

Homework #7: Stars

Physics 1040: Elementary Astronomy

Score: _____/41

Name: KEY

Dr. Sohl

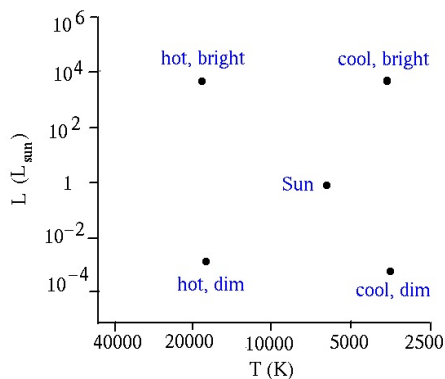
Part 1. Definitions. Make the *best* match from the following words with the definitions below.

absolute magnitude
 apparent magnitude
 binary star
 center of mass
 clusters
 core hydrogen burning
 core helium burning
 $E=mc^2$
 eclipsing binary

fission
 fusion
 giant
 H-R diagram
 inverse-square law
 light curve
 luminosity
 luminosity class
 main sequence
 mass-luminosity relation

nurseries
 OBAFGKM
 radial velocity
 red giant
 red supergiant
 spectral classification
 stellar evolution
 supergiant
 visual binary
 white dwarf

1. Young stars form near each other. These young stars become part of open star... 1 clusters
2. Star-forming nebulae (typically red with dark regions) are also known as stellar... 2 nurseries
3. As stars age and move around on the H-R diagram, the path they follow is known as... 3 stellar evolution
4. We use these star systems to determine the mass of stars. (Select the *most general* term.) 4 binary stars
5. One way to determine the mass of a star is if you know the luminosity. You then use the... 5 mass-luminosity relation
6. The energy for stars on the main sequence is a result of ---- burning. 6 core hydrogen burning
7. A concise and precise description of how much energy is produced by a nuclear reaction. 7 $E=mc^2$
8. When two stars orbit each other so that one moves in front of the other we call it an... 8 eclipsing binary
9. Velocity along the line of sight is the... 9 radial velocity
10. The spectral types (classification) of stars in order of decreasing temperature. 10 OBAFGKM
11. When any two objects orbit each other, they actually orbit around the common... 11 center of mass
12. A measure of how visually bright an object is to your eyes as viewed from Earth. 12 apparent magnitude
13. A measure of how bright an object is if it were viewed from a standard distance of 10 pc. 13 absolute magnitude
14. Stars typically located in the bottom left area of an H-R diagram. 14 white dwarfs
15. Stars typically located in the top right area of an H-R diagram. 15 red giant, giant, super giant
16. The line of stars that snakes across the HR diagram from upper left towards lower right. 16 main sequence
17. Our current nuclear power plants on earth use nuclear XXXX which is not what stars do. 17 fission

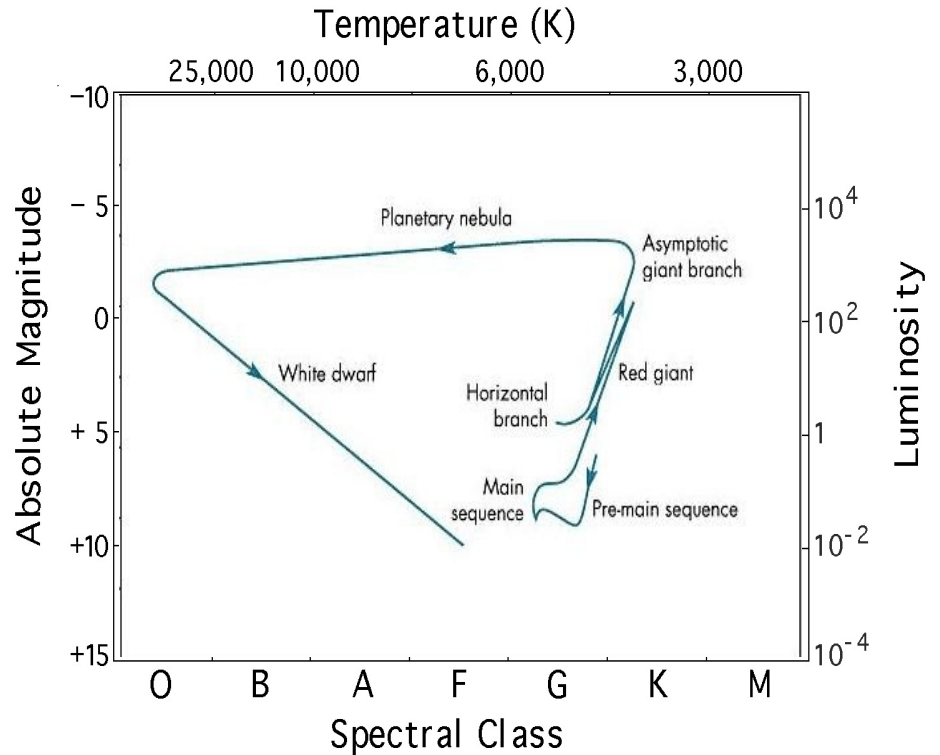


18. We study eclipsing binaries by watching their... 18 light curve
19. The total radiative power output of a star. 19 luminosity

Figure: An H-R Diagram. (Davison E. Soper, Institute of Theoretical Science, University of Oregon)

Part 2. Questions (2 points each, except as noted)

1. (4 points) On the H-R Diagram shown here, draw the evolutionary path of a star like our Sun. Note the key features. (Figure from: http://imagine.gsfc.nasa.gov/docs/science/know_12/stars.html)



2. (2 pts) The star Rigel has an apparent visual magnitude of 0.12 (call this m_1) and the star Betelgeuse has an apparent visual magnitude of 0.50 (call this m_2), both of these stars are in the constellation of Orion. How much brighter does Rigel appear than Betelgeuse? You can determine the ratio of apparent brightness by using the relation:

$$\frac{b_1}{b_2} = 2.5^{(m_2 - m_1)} . \quad \text{Show your work.}$$

$$\frac{b_1}{b_2} = 2.5^{(m_2 - m_1)} = 2.5^{(0.50 - 0.12)} = 2.5^{0.38} = 1.4$$

2. Rigel is 1.4 times brighter

3. Describe the difference between nuclear fusion and nuclear fission.

Fusion is the combining of light nuclei to make heavier elements. (This produces energy for elements below Fe.)

Fission is the splitting of heavy nuclei to make lighter elements. (This produces energy for elements above Fe.)

4. Absolute magnitude can be calculated from a star's apparent magnitude and XXXX. 4. Distance

5. The spectral type of a star is another way of describing what property of the star? 5. Temperature

6. A parsec (pc) is a measure of distance. How many lightyears are in a parsec? 6. 3.26

7. If a high mass star starts off with more fuel than a low mass star, how come the high mass star doesn't live as long as the low mass star?

8. What was the first clue that told us that the Sun can't possibly be burning fuel in the "normal" way that we are familiar with here on Earth? 8. The Sun is much too old

9. Star A and star B both have the same luminosity, but star A is three times as far away. How much brighter is star B than star A? 9. 9 times (get the hint, it is problem 9)

10. What one basic property determines almost everything about a star such as where a star will be along the main sequence, its luminosity, its evolution and fate? 10. Mass