

## Astronomy 45 Midterm study problems - Spring '01

(March 5, 2001)

- 1- At greatest brilliancy, Venus has an apparent visual magnitude,  $m_V = -4$ . The dimmest star visible to the naked eye has a magnitude of  $+6$ . How much brighter is Venus?
- 2- A star has a proper motion of 2.5 parsec per year, a parallex of  $0.32'$  and a radial velocity of 60 Km/s away from us. Calculate the angle between the direction of the star velocity and the line of sight from Earth.
- 3- Assume that the solar interior is all at a temperature of  $T = 10^7 \text{ }^\circ\text{K}$ , and that a typical photon has energy  $kT$ . Are there more photons, or more particles, in the sun? Take the solar particle density to be  $1.4 \text{ grams/cm}^3$  and assume that the particles have masses equal to the proton mass.
- 4- If your eyes are capable of seeing a star that delivers  $10^3$  photons in the V-band ( $\lambda = 550\text{nm}$ ) per second to your pupils (8 mm diameter), what is the faintest visual magnitude  $m_V$ ?
- 5- Consider a giant star with a radius of 1AU and a temperature of  $3000 \text{ }^\circ\text{K}$ . How much more energy does this star emit than an ordinary star at the same temperature but with a radius of 150,000 km?
- 6- At room temperature,  $T=300 \text{ K}$ , oxygen molecules have an average kinetic energy of  $\frac{3}{2}kT$ , where  $k = 1.38 \times 10^{-16} \text{ erg/K}$  is the Boltzman constant. Calculate the velocity of oxygen molecules. Now calculate the velocity for escape from Earth. Is this velocity dependent on mass?