Mirror, mirror

When you look in a mirror, you see an **image** of yourself. That's because light from the Sun or other **luminous** object bounces off your body. If some of that light is **reflected** from a smooth surface, like a mirror, you see an image of yourself. But are you seeing yourself exactly as others see you?

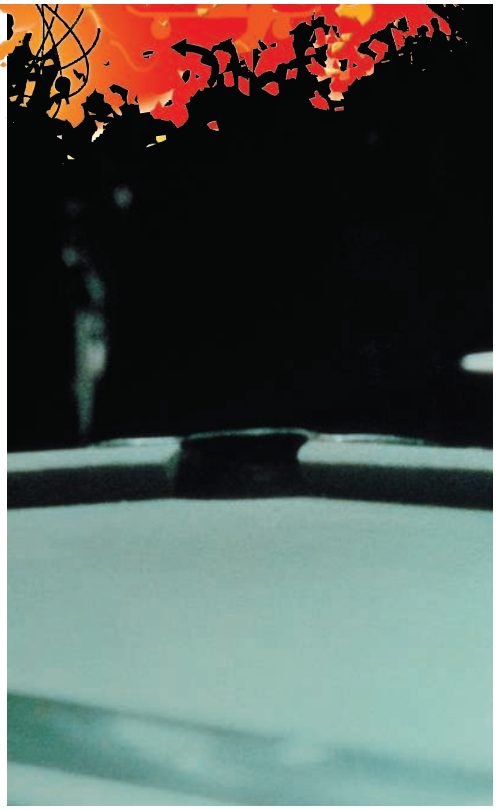
Flat mirrors like this are also known as **plane mirrors**. When you look at yourself in a plane mirror, you see an image.

The image in the photo on the left is formed because light coming from the baby is reflected from a smooth, shiny surface behind a thin sheet of glass.

The image is the same size and shape as the baby. But the way the baby sees himself in the mirror is not exactly the same as the way others see him. For example, when you look at the baby directly, his right arm is touching the mirror. When you look at the image in the mirror, it looks like his left arm is touching the mirror. His image is **laterally inverted**. In other words, it is reversed sideways.

Two kinds of reflection

You see a painted wall when you look at it because light is reflected from it. So, why can't you see an image of yourself in the wall as you can in a mirror? To answer this question you need to look very, very closely at the wall.



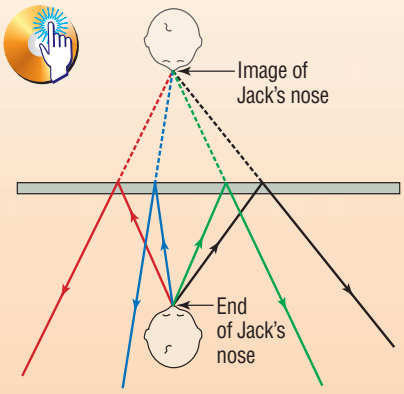
The Law of Reflection

In the photo above, Jenny needs to hit the centre ball with the white ball without disturbing the black ball. Luckily, she has remembered the Law of Reflection — anything that bounces from a surface comes away at the same angle from which it went in. Jenny has to work out which part of the cushion to aim for so that the 'in' angle and 'out' angle are the same.

Light energy from the lights in the room bounces from baby Jack's nose. It is reflected from the shiny, smooth, back surface of the mirror.

All of the light reflected from the mirror appears to be coming from one place. And that is exactly where the image of Jack's nose is.

*This type of reflection is called **regular reflection**.*

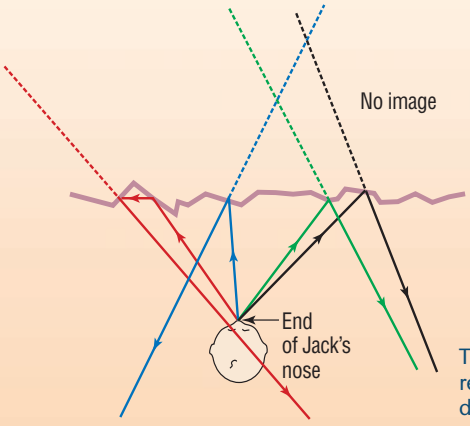


This type of reflection is called regular reflection.

