340	53.645	53.950	54.255	54.559
180	54.864	55.169	55.474	55.779	56.083	56.388	56.693	56.998	57.303	57.607
190	57.912	58.217	58.522	58.827	59.131	59.436	59.741	60.046	60.351	60.655
200	60.960	61.265	61.570	61.875	62.179	62.484	62.789	63.094	63.399	63.703
210	64.008	64.313	64.618	64.923	65.227	65.532	65.837	66.142	66.447	66.751
220	67.056	67.361	67.666	67.971	68.275	68.580	68.885	69.190	69.495	69.799
230	70.104	70.409	70.714	71.019	71.323	71.628	71.933	72.238	72.543	72.847
240	73.152	73.457	73.762	74.067	74.371	74.676	74.981	75.286	75.591	75.895
250	76.200	76.505	76.810	77.115	77.419	77.724	78.029	78.334	78.639	78.943
260	79.248	79.553	79.858	80.163	80.467	80.772	81.077	81.382	81.687	81.991
270	82.296	82.601	82.906	83.211	83.515	83.820	84.125	84.430	84.735	85.039
280	85.344	85.649	85.954	86.259	86.563	86.868	87.173	87.478	87.783	88.087
290	88.392	88.697	89.002	89.307	89.611	89.916	90.221	90.526	90.831	91.135

LENGTHS — FEET TO METERS (Continued)

	0	1	2	3	4	5	6	7	8	9
300	91.440	91.745	92.050	92.355	92.659	92.964	93.269	93.574	93.879	94.183
310	94.488	94.793	95.098	95.403	95.707	96.012	96.317	96.622	96.927	97.231
320	97.536	97.841	98.146	98.451	98.755	99.060	99.365	99.670	99.975	100.28
330	100.58	100.89	101.19	101.50	101.80	102.11	102.41	102.72	103.02	103.33
340	103.63	103.94	104.24	104.55	104.85	105.16	105.46	105.77	106.07	106.38
350	106.68	106.99	107.29	107.59	107.90	108.20	108.51	108.81	109.12	109.42
360	109.73	110.03	110.34	110.64	110.95	111.25	111.56	111.86	112.17	112.47
370	112.78	113.08	113.39	113.69	114.00	114.30	114.61	114.91	115.21	115.52
380	115.82	116.13	116.43	116.74	117.04	117.35	117.65	117.96	118.26	118.57
390	118.87	119.18	119.48	119.79	120.09	120.40	120.70	121.01	121.31	121.62
400	121.92	122.23	122.53	122.83	123.14	123.44	123.75	124.05	124.36	124.66
410	124.97	125.27	125.58	125.88	126.19	126.49	126.80	127.10	127.41	127.71
420	128.02	128.32	128.63	128.93	129.24	129.54	129.85	130.15	130.45	130.76
430	131.06	131.37	131.67	131.98	132.28	132.59	132.89	133.20	133.50	133.81
440	134.11	134.42	134.72	135.03	135.33	135.64	135.94	136.25	136.55	136.86
450	137.16	137.47	137.77	138.07	138.38	138.68	138.99	139.29	139.60	139.90
460	140.21	140.51	140.82	141.12	141.43	141.73	142.04	142.34	142.65	142.95
470	143.26	143.56	143.87	144.17	144.48	144.78	145.09	145.39	145.69	146.00
480	146.30	146.61	146.91	147.22	147.52	147.83	148.13	148.44	148.74	149.05
490	149.35	149.56	149.96	150.27	150.57	150.88	151.18	151.49	151.79	152.10

LENGTHS — FEET TO METERS (Continued)

	0	1	2	3	4	5	6	7	8	9
500	152.40	152.71	153.01	153.31	153.62	153.92	154.23	154.53	154.84	155.14
510	155.45	155.75	156.06	156.36	156.57	156.97	157.28	157.58	157.89	158.19
520	158.50	158.80	159.11	159.41	159.72	160.02	160.33	160.63	160.93	161.24
530	161.54	161.85	162.15	162.46	162.76	163.07	163.37	163.68	163.98	164.29
540	164.59	164.90	165.20	165.51	165.81	166.12	166.42	166.73	167.03	167.34
550	167.64	167.95	168.25	168.55	168.86	169.16	169.47	169.77	170.08	170.38
560	170.69	170.99	171.30	171.60	171.91	172.21	172.52	172.82	173.13	173.43
570	173.74	174.04	174.35	174.65	174.96	175.26	175.57	175.87	176.17	176.48
580	176.78	177.09	177.39	177.70	178.00	178.31	178.61	178.92	179.22	179.53
590	179.83	180.14	180.44	180.75	181.05	181.36	181.66	181.97	182.27	182.58
600	182.88	183.19	183.49	183.79	184.10	184.40	184.71	185.01	185.32	185.62
610	185.93	186.23	186.54	186.84	187.15	187.45	187.76	188.06	188.37	188.67
620	188.98	189.28	189.59	189.89	190.20	190.50	190.81	191.11	191.41	191.72
630	192.02	192.33	192.63	192.94	193.24	193.55	193.85	194.16	194.46	194.77
640	195.07	195.38	195.68	195.99	196.29	196.60	196.90	197.21	197.51	197.82
650	198.12	198.43	198.73	199.03	199.34	199.64	199.95	200.25	200.56	200.86
660	201.17	201.47	201.78	202.08	202.39	202.69	203.00	203.30	203.61	203.91
670	204.22	204.52	204.83	205.13	205.44	205.74	206.05	206.35	206.65	206.96
680	207.26	207.57	207.87	208.18	208.48	208.78	209.09	209.40	209.70	210.01
690	210.31	210.62	210.92	211.23	211.53	211.84	212.14	212.45	212.75	213.06

LENGTHS — FEET TO METERS (Continued)

	0	1	2	3	4	5	6	7	8	9
700	213.36	213.67	213.97	214.27	214.58	214.88	215.19	215.49	215.80	216.10
710	216.41	216.71	217.02	217.32	217.63	217.93	218.24	218.54	218.85	219.15
720	219.46	219.76	220.07	220.37	220.68	220.98	221.29	221.59	221.89	222.20
730	222.50	222.81	223.11	223.42	223.72	224.03	224.33	224.64	224.94	225.25
740	225.55	225.86	226.16	226.47	226.77	227.08	227.38	227.69	227.99	228.30
750	228.60	228.91	229.21	229.51	229.82	230.12	230.43	230.73	231.04	231.34
760	231.65	231.95	232.26	232.56	232.87	233.17	233.48	233.78	234.09	234.39
770	234.70	235.00	235.31	231.61	231.92	236.22	236.53	236.83	237.13	237.44
780	237.74	238.05	238.35	238.66	238.96	239.27	239.67	239.88	240.18	240.49
790	240.79	241.10	241.40	241.71	242.01	242.32	242.62	242.93	243.23	243.54
800	243.84	244.15	244.45	244.75	245.06	245.36	245.67	245.97	246.28	246.58
810	246.89	247.19	247.50	247.80	248.11	248.41	248.72	249.02	249.33	249.63
820	249.94	250.24	250.55	250.85	251 16	251.46	251.77	252.07	252.37	252.68
830	252.98	253.29	253.59	253.90	254.20	254.51	254.81	255.12	255.42	255.73
840	256.03	256.34	256.64	256.95	257.25	257.56	257.86	258.17	258.47	258.78
850	259.08	259.39	259.69	259.99	260.30	260.60	260.91	261.21	261.52	261.82
860	262.13	262.43	262.74	263.04	263.35	263.65	263.96	264.26	264.57	264.87
870	265.18	265.48	265.79	266.09	266.40	266.70	267.01	267.31	267.61	267.92
880	268.22	268.53	268.83	269.14	269.44	269.75	270.05	270.36	270.66	270.97
890	271.27	271.57	271.88	272.19	272.49	272.80	273.10	273.41	273.71	274.02

LENGTHS — FEET TO METERS (Continued)

	0	1	2	3	4	5	6	7	8	9
900	274.32	274.63	274.93	275.23	275.54	275.84	276.15	276.45	276.76	277.06
910	277.37	277.67	277.98	278.28	278.59	278.89	279.20	279.50	279.81	280.11
920	280.42	280.72	281.03	281.33	281.64	281.94	282.25	282.55	282.85	283.16
930	283.46	283.77	284.07	284.38	284.68	284.99	285.29	285.60	285.90	286.21
940	286.51	286.82	287.12	287.43	287.73	288.04	288.34	288.65	288.95	289.26
950	289.56	289.87	289.17	290.47	290.78	291.08	291.39	291.69	292.00	292.30
960	292.61	292.91	293.22	293.52	293.83	294.13	294.44	294.74	295.05	295.35
970	295.66	295.96	296.27	296.57	296.88	297.18	297.49	297.79	298.10	298.40
980	298.70	299.01	299.31	299.62	299.92	300.23	300.53	300.84	301.14	301.45
990	301.75	302.06	302.36	302.67	302.97	303.28	303.58	303.89	304.19	304.50

LENGTHS — KILOMETERS TO MILES

From 1 *to* 1,000 *Units*

Reduction factor: 1 kilometer = 0.6213699495 mile

Values found in the body of the table give, in miles, the length indicated in kilometers at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	0.62137	1.2427	1.8641	2.4855	3.1069	3.7282	4.3496	4.9710	5.5923
10	6.2137	6.8351	7.4564	8.0778	8.6992	9.3206	9.9419	10.563	11.185	11.806
20	12.427	13.049	13.670	14.292	14.913	15.534	16.156	16.777	17.398	18.020
30	18.641	19.262	19.884	20.505	21.127	21.748	22.369	22.991	23.612	24.233
40	24.855	25.476	26.098	26.719	27.340	27.962	28.583	29.204	29.826	30.447
50	31.069	31.690	32.311	32.933	33.554	34.175	34.797	35.418	36.039	36.661
60	37.282	37.904	38.525	39.146	39.768	40.389	41.010	41.632	42.253	42.875
70	43.496	44.117	44.739	45.360	45.981	46.603	47.224	47.845	48.467	49.088
80	49.710	50.331	50.952	51.574	52.195	52.816	53.438	54.059	54.681	55.302
90	55.923	56.945	57.166	57.787	58.409	59.030	59.652	60.273	60.894	61.516

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
100	62.137	62.758	63.380	64.001	64.622	65.244	65.865	66.487	67.108	67.729
110	68.351	68.972	69.593	70.215	70.836	71.458	72.079	72.700	73.322	73.943
120	74.564	75.186	75.807	76.429	77.050	77.671	78.293	78.914	79.535	80.157
130	80.778	81.399	82.021	82.642	83.264	83.885	84.506	85.128	85.749	86.370
140	86.992	87.613	88.235	88.856	89.477	90.099	90.720	91.341	91.963	92.584
150	93.205	93.827	94.448	95.070	95.691	96.312	96.934	97.555	98.176	98.798
160	99.419	100.04	100.66	101.28	101.90	102.53	103.15	103.77	104.39	105.01
170	105.63	106.25	106.88	107.50	108.12	108.74	109.36	109.98	110.60	111.23
180	111.85	112.47	113.09	113.71	114.33	114.95	115.57	116.20	116.82	117.44
190	118.06	118.68	119.30	119.92	120.55	121.17	121.79	122.41	123.03	123.65
200	124.27	124.90	125.52	126.14	126.76	127.38	128.00	128.62	129.24	129.87
210	130.49	131.11	131.73	132.35	132.97	133.59	134.22	134.84	135.46	136.08
220	136.70	137.32	137.94	138.57	139.19	139.81	140.43	141.05	141.67	142.29
230	142.92	143.54	144.16	144.78	145.40	146.02	146.64	147.26	147.89	148.51
240	149.13	149.75	150.37	150.99	151.61	152.24	152.86	153.48	154.10	154.72
250	155.34	155.96	156.59	157.21	157.83	158.45	159.07	159.69	160.31	160.93
260	161.56	162.18	162.80	163.42	164.04	164.66	165.28	165.91	166.53	167.15
270	167.77	168.39	169.01	169.63	170.26	170.88	171.50	172.12	172.74	173.36
280	173.98	174.60	175.23	175.85	176.47	177.09	177.71	178.33	178.95	179.58
290	180.20	180.82	181.44	182.06	182.68	183.30	183.93	184.55	185.17	185.79

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
300	186.41	187.03	187.65	188.28	188.90	189.52	190.14	190.76	191.38	192.00
310	192.62	193.25	193.87	194.49	195.11	195.73	196.35	196.97	197.60	198.22
320	198.84	199.46	200.08	200.70	201.32	201.95	202.57	203.19	203.81	204.43
330	205.05	205.67	206.29	206.92	207.54	208.16	208.78	209.40	210.02	210.64
340	211.27	211.89	212.51	213.13	213.75	214.37	214.99	215.62	216.24	216.86
350	217.48	218.10	218.72	219.34	219.96	220.59	221.21	221.83	222.45	223.07
360	223.69	224.31	224.94	225.56	226.18	226.80	227.42	228.04	228.66	229.29
370	229.91	230.53	231.15	231.77	232.39	233.01	233.64	234.26	234.88	235.50
380	236.12	236.74	237.36	237.98	238.61	239.23	239.85	240.47	241.09	241.71
390	242.33	242.96	243.58	244.20	244.82	245.44	246.06	246.68	247.31	247.93
400	248.55	249.17	249.79	250.41	251.03	251.65	252.28	252.90	253.52	254.14
410	254.76	255.38	256.00	256.63	257.25	257.87	258.49	259.11	259.73	260.35
420	260.98	261.60	262.22	262.84	263.46	264.08	264.70	265.32	265.95	266.57
430	267.19	267.81	268.43	269.05	269.67	270.30	270.92	271.54	272.16	272.78
440	273.40	274.02	274.65	275.27	275.89	276.51	277.13	277.75	278.37	279.00
450	279.62	280.24	280.86	281.48	282.10	282.72	283.34	283.97	284.59	285.21
460	285.83	286.45	287.07	287.69	288.32	288.94	289.56	290.18	290.80	291.42
470	292.04	292.67	293.29	293.91	294.53	295.15	295.77	296.39	297.01	297.64
480	298.26	298.88	299.50	300.12	300.74	301.36	301.99	302.61	303.23	303.85
490	304.47	305.09	305.71	306.34	306.96	307.58	308.20	308.82	309.44	310.06

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
500	310.68	311.31	311.93	312.55	313.17	313.79	314.41	315.03	315.66	316.28
510	316.90	317.52	318.14	318.76	319.38	320.01	320.63	321.35	321.87	322.49
520	323.11	323.73	324.36	324.98	325.60	326.22	326.84	327.46	328.08	328.70
530	329.33	329.95	330.57	331.19	331.81	332.43	333.05	333.68	334.30	334.92
540	335.54	336.16	336.78	337.40	338.03	338.65	339.27	339.89	340.51	341.13
550	341.75	342.37	343.00	343.62	344.24	344.86	345.48	346.10	346.72	347.35
560	347.97	348.59	349.21	349.83	350.45	351.07	351.70	352.32	352.94	353.56
570	354.18	354.80	355.42	356.04	356.67	357.29	357.91	358.53	359.15	359.77
580	360.39	361.02	361.64	362.26	262.88	363.50	364.12	364.74	365.37	365.99
590	366.61	367.23	367.85	368.47	369.09	369.72	370.34	370.96	371.58	372.20
600	372.82	373.44	374.06	374.69	375.31	375.93	376.55	377.17	377.79	378.41
610	379.04	379.66	380.28	380.90	381.52	382.14	382.76	383.39	384.01	384.63
620	385.25	385.87	386.49	387.11	387.73	388.36	388.98	389.60	390.22	390.84
630	391.46	392.08	392.71	393.33	393.95	394.57	395.19	395.81	396.43	397.06
640	397.68	398.30	398.92	399.54	400.16	400.78	401.40	402.03	402.65	403.27
650	403.89	404.51	405.13	405.75	406.38	407.00	407.62	408.24	408.86	409.48
660	410.10	410.73	411.35	411.97	412.59	413.21	413.83	414.45	415.08	415.70
670	416.32	416.94	417.56	418.18	418.80	419.42	420.05	420.67	421.29	421.91
680	422.53	423.15	423.77	424.40	425.02	425.64	426.26	426.88	427.50	428.12
690	428.75	429.37	429.99	430.61	431.23	431.85	432.47	433.09	433.72	434.34

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
700	434.96	435.58	436.20	436.82	437.44	438.07	438.69	439.31	439.93	440.55
710	441.17	441.79	442.42	443.04	443.66	444.28	444.90	445.52	446.14	446.76
720	447.39	448.01	448.63	449.25	449.87	450.49	451.11	451.74	452.36	452.98
730	453.60	454.22	454.84	455.46	456.09	456.71	457.33	457.95	458.57	459.19
740	459.81	460.44	461.06	461.68	462.30	462.92	463.54	464.16	464.78	465.41
750	466.03	466.65	467.27	467.89	468.51	469.13	469.76	470.38	471.00	471.62
760	472.24	472.86	473.48	474.11	474.73	475.35	475.97	476.59	477.21	477.83
770	478.45	479.08	479.70	480.32	480.94	481.56	482.18	482.80	483.43	484.05
780	484.67	485.29	485.91	486.53	487.15	487.78	488.40	489.02	489.64	490.26
790	490.88	491.50	492.13	492.75	493.37	493.99	494.61	495.23	495.85	496.47
800	497.10	497.72	498.34	498.96	499.58	500.20	500.82	501.45	502.07	502.69
810	503.31	503.93	504.55	505.17	505.80	506.42	507.04	507.66	508.28	508.90
820	509.52	510.14	510.77	511.39	512.01	512.63	513.25	513.87	514.49	515.12
830	515.74	516.36	516.98	517.60	518.22	518.84	519.47	520.09	520.71	521.33
840	521.95	522.57	523.19	523.81	524.44	525.06	525.68	526.30	526.92	527.54
850	528.16	528.79	529.41	530.03	530.65	531.27	531.89	532.51	533.14	533.76
860	534.38	535.00	535.62	536.24	536.86	537.49	538.11	538.73	539.35	539.97
870	540.59	541.21	541.83	542.46	543.08	543.70	544.32	544.94	545.56	546.18
880	546.81	547.43	548.05	548.67	549.29	549.91	550.53	551.16	551.78	552.40
890	553.02	553.64	554.26	554.88	555.50	556.13	556.75	557.37	557.99	558.61

LENGTHS — KILOMETERS TO MILES (Continued)

	0	1	2	3	4	5	6	7	8	9
900	559.23	559.85	560.48	561.10	561.72	562.34	562.96	563.58	564.20	564.83
910	565.45	566.07	566.69	567.31	567.93	568.55	569.17	569.80	570.42	571.04
920	571.66	572.28	572.90	573.52	574.15	574.77	575.39	576.01	576.63	577.25
930	577.87	578.50	579.12	579.74	580.35	580.98	581.60	582.22	582.85	583.47
940	584.09	584.71	585.33	585.95	586.57	587.19	587.82	588.44	589.06	589.68
950	590.30	590.92	591.54	592.17	592.79	593.41	594.03	594.65	595.27	595.89
960	596.52	597.14	597.76	598.38	599.98	599.62	600.24	600.86	601.49	602.11
970	602.73	603.35	603.97	604.59	605.21	605.84	606.46	607.08	607.70	608.32
980	608.94	609.56	610.19	610.81	611.43	612.05	612.67	613.29	613.91	614.53
990	615.16	615.78	616.40	617.02	617.64	618.26	618.88	619.51	620.13	620.75

LENGTHS — MILES TO KILOMETERS

From 1 *to* 1,000 *Units*

Reduction factor: 1 mile = 1.609347219 kilometers

Values found in the body of the table give, in kilometers, the length indicated in miles at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	1.6094	3.2187	4.8280	6.4374	8.0467	9.6561	11.265	12.875	14.484
10	16.094	17.703	19.312	20.922	22.531	24.140	25.750	27.359	28.968	30.578
20	32.187	33.796	35.406	37.015	38.624	40.234	41.843	43.452	45.062	46.671
30	48.280	49.890	51.499	53.109	54.718	56.327	57.937	59.546	61.155	62.765
40	64.374	65.983	67.593	69.202	70.811	72.421	74.030	75.639	77.249	78.858
50	80.467	82.077	83.686	85.295	86.905	88.514	90.123	91.733	93.342	94.952
60	96.561	98.170	99.780	101.39	103.00	104.61	106.22	107.83	109.44	111.05
70	112.65	114.26	115.87	117.48	119.09	120.70	122.31	123.92	125.53	127.14
80	128.75	130.36	131.97	133.58	135.19	136.79	138.40	140.01	141.62	143.23
90	144.84	146.45	148.06	149.67	151.28	152.89	154.50	156.11	157.72	159.33

LENGTHS — MILES TO KILOMETERS (Continued)

	0	1	2	3	4	5	6	7	8	9
100	160.94	162.54	164.15	165.76	167.37	168.98	170.59	172.20	173.81	175.42
110	177.03	178.64	180.25	181.86	183.47	185.07	186.68	188.29	189.90	191.51
120	193.12	194.73	196.34	197.95	199.56	201.17	202.78	204.39	206.00	207.61
130	209.22	210.82	212.43	214.04	215.65	217.26	218.87	220.48	222.09	223.70
140	225.31	226.92	228.53	230.14	231.75	233.36	234.96	236.57	238.18	239.79
150	241.40	243.01	244.62	246.23	247.84	249.45	251.06	252.67	254.28	255.89
160	257.50	259.10	260.71	262.32	263.93	265.54	267.15	268.76	270.37	271.98
170	273.59	275.20	276.81	278.42	280.03	281.64	283.25	284.85	286.46	288.07
180	289.68	291.29	292.90	294.51	296.12	297.73	299.34	300.95	302.56	304.17
190	305.78	307.39	308.99	310.60	312.21	313.82	315.43	317.04	318.65	320.26
200	321.87	323.48	325.09	326.70	328.31	329.92	331.53	333.13	334.74	336.35
210	337.96	339.57	341.18	342.79	344.40	346.01	347.62	349.23	350.84	352.45
220	354.06	355.67	357.28	358.88	360.49	362.10	363.71	365.32	366.93	368.54
230	370.15	371.76	373.37	374.98	376.59	378.20	379.81	381.42	383.02	384.63
240	386.24	387.86	389.46	391.07	392.68	394.29	395.90	397.51	399.12	300.73
250	402.34	403.95	405.56	407.16	408.77	410.38	411.99	413.60	415.21	416.82
260	418.43	420.04	421.65	423.26	424.87	426.48	428.09	429.70	431.31	432.91
270	434.52	436.13	437.74	439.35	440.96	442.57	444.18	445.79	447.40	449.01
280	450.62	452.27	453.84	455.45	457.05	458.66	460.27	461.88	463.49	465.10
290	466.71	468.32	469.93	471.54	473.15	474.76	476.37	477.98	479.59	481.19

LENGTHS — MILES TO KILOMETERS (Continued)

	0	1	2	3	4	5	6	7	8	9
300	482.80	484.41	486.02	487.63	489.24	490.85	492.46	494.07	495.68	497.29
310	498.90	500.51	502.12	503.73	505.34	506.94	508.55	510.16	511.77	513.38
320	514.99	516.60	518.21	519.82	521.43	523.04	524.65	526.26	527.87	529.48
330	531.08	532.69	534.30	535.91	537.52	539.13	540.74	542.35	543.96	545.57
340	547.18	548.79	550.40	552.01	553.62	555.22	556.83	558.44	560.05	561.66
350	563.27	564.88	566.49	568.10	569.71	571.32	572.93	574.54	576.15	577.76
360	579.37	580.97	582.58	584.19	585.80	587.41	589.02	590.63	592.24	593.85
370	595.46	597.07	598.68	600.29	601.90	603.51	605.12	606.72	608.33	609.94
380	611.55	613.16	614.77	616.38	317.99	619.60	621.21	622.82	624.43	626.04
390	627.65	629.25	630.86	632.47	634.08	635.69	637.30	638.91	640.52	642.13
400	643.74	645.35	646.96	648.57	650.18	651.79	653.40	655.00	656.61	658.22
410	659.83	661.44	663.05	664.66	666.27	667.88	669.49	671.10	672.71	674.32
420	675.93	677.54	679.14	680.75	682.36	683.97	685.58	687.19	688.80	690.41
430	692.02	693.63	695.24	696.85	698.46	700.07	701.68	703.28	704.89	706.50
440	708.11	709.72	711.33	712.94	714.55	716.16	717.77	719.38	720.99	722.60
450	724.21	725.82	727.42	729.03	730.64	732.25	733.86	735.47	737.08	738.69
460	740.30	741.91	743.52	745.13	746.74	748.35	749.96	751.57	753.17	754.78
470	756.39	758.00	759.61	761.22	762.83	764.44	766.05	767.66	769.27	770.88
480	772.49	774.10	775.71	777.31	778.92	780.53	782.14	783.75	785.36	786.97
490	788.58	790.19	791.80	793.41	795.02	796.63	798.24	799.85	801.45	803.06

LENGTHS—MILES TO KILOMETERS (Continued)

