

ASTR367

Midterm Review Topics

Equations to memorize

$$F = \frac{L}{4\pi d^2} \quad (1)$$

$$d = \frac{1}{p["]} \text{ pc} \quad (2)$$

$$m_1 - m_0 = -2.5 \log_{10}(F_1/F_0) \quad (3)$$

$$\frac{F_1}{F_0} = 10^{0.4(m_0 - m_1)} \quad (4)$$

$$M_1 - M_0 = -2.5 \log_{10}(L_1/L_0) \quad (5)$$

$$\frac{L_1}{L_0} = 10^{0.4(M_0 - M_1)} \quad (6)$$

$$m - M = 5 \log d - 5 \quad (7)$$

$$\lambda_{\max} = \frac{0.2898}{T(\text{K})} \text{ cm} \quad (8)$$

$$L = A\sigma T^4 \text{ (Stephan - Boltzmann; } A = 4\pi R^2 \text{ for spheres)} \quad (9)$$

$$\tau_\nu = \int \kappa_\nu \rho ds \quad (10)$$

Equations I would give you

$$B_\nu = \frac{2h\nu^3}{c^2} \frac{1}{e^{h\nu/kT} - 1} \quad (11)$$

$$B_\lambda = \frac{2hc^2}{\lambda^5} \frac{1}{e^{hc/\lambda kT} - 1} \quad (12)$$

$$f(v) = \sqrt{\left(\frac{m}{2\pi kT}\right)^3} 4\pi v^2 e^{-\frac{mv^2}{2kT}} \quad (13)$$

$$\frac{n_i}{n_j} = \frac{g_i}{g_j} e^{-E_{ij}/kT_{\text{ex}}} \quad (14)$$

$$\frac{n_{i+1}n_e}{n_i} \simeq 2 \left(\frac{2\pi m_e kT}{h^2}\right)^{3/2} \frac{g_{i+1}}{g_i} \exp\left[-\frac{\Phi_r}{kT}\right] \quad (15)$$

$$\frac{dP}{dr} = -G \frac{M_r \rho(r)}{r^2} = -\rho g \quad (16)$$

$$\frac{dM_r}{dr} = 4\pi r^2 \rho(r) \quad (17)$$

$$\frac{dL_r}{dr} = 4\pi r^2 \rho \epsilon \quad (18)$$

$$\frac{dT}{dr}_{\text{rad}} = -\frac{3}{4ac} \frac{\bar{\kappa} \rho}{T^3} \frac{L_r}{4\pi r^2} \quad (19)$$

$$\frac{dT}{dr}_{\text{adiabatic}} = -\left(1 - \frac{1}{\gamma}\right) \frac{\mu m_H}{k} \frac{GM_r}{r^2} \quad (20)$$

Units

cgs vs SI

Degrees minutes seconds

Solid angle

Intensity, flux, luminosity definitions and their relationships to each other

Parallax

Apparent and absolute magnitudes

Astronomical filters and colors

Blackbodies

Units of blackbodies

How filters and blackbodies interact for astronomical colors

Color-magnitude diagrams

Stellar Spectra

Kirchoff's Laws

Optical depth

Sources of opacity

Maxwell-Boltzmann speed distribution

Boltzmann equation

Saha equation

Local Thermodynamic Equilibrium

Line Broadening mechanisms

Curve of growth and equivalent width

Stars

Basic property ranges and reasons
Initial mass function
Spectral types
Mass-Luminosity relation
Metallicity definition
H-R diagram including accurate axes

Stellar Interiors

Hydrostatic equilibrium
Eddington luminosity
Radiation vs. convection
Nucleosynthesis and main fusion reactions