Name _____

Astronomy 161 – Solar System Astronomy
Autumn Quarter 2009 – Prof. Gaudi
Homework #4

Due Monday, November 16 in class

Instructions

Answer the following five multiple-choice questions by circling the correct answer. Each question is worth the number of points given in parentheses (out of a total of 100). In addition, there is one extra credit question.

No late homework will be accepted.

Question 1 (20 points)

According to Wien's law, at what wavelength does the Sun's apparent brightness peak? (Assume the Sun has a temperature of 5800K and is perfect blackbody.)
   a) 0.15 meters
   b) 1.5 centimeters
   c) 5000 nanometers
   d) 0.5 micrometers
   e) 1.5 nanometers

Question 2 (20 points)

The brightness of the star Horace peaks at a wavelength of 1.5 micrometers. How much hotter or cooler is Horace than the Sun? (Assume Horace is a perfect blackbody.)
   a) Horace is three times hotter.
   b) Horace is ten times cooler.
   c) Horace is the same temperature.
   d) Horace is ten times hotter.
   e) Horace is three times cooler.

Question 3 (20 points)

Again assuming Horace and the Sun are perfect blackbodies, the energy per second unit area emitted by Horace as compared to the Sun is

a) 3 times smaller.
b) 9 times larger.
c) 27 times smaller.
d) 81 times smaller.
e) 81 times larger.

Question 4 (20 points)

I put a jar of a radioactive element, Notgonnalastlongium, on a shelf in my closet. After six days, I look in the jar, and I find that I have only 12.5% of my Notgonnalastlongium left, and the rest has decayed into Hereforeverium. What is the half-life of Notgonnalastlongium?

a) two days
b) three days
c) six days
d) one day
e) 12.5 days

Question 5 (20 points)

The Large Binocular Telescope (LBT) has two mirrors, each with a diameter 8.4 meters. How much total light does the LBT collect as compared to the Hubble Space Telescope, which has a single 2.4 meter diameter meter?

a) about 42.875 times more light
b) about 3.5 times more light
c) about 7 times more light
d) about 12.25 times more light.
e) about 24.5 times more light.

Extra Credit Question:

Question 6 (20 points)

The luminosity **L** of a black body (the energy emitted per second) is just its surface area, **A**, times the energy emitted per second per unit area, **E**. Thus

$$L = A \times E.$$

It turns out that Horace (from Questions 2 and 3) has a radius that is nine times bigger than that of the Sun. What is the luminosity of Horace compared to the luminosity of the Sun? *(Hint: the Stefan-Boltzmann Law gives the equation for **E**, and use the formula for the surface area of a sphere to determine **A**.)*

    a) Horace is 9 times less luminous.
    b) Horace is 81 times more luminous.
    c) Horace is 3 times less luminous.
    d) Horace has the same luminosity as the Sun.
    e) Horace is 9 times more luminous.