

Physical Constants

Quantity	Symbol, equation	Value
Speed of light	c	$2.997\,9 \times 10^8 \text{ m s}^{-1}$
Electron charge	e	$1.602 \times 10^{-19} \text{ C}$
Planck constant	h	$6.626 \times 10^{-34} \text{ J s}$
Planck constant, reduced	$\hbar = h/2\pi$	$1.055 \times 10^{-34} \text{ J s}$
Conversion constant	$\hbar c$	$197.327 \text{ MeV fm} = 197.327 \text{ eV nm}$
Electron mass	m_e	$9.109 \times 10^{-31} \text{ kg} = 0.511 \text{ MeV}/c^2$
Proton mass	m_p	$1.673 \times 10^{-27} \text{ kg} = 938.272 \text{ MeV}/c^2$
Neutron mass	m_n	$1.675 \times 10^{-27} \text{ kg} = 939.566 \text{ MeV}/c^2$
Fine structure constant	$\alpha = e^2/\hbar c$	$1/137.036$
Classical electron radius	$r_e = e^2/m_e c^2$	$2.818 \times 10^{-15} \text{ m}$
Electron Compton wavelength	$\lambda = h/m_e c = r_e/\alpha$	$2.426 \times 10^{-12} \text{ m}$
Proton Compton wavelength	$\lambda = h/m_p c$	$1.321 \times 10^{-15} \text{ m}$
Bohr radius	$a_0 = r_e/\alpha^2$	$0.529 \times 10^{-10} \text{ m}$
Rydberg energy	$\mathcal{R} = m_e c^2 \alpha^2/2$	13.606 eV
Bohr magneton	$\mu_B = e\hbar/2m_e$	$5.788 \times 10^{-11} \text{ MeV T}^{-1}$
Nuclear magneton	$\mu_N = e\hbar/2m_p$	$3.152 \times 10^{-14} \text{ MeV T}^{-1}$
Avogadro number	N_A	$6.022 \times 10^{23} \text{ mol}^{-1}$
Boltzmann constant	k	$1.381 \times 10^{-23} \text{ J K}^{-1}$ $= 8.617 \times 10^{-5} \text{ eV K}^{-1}$
Gas constant	$R = N_A k$	$8.31 \text{ J mol}^{-1} \text{ K}^{-1}$
Gravitational constant	G	$6.673 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$
Permittivity of free space	$\epsilon_0 = 1/\mu_0 c^2$	$8.854 \times 10^{-12} \text{ F m}^{-1}$
Permeability of free space	μ_0	$4\pi \times 10^{-7} \text{ N A}^{-2}$

Conversion of units

$$\begin{aligned}
 1 \text{ fm} &= 10^{-15} \text{ m}, & 1 \text{ barn} &= 10^{-28} \text{ m}^2 = 100 \text{ fm}^2, & 1 \text{ G} &= 10^{-4} \text{ T} \\
 1 \text{ atmosphere} &= 101\,325 \text{ Pa}, & \text{Thermal energy at } T = 300 \text{ K: } kT &= [38.682]^{-1} \text{ eV} \\
 0^\circ\text{C} &= 273.15 \text{ K}, & 1 \text{ eV} &= 1.602 \times 10^{-19} \text{ J}, & 1 \text{ eV}/c^2 &= 1.783 \times 10^{-36} \text{ kg}
 \end{aligned}$$