

# RAFT IDEAS

**Topics:** Light and Waves,  
Vision, Perception

## Materials List

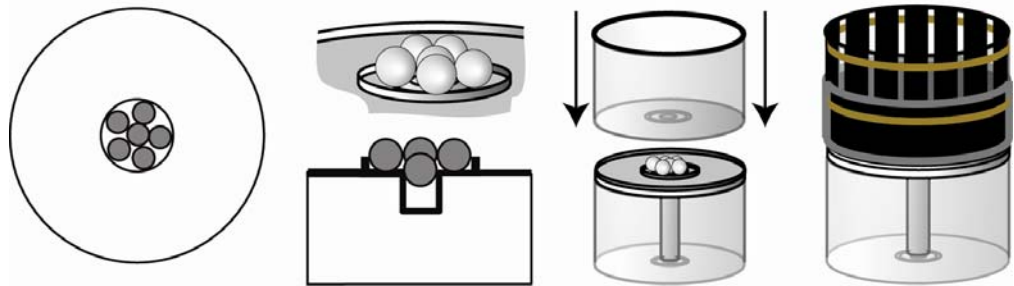
- ✓ Bulk CD container plus an extra bulk CD container cover (Note: only certain styles of bulk CD containers will have suitable molded openings and base rings)
- ✓ 6 Marbles with identical diameters
- ✓ Black paper
- ✓ 2 Large diameter rubber bands
- ✓ White paper
- ✓ Tape
- ✓ Optional: small stickers

This activity can be used to teach:

- Light (CA Science Standards: Grade 3, 2.a)
- Perception (CA Science Standards: Grade 3, 2.a)
- Light and Vision (CA Science Standards: Grade 7, 6.0)

## Pictures in Motion

Produce animation with an early motion picture device!



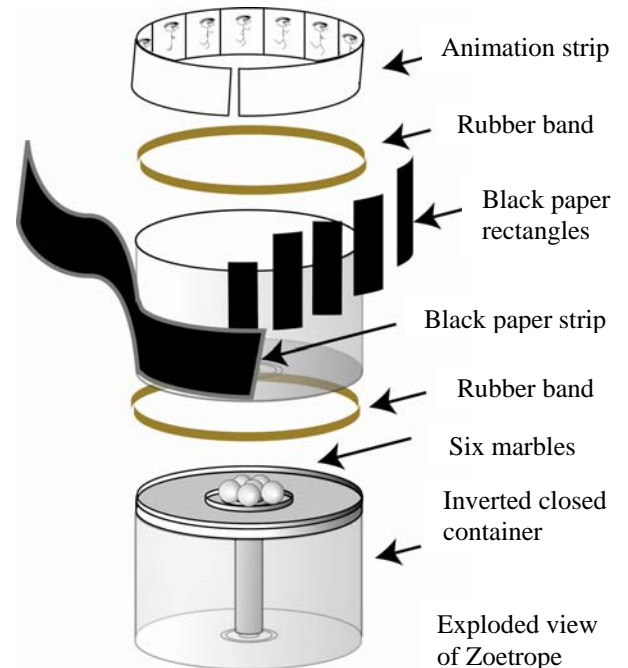
Create “motion pictures” by combining “persistence of vision”, student drawings, and a RAFTy version of an early motion picture maker - the Zoetrope!

### Assembly

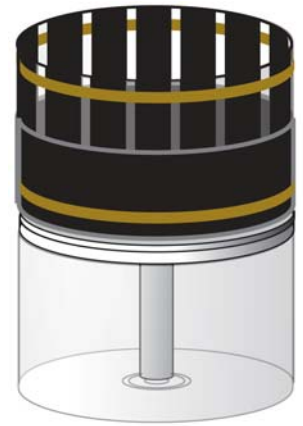
1. Invert a closed bulk CD container (cover with base/post).
2. Place a marble in the center hole (opening) of the bottom, and then place 5 marbles around the center marble. Contain the marbles within the molded ring.

3. Invert the 2nd bulk cover and place on the marbles as shown.
4. Spin the top cover. The cover should spin smoothly and for about 10 seconds. Not all bulk CD containers will have the required opening, molded ring and indentation to create a smoothly rotating device. The marbles’ diameter and roundness are also critical. If the top cover does not spin smoothly - try different marbles and/or a different brand of bulk CD container.

5. Cut a strip of black paper about 4 cm (1-1/2”) wide by 40 to 42 cm (16”) long (or tape short strips together). Wrap the strip around the lower part of the inverted top cover and secure in place with a rubber band. The rubber band should be placed near the top of the paper strip.
6. Cut 12 rectangles of black paper. The length of the rectangles should be about 8 cm (3”). The rectangle’s width can be calculated by measuring the circumference of the cover, subtracting 3.6 cm (1-1/2”), and then dividing by 12. The resulting width will be approximately 3 cm (1-3/16”). The width must be cut exactly as measured to provide the gaps in step 9.
7. Slide the 12 rectangles under the black strip wrapped around the cover.
8. Add a rubber band around the top of the strips, as shown.
9. Carefully reposition the rectangles to provide a 3 mm (1/8”) wide gap (viewing slit) between each pair. Trim and adjust as needed.



