Astronomy Homework # 4

Name__________________________ DUE: **March 4** (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. Numerical answers to questions do not need to be written in complete sentences and you should show your work where ever it is appropriate. Partial credit may be given for showing your work even if your result is incorrect. You will also be graded on the use of significant figures, proper units of measure and proper scientific notation. 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. Homework can be turned in at the office Latham 121 during business hours, during class, or on-line at e-Learning.

1. (14 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 characteristics below.

Name: Spectral Type:

Temperature (T): Luminosity (L):

On the last homework you determined the Main Sequence mass for your star. If your value for the mass on the last homework was not correct, the correct value for mass is available at the course website – you'll want to use the **correct mass** value to answer these questions. Provide the mass of your star below -

Mass of your star:

a. What is the approximate amount of time your star would spend on the Main Sequence? Use the formula given in the notes (Main Sequence notes).

b. List all of the elements that your star will fuse in its core in order for it to produce energy during its entire life time, both on the Main Sequence and after it leaves the Main Sequence. Don't list the fusion products, but just the elements that are fused ("burned").

c. What will ultimately happen to your star at the end of its evolution? Basically what form will it finally end up in (don't list all of the stage before the end).

The luminosity (L) and temperature (T) values that you used previously (and that you wrote on page 1) are the Main Sequence values for your star. On the last page of this lab is an HR diagram showing the evolutionary paths of stars of different masses (indicated in solar mass values). The diagonal line is the approximate location of the Main Sequence. To put your star on the Main Sequence you need to first convert your L and T values to logarithmic values. There are Log keys on scientific calculators, so use this key to convert your values of L and T.

d. (2 points) What are the logarithmic values for your stars' temperature and luminosity on the Main Sequence?

Log (T) = ______________________ Log (L) = ____________________

Graph this value on the H-R diagram – it should be close to the diagonal Main Sequence line.

e. Using the other stars' evolutionary paths as guides, draw the evolutionary path of your star on the H-R diagram.

f. **Mark and label** on your graph the location that your star will have its greatest radius.

g. (2 points) What are the approximate corresponding Log (T) and Log (L) values for the location with the largest radius for your star (the location you indicated in part "f")?

Log (T) = ____________________ Log (L) = ____________________

h. (2 points) In order to use the values you just obtained, you need to take their anti-log, which basically means taking 10 to the power of the values from part "g". For example if your value for Log (L) was 3.7, then the value for the luminosity would be $10^{3.7}$ = 5000 times the luminosity of the Sun ($L_\odot$). Determine the values for the luminosity and the temperature using the values from part "g".

Temperature (in K) = ______________ Luminosity (in $L_\odot$) = ________________

i. (2 points) Determine the radius of your star using the values from part "h". 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 $R_\odot$.

2. (6 points total) Follow the *Recent Supernova* link at the course website to a list of recently reported supernovae. The most recent one reported is at the top of the list. The first column is the name of the supernova (which is based upon the year of discovery and order of discovery), then there are columns with a bunch of other information. Be sure to scroll to the right to see all of the available columns of data. Use the most recent supernova (the one at the top of the list) with a defined type, either a type I or II but not "?" and provide the information about it below.

Supernova name:

Apparent Magnitude, m (from the "Mag." column):

Type (Ia, IIn, IIp, etc but not "?"):

