ATOMIC CONSTANTS, 1955 ADJUSTED VALUES, COMPUTED BY
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TABLE OF CONSTANTS

Computed by W. B. Nottingham and based on the 1955 adjusted values of Atomic Constants in Tables 19 and 20, Handbuch der Physik, Vol. XXXV Atoms 1, 1957

	m.k.s.	c.g.s.
Avogadro's number N_o	6.0249×10^{26} molecules/kilo-mole	6.0249×10^{23} molecules/gram-mole
mass of a unit atomic weight $1/N_o$	1.6598×10^{-27} kg	1.6598×10^{-24} gm
Loschmidt's constant $L_o = N_o/V_o$	2.6872×10^{25} molecules/cu.m	2.6872×10^{19} molecules/cu cm
Boltzmann's constant (k)	1.3804×10^{-23} joule/degree	1.3804×10^{-16} erg/degree
gas constant $R = N_o k$	8.3170×10^{3} joule/kilo-mole-degree	8.3170×10^{7} erg/gm-mole-degree
——— ——— (calories)	1.9878×10^{3} cal/kilo-mole-degree	1.9878 x cal/gm-mole-degree
electron charge (e)	1.6021×10^{-19} coulomb	4.8029×10^{-10} statcoulomb
electron mass (m)	9.1083×10^{-31} kg	9.1083×10^{-28} gm
electron charge-mass ratio (e/m)	1.7589×10^{11} coulomb/kg	5.2731×10^{17} statcoulomb/gm
proton mass (M_p)	1.67239×10^{-27} kg	1.67239×10^{-24} gm
ratio (unit atomic wt.)/(electron wt.) ($1/N_o m$)	1822.3	1822.3
Planck's constant (h)	6.6252×10^{-34} joule-sec	6.6252×10^{-27} erg-sec
——— ——— cubed (h^3)	2.9080×10^{-100} $(\text{joule-sec})^3$	2.9080×10^{-79} $(\text{erg-sec})^3$
——— ——— ($h/2\pi$)	1.0544×10^{-34} joule-sec	1.0544×10^{-27} erg-sec
velocity of light (c)	2.99793×10^{8} meter/sec	2.99793×10^{10} cm/sec
——— ——— ——— square (c^2)	8.98758×10^{16} $\text{meter}^2/\text{sec}^2$	8.98758×10^{20} cm^2/sec^2
mass of mercury atom	3.330×10^{-25} kg	3.330×10^{-22} gm
Faraday Constant $F = N_o e$	9.6522×10^{7} coul/kilo-mole	2.8937×10^{14} statcoulomb/gm-mole

TABLE OF CONSTANTS (contd.)

	m.k.s.	c.g.s.
$\epsilon_o = 10 / 4\pi c^2$	8.8543×10^{-12} farad/m	---------------
$\mu_o = 4\pi\ 10^{-7}$	1.2566×10^{-6} henry/m	---------------
$4\pi\ \epsilon_o = 10^7 / c^2$	1.1127×10^{-10} farad/m	---------------
$(4\pi\ \epsilon_o)^{-1} = c^2 / 10^7$	8.9874×10^9 meter/farad	---------------
electron-volt equivalent of 1 cent. deg. (k/e)	8.6164×10^{-5} ev/degree	---------------
temperature equivalent of 1 ev (e/k)	11,606 coulomb-degree/joule	---------------
0.4343 e/k	5040 coulomb-degree/joule	---------------
calorie per gm-mole equivalent of 1 ev ($e\ N_o / 4.1840$)	-------------	23,069 cal/gm-mole
kilo-cal per kg-mole equivalent of 1 ev ($e\ N_o / 4.1840$)	23,069 kilo-cal/kg-mole	---------------
frequency equivalent of 1.0 ev; (e/h)	2.4182×10^{14} cycles/sec	---------------
wavelength equivalent of 1.0 ev; (hc/e)	1.2397×10^{-6} m	12,397 Å
density of Hg (at 20°C)	13.546×10^3 kg/m^3	13.546 gm/cm^3
acceleration of gravity (Cambridge, Mass.)	9.80398 meter/sec^2	980.398 cm/sec^2
ice point	273.16°K	273.16°K
volume of 1 gram-mole of a perfect gas; V_o 1 std. atmo 0°C	------------	22.421 liters
volume of 1 kg-mole of a perfect gas; V_o 1 std. atmo 0°C	22.421 cu.m	---------------

CONVERSION FACTORS

	m.k.s.	c.g.s.
1 standard atmosphere (76 cm Hg)	1.0132×10^5 newton/m^2	1.0132×10^6 dyne/cm^2
1 mm Hg pressure or 1 Tor	133.32 newton/m^2	1333.2 dyne/cm^2
1 Bar (approximately 1 atmosphere)	10^5 newton/m^2	10^6 dyne/cm^2
1 Barye (10^{-6} Bar)	10^{-1} newton/m^2	1 dyne/cm^2
1 Ångstrom unit	10^{-10} m	10^{-8} cm
1 micron	10^{-6} m	10^{-4} cm 10^{-3} mm
1 calorie	4.1840 joules	4.1840×10^7 ergs
force (newton)	1 newton	10^5 dynes
current (ampere)	1 ampere (coulomb/sec)	3×10^9 statcoulombs/sec
electric potential (volt)	1 volt	1/300 statvolts
mass of a unit atomic weight $1/N_o$	1.6598×10^{-27} kg	1.6598×10^{-24} gm

