

# Astronomy 102: Constants and Formulae

## Potentially useful constants and formulae

$$R_{\odot} = 6.96 \times 10^5 \text{ km}$$

$$M_{\odot} = 1.99 \times 10^{30} \text{ kg}$$

$$L_{\odot} = 3.8 \times 10^{26} \text{ W}$$

$$1 \text{ pc} = 3.26 \text{ yr}$$

$$1 \text{ pc} = 206,265 \text{ AU}$$

$$1 \text{ pc} = 3.086 \times 10^{16} \text{ m}$$

$$1 \text{ AU} = 1.496 \times 10^{11} \text{ m}$$

$$1 \text{ km} = 1,000 \text{ m}$$

$$\pi \text{ rad} = 180^\circ$$

$$206,265 \text{ arcsec} = 1 \text{ rad}$$

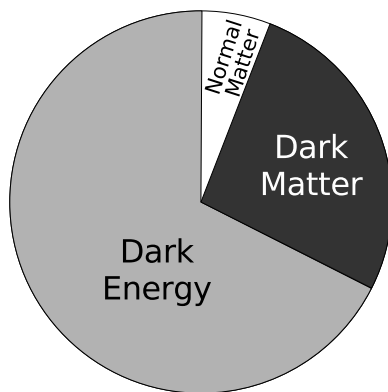
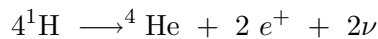
$$3,600 \text{ arcsec} = 60 \text{ arcmin} = 1^\circ$$

$$d_{\text{Vega}} = 7.76 \text{ pc}$$

$$L_{\text{Vega}} = 130 L_{\odot}$$

$$c = 3.00 \times 10^8 \text{ m s}^{-1} = 1 \text{ yr/yr}$$

$$h = 6.626 \times 10^{-34} \text{ J s}^{-1}$$



$$E = mc^2$$

$$\lambda f = c \quad f = \frac{c}{\lambda} \quad \lambda = \frac{c}{f}$$

$$E = hf$$

$$L = A\sigma T^4$$

$$L = (4\pi R^2)\sigma T^4$$

$$B = \frac{L}{4\pi d^2}$$

$$A = \frac{b}{d} \quad (\text{for } A \ll 1, A \text{ in rad})$$

$$d = \frac{1}{p} \quad (d \text{ in pc}, p \text{ in arcsec})$$

$$z = \frac{\Delta\lambda}{\lambda} = \frac{\lambda_{\text{obs}} - \lambda_{\text{orig}}}{\lambda_{\text{orig}}}$$

$$z = \frac{v}{c} \quad (\text{for } v \ll c)$$

$$z = \frac{d}{ct_H} \quad (\text{for } z \ll 1)$$

$$z = \frac{\Delta d}{d}$$

$$1 + z = \frac{\text{Size Now}}{\text{Size Then}}$$

$$z = \frac{\Delta t}{t_H} \quad (\text{for } z \ll 1)$$

$$t_H = 13.8 \text{ Gyr}$$

$$1 \text{ Gyr} = 1 \text{ billion years} = 10^9 \text{ years}$$

$$1 \text{ Gpc} = 1 \text{ billion pc} = 10^9 \text{ pc}$$

$$1 \text{ Mpc} = 1 \text{ million pc} = 10^6 \text{ pc}$$

$$\text{Age of Solar System: } 4.6 \times 10^9 \text{ years}$$

$$\text{Age of Universe: } 13.7 \times 10^9 \text{ years}$$

$$\text{Lifetime of } 1 M_{\odot} \text{ star (type G on main sequence): } 10^{10} \text{ yr (10 Gyr)}$$

$$\text{Lifetime of } 3 M_{\odot} \text{ star (type A on main sequence): } 4 \times 10^8 \text{ yr (400 Myr)}$$

$$\text{Lifetime of } 8 M_{\odot} \text{ star (type B on main sequence): } 4 \times 10^7 \text{ yr (40 Myr)}$$

$$\text{“High-mass” star (will go supernova): } M > 8 M_{\odot}$$