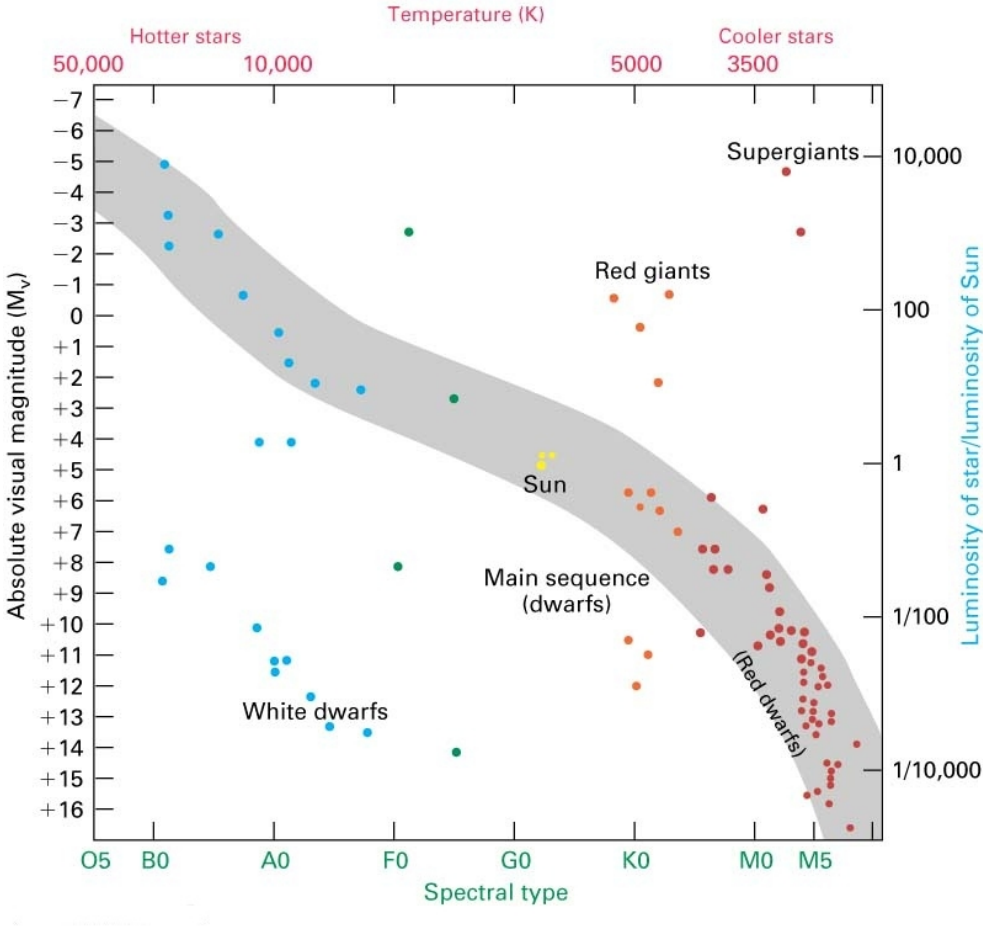
PHYS 1061 Stars and Galaxies Name_____
Gen. Ed. Outcome: *Scientific and Quantitative Literacy*

Stellar Properties and the H-R Diagram

The Hertzsprung-Russell (H-R) diagram is a plot of stellar luminosity versus spectral type, color, or temperature. It is sometimes called the color-luminosity diagram, but the x-axis does not have to be a color index, as you can see in the sample below. Answer the questions based on this particular H-R diagram.



1. (2pts) What are the two labels shown on the x-axes? 1)_____2) _____
   How about the y-axes? 1)_____2)_____
2. (3pts) On which part of the H-R diagram would you find the following stars? Your answer should be one of the following: TR (Top Right), TL (Top Left), BL (Bottom Left), BR (Bottom Right), C (Center), or TM (Top Middle).
   A. Stars that are blue but faint: _____.
   B. Stars that are cold and luminous: _____.
   C. Stars that are yellow/white but are much brighter than the Sun: _____.
   D. Stars that are red and faint: _____.
   E. Stars that are super hot and luminous: _____. F. A G2 V (dwarf) star: _____.
3. (2pts) Plot the following stars on the H-R diagram above and label them with their corresponding letter.
   A. Star with 10 times the luminosity of the Sun and spectral type K5.
   B. Star with spectral type B5 and Mv=+10.
   C. Star with L=10,000 L⊙ and surface temperature 10,000 K.
   D. Star with Mv=+5 and surface temperature 3500 K.

4. (2pts) Why should temperature and spectral type both work as the x-axis on the H-R Diagram? This is like asking "why should there be only one temperature for a given spectral type?"

5. (2pts) Why could a color index like B-V also be used for the x-axis?

6. (2pts) Why will mass <u>not</u> work as a proxy for temperature on the x-axis? (Does every blue-hot star have the same mass?) Would mass work as a proxy for temperature for Main sequence stars only?

The relationship between a star's luminosity, L, radius, R, and temperature, T is: $L = 4 \pi R^2 \sigma T^4$, where $\sigma = 5.67 \times 10^{-8}$ W/m^{2}K^4 and L is in Watts.

7. (2pts) If stars A and B have the same surface temperature, how could star A be 100 times more luminous than star B? (Be quantitative.)

8. (3pts) Calculate the luminosity of the Sun if it has T=5775 K and R=6.95×10^8 m. Look the answer up. Does your answer agree? (What is the other source?)

9. (2pts) If stars A and B have the same radius (and composition), but different luminosities do they necessarily have different colors? If so, would the more luminous star be bluer or redder?

10. (4pts) Now consider the star you had for the "Stellar Properties" assignment.
    1. What is its name? _____
    2. Draw a "*" on the H-R diagram where your star belongs and label it with your stars name.
    3. Compare the temperature and luminosity of your star to that of the Sun.
    4. Is your star a main sequence star (using this diagram)?
11. (2pts) Use the L and T of your star (in solar units) to calculate its radius, R in solar radii.

12. (2pts) It is said that a cluster of 1000 MS dwarf stars would have a total luminosity approximately equal to the Sun's. Explain why you think that this is, or is not, accurate.

13. (2pt) If this H-R Diagram showed all of the stars within 10 LY of the Sun, what spectral type would you say is the most common? Why?