

## Fundamental Constants 1999

<i>quantity</i>	<i>symbol</i>	<i>1999 value</i> <i>(std. uncertainty)</i>	<i>unit</i>	<i>relative std. uncert.</i> <i><math>u_r \times 10^9</math> (i.e. ppb)</i>
Planck constant	$h$	6.626 068 76 (52)	$\times 10^{-34}$ J s	78
elementary charge (charge on a proton)	$e$	1.602 176 462 (63)	$\times 10^{-19}$ C	39
electron rest mass	$m_e$	9.109 381 88 (72)	$\times 10^{-31}$ kg	79
proton rest mass	$m_p$	1.672 621 58 (13)	$\times 10^{-27}$ kg	79
atomic mass constant (unified atomic mass unit, $m(^{12}\text{C})/12$ )	$u = m_u$	1.660 538 73 (13)	$\times 10^{-27}$ kg	79
Avogadro constant	$L, N_A$	6.022 141 99 (47)	$\times 10^{23}$ mol <sup>-1</sup>	79
Boltzmann constant	$k, (k_B)$	1.380 650 3 (24)	$\times 10^{23}$ J K <sup>-1</sup>	1700
Faraday constant	$F$	9.648 534 15 (39)	$\times 10^4$ C mol <sup>-1</sup>	40
gas constant	$R$	8.314 472 (15)	J mol <sup>-1</sup> K <sup>-1</sup>	1700
fine structure constant	$\alpha$	7.297 352 533 (27)	$\times 10^{-3}$	3.7
Bohr radius	$a_0$	0.529 177 208 3 (19)	$\times 10^{-10}$ m	3.7
Hartree energy	$E_h$	4.359 743 81 (34)	$\times 10^{-18}$ J	78
Rydberg constant	$R_\infty$	1.097 373 156 854 8 (83)	$\times 10^7$ m <sup>-1</sup>	0.0076
Bohr magneton	$\mu_B$	9.274 008 99 (37)	$\times 10^{-24}$ J T <sup>-1</sup>	40
Landé $g$ factor for free electron	$g$	2.002 319 304 373 7 (82)		0.0041
nuclear magneton	$\mu_N$	5.050 783 17 (20)	$\times 10^{-27}$ J T <sup>-1</sup>	40
Newtonian constant of gravitation	$G$	6.673 (10)	$\times 10^{-11}$ m <sup>3</sup> kg <sup>-1</sup> s <sup>-2</sup>	$1.5 \times 10^6$

1999 issue of the best estimates of the fundamental constants, released by CODATA and produced by NIST. Visit <<http://physics.nist.gov/cuu/Constants/>> for more details.

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