

## Chapter 17: Useful Information

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**Table Chapter17.1: Important Constants**<sup>1</sup>

Symbol	Meaning	Best Value	Approximate Value
$c$	Speed of light in vacuum	$2.99792458 \times 10^8 \text{ m/s}$	$3.00 \times 10^8 \text{ m/s}$
$G$	Gravitational constant	$6.67430(15) \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2$	$6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2$
$N_A$	Avogadro's number	$6.02214076 \times 10^{23}$	$6.02 \times 10^{23}$
$k$	Boltzmann's constant	$1.380649 \times 10^{-23} \text{ J/K}$	$1.38 \times 10^{-23} \text{ J/K}$
$R$	Gas constant	$8.314462618 \text{ J/mol} \cdot \text{K}$	$8.31 \text{ J/mol} \cdot \text{K}$
$\sigma$	Stefan-Boltzmann constant	$5.670374419 \times 10^{-8} \text{ W/m}^2 \cdot \text{K}$	$5.67 \times 10^{-8} \text{ W/m}^2 \cdot \text{K}$
$k$	Coulomb force constant	$8.9875517923(13) \times 10^9 \text{ N} \cdot \text{m}^2/\text{C}^2$	$8.99 \times 10^9 \text{ N} \cdot \text{m}^2/\text{C}^2$
$e$	Elementary charge	$1.602176634 \times 10^{-19} \text{ C}$	$1.60 \times 10^{-19} \text{ C}$
$\epsilon_0$	Permittivity of free space	$8.8541878128(13) \times 10^{-12} \text{ C}^2/\text{N} \cdot \text{m}^2$	$8.85 \times 10^{-12} \text{ C}^2/\text{N} \cdot \text{m}^2$
$\mu_0$	Permeability of free space	$4\pi \times 10^{-7} \text{ T} \cdot \text{m/A}$	$1.26 \times 10^{-6} \text{ T} \cdot \text{m/A}$
$h$	Planck's constant	$6.62607015 \times 10^{-34} \text{ J} \cdot \text{s}$	$6.63 \times 10^{-34} \text{ J} \cdot \text{s}$

**Table Chapter17.2: Submicroscopic Masses**<sup>2</sup>

Symbol	Meaning	Best Value	Approximate Value
$m_e$	Electron mass	$9.1093837015(28) \times 10^{-31} \text{ kg}$	$9.11 \times 10^{-31} \text{ kg}$
$m_p$	Proton mass	$1.67262192369(51) \times 10^{-27} \text{ kg}$	$1.67 \times 10^{-27} \text{ kg}$
$m_n$	Neutron mass	$1.67492749804(95) \times 10^{-27} \text{ kg}$	$1.67 \times 10^{-27} \text{ kg}$
$u$	Atomic mass unit	$1.66053906660(50) \times 10^{-27} \text{ kg}$	$1.66 \times 10^{-27} \text{ kg}$

**Table Chapter17.3: Solar System Data**

Sun	mass	$1.99 \times 10^{30} \text{ kg}$
	average radius	$6.96 \times 10^8 \text{ m}$
	Earth-sun distance (average)	$1.496 \times 10^{11} \text{ m}$
Earth	mass	$5.9736 \times 10^{24} \text{ kg}$
	average radius	$6.376 \times 10^6 \text{ m}$

Moon	orbital period	$3.16 \times 10^7 \text{ s}$
	mass	$7.35 \times 10^{22} \text{ kg}$
	average radius	$1.74 \times 10^6 \text{ m}$
	orbital period (average)	$2.36 \times 10^6 \text{ s}$
	Earth-moon distance (average)	$3.84 \times 10^8 \text{ m}$

**Table Chapter17.4:** Metric Prefixes for Powers of Ten and Their Symbols

Prefix	Symbol	Value	Prefix	Symbol	Value
tera	T	$10^{12}$	deci	d	$10^{-1}$
giga	G	$10^9$	centi	c	$10^{-2}$
mega	M	$10^6$	milli	m	$10^{-3}$
kilo	k	$10^3$	micro	$\mu$	$10^{-6}$
hecto	h	$10^2$	nano	n	$10^{-9}$
deka	da	$10^1$	pico	p	$10^{-12}$
—	—	$10^0 (= 1)$	femto	f	$10^{-15}$

**Table Chapter17.5:** The Greek Alphabet

Alpha	A	$\alpha$	Eta	H	$\eta$	Nu	$N$	$\nu$	Tau	T	$\tau$
Beta	B	$\beta$	Theta	$\Theta$	$\theta$	Xi	$\Xi$	$\xi$	Upsilon	$\Upsilon$	$\upsilon$
Gamma	$\Gamma$	$\gamma$	Iota	I	$\iota$	Omicron	O	$o$	Phi	$\Phi$	$\phi$
Delta	$\Delta$	$\delta$	Kappa	K	$\kappa$	Pi	$\Pi$	$\pi$	Chi	X	$\chi$
Epsilon	E	$\varepsilon$	Lambda	$\Lambda$	$\lambda$	Rho	P	$\rho$	Psi	$\Psi$	$\psi$
Zeta	Z	$\zeta$	Mu	M	$\mu$	Sigma	$\Sigma$	$\sigma$	Omega	$\Omega$	$\omega$

