

# Discovering Color With a Prism

## Objective



The student will observe what happens to light as it passes through a prism. The student will experiment with white light that is composed of a continuous band of colors. The band of colors appears in the same pattern as the colors of a rainbow.

## Theory



This experiment was first done by Sir Isaac Newton (1642–1727). Newton let a beam of sunlight pass through a glass prism and observed the white light spectrum. In a vacuum, light of all colors travels at the same speed. When light passes through a material, such as glass or water, the red light at one end of the spectrum travels faster than the violet light at the other end of the spectrum. This difference in speed causes a change in the direction of light when going from air to glass and from glass to air. This change of direction is called refraction, and is greater for violet light than for red light. The speed of light in the glass depends on the color; thus we get a continuous band as in the rainbow.

## Science and Mathematics Standards



### Science Standards

- Science as Inquiry
- Physical Science

### Mathematics Standards

- Problem Solving
- Communication
- Connection
- Computation/Estimation
- Measurement

## Materials



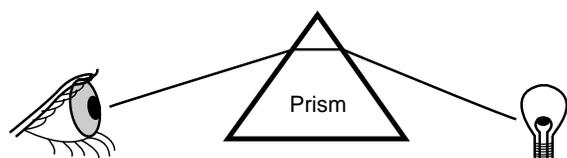
- glass or plastic prism
- light sources, including an incandescent lamp, fluorescent lamp, cadmium lamp
- a prism made out of acrylic plastic (see page 40) (optional)



### Procedures



1. Hold the small prism with one finger at the top and one finger at the bottom. Position the prism 2 to 3 inches in front of your eye. Look through one side of it in the direction of the light source as shown below.
2. First, look at the incandescent lamp. Observe the colors that are visible as you view this lamp.
3. Next, view the fluorescent lamp and then the cadmium lamp. (The kinds of light source may vary.)
4. Record your observations in the next section.



### Observations, Data, and Conclusions



1. Observe the colors from the three different light sources and list them in order in the chart below. Start with the first color on the left and list them as you see them. (Hint: ROY G. BIV—red, orange, yellow, green, blue, indigo, violet)
2. What differences and/or similarities did you observe in each light source when looking through the glass, plastic or acrylic plastic?
3. Were the colors always in the same order?
4. Were the colors always in bands?
5. Did the bands always form the same shapes?

Hint: An artificial light source will not transmit the complete spectrum unless it is a white light source.

Light Source	Colors
Incandescent Lamp	
Fluorescent Lamp	
Cadmium Lamp	



## Additional Activities

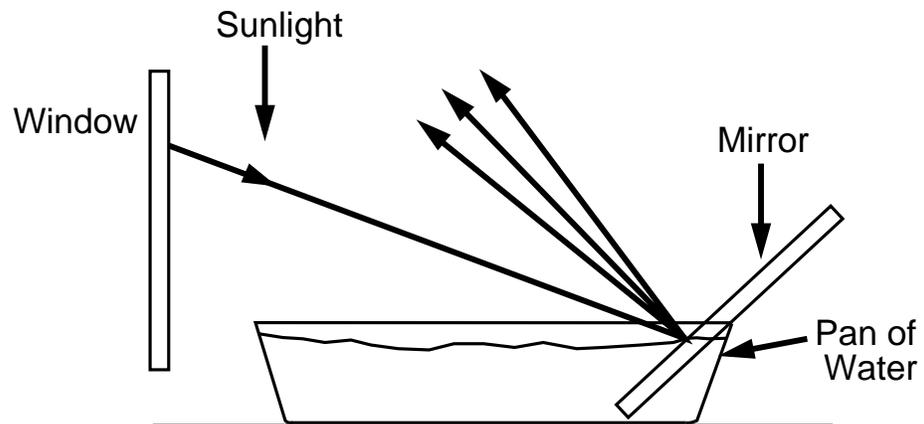


Repeat the previous activities with a high quality prism (highly dispersive). What differences do you observe between the acrylic plastic or plastic prism and the prism made out of optical quality glass?

## Junior Home Scientist



You can make a prism at home by placing a flat mirror in a shallow pan of water. Put the pan of water in a window where the Sun can shine into the water. (See the figure below.) The sunlight reflected from the mirror can be seen as a rainbow of colors reflected on a wall.



## Fabrication of a Prism From Acrylic Plastic

### Materials



- acrylic plastic about one-half inch thick.
- Hacksaw with fine blade or band saw, very fine sandpaper (400 or 600 grit, possibly available at auto paint stores or auto body repair shops), very fine file, craft felt, silver polish, one small board with two tacks (optional).

### Procedures



1. Place the plastic in a bench vise and cut it to shape with a fine-blade hacksaw. The angles should be as near 60 degrees as possible. File the cut edges smooth.
2. Put a piece of fine sandpaper (400 or 600 grit) on a flat surface. Rub the cut face or edge of the prism on the sandpaper holding the face or cut edge flat against the paper in order to get a nice flat face. Continue sanding and using finer and finer sandpaper until the surface is smooth, free of scratches, and has a translucent appearance.
3. Now the plastic is ready to polish to make the surface transparent. The polishing pad is a 2-inch  $\times$  4-inch piece of craft felt. Tack the felt to a board or hold it stretched on a flat surface. Wet the felt with water and put a small amount of silver polish on the felt. Rub the plastic on the felt strip. Expect to spend one-half hour or more to polish a single edge or face of the plastic. When finished, wet the plastic with water and pat it dry so the surface will not be scratched.