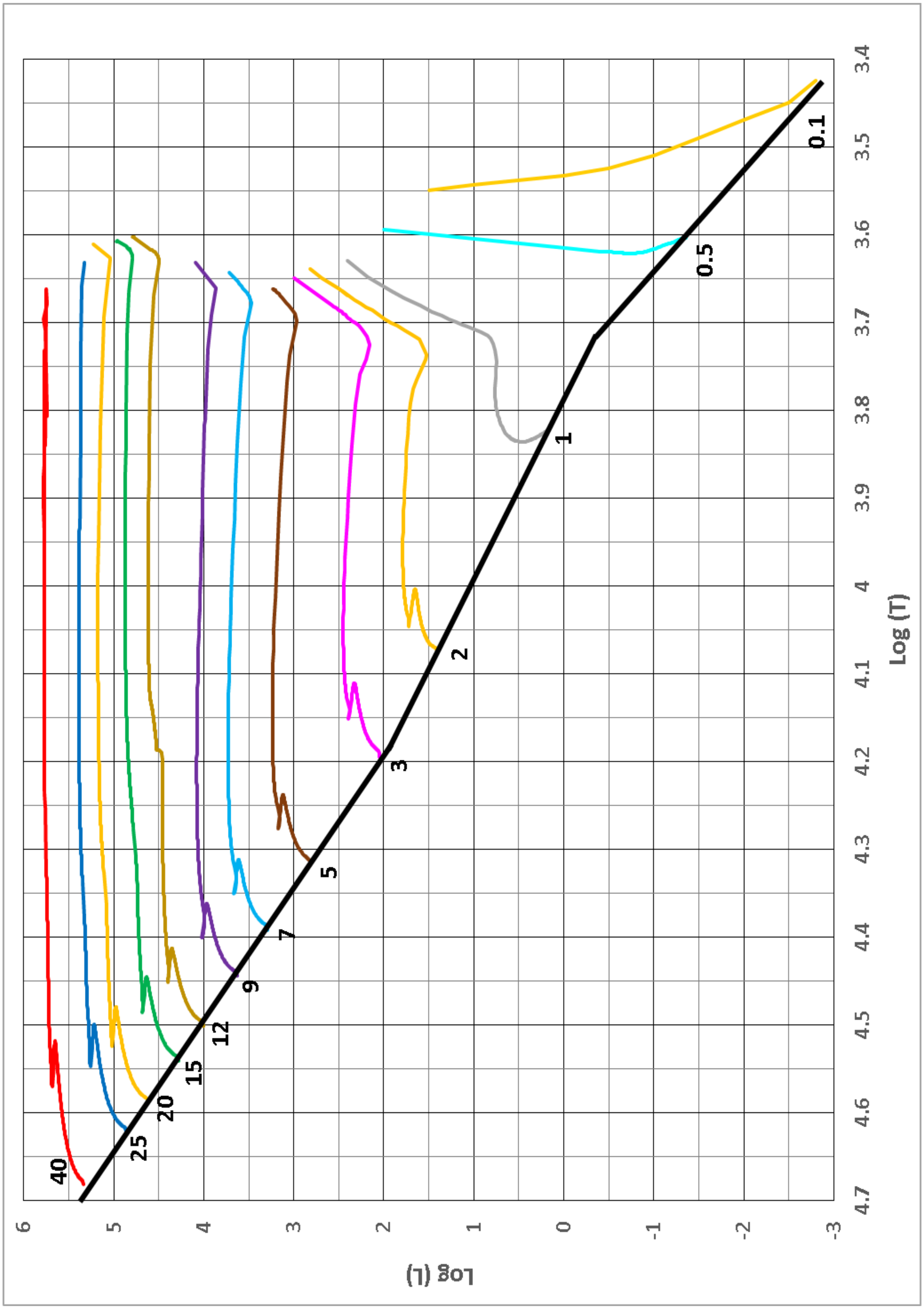
If your supernova is a type I of any sort its absolute magnitude, M, should have been -19, while if it were a type II its absolute magnitude would have been -16.

a. What is the absolute magnitude for your supernova based upon the type, -16 or -19?

b. (2 points) Use the relation $d = 10^{(m-M+5)/5}$ to determine the distance to the supernova with the magnitude from the website as your value for m and the absolute magnitude, M, you determined based upon the type. In this formula distance is in parsecs. Also be careful since the formula is 10 to the power of $(m-M+5)/5$.

c. (2 points) If the supernova you looked at occurred in our galaxy at the distance of Deneb, how bright would it appear in the night sky? To determine this, use the distance of Deneb, 433 pc, the absolute magnitude for your supernova, and the formula $m = M - 5 + 5\,Log(d)$, where m is the apparent magnitude (the number we're looking for here).

d. For a supernova to be visible in daylight it would need to be brighter than an apparent magnitude of -5. Would the supernova brightness you determined in part c be visible in daylight?


Log (L)
Log (T)
6
5
4
3
2
1
0
-1
-2
-3
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
3.4
40
25
20
15
12
9
7
5
3
2
1
0.5
0.1