	0	1	2	3	4	5	6	7	8	9
500	804.67	806.28	807.89	809.50	811.11	812.72	814.33	815.94	817.55	819.16
510	820.77	822.38	823.99	825.60	827.20	828.81	830.42	832.03	833.64	835.25
520	836.86	838.47	840.08	841.69	843.30	844.91	846.52	848.13	849.74	851.34
530	852.95	854.56	856.17	857.78	859.39	861.00	862.61	864.22	865.83	867.44
540	869.05	870.66	872.27	873.88	875.48	877.09	878.70	880.31	881.92	883.53
550	885.14	886.75	888.36	889.97	891.58	893.19	894.80	896.41	898.02	899.63
560	901.23	902.84	904.45	906.06	907.67	909.28	910.89	912.50	914.11	915.72
570	917.33	918.94	920.55	922.16	923.77	925.37	926.98	928.59	930.20	931.81
580	933.42	935.03	936.64	938.25	939.86	941.47	943.08	944.69	946.30	947.91
590	949.51	951.12	952.73	954.34	955.95	957.56	959.17	960.78	962.39	964.00
600	965.61	967.22	968.83	970.44	972.05	973.66	975.26	976.87	978.48	980.09
610	981.70	983.31	984.92	986.53	988.14	989.75	991.36	992.97	994.58	996.19
620	997.80	999.40	1,001.0	1,002.6	1,004.2	1,005.8	1,007.5	1,009.1	1,010.7	1,012.3
630	1,013.9	1,015.5	1,017.1	1,018.7	1,020.3	1,021.9	1,023.5	1,025.2	1,026.8	1,028.4
640	1,030.0	1,031.6	1,033.2	1,034.8	1,036.4	1,038.0	1,039.6	1,041.2	1,042.9	1,044.5
650	1,046.1	1,047.7	1,049.3	1,050.9	1,052.5	1,054.1	1,055.7	1,057.3	1,059.0	1,060.6
660	1,062.2	1,063.8	1,065.4	1,067.0	1,068.6	1,070.2	1,071.8	1,073.4	1,075.0	1,076.7
670	1,078.3	1,079.9	1,081.5	1,083.1	1,084.7	1,086.3	1,087.9	1,089.5	1,091.1	1,092.7
680	1,094.4	1,096.0	1,097.6	1,099.2	1,100.8	1,102.4	1,104.0	1,105.6	1,107.2	1,108.8
690	1,110.4	1,112.1	1,113.7	1,115.3	1,116.9	1,118.5	1,120.1	1,121.7	1,123.3	1,124.9

LENGTHS — MILES TO KILOMETERS (Continued)

	0	1	2	3	4	5	6	7	8	9
700	1,126.5	1,128.2	1,129.8	1,131.4	1,133.0	1,134.6	1,136.2	1,137.8	1,139.4	1,141.0
710	1,142.6	1,144.2	1,145.9	1,147.5	1,149.1	1,150.7	1,152.3	1,153.9	1,155.5	1,157.1
720	1,158.7	1,160.3	1,161.9	1,163.6	1,165.2	1,166.8	1,168.4	1,170.0	1,171.6	1,173.2
730	1,174.8	1,176.4	1,178.0	1,179.7	1,181.3	1,182.9	1,184.5	1,186.1	1,187.7	1,189.3
740	1,190.9	1,192.5	1,194.1	1,195.7	1,197.4	1,199.0	1,200.6	1,202.2	1,203.8	1,205.4
750	1,207.0	1,208.6	1,210.2	1,211.8	1,213.4	1,215.1	1,216.7	1,218.3	1,219.9	1,221.5
760	1,223.1	1,224.7	1,226.3	1,227.9	1,229.5	1,231.2	1,232.8	1,234.4	1,236.0	1,237.6
770	1,239.2	1,240.8	1,242.4	1,244.0	1,245.6	1,247.2	1,248.9	1,250.5	1,252.1	1,253.7
780	1,255.3	1,256.9	1,258.5	1,260.1	1,261.7	1,263.3	1,264.9	1,266.6	1,268.2	1,269.8
790	1,271.4	1,273.0	1,274.6	1,276.2	1,277.8	1,279.4	1,281.0	1,282.6	1,284.3	1,285.9
800	1,287.5	1,289.1	1,290.7	1,292.3	1,293.9	1,295.5	1,297.1	1,298.7	1,300.4	1,302.0
810	1,303.6	1,305.2	1,306.8	1,308.4	1,310.0	1,311.6	1,313.2	1,314.8	1,316.4	1,318.1
820	1,319.7	1,321.3	1,322.9	1,324.5	1,326.1	1,327.7	1,329.3	1,330.9	1,332.5	1,334.1
830	1,335.8	1,337.4	1,339.0	1,340.6	1,342.2	1,343.8	1,345.4	1,347.0	1,348.6	1,350.2
840	1,351.9	1,353.5	1,355.1	1,356.7	1,358.3	1,359.9	1,361.5	1,363.1	1,364.7	1,366.3
850	1,367.9	1,369.6	1,371.2	1,372.7	1,374.4	1,376.0	1,377.6	1,379.2	1,380.8	1,382.4
860	1,384.0	1,385.6	1,387.3	1,388.9	1,390.5	1,392.1	1,393.7	1,395.3	1,396.9	1,398.5
870	1,400.1	1,401.7	1,403.4	1,405.0	1,406.6	1,408.2	1,409.8	1,411.4	1,413.0	1,414.6
880	1,416.2	1,417.8	1,419.4	1,421.1	1,422.7	1,424.3	1,425.9	1,427.5	1,429.1	1,430.7
890	1,432.3	1,433.9	1,435.5	1,437.1	1,438.8	1,440.4	1,442.0	1,443.6	1,445.2	1,446.8

LENGTHS — MILES TO KILOMETERS (Continued)

	0	1	2	3	4	5	6	7	8	9
900	1,448.4	1,450.0	1,451.6	1,453.2	1,454.8	1,456.5	1,458.1	1,459.7	1,461.3	1,462.9
910	1,464.5	1,466.1	1,467.7	1,469.3	1,470.9	1,472.6	1,474.2	1,475.8	1,477.4	1,479.0
920	1,480.6	1,482.2	1,483.8	1,485.4	1,487.0	1,488.6	1,490.3	1,491.9	1,493.5	1,495.1
930	1,496.7	1,498.3	1,499.9	1,501.5	1,503.1	1,504.7	1,506.3	1,508.0	1,509.6	1,511.2
940	1,512.8	1,514.4	1,516.0	1,517.6	1,519.2	1,520.8	1,522.4	1,524.1	1,525.7	1,527.3
950	1,528.8	1,530.5	1,532.1	1,533.7	1,535.3	1,536.9	1,538.5	1,540.1	1,541.8	1,543.4
960	1,545.0	1,546.6	1,548.2	1,549.8	1,551.4	1,553.0	1,554.6	1,556.2	1,557.8	1,559.5
970	1,561.1	1,562.7	1,564.3	1,565.9	1,567.5	1,569.1	1,570.7	1,572.3	1,573.9	1,575.6
980	1,577.2	1,578.8	1,580.4	1,582.0	1,583.6	1,585.2	1,586.8	1,588.4	1,590.0	1,591.6
990	1,593.3	1,594.9	1,596.5	1,598.1	1,599.7	1,601.3	1,602.9	1,604.5	1,606.1	1,606.7

CAPACITIES — LITERS TO LIQUID QUARTS

From 1 *to* 1,000 *Units*

Reduction factor: 1 liter = 1.056681869 liquid quarts

The values found in the body of the table give, in liquid quarts, the capacities indicated in liters at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	1.0567	2.1134	3.1701	4.2267	5.2834	6.3401	7.3968	8.4535	9.5101
10	10.567	11.624	12.680	13.737	14.794	15.850	16.907	17.964	19.020	20.077
20	21.134	22.190	23.247	24.304	25.360	26.417	27.474	28.530	29.587	30.644
30	31.700	32.757	33.814	34.871	35.927	36.984	38.041	39.097	40.154	41.211
40	42.267	43.324	44.381	45.437	46.494	47.551	48.607	49.664	50.721	51.777
50	52.834	53.891	54.947	56.004	57.061	58.118	59.174	60.231	61.288	62.344
60	63.401	64.458	65.514	66.571	67.628	68.684	69.741	70.798	71.854	72.911
70	73.968	75.024	76.081	77.138	78.194	79.251	80.308	81.365	82.421	83.478
80	84.535	85.591	86.648	87.705	88.761	89.818	90.875	91.931	92.988	94.045
90	95.101	96.158	97.215	98.271	99.328	100.38	101.44	102.50	103.55	104.61

CAPACITIES — LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
100	105.67	106.72	107.78	108.84	109.89	110.95	112.01	113.06	114.12	115.18
110	116.24	117.29	118.35	119.41	120.46	121.52	122.58	123.63	124.69	125.75
120	126.80	127.86	128.92	129.97	131.03	132.09	133.14	134.20	135.26	136.31
130	137.37	138.43	139.48	140.54	141.60	142.65	143.71	144.77	145.82	146.88
140	147.94	148.99	150.05	151.11	152.16	153.22	154.28	155.33	156.39	157.45
150	158.50	159.56	160.62	161.67	162.73	163.79	164.84	165.90	166.96	168.01
160	169.07	170.13	171.18	172.24	173.30	174.35	175.41	176.47	177.52	178.58
170	179.64	180.69	181.75	182.81	183.86	184.92	185.98	187.03	188.09	189.15
180	190.20	191.26	192.32	193.37	194.43	195.49	196.54	197.60	198.66	199.71
190	200.77	201.83	202.88	203.94	205.00	206.05	207.11	208.17	209.22	210.28
200	211.34	212.39	213.45	214.51	215.56	216.62	217.68	218.73	219.79	220.85
210	221.90	222.96	224.02	225.07	226.13	227.19	228.24	229.30	230.36	231.41
220	232.47	233.53	234.58	235.64	236.70	237.75	238.81	239.87	240.92	241.98
230	243.04	244.09	245.15	246.21	247.26	248.32	249.38	250.43	251.49	252.55
240	253.60	254.66	255.72	256.77	257.83	258.89	259.94	261.00	262.06	263.11
250	264.17	265.23	266.28	267.34	268.40	269.45	270.51	271.57	272.62	273.68
260	274.74	275.79	276.85	277.91	278.96	280.02	281.08	282.13	283.19	284.25
270	285.30	286.36	287.42	288.47	289.53	290.59	291.64	292.70	293.76	294.81
280	295.87	296.93	297.98	299.04	300.10	301.15	302.21	303.27	304.32	305.38
290	306.44	307.49	308.55	309.61	310.66	311.72	312.78	313.83	314.89	315.95

CAPACITIES — LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
300	317.00	318.06	319.12	320.17	321.23	322.29	323.34	324.40	325.46	326.51
310	327.57	328.63	329.68	330.74	331.80	332.85	333.91	334.97	336.02	337.08
320	338.14	339.19	340.25	341.31	342.36	343.42	344.48	345.53	346.59	347.65
330	348.71	349.76	350.82	351.88	352.93	353.99	355.05	356.10	357.16	358.22
340	359.27	360.33	361.39	362.44	363.50	364.56	365.61	366.67	367.73	368.78
350	369.84	370.90	371.95	373.01	374.07	375.12	376.18	377.24	378.29	379.35
360	380.41	381.46	382.52	383.58	384.63	385.69	386.75	387.80	388.86	389.92
370	390.97	392.03	393.09	394.14	395.20	396.26	397.31	398.37	399.43	400.48
380	401.54	402.60	403.65	404.71	405.77	406.82	407.88	408.94	409.99	411.05
390	412.11	413.16	414.22	415.28	416.33	417.39	418.45	419.50	420.56	421.62
400	422.67	423.73	424.79	425.84	426.90	427.96	429.01	430.07	431.13	432.18
410	433.24	434.30	435.35	436.41	437.47	438.52	439.58	440.64	441.69	442.75
420	443.81	444.86	445.92	446.98	448.03	449.09	450.15	451.20	452.26	453.32
430	454.37	455.43	456.49	457.54	458.60	459.66	460.71	461.77	462.83	463.88
440	464.94	466.00	467.05	468.11	469.17	470.22	471.28	472.34	473.39	474.45
450	475.51	476.56	477.62	478.68	479.73	480.79	481.85	482.90	483.96	485.02
460	486.07	487.13	488.19	489.24	490.30	491.36	492.41	493.47	494.53	495.58
470	496.64	497.70	498.75	499.81	500.87	501.92	502.98	504.04	505.09	506.15
480	507.21	508.26	509.32	510.38	511.43	512.49	513.55	514.60	515.66	516.72
490	517.77	518.83	519.89	520.94	522.00	523.06	524.11	525.17	526.23	527.28

CAPACITIES — LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
500	528.34	529.40	530.45	531.51	532.57	533.62	534.68	535.74	536.79	537.85
510	538.91	539.96	541.02	542.08	543.13	544.19	545.25	546.30	547.36	548.42
520	549.47	550.53	551.59	552.64	553.70	554.76	555.81	556.87	557.93	558.98
530	560.04	561.10	562.15	563.21	564.27	565.32	566.38	567.44	568.49	569.55
540	570.61	571.66	572.72	573.78	574.83	575.89	576.95	578.00	579.06	580.12
550	581.18	582.23	583.29	584.35	585.40	586.46	587.52	588.57	589.63	590.69
560	591.74	592.80	593.86	594.91	595.97	597.03	598.08	599.14	600.20	601.25
570	602.31	603.37	604.42	605.48	606.54	607.59	608.65	609.71	610.76	611.82
580	612.88	613.93	614.99	616.05	617.10	618.16	619.22	620.27	621.33	622.39
590	623.44	624.50	625.56	626.61	627.67	628.73	629.78	630.84	631.90	632.95
600	634.01	635.07	636.12	637.18	638.24	639.29	640.35	641.41	642.46	643.52
610	644.58	645.63	646.69	647.75	648.80	649.86	650.92	651.97	653.03	654.09
620	655.14	656.20	657.26	658.31	659.37	660.43	661.48	662.54	663.60	664.65
630	665.71	666.77	667.82	668.88	669.94	670.99	672.05	673.11	674.16	675.22
640	676.28	677.33	678.39	679.45	680.50	681.56	682.62	683.67	684.73	685.79
650	686.84	687.90	688.96	690.01	691.07	692.13	693.18	694.24	695.30	696.35
660	697.41	698.47	699.52	700.58	701.64	702.69	703.75	704.81	705.86	706.92
670	707.98	709.03	710.09	711.15	712.20	713.26	714.32	715.37	716.43	717.49
680	718.54	719.60	720.66	721.71	722.77	723.83	724.88	725.94	727.00	728.05
690	729.11	730.17	731.22	732.28	733.34	734.39	735.45	736.51	737.56	738.62

CAPACITIES — LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
700	739.68	740.73	741.79	742.85	743.90	744.96	746.02	747.07	748.13	749.19
710	750.24	751.30	752.36	753.41	754.47	755.53	756.58	757.64	758.70	759.75
720	760.81	761.87	762.92	763.98	765.04	766.09	767.15	768.21	769.26	770.32
730	771.38	772.43	773.49	774.55	775.60	776.61	777.72	778.77	779.83	780.89
740	781.94	783.00	784.06	785.11	786.17	787.23	788.28	789.34	790.40	791.45
750	792.51	793.57	794.62	795.68	796.74	797.79	798.85	799.91	800.96	802.02
760	803.08	804.13	805.19	806.25	807.30	808.36	809.42	810.47	811.53	812.59
770	813.65	814.70	815.76	816.82	817.87	818.93	819.99	821.04	822.10	823.16
780	824.21	825.27	826.33	827.38	828.44	829.50	830.55	831.61	832.67	833.72
790	834.78	835.84	836.89	837.95	839.01	840.06	841.12	842.18	843.23	844.29
800	845.35	846.40	847.46	848.52	849.57	850.63	851.69	852.74	853.80	854.86
810	855.91	856.97	858.03	859.08	860.14	861.20	862.25	863.31	864.37	865.42
820	866.48	867.54	868.59	869.65	870.71	871.76	872.82	873.88	874.93	875.99
830	877.05	878.10	879.16	880.22	881.27	882.33	883.39	884.44	885.50	886.56
840	887.61	888.67	889.73	890.78	891.84	892.90	893.95	895.01	896.07	897.12
850	898.18	899.24	900.29	901.35	902.41	903.46	904.52	905.58	906.63	907.69
860	908.75	909.80	910.86	911.92	912.97	914.03	915.09	916.14	917.20	918.26
870	919.31	920.37	921.43	922.48	923.54	924.60	925.65	926.71	927.77	928.82
880	929.88	930.94	931.99	933.05	934.11	935.16	936.22	937.28	938.33	939.39
890	940.47	941.50	942.56	953.62	944.67	945.73	946.79	947.84	948.90	949.96

CAPACITIES — LITERS TO LIQUID QUARTS (Continued)

	0	1	2	3	4	5	6	7	8	9
900	951.01	952.07	953.13	954.18	955.24	956.30	957.35	958.41	959.47	960.52
910	961.58	962.64	963.69	964.75	965.81	966.86	967.92	968.98	970.03	971.09
920	972.15	973.20	974.26	975.32	976.37	977.43	978.49	979.54	980.60	981.66
930	982.71	983.77	984.83	985.88	986.94	988.00	989.05	990.11	991.17	992.22
940	993.28	994.34	995.39	996.45	997.51	998.56	999.62	1,000.7	1,001.7	1,002.8
950	1,003.8	1,004.9	1,006.0	1,007.0	1,008.1	1,009.1	1,010.2	1,011.2	1,012.3	1,013.4
960	1,014.4	1,015.5	1,016.5	1,017.6	1,018.6	1,019.7	1,020.8	1,021.8	1,022.9	1,023.9
970	1,025.0	1,026.0	1,027.1	1,028.2	1,029.2	1,030.3	1,031.3	1,032.4	1,033.4	1,034.5
980	1,035.5	1,036.6	1,037.7	1,038.7	1,039.8	1,040.8	1,041.9	1,042.9	1,044.0	1,045.1
990	1,046.1	1,047.2	1,048.2	1,049.3	1,050.3	1,051.4	1,052.5	1,053.5	1,054.6	1,055.6

CAPACITIES — LIQUID QUARTS TO LITERS

From 1 *to* 1,000 *Units*

Reduction factor; 1 liquid quart = 0.9463586241 liter

The values found in the body of the table give, in liters, the capacities indicated in liquid quarts at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	0.94636	1.8927	2.8391	3.7854	4.7318	5.6782	6.6245	7.5709	8.5172
10	9.4636	10.410	11.353	12.303	13.249	14.195	15.142	16.088	17.034	17.981
20	18.927	19.874	20.820	21.766	22.713	23.659	24.605	25.552	26.498	27.444
30	28.391	29.337	30.283	31.230	32.176	33.123	34.069	35.015	35.962	36.908
40	37.854	38.801	39.747	40.693	41.640	42.586	43.533	44.479	45.425	46.372
50	47.318	48.264	49.211	50.157	51.103	52.050	52.996	53.942	54.889	55.835
60	56.782	57.728	58.674	59.621	60.567	61.513	62.460	63.406	64.352	65.299
70	66.245	67.191	68.138	69.084	70.031	70.977	71.923	72.870	73.816	74.862
80	75.709	76.655	77.601	78.548	79.494	80.440	81.387	82.333	83.280	84.226
90	85.172	86.119	87.065	88.011	88.958	89.904	90.850	91.797	92.743	93.690

CAPACITIES — LIQUID QUARTS TO LITERS (Continued)

	0	1	2	3	4	5	6	7	8	9
100	94.636	95.582	96.529	97.475	98.421	99.368	100.31	101.26	102.21	103.15
110	104.10	105.05	105.99	106.94	107.88	108.83	109.78	110.72	111.67	112.62
120	113.56	114.51	115.46	116.40	117.35	118.29	119.24	120.19	121.13	122.08
130	123.03	123.97	124.92	125.87	126.81	127.76	128.70	129.65	130.60	131.54
140	132.49	133.44	134.38	135.33	136.28	137.22	138.17	139.11	140.06	141.01
150	141.95	142.90	143.85	144.79	145.74	146.69	147.63	148.58	149.52	150.47
160	151.42	152.36	153.31	154.26	155.20	156.15	157.10	158.04	158.99	159.93
170	160.88	161.83	162.77	163.72	164.67	165.61	166.56	167.51	168.45	169.40
180	170.34	171.29	172.24	173.18	174.13	175.08	176.02	176.97	177.92	178.86
190	179.81	180.75	181.70	182.65	183.59	184.54	185.49	186.43	187.38	188.33
200	189.27	190.22	191.16	192.11	193.06	194.00	194.95	195.90	196.84	197.79
210	198.74	199.68	200.63	201.57	202.52	203.47	204.41	205.36	206.31	207.25
220	208.20	209.15	210.09	211.04	211.98	212.93	213.88	214.82	215.77	216.72
230	217.66	218.61	219.56	220.50	221.45	222.39	223.34	224.29	225.23	226.18
240	227.13	228.07	229.02	229.97	230.91	231.86	232.80	233.75	234.70	235.64
250	236.59	237.54	238.48	239.43	240.38	241.32	242.27	243.21	244.16	245.11
260	246.05	247.00	247.95	248.89	249.84	250.79	251.73	252.68	253.62	254.57
270	255.52	256.46	257.41	258.36	259.30	260.25	261.19	262.14	263.09	264.03
280	264.98	265.93	266.87	267.82	268.77	269.71	270.66	271.60	272.55	273.50
290	274.44	275.39	276.34	277.28	278.23	279.18	280.12	281.07	282.01	282.96

CAPACITIES — LIQUID QUARTS TO LITERS (Continued)

	0	1	2	3	4	5	6	7	8	9
300	283.91	284.85	285.80	286.75	287.69	288.64	289.59	290.53	291.48	292.42
310	293.37	294.32	295.26	296.21	297.16	298.10	299.05	300.00	300.94	301.89
320	302.83	303.78	304.73	305.67	306.62	307.57	308.51	309.46	310.41	311.35
330	312.30	313.24	314.19	315.14	316.08	317.03	317.98	318.92	319.87	320.82
340	321.76	322.71	323.65	324.60	325.55	326.49	327.44	328.39	329.33	330.28
350	331.23	332.17	333.12	334.06	335.01	335.96	336.90	337.85	338.80	339.74
360	340.69	341.64	342.58	343.53	344.47	345.42	346.37	347.31	348.26	349.21
370	350.15	351.10	352.05	352.99	353.94	354.88	355.83	356.78	357.72	358.67
380	359.62	360.56	361.51	362.46	363.40	364.35	365.29	366.24	367.19	368.13
390	369.08	370.03	370.97	371.92	372.87	373.81	374.76	375.70	376.65	377.60
400	378.54	379.49	380.44	381.38	382.33	383.28	384.22	385.17	386.11	387.06
410	388.01	388.95	389.90	390.85	391.79	392.74	393.69	394.63	395.58	396.52
420	397.47	398.42	399.36	400.31	401.26	402.20	403.15	404.10	405.04	405.99
430	406.93	407.88	408.83	409.77	410.72	411.67	412.61	413.56	414.51	415.45
440	416.40	417.34	418.29	419.24	420.18	421.13	422.08	423.02	423.97	424.92
450	425.86	426.81	427.75	428.70	429.65	430.59	431.54	432.49	433.43	434.38
460	435.32	436.27	437.22	438.16	439.11	440.06	441.00	441.95	442.90	443.84
470	444.79	445.73	446.68	447.63	448.57	449.52	450.47	451.41	452.36	453.31
480	454.25	455.20	456.14	457.09	458.04	458.98	459.93	460.88	461.82	462.77
490	463.72	464.66	465.61	466.55	467.50	468.45	469.39	470.34	471.29	472.23

CAPACITIES—LIQUID QUARTS TO LITERS (Continued)

	0	1	2	3	4	5	6	7	8	9
500	473.18	474.13	475.07	476.02	476.96	477.91	478.86	479.80	480.75	481.70
510	482.64	483.59	484.54	485.48	486.43	487.37	488.32	489.27	490.21	491.16
520	492.11	493.05	494.00	494.95	495.89	496.84	497.78	498.73	499.68	500.62
530	501.57	502.52	503.46	504.41	505.36	506.30	507.25	508.19	509.14	510.09
540	511.03	511.97	512.93	513.87	514.82	515.77	516.71	517.66	518.60	519.55
550	520.50	521.44	522.39	523.34	524.28	525.23	526.18	527.12	528.07	529.01
560	529.96	530.91	531.85	532.80	533.75	534.69	535.64	536.59	537.53	538.48
570	539.42	540.37	541.32	542.26	543.21	544.16	545.10	546.05	547.00	547.94
580	548.89	549.83	550.78	551.73	552.67	553.62	554.57	555.51	556.46	557.41
590	558.35	559.30	560.24	561.19	562.14	563.08	564.03	564.98	565.92	566.87
600	567.82	568.76	569.71	570.65	571.60	572.55	573.49	574.44	575.39	576.33
610	577.28	578.23	579.17	580.12	581.06	582.01	582.96	583.90	584.85	585.80
620	586.74	587.69	588.64	589.58	590.53	591.47	592.42	593.37	594.31	595.26
630	596.21	597.15	598.10	599.05	599.99	600.94	601.88	602.83	603.78	604.72
640	605.67	606.62	607.56	608.51	609.45	610.40	611.35	612.29	613.24	614.19
650	615.13	616.08	617.03	617.97	618.92	619.86	620.81	621.76	622.70	623.65
660	624.60	625.54	626.49	627.44	628.38	629.33	630.27	631.22	632.17	633.11
670	634.06	635.01	635.95	636.90	637.85	638.79	639.74	640.68	641.63	642.58
680	643.52	644.47	645.42	646.36	647.31	648.26	649.20	650.15	651.09	652.04
690	652.99	653.93	654.88	655.83	656.77	657.72	658.67	659.61	660.56	661.50

