

## 66.12: Physical Constants

**Table 66.12.1.** Fundamental physical constants (CODATA 2018).

Description	Symbol	Value
Speed of light (vacuum)	$c$	$2.99792458 \times 10^8 \text{ m/s}$
Gravitational constant	$G$	$6.67430 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$
Elementary charge	$e$	$1.602176634 \times 10^{-19} \text{ C}$
Permittivity of free space	$\epsilon_0$	$8.8541878128 \times 10^{-12} \text{ F/m}$
Permeability of free space	$\mu_0$	$1.2566370621210^{-6} \text{ N/A}^2$
Coulomb constant $\left(\frac{1}{4\pi\epsilon_0}\right)$	$k_e$	$8.9875517923 \times 10^9 \text{ m/F}$
Electron mass	$m_e$	$9.1093837015 \times 10^{-31} \text{ kg}$
Proton mass	$m_p$	$1.67262192369 \times 10^{-27} \text{ kg}$
Neutron mass	$m_n$	$1.67492749804 \times 10^{-27} \text{ kg}$
Atomic mass unit ( $\text{amu}$ )	$u$	$1.66053906660 \times 10^{-27} \text{ kg}$
Planck constant	$h$	$6.62607015 \times 10^{-34} \text{ J}\cdot\text{s}$
Planck constant $\div 2\pi$	$\hbar$	$1.0545718176461564 \times 10^{-34} \text{ Js}$
Boltzmann constant	$k_B$	$1.380649 \times 10^{-23} \text{ J/K}$
Avogadro constant	$N_A$	$6.02214076 \times 10^{23} \text{ mol}^{-1}$

**Table 66.12.2.** Other physical constants.

Description	Symbol	Value
Acceleration due to gravity at Earth surface	$g$	$9.80 \text{ m/s}^2$
Radius of the Earth (eq.)	$R_\oplus$	$6378.140 \text{ km}$
Mass of the Earth	$M_\oplus$	$5.97320 \times 10^{24} \text{ kg}$
Earth gravity constant	$G M_\oplus$	$3.986005 \times 10^{14} \text{ m}^3 \text{ s}^{-2}$
Speed of sound in air $\left(20^\circ\text{C}\right)$	$v_{\text{snd}}$	$343 \text{ m/s}$
Density of air (sea level)	$\rho_{\text{air}}$	$1.29 \text{ kg/m}^3$
Density of water	$\rho_w$	$1 \text{ g/cm}^3 = 1000 \text{ kg/m}^3$
Index of refraction of water	$n_w$	$1.33$
Resistivity of copper ( $20^\circ\text{C}$ )	$\rho_{\text{Cu}}$	$1.68 \times 10^{-8} \Omega\text{m}$

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