

The Herschel experiment



This experiment was carried out for the first time by astronomer William Herschel, in 1800 in England.

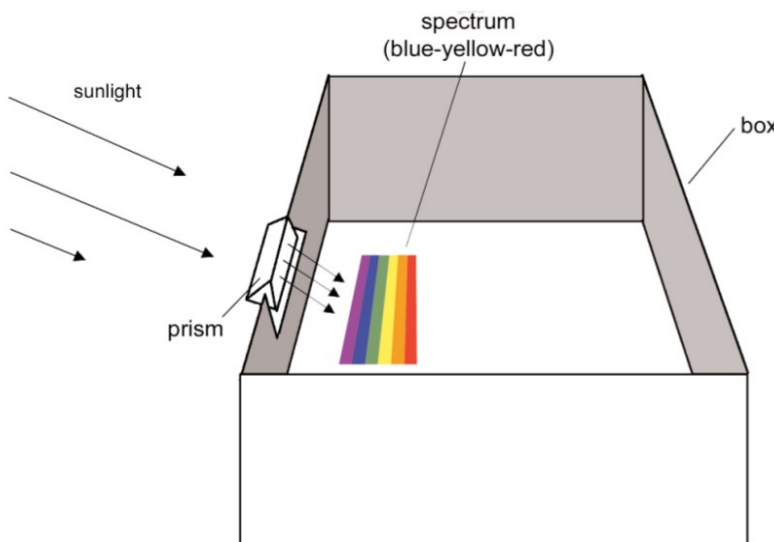
Your group will construct a device to measure temperatures in different parts (colors) of the spectrum of sunlight.

Materials per group:

- ▼ A glass prism
- ▼ 4 thermometers with blackened bulbs
- ▼ Scissors
- ▼ A blank sheet of white paper
- ▼ a cardboard box
- ▼ Tape
- ▼ support jack

You will construct a device like the one shown in Figure 1.

Figure 1.



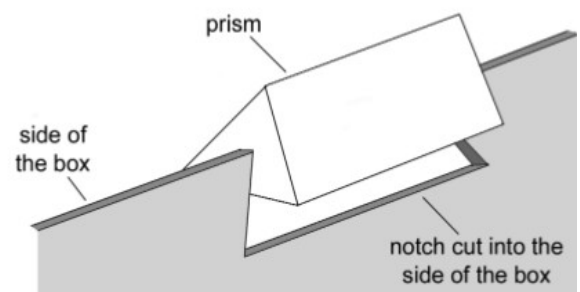
The experiment device.

Place a white sheet of paper in the bottom of a cardboard box.

Procedures

Preparing the device

- 1) Put the white sheet of paper to the bottom of the box.
- 2) Cut a notch* in the edge of the box. Make sure the notch is just the right size for the prism to fit tightly while still allowing it to rotate. You can achieve this by making the side cuts so that the space is slightly less than the length of the prism, while the bottom cut is slightly deeper than the width of the prism. Now slide the prism into the notch.



- 3) Take the box to the experiment site.

WARNING: Do not look directly at the Sun!

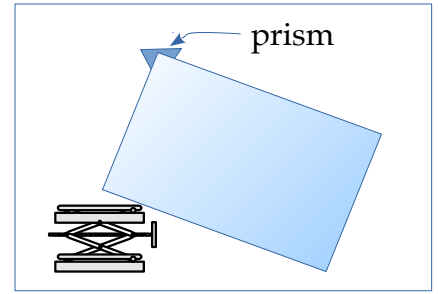
Looking for even a few seconds can cause permanent damage to the eyes!

Note that sunglasses do not provide an adequate safeguard against looking directly at the Sun.

*Notch = encoche

4) Set down the experiment device and place the thermometers so that they are in the shade inside the box. Let the box sit for five minutes. Check the temperature of the thermometers and record the result in the data table below.

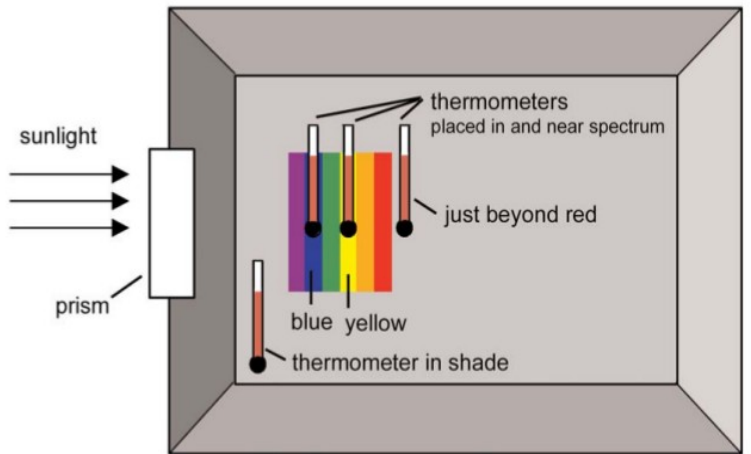
5) Place the box so that the side with the prism faces the Sun. Lift the prism side of the box with a support jack so that you get a nice, wide spectrum on the sheet of paper.



6) Place the thermometers on the spectrum so that one thermometer is on the **blue** band, one is on the **yellow**, and the third one is **just beyond the red** end of the spectrum where there is no visible light. Leave the fourth thermometer in a **shaded area** of the box.

Tape the thermometers to the bottom of the box so that they do not move during the experiment, and they are easy to read. Be careful not to move the box while you tape down the thermometers!

Note that the Sun moves during the experiment. Make sure that each thermometer remains on its own color.



After about 5 min, record the temperatures in the data table.

| Temperature in the shade | Temperature in the color _____ | Temperature in the color _____ | Temperature beyond the red |
|--------------------------|--------------------------------|--------------------------------|----------------------------|
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Answer the following questions.

1. Compare the temperature in the shade to the other temperatures. Conclusion?

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2. Which thermometer recorded the highest temperature? The lowest?

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3. What does this tell you about the sunlight's radiation beyond the visible light spectrum?

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4. What was Herschel's discovery with this experiment?

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