Classified Stars

Objective:	To explore the similarities of stars through a Hertzsprung-Russell diagram.

Grade Level: 9-12
Subject(s): Space Science
Prep Time: < 10 minutes
Duration: 30 minutes
Materials Category: None

National Education Standards	
Science	1b, 5d
Mathematics	
Technology (ISTE)	
Technology (ITEA)	
Geography	

Materials:

- Student Sheets
- Rulers (optional)
- Colored pencils or crayons (optional)

Related Links:

Imagine the Universe: Life Cycle of Stars
http://imagine.gsfc.nasa.gov/docs/teachers/lifecycles/Imagine2.pdf

Supporting NASAexplores Article(s):

Staring at the Sun
http://www.nasaexplores.com/show2_articlea.php?id=05-102

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Teacher Sheet(s)

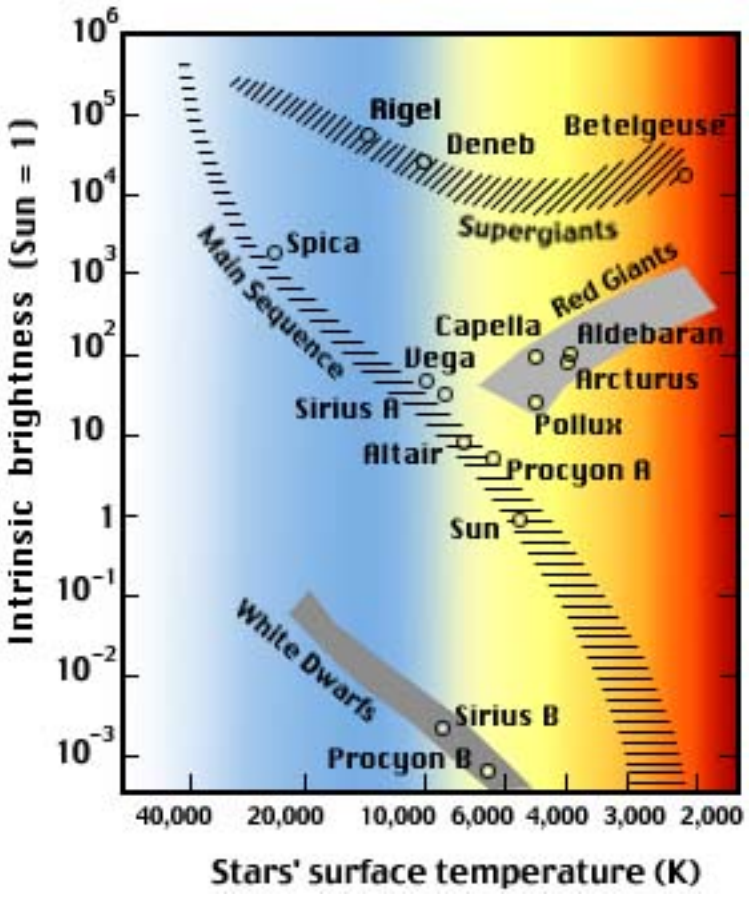
Pre-lesson Instructions

- Duplicate the Student Sheets (one per student).
- If needed, provide rulers to students to aid in reading the diagram.
- If desired, provide colored pencils or crayons for students to use on the Students Sheets.

Background Information

At the beginning of the 1900's, two astronomers, Danish Ejnar Hertzsprung and American Henry Russell, determined a pattern in the life of stars. They arranged stars on a chart according to their color and brightness. The most amazing thing is that they did not even know one other, and did their experiments completely independent of each other. Therefore, this chart is called the Hertzsprung-Russell (HR) diagram.