10. Cut a strip of white paper 3 - 4 cm (1-1/4 to 1-3/4") wide and 39 cm (15-1/4") long (tape short strips together, if needed). Curve the strip and insert inside the inverted top cover. Press the strip against the inside of the cover and mark the overlap point. Divide the distance from the far end of the strip to the overlap point into 12 equal sections. The division can be done mathematically or by folding the strip in half twice, unfolding, and then creating 3 sections in each of the 4 folded areas. Blackline masters for creating strips with 12 sections are provided at the end of this activity.
11. Make a drawing in each of the 12 sections of the white paper strip. Simple, dark drawings are best. The animation could be in 2 steps by repeating a pattern of 2 different pictures, or in steps of 3, 4, 6, or 12. Be careful to keep the images in the correct sequence and to coordinate the beginning and end points.
12. Put the animation strip in the cover with the animation facing toward the center.



### To Do and Notice

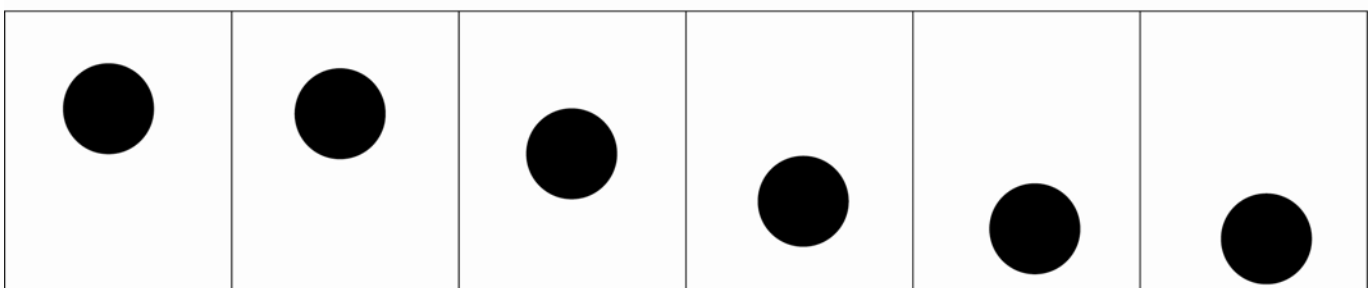
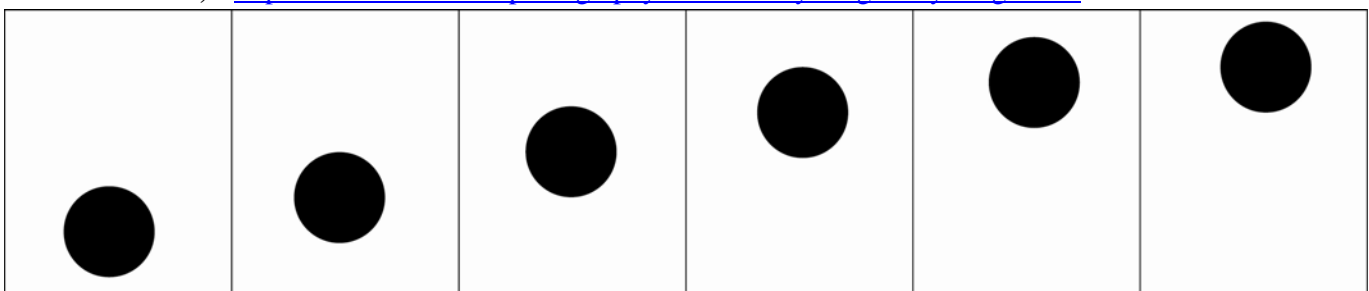
Spin the Zoetrope and peer through the slits. Do the images appear to flow together creating the illusion of an object in motion? To enhance the illusion, be sure the animation strip is brightly illuminated. Create more animations, simple or complex. Shape stickers (dots, squares) can be used with or without simple line drawings.

### The Science Behind the Activity

A Zoetrope and other motion picture projectors work because they project images “faster than the eye can see.” When an image is sent from the eye to the brain, the image lingers until the next image is perceived. This phenomenon is known as “persistence of vision.” If the images are projected quickly enough, the brain melds them together and assumes that the images are actually of an object moving in the real world. William Horner invented the Zoetrope in 1834. In 1872 an artist named Eadweard Muybridge developed the first method of photographing people and animals in motion. He also invented the Zoopraxiscope, a machine similar to the Zoetrope, to project the images he developed for group viewing. Thomas Edison developed his idea further for the Kinetoscope in 1891 and is credited with inventing “movies” and the industry that followed. For the RAFTY Zoetrope, the width of the slits and the use of brightly lit images, interspaced with black (with no images), are important factors in creating the illusion of motion. The marbles, acting as a low friction bearing, allow the long spins needed to provide the rapid presentation of the images, as seen through the slits.

**Web Resources** (Visit [www.raft.net/more](http://www.raft.net/more) for how-to videos and more ideas!)

- For information on the history of motion pictures - <http://www.howstuffworks.com/movie-projector1.htm>
- Muybridge’s works - (**Teacher Note: To better visualize the motions of bodies, Muybridge often used nude artistic models. The website below, which contains his works, may not be appropriate for young students!**) - <http://www.masters-of-photography.com/M/muybridge/muybridge.html>



# Pictures in Motion