October 30, 2006

Astronomy 102: Examination 3

Potentially useful constants and formulae

$$R_\odot = 6.96 \times 10^5 \text{ km}$$
$$M_\odot = 1.99 \times 10^{30} \text{ kg}$$
$$L_\odot = 3.8 \times 10^{26} \text{ W}$$
$$c = 3.00 \times 10^8 \text{ m s}^{-1}$$
$$h = 6.626 \times 10^{-34} \text{ J s}^{-1}$$
$$1\,\text{pc} = 3.26 \text{ lyr}$$
$$1\,\text{pc} = 206,265 \text{ AU}$$
$$1\,\text{pc} = 3.086 \times 10^{16} \text{ m}$$
$$1\,\text{AU} = 1.496 \times 10^{11}\,\text{m}$$
$$1\,\text{km} = 1,000\,\text{m}$$
$$\pi\,\text{rad} = 180^\circ$$
$$206,265\,\text{arcsec} = 1\,\text{rad}$$
$$3,600\,\text{arcsec} = 60\,\text{arcmin} = 1^\circ$$

$$E = m\,c^2$$
$$\lambda\,f = c \quad f = \frac{c}{\lambda} \quad \lambda = \frac{c}{f}$$
$$E = h\,f$$
$$L = A\,\sigma\,T^4$$
$$L = (4\pi\,R^2)\,\sigma\,T^4$$
$$B = \frac{L}{4\pi\,d^2}$$
$$z = \frac{\Delta\lambda}{\lambda} = \frac{\lambda_{\text{obs}} - \lambda_{\text{orig}}}{\lambda_{\text{orig}}}$$
$$z = \frac{v}{c} \quad (\text{for v} \ll \text{c})$$
$$A = \frac{b}{d} \quad (\text{for } A \ll 1,\ A \text{ in rad})$$
$$d = \frac{1}{p} \quad (d \text{ in pc}, p \text{ in arcsec})$$

$$d_{\text{Vega}} = 7.76\,\text{pc}$$
$$L_{\text{Vega}} = 130\,L_\odot$$

Age of Solar System:	4.6×10^9 years
Age of Universe:	13.7×10^9 years
Lifetime of 1 $M_\odot$ star (type G on main sequence):	10^{10} yr (10 Gyr)
Lifetime of 3 $M_\odot$ star (type A on main sequence):	4×10^8 yr (400 Myr)
Lifetime of 8 $M_\odot$ star (type B on main sequence):	4×10^7 yr (40 Myr)
"High-mass" star (will go supernova):	$M > 8\,M_\odot$