

Name _____

Star Color & Temperature



Purpose: To examine the relationship between star color and temperature

Background Information:

Stars are classified by their spectra (the elements that they absorb) – this is the color of a star. They are also classified by their temperature. There are seven main types of stars. In order of decreasing temperature, the classifications are O, B, A, F, G, K, and M.

The Hertzsprung -Russell (H-R) Diagram is a graph that plots stars color (spectral type or surface temperature) vs. its luminosity (intrinsic brightness or absolute magnitude). On it, astronomers plot stars' color, temperature, luminosity, spectral type, and evolutionary stage. This diagram shows that there are 3 very different types of stars:

- Most stars, including the sun, are "main sequence stars," fueled by nuclear fusion converting hydrogen into helium. For these stars, the hotter they are, the brighter. These stars are in the most stable part of their existence; this stage generally lasts for about 5 billion years.
- As stars begin to die, they become giants and supergiants (above the main sequence). These stars have depleted their hydrogen supply and are very old. The core contracts as the outer layers expand. These stars will eventually explode (becoming a planetary nebula or supernova, depending on their mass) and then become white dwarfs, neutron stars, or black holes (again depending on their mass).
- Smaller stars (like our Sun) eventually become faint white dwarfs (hot, white, dim stars) that are below the main sequence. These hot, shrinking stars have depleted their nuclear fuels and will eventually become cold, dark, black dwarfs. (<http://www.enchantedlearning.com/>)

Materials:

Colored pencils (red, orange, yellow, blue)

Procedure:

1. Study the star data charts given.
2. Note that the sun is used as a standard of brightness, and is given a value of 1. The brightness given for each other star shows how that star compares with the sun.
3. Plot the data from both charts on the graph.
4. Stars with surface temperatures up to 3,500°C are red. Lightly color a vertical band from 2000°C to 3500°C a light red.
5. Lightly color other bands as follows: Stars up to 5000°C are orange-red, up to 6000°C yellow-white, up to 7500°C blue-white, and up to 40,000°C blue.
6. Label the main sequence, red super giants, and the white dwarf stars.
7. Circle and label dwarf stars, red giants, blue giants and main sequence stars.

Data:

	Star Name	Temperature (C°)	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	DENEK	9900	40000
27	BETA CRUCIS	22000	6000

Spectral Class		O	B	A	F	G	K	M
Brightness	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							
		40,000	20,000	10,000	7,000	6,000	4,500	3,000
Approximate Temperature (Co)								

Data Analysis:

1. Describe the relationship between temperature and brightness.

2. Describe the relationship between temperature and color.

Questions:

1. What group do most of the stars you graphed belong to?
2. How does the sun compare to the other stars on the main sequence?
3. What spectral class does our sun belong to?
4. If a star is class K, what is its temperature and color?
5. Betelgeuse is 480 light years away and has a surface temperature of only 3200 K (3473°Celsius). Yet Betelgeuse is one of the brightest stars as seen from Earth. Why do you think it is so bright?
6. Complete the chart by checking the appropriate boxes.

Description of Star	Location on Diagram			
	Top	Right	Bottom	Left
Hot stars are found				
Faint stars are found				
Luminous stars are found				
Cool stars are found				
Large Blue stars are found				
Small Red stars are found				
Small Blue stars are found				
Really Large Red stars are found				

7. The stars located in the lower right portion of your chart are cool and dim. What are the characteristics of a star in the upper left portion of the diagram?
8. What are the characteristics of a star located in the upper right portion of the diagram?
9. Compare our Sun with the red supergiant, Antares. Which star is further along in its life cycle? _____
Explain your answer.