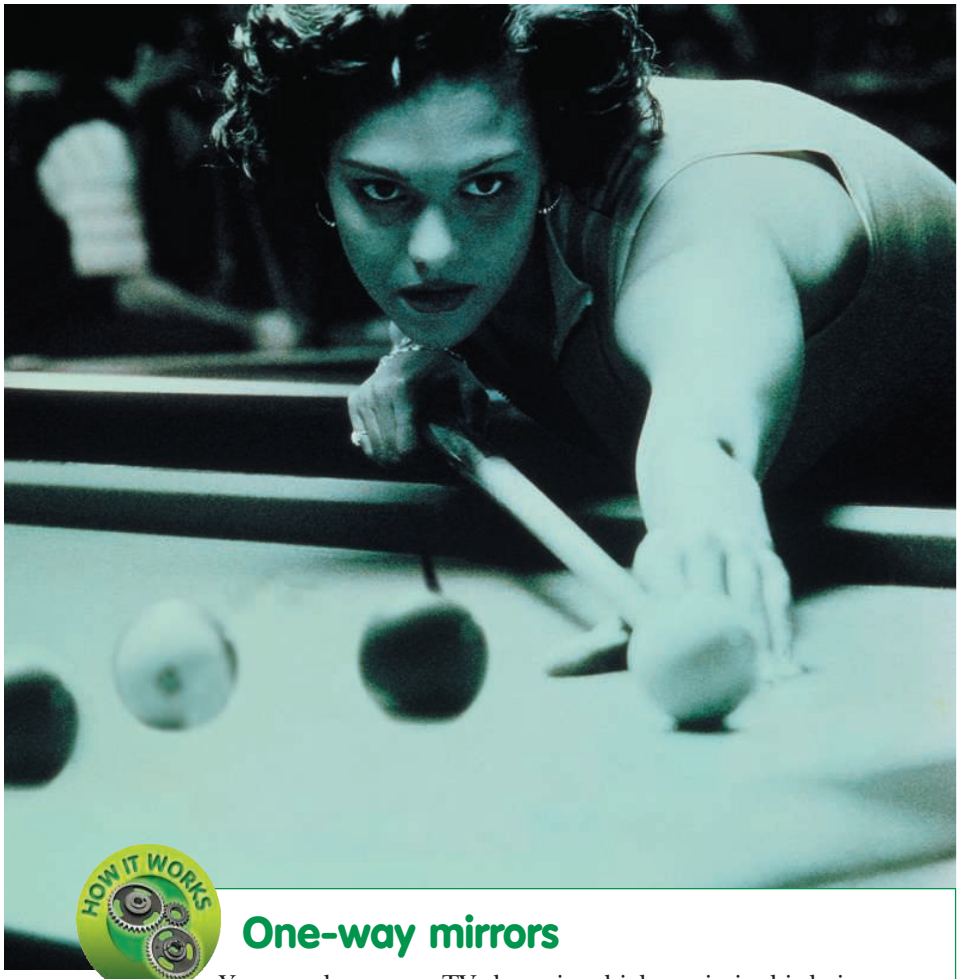
Light energy from the lights in the room bounces from Jack's nose. It is reflected from the surface of the painted wall. Notice that the Law of Reflection is obeyed wherever light meets the surface.

Because the surface is not smooth, the light is reflected in all directions. It doesn't all appear to be coming from a single point behind the wall. There is no image of Jack's nose.

*This type of reflection is called **diffuse reflection**.*



This type of reflection is called diffuse reflection.



One-way mirrors

You may have seen TV shows in which a criminal is being questioned while detectives watch through a 'one-way' mirror. A 'one-way' mirror is made from a darker type of glass than a normal mirror. The metal coating on the glass is much thinner than the coating on a normal mirror. It allows half of the light to go through. The other half is reflected. If the rooms on both sides of the mirror are well lit, you can actually see through it from both sides. The mirror becomes a one-way mirror only when the lighting is right.

The interview room is brightly lit. There is plenty of light bouncing off the suspect, the two detectives and everything else in the room. Enough reflected light goes through the mirror to allow the detectives in the viewing room to see what's happening. The rest of the light is reflected from the mirror. This allows the people in the interview room to see a clear image of themselves.

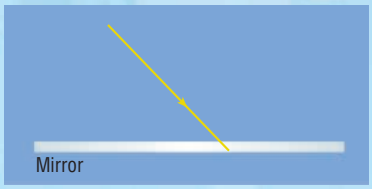
The viewing room on the other side of the mirror is only dimly lit. There is very little light bouncing off the detectives and the room. So these detectives can't see themselves in the mirror. More importantly, there is not enough light going through the mirror to allow the suspect in the interview room to see who's watching.

Go to worksheet 10.7: Mirror writing

Activities

REMEMBER

1. Copy the diagram and complete it by carefully drawing the path of the light after it is reflected from the mirror.



2. Why can't you see your image when you look at a painted wall even though it reflects light?

THINK

3. The image of the baby on the opposite page is formed because some of the light coming from him is reflected from the mirror. Where does this light come from originally?
4. Which of the baby's ears is visible in the photo — left or right?
5. Write down three capital letters of the alphabet that (if you wrote them on a piece of card and held it up to a mirror) would not look any different in the mirror.
6. Why is the word 'fire' on the fire truck shown below printed in two different ways?

learning

I CAN:

- ☐ describe images in plane mirrors
- ☐ draw a diagram to illustrate the Law of Reflection
- ☐ explain why mirrors produce images while most other surfaces do not.

Mirrors with a curve

Curved mirrors can produce some very strange **images**. If you stand in front of a curved mirror, your image can be large, small or even upside down. Some curved mirrors even allow you to see around corners. Curved mirrors obey the Law of Reflection — just as flat mirrors do. But their shape causes the image they produce to be quite different from a flat-mirror image.

Mirrors that are curved outwards are called **convex mirrors**. These mirrors collect light from a wide angle and **reflect** it towards your eyes. The images in convex mirrors are smaller than those in a plane mirror. But there is one other difference. What is it?