The diagram shows you how the sizes and colors of stars change with brightness and temperatures. The largest stars in the galaxy are found near the top; the smallest stars are near the bottom. The bluest stars appear on the left, and the reddest stars on the right. The stars that appear near the top of the chart are the brightest and those toward the bottom are the faintest. The hottest stars are plotted at the far left and the coolest stars appear at the far right. Of course, this diagram does not show how the stars would appear to you while gazing into the night sky. The absolute magnitude and luminosity are used for that. They give you the relative brightness based on all of the stars being the same distance away from the earth.



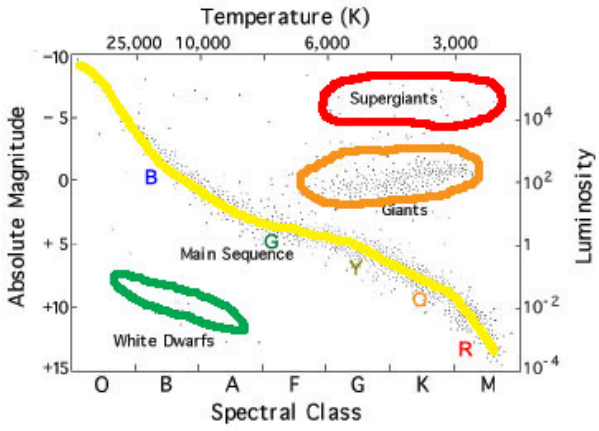
On this diagram, you do not see all of the individual stars. Since there are so many stars, only a few were actually scattered around and along each of the areas that you see. The four major star types are white dwarf, main sequence, giant, and supergiant, but there are many groups of stars that fit within each type. Each star is also classified by its spectral class. Each star has a unique composition, which is noted in its spectral class. The different spectral classes are OBAFGKM, where O are the bright, hot, blue stars, and M are the dim, cold, red stars.

Guidelines

1. Read orally the 9-12 NASAexplores article, "Staring at the Sun."
2. Distribute the Student Sheets.
3. Have students read about the HR diagram.
4. Instruct students to answer the questions based on the information and diagram given.

Discussion / Wrap-up

- Ask the students, "What makes one star different from another, besides its position in the universe?" *Some possible answers may be: mass, size, color, temperature, brightness, lifespan, age, and activity.*
- Ask the students, "Which star is hotter: a blue one or a red one?" *The blue star is hotter than the red one. They will find the answer during the lesson. This can be a great pre-test and post-test question.*
- Answers to the questions:
    - *a) An M star is red.*
    - *b) It is a K class star.*
    - *c) Possible answers for this could be: F and G; A, F, and G; F, G and K.*
    - *d) Supergiants are -5 to -10 absolute magnitude.*
    - *e) Most stars are main sequence stars.*
    - *f) Our sun would have a temperature range of 4,500 to 6,000 Kelvin, a luminosity range of 0.1 to 5, and an absolute magnitude range of +4 to +7.*
    - *g) Here is how their HR diagram might look:*



Extensions

- None

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Student Sheet(s)

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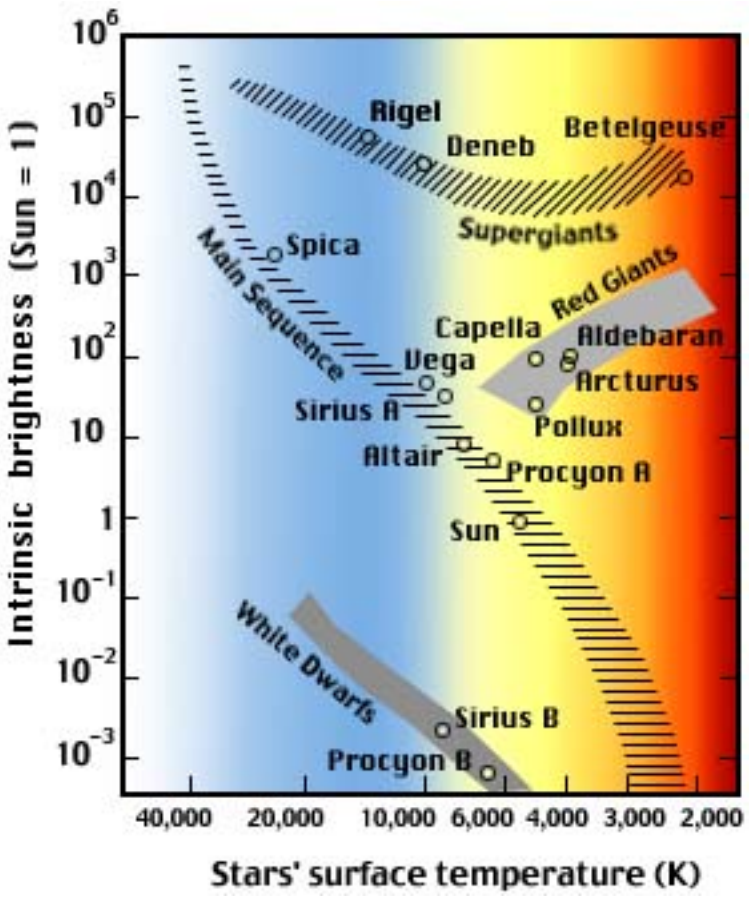