CAPACITIES—LIQUID QUARTS TO LITERS (Continued)

	0	1	2	3	4	5	6	7	8	9
700	662.45	663.40	664.34	665.29	666.24	667.18	668.13	669.08	670.02	670.97
710	671.91	672.86	673.81	674.75	675.70	676.65	677.59	678.54	679.49	680.43
720	681.38	682.32	683.27	684.22	685.16	686.11	687.06	688.00	688.95	689.90
730	690.84	691.79	692.73	693.68	694.63	695.57	696.52	697.47	698.41	699.36
740	700.31	701.25	702.20	703.14	704.09	705.04	705.98	706.93	707.88	708.82
750	709.77	710.72	711.66	712.61	713.55	714.50	715.45	716.39	717.34	718.29
760	719.23	720.18	721.13	722.07	723.02	723.96	724.91	725.86	726.80	727.75
770	728.70	729.64	730.59	731.54	732.48	733.43	734.37	735.32	736.27	737.21
780	738.16	739.11	740.05	741.00	741.95	742.89	743.84	744.78	745.73	746.68
790	747.62	748.57	749.52	750.46	751.41	752.36	753.30	754.25	755.19	756.14
800	757.09	758.03	758.98	759.93	760.87	761.82	762.77	763.71	764.66	765.60
810	766.55	767.50	768.44	769.39	770.34	771.28	772.23	773.18	774.12	775.07
820	776.01	776.96	777.91	778.85	779.80	780.75	781.69	782.64	783.58	784.53
830	785.48	786.42	787.37	788.32	789.26	790.21	791.16	792.10	793.05	793.99
840	794.94	795.89	796.83	797.78	798.73	799.67	800.62	801.57	802.51	803.46
850	804.40	805.35	806.30	807.24	808.19	809.14	810.08	811.03	811.98	812.92
860	813.87	814.81	815.76	816.71	817.65	818.60	819.55	820.49	821.44	822.39
870	823.33	824.28	825.22	826.17	827.12	828.06	829.01	829.96	830.90	831.85
880	832.80	833.74	834.69	835.63	836.58	837.53	838.47	839.42	840.37	841.31
890	842.26	843.21	844.15	845.10	846.04	846.99	847.94	848.88	849.83	850.78

CAPACITIES — LIQUID QUARTS TO LITERS (Continued)

	0	1	2	3	4	5	6	7	8	9
900	851.72	852.67	853.62	854.56	855.51	856.45	857.40	858.35	859.29	860.24
910	861.19	862.13	863.08	864.03	864.97	865.92	866.86	867.81	868.76	869.70
920	870.65	871.60	872.54	873.49	874.44	875.38	876.33	877.27	878.22	879.17
930	880.11	881.06	882.01	882.95	883.90	884.85	885.79	886.74	887.68	888.63
940	889.57	890.52	891.47	892.42	893.36	894.31	895.26	896.20	897.15	898.09
950	899.04	899.99	900.93	901.88	902.83	903.77	904.72	905.67	906.61	907.56
960	908.50	909.45	910.40	911.34	912.29	913.24	914.18	915.13	916.08	917.02
970	917.97	918.91	919.86	920.81	921.75	922.70	923.65	924.59	925.54	926.49
980	927.43	928.38	929.32	930.27	931.22	932.16	933.11	934.06	935.00	935.95
990	936.90	937.84	938.79	939.73	940.68	941.63	942.57	943.52	944.47	945.41

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS

From 1 *to* 1,000 *Units*

Reduction factor: 1 kilogram = 2.204622341 avoirdupois pounds

The values found in the body of the table give, in avoirdupois pounds, the weights indicated in kilograms at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	2.2046	4.4092	6.6139	8.8185	11.023	13.278	15.432	17.637	19.842
10	22.046	24.251	26.456	28.660	30.865	33.069	35.274	37.479	39.683	41.888
20	44.092	46.297	48.502	50.706	52.911	55.116	57.320	59.525	61.729	63.934
30	66.139	68.343	70.548	72.753	74.957	77.162	79.366	81.571	83.776	85.980
40	88.185	90.390	92.594	94.799	97.003	99.208	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.20
90	198.42	200.62	202.83	205.03	207.23	209.44	211.64	213.85	216.05	218.26

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
100	220.46	222.67	224.87	227.08	229.28	231.49	233.69	235.89	238.10	240.30
110	242.51	244.71	246.92	249.12	251.33	253.53	255.74	257.94	260.15	262.35
120	264.55	266.76	268.96	271.17	273.37	275.58	277.78	279.99	282.19	284.40
130	286.60	288.81	291.01	293.21	295.42	297.62	299.83	302.03	304.24	306.44
140	308.65	310.85	313.06	315.26	317.47	319.67	321.87	324.08	326.28	328.49
150	330.69	332.90	335.10	337.31	339.51	341.72	343.92	346.13	348.33	350.54
160	352.74	354.94	357.15	359.35	361.56	363.76	365.97	368.17	370.38	372.58
170	374.79	376.99	379.20	381.40	383.60	385.81	388.01	390.22	392.42	394.63
180	396.83	399.04	401.24	403.45	405.65	407.86	410.06	412.26	414.47	416.67
190	418.88	421.08	423.29	425.49	427.70	429.90	432.11	434.31	436.52	438.72
200	440.92	443.13	445.33	447.54	449.74	451.95	454.15	456.36	458.56	460.77
210	462.97	465.18	467.38	469.58	471.79	473.99	476.20	478.40	480.61	482.81
220	485.02	487.22	489.43	491.63	493.84	496.04	498.24	500.45	502.65	504.86
230	507.06	509.27	511.47	513.68	515.88	518.09	520.29	522.50	524.70	526.90
240	529.11	531.31	533.52	535.72	537.93	540.13	542.34	544.54	546.75	548.95
250	551.16	553.36	555.56	557.77	559.97	562.18	564.38	566.59	568.79	571.00
260	573.20	575.41	577.61	579.82	582.02	584.22	586.43	588.63	590.84	593.04
270	595.25	597.45	599.66	601.86	604.07	606.27	608.48	610.68	612.89	615.09
280	617.29	619.50	621.70	623.91	626.11	628.32	630.52	632.73	634.93	637.14
290	639.34	641.55	643.75	645.95	648.16	650.36	652.57	654.77	656.98	659.18

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
300	661.39	663.59	665.80	668.00	670.21	672.41	674.61	676.82	679.02	681.23
310	683.43	685.64	687.84	690.05	692.25	694.46	696.66	698.87	701.07	703.27
320	705.48	707.68	709.89	712.09	714.30	716.50	718.71	720.91	723.12	725.32
330	727.53	729.73	731.93	734.14	736.35	738.55	740.75	742.96	745.16	747.37
340	749.57	751.78	753.98	756.19	758.39	760.59	762.80	765.00	767.21	769.41
350	771.62	773.82	776.03	778.23	780.44	782.64	784.85	787.05	789.25	791.46
360	793.66	795.87	798.07	800.28	802.48	804.69	806.89	809.10	811.30	813.51
370	815.71	817.91	820.12	822.32	824.53	826.73	828.94	831.14	833.35	835.55
380	837.76	839.96	842.17	844.37	846.58	848.78	850.98	853.19	855.38	857.60
390	859.80	862.01	864.21	866.42	868.62	870.83	873.03	875.24	877.44	879.64
400	881.85	884.05	886.26	888.46	890.67	892.87	895.08	897.28	899.49	901.69
410	903.90	906.10	908.30	910.51	912.71	914.92	917.12	919.33	921.53	923.74
420	925.94	928.15	930.35	932.56	934.76	936.96	939.17	941.37	943.58	945.78
430	947.99	950.20	952.40	954.60	956.71	959.01	961.22	963.42	965.62	967.83
440	970.03	972.24	974.44	976.65	978.85	981.06	983.26	985.47	987.67	989.88
450	992.08	994.28	996.49	998.69	1,000.9	1,003.1	1,005.3	1,007.5	1,009.7	1,011.9
460	1,014.1	1,016.3	1,018.5	1,020.7	1,022.9	1,025.1	1,027.4	1,029.6	1,031.8	1,034.0
470	1,036.2	1,038.4	1,040.6	1,042.8	1,045.0	1,047.2	1,049.4	1,051.6	1,053.8	1,056.0
480	1,058.2	1,060.4	1,062.6	1,064.8	1,067.0	1,069.2	1,071.4	1,073.7	1,075.9	1,078.1
490	1,080.3	1,082.5	1,084.7	1,086.9	1,089.1	1,091.3	1,093.5	1,095.7	1,097.9	1,100.1

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
500	1,102.3	1,104.5	1,106.7	1,108.9	1,111.1	1,113.3	1,115.5	1,117.7	1,119.9	1,122.2
510	1,124.4	1,126.6	1,128.8	1,131.0	1,133.2	1,135.4	1,137.6	1,139.8	1,142.0	1,144.2
520	1,146.4	1,148.6	1,150.8	1,153.0	1,155.2	1,157.4	1,159.6	1,161.8	1,164.0	1,166.2
530	1,168.4	1,170.7	1,172.9	1,175.1	1,177.3	1,179.5	1,181.7	1,183.9	1,186.9	1,188.3
540	1,190.5	1,192.7	1,194.9	1,197.1	1,199.3	1,201.5	1,203.7	1,205.9	1,208.1	1,210.3
550	1,212.5	1,214.7	1,217.0	1,219.2	1,221.4	1,223.6	1,225.8	1,228.0	1,230.2	1,232.4
560	1,234.6	1,236.8	1,239.0	1,241.2	1,243.4	1,245.6	1,247.8	1,250.0	1,252.2	1,254.4
570	1,256.6	1,258.8	1,261.0	1,263.2	1,265.5	1,267.7	1,269.9	1,272.1	1,274.3	1,276.5
580	1,278.7	1,280.9	1,283.1	1,285.3	1,287.5	1,289.7	1,291.9	1,294.1	1,296.3	1,298.5
590	1,300.7	1,302.9	1,305.1	1,307.3	1,309.5	1,311.8	1,314.0	1,316.2	1,318.3	1,320.6
600	1,322.8	1,325.0	1,327.2	1,329.4	1,331.6	1,333.8	1,336.0	1,338.2	1,340.4	1,342.6
610	1,344.8	1,347.0	1,349.2	1,351.4	1,353.6	1,355.8	1,358.0	1,360.3	1,362.5	1,364.7
620	1,366.9	1,369.1	1,371.3	1,375.5	1,375.7	1,377.9	1,380.1	1,382.3	1,384.5	1,386.7
630	1,388.9	1,391.1	1,393.3	1,395.5	1,397.7	1,399.9	1,402.1	1,404.3	1,406.5	1,408.8
640	1,411.0	1,413.2	1,415.4	1,417.6	1,419.8	1,422.0	1,424.2	1,426.4	1,428.6	1,430.8
650	1,433.0	1,435.2	1,437.4	1,439.6	1,441.8	1,444.0	1,446.2	1,448.4	1,450.6	1,452.8
660	1,455.1	1,457.3	1,459.5	1,461.7	1,463.9	1,466.1	1,468.3	1,470.5	1,472.7	1,474.9
670	1,477.1	1,479.3	1,481.5	1,483.7	1,485.9	1,488.1	1,490.3	1,492.5	1,494.7	1,496.9
680	1,499.1	1,501.3	1,503.6	1,505.8	1,508.0	1,510.2	1,512.4	1,514.6	1,516.8	1,519.0
690	1,521.2	1,523.4	1,525.6	1,527.8	1,530.0	1,532.2	1,534.4	1,536.6	1,538.8	1,541.0

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
700	1,543.2	1,545.4	1,547.6	1,549.8	1,552.1	1,554.3	1,556.5	1,558.7	1,560.9	1,563.1
710	1,565.3	1,567.5	1,569.7	1,571.9	1,574.1	1,576.3	1,578.5	1,580.7	1,582.9	1,585.1
720	1,587.3	1,589.5	1,591.7	1,593.9	1,596.1	1,598.4	1,600.6	1,602.8	1,605.0	1,607.2
730	1,609.4	1,611.6	1,613.8	1,616.0	1,618.2	1,620.4	1,622.6	1,624.8	1,627.0	1,629.2
740	1,631.4	1,633.6	1,635.8	1,638.0	1,640.2	1,642.4	1,644.6	1,646.9	1,649.1	1,651.3
750	1,653.5	1,655.7	1,657.9	1,660.1	1,662.3	1,664.5	1,666.7	1,668.9	1,671.1	1,673.3
760	1,675.5	1,677.7	1,679.9	1,682.1	1,684.3	1,686.5	1,688.7	1,690.9	1,693.2	1,695.4
770	1,697.6	1,699.8	1,702.0	1,704.2	1,706.4	1,708.6	1,710.8	1,713.0	1,715.2	1,717.4
780	1,719.6	1,721.8	1,724.0	1,726.2	1,728.4	1,730.6	1,732.8	1,735.0	1,737.2	1,739.4
790	1,741.7	1,743.9	1,746.1	1,748.3	1,750.5	1,752.7	1,754.9	1,757.1	1,759.3	1,761.5
800	1,763.7	1,766.0	1,768.1	1,770.3	1,772.5	1,774.7	1,776.9	1,779.1	1,781.3	1,783.5
810	1,785.7	1,787.9	1,790.2	1,792.4	1,794.6	1,796.8	1,799.0	1,801.2	1,803.4	1,805.6
820	1,807.8	1,810.0	1,812.2	1,814.4	1,816.6	1,818.8	1,821.0	1,823.2	1,825.4	1,827.6
830	1,829.8	1,832.0	1,834.2	1,836.5	1,838.7	1,840.9	1,843.1	1,845.3	1,847.5	1,849.7
840	1,851.9	1,854.1	1,856.3	1,858.5	1,860.7	1,862.9	1,865.1	1,867.3	1,869.5	1,871.7
850	1,873.9	1,876.1	1,878.3	1,880.5	1,882.7	1,885.0	1,887.2	1,889.4	1,891.6	1,893.8
860	1,896.0	1,898.2	1,900.4	1,902.6	1,904.8	1,907.0	1,909.2	1,911.4	1,913.6	1,915.8
870	1,918.0	1,920.2	1,922.4	1,924.6	1,926.8	1,929.0	1,931.2	1,933.5	1,935.7	1,937.9
880	1,940.1	1,942.3	1,944.5	1,946.7	1,948.9	1,951.1	1,953.3	1,955.6	1,957.7	1,959.9
890	1,962.1	1,964.3	1,966.5	1,968.7	1,970.9	1,973.1	1,975.3	1,977.5	1,979.8	1,982.0

WEIGHTS — KILOGRAMS TO AVOIRDUPOIS POUNDS (Continued)

	0	1	2	3	4	5	6	7	8	9
900	1,984.2	1,986.4	1,988.6	1,990.8	1,993.0	1,995.2	1,997.4	1,999.6	2,001.8	2,004.0
910	2,006.2	2,008.4	2,010.6	2,012.8	2,015.0	2,017.2	2,019.4	2,021.6	2,023.8	2,026.0
920	2,028.3	2,030.5	2,032.7	2,034.9	2,037.1	2,039.3	2,041.5	2,043.7	2,045.9	2,048.1
930	2,050.3	2,052.5	2,054.7	2,056.9	2,059.1	2,061.3	2,063.5	2,065.7	2,067.9	2,070.1
940	2,072.3	2,074.5	2,076.8	2,079.0	2,081.2	2,083.4	2,085.6	2,087.8	2,090.0	2,092.2
950	2,094.4	2,096.6	2,098.8	2,101.0	2,103.2	2,105.4	2,107.6	2,109.8	2,112.0	2,114.2
960	2,116.4	2,118.6	2,120.8	2,123.1	2,125.3	2,127.5	2,129.7	2,131.9	2,134.1	2,136.3
970	2,138.5	2,140.7	2,142.9	2,145.1	2,147.3	2,149.5	2,151.7	2,153.9	2,156.1	2,158.3
980	2,160.5	2,162.7	2,164.9	2,167.1	2,169.3	2,171.6	2,173.8	2,176.0	2,178.2	2,180.4
990	2,182.6	2,184.8	2,187.0	2,189.2	2,191.4	2,193.6	2,195.8	2,198.0	2,200.2	2,202.4

WEIGHTS — AVOIRDUPOIS POUNDS TO KILOGRAMS

From 1 *to* 1,000 *Units*

Reduction factor: 1 avoirdupois pound = 0.4535924277 kilogram

The values found in the body of the table give, in kilograms, the weights indicated in avoirdupois pounds at the top and side.

	0	1	2	3	4	5	6	7	8	9
0	....	0.45359	0.90718	1.3608	1.8144	2.2680	2.7216	3.1752	3.6287	4.0823
10	4.5359	4.9895	5.4431	5.8967	6.3503	6.8039	7.2575	7.7111	8.1647	8.6183
20	9.0719	9.5254	9.9790	10.433	10.886	11.340	11.793	12.247	12.701	13.154
30	13.608	14.061	14.515	14.969	15.422	15.876	16.329	16.783	17.237	17.690
40	18.144	18.597	19.051	19.504	19.958	20.412	20.865	21.319	21.772	22.226
50	22.680	23.133	23.587	24.040	24.494	24.948	25.401	25.855	26.308	26.762
60	27.216	27.669	28.123	28.576	29.030	29.484	29.937	30.391	30.844	31.298
70	31.751	32.205	32.659	33.112	33.566	34.019	34.473	34.927	35.380	35.834
80	36.287	36.741	37.195	37.648	38.102	38.555	39.009	39.463	39.916	40.370
90	40.823	41.277	41.731	42.184	42.638	43.091	43.545	43.998	44.452	44.906

WEIGHTS — AVOIRDUPOIS POUNDS TO KILOGRAMS (Continued)

	0	1	2	3	4	5	6	7	8	9
100	45.359	45.813	46.266	46.720	47.174	47.627	48.081	48.534	48.988	49.442
110	49.895	50.349	50.802	51.256	51.710	52.163	52.617	53.070	53.524	53.978
120	54.431	54.885	55.338	55.792	56.245	56.699	57.153	57.606	58.060	58.513
130	58.967	59.421	59.874	60.328	60.781	61.235	61.689	62.142	62.596	63.049
140	63.503	63.957	64.410	64.864	65.317	65.771	66.224	66.678	67.132	67.585
150	68.039	68.492	68.946	69.400	69.853	70.307	70.760	71.214	71.668	72.121
160	72.575	73.028	73.482	73.936	74.389	74.843	75.296	75.750	76.204	76.657
170	77.111	77.564	78.018	78.471	78.925	79.379	79.832	80.286	80.739	81.193
180	81.647	82.100	82.554	83.007	83.461	83.915	84.368	84.822	85.275	85.729
190	86.183	86.636	87.090	87.543	87.997	88.451	88.904	89.358	89.811	90.256
200	90.718	91.172	91.626	91.179	92.533	92.986	93.440	93.894	94.347	94.801
210	95.254	95.708	96.162	96.615	97.069	97.522	97.976	98.430	98.883	99.337
220	99.790	100.24	100.70	101.15	101.60	102.06	102.51	102.97	103.42	103.87
230	104.33	104.78	105.23	105.69	106.14	106.59	107.05	107.50	107.96	108.41
240	108.86	109.32	109.77	110.22	110.68	111.13	111.58	112.04	112.49	112.94
250	113.40	113.85	114.31	114.76	115.21	115.67	116.12	116.57	117.03	117.48
260	117.93	118.39	118.84	119.29	119.75	120.20	120.66	121.11	121.56	122.02
270	122.47	122.92	123.38	123.83	124.28	124.74	125.19	125.65	126.10	126.55
280	127.01	127.46	127.91	128.37	128.82	129.27	129.73	130.18	130.63	131.09
290	131.54	132.00	132.45	132.90	133.36	133.81	134.26	134.72	135.17	135.62

WEIGHTS — AVOIRDUPOIS POUNDS TO KILOGRAMS (Continued)

	0	1	2	3	4	5	6	7	8	9
300	136.08	136.53	136.98	137.44	137.89	138.35	138.80	139.25	139.71	140.16
310	140.61	141.07	141.52	141.97	142.43	142.88	143.34	143.79	144.24	144.70
320	145.15	145.60	146.06	146.51	146.96	147.42	147.87	148.32	148.78	149.23
330	149.69	150.14	150.59	151.05	151.50	151.95	152.41	152.86	153.31	153.77
340	154.22	154.68	155.13	155.58	156.04	156.49	156.94	157.40	157.85	158.30
350	158.76	159.21	159.66	160.12	160.57	161.03	161.48	161.93	162.39	162.84
360	163.29	163.75	164.20	164.65	165.11	165.56	166.01	166.47	166.92	167.38
370	167.83	168.28	168.74	169.19	169.64	170.10	170.55	171.00	171.46	171.91
380	172.37	172.82	173.27	173.73	174.18	174.63	175.09	175.54	175.99	176.45
390	176.90	177.35	177.81	178.26	178.72	179.17	179.62	180.08	180.53	180.98
400	181.44	181.89	182.34	182.80	183.25	183.70	184.16	184.61	185.07	185.52
410	185.97	186.43	186.88	187.33	187.79	188.24	188.69	189.15	189.60	190.06
420	190.51	190.96	191.42	191.87	192.32	192.78	193.23	193.68	194.14	194.59
430	195.04	195.50	195.95	196.41	196.86	197.31	197.77	198.22	198.67	199.13
440	199.58	200.03	200.49	200.94	201.40	201.85	202.30	202.76	203.21	203.66
450	204.12	204.57	205.02	205.48	205.93	206.38	206.84	207.29	207.75	208.20
460	208.65	209.11	209.56	210.01	210.47	210.92	211.37	211.83	212.28	212.73
470	213.19	213.64	214.10	214.55	215.00	215.46	215.91	216.36	216.82	217.27
480	217.72	218.18	218.63	219.09	219.54	219.99	220.45	220.90	221.35	221.81
490	222.26	222.71	223.17	223.62	224.07	224.53	224.98	225.44	225.89	226.34

WEIGHTS — AVOIRDUPOIS POUNDS TO KILOGRAMS (Continued)

	0	1	2	3	4	5	6	7	8	9
500	226.80	227.25	227.70	228.16	228.61	229.06	229.52	229.97	230.42	230.88
510	231.33	231.79	232.24	232.69	233.15	233.60	234.05	234.51	234.96	235.41
520	235.87	236.32	236.78	237.23	237.68	238.14	238.59	239.04	239.50	239.95
530	240.40	240.86	241.31	241.76	242.22	242.67	243.13	243.58	244.03	244.49
540	244.94	245.39	245.85	246.30	246.75	247.21	247.66	248.12	248.57	249.02
550	249.48	249.93	250.38	250.84	251.29	251.74	252.20	252.65	253.10	253.56
560	254.01	254.47	254.92	255.37	255.83	256.28	256.73	257.19	257.64	258.09
570	258.55	259.00	259.45	259.91	260.36	260.82	261.27	261.72	262.18	262.63
580	263.08	263.54	263.99	264.44	264.90	265.35	265.81	266.26	266.71	267.17
590	267.62	268.07	268.53	268.98	269.43	269.89	270.34	270.79	271.25	271.70
600	272.16	272.61	273.06	273.52	273.97	274.42	274.88	275.33	275.78	276.24
610	276.69	277.14	277.60	278.05	278.51	278.96	279.41	279.87	280.32	280.77
620	281.23	281.68	282.13	282.59	283.04	283.50	283.95	284.40	284.86	285.31
630	285.76	286.22	286.67	287.12	287.58	288.03	288.48	288.94	289.39	289.85
640	290.30	290.75	291.21	291.66	292.11	292.57	293.02	293.47	293.93	294.38
650	294.84	295.29	295.74	296.20	296.65	297.10	297.56	298.01	298.46	298.92
660	299.27	299.82	300.28	300.73	301.19	301.64	302.09	302.55	303.00	303.45
670	303.91	304.35	304.81	305.27	305.72	306.17	306.63	307.08	307.54	307.99
680	308.44	308.90	309.38	309.80	310.26	310.71	311.16	311.62	312.07	312.53
690	312.98	313.43	313.89	314.34	314.79	315.25	315.70	316.15	316.61	317.06

WEIGHTS — AVOIRDUPOIS POUNDS TO KILOGRAMS (Continued)

	0	1	2	3	4	5	6	7	8	9
700	317.51	317.97	318.42	318.88	319.33	319.78	320.24	320.69	321.14	321.60
710	322.05	322.50	322.96	323.41	323.86	324.32	324.77	325.23	325.68	326.13
720	326.59	327.04	327.49	327.95	328.40	328.85	329.31	329.76	330.22	330.67
730	331.12	331.58	332.03	332.48	332.94	333.39	333.84	334.30	334.75	335.21
740	335.66	336.11	336.57	337.02	337.47	337.93	338.38	338.83	339.29	339.74
750	340.19	340.65	341.10	341.56	342.01	342.46	342.92	343.37	343.82	344.28
760	344.73	345.18	345.64	346.09	346.54	347.00	347.45	347.91	348.36	348.81
770	349.27	349.72	350.17	350.63	351.08	351.53	351.99	352.44	352.89	353.35
780	353.80	354.26	354.71	355.16	355.62	356.07	356.52	356.98	357.43	357.88
790	358.34	358.79	359.25	359.70	360.15	360.61	361.06	361.51	361.97	362.42
800	362.87	363.33	363.78	364.23	364.69	365.14	365.60	366.05	366.50	366.96
810	367.41	367.86	368.32	368.77	369.22	369.68	370.13	370.59	371.04	371.49
820	371.95	372.40	372.85	373.31	373.76	374.21	374.67	375.12	375.57	376.03
830	376.48	376.94	377.39	377.84	378.30	378.75	379.20	379.66	380.11	380.56
840	381.02	381.47	381.92	382.38	382.83	383.29	383.74	384.19	384.65	385.10
850	385.55	386.01	386.46	386.91	387.37	387.82	388.28	388.73	389.18	389.64
860	390.09	390.54	391.00	391.45	391.90	392.36	392.81	393.26	393.72	394.17
870	394.63	395.08	395.53	395.99	396.44	396.89	397.35	397.80	398.25	398.71
880	399.16	399.61	400.07	400.52	400.98	401.43	401.88	402.34	402.79	403.24
890	403.70	404.15	404.60	405.06	405.51	405.97	406.42	406.87	407.33	407.78

WEIGHTS—AVOIRDUPOIS POUNDS TO KILOGRAMS (Continued)

	0	1	2	3	4	5	6	7	8	9
900	408.23	408.69	409.14	409.59	410.05	410.50	410.95	411.41	411.86	412.32
910	412.77	413.22	413.68	414.13	414.58	415.04	415.49	415.94	416.40	416.85
920	417.31	417.76	418.21	418.67	419.12	419.57	420.03	420.48	420.93	421.39
930	421.84	422.29	422.75	423.20	423.66	424.11	424.56	425.02	425.47	425.92
940	426.38	426.83	427.28	427.74	428.19	428.64	429.10	429.55	430.01	430.46
950	430.91	431.37	431.82	432.27	432.73	433.18	433.63	434.09	434.54	435.00
960	435.45	435.90	436.36	436.81	437.26	437.72	438.17	438.62	439.08	439.53
970	439.98	440.44	440.89	441.35	441.80	442.25	442.71	443.16	443.61	444.07
980	444.52	444.97	445.43	445.88	446.33	446.79	447.24	447.70	448.15	448.60
990	449.06	449.51	449.96	450.42	450.87	451.32	451.78	452.23	452.69	453.14

TEMPERATURES — CENTIGRADE TO FAHRENHEIT

Conversion Table

The values in the body of the table give, in degrees Fahrenheit, the temperatures indicated in degrees Centigrade at the top and side.

