Science Activities

Title: **My Shadow**
Author: **Robert Louis Stevenson**
Illustrator: **Ted Rand**

Shadow Tag

Key Words: light, shadows

Concept: When an object moves, its shadow moves and changes shape.

We sometimes talk about shadows as if they were objects like a rock or a cup. This game will help remind you that though we can see shadows they certainly are not like other objects. For one thing, they can be rather difficult to catch.

Materials: sunny day, several friends, large open area

Directions:

1. Shadow tag is a game of tag adapted to shadow-play. One person is IT. IT tries to tag another player by stepping on his or her shadow. Once a person is tagged, they are IT. This game is more difficult than regular tag because shadows can be hard to catch. Before and after the game, discuss the following questions. If students still have trouble answering some of the questions, play the game again or play it at different times of the day.
2. What makes a shadow outside during the day? (light from the sun and solid objects)
3. How can a shadow change? (e.g. as an object moves the shape of the shadow changes, at different times of day the length of the shadow changes)
4. What about a shadow doesn't change? (e.g. the direction it points relative to the sun, it stays one even color)
5. How can a shadow hide? (e.g. inside the shadow of a larger object)
6. How might the game be different if you played it at different times of day? (e.g. hear the middle of the day, the shadows would be shorter and harder to catch, but there would be fewer places for the shadows to hide)

Shadow Boxes

Key Words: light, shadows, shapes

Concept: A shadow does not always have the same shape as the object that made it.

Sonny Fontana used his hand to make shadows, but the shadows didn't look much like hands, they looked like animals and people. Other everyday objects can make shadows

that don't look like the objects that made them. Can you guess what an object is by its shadow?

Materials: Shoe box or other similar box, scissors, white typing paper, pencil, tape, several objects small enough to fit inside the box, clay, lamp without a shade, area with dim lighting

Directions:

1. To begin making a shadow box, cut a large rectangular opening, about 7" x 10" in the bottom of a shoe box.
2. Tape white typing paper inside the box to cover the rectangular opening you just cut. Make sure that the paper lies flat and there are no gaps between the paper and the box.
3. Collect several common objects that will fit inside the box (cup, toy, rock, comb, toothbrush, etc.). Items that are not symmetrical can make some interesting shadows.
4. Stand the box on a table. Place an object in the box. (You may need to use a small amount of clay on the bottom of the object so it will stand up in the box.) Darken the room and position a lamp behind the open side of the box so that a shadow is cast by the object onto the paper. Try rotating the object. How does the shadow change? When does the shadow look most like the object? When the least?
5. Position the object so that it makes a shadow that you think is interesting. Ask some friends to look at the shadow but not the object in the box. Have them draw a picture showing what they think is in the box, then show them the object. They may be surprised! You can try it again and again with a different object each time.

Blur(st) of Light

Key Words: light, shadows

Concept: Some lights have features to blur shadows.

Some light bulbs are better for making shadows than others. In fact, many of the lights we use in our homes have special features to blur shadows. Fewer shadows in a room are easier on our eyes.

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Materials: various light bulbs, egg carton, knife, a marker, a smooth surface for casting shadows, lamp, gloves, a lamp shade (optional)

Directions:

1. Collect between two and six light bulbs. Include at least one bulb that is clear and one that is frosted. You may also want to select bulbs of different sizes, shapes, colors, and wattages.
2. To prepare an egg carton to display the bulbs, use a knife to cut an X in the bottom of several of the individual cups in the egg carton. Then turn the carton upside down and carefully place a bulb in each of the cut egg carton cups. Tape this down to a table and mark each cup with a numeral so that individual bulbs can be discussed.
3. Remind students that shadows are formed when light rays traveling in a straight line are blocked by an object. However, if there is more than one light source or if the light rays from a single source are scattered and reflected by other objects, then the shadows will be fuzzy or blurred, unlike the clear shadows Sonny made. You may want to show students how a lampshade helps scatter the light coming from the bulb and so decreases the contrast of shadows in the room. Ask students to look at the bulbs and predict which bulb(s) will make the best (clearest or sharpest) shadows and why.
4. After students have had a chance to discuss their predictions, place the bulbs, one at a time, in a lamp. (Be careful to remove hot bulbs with a glove.) Have students decide which bulb(s) makes the best shadows. Can they explain why? (The bulbs do not scatter the light.)

In the Dark

Key Words: light, camera obscura, camera, ray

Concept: Light rays travel in straight lines through a pinhole making an upside-down image.

The first “photographer,” a French physicist named Nicephore Niepce, found out that the light coming through a small hole in an outside wall of a dark room would form an upsidedown image on the opposite wall. The device he used was called a camera obscura, which means “dark chamber.”

Materials: 12 oz. frozen juice can with both ends removed, black construction paper

(8” square), waxed paper, aluminum foil (5” square), tape, scissors, straight pin

Directions:

1. Roll a sheet of black paper into a cone shape. Place the wide end of the cone in a juice can and allow the wide end to open until it is the size of the can. While holding it so it keeps its shape, pull the cone out of the can. Adjust the cone slightly by making the wide end just a bit bigger (this way it will fit snugly when back in the can) and the small end about a ½ inch in diameter, then tape across the seam of the cone.
2. Using scissors, trim the wide end of the cone so that it is even all the way around. Don’t cut much off or the size of your cone will need to be readjusted.
3. Make a waxed paper circle the same size as the wide end of the cone by tracing around the end of the cone. Cut out the circle and tape it to the wide end of the cone keeping the waxed paper flat. This will be your viewing screen.
4. Fold a sheet of foil over one end of the juice can. Tape the foil down to the sides of the can so that it fits tightly and is smooth across the end of the can. Using a straight pin, punch a small hole (1 mm) in the center of the foil. This will be the aperture.
5. Place the wide end of the cone in the other end of the juice can.
6. Point the foil end of your camera at a sunlit scene or a bright light. Look through the cone and you will see an image projected on the screen. However, the image will be upside down! This is because the light rays from the top of the image enter through the hole and are focused on the bottom of the screen. The light rays from the bottom of the image are focused on the top of the screen. Try sliding the cone in and out of the can. The image on the screen will get smaller and larger.
7. *Extension:* To help understand why the image is upside down, find a flashlight and a piece of cardboard (at least 8.5” x 11’). In a dimly lit room, shine a flashlight through a hole in a piece of cardboard onto a wall. Hold the flashlight low and shine it up through the hole, and the beam of light will point upwards behind the hole. This is like the light reflected from the bottom of the image viewed in the camera obscura. This light passes through the hole and hits the top of the viewing screen. Hold the flashlight high, and the beam of light will point downwards on the other side of the hole. This is like the light from the top of the image that enters the camera and is focused on the bottom of the screen.