**Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Lab Night \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**HR DIAGRAM AND PROPERTIES OF STARS (Non CLEA Ver 2/24/16)**

**PART I HR DIAGRAM**

Plot the stars listed below on an HR Diagram. Graph paper with scales will be provided. The spectral type and absolute magnitude are in Table 10.1 (provided). Tables 10.2 & 10.3 and formulae are in the background information (#17) found at: <http://www.auburn.edu/academic/cosam/departments/physics/intro-courses/ugrad-lab/physics1150/index.htm>).

**List:** Sun, Sirius, Rigel, Vega, Capella, Betelgeuse, Arcturus, Canopus, Procyon, Altair, Deneb, Castor, Regulus & Antares. **Label stars with name & arrow**. If a star is a double star plot only the brightest. Alpha Centauri (aka Rigel Kentaurus) has been plotted as example.

**Questions about stars in HR Diagram**

1. Based on spectral class which of these is the hottest? \_\_\_\_\_\_\_\_\_\_\_\_

2. Based on spectral class which of these is the coolest? \_\_\_\_\_\_\_\_\_\_\_\_\_

3. Which of these is the brightest (absolute magnitude)? \_\_\_\_\_\_\_\_

4. Which of these is the dimmest (absolute magnitude? \_\_\_\_\_\_\_\_\_\_

5. Which of these stars is a red giant (Class III, Spectral type K or M, single star)? If more than one list either. \_\_\_\_\_\_\_\_\_\_\_

6. The region of the HR diagram that stars spend most of their life in is called? \_\_\_\_\_\_\_\_\_\_\_\_\_

7. Name one of the stars listed that is in this part of the HR diagram. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. The Roman numeral designation for white dwarf stars is what? \_\_\_\_\_\_\_\_\_\_\_\_\_\_

9. Which of these stars is a binary with a white dwarf as one of the two stars? See table 10.2. List the name of the binary star that is not the white dwarf. If there is more than one binary system, list either. \_\_\_\_\_\_\_\_\_\_

**PART II PROPERTIES OF NEARBY STARS**

This part uses tables 10.1, 10.2 and 10.3 in the background information.

1. Which type of star is most common in each table? Choices are: Main Sequence (V), Giants (combine all I,II,III,IV types), White Dwarfs. Do not count Sun. Go to the tables to count.

 Table 10.1.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Table 10.2.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Table 10.3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. In Table 10.1, the brightest stars, how many stars are brighter than the Sun? Brighter means lower magnitude (M) not higher. **If double both must be considered**.

 # brighter than the sun: \_\_\_\_\_\_\_\_

In Table 10.2, the closest stars, how many stars are brighter than the sun? Brighter means lower magnitude (M) not higher. **If double both must be considered**.

 # brighter than the sun: \_\_\_\_\_\_\_\_

3. How many of the star systems in Table 10.1 (brightest) are also in Table 10.2 (closest)? Do not count the Sun. **If a star is a double star, only count once.**

 # = \_\_\_\_\_\_\_\_\_\_\_\_\_

4. How many of the stars in table 10.1 are hotter than the Sun (spectral classes O,B,A,F)? **If double star both must be considered**.

 # = \_\_\_\_\_\_\_\_\_\_

How many of the stars in table 10.2 are hotter than the Sun (spectral classes O,B,A,F)? **If double star both must be considered**.

 # = \_\_\_\_\_\_\_\_\_\_

5. Based on answers to 1-4 above fill in the blanks using **close, hot or large**. The twenty brightest stars in the night sky are most likely to be bright because they are \_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_ not because they are \_\_\_\_\_\_\_\_\_\_\_\_.

**Part III Size and Distance**

**STELLAR RADIUS**

Use the equation for L, R &T in background material to calculate the radius of these stars compared to the Sun. If you solve for ratio of star values to Sun values the 4 pi and sigma drop out of the equation ***See example calculation below.***

Star L(star)/ L(Sun) T (star)/ T(Sun) R(star)/ R(Sun)

Vega 50 1.8

Spica 500 4.0

**SPECTROSCOPIC PARALLAX**

Given the information below about some stars, find the distances to each star using the technique of spectroscopic parallax. Use Voyager info panel to find the apparent magnitude (m) and absolute magnitude (M and Spectral Class. Then **calculate** the distance in **parsecs** using the formula for D below Fig 2 in HR diagram background material.  **You distance value should be within 1 pc of Voyager value. If it is not correct your error.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name of Star | Spectral Class | Apparent Magnitude (m) | Absolute Magnitude, (M) | Calculated Distance (pc) | Voyager Distance (pc) |
| Nekkar |   |   |  |  |  |
| Tarazed |   |  |  |  |  |
| Kochab |   |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

*Example Calculation using Regulus*

Distance

M= -0.3 m = 1.35

Log D = (m-M)/5 +1 = (1.35 +.3)/5 + 1= 1.33

D= 21.3 pc

Radius

Given T(star)/T(sun) = 2.156 and L(star)/L(sun) = 288 then

Dividing star values by Sun values gives:

(R(star)/R(Sun))2 = L(star)/L(Sun) divided by (T(star)/T(Sun))4 = 288/ 2.1564

Take square root of both sides to get

R(star)/R(sun) = 16.97/2.1562 = 3.65

Points (Total = 100)

Part I For each star 1pt for plot, 1 pt for label

Part I Questions 2 pt each

Part II 3 pts each blank except #5 2 pts each

Part III 3 pts each radius

Part III Spectroscopic Parallax 1 pt each table entry except 2 pts for calculated distance in pc.