1° C. = 1.8° F.

For temperatures below 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
0	+ 32.0	30.2	28.4	26.6	24.8	23.0	21.2	19.4	17.6	15.8
– 10	+ 14.0	12.2	10.4	8.6	6.8	5.0	3.2	+ 1.4	– 0.4	– 2.2
– 20	– 4.0	5.8	7.6	9.4	11.2	13.0	14.8	16.6	18.4	20.2
– 30	– 22.0	23.8	25.6	27.4	29.2	31.0	32.8	34.6	36.4	38.2
– 40	– 40.0	41.8	43.6	45.4	47.2	49.0	50.8	52.6	54.4	56.2
– 50	– 58.0	59.8	61.6	63.4	65.2	67.0	68.8	70.6	72.4	74.2
– 60	– 76.0	77.8	79.6	81.4	83.2	85.0	86.8	88.6	90.4	92.2
– 70	– 94.0	95.8	97.6	99.4	101.2	103.0	104.8	106.6	108.4	110.2
– 80	– 112.0	113.8	115.6	117.4	119.2	121.0	122.8	124.6	126.4	128.2
– 90	– 130.0	131.8	133.6	135.4	137.2	139.0	140.8	142.6	144.4	146.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
− 100	−148.0	149.8	151.6	153.4	155.2	157.0	158.8	160.6	162.4	164.2
− 110	−166.0	167.8	169.6	171.4	173.2	175.0	176.8	178.6	180.4	182.2
− 120	−184.0	185.8	187.6	189.4	191.2	193.0	194.8	196.6	198.4	200.2
− 130	−202.0	203.8	205.6	207.4	209.2	211.0	212.8	214.6	216.4	218.2
− 140	−220.0	221.8	223.6	225.4	227.2	229.0	230.8	232.6	234.4	236.2
− 150	−238.0	239.8	241.6	243.4	245.2	247.0	248.8	250.6	252.4	254.2
− 160	−256.0	257.8	259.6	261.4	263.2	265.0	266.8	268.6	270.4	272.2
− 170	−274.0	275.8	277.6	279.4	281.2	283.0	284.8	286.6	288.4	290.2
− 180	−292.0	293.8	295.6	297.4	299.2	301.0	302.8	304.6	306.4	308.2
− 190	−310.0	311.8	313.6	315.4	317.2	319.0	320.8	322.6	324.4	326.2
− 200	−328.0	329.8	331.6	333.4	335.2	337.0	338.8	340.6	342.4	344.2
− 210	−346.0	347.8	349.6	351.4	353.2	355.0	356.8	358.6	360.4	362.2
− 220	−364.0	365.8	367.6	369.4	371.2	373.0	374.8	376.6	378.4	380.2
− 230	−382.0	383.8	385.6	387.4	389.2	391.0	392.8	394.6	396.4	398.2
− 240	−400.0	401.8	403.6	405.4	407.2	409.0	410.8	412.6	414.4	416.2
− 250	−418.0	419.8	421.6	423.4	425.2	427.0	428.8	430.6	432.4	434.2
− 260	−436.0	437.8	439.6	441.4	443.2	445.0	446.8	448.6	450.4	452.2
− 270	−454.0	455.8	457.6	459.4	......	......	......	......	......	......

− 273° C. = −459.4° F. = absolute zero

For	°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
interpolation	°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
0	32.0	33.8	35.6	37.4	39.2	41.0	42.8	44.6	46.4	48.2
10	50.0	51.8	53.6	55.4	57.2	59.0	60.8	62.6	64.4	66.2
20	68.0	69.8	71.6	73.4	75.2	77.0	78.8	80.6	82.4	84.2
30	86.0	87.8	89.6	91.4	93.2	95.0	96.8	98.6	100.4	102.2
40	104.0	105.8	107.6	109.4	111.2	113.0	114.8	116.6	118.4	120.2
50	122.0	123.8	125.6	127.4	129.2	131.0	132.8	134.6	136.4	138.2
60	140.0	141.8	143.6	145.4	147.2	149.0	150.8	152.6	154.4	156.2
70	158.0	159.8	161.6	163.4	165.2	167.0	168.8	170.6	172.4	174.2
80	176.0	177.8	179.6	181.4	183.2	185.0	186.8	188.6	190.4	192.2
90	194.0	195.8	197.6	199.4	201.2	203.0	204.8	206.6	208.4	210.2
100	212.0	213.8	215.6	217.4	219.2	221.0	222.8	224.6	226.4	228.2
110	230.0	231.8	233.6	235.4	237.2	239.0	240.8	242.6	244.4	246.2
120	248.0	249.8	251.6	253.4	255.2	257.0	258.8	260.6	262.4	264.2
130	266.0	267.8	269.6	271.4	273.2	275.0	276.8	278.6	280.4	282.2
140	284.0	285.8	287.6	289.4	291.2	293.0	294.8	296.6	298.4	300.2
150	302.0	303.8	305.6	307.4	309.2	311.0	312.8	314.6	316.4	318.2
160	320.0	321.8	323.6	325.4	327.2	329.0	330.8	332.6	334.4	336.2
170	338.0	339.8	341.6	343.4	345.2	347.0	348.8	350.6	352.4	354.2
180	356.0	357.8	359.6	361.4	363.2	365.0	366.8	368.6	370.4	372.2
190	374.0	375.8	377.6	379.4	381.2	383.0	384.8	386.6	388.4	390.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
200	392.0	393.8	395.6	397.4	399.2	401.0	402.8	404.6	406.4	408.2
210	410.0	411.8	413.6	415.4	417.2	419.0	420.8	422.6	424.4	426.2
220	428.0	429.8	431.6	433.4	435.2	437.0	438.8	440.6	442.4	444.2
230	446.0	447.8	449.6	451.4	453.2	455.0	456.8	458.6	460.4	462.2
240	464.0	465.8	467.6	469.4	471.2	473.0	474.8	476.6	478.4	480.2
250	482.0	483.8	485.6	487.4	489.2	491.0	492.8	494.6	496.4	498.2
260	500.0	501.8	503.6	505.4	507.2	509.0	510.8	512.6	514.4	516.2
270	518.0	519.8	521.6	523.4	525.2	527.0	528.8	530.6	532.4	534.2
280	536.0	537.8	539.6	541.4	543.2	545.0	546.8	548.6	550.4	552.2
290	554.0	555.8	557.6	559.4	561.2	563.0	564.8	566.6	568.4	570.2
300	572.0	573.8	575.6	577.4	579.2	581.0	582.8	584.6	586.4	588.2
310	590.0	591.8	593.6	595.4	597.2	599.0	600.8	602.6	604.4	606.2
320	608.0	609.8	611.6	613.4	615.2	617.0	618.8	620.6	622.4	624.2
330	626.0	627.8	629.6	631.4	633.2	635.0	636.8	638.6	640.4	642.2
340	644.0	645.8	647.6	649.4	651.2	653.0	654.8	656.6	658.4	660.2
350	662.0	663.8	665.6	667.4	669.2	671.0	672.8	674.6	676.4	678.2
360	680.0	681.8	683.6	685.4	687.2	689.0	690.8	692.6	694.4	696.2
370	698.0	699.8	701.6	703.4	705.2	707.0	708.8	710.6	712.4	714.2
380	716.0	717.8	719.6	721.4	723.2	725.0	726.8	728.6	730.4	732.2
390	734.0	735.8	737.6	739.4	741.2	743.0	744.8	746.6	748.4	750.2

For interpolation											
	°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
	°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
400	752.0	753.8	755.6	757.4	759.2	761.0	762.8	764.6	766.4	768.2
410	770.0	771.8	773.6	775.4	777.2	779.0	780.8	782.6	784.4	786.2
420	788.0	789.8	791.6	793.4	795.2	797.0	798.8	800.6	802.4	804.2
430	806.0	807.8	809.6	811.4	813.2	815.0	816.8	818.6	820.4	822.2
440	824.0	825.8	827.6	829.4	831.2	833.0	834.8	836.6	838.4	840.2
450	842.0	843.8	845.6	847.4	849.2	851.0	852.8	854.6	856.4	858.2
460	860.0	861.8	863.6	865.4	867.2	869.0	870.8	872.6	874.4	876.2
470	878.0	879.8	881.6	883.4	885.2	887.0	888.8	890.6	892.4	894.2
480	896.0	897.8	899.6	901.4	903.2	905.0	906.8	908.6	910.4	912.2
490	914.0	915.8	917.6	919.4	921.2	923.0	924.8	926.6	928.4	930.2
500	932.0	933.8	935.6	937.4	939.2	941.0	942.8	944.6	946.4	948.2
510	950.0	951.8	953.6	955.4	957.2	959.0	960.8	962.6	964.4	966.2
520	968.0	969.8	971.6	973.4	975.2	977.0	978.8	980.6	982.4	984.2
530	986.0	987.8	989.6	991.4	993.2	995.0	996.8	998.6	1000.4	1002.2
540	1004.0	1005.8	1007.6	1009.4	1011.2	1013.0	1014.8	1016.6	1018.4	1020.2
550	1022.0	1023.8	1025.6	1027.4	1029.2	1031.0	1032.8	1034.6	1036.4	1038.2
560	1040.0	1041.8	1043.6	1045.4	1047.2	1049.0	1050.8	1052.6	1054.4	1056.2
570	1058.0	1059.8	1061.6	1063.4	1065.2	1067.0	1068.8	1070.6	1072.4	1074.2
580	1076.0	1077.8	1079.6	1081.4	1083.2	1085.0	1086.8	1088.6	1090.4	1092.2
590	1094.0	1095.8	1097.6	1099.4	1101.2	1103.0	1104.8	1106.6	1108.4	1110.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
600	1112.0	1113.8	1115.6	1117.4	1119.2	1121.0	1122.8	1124.6	1126.4	1128.2
610	1130.0	1131.8	1133.6	1135.4	1137.2	1139.0	1140.8	1142.6	1144.4	1146.2
620	1148.0	1149.8	1151.6	1153.4	1155.2	1157.0	1158.8	1160.6	1162.4	1164.2
630	1166.0	1167.8	1169.6	1171.4	1173.2	1175.0	1176.8	1178.6	1180.4	1182.2
640	1184.0	1185.8	1187.6	1189.4	1191.2	1193.0	1194.8	1196.6	1198.4	1200.2
650	1202.0	1203.8	1205.6	1207.4	1209.2	1211.0	1212.8	1214.6	1216.4	1218.2
660	1220.0	1221.8	1223.6	1225.4	1227.2	1229.0	1230.8	1232.6	1234.4	1236.2
670	1238.0	1239.8	1241.6	1243.4	1245.2	1247.0	1248.8	1250.6	1252.4	1254.2
680	1256.0	1257.8	1259.6	1261.4	1263.2	1265.0	1266.8	1268.6	1270.4	1272.2
690	1274.0	1275.8	1277.6	1279.4	1281.2	1283.0	1284.8	1286.6	1288.4	1290.2
700	1292.0	1293.8	1295.6	1297.4	1299.2	1301.0	1302.8	1304.6	1306.4	1308.2
710	1310.0	1311.8	1313.6	1315.4	1317.2	1319.0	1320.8	1322.6	1324.4	1326.2
720	1328.0	1329.8	1331.6	1333.4	1335.2	1337.0	1338.8	1340.6	1342.4	1344.2
730	1346.0	1347.8	1349.6	1351.4	1353.2	1355.0	1356.8	1358.6	1360.4	1362.2
740	1364.0	1365.8	1367.6	1369.4	1371.2	1373.0	1374.8	1376.6	1378.4	1380.2
750	1382.0	1383.8	1385.6	1387.4	1389.2	1391.0	1392.8	1394.6	1396.4	1398.2
760	1400.0	1401.8	1403.6	1405.4	1407.2	1409.0	1410.8	1412.6	1414.4	1416.2
770	1418.0	1419.8	1421.6	1423.4	1426.2	1427.0	1428.8	1430.6	1432.4	1434.2
780	1436.0	1437.8	1439.6	1441.4	1443.2	1445.0	1446.8	1448.6	1450.4	1452.2
790	1454.0	1455.8	1457.6	1459.4	1461.2	1463.0	1464.8	1466.6	1468.4	1470.2

For interpolation										
	°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
	°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
800	1472.0	1473.8	1475.6	1477.4	1479.2	1481.0	1482.8	1484.6	1486.4	1488.2
810	1490.0	1491.8	1493.6	1495.4	1497.2	1499.0	1500.8	1502.6	1504.4	1506.2
820	1508.0	1509.9	1511.6	1513.4	1515.2	1517.0	1518.8	1520.6	1522.4	1524.2
830	1526.0	1527.8	1529.6	1531.4	1533.2	1535.0	1536.8	1538.6	1540.4	1542.2
840	1544.0	1545.8	1547.6	1549.4	1551.2	1553.0	1554.8	1556.6	1558.4	1560.2
850	1562.0	1563.8	1565.6	1567.4	1569.2	1571.0	1572.8	1574.6	1576.4	1578.2
860	1580.0	1581.8	1583.6	1585.4	1587.2	1589.0	1590.8	1592.6	1594.4	1596.2
870	1598.0	1599.8	1601.6	1603.4	1605.2	1607.0	1608.8	1610.6	1612.4	1614.2
880	1616.0	1617.8	1619.6	1621.4	1623.2	1625.0	1626.8	1628.6	1630.4	1632.2
890	1634.0	1635.8	1637.6	1639.4	1641.2	1643.0	1644.8	1646.6	1648.4	1650.2
900	1652.0	1653.8	1655.6	1657.4	1659.2	1661.0	1662.8	1664.6	1666.4	1668.2
910	1670.0	1671.8	1673.6	1675.4	1677.2	1679.0	1680.8	1682.6	1684.4	1686.2
920	1688.0	1689.8	1691.6	1693.4	1695.2	1697.0	1698.8	1700.6	1702.4	1704.2
930	1706.0	1707.8	1709.6	1711.4	1713.2	1715.0	1716.8	1718.6	1720.4	1722.2
940	1724.0	1725.8	1727.6	1729.4	1731.2	1733.0	1734.8	1736.6	1738.4	1740.2
950	1742.0	1743.8	1745.6	1747.4	1749.2	1751.0	1752.8	1754.6	1756.4	1758.2
960	1760.0	1761.8	1763.6	1765.4	1767.2	1769.0	1770.8	1772.6	1774.4	1776.2
970	1778.0	1779.8	1781.6	1783.4	1785.2	1787.0	1788.8	1790.6	1792.4	1794.2
980	1796.0	1797.8	1799.6	1801.4	1803.2	1805.0	1806.8	1808.6	1810.4	1812.2
990	1814.0	1815.8	1817.6	1819.4	1821.2	1823.0	1824.8	1826.6	1828.4	1830.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1000	1832.0	1833.8	1835.6	1837.4	1839.2	1841.0	1842.8	1844.6	1846.4	1848.2
1010	1850.0	1851.8	1853.6	1855.4	1857.2	1859.0	1860.8	1862.6	1864.4	1866.2
1020	1868.0	1869.8	1871.6	1873.4	1875.2	1877.0	1878.8	1880.6	1882.4	1884.2
1030	1886.0	1887.8	1889.6	1891.4	1893.2	1895.0	1896.8	1898.6	1900.4	1902.2
1040	1904.0	1905.8	1907.6	1909.4	1911.2	1913.0	1914.8	1916.6	1918.4	1920.2
1050	1922.0	1923.8	1925.6	1927.4	1929.2	1931.0	1932.8	1934.6	1936.4	1938.2
1060	1940.0	1941.8	1943.6	1945.4	1947.2	1949.0	1950.8	1952.6	1954.4	1956.2
1070	1958.0	1959.8	1961.6	1963.4	1965.2	1967.0	1968.8	1970.6	1972.4	1974.2
1080	1976.0	1977.8	1979.6	1981.4	1983.2	1985.0	1986.8	1988.6	1990.4	1992.2
1090	1994.0	1995.8	1997.6	1999.4	2001.2	2003.0	2004.8	2006.6	2008.4	2010.2
1100	2012.0	2013.8	2015.6	2017.4	2019.2	2021.0	2022.8	2024.6	2026.4	2028.2
1110	2030.0	2031.8	2033.6	2035.4	2037.2	2039.0	2040.8	2042.6	2044.4	2046.2
1120	2048.0	2049.8	2051.6	2053.4	2055.2	2057.0	2058.8	2060.6	2062.4	2064.2
1130	2066.0	2067.8	2069.6	2071.4	2073.2	2075.0	2076.8	2078.6	2080.4	2082.2
1140	2084.0	2085.8	2087.6	2089.4	2091.2	2093.0	2094.8	2096.6	2098.4	2100.2
1150	2102.0	2103.8	2105.6	2107.4	2109.2	2111.0	2112.8	2114.6	2116.4	2118.2
1160	2120.0	2121.8	2123.6	2125.4	2127.2	2129.0	2130.8	2132.6	2134.4	2136.2
1170	2138.0	2139.8	2141.6	2143.4	2145.2	2147.0	2148.8	2150.6	2152.4	2154.2
1180	2156.0	2157.8	2159.6	2161.4	2163.2	2165.0	2166.8	2168.6	2170.4	2172.2
1190	2174.0	2175.8	2177.6	2179.4	2181.2	2183.0	2184.8	2186.6	2188.4	2190.2

For interpolation										
	°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
	°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1200	2192.0	2193.8	2195.6	2197.4	2199.2	2201.0	2202.8	2204.6	2206.4	2208.2
1210	2210.0	2211.8	2213.6	2215.4	2217.2	2219.0	2220.8	2222.6	2224.4	2226.2
1220	2228.0	2229.8	2231.6	2233.4	2235.2	2237.0	2238.8	2240.6	2242.4	2244.2
1230	2246.0	2247.8	2249.6	2251.4	2253.2	2255.0	2256.8	2258.6	2260.4	2262.2
1240	2264.0	2265.8	2267.6	2269.4	2271.2	2273.0	2274.8	2276.6	2278.4	2280.2
1250	2282.0	2283.8	2285.6	2287.4	2289.2	2291.0	2292.8	2294.6	2296.4	2208.2
1260	2300.0	2301.8	2303.6	2305.4	2307.2	2309.0	2310.8	2312.6	2314.4	2316.2
1270	2318.0	2319.8	2321.6	2323.4	2325.2	2327.0	2328.8	2330.6	2332.4	2334.2
1280	2336.0	2337.8	2339.6	2341.4	2343.2	2345.0	2346.8	2348.6	2350.4	2352.2
1290	2354.0	2355.8	2357.6	2359.4	2361.2	2363.0	2364.8	2366.6	2368.4	2370.2
1300	2372.0	2373.8	2375.6	2377.4	2379.2	2381.0	2382.8	2384.6	2386.4	2388.2
1310	2390.0	2391.8	2393.6	2395.4	2397.2	2399.0	2400.8	2402.6	2404.4	2406.2
1320	2408.0	2409.8	2411.6	2413.4	2415.2	2417.0	2418.8	2420.6	2422.4	2424.2
1330	2426.0	2427.8	2429.6	2431.4	2433.2	2435.0	2436.8	2438.6	2440.4	2442.2
1340	2444.0	2445.8	2447.6	2449.4	2451.2	2453.0	2454.8	2456.6	2458.4	2460.2
1350	2462.0	2463.8	2465.6	2467.4	2469.2	2471.0	2472.8	2474.6	2476.4	2478.2
1360	2480.0	2481.8	2483.6	2485.4	2487.2	2489.0	2490.8	2492.6	2494.4	2496.2
1370	2498.0	2499.8	2501.6	2503.4	2505.2	2507.0	2508.8	2510.6	2512.4	2514.2
1380	2516.0	2517.8	2519.6	2521.4	2523.2	2525.0	2526.8	2528.6	2530.4	2532.2
1390	2534.0	2535.8	2537.6	2539.4	2541.2	2543.0	2544.8	2546.6	2548.4	2550.2

TEMPERATURES—CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1400	2552.0	2553.8	2555.6	2557.4	2559.2	2561.0	2562.8	2564.6	2566.4	2568.2
1410	2570.0	2571.8	2573.6	2575.4	2577.2	2579.0	2580.8	2582.6	2584.4	2586.2
1420	2588.0	2589.8	2591.6	2593.4	2595.2	2597.0	2598.8	2600.6	2602.4	2604.2
1430	2606.0	2607.8	2609.6	2611.4	2613.2	2615.0	2616.8	2618.6	2620.4	2622.2
1440	2624.0	2625.8	2627.6	2629.4	2631.2	2633.0	2634.8	2636.6	2638.4	2640.2
1450	2642.0	2643.8	2645.6	2647.4	2649.2	2651.0	2652.8	2654.6	2656.4	2658.2
1460	2660.0	2661.8	2663.6	2665.4	2667.2	2669.0	2670.8	2672.6	2674.4	2676.2
1470	2678.0	2679.8	2681.6	2683.4	2685.2	2687.0	2688.8	2690.6	2692.4	2694.2
1480	2696.0	2697.8	2699.6	2701.4	2703.2	2705.0	2706.8	2708.6	2710.4	2712.2
1490	2714.0	2715.8	2717.6	2719.4	2721.2	2723.0	2724.8	2726.6	2728.4	2730.2
1500	2732.0	2733.8	2735.6	2737.4	2739.2	2741.0	2742.8	2744.6	2746.4	2748.2
1510	2750.0	2751.8	2753.6	2755.4	2757.2	2759.0	2760.8	2762.6	2764.4	2766.2
1520	2768.0	2769.8	2771.6	2773.4	2775.2	2777.0	2778.8	2780.6	2782.4	2784.2
1530	2786.0	2787.8	2789.6	2791.4	2793.2	2795.0	2796.8	2798.6	2800.4	2802.2
1540	2804.0	2805.8	2807.6	2809.4	2811.2	2813.0	2814.8	2816.6	2818.4	2820.2
1550	2822.0	2823.8	2825.6	2827.4	2829.2	2831.0	2832.8	2834.6	2836.4	2838.2
1560	2840.0	2841.8	2843.6	2845.4	2847.2	2849.0	2850.8	2852.6	2854.4	2856.2
1570	2858.0	2859.8	2861.6	2863.4	2865.2	2867.0	2868.8	2870.6	2872.4	2874.2
1580	2876.0	2877.8	2879.6	2881.4	2883.2	2885.0	2886.8	2888.6	2890.4	2892.2
1590	2894.0	2895.8	2897.6	2899.4	2901.2	2903.0	2904.8	2906.6	2908.4	2910.2