SELECTED ATOMIC WEIGHTS

Electron 5.487×10^{-4}

A = 39.9	Ne = 20.18	He = 4.033	O_2 = 32.0
H_2 = 2.016	N_2 = 28.02	Hg = 200.6	W = 184.0

MATHEMATICAL CONSTANTS

base of natural logs(e) = 2.71821818	$1/\pi = 0.3183099$
$e^{-1} = 0.36788$	$4\pi = 12.5663706$
$(1 - e^{-1}) = 0.63212$	$1/4\pi = 0.0795775$
$\log_{10} e = 0.434294$	$\log_{10} \pi = 0.49715$
$\log_e 10 = 2.302585$	$\log_{10} 4\pi = 1.09921$
$\pi = 3.14159265$	$\log_e \pi = 1.14473$

SOME USEFUL EQUATIONS

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} \ldots \qquad \ln(1 + x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} \ldots$$

$$\int_{-\infty}^{+\infty} e^{-a^2x^2}\, dx = \frac{\sqrt{\pi}}{a}$$

$$\int_0^{\infty} x^n e^{-a^2x^2}\, dx =$$

For even values of n:

$$n = 0 \ldots\ldots\ldots\ldots = \frac{\sqrt{\pi}}{2a}$$

$$n = 2 \ldots\ldots\ldots\ldots = \frac{\sqrt{\pi}}{4a^3}$$

$$n = 4 \ldots\ldots\ldots\ldots = \frac{3\sqrt{\pi}}{8a^5}$$

$$\int_0^{\infty} x^n e^{-a^2x^2}\, dx =$$

For odd values of n:

$$n = 1 \ldots\ldots\ldots\ldots = \frac{1}{2a^2}$$

$$n = 3 \ldots\ldots\ldots\ldots = \frac{1}{2a^4}$$

$$n = 5 \ldots\ldots\ldots\ldots = \frac{1}{a^6}$$

SOME USEFUL EQUATIONS (contd.)

Equation for particle current of Maxwell-Boltzmann gas: $I = \frac{N}{V}\left(\frac{kT}{2\pi m}\right)^{1/2} = \frac{P}{(2\pi mkT)^{1/2}}$

For electrons at $300^\circ K$: $\left(\frac{kT}{2\pi m}\right)^{1/2} = 2.690 \times 10^4$ m/sec; $\frac{1}{(2\pi mkT)^{1/2}} = 6.4957 \times 10^{24}$

Equation of state for ideal gas: $P = \frac{N}{V} kT =$ pressure; $\frac{N}{V} =$ concentration of atoms (number/unit volume).

For potential energy ϵ_c the constant $\frac{a}{H^3} = \frac{N}{(2\pi mkT)^{3/2}} \left[\iiint_V e^{-\frac{\epsilon_c}{kT}}\, dxdydz\right]^{-1}$

For potential energy $\epsilon_c = 0$; $\frac{a}{H^3} = \frac{N}{V}(2\pi mkT)^{-3/2}$

E = total kinetic energy per particle; f(E) = fraction of particles per unit range in energy with energy E.

Maxwell-Boltzmann energy distribution; $f(E)\,dE = \frac{2\pi}{(\pi kT)^{3/2}} E^{1/2} e^{-\frac{E}{kT}}\, dE.$

Fermi-Dirac energy distribution with $n = (N/V)$; $f(E)\,dE = \frac{8\sqrt{2}\,\pi\, m^{3/2}}{n\, h^3} \frac{E^{1/2}\, dE}{\left(e^{\frac{E - W_i}{kT}} + 1\right)}$

SOME USEFUL EQUATIONS (contd.)

Particle current $I(W_x)$ in x-direction per unit energy range of W_x (Fermi statistics)

$$I(W_x)\,dW_x = \frac{4\pi mkT}{h^3}\,\ln\left(1 + e^{-\frac{(W_x - W_i)}{kT}}\right)dW_x \,.$$

For high concentrations of electrons: $W_i = \frac{h^2}{2m}\left(\frac{3n}{8\pi}\right)^{2/3}\left\{1 - \frac{\pi^2}{12}\left[\frac{kT}{\frac{h^2}{2m}\left(\frac{3n}{8\pi}\right)^{2/3}}\right]^2 + \right\}.$

For $T = 0$, $W_i = \frac{h^2}{2m}\left(\frac{3n}{8\pi}\right)^{2/3}$.

For low concentrations of electrons; $W_i = -kT\,\ln\left[\frac{2}{nh^3}\,(2\pi mkT)^{3/2}\right]$.