

# RAFT IDEAS

**Topics:** Reflection, Prisms, Symmetry

## Materials List

- ✓ Clear plastic tennis ball container with lid, or equivalent
- ✓ Mylar
- ✓ Masking Tape
- ✓ Transparent plastic
- ✓ Cardboard
- ✓ Double-stick tape
- ✓ Colored materials, beads, paper clips, paper scraps
- ✓ Gift wrap or colored paper
- ✓ Optional: Die for 7.3 cm ( $2\frac{7}{8}$ " ) circle (Available at RAFT)

This activity can be used to teach:

Common Core Math:

- Symmetry (Grade 4, Geometry, 3)
- Angles (Grade 4, Measurement and Data, 5)

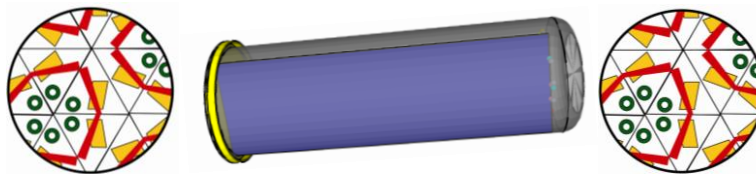
Next Generation Science Standards:

- Reflection (Grade 4, Physical Science 4-2)
- Waves are reflected, absorbed, or transmitted (Middle School, Physical Science 4-2)



# Tennis Ball Can Kaleidoscope

You Can Renew the View



This wonderful kaleidoscope can be constructed with materials that are easily available.

## Assembly

### Mirror System:

1. Cut three  $5\frac{3}{4}$  cm x 19 cm ( $2\frac{1}{4}$ " x  $7\frac{1}{2}$ " ) strips of cardboard, and three Mylar strips of the same proportions. In general, for a 3-mirror system, the width of each strip is 0.86 of the diameter of the tube; the length is  $\sim 2$ cm ( $\frac{3}{4}$ " ) less than the length.
2. Place very narrow pieces of double stick tape at each end of the cardboard strips. Carefully place the strips of Mylar over each of the cardboard strips and gently tap them on to form a smooth surface. Turn over and press hard on the ends.
3. Lay the three strips next to each other with the shiny side down, with a small gap between each strip. Use masking tape to attach the three strips to each other.
4. Fold the three strips into a triangular prism with the mirrors inside - tape together.
5. Test to see if it fits into your tennis ball container. If the prism is too big, take it apart and trim the width of the strips, then re-tape. If there is distortion, check the seams between the rectangles. Trim if necessary.

### Eyepiece

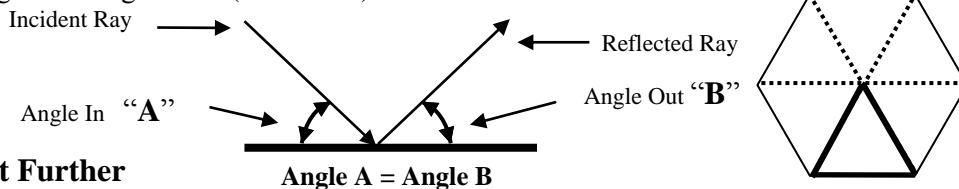
1. Cut out a hole 1 cm - 2 cm ( $\frac{1}{2}$ " -  $\frac{3}{4}$ " ) in the plastic lid of the tennis ball container.
2. On the inside of the lid, tape a small square of transparent plastic over the hole.

### Object Chamber

1. Cut a disc of clear plastic with a diameter slightly less than the inside diameter of the container - 7.3 cm ( $2\frac{7}{8}$ " ) for a tennis ball can. Check fit; trim if needed.
2. Put colored items on the bottom of the container. A few longer items (large paper clips, etc.) can help move the smaller colored items (pony beads, etc.) into view.
3. Place the clear disc in the tennis ball can. Use the mirror system to push the disc into the can. Stop when the top of the mirror system is flush with the top of the can. This will leave a chamber at the bottom of the can disc in which the colored items can move around. Place the lid on the container.
4. Look through the kaleidoscope and turn it. You can adjust or change the quantity, type, and size of material in the object chamber as many times as you wish!

## The Content Behind the Activity

Since their invention by Scottish scientist Sir David Brewster in 1816, kaleidoscopes have been amazing and entertaining young and old alike. Images from flat mirrors appear as the real objects, except they are reversed. A mirrored prism creates a series of reflections yielding beautiful, symmetric patterns. The general rule for a reflected ray is "angle in = angle out". (See below)



## Taking it Further

See RAFT Idea Sheets *Color Wheel Kaleidoscope* and *Hinged Mirror Kaleidoscope*.

**Web Resources** (Visit [www.raft.net/raft-idea?isid=490](http://www.raft.net/raft-idea?isid=490) for more resources!)