

FUNDAMENTAL CONSTANTS

Quantity	Symbol	Value*
Avogadro's number	N_A	$6.022\ 1367 \times 10^{23} \text{ mol}^{-1}$
Boltzmann's constant	k	$1.380\ 658 \times 10^{-23} \text{ J/K}$
Electron charge magnitude	e	$1.602\ 177\ 33 \times 10^{-19} \text{ C}$
Permeability of free space	μ_0	$4\pi \times 10^{-7} \text{ T}\cdot\text{m/A}$
Permittivity of free space	ϵ_0	$8.854\ 187\ 817 \times 10^{-12} \text{ C}^2/(\text{N}\cdot\text{m}^2)$
Planck's constant	h	$6.626\ 0755 \times 10^{-34} \text{ J}\cdot\text{s}$
Mass of electron	m_e	$9.109\ 3897 \times 10^{-31} \text{ kg}$
Mass of neutron	m_n	$1.674\ 9286 \times 10^{-27} \text{ kg}$
Mass of proton	m_p	$1.672\ 6231 \times 10^{-27} \text{ kg}$
Speed of light in vacuum	c	$2.997\ 924\ 58 \times 10^8 \text{ m/s}$
Universal gravitational constant	G	$6.672\ 59 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$
Universal gas constant	R	$8.314\ 510 \text{ J}/(\text{mol}\cdot\text{K})$

* 1986 CODATA recommended values.

USEFUL PHYSICAL DATA

Acceleration due to earth's gravity	$9.80 \text{ m/s}^2 = 32.2 \text{ ft/s}^2$
Atmospheric pressure at sea level	$1.013 \times 10^5 \text{ Pa} = 14.70 \text{ lb/in.}^2$
Density of air (0 °C, 1 atm pressure)	1.29 kg/m^3
Speed of sound in air (20 °C)	343 m/s
Water	
Density (4 °C)	$1.000 \times 10^3 \text{ kg/m}^3$
Latent heat of fusion	$3.35 \times 10^5 \text{ J/kg}$
Latent heat of vaporization	$2.26 \times 10^6 \text{ J/kg}$
Specific heat capacity	$4186 \text{ J}/(\text{kg}\cdot\text{C}^\circ)$
Earth	
Mass	$5.98 \times 10^{24} \text{ kg}$
Radius (equatorial)	$6.38 \times 10^6 \text{ m}$
Mean distance from sun	$1.50 \times 10^{11} \text{ m}$
Moon	
Mass	$7.35 \times 10^{22} \text{ kg}$
Radius (mean)	$1.74 \times 10^6 \text{ m}$
Mean distance from earth	$3.85 \times 10^8 \text{ m}$
Sun	
Mass	$1.99 \times 10^{30} \text{ kg}$
Radius (mean)	$6.96 \times 10^8 \text{ m}$

CONVERSION FACTORS

Length

1 in. = 2.54 cm
 1 ft = 0.3048 m
 1 mi = 5280 ft = 1.609 km
 1 m = 3.281 ft
 1 km = 0.6214 mi
 1 angstrom (Å) = 10^{-10} m

Mass

1 slug = 14.59 kg
 1 kg = 1000 grams = 6.852×10^{-2} slug
 1 atomic mass unit (u) = 1.6605×10^{-27} kg
 (1 kg has a weight of 2.205 lb where the acceleration due to gravity is 32.174 ft/s²)

Time

1 day = 24 h = 1.44×10^3 min = 8.64×10^4 s
 1 yr = 365.24 days = 3.156×10^7 s

Speed

1 mi/h = 1.609 km/h = 1.467 ft/s = 0.4470 m/s
 1 km/h = 0.6214 mi/h = 0.2778 m/s = 0.9113 ft/s

Force

1 lb = 4.448 N
 1 N = 10^5 dynes = 0.2248 lb

Work and Energy

1 J = 0.7376 ft·lb = 10^7 ergs
 1 kcal = 4186 J
 1 Btu = 1055 J
 1 kWh = 3.600×10^6 J
 1 eV = 1.602×10^{-19} J

Power

1 hp = 550 ft·lb/s = 745.7 W
 1 W = 0.7376 ft·lb/s

Pressure

1 Pa = 1 N/m² = 1.450×10^{-4} lb/in.²
 1 lb/in.² = 6.895×10^3 Pa
 1 atm = 1.013×10^5 Pa = 1.013 bar =
 14.70 lb/in.² = 760 torr

Volume

1 liter = 10^{-3} m³ = 1000 cm³ = 0.03531 ft³
 1 ft³ = 0.02832 m³ = 7.481 U.S. gallons
 1 U.S. gallon = 3.785×10^{-3} m³ = 0.1337 ft³

Angle

1 radian = 57.30°
 1° = 0.01745 radian

STANDARD PREFIXES USED TO DENOTE MULTIPLES OF TEN

Prefix	Symbol	Factor
Tera	T	10^{12}
Giga	G	10^9
Mega	M	10^6
Kilo	k	10^3
Hecto	h	10^2
Deka	da	10^1
Deci	d	10^{-1}
Centi	c	10^{-2}
Milli	m	10^{-3}
Micro	μ	10^{-6}
Nano	n	10^{-9}
Pico	p	10^{-12}
Femto	f	10^{-15}

BASIC MATHEMATICAL FORMULAE

Area of a circle = πr^2
Circumference of a circle = $2\pi r$
Surface area of a sphere = $4\pi r^2$
Volume of a sphere = $\frac{4}{3}\pi r^3$
Pythagorean theorem: $h^2 = h_o^2 + h_a^2$
Sine of an angle: $\sin \theta = h_o/h$
Cosine of an angle: $\cos \theta = h_a/h$
Tangent of an angle: $\tan \theta = h_o/h_a$
Law of cosines: $c^2 = a^2 + b^2 - 2ab \cos \gamma$
Law of sines: $a/\sin \alpha = b/\sin \beta = c/\sin \gamma$
Quadratic formula: If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$