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FUNDAMENTAL PHYSICAL CONSTANTS

(Reprinted from the Review of
Modern Physics, Vol. 41, p. 375, 1969)

The numbers in parentheses are the standard-deviation uncertainties

Quantity	Symbol	Value	Error (ppm)	SI	Units	egs
Velocity of light	c	2.9979250(10)	0.33	10^8 m sec ⁻¹	10^{10} cm sec ⁻¹	
Fine-structure constant, $[hc^2/4\pi(e^2/\hbar c)]$	α^{-1}	7.297351(11)	1.5	10^{-3}		
Electron charge	e	1.6021917(70)	4.4	10^{-19} C	10^{-20} esu	
Planck's constant	h	6.6260755(60)	7.6	10^{-34} J·sec	10^{-27} erg·sec	
Avogadro's number	N	6.022169(40)	6.6	10^{23} kmole ⁻¹	10^{23} mole ⁻¹	
Atomic mass unit	amu	1.66053(11)	6.6	10^{-27} kg	10^{-24} g	
Electron rest mass	m_e	9.109558(54)	5.0	10^{-31} kg	10^{-28} g	
Proton rest mass	M_p	1.672614(11)	6.6	10^{-27} kg	10^{-24} g	
Neutron rest mass	M_n	1.674920(11)	6.6	10^{-27} kg	10^{-24} g	
Ratio of proton mass to electron mass	M_p/m_e	1.836108(11)	6.2			
Electron charge to mass ratio	e/m_e	1.758820(54)	3.1	10^{11} C kg ⁻¹	10^7 esu g ⁻¹	
Magnetic flux quantum, $[hc/2e]$	Φ_0	2.067836(69)	3.3	10^{-15} T·m ²	10^{-17} G·cm ²	
Quantum of circulation	$h/2m_e$	4.135708(14)	3.3	10^{-10} J·sec C ⁻¹	10^{-11} erg·sec esu ⁻¹	
Faraday constant, N_e	F	9.648670(54)	5.5	10^5 C kmole ⁻¹	10^4 esu mole ⁻¹	
Rydberg constant, $[hcR_\infty]$	R_∞	1.09737312(11)	0.10	10^7 m ⁻¹	10^6 cm ⁻¹	
Bohr radius, $[a_0]$	a_0	6.2917715(61)	1.5	10^{-11} m	10^{-9} cm	
Classical electron radius, $[r_e]$	r_e	2.817938(13)	4.6	10^{-15} m	10^{-13} cm	
Electron magnetic moment in Bohr magnetons, $[\mu_B/2\mu_B]$	μ_B/μ_B	1.0011586389(31)	0.0031			
Electron magnetic moment	μ_B	9.274009(65)	7.0	10^{-24} J T ⁻¹	10^{-21} erg G ⁻¹	
Gyromagnetic ratio of protons in H ₂ O	$\gamma_p/2\pi$	2.6751270(62)	3.1	10^8 rad sec ⁻¹ ·T ⁻¹	10^6 rad sec ⁻¹ ·G ⁻¹	
$\gamma_p/2\pi$ corrected for diamagnetism of H ₂ O	$\gamma_p/2\pi$	4.257597(13)	3.1	10^8 rad sec ⁻¹ ·T ⁻¹	10^6 rad sec ⁻¹ ·G ⁻¹	
Magnetic moment of H ₂ O in Bohr magnetons	μ_p/μ_B	1.52069312(10)	0.066	10^{-3}	10^{-3}	
Proton magnetic moment in Bohr magnetons	μ_p/μ_B	1.52103264(46)	0.30	10^{-3}	10^{-3}	
Magnetic moment of protons in H ₂ O in nuclear magnetons	μ_p/μ_N	2.792709(17)	7.0	10^{-26} J T ⁻¹	10^{-23} erg G ⁻¹	
μ_p/μ_N corrected for diamagnetism of H ₂ O	μ_p/μ_N	2.792782(17)	6.2			
Nuclear magneton, $[\mu_N/2\pi M_p c]$	μ_N	5.050781(50)	10	10^{-27} J T ⁻¹	10^{-24} erg G ⁻¹	
Compton wavelength of the electron, $h/m_e c$	λ_C	2.4263096(74)	3.1	10^{-10} m	10^{-10} cm	
	$\lambda_C/2\pi$	3.861592(12)	3.1	10^{-10} m	10^{-11} cm	

Courtesy of RCA Laboratories, Princeton, N.J.

Compiled by B. N. Taylor, W. H. Parker, and D. N. Langenberg

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in the last digits of the quoted value, computed on the basis of internal consistency.

