**How Is a Star’s Color Related to Its Temperature? Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

***Schulman Labs 2011*  Hour:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

On a clear night you have surely noticed that some stars are brighter than others. But stars also have different colors. Rigel is blue, and Betelgeuse is red. Capella and our sun are yellow. In this activity you will make your own Hertzsprung-Russell diagram. You will see how star brightness, color, temperature, and class are related.

**Materials:**

Colored pencils (red, orange, yellow, blue)

**Procedure:**

1. Study the star data charts below. Note that the sun, used as a standard of brightness, is given a value of 1. The brightness given for each other star shows how that star compares with the sun.
2. Plot the data from both charts on the graph on the next page.
3. Stars with surface temperatures up to 3,500oC are red. Shade a vertical band from 2000oC to 3500oC a light red.
4. Shade other color bands as follows: Stars up to 5000o C are orange-red, up to 6000oC yellow-white, up to 7500oC blue-white, and up to 40,000oC blue.
5. Look for patterns in your graph. Compare it to the following [H-R diagram](http://pne.browardschools.com/teachers/pne_David_Schulman/Downloads/H-R%20diagram.jpg) .
6. Label the main sequence, red super giants, and the white dwarf stars.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Star Name** | **Temperature (Co)** | **Brightness (Luminosity) Sun = 1** |
| 1 | SUN | 5300 | 1 |
| 2 | ALPHA CENTAURI A | 5500 | 1.3 |
| 3 | ALPHA CENTAURI B | 3900 | 0.36 |
| 4 | BARNARD’S STAR | 2500 | 0.0004 |
| 5 | LALANDE 21185 | 2900 | 0.005 |
| 6 | SIRIUS A | 10100 | 23 |
| 7 | SIRIUS B | 10400 | 0.008 |
| 8 | ROSS 248 | 2400 | 0.0001 |
| 9 | 61 CYGNI A | 3900 | 0.08 |
| 10 | 61 CYGNI B | 3600 | 0.04 |
| 11 | PROCYON A | 6200 | 7.6 |
| 12 | PROCYON B | 7100 | 0.0005 |
| 13 | EPSILON INDI | 3900 | 0.13 |
| 14 | CANOPUS | 7100 | 1500 |
| 15 | ARCTURUS | 4200 | 90 |
| 16 | VEGA | 10400 | 60 |
| 17 | CAPELLA | 5600 | 150 |
| 18 | RIGEL | 11500 | 40000 |
| 19 | BETELGEUSE | 2900 | 17000 |
| 20 | ACHERNAR | 14000 | 200 |
| 21 | BETA CENTAURI | 21000 | 3300 |
| 22 | ALTAIR | 7700 | 10 |
| 23 | ALDEBARAN | 3900 | 90 |
| 24 | SPICA | 21000 | 1900 |
| 25 | ANTARES | 3100 | 4400 |
| 26 | DENEB | 9900 | 40000 |
| 27 | BETA CRUCIS | 22000 | 6000 |

**Hertzsprung-Russell Diagram**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 100000 |  |  |  |  |  |  |  |  |
| 50000 |  |  |  |  |  |  |  |  |
| 10000 |  |  |  |  |  |  |  |  |
| 5000 |  |  |  |  |  |  |  |  |
| 1000 |  |  |  |  |  |  |  |  |
| 500 |  |  |  |  |  |  |  |  |
| 100 |  |  |  |  |  |  |  |  |
| 50 |  |  |  |  |  |  |  |  |
| 10 |  |  |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |  |  |
| 1 |  |  |  |  |  |  |  |  |
| 0.5 |  |  |  |  |  |  |  |  |
| 0.1 |  |  |  |  |  |  |  |  |
| 0.05 |  |  |  |  |  |  |  |  |
| 0.01 |  |  |  |  |  |  |  |  |
| 0.005 |  |  |  |  |  |  |  |  |
| 0.001 |  |  |  |  |  |  |  |  |
| 0.0005 |  |  |  |  |  |  |  |  |
| 0.0001 |  |  |  |  |  |  |  |  |

**Spectral Class O B A F G K M**

**Brightness**

40000 20000 10000 7000 6000 4500 3000

**Approximate Temperature (Co)**

Questions

1. What is the general relationship between temperature and star brightness?
2. What relationship do you see between star color and temperature?
3. List the 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? \_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. If a star is class B, what is its temperature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and color\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_?
7. Dwarf stars are smaller than our Sun. How can they be so bright?
8. Circle and label dwarf stars, red giants, blue giants and main sequence stars.