Formula Sheet

Intensity Ratio: $\frac{I_A}{I_B} = 2.512^{M^B - M^A}$

Magnitude Difference: $M_A - M_B = 2.5 \log \frac{I_A}{I_B}$

Small Angle Formula: $\frac{angular\ diameter - arcseconds}{206265} = \frac{linear\ diameter}{distance}$

Circular Velocity: $V_C = \sqrt{\frac{GM}{r - meters}}$

M = mass of central body (kg)
G = 6.67×10^{-11} m^3/s^2kg
* Answer in m/s

Compare LGP: $\frac{LGP_A}{LGP_B} = \left(\frac{D_A}{D_B}\right)^2$

D = diameter
* Answer in times (×)

Resolving Power: $\alpha = \frac{11.6}{D(cm)}$

D = diameter (cm)
* Answer in arcseconds

Magnification: $M = \frac{F_O}{F_E}$

F_O = focal length of objective
F_e = focal length of eyepiece

Wien's Law: $\lambda_{max} = \frac{3{,}000{,}000}{T - degrees\ Kelvin}$ * Answer in nm

$\lambda_{max} = \frac{.2987}{T} \times 10^8 \text{Å}$

$T = \frac{2.9 \times 10^8 \text{Å}}{peak\ \lambda}$

Stefan-Boltzmann Law: $E = \sigma T^4 (J/s/m^2)$

T = K
$\sigma = 5.67 \times 10^{-8} J/m^2 s\ degree^4$
* Answer in J

Doppler Formula: $\frac{V_r}{c} = \frac{\Delta\lambda}{\lambda_o}$

V_r = radial velocity Δ_λ = change in λ
c = 300,000 km/s λ_o = observed λ

Fusion Explained: $E = mc^2$

m = kg * Answer in Joules
c = 3×10^8 m/s

Distance to Star: $d = \frac{206{,}265}{p - arcseconds}$

p = parallax * Answer in AU

F Ratio: $\frac{focal\ length (mm)}{objective\ diameter\ (mm)}$

Distance Modulus: $m_v - M_v = -5 + 5\log d \quad d = 10^{\frac{m_V - M_v + 5}{5}} = pc$

Luminosity of Star: $\frac{L}{L_\odot} = \left(\frac{R}{R_\odot}\right)\left(\frac{T}{T_\odot}\right)$ * Answer in times (×)

Mass of Binary System: $M_A + M_B = \frac{a^3}{p^2}$ M = solar masses
p = orbital period (yrs) a = AU

Kepler's 3rd Law: $p^2 = a^3$ p = orbital period (yrs) a = distance (AU)

Mass-Luminosity Relation: $L = M^{3.5}$ M = star mass in M_O * Answer in times (×)

Life Expectancy: $T = \frac{1}{M^{2.5}}$ M = star mass in M_O
* Answer in O lifetimes × 10 billion = years

Schwarzschild Radius: $R_S = \frac{2GM}{c^2}$ G = 6.67×10^{-11} m^3/s^2kg M = mass (kg)
C = 3×10^8 m/s * Answer in m

Hubble Law: $V_r = \text{Hd}$ V_r = velocity of recession of galaxy (km/s)
H = 20km/s/Mpc d = distance (Mpc)

Redshift: $Z = \frac{\Delta\lambda}{\lambda_O}$ $\Delta\lambda$ = change in λ λ_O = unshifted λ

Age of Universe: $\text{T}_U = \frac{1}{H} \times 10^{12} years$ H = 70 km/s/Mpc
* Answer in years

Distance-Rate-Time: $d = rt$

$r = \frac{d}{t}$

$t = \frac{d}{r}$

Newton's Law of Gravity: $F = G\frac{m_1 m_2}{r^2}$ G = 6.67×10^{-11} m^3/s^2kg
$m_1 m_2$ = masses of objects in kg
r = distance between the two masses (m)
F = the strength of the gravitational force (N)

Kepler's 1st Law (Eccentricity): $e = \frac{c}{a}$

Ratio: $\frac{distance}{size/separation}$

Frequency: $v = \frac{c}{\lambda}$

Flux: $\frac{1}{d^2}$

$$L(M_V) = r^2$$

$$\frac{distance\ to\ star}{diameter\ of\ earth's\ orbit} = \frac{focal\ length\ of\ scope\ (mm)}{parallax\ shift}$$

Diameter of orbit: 300,000 km
* Answer in km

Dispersion Distance: $D = \frac{T_2 - T_1}{124.5\left(\left(\frac{1}{f_2}\right)^2 - \left(\frac{1}{f_1}\right)^2\right)}$

$$\left(\frac{1}{400}\right)^2 - \left(\frac{1}{600}\right)^2 = 3.472 \times 10^{-6}$$

$$\left(\frac{1}{400}\right)^2 - \left(\frac{1}{800}\right)^2 = 4.688 \times 10^{-6}$$

$$\left(\frac{1}{600}\right)^2 - \left(\frac{1}{800}\right)^2 = 1.215 \times 10^{-6}$$

Constants

$$1\ AU = 1.495979 \times 10^{11}\ m$$

$$1\ parsec = 206{,}265\ AU$$

$$= 3.085678 \times 10^{16}\ m$$

$$= 3.261633\ light\ years$$

$$1\ light\ year = 9.46053 \times 10^{15}\ m$$

$$c, or\ the\ speed\ of\ light = 2.997925 \times \frac{10^8 m}{s}$$

$$G, or\ the\ gravitational\ constant = \left(6.67 \times 10^{(-11)}\right) + (m^3/s^2\ )/kg$$

$$M_{\oplus} = 5.976 \times 10^{24} kg$$

$$R_{\oplus} = 6{,}378.164\ km$$

$$M_{\odot} = 1.989 \times 10^{30}\ kg$$

$$R_{\odot} = 6.9599 \times 10^{8}\ m$$

$$L_{\odot} = 3.826 \times 10^{26}\ kg$$

$$M\ of\ the\ Moon = 7.350 \times 10^{22}\ kg$$

$$R\ of\ the\ Moon = 1738\ km$$

$$M\ of\ H\ atom = 1.67352 \times 10^{-27} kg$$

$$1\ arc\ minute\ (1') = \frac{1}{60°}$$

$$1\ arc\ second\ (1") = \frac{1}{60'}$$

$$1\ Megaton = 1{,}000{,}000\ of\ TNT = 4.5 \times 10^{15} J$$