Fundamental Physical Constants — Frequently used constants

Quantity	Symbol	Value	Unit	Relative std. uncert. u_r
speed of light in vacuum	c	299 792 458	m s^{-1}	exact
Newtonian constant of gravitation	G	6.674 30(15) $\times 10^{-11}$	m^3 kg^{-1} s^{-2}	2.2×10^{-5}
Planck constant*	h	6.626 070 15 $\times 10^{-34}$	J Hz^{-1}	exact
	$\hbar$	1.054 571 817 ... $\times 10^{-34}$	J s	exact
elementary charge	e	1.602 176 634 $\times 10^{-19}$	C	exact
vacuum magnetic permeability $4\pi\alpha\hbar/e^2c$	μ_0	1.256 637 061 27(20) $\times 10^{-6}$	N A^{-2}	1.6×10^{-10}
vacuum electric permittivity $1/\mu_0c^2$	ϵ_0	8.854 187 8188(14) $\times 10^{-12}$	F m^{-1}	1.6×10^{-10}
Josephson constant $2e/h$	K_J	483 597.848 4 ... $\times 10^9$	Hz V^{-1}	exact
von Klitzing constant $\mu_0c/2\alpha = 2\pi\hbar/e^2$	R_K	25 812.807 45 ...	Ω	exact
magnetic flux quantum $2\pi\hbar/(2e)$	Φ_0	2.067 833 848 ... $\times 10^{-15}$	Wb	exact
conductance quantum $2e^2/2\pi\hbar$	G_0	7.748 091 729 ... $\times 10^{-5}$	S	exact
electron mass	m_e	9.109 383 7139(28) $\times 10^{-31}$	kg	3.1×10^{-10}
proton mass	m_p	1.672 621 925 95(52) $\times 10^{-27}$	kg	3.1×10^{-10}
proton-electron mass ratio	m_p/m_e	1836.152 673 426(32)		1.7×10^{-11}
fine-structure constant $e^2/4\pi\epsilon_0\hbar c$	α	7.297 352 5643(11) $\times 10^{-3}$		1.6×10^{-10}
inverse fine-structure constant	α^{-1}	137.035 999 177(21)		1.6×10^{-10}
Rydberg frequency $\alpha^2m_ec^2/2h$	cR_∞	3.289 841 960 2500(36) $\times 10^{15}$	Hz	1.1×10^{-12}
Boltzmann constant	k	1.380 649 $\times 10^{-23}$	J K^{-1}	exact
Avogadro constant	N_A	6.022 140 76 $\times 10^{23}$	mol^{-1}	exact
molar gas constant N_Ak	R	8.314 462 618 ...	J mol^{-1} K^{-1}	exact
Faraday constant N_Ae	F	96 485.332 12 ...	C mol^{-1}	exact
Stefan-Boltzmann constant $(\pi^2/60)k^4/\hbar^3c^2$	σ	5.670 374 419 ... $\times 10^{-8}$	W m^{-2} K^{-4}	exact
Non-SI units accepted for use with the SI				
electron volt (e/C) J	eV	1.602 176 634 $\times 10^{-19}$	J	exact
(unified) atomic mass unit $\frac{1}{12}m(^{12}C)$	u	1.660 539 068 92(52) $\times 10^{-27}$	kg	3.1×10^{-10}

* The energy of a photon with frequency ν expressed in unit Hz is $E = h\nu$ in J. Unitary time evolution of the state of this photon is given by $\exp(-iEt/\hbar)|\varphi\rangle$, where $|\varphi\rangle$ is the photon state at time $t = 0$ and time is expressed in unit s. The ratio $Et/\hbar$ is a phase.

