

**Intro. Astrophysics II**

NAME:

**HW #1****Due Friday, Jan. 16 in class**

FOR ALL PROBLEMS, SHOW YOUR WORK

1. The “solar constant” is the mean integrated flux of the Sun at 1 AU, measured above the earth’s atmosphere, and has a value of  $1360 \text{ W m}^{-2} = 1.36 \times 10^6 \text{ erg s}^{-1} \text{ cm}^{-2}$  (note that your textbook *usually* uses cgs units instead of SI units). At what distance would a 100 W bulb produce the same radiant flux? Assume here that the 100 W really is the energy *radiated*, not *consumed* by the bulb (the latter is what the actual rating of the bulbs are – which is why compact fluorescent lights use lumens and give the *equivalent wattage* of an incandescent bulb that produces the same number of lumens)! (1 point)

2. Consider a model star consisting of a spherical blackbody with a surface temperature of 28,000 K and a radius of  $5.16 \times 10^9 \text{ m}$ . Let this model star be located 180 pc from Earth. Determine the following for this star (7 points):

- a. Luminosity (in Watts and  $L_{\odot}$ )
- b. Absolute bolometric magnitude  $M_{bol}$  (assume  $M_{bol, \odot} = +4.75$  for this problem)
- c. Apparent bolometric magnitude
- d. Distance modulus m-M
- e. Radiant flux at the star’s surface ( $\text{W m}^{-2}$ ) – call this  $\mathfrak{S} = \pi B(T)$
- f. Radiant flux at the surface of the Earth (and compare with the solar constant -  $1360 \text{ W m}^{-2}$  - by forming ratio of the two quantities.
- g. Peak wavelength  $\lambda_{\max}$  in units of  $\lambda F_{\lambda}$

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3. A crime scene investigator finds the partly-decomposed body of a victim on the floor of their apartment living room. Another investigator takes a thermal image of the victim and the first investigator that integrates the brightness from 3-30  $\mu\text{m}$ . Approximately how much brighter is the face of the investigator than that of the victim? Describe how you determined this ratio, and what assumptions you have used. (4 points)