

Table of Physical Constants

Revised January 2008

Electron rest mass	m_e	$9.109 \times 10^{-31} \text{ kg}$
Proton rest mass	M_p	$1.6726 \times 10^{-27} \text{ kg}$
Electronic charge	e	$1.6022 \times 10^{-19} \text{ C}$
Speed of light in free space	c	$2.9979 \times 10^8 \text{ m s}^{-1}$
Permeability of free space	μ_0	$4\pi \times 10^{-7} \text{ H m}^{-1}$
Permittivity of free space	ϵ_0	$8.854 \times 10^{-12} \text{ F m}^{-1}$
Planck's constant	h	$6.626 \times 10^{-34} \text{ J s}$
Reduced Planck's constant	$\hbar = h/2\pi$	$1.0546 \times 10^{-34} \text{ J s}$
	$\hbar c$	197.33 MeV fm
Boltzmann's constant	k_B	$1.3807 \times 10^{-23} \text{ J K}^{-1}$
Gas constant	$\mathcal{R} = k_B/m_H$	$8.250 \times 10^3 \text{ J kg}^{-1} \text{ K}^{-1}$
Molar gas constant	R	$8.315 \text{ J mol}^{-1} \text{ K}^{-1}$
Avogadro's number	N_A	$6.022 \times 10^{23} \text{ mol}^{-1}$
Standard molar volume		$22.414 \times 10^{-3} \text{ m}^3 \text{ mol}^{-1}$
Unified atomic mass unit (^{12}C scale)	u	$931.5 \text{ MeV}/c^2 = 1.660538 \times 10^{-27} \text{ kg}$
Mass of hydrogen atom	m_H	$1.0078u = 1.6735 \times 10^{-27} \text{ kg}$
Bohr magneton	μ_B	$9.274 \times 10^{-24} \text{ A m}^2 \text{ or J T}^{-1}$
Nuclear magneton	μ_N	$5.051 \times 10^{-27} \text{ A m}^2 \text{ or J T}^{-1}$
Proton magnetic moment	μ_p	$2.7928\mu_N$
Neutron magnetic moment	μ_n	$-1.9130\mu_N$
Bohr radius	a_0	$5.292 \times 10^{-11} \text{ m}$
Fine structure constant	$\alpha = e^2/(4\pi\epsilon_0\hbar c)$	$(137.04)^{-1}$
Compton wavelength of electron	$\lambda_C = h/(m_e c)$	$2.4263 \times 10^{-12} \text{ m}$
Rydberg's constant	R_∞	$1.0974 \times 10^7 \text{ m}^{-1}$
	$R_\infty hc$	13.606 eV
Stefan-Boltzmann constant	σ	$5.671 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$
Radiation density constant	$a = 4\sigma/c$	$7.561 \times 10^{-16} \text{ J m}^{-3} \text{ K}^{-4}$
Gravitational constant	G	$6.673 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$

Rest masses of some leptons and hadrons in MeV/c^2 :

$e^\pm 0.5110$, $\mu^\pm 105.66$, $\tau^\pm 1777$, $\pi^0 134.98$, $\pi^\pm 139.57$, $K^\pm 493.7$, $K^0 497.7$, $\eta 547$, $D^0 1865$, $D^\pm 1869$, $p 938.3$, $n 939.6$, $\Lambda^0 1115.7$, $\Sigma^+ 1189$, $\Sigma^0 1193$, $\Sigma^- 1197$, $\Xi^0 1315$, $\Xi^- 1321$, $\Omega^- 1672$, $Z^0 91.187 \times 10^3$, $W^\pm 80.41 \times 10^3$.

Quark	Charge	I_3	S	C	B	T	Mass (GeV/c^2)
u	$+\frac{2}{3}$	$\frac{1}{2}$	0	0	0	0	~ 0.003
d	$-\frac{1}{3}$	$-\frac{1}{2}$	0	0	0	0	~ 0.006
c	$+\frac{2}{3}$	0	0	+1	0	0	~ 1.25
s	$-\frac{1}{3}$	0	-1	0	0	0	~ 0.11
t	$+\frac{2}{3}$	0	0	0	0	+1	174.3
b	$-\frac{1}{3}$	0	0	0	-1	0	4.2

Astrophysical Data

1 astronomical unit	AU	1.496×10^{11} m
1 parsec	pc	3.086×10^{16} m
Luminosity of Sun	L_{\odot}	3.85×10^{26} W
Mass of Sun	M_{\odot}	1.989×10^{30} kg
Radius of Sun	R_{\odot}	6.96×10^8 m
Mass of Earth	M_E	5.9742×10^{24} kg
Radius of Earth	R_E	6.3781×10^6 m

Other data and conversion factors

1 ångstrom	Å	10^{-10} m
1 fermi	fm	10^{-15} m
1 barn	b	10^{-28} m ²
1 pascal	Pa	1 Nm^{-2}
1 standard atmosphere		1.0132×10^5 Pa
Standard acceleration due to gravity	g	9.807 m s^{-2}
1 electron volt	eV	1.6022×10^{-19} J
	eV/hc	$8.065 \times 10^5 \text{ m}^{-1}$
	eV/k _B	1.1604×10^4 K
Wavelength of 1 eV photon		1.2399×10^{-6} m

Trigonometrical identities

$$\sin(\theta + \phi) = \sin(\theta) \cos(\phi) + \cos(\theta) \sin(\phi)$$

$$\cos(\theta + \phi) = \cos(\theta) \cos(\phi) - \sin(\theta) \sin(\phi)$$

$$\sin \alpha + \sin \beta = 2 \sin \frac{1}{2}(\alpha + \beta) \cos \frac{1}{2}(\alpha - \beta)$$

$$\cos \alpha + \cos \beta = 2 \cos \frac{1}{2}(\alpha + \beta) \cos \frac{1}{2}(\alpha - \beta)$$

$$\cos \alpha - \cos \beta = 2 \sin \frac{1}{2}(\alpha + \beta) \sin \frac{1}{2}(\beta - \alpha)$$

$$\text{In a triangle ABC, } a/\sin A = b/\sin B = c/\sin C$$

$$\text{and } a^2 = b^2 + c^2 - 2bc \cos A$$

Prefixes

$$\text{T} = \text{tera} = 10^{12}$$

$$\text{G} = \text{giga} = 10^9$$

$$\text{M} = \text{mega} = 10^6$$

$$\text{k} = \text{kilo} = 10^3$$

$$\text{c} = \text{centi} = 10^{-2}$$

$$\text{m} = \text{milli} = 10^{-3}$$

$$\mu = \text{micro} = 10^{-6}$$

$$\text{n} = \text{nano} = 10^{-9}$$

$$\text{p} = \text{pico} = 10^{-12}$$

$$\text{f} = \text{femto} = 10^{-15}$$