

Some Physical Constants

Quantity	Symbol	Value ^a
Atomic mass unit	u	1.660 538 782 (83) × 10 ⁻²⁷ kg 931.494 028 (23) MeV/c ²
Avogadro's number	N _A	6.022 141 79 (30) × 10 ²³ particles/mol
Bohr magneton	$\mu_B = \frac{e\hbar}{2m_e}$	9.274 009 15 (23) × 10 ⁻²⁴ J/T
Bohr radius	$a_0 = \frac{\hbar^2}{m_e e^2 k_e}$	5.291 772 085 9 (36) × 10 ⁻¹¹ m
Boltzmann's constant	$k_B = \frac{R}{N_A}$	1.380 650 4 (24) × 10 ⁻²³ J/K
Compton wavelength	$\lambda_C = \frac{h}{m_e c}$	2.426 310 217 5 (33) × 10 ⁻¹² m
Coulomb constant	$k_e = \frac{1}{4\pi\epsilon_0}$	8.987 551 788 ... × 10 ⁹ N·m ² /C ² (exact)
Deuteron mass	m _d	3.343 583 20 (17) × 10 ⁻²⁷ kg 2.013 553 212 724 (78) u
Electron mass	m _e	9.109 382 15 (45) × 10 ⁻³¹ kg 5.485 799 094 3 (23) × 10 ⁻⁴ u 0.510 998 910 (13) MeV/c ²
Electron volt	eV	1.602 176 487 (40) × 10 ⁻¹⁹ J
Elementary charge	e	1.602 176 487 (40) × 10 ⁻¹⁹ C
Gas constant	R	8.314 472 (15) J/mol·K
Gravitational constant	G	6.674 28 (67) × 10 ⁻¹¹ N·m ² /kg ²
Neutron mass	m _n	1.674 927 211 (84) × 10 ⁻²⁷ kg 1.008 664 915 97 (43) u 939.565 346 (23) MeV/c ²
Nuclear magneton	$\mu_n = \frac{e\hbar}{2m_p}$	5.050 783 24 (13) × 10 ⁻²⁷ J/T
Permeability of free space	μ ₀	4π × 10 ⁻⁷ T·m/A (exact)
Permittivity of free space	$\epsilon_0 = \frac{1}{\mu_0 c^2}$	8.854 187 817 ... × 10 ⁻¹² C ² /N·m ² (exact)
Planck's constant	h	6.626 068 96 (33) × 10 ⁻³⁴ J·s
	$\hbar = \frac{h}{2\pi}$	1.054 571 628 (53) × 10 ⁻³⁴ J·s
Proton mass	m _p	1.672 621 637 (83) × 10 ⁻²⁷ kg 1.007 276 466 77 (10) u 938.272 013 (23) MeV/c ²
Rydberg constant	R _H	1.097 373 156 852 7 (73) × 10 ⁷ m ⁻¹
Speed of light in vacuum	c	2.997 924 58 × 10 ⁸ m/s (exact)

Note: These constants are the values recommended in 2006 by CODATA, based on a least-squares adjustment of data from different measurements. For a more complete list, see P. J. Mohr, B. N. Taylor, and D. B. Newell, "CODATA Recommended Values of the Fundamental Physical Constants: 2006." *Rev. Mod. Phys.* **80**:2, 633–730, 2008.

^aThe numbers in parentheses for the values represent the uncertainties of the last two digits.

Solar System Data

Body	Mass (kg)	Mean Radius (m)	Period (s)	Mean Distance from the Sun (m)
Mercury	3.30×10^{23}	2.44×10^6	7.60×10^6	5.79×10^{10}
Venus	4.87×10^{24}	6.05×10^6	1.94×10^7	1.08×10^{11}
Earth	5.97×10^{24}	6.37×10^6	3.156×10^7	1.496×10^{11}
Mars	6.42×10^{23}	3.39×10^6	5.94×10^7	2.28×10^{11}
Jupiter	1.90×10^{27}	6.99×10^7	3.74×10^8	7.78×10^{11}
Saturn	5.68×10^{26}	5.82×10^7	9.29×10^8	1.43×10^{12}
Uranus	8.68×10^{25}	2.54×10^7	2.65×10^9	2.87×10^{12}
Neptune	1.02×10^{26}	2.46×10^7	5.18×10^9	4.50×10^{12}
Pluto ^a	1.25×10^{22}	1.20×10^6	7.82×10^9	5.91×10^{12}
Moon	7.35×10^{22}	1.74×10^6	—	—
Sun	1.989×10^{30}	6.96×10^8	—	—

^aIn August 2006, the International Astronomical Union adopted a definition of a planet that separates Pluto from the other eight planets. Pluto is now defined as a "dwarf planet" (like the asteroid Ceres).

Physical Data Often Used

Average Earth–Moon distance	3.84×10^8 m
Average Earth–Sun distance	1.496×10^{11} m
Average radius of the Earth	6.37×10^6 m
Density of air (20°C and 1 atm)	1.20 kg/m ³
Density of air (0°C and 1 atm)	1.29 kg/m ³
Density of water (20°C and 1 atm)	1.00×10^3 kg/m ³
Free-fall acceleration	9.80 m/s ²
Mass of the Earth	5.97×10^{24} kg
Mass of the Moon	7.35×10^{22} kg
Mass of the Sun	1.99×10^{30} kg
Standard atmospheric pressure	1.013×10^5 Pa

Note: These values are the ones used in the text.

Some Prefixes for Powers of Ten

Power	Prefix	Abbreviation	Power	Prefix	Abbreviation
10^{-24}	yocto	y	10^1	deka	da
10^{-21}	zepto	z	10^2	hecto	h
10^{-18}	atto	a	10^3	kilo	k
10^{-15}	femto	f	10^6	mega	M
10^{-12}	pico	p	10^9	giga	G
10^{-9}	nano	n	10^{12}	tera	T
10^{-6}	micro	μ	10^{15}	peta	P
10^{-3}	milli	m	10^{18}	exa	E
10^{-2}	centi	c	10^{21}	zetta	Z
10^{-1}	deci	d	10^{24}	yotta	Y