NCPHO List of Constants

Fundamental Physics Constants

Speed of light in vacuum	c	$2.998 \cdot 10^{8}\,\mathrm{m \cdot s^{-1}}$
Permittivity of free space	ε_0	$8.854 \cdot 10^{-12}\,\mathrm{F \cdot m^{-1}}$
Permeability of free space	μ_0	$1.257 \cdot 10^{-6}\,\mathrm{H \cdot m^{-1}}$
Gravitational constant	G	$6.674 \cdot 10^{-11}\,\mathrm{m^3 \cdot kg^{-1} \cdot s^{-2}}$
Planck constant	h	$6.626 \cdot 10^{-34}\,\mathrm{J \cdot s}$
Reduced Planck constant	$\hbar$	$1.055 \cdot 10^{-34}\,\mathrm{J \cdot s}$
Elementary charge	e	$1.602 \cdot 10^{-19}\,\mathrm{C}$
Coulomb constant	k_e	$8.988 \cdot 10^{9}\,\mathrm{N \cdot m^2 \cdot C^{-2}}$
Avogadro constant	N_A	$6.022 \cdot 10^{23}\,\mathrm{mol^{-1}}$
Boltzmann constant	k_B	$1.381 \cdot 10^{-23}\,\mathrm{J \cdot K^{-1}}$
Molar gas constant	R	$8.314\,\mathrm{J \cdot mol^{-1} \cdot K^{-1}}$
Stefan-Boltzmann const.	σ	$5.670 \cdot 10^{-8}\,\mathrm{W \cdot m^{-2} \cdot K^{-4}}$
Wien's displacement const.	b	$2.898 \cdot 10^{-3}\,\mathrm{m \cdot K}$

Particle & Atomic Constants

Electron mass	m_e	$9.109 \cdot 10^{-31}\,\mathrm{kg}$
Proton mass	m_p	$1.673 \cdot 10^{-27}\,\mathrm{kg}$
Neutron mass	m_n	$1.675 \cdot 10^{-27}\,\mathrm{kg}$
Atomic mass unit	u	$1.661 \cdot 10^{-27}\,\mathrm{kg}$
Electron volt	$1\,\mathrm{eV}$	$1.602 \cdot 10^{-19}\,\mathrm{J}$
Rydberg constant	R_∞	$1.097 \cdot 10^{7}\,\mathrm{m^{-1}}$
Bohr radius	a_0	$5.292 \cdot 10^{-11}\,\mathrm{m}$
Bohr magneton	μ_B	$9.274 \cdot 10^{-24}\,\mathrm{J \cdot T^{-1}}$

Astronomical Constants

Mass of Earth	$M_\oplus$	$5.974 \cdot 10^{24}\,\mathrm{kg}$
Mass of Sun	$M_\odot$	$1.989 \cdot 10^{30}\,\mathrm{kg}$
Mass of Moon	M_L	$7.348 \cdot 10^{22}\,\mathrm{kg}$
Mean radius of Earth	$R_\oplus$	$6.371 \cdot 10^{6}\,\mathrm{m}$
Mean radius of Sun	$R_\odot$	$6.957 \cdot 10^{8}\,\mathrm{m}$
Mean radius of Moon	R_L	$1.737 \cdot 10^{6}\,\mathrm{m}$
Earth-Sun dist. (AU)	au	$1.496 \cdot 10^{11}\,\mathrm{m}$
Earth-Moon dist.	d_L	$3.844 \cdot 10^{8}\,\mathrm{m}$
Nominal solar lum.	$L_\odot$	$3.828 \cdot 10^{26}\,\mathrm{W}$
Parsec	pc	$3.086 \cdot 10^{16}\,\mathrm{m}$
Light year	ly	$9.461 \cdot 10^{15}\,\mathrm{m}$

Properties of Matter & Env.

Standard gravity	g	$9.81\,\mathrm{m \cdot s^{-2}}$
Sound speed (air)*	c_{air}	$343\,\mathrm{m \cdot s^{-1}}$
Density of air*	ρ_{air}	$1.204\,\mathrm{kg \cdot m^{-3}}$
Std. Atmosphere	P_0	$1.013 \cdot 10^{5}\,\mathrm{Pa}$
Std. Temperature	T_0	$273.15\,\mathrm{K}\,(0°\mathrm{C})$
Room Temperature	T_{rm}	$293.15\,\mathrm{K}\,(20°\mathrm{C})$

**at 20°C and 1 atm*

Properties of Water

Density	ρ_w	$998\,\mathrm{kg \cdot m^{-3}}$
Molar mass	$M_{\mathrm{H_2O}}$	$18.02\,\mathrm{g \cdot mol^{-1}}$
Specific heat cap.	c_w	$4184\,\mathrm{J \cdot kg^{-1} \cdot K^{-1}}$
Latent heat fusion	L_f	$3.34 \cdot 10^{5}\,\mathrm{J \cdot kg^{-1}}$
Latent heat vap.	L_v	$2.26 \cdot 10^{6}\,\mathrm{J \cdot kg^{-1}}$
Index of refraction	n	1.333
Dynamic viscosity*	μ	$1.002 \cdot 10^{-3}\,\mathrm{Pa \cdot s}$
Surface tension*	γ	$7.28 \cdot 10^{-2}\,\mathrm{N \cdot m^{-1}}$

**at 20°C*

Math & Useful Conversions

Pi	π	3.14159
Euler's number	e	2.71828
Radians to Degrees	$1\,\mathrm{rad}$	$180°/\pi \approx 57.3°$
Calorie (thermo.)	$1\,\mathrm{cal}$	$4.184\,\mathrm{J}$
Horsepower	$1\,\mathrm{hp}$	$746\,\mathrm{W}$
Angstrom	$1\,\text{Å}$	$10^{-10}\,\mathrm{m}$

Small Angle Approximation ($\theta \ll 1\,\mathrm{rad}$):
$\sin\theta \approx \theta \approx \tan\theta, \quad \cos\theta \approx 1 - \theta^2/2$

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Unless otherwise stated, assume standard conditions (20°C, 1 atm) and ignore air resistance.