

Appendix B

Constants and Conversions

Fundamental Constants

Gravitational Constant: $G = 6.6726 \times 10^{-8} \text{ dyn cm}^2 \text{ g}^{-2}$
 $= 6.6726 \times 10^{-8} \text{ gm}^{-1} \text{ cm}^3 \text{ s}^{-2}$
 $= 6.6726 \times 10^{-8} \text{ erg cm g}^{-2}$
 $= 2.959 \times 10^{-4} M_{\odot}^{-1} \text{ AU}^3 \text{ days}^{-2}$

Speed of Light: $c = 2.99792458 \times 10^{10} \text{ cm/s}$

Planck's Constant: $h = 2\pi\hbar = 6.6260755 \times 10^{-27} \text{ erg s}$
 $= 4.136 \times 10^{-21} \text{ MeV s}$

Electrical Charge Unit: $e = 4.8032068 \times 10^{-10} \text{ esu}$

Fine Structure Constant: $\alpha = 1/137$

Mass of Electron: $m_e = 9.1093898 \times 10^{-28} \text{ g}$
 $= 5.4858 \times 10^{-4} \text{ amu}$
 $= 0.5109991 \text{ MeV}/c^2$

Mass of Proton: $m_p = 1.6726231 \times 10^{-24} \text{ g}$
 $= 1.00727647 \text{ amu}$
 $= 938.27231 \text{ MeV}/c^2$

Mass of Neutron: $m_n = 1.6749286 \times 10^{-24} \text{ g}$
 $= 1.0086649 \text{ amu}$
 $= 939.56563 \text{ MeV}/c^2$

1 atomic mass unit (amu) = $1.6605402 \times 10^{-24} \text{ g}$

Avogadro's Number: $N_A = 6.0221367 \times 10^{23} \text{ mole}^{-1}$

Boltzmann's Constant: $k = 1.38065 \times 10^{-16} \text{ erg/K}$
 $= 8.617389 \times 10^{-5} \text{ eV/K}$

Ideal Gas Constant: $R_{\text{gas}} \equiv N_A k = 8.314511 \times 10^7 \text{ erg K}^{-1} \text{ mole}^{-1}$
 Stefan–Boltzmann Constant: $\sigma = 5.67051 \times 10^{-5} \text{ erg cm}^{-2} \text{ K}^{-4} \text{ s}^{-1}$
 Radiation Density Constant: $a \equiv 4\sigma/c = 7.56591 \times 10^{-15} \text{ erg cm}^{-3} \text{ K}^{-4}$
 Planck Mass: $M_P = 1.2 \times 10^{19} \text{ GeV}/c^2$
 Planck Length: $\ell_P = 1.6 \times 10^{-33} \text{ cm}$
 Planck Timescale: $t_P = 5.4 \times 10^{-44} \text{ s}$
 Planck Temperature: $T_P = 1.4 \times 10^{32} \text{ K}$

Solar Quantities

Solar Luminosity: $L_{\odot} = 3.827 \times 10^{33} \text{ erg/s}$
 Solar Mass: $M_{\odot} = 1.989 \times 10^{33} \text{ g}$
 Effective Surface Temperature: $T_{\odot}^{\text{eff}} = 5780 \text{ K}$
 Solar Radius: $R_{\odot} = 6.96 \times 10^{10} \text{ cm}$
 Central Density: $\rho_{\odot}^{\text{core}} \simeq 160 \text{ g/cm}^3$
 Central Pressure: $P_{\odot}^{\text{core}} \simeq 2.7 \times 10^{17} \text{ dyn cm}^{-2}$
 Central Temperature: $T_{\odot}^{\text{core}} \simeq 1.6 \times 10^7 \text{ K}$
 Color Indices: $B - V = 0.63 \quad U - B = 0.13$
 Solar Constant: $1.1388 \times 10^6 \text{ erg cm}^{-2} \text{ s}^{-1}$

General Quantities

1 Tropical Year = $3.1556926 \times 10^7 \text{ seconds} = 365.24219 \text{ days}$
 1 parsec (pc) = $3.0857 \times 10^{18} \text{ cm}$
 1 parsec (pc) = 206,265 AU = 3.2616 LY
 1 light year (LY) = $9.4605 \times 10^{17} \text{ cm}$
 1 Astronomical Unit (AU) = $1.49598 \times 10^{13} \text{ cm}$
 Energy Per Gram from H \rightarrow He Fusion = $6.3 \times 10^{18} \text{ erg/g}$
 Mass of Earth = $M_{\oplus} = 5.98 \times 10^{27} \text{ g}$

Conversion Factors

1 eV = $1.60217733 \times 10^{-12} \text{ ergs}$
 1 amu = $1.6605402 \times 10^{-24} \text{ g}$
 1 fm = 10^{-13} cm
 0 K = -273.16 Celsius

1 atomic unit (a_0) = 0.52918×10^{-8} cm
1 atmosphere (atm) = 1.013250×10^6 dyn cm $^{-2}$
1 Pascal (Pa) = $1 \text{ N m}^{-2} = 10$ dyn cm $^{-2}$
1 arc second = $1'' = 4.848 \times 10^{-6}$ radians = $1/3600$ degree
1 Å = 10^{-8} cm
1 barn (b) = 10^{-24} cm 2
1 Newton (N) = 10^5 dyn
1 Watt (W) = $1 \text{ J s}^{-1} = 10^7$ erg s $^{-1}$
Opacity Units: $1 \text{ m}^2 \text{ kg}^{-1} = 10 \text{ cm}^2 \text{ g}^{-1}$