

Homework # 3

Name _____

DUE: September 30 (at the start of class)

Your homework grade depends not only upon your getting the correct answer but also grammar, spelling and punctuation, particularly in questions that require explanations. Obviously numerical answers to problems do not need to be written in complete sentences. You will also be graded on the use of significant figures, proper units of measure and proper scientific notation. Partial credit may be given for showing your work even if your result is incorrect. You may work with others in determining the answers to the questions, but what you write should be in your own words – any homework assignments that look too similar to that of other students will receive no credit. Unless otherwise noted, all questions are worth 1 point.

1. (8 points total) Let's look at the scale of things. First there is the Earth, which is only about 12,800 km in diameter. The Sun on the other hand has a diameter of 1.40×10^6 km.

a. How many times wider is the Sun compared to the Earth?

b. The distance from the Earth to the Sun, which we usually give as 1 AU, is approximately 1.50×10^8 km. How many Suns could you fit into that span of distance, side by side?

c. How many Earths would fit side by side in that distance?

d. Light travels at a speed of 3.00×10^5 km/s. How long does it take light to get from the Sun to the Earth on average?

e. 1 parsec is equal to about 206,000 AU. How many km is that equivalent to?

f. How long would it take light to travel 1 parsec?

g. The closest star beyond the Sun, Proxima Centauri, is 1.3 parsecs away. How long would it take light to travel that distance?

h. Of course you can't travel at the speed of light, but if you traveled at the fastest spacecraft speed (17.1 km/s) to Proxima Centauri, how long would it take you?

2. (4 points total) At the course website is a link to a *Star Generator*. This program will assign you a star based upon the initials of your name. Input your first and last initials to get your star. If you have problems with the program, let me know. Failure to use the correct star (based upon your name) will result in no points for this part of the homework. Once you have your star, look up its characteristics in the "Spectral Type Characteristics" table – your star is a Main Sequence type (V). Do not use other resources to obtain information about your star.

What is your star's name and spectral type? What is the typical temperature for your star?

a. At which wavelength would your star produce most of its light (use Wiens' Law)?

b. What type of light does your star mainly produce (visible, x-ray, etc.)?

c. Determine the radius of your star. To use the simple version of the L-R-T relation, you need to first divide the star's temperature by 5800 (so that it is in terms of the Sun's temperature) before you put it into the L-R-T relation, $L=R^2 T^4$. Using this formula gives the radius in terms of the Sun's radius.

d. What is a typical mass for your star? Use the relation given in the notes between the luminosity and mass, $L=M^{3.5}$, where values are given in terms of the Sun's values.

3. (8 points total) Follow the link at the course website to the spectra program. There you will see the spectra of various stars displayed. The amount of light that is given out at each wavelength is displayed on the vertical axis – though it isn't numbered and the scale is different for each type of star. Absorption features would look like valleys in this type of display. The spectra that are shown in black are the “comparison” spectra that you'll use to identify some unknown spectra – but we'll get to that later. The spectra are arranged in the correct spectral sequence going from O5 to M5. Use the *right* and *left arrow keys* on your computer keyboard to change from one spectral type to another.

If you click on the buttons number 1 – 5 you'll see an unknown spectra displayed in red. Determine the stellar spectral type for the unknown spectra. Your designation should not only include the letter (OBAFGKM – no LT types are here), but also a number. So your answer could be B4, K2, A9, etc. Don't just write B, K or A.

a. Unknown #1

b. Unknown #2

c. Unknown #3

d. Unknown #4

e. Unknown #5

f. (3 points) If you look at the B0 spectra, you'd see that most of that star comes out at short wavelengths (UV). Can we observe those stars in the sky with our eyes? Why or why not?