

# Spectroscope

[http://stardate.org/teachers/plans/plan.php?lp\\_id=2](http://stardate.org/teachers/plans/plan.php?lp_id=2)

### Focus on Inquiry

The student will make inferences and explanations based on observations recorded using student-made spectroscopes during an investigation of flame color.

### Lesson Overview

Students will build a spectroscope and interpret their observations by applying concepts of conservation of energy and properties of matter, as well as observe all three kinds of spectra: continuous, emission, and absorption.

<b>Duration</b> 55 minutes	<b>Setting</b> Classroom	<b>Grouping</b> Cooperative groups of 3-4 students	<b>PTI Inquiry Subskills</b> <b>2.5, 3.2, 5.2, 5.3, 5.8, 7.3</b>
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Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
<i>Engage</i>	5 min	None	None	2	Students read the StarDate radio script about the electromagnetic spectrum.
<i>Explore</i>	20 min	2.5, 3.2, 5.8	None	3	Students build a spectroscope and use it to interpret their observations.
<i>Explain</i>	10 min	5.2, 5.3	None	3	Students propose explanations based on their observations.
<i>Expand</i>	10 min	5.2, 5.3	None	3	Students reexamine their spectroscopes and make inferences and explanations based on their observations.
<i>Evaluate</i>	10	7.3	None	3	Students compare and contrast two stars based on their temperature and color differences.

**Level of Student Engagement**

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

### National Science Education Standards – Inquiry

Use appropriate tools and techniques to gather, analyze, and interpret data.  
Think critically and logically to make the relationships between evidence and explanations.  
Communicate scientific procedures and explanations.



### National Science Education Standards – Earth Science

The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle. Seasons result from variations in the amount of the sun's energy hitting the surface, due to the tilt of the earth's rotation on its axis and the length of the day.

### Louisiana Grade Level Expectations – Inquiry

- Gr. 8, Inquiry GLE#6 - Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3)
- Gr. 8, Inquiry GLE#12 - Use data and information gathered to develop an explanation of experimental results (SI-M-A4)
- Gr. 8, Inquiry GLE#14 - Develop models to illustrate or explain conclusions reached through investigation (SI-M-A5)
- Gr. 8, Inquiry GLE#16 - Use evidence to make inferences and predict trends (SI-M-A5)
- Gr. 8, Inquiry GLE#19 - Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)
- Gr. 8, Inquiry GLE#23 - Use relevant safety procedures and equipment to conduct scientific investigations (SI-M-A8)



### Louisiana Grade Level Expectations Earth Science

- Gr. 8, GLE#37 - Use a Hertzsprung-Russell diagram and other data to compare the approximate mass, size, luminosity, temperature, structure, and composition of the Sun to other stars (ESS-M-C1)

## **Materials List**

### **Whole Class**

- Incandescent light bulb (60-100 watt frosted) and base
- Optional: String of clear holiday lights
- Fluorescent light (single bulb)
- Transmission grating slides (35mm slide)
- Manila folders
- Black construction paper (9 x 11 inches)
- Optional: Glo-Doodler (by Colorforms) -- a toy writing tablet with a hot pink plastic sheet that "glows" when you write on it. It also strongly absorbs green light and emits yellow, orange and red.

### **Per Spectroscope**

- Half of a manila folder: cut a whole manila folder along the fold to produce two 8 x 11 sheets.
- 1 sheet of black construction paper
- 2 small (20 mm or 3/4 inch) binder clips
- 2 index cards (3 by 5 inch size) to make the adjustable slit
- Clear tape and 2 rubber bands
- 1 Transmission grating slide (35mm slide)

## **Advance Preparation**

1. Obtain materials listed in the materials list.
2. Download and print the Teacher Guide from the lesson website.
3. Follow the "Preparation" section instructions on the Teacher Guide to prepare for this lesson.
4. Download and print the StarDate radio program scripts for students to read.
5. Download and print copies of Student Worksheet for each student from the lesson website.

## **Other Information**

### **Objectives**

The learner will:

- observe the varying color of a flame.
- infer temperature of the varying colors.
- use an HR Diagram to determine actual temperature of stars.

### **Prior Knowledge Needed by the Students**

- None

### **Procedure**

#### ***Engage***

1. Follow the "Engage" section of this lesson.
2. Optional – You may choose to have one large candle set-up for the whole class activity.

#### ***Explore***

1. Discuss safety procedures with your class.
2. Follow the "Explore" section of the lesson, giving students adequate time to complete the activity.

#### ***Explain***

1. Follow the "Explain" section of the lesson.

#### ***Expand***

1. Follow the "Expand" section of the lesson plan.

**Evaluate**

1. Have students create a complete chart for the temperature and color of the two stars shown below in the chart.

Star	Temperature	Color	Size
Sun			
Betelgeuse			

2. Have students answer the following questions:
  - a. Why do most scientists say that our sun is an average star?
  - b. How are stars grouped?
  - c. Why are white dwarfs and red giants not found in the main sequence?
  - d. How is the color of a star and its age related?
3. Give students two different star names and have them compare and contrast them based on their temperature, color, and size.

**Blackline Master**

Student worksheet is found on lesson website.

**Supplementary Resources**

**Interactive HR Diagram**

[http://sunshine.chpc.utah.edu/labs/star\\_life/hr\\_interactive.html](http://sunshine.chpc.utah.edu/labs/star_life/hr_interactive.html)

This website contains an interactive HR diagram that is very useful for students once they have become familiar with the HR diagram and its uses. There is also an interactive quiz on this website.