**Table Chapter17.6:** SI Units

	Entity	Abbreviation	Name
Fundamental units	Length	m	meter
	Mass	kg	kilogram
	Time	s	second
	Current	A	ampere
Supplementary unit	Angle	rad	radian
Derived units	Force	$\text{N} = \text{kg} \cdot \text{m}/\text{s}^2$	newton
	Energy	$\text{J} = \text{kg} \cdot \text{m}^2/\text{s}^2$	joule
	Power	$\text{W} = \text{J}/\text{s}$	watt
	Pressure	$\text{Pa} = \text{N}/\text{m}^2$	pascal
	Frequency	$\text{Hz} = 1/\text{s}$	hertz
	Electronic potential	$\text{V} = \text{J}/\text{C}$	volt

Entity	Abbreviation	Name
Capacitance	$F = C/V$	farad
Charge	$C = s \cdot A$	coulomb
Resistance	$\Omega = V/A$	ohm
Magnetic field	$T = N/(A \cdot m)$	tesla
Nuclear decay rate	$Bq = 1/s$	becquerel

**Table Chapter17.7:** Selected British Units

Length	1 inch ( in ) = 2.54 cm (exactly)
	1 foot (ft) = 12 in = 0.3048 m
	1 yard(yd) = 3ft = 0.9144 m
	1 mile (mi) = 1760yd = 1.609 km
Force	1 pound (lb) = 4.448 N
Energy	1 British thermal unit (Btu) = $1.055 \times 10^3$ J
Power	1 horsepower (hp) = 746 W
Pressure	1lb/in <sup>2</sup> = $6.895 \times 10^3$ Pa

**Table Chapter17.8:** Other Units

Length	1 light year (ly) = $9.46 \times 10^{15}$ m
	1 astronomical unit (au) = $1.50 \times 10^{11}$ m
	1 nautical mile = 1.852 km
	1 angstrom (Å) = $10^{-10}$ m
Area	1 acre (ac) = $4.05 \times 10^3$ m <sup>2</sup>
	1 square foot (ft <sup>2</sup> ) = $9.29 \times 10^{-2}$ m <sup>2</sup>
	1 barn(b) = $10^{-28}$ m <sup>2</sup>
Volume	1 liter (L) = $10^{-3}$ m <sup>3</sup>
	1 U.S. gallon (gal) = $3.785 \times 10^{-3}$ m <sup>3</sup>
Mass	1 solar mass = $1.99 \times 10^{30}$ kg
	1 metric ton = $10^3$ kg
	1 atomic mass unit (u) = $1.6605 \times 10^{-27}$ kg
Time	1 year (y) = $3.16 \times 10^7$ s
	1 day (d) = 86,400 s
Speed	1 mile per hour (mph) = 1.609 km/h
	1 nautical mile per hour (naut) = 1.852 km/h
Angle	1 degree (°) = $1.745 \times 10^{-2}$ rad
	1 minute of arc (') = 1/60 degree
	1 second of arc (") = 1/60 minute of arc
	1 grad = $1.571 \times 10^{-2}$ rad
Energy	1 kiloton TNT (kT) = $4.2 \times 10^{12}$ J

	1 kilowatt hour ( $\text{kW} \cdot \text{h}$ ) = $3.60 \times 10^6 \text{ J}$
	1 food calorie ( $\text{kcal}$ ) = 4186 J
	1 calorie ( $\text{cal}$ ) = 4.186 J
	1 electron volt ( $\text{eV}$ ) = $1.60 \times 10^{-19} \text{ J}$
Pressure	1 atmosphere ( $\text{atm}$ ) = $1.013 \times 10^5 \text{ Pa}$
	1 millimeter of mercury ( $\text{mmHg}$ ) = 133.3 Pa
	1 torricelli ( $\text{torr}$ ) = 1 mmHg = 133.3 Pa
Nuclear decay rate	1 curie ( $\text{Ci}$ ) = $3.70 \times 10^{10} \text{ Bq}$

**Table Chapter17.9:** Useful Formulae

Circumference of a circle with radius $r$ or diameter $d$	$C = 2\pi r = \pi d$
Area of a circle with radius $r$ or diameter $d$	$A = \pi r^2 = \pi d^2 / 4$
Area of a sphere with radius $r$	$A = 4\pi r^2$
Volume of a sphere with radius $r$	$V = (4/3) (\pi r^3)$

## Footnotes

- 1 Stated values are according to the National Institute of Standards and Technology Reference on Constants, Units, and Uncertainty, [www.physics.nist.gov/cuu](http://www.physics.nist.gov/cuu) (2018 values). Values in parentheses are the uncertainties in the last digits. Numbers without uncertainties are exact as defined.
- 2 Stated values are according to the National Institute of Standards and Technology Reference on Constants, Units, and Uncertainty, [www.physics.nist.gov/cuu](http://www.physics.nist.gov/cuu) (2018 values). Values in parentheses are the uncertainties in the last digits. Numbers without uncertainties are exact as defined.

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