For interpolation											
	°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
	°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1600	2912.0	2913.8	2915.6	2917.4	2919.2	2921.0	2922.8	2924.6	2926.4	2928.2
1610	2930.0	2931.8	2933.6	2935.4	2937.2	2939.0	2940.8	2942.6	2944.4	2946.2
1620	2948.0	2949.8	2951.6	2953.4	2955.2	2957.0	2958.8	2960.6	2962.4	2964.2
1630	2966.0	2967.8	2969.6	2971.4	2973.2	2975.0	2976.8	2978.6	2980.4	2982.2
1640	2984.0	2985.8	2987.6	2989.4	2991.2	2993.0	2994.8	2996.6	2998.4	3000.2
1650	3002.0	3003.8	3005.6	3007.4	3009.2	3011.0	3012.8	3014.6	3016.4	3018.2
1660	3020.0	3021.8	3023.6	3025.4	3027.2	3029.0	3030.8	3032.6	3034.4	3036.2
1670	3038.0	3039.8	3041.6	3043.4	3045.2	3047.0	3048.8	3050.6	3052.4	3054.2
1680	3056.0	3057.8	3059.6	3061.4	3063.2	3065.0	3066.8	3068.6	3070.4	3072.2
1690	3074.0	3075.8	3077.6	3079.4	3081.2	3083.0	3084.8	3086.6	3088.4	3090.2
1700	3092.0	3093.8	3095.6	3097.4	3099.2	3101.0	3102.8	3104.6	3106.4	3108.2
1710	3110.0	3111.8	3113.6	3115.4	3117.2	3119.0	3120.8	3122.6	3124.4	3126.2
1720	3128.0	3129.8	3131.6	3133.4	3135.2	3137.0	3138.8	3140.6	3142.4	3144.2
1730	3146.0	3147.8	3149.6	3151.4	3153.2	3155.0	3156.8	3158.6	3160.4	3162.2
1740	3164.0	3165.8	3167.6	3169.4	3171.2	3173.0	3174.8	3176.6	3178.4	3180.2
1750	3182.0	3183.8	3185.6	3187.4	3189.2	3191.0	3192.8	3194.6	3196.4	3198.2
1760	3200.0	3201.8	3203.6	3205.4	3207.2	3209.0	3210.8	3212.6	3214.4	3216.2
1770	3218.0	3219.8	3221.6	3223.4	3225.2	3227.0	3228.8	3230.6	3232.4	3234.2
1780	3236.0	3237.8	3239.6	3241.4	3243.2	3245.0	3246.8	3248.6	3250.4	3252.2
1790	3254.0	3255.8	3257.6	3259.4	3261.2	3263.0	3264.8	3266.6	3268.4	3270.2

TEMPERATURES—CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
1800	3272.0	3273.8	3275.6	3277.4	3279.2	3281.0	3282.8	3284.6	3286.4	3288.2
1810	3290.0	3291.8	3293.6	3295.4	3297.2	3299.0	3300.8	3302.6	3304.4	3306.2
1820	3308.0	3309.8	3311.6	3313.4	3315.2	3317.0	3318.8	3320.6	3322.4	3324.2
1830	3326.0	3327.8	3329.6	3331.4	3333.2	3335.0	3336.8	3338.6	3340.4	3342.2
1840	3344.0	3345.8	3347.6	3349.4	3351.2	3353.0	3354.8	3356.6	3358.4	3360.2
1850	3362.0	3363.8	3365.6	3367.4	3369.2	3371.0	3372.8	3374.6	3376.4	3378.2
1860	3380.0	3381.8	3383.6	3385.4	3387.2	3389.0	3390.8	3392.6	3394.4	3396.2
1870	3398.0	3399.8	3401.6	3403.4	3405.2	3407.0	3408.8	3410.6	3412.4	3414.2
1880	3416.0	3417.8	3419.6	3421.4	3423.2	3425.0	3426.8	3428.6	3430.4	3432.2
1890	3434.0	3435.8	3437.6	3439.4	3441.2	3443.0	3444.8	3446.6	3448.4	3450.2
1900	3452.0	3453.8	3455.6	3457.4	3459.2	3461.0	3462.8	3464.6	3466.4	3468.2
1910	3470.0	3471.8	3473.6	3475.4	3477.2	3479.0	3480.8	3482.6	3484.4	3486.2
1920	3488.0	3489.8	3491.6	3493.4	3495.2	3497.0	3498.8	3500.6	3502.4	3504.2
1930	3506.0	3507.8	3509.6	3511.4	3513.2	3515.0	3516.8	3518.6	3520.4	3522.2
1940	3424.0	3525.8	3527.6	3529.4	3531.2	3533.0	3534.8	3536.6	3538.4	3540.2
1950	3542.0	3543.8	3545.6	3547.4	3549.2	3551.0	3552.8	3554.6	3556.4	3558.2
1960	3560.0	3561.8	3563.6	3565.4	3567.2	3569.0	3570.8	3572.6	3574.4	3576.2
1970	3578.0	3579.8	3581.6	3583.4	3585.2	3587.0	3588.8	3590.6	3592.4	3594.2
1980	3596.0	3597.8	3599.6	3601.4	3603.2	3605.0	3606.8	3608.6	3610.4	3612.2
1990	3614.0	3615.8	3617.6	3619.4	3621.2	3623.0	3624.8	3626.6	3628.4	3630.2

For interpolation										
°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2000	3632.0	3633.8	3635.6	3637.4	3639.2	3641.0	3642.8	3644.6	3646.4	3648.2
2010	3650.0	3651.8	3653.6	3655.4	3657.2	3659.0	3660.8	3662.6	3664.4	3666.2
2020	3668.0	3669.8	3671.6	3673.4	3675.2	3677.0	3678.8	3680.6	3682.4	3684.2
2030	3686.0	3687.8	3689.6	3691.4	3693.2	3695.0	3696.8	3698.6	3700.4	3702.2
2040	3704.0	3705.8	3707.6	3709.4	3711.2	3713.0	3714.8	3716.6	3718.4	3720.2
2050	3722.0	3723.8	3725.6	3727.4	3729.2	3731.0	3732.8	3734.6	3736.4	3738.2
2060	3740.0	3741.8	3743.6	3745.4	3747.2	3749.0	3750.8	3752.6	3754.4	3756.2
2070	3758.0	3759.8	3761.6	3763.4	3765.2	3767.0	3768.8	3770.6	3772.4	3774.2
2080	3776.0	3777.8	3779.6	3781.4	3783.2	3785.0	3786.8	3788.6	3790.4	3792.2
2090	3794.0	3795.8	3797.6	3799.4	3801.2	3803.0	3804.8	3806.6	3808.4	3810.2
2100	3812.0	3813.8	3815.6	3817.4	3819.2	3821.0	3822.8	3824.6	3826.4	3828.2
2110	3830.0	3831.8	3833.6	3835.4	3837.2	3839.0	3840.8	3842.6	3844.4	3846.2
2120	3848.0	3849.8	3851.6	3853.4	3855.2	3857.0	3858.8	3860.6	3862.4	3864.2
2130	3866.0	3867.8	3869.6	3871.4	3873.2	3875.0	3876.8	3878.6	3880.4	3882.2
2140	3884.0	3885.8	3887.6	3889.4	3891.2	3893.0	3894.8	3896.6	3898.4	3900.2
2150	3902.0	3903.8	3905.6	3907.4	3909.2	3911.0	3912.8	3914.6	3916.4	3918.2
2160	3920.0	3921.8	3923.6	3925.4	3927.2	3929.0	3930.8	3932.6	3934.4	3936.2
2170	3938.0	3939.8	3941.6	3943.4	3945.2	3947.0	3948.8	3950.6	3952.4	3954.2
2180	3956.0	3957.8	3959.6	3961.4	3963.2	3965.0	3966.8	3968.6	3970.4	3972.2
2190	3974.0	3975.8	3977.6	3979.4	3981.2	3983.0	3984.8	3986.6	3988.4	3990.2

TEMPERATURES—CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2200	3992.0	3993.8	3995.6	3997.4	3999.2	4001.0	4002.8	4004.6	4006.4	4008.2
2210	4010.0	4011.8	4013.6	4015.4	4017.2	4019.0	4020.8	4022.6	4024.4	4026.2
2220	4028.0	4029.8	4031.6	4033.4	4035.2	4037.0	4038.8	4040.6	4042.4	4044.2
2230	4046.0	4047.8	4049.6	4051.4	4053.2	4055.0	4056.8	4058.6	4060.4	4062.2
2240	4064.0	4065.8	4067.6	4069.4	4071.2	4073.0	4074.8	4076.6	4078.4	4080.2
2250	4082.0	4083.8	4085.6	4087.4	4089.2	4091.0	4092.8	4094.6	4096.4	4098.2
2260	4100.0	4101.8	4103.6	4105.4	4107.2	4109.0	4110.8	4112.6	4114.4	4116.2
2270	4118.0	4119.8	4121.6	4123.4	4125.2	4127.0	4128.8	4130.6	4132.4	4134.2
2280	4136.0	4137.8	4139.6	4141.4	4143.2	4145.0	4146.8	4148.6	4150.4	4152.2
2290	4154.0	4155.8	4157.6	4159.4	4161.2	4163.0	4164.8	4166.6	4168.4	4170.2
2300	4172.0	4173.8	4175.6	4177.4	4179.2	4181.0	4182.8	4184.6	4186.4	4188.2
2310	4190.0	4191.8	4193.6	4195.4	4197.2	4199.0	4200.8	4202.6	4204.4	4206.2
2320	4208.0	4209.8	4211.6	4213.4	4215.2	4217.0	4218.8	4220.6	4222.4	4224.2
2330	4226.0	4227.8	4229.6	4231.4	4233.2	4235.0	4236.8	4238.6	4240.4	4242.2
2340	4244.0	4245.8	4247.6	4249.4	4251.2	4253.0	4254.8	4256.6	4258.4	4260.2
2350	4262.0	4263.8	4265.6	4267.4	4269.2	4271.0	4272.8	4274.6	4276.4	4278.2
2360	4280.0	4281.8	4383.6	4285.4	4287.2	4289.0	4290.8	4292.6	4294.4	4296.2
2370	4298.0	4299.8	4301.6	4303.4	4305.2	4307.0	4308.8	4310.6	4312.4	4314.2
2380	4316.0	4317.8	4319.6	4321.4	4323.2	4325.0	4326.8	4328.6	4330.4	4332.2
2390	4334.0	4335.8	4337.6	4339.4	4341.2	4343.0	4344.8	4346.6	4348.4	4350.2

For interpolation	°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
	°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2400	4352.0	4353.8	4355.6	4357.4	4359.2	4361.0	4362.8	4364.6	4366.4	4368.2
2410	4370.0	4371.8	4373.6	4375.4	4377.2	4379.0	4380.8	4382.6	4384.4	4386.2
2420	4388.0	4389.8	4391.6	4393.4	4395.2	4397.0	4398.8	4400.6	4402.4	4404.2
2430	4406.0	4407.8	4409.6	4411.4	4413.2	4415.0	4416.8	4418.6	4420.4	4422.2
2440	4424.0	4425.8	4427.6	4429.4	4431.2	4433.0	4434.8	4436.6	4438.4	4440.2
2450	4442.0	4443.8	4445.6	4447.4	4449.2	4451.0	4452.8	4454.6	4456.4	4458.2
2460	4460.0	4461.8	4463.6	4465.4	4467.2	4469.0	4470.8	4472.6	4474.4	4476.2
2470	4478.0	4479.8	4481.6	4483.4	4485.2	4487.0	4488.8	4490.6	4492.4	4494.2
2480	4496.0	4497.8	4499.6	4501.4	4503.2	4505.0	4506.8	4508.6	4510.4	4512.2
2490	4514.0	4515.8	4517.6	4519.4	4521.2	4523.0	4524.8	4526.6	4528.4	4530.2
2500	4532.0	4533.8	4535.6	4537.4	4539.2	4541.0	4542.8	4544.6	4546.4	4548.2
2510	4550.0	4551.8	4553.6	4555.4	4557.2	4559.0	4560.8	4562.6	4564.4	4566.2
2520	4568.0	4569.8	4571.6	4573.4	4575.2	4577.0	4578.8	4580.6	4582.4	4584.2
2530	4586.0	4587.8	4589.6	4591.4	4593.2	4595.0	4596.8	4598.6	4600.4	4602.2
2540	4604.0	4605.8	4607.6	4609.4	4611.2	4613.0	4614.8	4616.6	4618.4	4620.2
2550	4622.0	4623.8	4625.6	4627.4	4629.2	4631.0	4632.8	4634.6	4636.4	4638.2
2560	4640.0	4641.8	4643.6	4645.4	4647.2	4649.0	4650.8	4652.6	4654.4	4656.2
2570	4658.0	4659.8	4661.6	4663.4	4665.2	4667.0	4668.8	4670.6	4672.4	4674.2
2580	4676.0	4677.8	4679.6	4681.4	4683.2	4685.0	4686.8	4688.6	4690.4	4692.2
2590	4694.0	4695.8	4697.6	4699.4	4701.2	4703.0	4704.8	4706.6	4708.4	4710.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2600	4712.0	4713.8	4715.6	4717.4	4719.2	4721.0	4722.8	4724.6	4726.4	4728.2
2610	4730.0	4731.8	4733.6	4735.4	4737.2	4739.0	4740.8	4742.6	4744.4	4746.2
2620	4748.0	4749.8	4751.6	4753.4	4755.2	4757.0	4758.8	4760.6	4762.4	4764.2
2630	4766.0	4767.8	4769.6	4771.4	4773.2	4775.0	4776.8	4778.6	4780.4	4782.2
2640	4784.0	4785.8	4787.6	4789.4	4791.2	4793.0	4794.8	4796.6	4798.4	4800.2
2650	4802.0	4803.8	4805.6	4807.4	4809.2	4811.0	4812.8	4814.6	4816.4	4818.2
2660	4820.0	4821.8	4823.6	4825.4	4827.2	4829.0	4830.8	4832.6	4834.4	4836.2
2670	4838.0	4839.8	4841.6	4843.4	4845.2	4847.0	4848.8	4850.6	4852.4	4854.2
2680	4856.0	4857.8	4859.6	4861.4	4863.2	4865.0	4866.8	4868.6	4870.4	4872.2
2690	4874.0	4875.8	4877.6	4879.4	4881.2	4883.0	4884.8	4886.6	4888.4	4890.2
2700	4892.0	4893.8	4895.6	4897.4	4899.2	4901.0	4902.8	4904.6	4906.4	4908.2
2710	4910.0	4911.8	4913.6	4915.4	4917.2	4919.0	4920.8	4922.6	4924.4	4926.2
2720	4928.0	4929.8	4931.6	4933.4	4935.2	4937.0	4938.8	4940.6	4942.4	4944.2
2730	4946.0	4947.8	4949.6	4951.4	4953.2	4955.0	4956.8	4958.6	4960.4	4962.2
2740	4964.0	4965.8	4967.6	4969.4	4971.2	4973.0	4974.8	4976.6	4978.4	4980.2
2750	4982.0	4983.8	4985.6	4987.4	4989.2	4991.0	4992.8	4994.6	4996.4	4998.2
2760	5000.0	5001.8	5003.6	5005.4	5007.2	5009.0	5010.8	5012.6	5014.4	5016.2
2770	5018.0	5019.8	5021.6	5023.4	5025.2	5027.0	5028.8	5030.6	5032.4	5034.2
2780	5036.0	5037.8	5039.6	5041.4	5043.2	5045.0	5046.8	5048.6	5050.4	5052.2
2790	5054.0	5055.8	5057.6	5059.4	5061.2	5063.0	5064.8	5066.6	5068.4	5070.2

For interpolation											
	°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
	°F	0 18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Continued)

Conversion Table

For temperatures above 0° C.

Temp. °C.	0	1	2	3	4	5	6	7	8	9
2800	5072.0	5073.8	5075.6	5077.4	5079.2	5081.0	5082.8	5084.6	5086.4	5088.2
2810	5090.0	5091.8	5093.6	5095.4	5097.2	5099.0	5100.8	5102.6	5104.4	5106.2
2820	5108.0	5109.8	5111.6	5113.4	5115.2	5117.0	5118.8	5120.6	5122.4	5124.2
2830	5126.0	5127.8	5129.6	5131.4	5133.2	5135.0	5136.8	5138.6	5140.4	5142.2
2840	5144.0	5145.8	5147.6	5149.4	5151.2	5153.0	5154.8	5156.6	5158.4	5160.2
2850	5162.0	5163.8	5165.6	5167.4	5169.2	5171.0	5172.8	5174.6	5176.4	5178.2
2860	5180.0	5181.8	5183.6	5185.4	5187.2	5189.0	5190.8	5192.6	5194.4	5196.2
2870	5198.0	5199.8	5201.6	5203.4	5205.2	5207.0	5208.8	5210.6	5212.4	5214.2
2880	5216.0	5217.8	5219.6	5221.4	5223.2	5225.0	5226.8	5228.6	5230.4	5232.2
2890	5234.0	5235.8	5237.6	5239.4	5241.2	5243.0	5244.8	5246.6	5248.4	5250.2
2900	5252.0	5253.8	5255.6	5257.4	5259.2	5261.0	5262.8	5264.6	5266.4	5268.2
2910	5270.0	5271.8	5273.6	5275.4	5277.2	5279.0	5280.8	5282.6	5284.4	5286.2
2920	5288.0	5289.8	5291.6	5293.4	5295.2	5297.0	5298.8	5300.6	5302.4	5304.2
2930	5306.0	5307.8	5309.6	5311.4	5313.2	5315.0	5316.8	5318.6	5320.4	5322.2
2940	5324.0	5325.8	5327.6	5329.4	5331.2	5333.0	5334.8	5336.6	5338.4	5340.2
2950	5342.0	5343.8	5345.6	5347.4	5349.2	5351.0	5352.8	5354.6	5356.4	5358.2
2960	5360.0	5361.8	5363.6	5365.4	5367.2	5369.0	5370.8	5372.6	5374.4	5376.2
2970	5378.0	5379.8	5381.6	5383.4	5385.2	5387.0	5388.8	5390.6	5392.4	5394.2
2980	5396.0	5397.8	5399.6	5401.4	5403.2	5405.0	5406.8	5408.6	5410.4	5412.2
2990	5414.0	5415.8	5417.6	5419.4	5421.2	5423.0	5424.8	5426.6	5428.4	5430.2

TEMPERATURES — CENTIGRADE TO FAHRENHEIT (Concluded)

Temp. °C.	0	1	2	3	4	5	6	7	8	9
3000	5432.0	5433.8	5435.6	5437.4	5439.2	5441.0	5442.8	5444.6	5446.4	5448.2
3010	5450.0	5451.8	5453.6	5455.4	5457.2	5459.0	5460.8	5462.6	5464.4	5466.2
3020	5468.0	5469.8	5471.6	5473.4	5475.2	5477.0	5478.8	5480.6	5482.4	5484.2
3030	5486.0	5487.8	5489.6	5491.4	5493.2	5495.0	5496.8	5498.6	5500.4	5502.2
3040	5504.0	5505.8	5507.6	5509.4	5511.2	5513.0	5514.8	5516.6	5518.4	5520.2
3050	5522.0	5523.8	5525.6	5527.4	5529.2	5531.0	5532.8	5534.6	5536.4	5538.2
3060	5540.0	5541.8	5543.6	5545.4	5547.2	5549.0	5550.8	5552.6	5554.4	5556.2
3070	5558.0	5559.8	5561.6	5563.4	5565.2	5567.0	5568.8	5570.6	5572.4	5574.2
3080	5576.0	5577.8	5579.6	5581.4	5583.2	5585.0	5586.8	5588.6	5590.4	5592.2
3090	5594.0	5595.8	5597.6	5599.4	5601.2	5603.0	5604.8	5606.6	5608.4	5610.2

For interpolation	°C	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
	°F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1.80

TEMPERATURES — FAHRENHEIT TO CENTIGRADE

Conversion Table

The values in the body of the table give in degrees Centigrade the temperatures indicated in degrees Fahrenheit at the top and side.

1° F. = 0.5556° C.

Temperatures below 0° F.

Temp. ° F.	0	1	2	3	4	5	6	7	8	9
0	− 17.78	18.33	18.89	19.44	20.00	20.56	21.11	21.67	22.22	22.78
− 10	− 23.33	23.89	24.44	25.00	25.56	26.11	26.67	27.22	27.78	28.33
− 20	− 28.89	29.44	30.00	30.56	31.11	31.67	32.22	32.78	33.33	33.89
− 30	− 34.44	35.00	35.56	36.11	36.67	37.22	37.78	38.33	38.89	39.44
− 40	− 40.00	40.56	41.11	41.67	42.22	42.78	43.33	43.89	44.44	45.00
− 50	− 45.56	46.11	46.67	47.22	47.78	48.33	48.89	49.44	50.00	50.56
− 60	− 51.11	51.67	52.22	52.78	53.33	53.89	54.44	55.00	55.56	56.11
− 70	− 56.67	57.22	57.78	58.33	58.89	59.44	60.00	60.56	61.11	61.67
− 80	− 62.22	62.78	63.33	63.89	64.44	65.00	65.56	66.11	66.67	67.22
− 90	− 67.78	68.33	68.89	69.44	70.00	70.56	71.11	71.67	72.22	72.78

TEMPERATURES—FAHRENHEIT TO CENTIGRADE (Continued)

Temp. ° F.	0	1	2	3	4	5	6	7	8	9
– 100	–73.33	73.89	74.44	75.00	75.56	76.11	76.67	77.22	77.78	78.33
– 110	–78.89	79.44	80.00	80.56	81.11	81.67	82.22	82.78	83.33	83.89
– 120	–84.44	85.00	85.56	86.11	86.67	87.22	87.78	88.33	88.89	89.44
– 130	–90.00	90.56	91.11	91.67	92.22	92.78	93.33	93.89	94.44	95.00
– 140	–95.56	96.11	96.67	97.22	97.78	98.33	98.89	99.44	100.00	100.56
– 150	–101.11	101.67	102.22	102.78	103.33	103.89	104.44	105.00	105.56	106.11
– 160	–106.67	107.22	107.78	108.33	108.89	109.44	110.00	110.56	111.11	111.67
– 170	–112.22	112.78	113.33	113.89	114.44	115.00	115.56	116.11	116.67	117.22
– 180	–117.78	118.33	118.89	119.44	120.00	120.56	121.11	121.67	122.22	122.76
– 190	–123.33	123.89	124.44	125.00	125.56	126.11	126.67	127.22	127.78	128.33
– 200	–128.89	129.44	130.00	130.56	131.11	131.67	132.22	132.78	133.33	133.89
– 210	–134.44	135.00	135.56	136.11	136.67	137.22	137.78	138.33	138.89	139.44
– 220	–140.00	140.56	141.11	141.67	142.22	142.78	143.33	143.89	144.44	145.00
– 230	–145.56	146.11	146.67	147.22	147.78	148.33	148.89	149.44	150.00	150.56
– 240	–151.11	151.67	152.22	152.78	153.33	153.89	154.44	155.00	155.56	156.11
– 250	–156.67	157.22	157.78	158.33	158.89	159.44	160.00	160.56	161.11	161.67
– 260	–162.22	163.78	163.33	163.89	164.44	165.00	165.56	166.11	166.67	167.22
– 270	–167.78	168.33	168.89	169.44	170.00	170.56	171.11	171.67	172.22	172.78
– 280	–173.33	173.89	174.44	175.00	175.56	176.11	176.67	177.22	177.78	178.33
– 290	–178.89	179.44	180.00	180.56	181.11	181.67	182.22	182.78	183.33	183.89

For interpolation										
	°F	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
	°C	0.06	0.11	0.17	0.22	0.28	0.33	0.39	0.44	0.50	0.56

TEMPERATURES — FAHRENHEIT TO CENTIGRADE (Continued)

Conversion Tables

Temperature below 0° F.

Temp. ° F	0	1	2	3	4	5	6	7	8	9
– 300	– 184.44	185.00	185.56	186.11	186.67	187.22	187.78	188.33	188.89	189.44
– 310	– 190.00	190.56	191.11	191.67	192.22	192.78	193.33	193.89	194.44	195.00
– 320	– 195.56	196.11	196.67	197.22	197.78	198.33	198.89	199.44	200.00	200.56
– 330	– 201.11	201.67	202.22	202.78	203.33	203.89	204.44	205.00	205.56	206.11
– 340	– 206.67	207.22	207.78	208.33	208.89	209.44	210.00	210.56	211.11	211.67
– 350	– 212.22	212.78	213.33	213.89	214.44	215.00	215.56	216.11	216.67	217.22
– 360	– 217.78	218.33	218.89	219.44	220.00	220.56	221.11	221.67	222.22	222.78
– 370	– 223.33	223.89	224.44	225.00	225.56	226.11	226.67	227.22	227.78	228.33
– 380	– 228.89	229.44	230.00	230.56	231.11	231.67	232.22	232.78	233.33	233.89
– 390	– 234.44	235.00	235.56	236.11	236.67	237.22	237.78	238.33	238.89	239.44
– 400	– 240.00	240.56	241.11	241.67	242.22	242.78	243.33	243.89	244.44	245.00
– 410	– 245.56	246.11	246.67	247.22	247.78	248.33	248.89	249.44	250.00	250.56
– 420	– 251.11	251.67	252.22	252.78	253.33	253.89	254.44	255.00	255.56	256.11
– 430	– 256.67	257.22	257.78	258.33	258.89	259.44	260.00	260.56	261.11	261.67
– 440	– 262.22	262.78	263.33	263.89	264.44	265.00	265.56	266.11	266.67	267.22
– 450	– 267.78	268.33	268.89	269.44	270.00	270.56	271.11	271.67	272.22	272.78

– 459.4° F. = – 273° C. = absolute zero.

