

The Hertzsprung – Russell Diagram Activity

Astronomers use two basic properties of stars to classify them. These two properties are luminosity and surface temperature. **Luminosity** refers to the brightness of the star relative to the brightness of our sun. Astronomers will often use a star's color to measure its temperature. Stars with low temperatures produce a reddish light while stars with high temperatures shine with a brilliant blue – white light. Surface temperatures of stars range from 3000°C to 50,000°C. When these surface temperatures are plotted against luminosity, the stars fall into groups. Using data similar to what you will plot in this activity, Danish astronomer Ejnar Hertzsprung and U.S. astronomer Henry Norris Russell independently arrived at similar results in what is now commonly referred to as the HR diagram.

Purpose: To make a Hertzsprung – Russell diagram using data from stars.

Procedure:

1. Plot the stars listed in the data table below on the graph paper provided.

Star	Luminosity (X Sun)	Surface Temp (X 1000°C)	Star	Luminosity (X Sun)	Surface Temp (X 1000°C)
Capella	125	6.0	Sun	1	5.6
Bellatrix	700	18	Betelgeuse	12500	3.1
Regulus	200	12	Sirius B	0.002	8.15
Spica	700	20	Beta Carinae	150	10
Rigel	75000	11.5	Sirius A	40	9.6
Pollux	70	4.8	Procyon B	0.001	6.6
Beta Centauri	4000	21	Alpha Centauri A	2	5.5
Achernar	800	12.5	Cygni A	0.08	3.9
Deneb	9000	9.4	Cygni B	0.06	3.8
Beta Tauri	800	12.5	Alpha Centauri B	0.05	4
Beta Crucis	10000	24	Procyon A	10	6.6
Alpha Crucis	7000	21	Tau Ceti	0.5	5
Vega	90	9.9	Kapteyn's Star	0.002	3.3
Canopus	1500	7.1	Ross 614A	20000	10
Antares	5500	3.2	Formalhaut	20	9

Questions: Answer these on the back of your graph.

1. Draw a circle around each grouping of stars on your graph, and label them as a main sequence, red giant, white dwarf, or supergiant.
2. Circle the dot representing the sun. What type of star is the sun?
3. How many types of stars are shown on the HR diagram?
4. Why are protostars not on the diagram?
5. How do the brightness and temperature of the sun compare with those of other stars?
6. What is the relationship between luminosity and temperature for stars on the main sequence?
7. Approximately what percentage of the stars on the diagram are main sequence stars?
8. What do you think will happen to the luminosity of the sun in 4 billion years after all the hydrogen is used up? What type of star will it become?