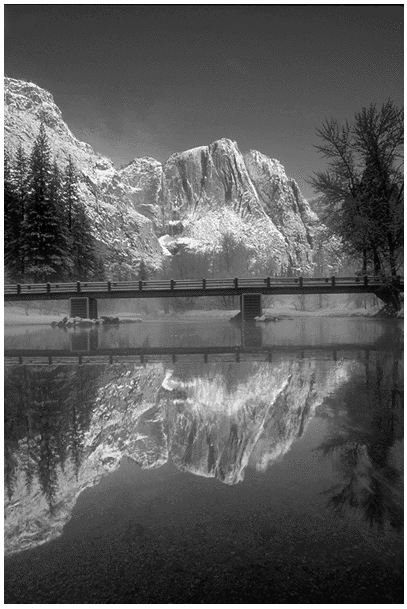
Lesson

30



Reflection

Bouncing back

Supply list:

- Flashlight	- White paper
- Hand mirror	- Black paper (not shiny)
- Aluminum foil	

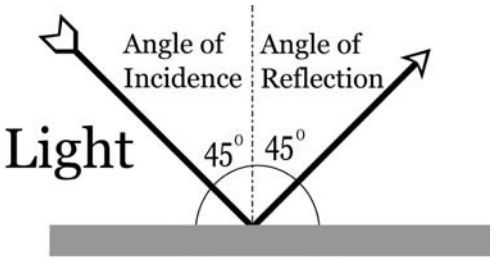
Additional Supplies for Challenge Section:

- Straight pins or tacks	- Protractor
- Modeling clay	- Colored markers
- Ruler	- Cardboard

Take a look in the mirror. What do you see? Do you see someone who looks just like you only backwards? When you raise your hand, the person in the mirror raises his/her hand. This phenomenon is called reflection. We are very familiar with reflections in a mirror. But just how does this phenomenon work?

Light waves travel in straight lines and are thus called rays of light. Rays of light continue in a straight line until they encounter an object. When the light hits an object the light is either absorbed or bounces off of the object. This bouncing light is called a reflection. As you learned in the previous lesson, we see objects because of the light that is reflected off of them.

Because light travels only in straight lines, it will reflect off of a smooth flat surface, such as a mirror, at the same angle that it hits the surface. The angle formed between the light ray that approaches the mirror and a line perpendicular to the mirror is called the angle of incidence. Look at the diagram to the right. You can see that the angle of incidence in this example is 45 degrees. The angle formed between the light ray that is leaving the mirror and the normal, or perpendicular line, is called the angle of reflection. In the drawing, you see that the angle of reflection is also 45 degrees.



When we think of reflections, we generally think of a mirror. But to varying degrees, light reflects off of nearly any surface. Nearly all of the light that hits a smooth shiny surface will be reflected. This surface could be a mirror, or it could be a still lake or pond. It could even be a shiny bumper or a window on the car in front of you on the road. Other surfaces reflect only a small amount of light. Surfaces that are not smooth or shiny may only reflect a small amount of light.

Reflecting Light:

Most mirrors have a silvery coating on the back, which reflects the light that hits it. You can test which materials would make the best mirrors by testing reflections off of various surfaces. Place a smooth piece of aluminum foil on a smooth surface near a wall. Shine a flashlight onto the foil at an angle. You should see a reflection of the flashlight beam on the wall. Next, crumple another piece of foil then spread it out and set it next to the smooth foil. It should not be perfectly flat. Again shine the flashlight on the foil. How does the reflection on the wall compare to that from the smooth foil? (Less of the light is reflected toward the wall. Because the surface of the foil is no longer smooth, some of the light is reflected in different directions. This is called diffusion.)

Repeat your test using white paper instead of aluminum foil. How does the reflection compare to the reflection from the smooth foil? The reflection is probably not as bright. Why? (The paper absorbs some of the light.) Again repeat the test using non-shiny black paper. How does this reflection compare to the others? (Black materials absorb nearly all the light that hits them so there should be very little reflection. If the paper is shiny however, it will reflect some light.)

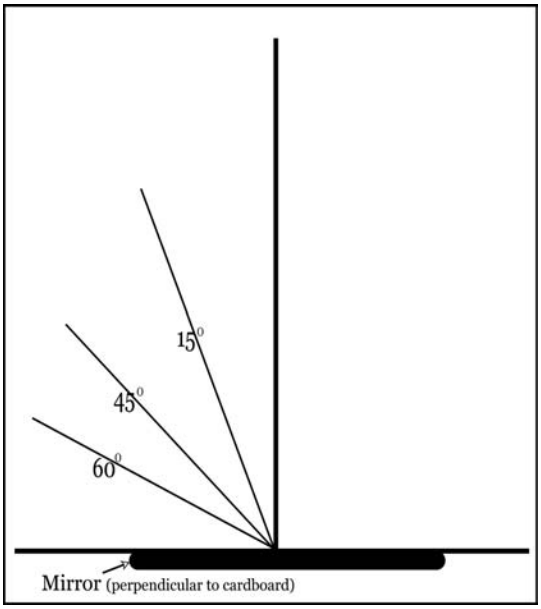
You can show that the angle of incidence is equal to the angle of reflection for light by conducting the following experiment. First, cut a thick piece of cardboard to be 12 inches by 16 inches. Draw a line across the cardboard about two inches from the narrow end of the

board. Draw a second line down the middle of the cardboard to form a cross shape on the board.

Using a protractor, draw a line that forms a 15 degree angle with the center line, a 45 degree line, and a 60 degree line all to the left of the center as shown in the diagram below.

Next, use modeling clay to fasten a small hand mirror so that it rests upright along the shorter line and is centered over the longer line as shown in the diagram. Turn off the lights in the room and place a flashlight so that it is pointing at the center of the mirror, shining along the 15 degree line. Use three pins or tacks to mark the line of the reflected light from the mirror.

Move the flashlight to shine on the mirror along the 45 degree line. Again mark the path of the reflected light ray. Finally, repeat this procedure for the 60 degree angle.



Turn on the lights. Remove the mirror. Carefully remove the pins from the first flashlight beam. Use a red marker and a ruler to draw a line connecting the holes made by the pins marking the first reflected ray. Repeat, using a blue marker to mark the path of the second test, and a green marker to mark the path of the light from the third test.

Use a protractor to measure the angle of reflection for each test. How did the angle of reflection compare with the angle of incidence for each test? Their measurements should be close. Why might the angles be slightly different? If your measurements are different by more than a few of degrees, what might be the explanation?

What did we learn?

What is a reflection? (Light that bounces off of a surface.)

Which types of materials best reflect light? (Smooth shiny materials)

What kind of path does light take? (It moves in waves that travel in straight lines.)

Taking it further

If light approaches a mirror at a 30 degree angle of incidence, at what angle will the light reflect off of the mirror? (30 degrees)

If the back of a mirror is not smooth, what is likely to happen to the image you see? (It will be distorted because the light is not reflecting at the angles you expect to see. It is diffused.)