remove thermometers from the spectrum or block the spectrum while reading the temperatures. If the colors move away from the bulbs or into the "beyond-red" bulb, you can note how much the Sun moved during the experiment, and repeat the experiment making sure the last bulb does not enter into light or move too far away from the red. The experiment is best done during the middle of the day in order to reduce this effect.

▼ If the box is placed so that the prism is far from the projected spectrum, the spectrum will spread out wider, and the different temperatures may be easier to measure. However, the thermometers will receive less solar energy and the temperature readings will be lower. The set-up described here is deemed to be the best way to negotiate the variables—but you and the students may want to experiment with different conditions.

▼ The differences between temperatures depend on the width of the spectrum, which in turn depends on several variables such as the time of the day and the size of the box. Regardless, the general trend of the temperatures going up from the blue end of the spectrum to the infrared should show up for all measurements.

▼ If you do not have access to the number of thermometers needed in this lesson, you can use thermal strips to illustrate the rise in temperature along the spectrum. However, by using this method, Benchmark 12C is no longer met, and the quantitative aspect of the lesson is lost.

Warm-up & Pre-assessment

1. Talk with students about sunlight. What is it? What do they know about it?

2. Discuss rainbows: What is a rainbow? How is it created?
Tell the students rainbows are created when sunlight passes through water droplets in the air and is broken into its constituent colors. Rainbows allow us to see all the colors of the sunlight, instead of just the combined light, which we see as white light.

3. Show a picture of a visible light spectrum—or a rainbow—with the constituent colors. Explain what a spectrum is—a display of the colors of which light is composed, arranged in order of wavelength. Explain how blue light has a shorter wavelength than red light. Ask if anyone knows why

the light breaks into separate colors when it passes through a water droplet or a glass prism. Explain that by passing through material light bends, and explain how colors of varying wavelengths bend different amounts.

4. Ask students if they think there are any other differences in the colors we see when sunlight passes through the prism. Write them down and discuss how they could test for any of the differences. (Make sure one of the ideas is the difference in intensity of the colors, or the resulting temperature of the colors.) Discuss the practicality of their experiments and whether they would detect the desired properties. Point out at some time that one way we feel sunlight is by the energy it carries—when we place our hand in sunlight it feels warmer than if our hand is in the shade.

5. Guide the students or introduce them to the idea of measuring temperatures in different parts of the spectrum to see if sunlight has an effect. Ask them where they should put two thermometers to compare different parts of the spectrum, and suggest that they have a third thermometer outside of the spectrum as a "control." The idea is to let the students discover for themselves that there is something going on outside of the visible spectrum. It is a good idea to also place a fourth thermometer completely away from the spectrum in a shaded area of the box as an additional control.

6. Have the students write down a hypothesis, or a prediction (based on the students' knowledge of the properties of light) about what will happen to each of the thermometers.

Teaching Tip

Use a KWL Chart to determine what students KNOW about light and rainbows; what they WANT to find out; and what they have LEARNED after conducting the experiment. This is a good way to connect new ideas with old ideas, and may increase students' retention and understanding of the new concepts.