Quantity	Symbol	Value	Error (ppm)	SI	Units	egs
Compton wavelength of the proton, $h/M_p c$	$\lambda_{Cp}/2\pi$	1.3214409(90)	6.8	10^{-15} m	10^{-13} cm	
Compton wavelength of the neutron, $h/M_n c$	$\lambda_{Cn}/2\pi$	2.103130(14)	6.8	10^{-16} m	10^{-14} cm	
Gas constant	R_0	8.31434(35)	42	10^8 J kmole ⁻¹ ·K ⁻¹	10^7 erg mole ⁻¹ ·K ⁻¹	
Boltzmann's constant, R_0/N	k	1.380652(59)	43	10^{-23} J K ⁻¹	10^{-16} erg K ⁻¹	
Stefan-Boltzmann constant, $\pi^2 k^4/60\pi^5 c^2$	σ	5.66961(96)	170	10^{-8} W m ⁻² K ⁴	10^{-5} erg sec ⁻¹ ·cm ² ·K ⁴	
First radiation constant, $8\pi^5 h c^2/15$	c_1	4.96579(38)	7.6	10^{-16} J·m	10^{-15} erg·cm	
Second radiation constant, hc/k	c_2	1.438833(61)	43	10^{-2} m·K	cm·K	
Gravitational constant, kx -unit-to-angstrom conversion factor, $\Lambda \equiv \Lambda(\text{Å})/\lambda(\text{kx})$; $\lambda(\text{Å})/k(\text{kx}) \equiv 1.531460$ kx	G	6.6732(31)	460	10^{-11} N·m ² ·kg ⁻²	10^{-8} dyn·cm ² ·g ⁻²	
Λ -to-angstrom conversion factor, $\Lambda \equiv \Lambda(\text{Å})/\lambda(\text{kx})$; $\lambda(\text{Å})/k(\text{kx}) \equiv 0.268000$ Å	Λ^*	1.0000197(56)	5.6			

*Note that the unified atomic mass scale, $M_u \equiv 12$ has been used throughout. The first factor in brackets, in to be included only if all quantities are expressed in atomic units. μ_B is the Bohr magneton, μ_N is the nuclear magneton, μ_p is the proton magnetic moment, μ_n is the neutron magnetic moment, μ_p/μ_N is the ratio of the proton magnetic moment to the nuclear magneton, μ_n/μ_N is the ratio of the neutron magnetic moment to the nuclear magneton, μ_p/μ_B is the ratio of the proton magnetic moment to the Bohr magneton, μ_n/μ_B is the ratio of the neutron magnetic moment to the Bohr magneton, μ_p/μ_N is the ratio of the proton magnetic moment to the nuclear magneton, μ_n/μ_N is the ratio of the neutron magnetic moment to the nuclear magneton, μ_p/μ_B is the ratio of the proton magnetic moment to the Bohr magneton, μ_n/μ_B is the ratio of the neutron magnetic moment to the Bohr magneton.

Energy Conversion Factors

Quantity	Value	Unit	Error (ppm)
1 kg	5.9998638(24)	10^{27} MeV	4.4
1 amu	931.4812(52)	MeV	5.5
Electron mass	0.5110041(16)	MeV	3.1
Proton mass	938.272088(48)	MeV	5.5
Neutron mass	939.56537(62)	MeV	5.5
1 electron volt	1.6021917(70)	10^{-19} J	4.4
	241.79659(81)	10^{18} erg	3.3
	8.065465(27)	10^8 eV	3.3
	1160485(49)	10^6 eV	4.4
Energy-wavelength conversion	12398.51(41)	10^6 eV·m	3.3
	12398.51(41)	10^6 eV·cm	3.3
Rydberg constant, R_∞	21.7991(17)	10^{11} erg	7.6
	13505826(46)	10^7 erg	3.3
	3298423(11)	10^8 Hz	3.3
	1574830(67)	10^8 K	4.4
Bohr magneton, μ_B	5.788381(18)	10^{-5} eV T ⁻¹	3.1
	1.3996108(43)	10^6 Hz T ⁻¹	3.1
	4685859(14)	10^{-2} cm ⁻¹ ·T ⁻¹	3.1
	0.571734(29)	K T ⁻¹	4.4
Nuclear magneton, μ_N	3.152526(21)	10^{-8} eV T ⁻¹	6.8
	7322700(42)	10^6 Hz T ⁻¹	5.5
	2342658(14)	10^{-4} m ⁻¹ ·T ⁻¹	5.5
	3.5946(16)	10^{-4} K T ⁻¹	3.1
Gas constant, R_0	8.31434(35)	10^8 m ³ ·atm kmole ⁻¹ ·K ⁻¹	4.4
Standard volume of ideal gas, V_0	22.1136	m ³ kmole ⁻¹	4.4

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