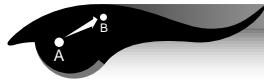


Making a Kaleidoscope

Objective



The student will experiment with multiple reflections in mirrors.

Theory



When three rectangular mirrors that are the same size are arranged in an *equilateral triangle* (See Glossary, page 73), rays of light from an object form multiple images due to reflections from the mirrors. The equilateral triangle formed by the mirrors has three equal angles of 60 degrees, and the sides have equal lengths.

Science and Mathematics Standards



Science Standards

- Science as Inquiry
- Physical Science

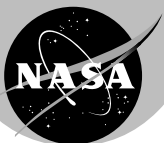
Mathematics Standards

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

Materials



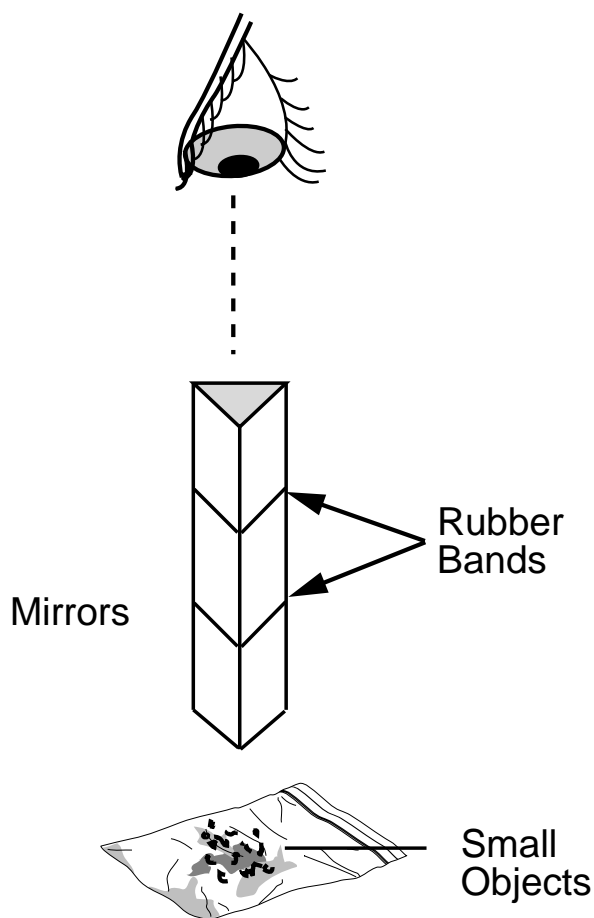
- 3 flat rectangular mirrors of equal size
- rubber bands
- Transparent tape
- small items to put in the kaleidoscope (glitter, confetti, ect.)
- a piece of white cardboard
- resealable bag



Procedures

A-B
C-D

1. Place the three mirrors together as shown, using the long side of each mirror. Put a few pieces of tape on the backs of the mirrors to hold them together.
2. Put two of the rubber bands around them to hold them securely together.
3. Use this simple kaleidoscope to do the following activities.
 - A. Hold the kaleidoscope in your hand and look through it at objects around the room.
 - B. Hold the kaleidoscope above the white cardboard and look down inside it. Put some object such as a coin, or the small pieces of colored paper in the resealable bag (keep them in the bag) on the white cardboard inside the kaleidoscope. Observe the images reflected in the mirrors.



Observations, Data, and Conclusions

1. How many images did you see?
2. Did the images appear to be the same size as the object?
3. How were the objects oriented with respect to the reflected images?

Junior Home Scientist Project



Construction of a Large Kaleidoscope Using PVC Pipe (Adult Supervision Is Required at All Times)

Materials



- 1 piece of PVC pipe 10 centimeters (about 4 inches) in diameter and about 16 inches long
- 12-inch mirror tile
- hack saw with fine blade
- 1 glass cutter
- sandpaper
- flat black spray paint
- white glue
- epoxy glue
- cardboard
- foam rubber used for packing and shipping
- scissors or utility knife
- thick leather gloves
- red, blue, or yellow paint (optional)
- contact paper (optional)

Procedures



1. Buy or cut to size the 16-inch length of PVC pipe. Sand the edges and corners of the pipe until they are smooth.
2. Use the flat black paint and spray the inside of the pipe. Leave the paint to dry overnight. Later, paint the outside of the pipe any color or design that you desire. Contact paper could also be used.
3. While wearing leather gloves, cut the 12-inch square mirror tile into 3-inch strips. Sand the edges of the mirrors.
4. Position the three strips of glass close to one end of the PVC pipe. Place the mirrors to form three 60-degree angles.
5. Use the epoxy to glue the mirrors inside the pipe. Pack foam behind each mirror to provide stability.
6. Cut a circular piece of cardboard to fit the inside diameter of the pipe. Cut a 1-inch hole in the middle of the cardboard.



7. Position this circular cardboard piece into the end of the PVC pipe and glue it with white glue to form the eye piece of the kaleidoscope.
8. Now cut another circular cardboard piece to fit the opposite end of the pipe. In the center of the cardboard cut a triangle with three 60-degree angles.
9. Match this triangular opening with the opening formed by the three mirrors and use the white glue to glue the cardboard into place.

Variations:

It is also possible to make a kaleidoscope using two mirrors positioned at a 20-degree angle. You may fill in the third side with a piece of mirror tile. Experiment with various angles of the mirrors and locations of the eyepiece holes. Kaleidoscopes made with smaller angles are more interesting.

