

**2014 CODATA RECOMMENDED VALUES OF THE FUNDAMENTAL  
CONSTANTS OF PHYSICS AND CHEMISTRY NIST SP 959** (Aug 2015)

See: P. J. Mohr, D. B. Newell, and B. N. Taylor, [arxiv.org/pdf/1507.07956v1.pdf](http://arxiv.org/pdf/1507.07956v1.pdf) (2015).  
A more extensive listing of constants is available in the reference given above and on  
the NIST Physical Measurement Laboratory Web site: [physics.nist.gov/constants](http://physics.nist.gov/constants).

Quantity	Symbol	Numerical value	Unit
speed of light in vacuum	$c, c_0$	299 792 458 (exact)	$\text{m s}^{-1}$
magnetic constant	$\mu_0$	$4\pi \times 10^{-7}$ (exact)	$\text{N A}^{-2}$
electric constant $1/\mu_0 c^2$	$\epsilon_0$	$8.854 187 817... \times 10^{-12}$	$\text{F m}^{-1}$
Newtonian constant of gravitation	$G$	$6.674 08(31) \times 10^{-11}$	$\text{m}^3 \text{kg}^{-1} \text{s}^{-2}$
Planck constant	$h$	$6.626 070 040(81) \times 10^{-34}$	$\text{J s}$
$h/2\pi$	$\hbar$	$1.054 571 800(13) \times 10^{-34}$	$\text{J s}$
elementary charge	$e$	$1.602 176 6208(98) \times 10^{-19}$	$\text{C}$
fine-structure constant $e^2/4\pi\epsilon_0\hbar c$	$\alpha$	$7.297 352 5664(17) \times 10^{-3}$	
inverse fine-structure constant	$\alpha^{-1}$	137.035 999 139(31)	
Rydberg constant $\alpha^2 m_e c/2h$	$R_\infty$	10 973 731.568 508(65)	$\text{m}^{-1}$
Bohr radius $\alpha/4\pi R_\infty$	$a_0$	$0.529 177 210 67(12) \times 10^{-10}$	$\text{m}$
Bohr magneton $e\hbar/2m_e$	$\mu_B$	$927.400 9994(57) \times 10^{-26}$	$\text{J T}^{-1}$

Quantity	Symbol	Numerical value	Unit
electron mass	$m_e$	$9.109\,383\,56(11) \times 10^{-31}$	kg
proton mass	$m_p$	$1.672\,621\,898(21) \times 10^{-27}$	kg
proton-electron mass ratio	$m_p/m_e$	1836.152 673 89(17)	
Avogadro constant	$N_A, L$	$6.022\,140\,857(74) \times 10^{23}$	mol <sup>-1</sup>
Faraday constant $N_A e$	$F$	96 485.332 89(59)	C mol <sup>-1</sup>
molar gas constant	$R$	8.314 4598(48)	J mol <sup>-1</sup> K <sup>-1</sup>
Boltzmann constant $R/N_A$	$k$	$1.380\,648\,52(79) \times 10^{-23}$	J K <sup>-1</sup>
Stefan-Boltzmann const. $\pi^2 k^4/60\hbar^3 c^2$	$\sigma$	$5.670\,367(13) \times 10^{-8}$	W m <sup>-2</sup> K <sup>-4</sup>
magnetic flux quantum $h/2e$	$\Phi_0$	$2.067\,833\,831(13) \times 10^{-15}$	Wb
Josephson constant $2e/h$	$K_J$	$483\,597.8525(30) \times 10^9$	Hz V <sup>-1</sup>
von Klitzing constant $h/e^2$	$R_K$	25 812.807 4555(59)	$\Omega$
electron volt ( $e/C$ ) J	eV	$1.602\,176\,6208(98) \times 10^{-19}$	J
(unified) atomic mass unit $\frac{1}{12}m(^{12}\text{C})$	u	$1.660\,539\,040(20) \times 10^{-27}$	kg

The number in parentheses is the one-sigma ( $1\sigma$ ) uncertainty in the last two digits of the given value.

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