1 eV (1 eV) = 1.602 176 634 $\times 10^{-19}$ J | $(1\text{ eV})/c^2$ = 1.782 661 921 ... $\times 10^{-36}$ kg | $(1\text{ eV})/hc$ = 8.065 543 937 ... $\times 10^5$ m^{-1} | $(1\text{ eV})/h$ = 2.417 989 242 ... $\times 10^{14}$ Hz

1 eV **(1 eV)/k = 1.160 451 812 ... $\times 10^4$ K**

1 eV ⇔ 11604.51812 K ⇔ 8065.543937 cm^{-1} ⇔ 1239.841984 nm $\lambda = \frac{c}{\nu}, h\nu = \frac{hc}{\lambda}$

1 eV = 96.48533212 kJ mol^{-1}

1 kJ mol^{-1} = 10.36426966 meV ⇔ 120.272 K

1 cal = 4.184 J, 1 kcal mol-1 = 43.3641 meV ⇔ 503.218 K

300 K = 25.852 meV = 2.4943 kJ mol-1

$$\mathrm{ATP^{4-} + H_2O \Rightarrow ADP^{3-} + HPO_4^{2-} + H^+ : \underbrace{-30.5\ kJ\ mol^{-1}}_{=\Delta_r G^\oplus} = -316\ meV \Leftrightarrow 3670\ K}$$

$$1\ \mathrm{F} = 1\ \mathrm{C\ V^{-1}}$$

$$\frac{e^2}{4\pi\epsilon_0 r} = \frac{[\mathrm{C^2}]}{[\mathrm{Fm^{-1}m}]} = [\mathrm{CV}] = [\mathrm{J}]$$

$$1\ \mathrm{D} = c^{-1} \times 10^{-21}\ \mathrm{C\ m} = 3.33564 \times 10^{-30}\ \mathrm{C\ m}$$

$$\frac{\mathrm{Weber}}{\mathrm{m^2}} = \frac{\mathrm{N}}{\mathrm{A\ m}} = \mathrm{T} = 10^4\ \mathrm{Gauss}$$

Dirac constant (exact)

$$\hbar = \frac{h}{2\pi} = 6.582119569 \times 10^{-16}\ \mathrm{eV\ s}$$

2022 CODA part2

1 atm = 760 mmHg = 760 Torr = 1013.25 hPa = 1013.25 mbar

2022 CODATA adjustment — From: **http://physics.nist.gov/constants**

Fundamental Physical Constants — Atomic and nuclear constants

Quantity	Symbol	Value	Unit	Relative std. uncert. u_r
		General		
fine-structure constant $e^2/4\pi\epsilon_0\hbar c$	α	$7.297\,352\,5643(11) \times 10^{-3}$		1.6×10^{-10}
inverse fine-structure constant	α^{-1}	$137.035\,999\,177(21)$		1.6×10^{-10}
Rydberg frequency $\alpha^2 m_e c^2/2h = E_h/2h$	cR_∞	$3.289\,841\,960\,2500(36) \times 10^{15}$	Hz	1.1×10^{-12}
energy equivalent	$hc\,R_\infty$	$2.179\,872\,361\,1030(24) \times 10^{-18}$	J	1.1×10^{-12}
		$13.605\,693\,122\,990(15)$	eV	1.1×10^{-12}
Rydberg constant	R_∞	$10\,973\,731.568\,157(12)$	$[m^{-1}]^*$	1.1×10^{-12}
Bohr radius $\hbar/\alpha m_e c = 4\pi\epsilon_0\hbar^2/m_e e^2$	a_0	$5.291\,772\,105\,44(82) \times 10^{-11}$	m	1.6×10^{-10}
Hartree energy $\alpha^2 m_e c^2 = e^2/4\pi\epsilon_0 a_0 = 2hcR_\infty$	E_h	$4.359\,744\,722\,2060(48) \times 10^{-18}$	J	1.1×10^{-12}
		$27.211\,386\,245\,981(30)$	eV	1.1×10^{-12}

= 1 au = 2 Ryd

2022年版(予定) [6]	2023年予定	バージョンx

新しいSIの定義に用いられるプランク定数 h、電気素量 e、ボルツマン定数 k、アボガドロ定数 N_A の4つについて、最終的な数値の決定を2018年1月28日に出版した[12]。これらの数値は「2017 special CODATA adjustment」と呼ばれている。
次に、新しいSIの定義の正式な採択に合わせて、新しい2018年版のCODATA推奨値となる「CODATA2018」を世界計量記念日の2019年5月20日に公表した。これは新しいSIの定義によって、様々な物理定数の数値（不確かさの数値を含む）を変更する必要があったからである。

CODATA; Committee on Data for Science and Technology