Astronomy Formula Sheet

Intensity Ratio:	$m_B - m_A = 2.5log\left(\frac{I_A}{I_B}\right)$ $\frac{I_A}{I_B} = 10^{0.4(m_B - m_A)}$	m = Magnitude I = Intensity
Small Angle Formula:	$\theta = 206265\frac{D}{d}$	θ = Angular Diameter (arcsecs) D = Diameter d =Distance
Circular Velocity:	$v = \sqrt{\frac{GM}{r}}$	v = circular velocity (m/s) G = Gravitational Constant M = Mass (kg) r = radius (meters)
Resolving Power:	$\Delta\theta = 251643\frac{\lambda}{d}$	$\Delta\theta$ = Angular separation (arcsecs) λ = Wavelength d = Optic Diameter
Compare LGP:	$\frac{LGP_A}{LGP_B} = \left(\frac{D_A}{D_B}\right)^2$	LGP = Light Gathering Power D = Optic Diameter
Magnification:	$M = \frac{F_O}{F_E}$	M = Magnification Power F_O = Objective focal length F_E = Eyepiece focal length
Wien's Law:	$\lambda_{peak} = \frac{2900000}{T}$	λ_{peak} = Peak wavelength (nm) T = Temperature (K)
Stefan-Boltzmann Law:	$F = \sigma T^4$ $L = 4\pi\sigma R^2 T^4$ $\frac{L}{L_\odot} = \left(\frac{R}{R_\odot}\right)^2\left(\frac{T}{T_\odot}\right)^4$	F = Flux (luminosity/area) (W/m^2) σ = Stefan-Boltzmann Constant T = Temperature (K) L = Luminosity (W) R = Radius (m)
Redshift:	$z + 1 = \frac{\lambda_O}{\lambda_E}$	z = Redshift λ_O = Observed Wavelength λ_E = Emitted Wavelength
Doppler Formula:	$v = cz$	v = Velocity (m/s) c = Speed of light (m/s) z = Redshift
Relativistic Doppler Shift:	$z + 1 = \sqrt{\frac{1 + (v/c)}{1 - (v/c)}}$	v = Velocity (m/s) c = Speed of light (m/s) z = Redshift
Hubble's Law:	$v = H_0 d$	v = Recessional velocity (km/s) H_0 = Hubble's Constant d = Distance
Fusion Explained:	$E = mc^2$	E = Energy (J) m = Mass (kg) c = Speed of light (m/s)

Parallax:	$d = \frac{1}{p}$	d = Distance (pc) p = Parallax Angle (arcseconds)
F Ratio:	$\frac{L_f}{D_O}$	L_f = Focal Length D_O = Objective Diameter
Distance Modulus:	$m - M = -5 + 5log(d)$ $d = 10^{\frac{m-M+5}{5}}$	m = Apparent magnitude M = Absolute Magnitude d = Distance (pc)
Orbit Eccentricity:	$e = \frac{c}{a}$	e = Orbital Eccentricity c = Distance from focus to center a = semimajor axis
Aphelion/Perihelion:	$R_a = a(1+e)$ $R_p = a(1-e)$	R_a = Orbit Aphelion R_p = Orbit Perihelion a = Semimajor Axis e = Eccentricity
Kepler's 3rd Law:	$M_A + M_B = \frac{a^3}{p^2}$ $p^2 = \frac{a^3}{M_A + M_B}$	M = Mass (solar masses) a = Semimajor axis (AU) p = Orbital Period (years)
Mass-Luminosity Relation:	$L = M^{3.5}$	M = Mass (solar masses) L = Luminosity (Solar luminosity)
Stellar Lifetime:	$\tau = 10^{10} M^{-2.5}$	M = Mass (solar masses) τ = Stellar Lifetime (years)
Schwarzschild Radius:	$r_s = \frac{2Gm}{c^2}$	r_s = Schwartzchild Radius (meters) G = Gravitational Constant c = Speed of light r = radius (meters)
Universal Gravitation:	$F = G\frac{m_A m_B}{r^2}$	F = Gravitational Force (N) G = Gravitational Constant m = mass (kg) r = radius (meters)
Inverse-Squares Law:	$I = \frac{L}{4\pi d^2}$	I = Light Intensity (W/m^2) L = Luminosity (W) d = Distance (m)
Vacuum Frequency:	$f = \frac{c}{\lambda}$	f = Wave frequency (Hz) c = Speed of Light (m/s) λ = wavelength (m)
Hubble Time:	$T_U = \frac{9.778 \times 10^{11}}{H_0}$	T_U = Age of the Universe (years) H_0 = Hubble Constant (km/s/Mpc)

Astronomical Constants and Conversions

Constants

Speed of Light = $c = 3 \times 10^8$ m/s

Gravitational Constant = G = 6.67×10^{-11}N m^2/kg^2

Mass of Earth = $M_\oplus = 5.97 \times 10^{24}$ kg

Radius of Earth = $R_\oplus = 6378$ km

Mass of the sun = $M_\odot = = 1.99 \times 10^{30}$ kg

Radius of the sun = $R_\odot = 6.96 \times 10^5$ km

Effective Temperature of the sun = $T_\odot = 5778$ K

Luminosity of the sun = $L_\odot = 3.9 \times 10^{26}$W

Mass of the Moon = $M_☾ = 7.346 \times 10^{22}$ kg

Radius of the Moon = $R_☾ = 1738.1$ km

Mass of a proton = $m_p = 1.6726 \times 10^{-27}$ kg

Mass of an Electron = $m_{e^-} = 9.109 \times 10^{-31}$ kg

Hubble's Constant = $H_0 = 70$ km/s/Mpc (**Note:** There is ongoing debate about the actual value)

Stefan-Boltzmann Constant = $\sigma = 5.67 \times 10^{-8}$ W/m^{2}K^4

Planck's Constant = $h = 6.626 \times 10^{-34}$ J s

Boltzmann Constant = $k_B = 1.380 \times 10^{-23}$ m^2 kg s^{-2} K^{-1}

Hα Spectral Line = 656.28 nm

Type Ia Supernova Absolute Magnitude = -19.3

Unit Conversions

1 Astronomical Unit = 1 AU = 1.5×10^8 km

1 Parsec = 1 pc = 3.09×10^{13}km = 3.26 ly

1 Light Year = 1 ly = 9.46×10^{12}km

1 Arc Minute = $1' = (\frac{1}{60})^\circ = (1.667 \times 10^{-2})^\circ$

1 Arcsecond = $1'' = (\frac{1}{60})' = (1.667 \times 10^{-2})'$

1 year = 31557600 seconds

1 Megaton (energy) = 1,000,000 tons of TNT = 4.184×10^{15} J

Important Note:
If constants or unit conversions are provided on the exam, use those instead of these.