TEMPERATURES—FAHRENHEIT TO CENTIGRADE (Continued)

Temperatures above 0° F.

Temp. °F	0	1	2	3	4	5	6	7	8	9
0	−17.78	17.22	16.67	16.11	15.56	15.00	14.44	13.89	13.33	12.78
+10	−12.22	11.67	11.11	10.56	10.00	9.44	8.89	8.33	7.78	7.22
20	−6.67	6.11	5.56	5.00	4.44	3.89	3.33	2.78	2.22	1.67
30	−1.11	−0.56	0.00	+0.56	+1.11	+1.67	+2.22	+2.78	+3.33	+3.89
40	+4.44	5.00	5.56	6.11	6.67	7.22	7.78	8.33	8.89	9.44
50	10.00	10.56	11.11	11.67	12.22	12.78	13.33	13.89	14.44	15.00
60	15.56	16.11	16.67	17.22	17.78	18.33	18.89	19.44	20.00	20.56
70	21.11	21.67	22.22	22.78	23.33	23.89	24.44	25.00	25.56	26.11
80	26.67	27.22	27.78	28.33	28.89	29.44	30.00	30.56	31.11	31.67
90	32.22	32.78	33.33	33.89	34.44	35.00	35.56	36.11	36.67	37.22
100	37.78	38.33	38.89	39.44	40.00	40.56	41.11	41.67	42.22	42.78
110	43.33	43.89	44.44	45.00	45.56	46.11	46.67	47.22	47.78	48.33
120	48.89	49.44	50.00	50.56	51.11	51.67	52.22	52.78	53.33	53.89
130	54.44	55.00	55.56	56.11	56.67	57.22	57.78	58.33	58.89	59.44
140	60.00	60.56	61.11	61.67	62.22	62.78	63.33	63.89	64.44	65.00
150	65.56	66.11	66.67	67.22	67.78	68.33	68.89	69.44	70.00	70.56
160	71.11	71.67	72.22	72.78	73.33	73.89	74.44	75.00	75.56	76.11
170	76.67	77.22	77.78	78.33	78.89	79.44	80.00	80.56	81.11	81.67
180	82.22	82.78	83.33	83.89	84.44	85.00	85.56	86.11	86.67	87.22
190	87.78	88.33	88.89	89.44	90.00	90.56	91.11	91.67	92.22	92.78

For interpolation										
°F	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°C	0.06	0.11	0.17	0.22	0.28	0.33	0.39	0.44	0.50	0.56

TEMPERATURES — FAHRENHEIT TO CENTIGRADE (Continued)

Conversion Tables

Temperatures above 0° F.

Temp. °F.	0	1	2	3	4	5	6	7	8	9
200	93.33	93.89	94.44	95.00	95.56	96.11	96.67	97.22	97.78	98.33
210	98.89	99.44	100.00	100.56	101.11	101.67	102.22	102.78	103.33	103.89
220	104.44	105.00	105.56	106.11	106.67	107.22	107.78	108.33	108.89	109.44
230	110.00	110.56	111.11	111.67	112.22	112.78	113.33	113.89	114.44	115.00
240	115.56	116.11	116.67	117.22	117.78	118.33	118.89	119.44	120.00	120.56
250	121.11	121.67	122.22	122.78	123.33	123.89	124.44	125.00	125.56	126.11
260	126.67	127.22	127.78	128.33	128.89	129.44	130.00	130.56	131.11	131.67
270	132.22	132.78	133.33	133.89	134.44	135.00	135.56	136.11	136.67	137.22
280	137.78	138.33	138.89	139.44	140.00	140.56	141.11	141.67	142.22	142.78
290	143.33	143.89	144.44	145.00	145.56	146.11	146.67	147.22	147.78	148.33
300	148.89	149.44	150.00	150.56	151.11	151.67	152.22	152.78	153.33	153.89
310	154.44	155.00	155.56	156.11	156.67	157.22	157.78	158.33	158.89	159.44
320	160.00	160.56	161.11	161.67	162.22	162.78	163.33	163.89	164.44	165.00
330	165.56	166.11	166.67	167.22	167.78	168.33	168.89	169.44	170.00	170.56
340	171.11	171.67	172.22	172.78	173.33	173.89	174.44	175.00	175.56	176.11
350	176.67	177.22	177.78	178.33	178.89	179.44	180.00	180.56	181.11	181.67
360	182.22	182.78	183.33	183.89	184.44	185.00	185.56	186.11	186.67	187.22
370	187.78	188.33	188.89	189.44	190.00	190.56	191.11	191.67	192.22	192.78
380	193.33	193.89	194.44	105.00	195.56	196.11	196.67	197.22	197.78	198.33
390	198.89	194.94	200.00	200.56	201.11	201.67	202.22	202.78	203.33	203.89

TEMPERATURES—FAHRENHEIT TO CENTIGRADE (Continued)

Temp. °F.	0	1	2	3	4	5	6	7	8	9
400	204.44	205.00	205.56	206.11	206.67	207.22	207.78	208.33	208.89	209.44
410	210.00	210.56	211.11	211.67	212.22	212.78	213.33	213.89	214.44	215.00
420	215.56	216.11	216.67	217.22	217.78	218.33	218.89	219.44	220.00	220.56
430	221.11	221.67	222.22	222.78	223.33	223.89	224.44	225.00	225.56	226.11
440	226.67	227.22	227.78	228.33	228.89	229.44	230.00	230.56	231.11	231.67
450	232.22	232.78	233.33	233.89	234.44	235.00	235.56	236.11	236.67	237.22
460	237.78	238.33	238.89	239.44	240.00	240.56	241.11	241.67	242.22	242.78
470	243.33	243.89	244.44	245.00	245.56	246.11	246.67	247.22	247.78	248.33
480	248.89	249.44	250.00	250.56	251.11	251.67	252.22	252.78	253.33	253.89
490	254.44	255.00	255.56	256.11	256.67	257.22	257.78	258.33	258.89	259.44
500	260.00	260.56	261.11	261.67	262.22	262.76	263.33	263.89	264.44	265.00
510	265.56	266.11	266.67	267.22	267.78	268.33	268.89	269.44	270.00	270.56
520	271.11	271.67	272.22	272.78	273.33	273.89	274.44	275.00	275.56	276.11
530	276.67	277.22	277.78	278.33	278.89	279.44	280.00	280.56	281.11	281.67
540	282.22	282.78	283.33	283.89	284.44	285.00	285.56	286.11	286.67	287.22
550	287.78	288.33	288.89	289.44	290.00	290.56	291.11	291.67	292.22	292.78
560	293.33	293.89	294.44	295.00	295.56	296.11	296.67	297.22	297.78	298.33
570	298.89	299.44	300.00	300.56	301.11	301.67	302.22	302.78	303.33	303.84
580	304.44	305.00	305.56	306.11	306.67	307.22	307.78	308.33	308.89	309.49
590	310.00	310.56	311.11	311.67	312.22	312.78	313.33	313.89	314.44	315.00

For interpolation										
°F	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
°C	0.06	0.11	0.17	0.22	0.28	0.33	0.39	0.44	0.50	0.56

TEMPERATURES — FAHRENHEIT TO CENTIGRADE (Continued)

Conversion Tables

Temperatures above 0° F.

Temp. ° F.	0	1	2	3	4	5	6	7	8	9
600	315.56	316.11	316.67	317.22	317.78	318.33	318.39	319.44	320.00	320.56
610	321.11	321.67	322.22	322.78	323.33	323.89	324.44	325.00	325.56	326.11
620	326.67	327.22	327.78	328.33	328.89	329.44	330.00	330.56	331.11	331.67
630	332.22	332.78	333.33	333.89	334.44	335.00	335.56	356.11	336.67	337.22
640	337.78	338.33	338.89	339.44	340.00	340.56	341.11	341.67	342.22	342.78
650	343.33	343.89	344.44	345.00	345.56	346.11	346.67	347.22	347.78	348.33
660	348.89	349.44	350.00	350.56	351.11	351.67	352.22	352.78	353.33	353.89
670	354.44	355.00	355.56	356.11	356.67	357.22	357.78	358.33	358.89	359.44
680	360.00	360.56	361.11	361.67	362.22	362.78	363.33	363.89	364.44	365.00
690	365.56	366.11	366.67	367.22	367.78	368.33	368.89	369.44	370.00	370.56
700	371.11	371.67	372.22	372.78	373.33	373.89	374.44	375.00	375.56	376.11
710	376.67	377.22	377.78	378.33	378.89	379.44	380.00	380.56	381.11	381.67
720	382.22	382.78	383.33	383.89	384.44	385.00	385.56	386.11	386.67	387.22
730	387.78	388.33	388.89	389.44	390.00	390.56	391.11	391.67	392.22	392.78
740	393.33	393.89	394.44	395.00	395.56	396.11	396.67	397.22	397.78	398.33
750	398.89	399.44	400.00	400.56	401.11	401.67	402.22	402.78	403.33	403.89
760	404.44	405.00	405.56	406.11	406.67	407.22	407.78	408.33	408.89	409.44
770	410.00	410.56	411.11	411.67	412.22	412.78	413.33	413.89	414.44	415.00
780	415.56	416.11	416.67	417.22	417.78	418.33	418.89	419.44	420.00	420.56
790	421.11	421.67	422.22	422.78	423.33	423.89	424.44	425.00	425.56	426.11

TEMPERATURES—FAHRENHEIT TO CENTIGRADE (Concluded)

Temp. 0° F.	0	1	2	3	4	5	6	7	8	9
800	426.67	427.22	427.78	428.33	428.89	429.44	430.00	430.56	431.11	431.67
810	432.22	432.78	433.33	433.89	434.44	435.00	435.56	436.11	436.67	437.22
820	437.78	438.33	438.89	439.44	440.00	440.56	441.11	441.67	442.22	442.78
830	443.33	443.89	444.44	445.00	445.56	446.11	446.67	447.22	447.78	448.33
840	448.89	449.44	450.00	450.56	451.11	451.67	452.22	452.78	453.33	453.89
850	454.44	455.00	455.56	456.11	456.67	457.22	457.78	458.33	458.89	459.44
860	460.00	460.56	461.11	461.67	462.22	462.78	463.33	463.89	464.44	465.00
870	465.56	466.11	466.67	467.22	467.78	468.33	468.89	469.44	470.00	470.56
880	471.11	471.67	472.22	472.78	473.33	473.89	474.44	475.00	475.56	476.11
890	476.67	477.22	477.78	478.33	478.89	479.44	480.00	480.56	481.11	481.67
900	482.22	482.78	483.33	483.89	484.44	485.00	485.56	486.11	486.67	487.22
910	487.78	488.33	488.89	489.44	490.00	490.56	491.11	491.67	492.22	492.78
920	493.33	493.89	494.44	495.00	495.56	496.11	496.67	497.22	497.78	498.33
930	498.89	499.44	500.00	500.56	501.11	501.67	502.22	502.78	503.33	503.89
940	504.44	505.00	505.56	506.11	506.67	507.22	507.78	508.33	508.89	509.44
950	510.00	510.56	511.11	511.67	512.22	512.78	513.33	513.89	514.44	515.00
960	515.56	516.11	516.67	517.22	517.78	518.33	518.89	519.44	520.00	520.56
970	521.11	521.67	522.22	522.78	523.33	523.89	524.44	525.00	525.56	526.11
980	526.67	527.22	527.78	523.33	528.89	529.44	530.00	530.56	531.11	531.67
990	532.22	532.78	533.33	533.89	534.44	535.00	535.56	536.11	536.67	537.22

For interpolation										
°F	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.10
°C	0.06	0.11	0.17	0.22	0.28	0.33	0.39	0.44	0.50	0.56

COMPARISON OF WIRE GAUGES

DIAMETER OF WIRE IN INCHES

Gauge No.	Brown & Sharpe.	Birmingham or Stub's.	Washburn & Moen.	Imperial or Brit. Std.	Stub's Steel.	U. S. Std. plate.	Music wire.
00000000	.....	....	....	....	..	....	.0083
0000000	.....	....	....	.500	..	....	.0087
000000	.....	....	....	.464	..	.46875	.0095
00000	.....	....	....	.432	..	.4375	.0100
0000	.4600	.454	3938	.400	..	40625	.0110
000	.4096	.425	.3625	.372	..	.375	.0120
00	.3648	.380	.3310	.348	..	.34375	.0133
0	.3249	.340	.3065	.324	..	.3125	.0144
1	.2893	.300	.2830	.300	.227	.28125	.0156
2	.2576	.284	.2625	.276	.219	.265625	.0166
3	.2294	.259	.2437	.252	.212	.25	.0178
4	.2043	.238	.2253	.232	.207	.234375	.0188
5	.1819	.220	.2070	.212	.204	.21875	.0202
6	.1620	.203	.1920	.192	.201	.203125	.0215
7	.1443	.180	.1770	.176	.199	.1875	.0230
8	.1285	.165	.1620	.160	.197	.171875	.0243
9	.1144	.148	.1483	.144	.194	.15625	.0256
10	.1019	.134	.1350	.128	.191	.140625	.0270
11	.09074	.120	.1205	.116	.188	.125	.0284
12	.08081	.109	.1055	.104	.185	.109375	.0296
13	.07196	.095	.0915	.092	.182	.09375	.0314
14	.06408	.083	.0800	.080	.180	.078125	.0326
15	.05707	.072	.0720	.072	.178	.0703125	.0345
16	.05082	.065	.0625	.064	.175	.0625	.0360
17	.04526	.058	.0540	.056	.172	.05625	.0377
18	.04030	.049	.0475	.048	.168	.05	.0395
19	.03589	.042	.0410	.040	.164	.04375	.0414
20	.03196	.035	.0348	.036	.161	.0375	.0434
21	.02846	.032	.0318	.032	.157	.034375	.0460
22	.02535	.028	.0286	.028	.155	.03125	.0483
23	.02257	.025	.0258	.024	.153	.028125	.0515
24	.02010	.022	.0230	.022	.151	.025	.0550

COMPARISON OF WIRE GAUGES (Continued)

Diameter of Wire in Inches

Gauge No.	Brown & Sharpe.	Birmingham or Stub's.	Washburn & Moen.	Imperial or Brit. Std.	Stub's steel.	U. S. Std. plate.	Music wire.
25	.01790	.020	.0204	.020	.148	.021875	.0586
26	.01594	.018	.0181	.018	.146	.01875	.0626
27	.01419	.016	.0173	.0164	.143	.0171875	.0658
28	.01264	.014	.0162	.0149	.139	.015625	.0720
29	.01126	.013	.0150	.0136	.134	.0140625	.0760
30	.01003	.012	.0140	.0124	.127	.0125	.0800
31	.008928	.010	.0132	.0116	.120	.0109375	.0820
32	.007950	.009	.0128	.0108	.115	.01015625	.0860
33	.007080	.008	.0118	.0100	.112	.009375	.0900
34	.006304	.007	.0104	.0092	.110	.00859375	.0950
35	.005614	.005	.0095	.0084	.108	.0078125	
36	.005000	.004	.0090	.0076	.106	.00703125	
37	.004453	....	....	.0068	.103	.006640625	
38	.003965	....	....	.0060	.101	.00625	
39	.003531	....	....	.0052	.099		
40	.003145	....	....	.0048	.097		

TWIST DRILL AND STEEL WIRE GAUGE

Inches

No.	Size	No.	Size.	No.	Size.	No.	Size.	No.	Size.	No.	Size
1	.2280	11	.1910	21	.1590	31	.1200	41	.0960	51	.0670
2	.2210	12	.1890	22	.1570	32	.1160	42	.0935	52	.0635
3	.2130	13	.1850	23	.1540	33	.1130	43	.0890	53	.0595
4	.2090	14	.1820	24	.1520	34	.1110	44	.0860	54	.0550
5	.2055	15	.1800	25	.1495	35	.1100	45	.0820	55	.0520
6	.2040	16	.1770	26	.1470	36	.1065	46	.0810	56	.0465
7	.2010	17	.1730	27	.1440	37	.1040	47	.0785	57	.0430
8	.1990	18	.1695	28	.1405	38	.1015	48	.0760	58	.0420
9	.1960	19	.1660	29	.1360	39	.0995	49	.0730	59	.0410
10	.1935	20	.1610	30	.1285	40	.0980	50	.0700	60	.0400

DIMENSIONS OF WIRE

Stub's Gauge

Giving the diameter and cross-section in English and metric system for the Birmingham or Stub's gauge.

Gauge No.	Diameter in ins.	Section in sq.ins.	Diameter in cms.	Section in sq.cms.
0000	0.454	0.16188	1.1532	1.0444
000	.425	.14186	.0795	0.9152
00	.380	.11341	0.9652	.7317
0	.340	.09079	.8636	.5858
1	0.300	0.07069	0.7620	0.4560
2	.284	.06335	.7214	.4087
3	.259	.05269	.6579	.3399
4	.238	.04449	.6045	.2870
5	.220	.03801	.5588	.2452
6	0.203	0.03237	0.5156	0.20881
7	.180	.02545	.4572	.16147
8	.165	.02138	.4191	.13795
9	.148	.01720	.3759	.11099
10	.134	.01410	.3404	.09098
11	0.120	0.011310	0.3048	0.07297
12	.109	.009331	.2769	.06160
13	.095	.007088	.2413	.04573
14	.083	.005411	.2108	.03491
15	.072	.004072	.1829	.02627
16	0.065	0.0033183	0.16510	0.021409
17	.058	.0026421	.14732	.017046
18	.049	.0018857	.12446	.012166
19	.042	.0013854	.10668	.008938
20	.035	.0009621	.08890	.006207
21	0.032	0.0008042	0.08128	0.005189
22	.028	.0006158	.07112	.003973
23	.025	.0004909	.06350	.003167
24	.022	.0003801	.05588	.002452
25	.020	.0003142	.05080	.002027
26	0.018	0.0002545	0.04572	0.0016417
27	.016	.0002011	.04064	.0012972
28	.014	.0001539	.03556	.0009932
29	.013	.0001327	.03302	.0008563
30	.012	.0001131	.03048	.0007297
31	0.010	0.00007854	0.02540	0.0005067
32	.009	.00006362	.02286	.0004104
33	.008	.00005027	.02032	.0003243
34	.007	.00003848	.01778	.0002483
35	.005	.00001963	.01270	.0001267
36	0.004	0.00001257	0.01016	0.0000811

DIMENSIONS OF WIRE (Continued)

British Standard Gauge

Giving the diameter and cross-section in English and metric system for the British Standard Gauge.

Gauge No.	Diameter in ins.	Section in sq.ins.	Diameter in cms.	Section in sq.cms.
7-0	0.500	0.1963	1.2700	1.267
6-0	.464	.1691	1.1786	1.091
5-0	0.432	0.1466	1.0973	0.9456
4-0	.400	.1257	1.0160	.8107
3-0	.372	.1087	0.9449	.7012
2-0	.348	.0951	.8839	.6136
0	.324	.0825	.8230	.5319
1	0.300	0.07069	0.7620	0.4560
2	.276	.05983	.7010	.3858
3	.252	.04988	.6401	.3218
4	.232	.04227	.5893	.2727
5	.212	.03530	.5385	.2277
6	0.192	0.02895	0.4877	0.18679
7	.176	.02433	.4470	.15696
8	.160	.02010	.4064	.12973
9	.144	.01629	.3658	.10507
10	.128	.01287	.3251	.08302
11	0.116	0.010568	0.2946	0.06818
12	.104	.008495	.2642	.05480
13	.092	.006648	.2337	.04289
14	.080	.005027	.2032	.03243
15	.072	.004071	.1829	.02627
16	0.064	0.003217	0.16256	0.020755
17	.056	.002463	.14224	.015890
18	.048	.001810	.12192	.011675
19	.040	.001257	.10160	.008107
20	.036	.001018	.09144	.006567
21	0.032	0.0008042	0.08128	0.005189
22	.028	.0006158	.07112	.003973
23	.024	.0004524	.06096	.002922
24	.022	.0003801	.05588	.002452
25	.020	.0003142	.05080	.002027
26	0.0180	0.0002545	0.04572	0.0016417
27	.0164	.0002112	.04166	.0013628
28	.0148	.0001728	.03759	.0011099
29	.0136	.0001453	.03454	.0009363
30	.0124	.0001208	.03150	.0007791
31	0.0116	0.00010568	0.02946	0.0006818
32	.0108	.00009161	.02743	.0005910
33	.0100	.00007854	.02540	.0005067
34	.0092	.00006648	.02337	.0004289
35	.0084	.00005542	.02134	.0003575
36	0.0076	0.00004536	0.01930	0.0002927
37	.0068	.00003632	.01727	.0002343
38	.0060	.00002827	.01524	.0001824
39	.0052	.00002124	.01321	.0001370
40	.0048	.00001810	.01219	.0001167
41	0.0044	0.00001521	0.01118	0.0000982
42	.0040	.00001257	.01016	.0000811
43	.0036	.00001018	.00914	.0000656
44	.0032	.00000804	.00813	.0000519
45	.0028	.00000616	.00711	.0000397
46	0.0024	0.00000452	0.00610	0.0000212
47	.0020	.00000314	.00508	.0000203
48	.0016	.00000201	.00406	.0000129
49	.0012	.00000113	.00305	.0000073
50	.0010	.00000079	.00254	.0000051

PLATINUM WIRE TABLE, BROWN & SHARPE GAUGE

Giving Diameter and Approximate Mass

Gauge No.	10	11	12	13	14	15	16
Diameter in dec. in....	0.106	0.091	0.081	0.072	0.064	0.057	0.051
Approximate mass in grams, per foot....	37.5	28.0	22.0	17.5	14.0	11.0	9.0
Gauge No.	17	18	19	20	21	22	
Diameter in dec. in...	0.045	0.041	0.036	0.032	0.029	0.026	
Approximate mass in grams, per foot.....	7.0	5.7	4.4	3.4	2.9	2.3	
Gauge No.	23	24	25	26	27	28	
Diameter in dec. in...	0.023	0.020	0.018	0.016	0.014	0.013	
Approximate mass in in grams, per foot...	1.8	1.4	1.1	0.9	0.7	0.6	
Gauge No.	29	30	31	32	33	34	35
Diameter in dec. in...	0.0115	0.010	0.009	0.008	0.007	0.0063	0.0056
Approximate mass in in grams, per foot...	0.45	0.35	0.28	0.22	0.17	0.15	0.11

RESISTANCE OF ALUMINUM WIRE

Giving the Resistance of Hard Drawn Aluminum Wire at 20° C.

(From the Bureau of Standards.)

Gauge number.	Ohms per 1000 ft.	Ohms per kilometer.	Gauge number.	Ohms per 1000 ft.	Ohms per kilometer.
0000	0.0804	0.264	20	16.7	54.6
000	.101	.333	21	21.0	68.9
00	.128	.419	22	26.5	86.9
0	.161	.529	23	33.4	110.
1	.203	.667	24	42.1	138.
2	.256	.841	25	53.1	174.
3	.323	1.06	26	67.0	220.
4	.408	1.34	27	84.4	277.
5	.514	1.69	28	106.	349.
6	.648	2.13	29	134.	440.
7	.817	2.68	30	169.	555.
8	1.03	3.38	31	213.	700.
9	1.30	4.26	32	269.	883.
10	1.64	5.38	33	339.	1110.
11	2.07	6.78	34	428.	1400.
12	2.61	8.55	35	540.	1770.
13	3.29	10.8	36	681.	2230.
14	4.14	13.6	37	858.	2820.
15	5.22	17.1	38	1080.	3550.
16	6.59	21.6	39	1360.	4480.
17	8.31	27.3	40	1720.	5640.
18	10.5	34.4			
19	13.2	43.3			

DIMENSIONS OF WIRE, B. & S. GAUGE, U. S.

