

Space Odyssey Online Teacher's Guide

Stellar Classification

Previsit Activity for Deep Space



courtesy USDA

Grades 9- 12
CDE Standards
Science: 4.4
Math: 1,2,6

Preparation and Materials

Estimated Preparation Time: 10 minutes

Estimated Activity Time: 45 minutes

Materials

Graph paper

Student activity sheet

Pencils

Calculators

HR diagrams

Learning Goals/Objectives

Students will

- Calculate the luminosity of stars given their magnitudes
- Plot stars on an HR diagram
- Compare plotted diagram to a real HR diagram

Connection to *Space Odyssey*

Students can learn about stars at our Life of a Star interactive in *Space Odyssey*.

Here they will choose a star based on its mass and learn about its life cycle.

Knowing how the HR diagram works will help students predict what will happen to a star during its life cycle. To find out more information, students can contact one of our Museum Galaxy Guides.

Advanced Preparation

Make copies of student activity sheet for each student in your class.

Classroom Activity

1. Familiarize your students with the HR diagram. Give them the vocabulary they need to be successful in this activity. You may also wish to mention that the HR diagram has been used historically to determine what happens to stars as they are born, evolve, and die.
2. It is also important for students to understand that because stars lie in very defined regions on the diagram, we are able to use it to determine the distances to those stars on the basis of their spectral type, luminosity, and magnitude.
3. You may wish to teach your students the mnemonic to remember the order of the spectral classes: Oh be a fine girl, kiss me.

4. Teach students the following equation to determine stellar luminosity, as defined by the Sun 's luminosity:

$$M_{\text{Sun}} - M_* = 2.5 \log L_*/L_{\text{Sun}}$$

5. Help students prepare their graph paper for successful plotting of their stars.
 - a. Along the x axis, students will label spectral types in the following order from left to right: O5, B0, B5, A0, A5, F0, F5, G0, G5, K0, K5, M0, M5. Have students leave space between each label to accommodate for spectral types not between 0 and 5.
 - b. Along the y axis, students will label luminosity in the following order from top to bottom: 10^6 , 10^5 , 10^4 , 10^3 , 100, 10, 1, 0.1, 0.01, 10^{-3} , 10^{-4} , 10^{-5} , 10^{-6}
6. Give students the activity sheet. Have students calculate luminosities and plot stars on their graph.
7. Assemble your students back into a group. Have them compare their charts to an HR diagram. Some questions for them to consider during your discussion include
 - a. What do they notice that is similar between the two charts?
 - b. What do they notice is different between the two charts?

Variations/Extensions

1. If you have access to Starry Night Pro, have students use the program to plot the HR diagram of the visible sky at night. Ask students to research and explain why that diagram looks so much different than the HR diagram that they are used to seeing.
2. Research to find the answer to the following questions: Which stars are most common in our galaxy? Which stars are rare? Based on what you know about stellar evolution, why should this be expected?

Resources

Books

Bennett, Jeffrey, Megan Donahue, Nicholas Schneider, and Mark Voit. *The Cosmic Perspective*. San Francisco: Addison Wesley, 2002.

Web sites

<http://cse.ssl.berkeley.edu/SegwayEd/lessons/StarTemp/>

<http://www.aw-bc.com/info/bennett/images/hrdiagram.jpg>

<http://www.smv.org/jims/l6a.htm>

<http://physics.njit.edu/~dgary/321/Lecture6.html>

Name: _____

Stellar Classification

Calculate the luminosity of the following stars using this equation: $M_{\text{Sun}} - M_* = 2.5 \log L_*/L_{\text{Sun}}$, where $M_{\text{Sun}} = 4.8$; M_* = magnitude of the star; and $L_{\text{Sun}} = 1$ solar luminosity. Find L_* . Complete the chart. Then plot your stars on your graph paper.

Star	Spectral Class	Absolute Magnitude	Calculated Luminosity
Sun	G2	4.8	
Sirius	A0	1.8	
Canopus	A9	-5.5	
Vega	A0	0.6	
Arcturus	K2	-0.1	
Alpha Centauri A	G2	4.5	
Rigel	B8	-6.7	
Altair	A7	2.3	
Agena	B1	-5.5	
Achernar	B3	-2.8	
Spica	B1	-3.6	
Fomalhaut	A3	1.8	
Castor	A2	0.6	
Alpha Centauri B	K1	5.6	
Alpha Centauri C	M5	15.2	
Procyon	F5	2.7	
Luytens's Star	M3	11.9	
Kapteyn's Star	M1	11.0	
Barnard's Star	M5	13.2	
Regulus	B7	-0.6	
Aldebaran	K5	-0.5	
Pollux	K0	1.2	
61 Cyg B	K7	8.4	
70 Oph A	K0	5.6	