Mirrors that are curved inwards are called **concave mirrors**. The images in concave mirrors can be large, small or upside down. Dentists use a concave mirror on a handle to get a magnified view of your teeth. A dentist's mirror is not curved as much as this soup spoon.

Describing mirror images

You will need:
convex mirror
concave mirror or a polished spoon
2 plane mirrors
glue stick or similar small object.

- Look at an image of yourself in a convex mirror. Move the mirror towards yourself and then further away to see how the image changes.

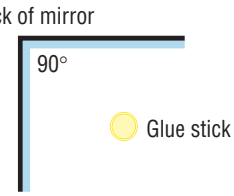
1. How is the image in the convex mirror different from your image in a plane mirror?

- Repeat the same observations with a concave mirror.

2. How is the image in the concave mirror different from your image in a plane mirror?

3. How does the image in a concave mirror change as your face gets closer to the mirror?

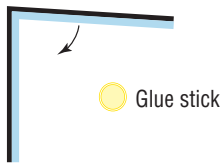
- Place two plane mirrors at right angles to each other and stand a glue stick between them. Look at the images of the glue stick.



4. How many images are there?

5. Are all of the images exactly the same? If not, explain how they are different.

6. Why do you think there are more than two images? (You'll need to think hard about this one!)

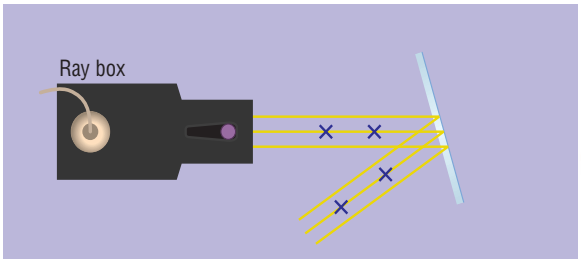


- Move the mirrors to gradually make the angle between them smaller.

7. What happens to the number of images as the angle between the mirrors gets smaller?

How does light behave when it meets different mirrors?

You will need:
ray-box kit
12 V power supply
sheet of white paper
ruler
pencil
protractor.



- Place the ray box on the edge of a sheet of white paper and connect it to the power supply.
- Put a plane mirror about 5 cm in front of the ray box.
- Draw a pencil line on the paper to show where the back of the glass part of the mirror is. You will need to move the mirror while you do this. Make sure that you put it back in exactly the same place.
- Use the pencil to mark two points on one **light ray** going into the mirror. Do the same for the ray as it goes away from the mirror.
- Remove the mirror and complete your ray diagram by drawing the path of the rays towards and away from the mirror. Use a ruler to draw the light rays.
- Use a protractor to measure the angle between the incoming ray and the mirror. Then use it to measure the angle between the outgoing ray and the mirror.

1. Are the angles the same? Is the Law of Reflection obeyed? If the angles are not the same, explain why you think they are different.

- Turn the sheet of paper over. Replace the plane mirror with a convex mirror and observe how the three rays are reflected.
- Look closely at where each ray meets the surface of the mirror.

2. Does it look like the Law of Reflection is obeyed at the surface of the convex mirror?

- Replace the convex mirror with a concave mirror.
- Again, look closely at where each ray meets the mirror surface.

3. Does it look like the Law of Reflection is obeyed at the surface of the concave mirror?

- Trace the shape of the front of the concave mirror and the paths of the rays towards and away from the mirror.
- The point where the reflected rays meet is called the **focus**, or focal point. Label the focus on your diagram. The **focal length** of the mirror is the distance between the mirror and the focus. Measure the focal length of the concave mirror and write it down on your diagram.
- Replace the concave mirror with another one that is either more curved or less curved.

4. What happens to the focus if you use a concave mirror that is more curved?

- Turn off the light box and let it cool while you answer the next two questions.

5. Which shaped mirror reflects light energy so that it spreads out?

6. If a mirror were used to reflect sunlight to cook a sausage, what shape would it need to be — plane, convex or concave?

Activities

REMEMBER

1. In which shaped mirror/s:
(a) can you see an upside-down image of yourself?
(b) can you always see an image that is smaller than the image in a plane mirror?
(c) is the image always right-side up?
(d) is the Law of Reflection obeyed?

2. Which shaped mirror:
(a) spreads light out?
(b) brings light rays together?

3. What is special about the focus, or focal point, of a concave mirror?

THINK

4. Describe the shape of the mirror in the photo at the top of the previous page.

5. Which shaped mirror could be used:
(a) to make a solar reflector to heat food?
(b) to allow you see around corners?

6. Why is a convex mirror used at the worksite shown at far left instead of a plane mirror?

7. A searchlight is designed to produce a beam that does not spread out. The lamp of a searchlight is placed in front of a large curved mirror. Would you expect the mirror of a searchlight to be concave or convex?

DRAW

8. Make sketches of a concave mirror and a convex mirror. Draw a light ray hitting each mirror. Now draw the light rays as you think they would be reflected from each mirror.

learning

I CAN:

- ☐ describe the images in convex and concave mirrors
- ☐ list some uses of convex and concave mirrors, and relate their use to the way they reflect light.