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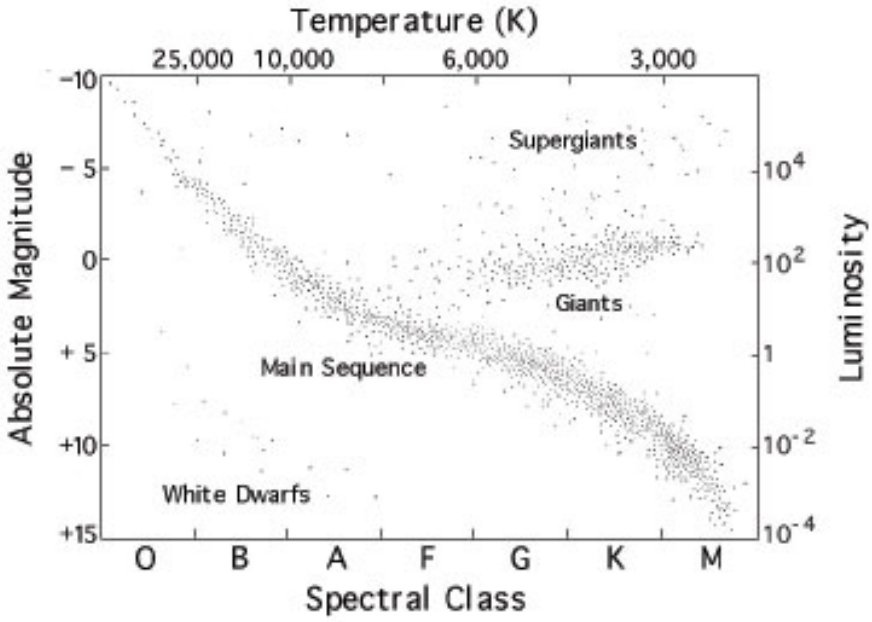
Procedure

1. Below is an HR-diagram.



2. Answer the following questions:
    a. What color would an M class star be?

    b. If a star has a temperature of 3,700 Kelvin and a luminosity of 0.1, what is its spectral class?

    c. If a star has an absolute magnitude of +5, what is (are) the possible spectral class (classes)?

    d. What range of absolute magnitudes would you expect a supergiant star to be?

    e. If you were to look at the sky at night, what type of star would you most likely see? To help answer this, draw a line through the pattern of the main sequence stars. Draw a circle around all of the white dwarf, supergiant and giant stars. When completed, you should have one wavy line and three ellipses (ovals).

    f. Our sun has a spectral class of G. What are the temperature, luminosity and magnitude ranges for our sun?

    g. If available, shade in the main sequence stars with the appropriate color. Otherwise, put an R (red), O (orange), Y (yellow), G (green), and B (blue) along the line you drew for question e.