

Homework # 4

Name _____

DUE: October 17 (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. (10 points total) Let's look at the star that you generated in the last homework assignment. And just so I can keep track, please write your star's name and spectral type below.

Name:

Spectral Type:

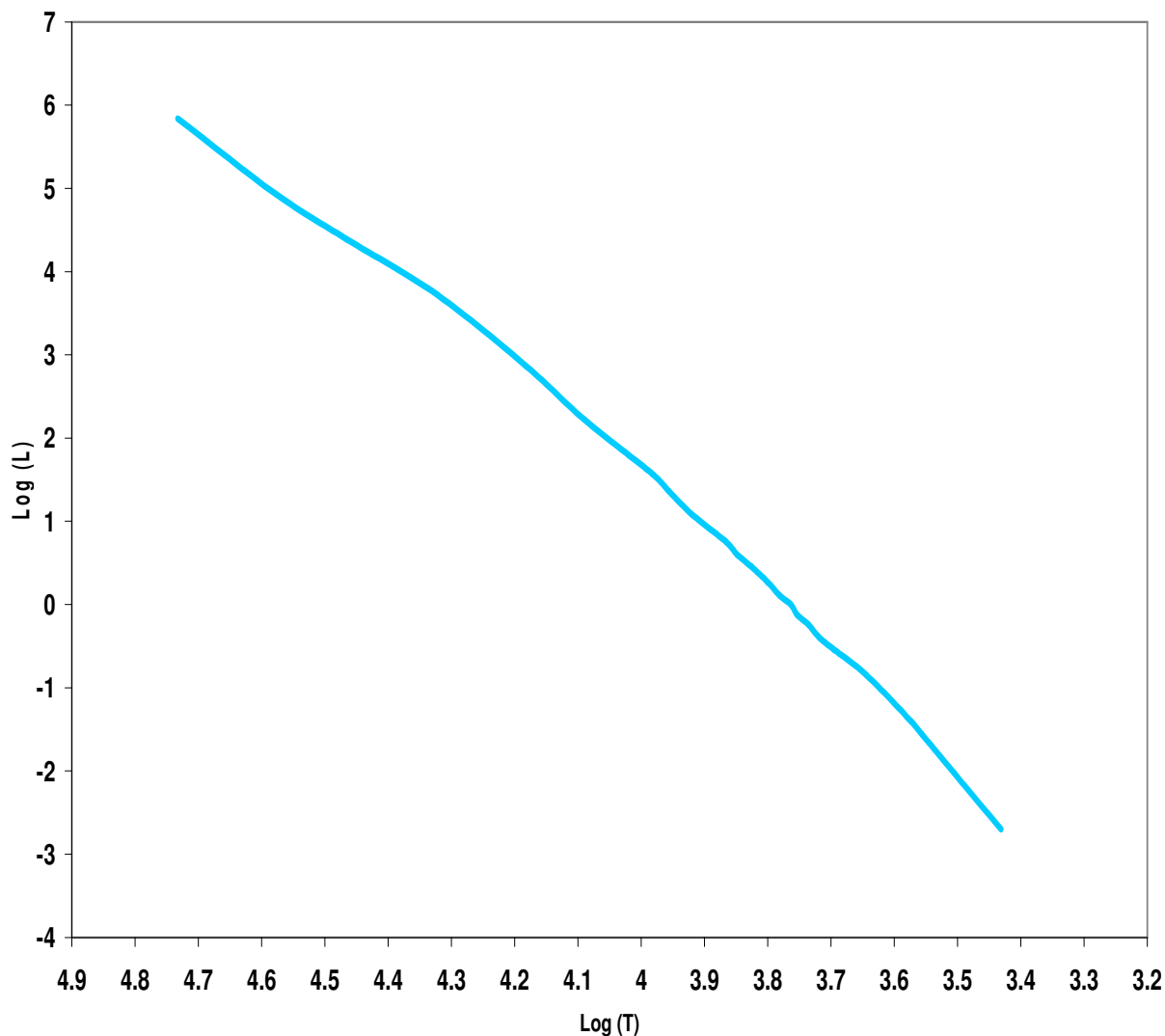
a. Previously you determined the Main Sequence mass for your star. What is the approximate amount of time your star would spend on the Main Sequence? Use the formula given in the notes.

b. (2 points) Which elements will your star use to produce energy through fusion during its entire life time?

c. Will your star be a Red Giant or a Supergiant after leaving the Main Sequence?

d. What is the eventual fate for your star after the Red Giant/Supergiant phase?

e. (3 points) In the H-R diagram below, map out the likely evolution of your star. Use the sample evolutionary paths shown at the course website as guides. Do not go beyond the Red Giant or Supergiant stage. The starting point should be based upon the Main Sequence values for the temperature and luminosity. Note that the graph below uses the Log values for both temperature and luminosity, so make sure you Log the Main Sequence values before you plot them.



f. (2 points) Stars can end their lives in a variety of ways, as a white dwarf, neutron star or black hole. If you look far into the future, which type of stellar remnant would be the most common in our galaxy? Explain your reasoning.

2. (2 points) Far into the future the Sun will eventually “die” by finally stopping all significant fusion in its core and will begin to blow its outer layers away. It is expected to lose about 40% of its mass during this process. How will the mass loss influence the Earth’s orbit about the Sun?

3. (2 points total) The phrase “we are made of star stuff” is often quoted. Is that an accurate statement? Explain your answer.

4. (6 points total) Time for some more calculations – this time you’ll calculate the density of some objects. For simplicity we’ll assume that all objects are spherical, so that their volumes are given by $V = \frac{4\pi R^3}{3}$

where R is the radius of the object. And of course density is just mass/volume. To make things a bit simpler, we’ll use one mass for each object, that of the Sun.

Object	Mass	Radius	Density
Sun	1.99×10^{30} kg	6.96×10^8 m	
Red Giant	1.99×10^{30} kg	6.00×10^{13} m	
White Dwarf	1.99×10^{30} kg	6.40×10^6 m	
Neutron Star	1.99×10^{30} kg	2.00×10^4 m	

a. Which, if any, of the above objects is denser than the Earth (you’ll have to find its density somewhere....and make sure you have it in the appropriate units)?

b. Which, if any, of the above objects has a density less than the Earth’s atmosphere at sea level?