Equation Sheet - General Astronomy - Spring 2013

$$d = 1/p \qquad D = \theta d \qquad F = ma \qquad v = \frac{dx}{dt} \qquad a = \frac{dv}{dt} \qquad F = G\frac{M_1 M_2}{d^2}$$

$$E = K + U \qquad K = \frac{1}{2}mv^2 \qquad U = -\int F(x)dx \qquad E = mc^2$$

$$\lambda \times f = c \qquad E = hf \qquad \lambda = \left[R_H\left(\frac{1}{n^2} - \frac{1}{m^2}\right)\right]^{-1} \qquad \frac{V}{c} = \frac{\lambda_{obs} - \lambda_0}{\lambda_0}$$

$$K = \frac{3}{2}kT \qquad \lambda = 2.9 \times 10^6(\text{nm})/T(\text{K}) \qquad F = L/4\pi D^2 \qquad L = 4\pi R^2 \sigma T^4$$

$$\bar{L} = l\sqrt{n} \qquad m_1 - m_2 = -2.5\log\left(\frac{F_1}{F_2}\right) \qquad \frac{F_1}{F_2} = 10^{(m_2 - m_1)/2.5}$$

$$M = m - 5\log_{10} D + 5 \qquad L = L_\odot \times 10^{(M_\odot - M_B)/2.5} \qquad \frac{L}{L_\odot} \approx \left(\frac{M}{M_\odot}\right)^{3.5}$$

$$\frac{4\pi^2}{G(m_1 + m_2)}a^3 = P^2 \qquad M_1 a_1 = M_2 a_2 \qquad M_1 v_1 = M_2 v_2 \qquad v = \frac{2\pi a}{P}$$

$$M_1 + M_2 = \frac{a^3}{P^2} \text{ for } M \text{ in } M_\odot,\ a \text{ in AU, and } P \text{ in years} \qquad v = \sqrt{\frac{GM(r)}{r}}$$

$$U = -\frac{3GM^2}{5R} \qquad K = \frac{3MkT}{2m_H} \qquad M = \frac{4}{3}\pi R^3 n M_H$$

$$M_J = 18 M_\odot \sqrt{\frac{T^3}{n}} \text{ for } T \text{ in K and } n \text{ in cm}^{-3}$$

$$I = \frac{2}{5}MR^2 \qquad L = \frac{4}{5}\pi M R^2 \nu \qquad \nu_f = \nu_i\left(\frac{R_i}{R_f}\right)^2 \qquad P = 4\pi^2 I \nu \frac{d\nu}{dt}$$

$$t' = t\sqrt{1 - \frac{v^2}{c^2}} \qquad l' = \frac{l}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$\nu' = \nu\sqrt{1 - \frac{2GM}{Rc^2}} \approx \nu\left(1 - \frac{gL}{c^2}\right) \qquad R_S = \frac{2GM}{c^2} = (2.95\,\mathrm{km})\frac{M}{M_\odot} \qquad L_{Edd} = 30,000 L_\odot (M/M_\odot)$$

$$M = 7.5\frac{\sigma^2 r_h}{G} \qquad v = Hd \qquad u_c = \rho_c c^2 = \frac{3H^2c^2}{8\pi G} = \qquad \Omega_0 = \rho/\rho_c \qquad \Omega_m = \frac{u_m}{u_c}$$

$$H(t)^2 = \frac{8\pi G}{3c^2}u(t) - \frac{\kappa c^2}{a^2 r_{c,0}^2} \qquad z = 1/a - 1 \qquad H = \frac{\dot{a}}{a}$$

$$\dot{a} = H_0\left[\frac{\Omega_{r,0}}{a^2} + \frac{\Omega_{m,0}}{a} + \Omega_\Lambda a^2\right]^{1/2} \qquad \ddot{a} = H_0^2\left[-\frac{\Omega_{r,0}}{a^3} - \frac{\Omega_{m,0}}{2a^2} + \Omega_\Lambda a\right]$$

$\theta(\mathrm{radians}) = 206265 \times \theta(\mathrm{arcseconds})$
$G = 6.67 \times 10^{-11}\,\mathrm{m^3\,kg^{-1}\,s^{-2}}$
$h = 6.626068 \times 10^{-34}\,\mathrm{m^2\,kg\,s^{-1}}$
$c = 299792458\,\mathrm{m/s}$
$R_H = 1.096878 \times 10^7\,\mathrm{m^{-1}}$
$k = 1.38 \times 10^{-23}\,\mathrm{J/K} = 8.62 \times 10^{-5}\,\mathrm{eV/K}$
$\sigma = 5.67 \times 10^{-8}\,\mathrm{W\,m^{-2}\,K^{-4}}$
$M_{Sun} = 1.99 \times 10^{30}\,\mathrm{kg} \qquad R_{Sun} = 696,000\,\mathrm{km} \qquad T_{Sun} = 5,800\,\mathrm{K}$
$L_{Sun} = 3.8 \times 10^{26}\,\mathrm{W} \qquad M_V(Sun) = 4.83 \qquad M_{Bol}(Sun) = 4.74$
$M_H = 1.6726 \times 10^{-27}\,\mathrm{kg}$
$M_{He} = 6.643 \times 10^{-27}\,\mathrm{kg}$
$M_{Earth} = 5.97 \times 10^{24}\,\mathrm{kg} \qquad R_{Earth} = 6,378\,\mathrm{km} \qquad D_{Earth-Sun} = 1.496 \times 10^{11}\,\mathrm{m}$
$1\,\mathrm{pc} = 3.086 \times 10^{16}\,\mathrm{m}$
$H_0 = 71\,\mathrm{km/s/Mpc}$
$u_C = 5200\ \mathrm{MeV\ m^{-3}}$