ASTR120 – Cheat Sheet for Final Exam

Constants

k = 1.38×10^{-23} Joules / Kelvin
h = 6.626×10^{-34} Joules sec
c = 2.9979×10^{8} m / sec
G = 6.67×10^{-11} m^3 / kg sec^2
AMU = 1.6605×10^{-27} kg
M_H = mass of H atom = 1.67×10^{-27} kg
$\sigma = 5.67 \times 10^{-8}$ Joules / m^2 K^4 sec
$\epsilon_o = 8.85418 \times 10^{-12}$ $coulomb^2$-$newton^{-1}$-m^{-2}
$4 \times mass(H) - mass(He) = 0.02862\ AMU$
$R_{Ryd} = 1.0974 \times 10^{7}$ m^{-1}
M(Sun) = 1.99×10^{30} kg
M(Earth) = 5.976×10^{24} kg
R(Sun) = 6.96×10^{8} m
R(Earth) = 6.38×10^{6} m
L(Sun) = 3.83×10^{26} Joules / sec
1 AU = 1.496×10^{11} m
1 Angstrom = 10^{-10} m
1 micron = 10^{-6} m
Earth-Moon distance = 3.84×10^{8} m

Planet	Semimajor Axis (AU)	Mass (Earth=1)	Planetary Diameter (Earth=1)	Surface Gravity (Earth=1)
Mercury	0.387	0.055	0.38	0.38
Venus	0.723	0.82	0.95	0.91
Earth	1.000	1.00	1.00	1.00
Mars	1.524	0.11	0.53	0.38
Jupiter	5.203	317.8	11.2	2.53
Saturn	9.538	94.3	9.41	1.07
Uranus	19.19	14.6	4.11	0.92
Neptune	30.06	17.2	3.81	1.18
Pluto	39.53	0.0025	0.17	0.09

Relevant Formula

$$C = 2\,\pi\,R \qquad A = \pi\,R^2 \qquad V = \frac{4}{3}\,\pi\,R^3$$

$$D = V\,t \qquad V = a\,t \qquad D = \frac{1}{2}\,a\,t^2$$

$$P^2 = A^3 \qquad V_{escape} = (\frac{2GM}{r})^{0.5} \qquad V_{circ} = (\frac{GM}{r})^{0.5}$$

$$\frac{x^2}{A^2} + \frac{y^2}{B^2} = 1 \qquad e = \frac{(A^2 - B^2)^{0.5}}{A} \qquad C = (A^2 - B^2)^{0.5}$$

$$Momentum = m\,V \qquad F = m\,a$$

$$F = \frac{G\,m_1\,m_2}{D^2} \qquad g = \frac{GM}{r^2}$$

$$\Delta a = -\frac{2GMr}{D^3} \qquad P^2 = \frac{4\pi^2}{G(M_1 + M_2)}\,A^3$$

$$E = \frac{1}{2}mV^2 \qquad \Phi = -\frac{G\,M}{r}$$

$$\frac{1}{2}\,m\,v^2 + (-\frac{G\,M\,m}{r}) = \text{constant} \qquad \text{Angular Momentum} = m\,V_\theta\,D$$

$$\text{Energy} = \frac{1}{2}mV^2 - \frac{GMm}{R} \qquad \text{Energy/sec} = E_0\,cos(lat - \delta_{sun})$$

$$HA = \text{RA} - \text{LST}$$

$$cos(Z) = sin(\phi)\,sin(\delta) + cos(\phi)\,cos(\delta)\,cos(HA)$$

$$sin(\delta) = sin(\phi)\,cos(Z) + cos(\phi)\,sin(Z)\,cos(A)$$

$$\text{Energy} = h\,\nu \qquad \nu = \frac{c}{\lambda}$$

$$B(T) = \frac{2\,h\,\nu^3}{c^2}\,\frac{1}{e^{\frac{h\,\nu}{kT}} - 1}$$

$$\lambda_{maximum} = \frac{2.898 \times 10^{-3}}{T} \; meters \qquad \text{Energy radiated} = \sigma T^4$$

$$\text{L} = 4\pi R^2 \sigma T^4 \qquad \text{energypersecondperarea} = \frac{L}{4\pi (distance)^2}$$

$$E = h R_{Ryd} c (1 - \frac{1}{m^2}) \qquad E(photon) = h R_{Ryd} c (\frac{1}{m^2} - \frac{1}{n^2})$$

$$\frac{\lambda - \lambda_{rest}}{\lambda_{rest}} = \frac{\Delta\lambda}{\lambda_{rest}} = (\frac{1 + \frac{V}{c}}{1 - \frac{V}{c}})^{\frac{1}{2}} - 1 \qquad \frac{\Delta\lambda}{\lambda_{rest}} = \frac{V}{c}$$

$$t_{us} = \frac{t_{trav}}{(1 - \frac{V^2}{c^2})^{\frac{1}{2}}} \qquad D_{us} = D_{trav} (1 - \frac{V^2}{c^2})^{\frac{1}{2}} = \frac{D_{trav}}{\gamma}$$

$$m = \frac{m_{rest}}{(1 - \frac{V^2}{c^2})^{\frac{1}{2}}} = \gamma m_{rest} \qquad E = m c^2$$

$$angular\ resolution \approx \frac{wavelength}{diameter\ of\ telescope}$$

$$\frac{sin\ i}{sin\ r} = \frac{n'}{n} \qquad y = A X^2 + B$$

$$s = f \frac{S}{57.296} \qquad ; B \propto B_o (\frac{A}{f})^2$$

$$\text{Probability of Velocity V} \propto (\frac{\text{m}}{2\pi\text{kT}})^{\frac{3}{2}} \text{e}^{-\frac{\text{mV}^2}{2\text{kT}}}$$

$$V_{mean} = (\frac{3kT}{m})^{\frac{1}{2}} \qquad \text{Total Energy} = \frac{3}{2} \text{n k T}$$

$$P = n k T \qquad \text{Pressure} = \text{P}_\text{o} \text{e}^{-\frac{\text{h}}{\text{H}}} \qquad H = \frac{kT}{m_{mean} g}$$

$$m_{mean} = \frac{\Sigma n_a m_a}{\Sigma n_a} \qquad \frac{P}{P_o} = (\frac{\rho}{\rho_o})^\gamma$$

$$F = \frac{1}{4\pi\epsilon_o} \frac{Z_1 Z_2 e^2}{r^2} \qquad \Phi_e = \frac{1}{4\pi\epsilon_o} \frac{Z_1 Z_2 e^2}{r}$$

$$m_1 r_1 = m_2 r_2 \qquad r_1 = \frac{m_2}{m_1 + m_2} D$$

$$V_{sun} = \frac{m_2}{m_1 + m_2} (\frac{G m_2}{r_1})^{\frac{1}{2}}$$

$$m_{planet} = 11 (\frac{M_{total}}{1 Msolar})^{\frac{2}{3}} (\frac{P}{1\ yr})^{\frac{1}{3}} V_{star} \quad Earth - masses$$