Diameter and cross-section of wires, Brown & Sharpe Gauge, mass of pure hard-drawn copper wire at 32° F. (density 8.90)

Gauge number.	Diam. in ins.	Cross-section in sq. in.	Pounds per ft.	Feet per lb.
0000	0.4600	0.1662	0.6412	1.560
000	.4096	.1318	.5085	1.967
00	.3648	.1045	.4033	2.480
0	.3249	.0829	.3198	3.127
1	0.2893	0.06573	0.2536	3.943
2	.2576	.05213	.2011	4.972
3	.2294	.04134	.1595	6.270
4	.2043	.03278	.1265	7.905
5	.1819	.02600	.1003	9.969
6	0.1620	0.02062	0.07955	12.57
7	.1443	.01635	.06309	15.85
8	.1285	.01297	.05003	19.99
9	.1144	.01028	.03968	25.20
10	.1019	.00815	.03146	31.78
11	0.09074	0.006467	0.02495	40.08
12	.08081	.005129	.01979	50.54
13	.07196	.004067	.01569	63.72
14	.06408	.003225	.01244	80.35
15	.05707	.002558	.00987	101.32
16	0.05082	0.002028	0.007827	127.8
17	.04526	.001609	.006207	161.1
18	.04030	.001276	.004922	203.2
19	.03589	.001012	.003904	256.2
20	.03196	.000802	.003096	323.1
21	0.02846	0.0006363	0.002455	408.2
22	.02535	.0005046	.001947	513.6
23	.02257	.0004001	.001544	647.7
24	.02010	.0003173	.001224	816.7
25	.01790	.0002517	.000971	1029.9
26	0.01594	0.0001996	0.0007700	1298.
27	.01419	.0001583	.0006107	1638.
28	.01264	.0001255	.0004843	2065.
29	.01126	.0000995	.0003841	2604.
30	.01003	.0000789	.0003046	3283.
31	0.008928	0.00006260	0.0002415	4140.
32	.007950	.00004964	.0001915	5221.
33	.007080	.00003937	.0001519	6583.
34	.006304	.00003122	.0001205	8301.
35	.005614	.00002476	.0000955	10468.
36	0.005000	0.00001963	0.00007576	13200.
37	.004453	.00001557	.00006008	16644.
38	.003965	.00001235	.00004765	20988.
39	.003531	.00000979	.00003778	26465.
40	.003145	.00000777	.00002996	33372.

MASS AND RESISTANCE FOR COPPER

Measure

Electrical resistance of pure hard-drawn copper wire at 32° F (density 8.90.)

Gauge number.	Ohms per ft.	Ft. per ohm.	Ohms per lb.	Lbs. per ohm.
0000	0.00004629	21601.	0.00007219	13852.
000	.00005837	17131.	.00011479	8712.
00	.00007361	13586.	.00018253	5479.
0	.00009282	10774.	.00029023	3445.
1	0.0001170	8544.	0.0004615	2166.8
2	.0001476	6775.	.0007338	1362.8
3	.0001861	5373.	.0011668	857.0
4	.0002347	4261.	.0018552	539.0
5	.0002959	3379.	.0029499	339.0
6	0.0003731	2680.	0.004690	213.22
7	.0004705	2125.	.007458	134.08
8	.0005933	1685.	.011859	84.32
9	.0007482	1337.	.018857	53.03
10	.0009434	1060.	.029984	33.35
11	0.001190	840.6	0.04768	20.973
12	.001500	666.6	.07581	13.191
13	.001892	528.7	.12054	8.296
14	.002385	419.2	.19166	5.218
15	.003008	332.5	.30476	3.281
16	0.003793	263.7	0.4846	2.0636
17	.004783	209.1	.7705	1.2979
18	.006031	165.8	1.2252	0.8162
19	.007604	131.5	1.9481	.5133
20	.009589	104.3	3.0976	.3228
21	0.01209	82.70	4.925	0.20305
22	.01525	65.59	7.832	.12768
23	.01923	52.01	12.453	.08030
24	.02424	41.25	19.801	.05051
25	.03057	32.71	31.484	.03176
26	0.03855	25.94	50.06	0.019976
27	.04861	20.57	79.60	.012563
28	.06130	16.31	126.57	.007901
29	.07729	12.94	201.26	.004969
30	.09746	10.26	320.01	.003125
31	0.1229	8.137	508.8	0.0019654
32	.1550	6.452	809.1	.0012359
33	.1954	5.117	1286.5	.0007773
34	.2464	4.058	2045.6	.0004889
35	.3107	3.218	3252.6	.0003074
36	0.3918	2.552	5172.	0.0001934
37	.4941	2.024	8224.	.0001216
38	.6230	1.605	13076.	.0000765
39	.7856	1.273	20792.	.0000481
40	.9906	1.009	33060.	.0000303

DIMENSIONS OF WIRE B. & S. GAUGE,

Metric

Diameter, cross-section of wires, Brown & Sharpe gauge, mass of pure hard-drawn copper wire at 0° C. (density 8.90).

Gauge number.	Diam. in cm.	Cross-section in sq.cm.	Grams per meter.	Meters per gram.
0000	1.1684	1.0722	954.3	0.001048
000	.0405	0.8503	756.8	.001322
00	0.9266	.7643	600.1	.001666
0	.8251	.5348	475.9	.002101
1	0.7348	0.4241	377.4	0.002649
2	.6544	.3363	299.3	.003341
3	.5827	.2667	237.4	.004213
4	.5189	.2115	188.2	.005312
5	.4621	.1677	149.3	.006699
6	0.4115	0.13302	118.39	0.00845
7	.3665	.10549	93.88	.01065
8	.3264	.08366	74.45	.01343
9	.2906	.06634	59.04	.01694
10	.2588	.05261	46.82	.02136
11	0.2305	0.04172	37.13	0.02693
12	.2053	.03309	29.45	.03396
13	.1828	.02624	23.35	.04282
14	.1628	.02081	18.52	.05400
15	.1450	.01650	14.69	.06809
16	0.12908	0.013087	11.648	0.0859
17	.11495	.010378	9.237	.1083
18	.10237	.008231	7.325	.1365
19	.09116	.006527	5.809	.1721
20	.08118	.005176	4.607	.2171
21	0.07229	0.004105	3.653	0.2737
22	.06438	.003255	2.898	.3450
23	.05733	.002582	2.298	.4352
24	.05106	.002047	1.822	.5488
25	.04545	.001624	1.445	.6920
26	0.04049	0.0012876	1.1459	0.873
27	.03606	.0010211	.9088	1.100
28	.03211	.0008098	.7207	1.388
29	.02859	.0006422	.5715	1.750
30	.02546	.0005093	.4532	2.206
31	0.02268	0.0004039	0.3594	2.782
32	.02019	.0003203	.2850	3.508
33	.01798	.0002540	.2261	4.424
34	.01601	.0002014	.1793	5.578
35	.01426	.0001597	.1422	7.034
36	0.01270	0.0001267	0.1127	8.87
37	.01131	.0001005	.0894	11.18
38	.01007	.0000797	.0709	14.10
39	.00897	.0000632	.0562	17.78
40	.00799	.0000501	.0446	22.43

MASS AND RESISTANCE FOR COPPER (Continued)

System

Electrical resistance of pure hard-drawn copper wire at 0° C. (density 8.90).

Gauge number.	Ohms per meter.	Meters per ohm.	Ohms per gram.	Grams per ohm.
0000	0.0001519	6584.	0.0000001592	6283000.
000	.0001915	5221.	.0000002531	3951000.
00	.0002415	4141.	.0000004024	2485000.
0	.0003045	3284.	.0000006398	1563000.
1	0.0003840	2604.	0.000001017	928900.
2	.0004842	2065.	.000001618	618200.
3	.0006106	1638.	.000002572	388800.
4	.0007699	1299	.000004090	244500.
5	.0009709	1030.	.000006504	153800.
6	0.001224	816.9	0.00001034	96700.
7	.001544	647.8	.00001644	60820.
8	.001947	513.7	.00002615	38250.
9	.002455	407.4	.00004157	24050.
10	.003095	323.1	.00006610	15130.
11	0.003903	256.2	0.00010511	9514.
12	.004922	203.2	.00016712	5984.
13	.006206	161.1	.00026574	3763.
14	.007826	127.8	.00042254	2367.
15	.009868	101.3	.00067187	1488.
16	0.01244	80.37	0.0010683	936.1
17	.01569	63.73	.0016987	588.7
18	.01979	50.54	.0027010	370.2
19	.02495	40.08	.0042948	232.8
20	.03146	31.79	.0068290	146.4
21	0.03967	25.21	0.010859	92.09
22	.05002	19.99	.017266	57.92
23	.06308	15.85	.027454	36.42
24	.07954	12.57	.043653	22.91
25	.10030	9.97	.069411	11.88
26	0.12647	7.907	0.11037	9.060
27	.15948	6.270	.17549	5.698
28	.20110	4.973	.27904	3.584
29	.25358	3.943	.44369	2.254
30	.31976	3.127	.70550	1.417
31	0.4032	2.480	1.1218	0.8914
32	.5084	1.967	1.7837	.5606
33	.6411	1.560	2.8362	.3526
34	.8085	1.237	4.5097	.2217
35	1.0194	0.981	7.1708	.1394
36	1.2855	0.7779	11.376	0.08790
37	1.6210	.6169	18.130	.05516
38	2.0440	.4892	28.828	.03469
39	2.5775	.3880	45.838	.02182
40	3.2501	.3076	72.885	.01372

CROSS-SECTION AND MASS OF WIRES

U. S. Measure

Diameters are given in mils (1 mil = .001 in.), and area in square mils (1 sq. mil = .000001 sq.in.). For sections and masses for one-tenth the diameters given, divide by 100 and for sections and masses for ten times the diameter multiply by 100.

Diam. in mils.	Cross-sec. in sq. mils.	Pounds per foot.			
		Copper, density 8.90.	Iron, density 7.80.	Brass, density 8.56.	Aluminum, density 2.67.
10	78.54	0.000303	0.0002656	0.0002915	0.0000909
11	95.03	0367	03214	03527	01100
12	113.10	0436	03825	04197	01309
13	132.73	0512	04488	04926	01536
14	153.94	0594	05206	05713	01782
15	176.71	0.000682	0.0005976	0.0006558	0.0002045
16	201.06	0776	06799	07461	02327
17	226.98	0876	07675	08423	02627
18	254.47	0982	08605	09443	02946
19	283.53	1094	09588	10522	03282
20	314.16	0.001212	0.001062	0.001166	0.0003636
21	346.36	1336	1171	1285	04009
22	380.13	1467	1286	1411	04400
23	415.48	1603	1405	1542	04809
24	452.39	1746	1530	1679	05237
25	490.87	0.001894	0.001660	0.001822	0.0005682
26	530.93	2046	1795	1970	06147
27	572.56	2209	1936	2125	06628
28	615.75	2376	2082	2285	07127
29	660.52	2549	2234	2451	07646
30	706.86	0.002727	0.002390	0.002623	0.0008182
31	754.77	2912	2552	2801	08737
32	804.25	3103	2720	2985	09309
33	855.30	3300	2892	3174	09900
34	907.92	3503	3070	3369	10509
35	962.11	0.003712	0.003253	0.003570	0.001114
36	1017.88	3927	3442	3777	1178
37	1075.21	4149	3636	3990	1245
38	1134.11	4376	3844	4218	1316
39	1194.59	4609	4040	4433	1383
40	1256.64	0.004849	0.004249	0.004664	0.001455
41	1320.25	5094	4465	4900	1528
42	1385.44	5346	4685	5141	1604
43	1452.20	5603	4911	5389	1681
44	1520.53	5867	5142	5643	1760
45	1590.43	0.006137	0.005378	0.005902	0.001841
46	1661.90	6412	5620	6167	1924
47	1734.94	6694	5867	6438	2008
48	1809.56	6982	6119	6715	2095
49	1885.74	7276	6377	6998	2183
50	1963.50	0.007576	0.006640	0.007287	0.002273
51	2042.82	7882	6908	7581	2365
52	2123.72	8194	7181	7881	2458
53	2206.18	8512	7460	8187	2554
54	2290.22	8837	7744	8499	2651

CROSS-SECTION AND MASS OF WIRES (Continued)

U. S. Measure (Continued)

Diameters are given in mils (1 mil =.001 in.), and area in square mils (1 sq. mil =.000001 sq. in.). For sections and masses for one-tenth the diameters given, divide by 100 and for sections and masses for ten times the diameter multiply by 100.

Diam. in mils.	Cross-sec. in sq. mils.	Pounds per foot.			
		Copper, density 8.90.	Iron, density 7.80.	Brass, density 8.56.	Aluminum, density 2.67.
55	2375.83	0.009167	0.008034	0.008817	0.002750
56	2463.01	09504	08329	09140	2851
57	2551.76	09846	08629	09470	2954
58	2642.08	10195	08934	09805	3058
59	2733.97	10549	09245	10146	3165
60	2827.43	0.01091	0.00956	0.01049	0.003273
61	2922.47	1128	0988	1085	3383
62	3019.07	1165	1021	1120	3495
63	3117.25	1203	1054	1157	3608
64	3216.99	1241	1088	1194	3724
65	3318.31	0.01280	0.01122	0.01231	0.003841
66	3421.19	1320	1157	1270	3960
67	3525.65	1360	1192	1308	4081
68	3631.68	1401	1228	1348	4204
69	3739.28	1443	1264	1388	4328
70	3848.45	0.01485	0 01302	0.01429	0.004456
71	3959.19	1528	1339	1469	4583
72	4071.50	1571	1377	1511	4713
73	4185.39	1615	1415	1553	4845
74	4300.84	1660	1454	1596	4978
75	4417.86	0.01705	0.01494	0.01639	0.005114
76	4536.46	1751	1534	1684	5251
77	4656.63	1797	1575	1728	5390
78	4778.36	1844	1616	1773	5531
79	4901.67	1892	1658	1819	5674
80	5026.55	0.01939	0.01700	0.01865	0.005818
81	5153.00	1988	1743	1912	5965
82	5281.02	2038	1786	1960	6113
83	5410 61	2088	1830	2008	6263
84	5541.77	2138	1874	2057	6415
85	5674.50	0.02189	0.01919	0.02106	0 006568
86	5808.80	2241	1964	2156	6724
87	5944.68	2294	2010	2206	6881
88	6082.12	2347	2057	2257	7040
89	6221.14	2400	2104	2309	7201
90	6361.73	0.02455	0.02151	0.02360	0.007364
91	6503.88	2509	2199	2414	7528
92	6647.61	2565	2248	2467	7695
93	6792 91	2621	2297	2521	7863
94	6939.78	2678	2347	2575	8033
95	7088.22	0.02735	0.02397	0.02630	0.008205
96	7238.23	2793	2448	2686	8378
97	7389.81	2851	2499	2742	8554
98	7542.96	2910	2551	2799	8731
99	7697.69	2970	2603	2857	8910
100	7853.98	0.03030	0.02656	0.02915	0.009091

CROSS-SECTION AND MASS OF WIRES (Continued)

Metric Measure

Diameters are given in thousandths of a centimeter and area of section in square thousandths of a centimeter. 1 (cm./1000)^2 = .000001 sq. cm. For sections and masses for diameters 1/10 or 10 times those of the table, divide or multiply by 100.

Diam. in thousandths of a cm.	Cross-section in square thousandths of a cm.	Grams per meter.			
		Copper, density 8.90.	Iron, density 7.80.	Brass, density 8.56.	Aluminum, density 2.67.
10	78.54	0.06990	0.06126	0.06723	0.02097
11	95.03	.08458	.07412	.08135	.02537
12	113.10	.10065	.08822	.09681	.03020
13	132.73	.11813	.10353	.11362	.03544
14	153.94	.13701	.12008	.13177	.04110
15	176.71	0.1573	0.1378	0.1513	0.04718
16	201.06	.1789	.1568	.1721	.05368
17	226.98	.2020	.1770	.1943	.06060
18	254.47	.2265	.1985	.2178	.06794
19	283.53	.2523	.2212	.2427	.07570
20	314.16	0.2796	0.2450	0.2689	0.08388
21	346.36	.3083	.2702	.2965	.09248
22	380.13	.3383	.2965	.3254	.10149
23	415.48	.3698	.3241	.3557	.11093
24	452.39	.4026	.3529	.3872	.12079
25	490.87	0.4369	0.3829	0.4202	0.1311
26	530.93	.4725	.4141	.4545	.1418
27	572.56	.5096	.4466	.4901	.1529
28	615.75	.5480	.4803	.5271	.1644
29	660.52	.5879	.5152	.5654	.1764
30	706.86	0.6291	0.5514	0.6051	0.1887
31	754.77	.6717	.5887	.6461	.2015
32	804.25	.7158	.6273	.6884	.2147
33	855.30	.7612	.6671	.7321	.2284
34	907.92	.8081	.7082	.7772	.2424
35	962.11	0.856	0.7504	0.8236	0.2569
36	1017.88	.906	.7939	.8713	.2718
37	1075.21	.957	.8387	.9204	.2871
38	1134.11	1.012	.8866	.9730	.3035
39	1194.59	.063	.9318	1.0230	.3190
40	1256.64	1.118	0.980	1.076	0.3355
41	1320.25	.175	1.030	.130	.3525
42	1385.44	.233	.081	.186	.3699
43	1452.20	.292	.133	.243	.3877
44	1520.53	.353	.186	.302	.4060
45	1590.43	1.415	1.241	1.361	0.4246
46	1661.90	.479	.296	.423	.4437
47	1734.94	.544	.353	.485	.4632
48	1809.56	.611	.411	.549	.4832
49	1885.74	.678	.471	.614	.5035
50	1963.50	1.748	1.532	1.681	.5243
51	2042.82	.818	.593	.753	.5454
52	2123.72	.890	.657	.818	.5670
53	2206.18	.964	.721	.888	.5891
54	2290.22	2.038	.786	.960	.6115

CROSS-SECTION AND MASS OF WIRES (Continued)

Metric Measure (Continued)

Diameters are given in thousandths of a centimeter and area of section in square thousandths of a centimeter. 1 (cm. /1000)² = .000001 sq. cm. For sections and masses for diameters 1/10 or 10 times those of the table, divide or multiply by 100.

Diam. in thousandths of a cm.	Cross-section in square thousandths of a cm.	Grams per meter.			
		Copper, density 8.90.	Iron, density 7.80.	Brass, density 8.56.	Aluminum, density 2.67.
55	2375.83	2.114	1.853	2.034	0.6343
56	2463.01	.192	.921	.108	.6576
57	2551.76	.271	.990	.184	.6813
58	2642.08	.351	2.061	.262	.7054
59	2733.97	.433	.132	.340	.7300
60	2827 43	2.516	2.205	2.420	0.7549
61	2922.47	.601	.280	.502	.7803
62	3019.07	.687	.355	.584	.8061
63	3117.25	.774	.431	.668	.8323
64	3216.99	.863	.509	.760	.8589
65	3318.31	2.953	2.588	2.840	0.8860
66	3421.19	3.045	.669	.929	.9135
67	3525.65	.138	.750	3.018	.9413
68	3631.68	.232	.833	.109	.9697
69	3739.28	.328	.917	.201	.9984
70	3848.45	3.426	3.003	3.295	1.028
71	3959 19	.524	.088	.389	.057
72	4071 50	.624	.176	.485	.087
73	4185.39	.725	.265	.583	.117
74	4300 84	.828	.355	.682	.148
75	4417 86	3.932	3.446	3.782	1.180
76	4536 46	4 037	.538	.883	.211
77	4656 63	.144	.632	.986	.243
78	4778.36	.253	.727	4.090	.276
79	4901 67	.362	.823	.177	.309
80	5026 55	4.474	3.921	4.303	1.342
81	5153.00	.586	4.019	.411	.376
82	5281.02	.700	.119	.521	.410
83	5410.61	.815	.220	.631	.445
84	5541.77	.932	.323	.744	.480
85	5674.50	5 050	4.426	4.857	1.515
86	5808 80	.170	.531	.972	.551
87	5944.68	.291	.637	5.089	.587
88	6082.12	.413	.744	.206	.624
89	6221.14	.537	.852	.325	.661
90	6361.73	5.662	4.962	5.446	1.699
91	6503.88	.788	5.073	.567	.737
92	6647.61	.916	.185	.690	.775
93	6792.91	6.046	.298	.815	.814
94	6939.78	.176	.413	.940	.853
95	7088.22	6.309	5.529	6.068	1.893
96	7238.23	.442	.646	.196	.933
97	7389.81	.577	.764	.326	.973
98	7542.96	.713	.884	.457	2.014
99	7697.69	.851	6.004	.589	.055
100	7853.98	6.990	6.126	6.723	2.097

APPROXIMATE RESISTANCE OF WIRES

Giving the resistance in ohms of one centimeter length at 20°C. Owing to varying composition and physical condition, these values can be considered only as approximations.

Gauge No. B. & S.	Diam. in cms.	Brass	Con-stantin	German silver	Iron	Manganin
10	.2588	.00014	.00093	.00056	.00023	.00080
12	.2053	.00023	.00148	.00089	.00036	.00127
14	.1628	.00037	.0024	.00142	.00058	.0020
16	.1291	.00058	.0037	.0023	.00092	.0032
18	.1024	.00091	.0059	.0036	.00146	.0051
20	.08118	.00147	.0095	.0057	.0023	.0081
22	.06438	.0023	.0150	.0090	.0037	.0129
24	.05106	.0037	.024	.0144	.0059	.021
26	.04049	.0059	.038	.023	.0093	.033
27	.03606	.0075	.048	.029	.0118	.041
28	.03211	.0093	.061	.036	.0148	.052
30	.02546	.0147	.096	.058	.024	.083
32	.02019	.024	.153	.092	.038	.131
34	.01601	.038	.24	.148	.060	.209
36	.01270	.060	39	.23	.094	.33
40	.00799	.15	.98	.59	.24	.84

PROBLEMS

THE METHOD OF SOLVING CHEMICAL PROBLEMS

(From Talbot's Quantitative Analysis, by permission.)

Detailed solutions of a few typical problems are given below. The student should study these carefully, and assure himself that they are fully understood.

1. A "chemical factor" expresses the ratio between a specific quantity of a chemical compound and the *equivalent* quantity of some other body. For example, if it is wished to determine the weight of sulphur which corresponds to a specific weight of barium sulphate, the latter is multiplied by the factor, or ratio, represented by the fraction $\frac{S}{BaSO_4}$, or $\frac{32.07}{233.50} = 0.1373$. It may also be expressed by the proportion $\overset{233.5}{BaSO_4} : \overset{32.07}{S} = \text{wt. } BaSO_4 : x$, from which it is plain that $x = \frac{32.07}{233.50} \cdot \text{wt. } BaSO_4$.

Again, if the weight of FeO in Fe_2O_3 is desired, the factor becomes $\frac{2\,FeO}{Fe_2O_3} = \frac{144.04}{160.04} = 0.9000$. Similarly, the factor for the conversion of KCl to K_2O is $\frac{K_2O}{2\,KCl} = \frac{94.22}{149.12} = 0.6320$. The logarithmic equivalents of these values are called log factors.

In the calculation of these factors, the atomic or molecular relations of the two substances must be kept clearly in mind; thus, it is plainly *incorrect* to express the ratio of ferrous to ferric oxide by the fraction $\frac{FeO}{Fe_2O_3}$, since each molecule of the higher oxide must correspond to two molecules of the lower. Carelessness in this respect is one of the most frequent sources of error.

2. To calculate the volume of a reagent required for a specific operation, it is necessary to know the exact reaction which is to be brought about, and, as with the calculation of factors, to keep in mind the molecular relations between the reagent and the substance reacted upon. For example, to estimate the weight of barium chloride necessary to precipitate the sulphur from 0.1 gram of pure pyrite (FeS_2), the proportion should stand $\overset{488.70}{2BaCl_2 \cdot 2\,H_2O} : \overset{120.16}{FeS_2} = x : 0.1$, where x represents the weight of the chloride

'Talbot's "Quantitative Analysis."

required. Each of the two atoms of sulphur will form a molecule of sulphuric acid upon oxidation, which, in turn, will require a molecule of the barium chloride for precipitation. To determine the quantity of the barium chloride required, it is necessary to include in its molecular weight the water of crystallization, since this is inseparable from the chloride when it is weighed. This applies equally to other similar instances.

If the strength of an acid is expressed in percentage by weight, due regard must be paid to its specific gravity. For example, hydrochloric acid (sp. gr. 1.12) contains 23.8 per cent HCl by weight; *i.e.*, 0.2666 gram.

3. No rules for universal application to "indirect gravimetric analyses" can be laid down. A single example will be explained.

Given a mixture of KCl + NaCl weighing 0.15 gram, which contains 53 per cent chlorine, to calculate the weight of KCl and NaCl in the mixture.

The weight of chlorine in the mixture is (0.15 × 0.53) or 0.0795 gram. Assuming that this chlorine was all in combination with potassium, the corresponding weight of KCl would be 0.1672 gram (Cl : KCl = 0.0795 : 0.1672). This is an excess of 0.0172 gram over the actual weight of the mixture, and it is plain that this difference is occasioned by the replacement of certain of the molecules of potassium chloride, weighing 74.56 units, by molecules of sodium chloride weighing 58.50 units. To express this, let it be supposed that the mixture is made up of n molecules KCl and n' molecules NaCl; then it may be said that $n\overset{74.56}{\mathrm{KCl}} + n'\overset{58.50}{\mathrm{NaCl}} = 0.15$ gram, and $n\overset{74.56}{\mathrm{KCl}} + n'\overset{74.56}{\mathrm{KCl}} = 0.1672$ gram, then by subtracting the first equation from the second it is shown that $n'(\overset{74.56}{\mathrm{KCl}} - \overset{58.50}{\mathrm{NaCl}}) = 0.0172$ gram. That is, the difference in weight is equal to n' times the difference in the molecular weights of the two chlorides. The actual weight of NaCl present (x) is equal to $58.50n'$, or, since $n' = \frac{0.0172}{74.56 - 58.50}, x = 58.50\left(\frac{0.0172}{74.56 - 58.50}\right)$. This may be expressed in the form $(74.56 - 58.50) : 58.50 = 0.0172 : x$, from which $x = 0.0626$. The weight of NaCl subtracted from that of the mixture gives the weight of KCl.

