

Kaleidoscopes

Overview: In the simplest sense, a kaleidoscope is a tube lined with mirrors. Whether you leave the end open or tape on a bag of beads is up to you, but the main idea is to provide enough of an optical illusion to wow your friends. Kaleidoscopes are an example of using light reflectors, which don't give off any light, but still bounce light back to your eyes.

The first kaleidoscopes were constructed in 1816 by a scientist while studying polarization (you'll learn more about polarization in a future lesson). Kaleidoscopes were quickly picked up as an amusement gadget by the public and have stayed with us ever since. Today you will be making your very own kaleidoscope.

What to Learn: Kaleidoscopes are an example of using light reflectors, which don't give off any light, but still bounce light back to your eyes. Light is reflected from mirrors and other surfaces.

Materials

Mirror Kaleidoscope

- 4-5 mirrors, all the same size
- tape
- scissors

Mylar Kaleidoscope

- Mylar
- index card or piece of cardboard
- hot glue gun
- scissors

Experiment

Mirror Kaleidoscope

1. Lay out a strip of tape, sticky side up.
2. Center one mirror on the tape with its reflective side pointing up.
3. Attach the second and third mirrors close to the first at 90-degree angles. One will be on the left; the other will be on the right.
4. Rip the excess tape off of one end and then carefully tape together the three identical mirrors, forming a triangular shape. Make sure that the reflective surface is on the inside.
5. Tape all the rough edges very well and peek through the opening as you walk around.
6. Look at the images the mirrors make on the inside while pointing it at various objects.

Mylar Kaleidoscope

1. Fold the index card into three equal pieces in order to make it a triangular tube.
2. Make sure your Mylar is the same size as each fold of the tube. Trim as needed.
3. Glue the Mylar down to the cardboard.
4. Fold your tube again, just making sure that the edges are as crisp as possible.
5. Tape lengthwise along the top edge of your triangular tube.
6. If you are making both kaleidoscopes, compare the reflections you see in this longer tube with those you saw in the mirror kaleidoscope.

Kaleidoscope Data Table

Number of Mirrors Used	Type of Mirror (Mylar or Glass, Flat or Curved, Shape and Size)	How were the Mirrors Arranged? (Triangle, Square...)	Effect on Image (What did it look like?)

Reading

A candle is a light source (or source of light waves). So are a campfire, a light bulb, and the sun. An apple, however, reflects light. It doesn't give off any light on its own, but you can see it because light bounces off the apple into your eye. If you shut off the light, you can't see the apple. In this same way, the sun is a light source, and the moon is a light reflector.

Light can be reflected off the surface of different materials. The incident angle of the light (the angle the light hits the material) is always the same as the reflected angle of light. We're going to build a kaleidoscope that uses mirrors to reflect light.

Kaleidoscopes use light from a source, such as the lights in your room or the sun in the sky, and reflect the light back to our eyes. The reflections bouncing all around on the mirrors or Mylar make interesting shapes for our eyes to see.

There are many variations for this experiment. You can do both the mirror and Mylar kaleidoscopes, or simply choose one that works best with the materials you're able to find.

For the Mirror Kaleidoscope, you'll find that if you use only two mirrors, you'll get a solid background. Add a third mirror and tilt together into a triangle (as shown in the video) and you'll get the entire field filled with the pattern. You can place transparent objects at the end (like marbles floating in water or mineral oil) or just leave it open and point at the night stars.

By changing the size and shape of the mirrors, you can change the dimensional effect you see. Just be sure to look at the mirror surface, not the opening. You can also make mirrors wider at the bottom and narrower at the top (this is easier to do with the Mylar-cardboard mirrors). Use four or five mirrors instead of three in different combinations to get different effects. You can also change the length of the mirrors or use curved mirrors instead of flat by lining the inside of an oatmeal box with Mylar.

Exercises

1. What is a light source?
2. What is a light reflector?
3. Sketch an image of something interesting that you were able to see as the light reflected from the multiple surfaces of the kaleidoscope to your eyes:

Answers to Exercises : Kaleidoscopes

1. What is a light source? Please give an example. (a source of light waves – the sun, light bulbs, fire, etc. are all examples)
2. What is a light reflector? Please give an example. (A reflector does not emit light. Instead it bounces light off of it and reflects the light back to our eyes. Water, mirrors, the moon are all examples.)
3. Sketch an image of something interesting that you were able to see as the light reflected from the multiple surfaces of the kaleidoscope to your eyes.