On the Spot

Hands-On Activity

Background Information
When sunlight falls on the eyes, the brain registers it as a visible image. But there is an invisible part that we miss because human vision is sensitive only to a narrow range of wavelengths. In the 18th century, astronomers William Herschel and Johann Ritter proved the existence of invisible waves of sunlight. Herschel proved the existence of infrared waves, and Ritter proved the existence of ultraviolet rays.

The only way to detect this invisible radiation is to use special instruments. The spectrometer collects different wavelengths of light and analyzes them. In this activity, you'll reenact Herschel's and Ritter's experiments, seeing for yourself evidence that radiant energy exists above and below the visible portion of the spectrum.

What You Need

- prism
- light source
- three weather thermometers
- pencil and felt-tip pen
- several sheets of blueprint paper
- one quart (about 1 liter) of household ammonia
- flat pan

What To Do

1. Start with William Herschel's experiment. Allow the three thermometers to register the air temperature where the experiment will be done for about five minutes. Carefully note the temperatures and record them on the attached worksheet.

2. Using the prism, create a spectrum with sunlight as the source.

3. Place the first thermometers in the violet range of the spectrum, the second thermometer in the spectrum's center, and the third thermometer barely beyond the spectrum's red end.

4. Leave the thermometers in the spectrum for at least five minutes, moving them carefully as the sunlight moves the spectrum. Temperature changes may be slight, so observe carefully.

5. On the worksheet, record the final temperature readings in the chart, and answer questions 2 and 3.

6. Now re-create Johann Ritter's experiment. Using sunlight from an open window and the prism, create a spectrum on a horizontal surface. (Glass blocks most ultraviolet light.) Make sure the prism is resting on a stable object so that it won't move.

7. Working quickly so that the paper is not exposed to too much light, cut a piece of blueprint paper about four times larger than the spectrum.

8. Place the paper beneath the spectrum. Then, outline the area covered by the spectrum with a felt-tip pen and label the violet end.

9. Put just enough household ammonia in the bottom of the pan to cover the bottom to a depth about 0.5 inches (1 cm). Place the pan near an open window.

10. Take the blueprint paper from underneath the prism, and hold it over the ammonia so the fumes process the paper.

11. Answer questions 4 and 5 on the worksheet.

Worksheet
On the Spot

Name_____

Herschel's Infrared Experiment

1. Record the initial and experiment thermometer readings below.

Thermometer	Reading	Temperature
1	Initial Air	
2	Initial Air	
3	Initial Air	
1	Violet Range	
2	Spectrum Center	
3	Beyond Red Range	

2. Why was there an increase in temperature beyond the red end of the spectrum?

3. What does this demonstrate about what exists beyond the visible red?

4. What changes do you see in the area just beyond the violet end?

5. What does this demonstrate about the area beyond the violet end of the spectrum?