Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pd: \_\_\_\_\_ Ast: \_\_\_\_\_

**HR Diagram:**

**How is a Star’s Color Related to its Temperature?**

**BACKGROUND:** On a clear night as you look up into the sky, you have surely noticed that some stars appear brighter than others. What many people don’t realize is that stars also have different colors. This difference in color has been noted by astronomers and can be observed through modern telescopes. Scientists use a tool called a Herztsprung-Russel Diagram to show relationships using the colors of stars. An HR diagram is named after two astronomers who independently noticed patterns in the color and temperature of stars. It plots stars on a graph based on their temperature and relative brightness. In this activity, you will develop your own HR diagram using data on a small number of known stars to see how star brightness, color, temperature, and spectral class are related.

**MATERIALS:** Use the data table on the back of this paper to plot each star on the graph. You will use colored pencils (Blue, Light Blue, White (gray), Light Yellow, Yellow, Orange, & Red) to fill in the data on the graph.

**PROCEDURE:**

1. Study the data table on the back of the paper. Note that the Sun is used as a standard of brightness; it is given a value of 1. The brightness given for all of the other stars shows how that star’s brightness compares to the Sun.
2. Plot the data from the chart on the graph on the back of this paper. Use the colored pencil that matches the color listed in the chart. Estimate the location of the temperatures (don’t get bogged down in being perfect).
3. Look for patterns in your graph.
4. Answer the questions below.

**DATA:** Data table can be found on the back side of this paper.

**QUESTIONS:**

1. What is the general relationship between temperature and star brightness for main sequence stars?
2. What relationship do you see between star color and temperature in main sequence stars?
3. List the star colors from coolest to hottest.
4. How does the Sun compare to the other stars on the main sequence?
5. What spectral class does our Sun belong to?

***Refer to the HR diagram on page 97 of your textbook to answer the following questions.***

1. Label White Dwarfs, Red Dwarfs, Main-Sequence Stars, Giants, and Supergiants on your diagram.
2. How do White Dwarf stars compare to our Sun?
3. How do Supergiants compare to our Sun?

**HERTZSPRUNG-RUSSELL DIAGRAM**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Spectral Class** | **B** | **A** | **F** | **G** | **K** | **M** |  |
| * **Relative Brightness (Sun = 1) 🡪**
 | **100K** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **1000** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **.001** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **.0001** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|  | **24000** | **22000** | **20000** | **18000** | **16000** | **14000** | **12000** | **10000** | **8000** | **6000** | **4000** | **2000** |  |
| **🡨 Approximate Temperature (K) 🡨** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **#** | **Star Name** | **Temperature (K)** | **Brightness: Sun = 1** | **Color** |
| 1 | SUN | 5600 | 1 | Yellow |
| 2 | ALPHA CENTAURI A | 5800 | 1.3 | Yellow |
| 3 | ALPHA CENTAURI B | 4200 | 0.36 | Orange |
| 4 | LALANDE 21185 | 3200 | 0.005 | Red |
| 5 | SIRIUS A | 10400 | 23 | Light Blue |
| 6 | SIRIUS B | 10700 | 0.008 | Light Blue |
| 7 | ROSS 248 | 2700 | 0.0001 | Red |
| 8 | 61 CYGNI A | 4200 | 0.08 | Orange |
| 9 | 61 CYGNI B | 3900 | 0.04 | Red |
| 10 | PROCYON A | 6500 | 7.6 | Light Yellow |
| 11 | PROCYON B | 7400 | 0.0005 | White |
| 12 | EPSILON INDI | 4200 | 0.13 | Orange |
| 13 | CANOPUS | 7400 | 1500 | White |
| 14 | ARCTURUS | 4500 | 90 | Orange |
| 15 | VEGA | 10700 | 60 | Light Blue |
| 16 | CAPELLA | 5900 | 150 | Light Yellow |
| 17 | RIGEL | 11800 | 40000 | Light Blue |
| 18 | BETELGEUSE | 3200 | 17000 | Red |
| 19 | ACHERNAR | 14300 | 200 | Light Blue |
| 20 | BETA CENTAURI | 21300 | 3300 | Blue |
| 21 | ALTAIR | 8000 | 10 | White |
| 22 | ALDEBARAN | 4200 | 90 | Orange |
| 23 | SPICA | 21300 | 1900 | Blue |
| 24 | ANTARES | 3400 | 4400 | Red |
| 25 | DENEB | 10200 | 40000 | Light Blue |
| 26 | BETA CRUCIS | 22300 | 6000 | Blue |