The weights of the chlorides may also be calculated algebraically by solving the equations $x + y = 0.15$ and $\frac{35.45}{74.56}x + \frac{35.45}{58.50}y = 0.0795$, where x is the weight of KCl and y is the weight of NaCl in the mixture.

4. It is sometimes desirable to weigh out such a quantity of substance for analysis, that the number of cubic centimeters of standard solution entering into the reaction shall represent directly the percentage of the desired constituent. This may be readily done, by considering the relation of the solution to a normal solution and the atomic or molecular weight of the desired component. For example, suppose it is desired to calculate such a weight for K_2CO_3 in pearl ash, when a half-normal acid solution

is used. Since half-normal acid and alkali solutions are equivalent, and since by definition the half-normal K_2CO_3 solution contains 34.55 grams per liter, each cubic centimeter of the acid solution must be equivalent to 0.03455 gram K_2CO_3. Hence, 100 cc. would neutralize 3.455 grams pure K_2CO_3 and this becomes the desired weight of the pearl ash. Similarly the required weight of limonite where the iron (Fe) is to be determined by means of a deci-normal $K_2Cr_2O_7$ solution is 0.5602 gram.

5. One of the most frequently recurring cases in volumetric analysis is that in which it is wished to express the value of a specific solution in terms of some substance other than that against which it has been standardized as for instance, the value of a permanganate solution which has been standardized against oxalic acid, in terms of iron. Although such problems apparently vary widely, there are common principles which can be applied to them all. These are stated below, and the student should assure himself that they are fully understood.

Suppose, for example, it is desired to find the iron value (Fe) of a permanganate solution, of which 1 cc. is equivalent to 0.006302 gram $C_2H_2O_4 . 2H_2O$.

From a comparison of the reactions it is seen that 10 molecules of ferrous sulphate and 5 molecules of oxalic acid each react with the same amount (2 molecules) of the permanganate. These two quantities being, then, equivalent to the same third quantity, must be equivalent to each other; in other words, 10 molecules of ferrous sulphate and 5 molecules of oxalic acid have the same reducing power. But, as stated above, the value is desired in terms of metallic iron (Fe), not $FeSO_4$, but as it is plain that $10FeSO_4$ are equivalent to 10Fe, it is proper to make the proportion

$$\overset{560.2}{10\,Fe} : \overset{630.25}{5C_2H_2O_4 . 2\,H_2O} = x : 0.006302$$

in which $x = 0.005602$ gram. Here, again, as in example 2, it is necessary to include the water of crystallization in the molecular weight of the oxalic acid, as it is weighed with it.

The same conclusion is arrived at, if we consider the relation of the solution to the normal. As given, it is deci-normal and must, therefore, be equivalent to a deci-normal solution of iron. From the equations cited, it is seen that $10FeSO_4$, unite with 5O, therefore each molecule is equivalent to 1 hydrogen atom in reducing power. The normal solution must, then, contain 1 gram-molecule of ferrous sulphate, or 56.02 grams Fe, and each cubic centimeter of the deci-normal solution would contain 0.005602 gram, the value obtained above.

Again, suppose the value of the same permanganate solution were desired in terms of molybdenum (Mo), the reactions with permanganate being

$$5Mo_{12}O_{19} + 17Mn_2O_7 = 60MoO_3 + 34MnO, \text{ and}$$
$$5C_2H_2O_4 . 2H_2O + Mn_2O_7 = 2MnO + 10CO_2 + 15H_2O.$$
(Mn_2O_7 is the anhydride of $HMnO_4$.)

It is plain that in these equations as they stand, the molecular quantities of oxidizing agent are not equal. They can be made so by simply multiplying the second equation by 17, and they then become,

$$5Mo_{12}O_{19} + 17Mn_2O_7 = 34MnO + 60MoO_3, \text{ and}$$
$$85C_2H_2O_4 . 2H_2O + 17Mn_2O_7 = 34MnO + 170\ CO_2 + 255\ H_2O.$$

It is now possible to reason in the same way as before, and to conclude that 85 molecules of the oxalic acid have the same reducing power as 5 molecules of the oxide $Mo_{12}O_{19}$, or 60 atoms of molybdenum. Accordingly,

$$\overset{5758.8}{60Mo} : \overset{10714.25}{85C_2H_2O_4.2H_2O} : : x : 0.006302$$

in which x 0.003387 gram.

Since $5Mo_{12}O_{19}$ unite with 85O, a normal solution of the former as a reducing agent, would contain 1/170 of the 5 gram-molecules or 33.87 grams Mo, and the deci-normal solution 3.387 grams per liter. This agrees with the values already obtained.

6. It is sometimes necessary to calculate the value of solutions according to the principles just explained, when several successive reactions are involved. Such problems may be solved by a series of proportions, but it is usually possible, after stating these to eliminate the common factors and solve but a single one.

For example, suppose it is desired to express the value of a permanganate solution, of which 1 cc. = 0.008 gram iron (Fe), in terms of calcium oxide (CaO). The reactions involved in the volumetric determination of calcium are the following; $CaCl_2 + (NH_4)_2C_2O_4 = CaC_2O_4 + 2NH_4Cl$; $CaC_2O_4 + H_2SO_4 + 2H_2O = CaSO_4 + C_2H_2O_4 . 2H_2O$; $5C_2H_2O_4 . 2H_2O + 2KMnO_4 + 3H_2SO_4 = K_2SO_4 + MnSO_4 + 10CO_2 + 18H_2O$.

From the considerations stated under 5, the following proportions may be made.

$$10Fe : 5C_2H_2O_4 . 2H_2O = 0.008 : x$$
$$5C_2H_2O_4 . 2H_2O : 5CaC_2O_4 = x : y$$
$$5CaC_2O_4 : 5CaO = y : x$$

Canceling the common factors, there remains simply

$$\overset{560.2}{10Fe} : \overset{280.4}{5\ CaO} = 0.008 : z$$

Similarly, from the reactions, the equivalent of the iodine liberated may be calculated in terms of MnO_2 as follows: Supposing the weight of iodine to be 0.5 gram then

$$2I : 2KI = 0.5 : x$$
$$2KI : 2Cl = x : y$$
$$2Cl : 2HCl = y : z$$
$$2HCl : MnO_2 = z : w$$

Canceling the common factors, there remains

$$2I : MnO_2 = 0.5 : w$$

To solve such problems as 5 and 6, it is necessary to know the reactions involved, and the way in which the various components break up; then to compare the reactions and to search for those molecular quantities of the compounds in question, which are *equivalent* in their action upon a common agent. Having found these, as shown above, express the molecular ratio between them in the form of a proportion; as, for example, $\overset{253.7}{2\,I} : \overset{86.99}{MnO_2} = 0.5 : w$. Expressed in the form $w = \frac{86.99}{253.7}\,0.5$, it is plain that this ratio is in no way different in principle from the chemical factor mentioned in paragraph 1; indeed, it is the factor for the conversion of iodine to manganese dioxide.

PROBLEMS IN ELEMENTARY PHYSICS

1. A map is drawn to the scale 1 mile to the inch. What area on the map in square centimeters represents 10 square miles? Ans. 64.5 sq.cm.

2. Express a velocity of 2500 cm. per second in feet per minute. Ans. 4921.2 feet per minute.

3. A rectangular tank 15 cm.×163 mm.×6 meters, inside measurements, is filled with water. Express the mass of the water in kilograms. One c.cm. of water weighs 1 gram (approximately). Ans. 146.7 kg.

4. The radius of a circle is 12 cm., what is the angle in degrees subtended by an arc of 16 cm.? Ans. 76.39°.

5. The pitch of the screw in a micrometer caliper is 0.5 mm.; the rotating head of the instrument carries 50 divisions; the vernier of the shank over which the head turns has 10 divisions which occupy the space of 9 smallest divisions on the head. What is the smallest distance which can be measured without estimation? Ans. 0.001 mm.

6. How far from the point of observation must a scale be placed in order that 1 cm. on the scale will subtend an angle of 1 minute? Ans. 3438 cm.

7. A river is 1 kilometer in width, and the current has a velocity of 4 km. per hour. What direction must be taken by a launch moving at 8 km. per hour in order to land directly opposite the starting point? What will be the total time for the trip? Ans. The launch must steer 30° upstream; 8.7 minutes.

8. A pendulum having a period of 1 second and a pendulum of nearly the same period are arranged so that it is possible to observe when the two reach the mid point of their respective oscillations at the same instant going in the same direction. The time elapsing between coincidences is 106 seconds. If the unknown is shorter than the known pendulum, what is its period? Ans. 0.9906 sec.

9. A body starts from rest and moves for 10 seconds with a uniform acceleration of 5 cm./sec.^{2}, for the next 20 seconds it moves uniformly at the velocity acquired and is finally brought to rest with a uniform acceleration of -5. cm./sec.^{2}, what is

the total space covered and the time occupied? Ans. 1500 cm., 40 sec.

10. Find the value of a constant force which, acting on a mass of 500 grams for 2 seconds, produces an increase in velocity of 10 cm./sec. Ans. 2500 dynes.

11. What is the weight in dynes of a sphere whose mass is 100 grams? If a spherical mass of 1000 kg. is placed vertically beneath the body so that their centers are separated by a distance of 50 cm., what is the apparent increase in weight? (g. = 980. cm./sec.^{2}, the gravitational constant $= 6.66 \times 10^{-8}$, C. G. S.) Ans. 98,000 dynes; .0026 dyne.

12. A uniform bar, 100 cm. long, is supported on a knife edge 30 cm. from one end. A mass of 500 g. is suspended at a distance of 5 cm. and a mass of 200 g. at a distance of 60 cm from the same end. If the system is in equilibrium, what is the mass of the bar? Ans. 325 g.

13. The beam of a balance is 25 cm. long and weighs 50 g. If the center of gravity is 0.05 cm. below the central knife edge through what angle will the beam be deflected by the addition of 0.001 gram to one of the pans? Ans. 0° 17.2′.

14. The mean radius of the earth is about 6,370,000 meters. What is the acceleration toward the center of a point on the equator due to the rotation of the earth? Ans. 2910.3 meters per sec. per sec.

15. If the period of simple harmonic motion is 10 seconds and the amplitude 20 cm., what is the displacement, velocity and acceleration 2 seconds after the particle has passed its mid point in a positive direction? Ans. Displacement 19.02 cm., velocity 3.88 cm./sec., acceleration -7.51 cm./sec.^{2}.

16. A body of 60 g. mass falls freely from rest for 6 seconds, what is its momentum and kinetic energy at the end of the period? (g. = 980 cm./sec.^{2}.) How far does the body fall? How much work would be done in raising it to its original position? Ans. Momentum, 352,800 g. cm./sec.; kinetic energy, 1.037×10^9 ergs; space passed over 17,640 cm.; potential energy (mgh) 1.037×10^9 ergs.

17. What power is delivered by a hoisting engine in pulling a mass of 200 kg., (1) Upward against gravity, 5 meters per second; (2) along a horizontal plane whose coefficient of friction with the block is 0.20 at the rate of 2 meters per second; (3) along a perfectly smooth (frictionless) horizontal plane at any velocity; (4) up an incline of 45° with the horizontal with a coefficient of friction of 0.1 at the rate of 1 meter (measured along the incline) per second? (The hoisting apparatus is to be considered frictionless.) Ans. (1) 980 watts. (2) 784 watts. (3) No work is done. (4) 15,240 watts.

18. A bullet fired from a gun 1 cm. in internal diameter and 75 cm. long has a muzzle velocity of 500 meters per second. What uniform pressure in the barrel would cause this velocity if the bullet weighs 25 g.? Ans. 1.061×10^9 dynes per sq. cm.

19. The pitch of a jack screw is 1 cm; the power is applied at the end of a lever 24 cm. long. When force of 30,000 dynes is applied at the lever the lifting force is 1,200,000 dynes, what

portion of the force applied is used to overcome friction? What is the efficiency? Ans. 22,040 dynes; 34.1%.

20. It is required to find the density of a cylinder of alloy. A ballast load is placed on one pan of the balance, which requires 292.560 g. to counterbalance. The sample is added to the pan containing the weights and the amount to effect equilibrium is reduced to 88.480 g. When the sample is suspended below the pan in water (density 0.9977) the mass necessary in the pan is 148.627 g. The density of the brass weights was 8.45, the density of air at the temperature and pressure of the experiment 0.00115. Find the true density, making correction for buoyancy of the air. Ans. 3.383.

21. The cross-section of the stem of an hydrometer has an area of 0.2 sq.cm. The total volume immersed when the instrument floats in water at 4° C. is 6. cu.cm. If in another liquid the hydrometer sinks until 8 cm. additional length of stem is immersed, what is the specific gravity the liquid? Ans. 0.7894.

22. The volume of the cylinder of an air pump cleared at each stroke of the piston is 2000 cc. If the volume of the vessel to be exhausted with connecting tubes is 4000 cc., what pressure should be obtained by 10 strokes? Ans. 0.0173 the original pressure.

23. Water at a temperature of 20.3° C. rises to a height of 6.128 cm. in a tube whose radius is 0.0247. Compute the surface tension, taking g. = 980. Ans. 74.15 dynes/cm.

24. A glass tube closed at one end is 100 cm. long. A column of mercury 91 cm. long is poured into the tube and it is then inverted with the lower (open) end in a dish of mercury. The air now fills 40 cm. at the top of the tube and a column of mercury 58 cm. long is supported below. What is the barometric pressure? Ans. 74.84 cm.

25. A wire 100 cm. long and 0.3 mm. in radius is stretched 2 mm. by the addition of a weight of 10 kilos. Compute the value of Young's Modulus. Ans. 17.3×10^{11} dynes/sq.cm.

26. The thermal coefficient of linear expansion of brass is 0.000018. A cylindrical bar is 100 cm. long at 20° C. and has a density of 8.450, what is the length and density at 0° C? Ans. Length 99.964 cm., density 8.451 g./cm.^{3}.

27. A steel rod is measured with a brass scale at 15° C. The rod appears to be 200 cm. long. The scale is correct at 0° C. What is the true length of the rod at 0°? The coefficient of expansion for steel is .000011. Ans. 200.021 cm.

28. If the volume of a portion of gas is 1000 ccm. under a pressure of 30.5 cm. of mercury and at a temperature 0° C., what will be the volume under a pressure of 29.5 cm. and a temperature of 20° C.? Ans. 1109 c. cm.

29. The mass of a copper calorimeter is 110 grams. It contains 400 grams of water at a temperature of 16° C. A solid mass of 60 grams at a temperature of 98° C. is placed in the water. The temperature reaches equilibrium at 21° C. Neglecting radiation, find the specific heat of the solid. Ans. 0.443 cal./g.

30. Two hollow brass cones fit together and are arranged so that the outer cone can be rotated while the inner cone may be held stationary by the application of a force sufficient to overcome the friction between the cones. A horizontal pulley 30 cm. in diameter is attached to the inner cone and a cord wrapped around this pulley and passing over another pulley at the side supports a weight of 100 grams. The mass of the two cones is 400 g., and 25 cc. of water is placed in the inner cone. The outer cone is rotated rapidly enough to keep the weight suspended and makes 1500 revolutions. What temperature change will occur in the cones, neglecting radiation? (The mechanical equivalent of heat is 4.18×10^7 ergs.) Ans. 5.33° C.

31. A source of sound whose frequency is 2000 per sec. is moving toward the observer at the rate of 7200 kilometers per hour. The temperature of the air is 20° C. What is the apparent pitch? Ans. 2116.4 per sec.

32. What are the relative potentials of two insulated conducting spheres charged with equal quantities of electricity if their radii are 5 and 10 cm. respectively? Ans. 2 to 1.

33. What is the force acting between two concentrated positive charges of 6 and 8 units, separated by a distance of 4 cm. in air? Ans. 3 dynes.

34. What is the resistance of 48,500 cm. of copper wire 1 millimeter in diameter at 0° C.? The specific resistance of copper is .0000017. Ans. 0.26 ohm.

35. A circuit is composed of 8 cells in two groups. The two groups are in parallel and each consists of 4 cells in series. The electromotive force of each cell is 1.4 volts and the internal resistance 0.1 ohm. The external circuit consists of a series of 5 coils, each having a resistance of 200 ohms. If a galvanometer whose resistance is 1000 ohms is placed in parallel with one of the coils, what current will flow through the galvanometer? Ans. 0.0011 amp.

36. A cell whose electromotive force is 1 volt and internal resistance 5 ohms is connected in series with a resistance of 2000 ohms and a galvanometer whose resistance is 98 ohms. The galvanometer terminals are connected by a shunt having a resistance of 1 ohm and the scale is 25 cm. from the mirror. The deflection, observed by a telescope, is 0.55 cm. What is the figure of merit—that is, the current which would cause a scale deflection of 1 mm. if the scale were 1 meter from the mirror? Ans. 0.000000229 amp.

37. The horizontal intensity of the earth's magnetism at a certain locality is 0.20 gauss and the dip is 70°; what is the value of the total intensity? Ans. 0.585 gauss.

38. A standard candle and an electric incandescent of unknown intensity are 500 cm. apart. A photometer screen shows even illumination when placed 100 cm. from the candle. The standard candle is found to have consumed spermaceti at the rate of 124 grains per hour during the test. If the intensity of the candle is 1 international candle when burning 120 grains per hour, what is the horizontal candle power of the unknown? Ans. 15.47 international candles.

39. An object 43.6 cm. from a concave spherical mirror gives a sharp image 66.5 cm. from the mirror; find the principal focus and radius of curvature of the mirror. Ans. Focus 26.33 cm., radius of curvature, 52.6 cm.

40. Light divergent from a point source 20.5 cm. from a double concave lens has its divergence increased by the lens so that it appears to come from a point 113.9 cm. from the lens (on the same side as the source). The radius of curvature of both faces is 25.1 cm., what is the principal focus and index of refraction of the lens? Ans. Principal focus −25.0 cm.; index of refraction 1.50.

41. The angle of minimum deviation of a prism is observed and found to be 60° 2.5′. If the angle of the prism is 59° 54′, what is the index of refraction of the material of the prism? Ans. 1.734.

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Rubber Laboratory Aprons

These aprons are all cut 46″ long and 36″ wide, an ample length to protect one's clothing. They are cut to fit the body and in no way hamper the movements of the wearer.

No. 140 APRONS — Black Rubber, recommended especially for high school work, but giving splendid satisfaction under harder usage. **Grade 1290. Per Dozen.....9.00**

No. 142 APRONS — Black Rubber. Heavier than No. 140. Our most popular number. Excellent for general use. **Grade 1230.**
Per Dozen **10.50**

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No. 146 APRONS — Red Rubber. An unusually serviceable apron. **Grade 1215.**
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No. 148 APRONS — Heavy Black Rubber. Will withstand the hardest usage. **Grade 1000.**
Per Dozen **30.00**

Rubber Laboratory Sleeves

Sleeves, to match Nos. 140–146 Aprons, are long and roomy. They are made with elastic ends which insure a snug fit and yet allow them to be easily and quickly removed.

No. 140S SLEEVES — Grade 1290. Per Dozen **3.00**

No 142S SLEEVES — Grade 1230. Also recommended for use with Aprons **Grade 1000. Per Dozen** **3.60**

No. 144S SLEEVES — Grade 1260. Per Dozen **3.60**

No. 146S SLEEVES — Grade 1215. Per Dozen **4.20**

No. 6050 Rubber Tubing

Tubing designed for ordinary purposes will not serve the requirements of the laboratory. The following grades of tubing, made according to our own specifications are noted for their long wearing qualities, flexibility, and elasticity.

Grade 423 RUBBER TUBING — White Wrapped Light Wall, carefully made of the best materials and finished in a superior manner. For general laboratory use.

Inside diam. in.	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$
Wall, in.	$\frac{1}{32}$	$\frac{3}{64}$	$\frac{1}{16}$	$\frac{5}{64}$	$\frac{3}{32}$
Approx. ft. per lb.	65	35	24	14	10

Inside diam. in.	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	1
Wall, in.	$\frac{7}{64}$	$\frac{1}{8}$	$\frac{9}{64}$	$\frac{5}{32}$
Approx. ft. per lb.	5	4	$2\frac{1}{2}$	2

Grade 435 RUBBER TUBING — White Wrapped Pressure Tubing, Heavy Wall, of the same composition as Grade 423. Recommended especially for burner connections.

Inside diam. in.	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$
Wall, in.	$\frac{5}{64}$	$\frac{3}{32}$	$\frac{7}{64}$
Approx. ft. per lb.	32	16	11

Inside diam. in.	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{1}{2}$
Wall, in.	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
Approx. ft. per lb.	8	7	5

Grade 508 RUBBER TUBING — Pure Gum Red Antimony, of the finest selected crude rubber treated by the most improved methods.

Inside diam. in.	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$
Wall, in.	$\frac{1}{32}$	$\frac{3}{64}$	$\frac{1}{16}$
Approx. ft. per lb.	96	48	30
Inside diam. in.	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{1}{2}$
Wall, in.	$\frac{5}{64}$	$\frac{3}{32}$	$\frac{7}{64}$
Approx. ft. per lb.	20	10	8

Grade 572 RUBBER TUBING — Black Pure Gum. The best for general laboratory use.

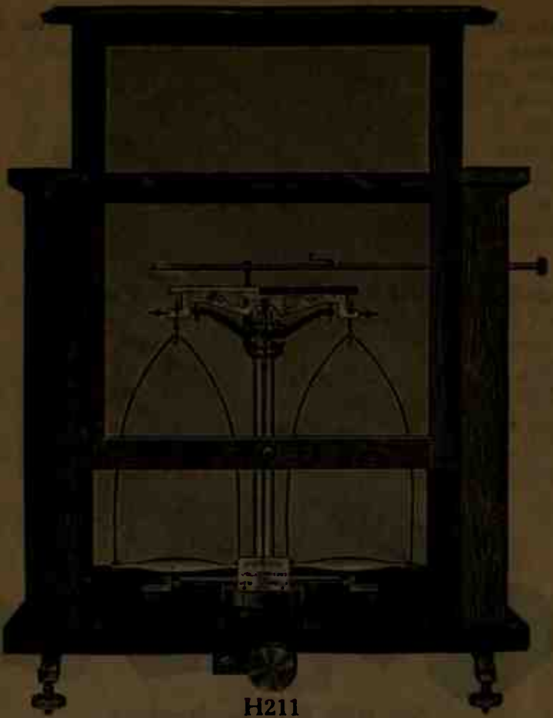
Inside diam. in.	$\frac{1}{8}$	$\frac{5}{32}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$
Wall, in.	$\frac{1}{32}$	$\frac{3}{64}$	$\frac{3}{64}$	$\frac{1}{16}$	$\frac{5}{64}$
Approx. ft. per lb.	130	80	64	40	25
Inside diam. in.	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	1
Wall, in.	$\frac{3}{32}$	$\frac{7}{64}$	$\frac{1}{8}$	$\frac{9}{64}$	$\frac{5}{32}$
Approx. ft. per lb.	18	11	8	7	5

No. 6036 Rubber Stoppers

The compounds from which our stoppers are made are scientifically prepared and absolutely free from any substance that might cause the rubber to deteriorate.

Dimensions and Approximate Number per Pound

No.	Top Diam.	Bottom Diam.	Number per Pound Solid	1-hole	2-hole
00	14mm	10mm	117	121	125
0	16mm	12mm	82	84	85
1	18mm	14mm	59	64	68
2	20mm	16mm	53	55	57
3	23mm	18mm	39	41	43
4	25mm	20mm	32	34	36
5	27mm	23mm	26	28	29
6	32mm	26mm	20	21	22
7	36mm	30mm	15	15	16
8	40mm	33mm	12	12	13
9	45mm	37mm	10	10	10
10	50mm	42mm	8	8	8
11	56mm	50mm	6	6	6
12	65mm	58mm	4	4	4
13	70mm	60mm	3	3	3



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Base — Black slate, $\frac{3}{4}$ inches thick.

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H710

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Correctly designed and accurately calibrated. Graduations are fine and distinct and filled with a special resistant compound which will withstand the hardest laboratory usage.

Through our connections with first class glass blowers we are in a position to furnish special glassware blown to blue print or sketch. We guarantee such glassware to show the same degree of accuracy and careful workmanship as our standard laboratory glassware.

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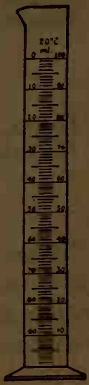

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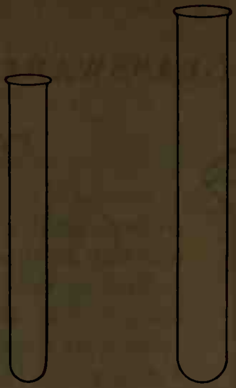

H7220

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Length, in.	3	4	5	5	5	6
Diameter, in.	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{5}{8}$

Length, in.	*6	*6	7	8	10	12
Diameter, in.	$\frac{3}{4}$	1	$\frac{7}{8}$	1	1	1

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