Inquiry Investigation 11.1

Reflecting Light off a Plane Mirror

INQUIRY SKILLS	
● Questioning	○ Hypothesizing
● Predicting	○ Planning
● Conducting	● Recording
● Analyzing	● Evaluating
● Communicating	

Mirrors—dentists use them to examine your teeth, drivers use them to monitor traffic, decorators use them to make rooms seem larger, and you use them to check that you don't have the remains of your lunch on your nose. Regular, flat mirrors are called **plane mirrors.** (Here, the word *plane* means "a flat, two-dimensional surface," just as it does in mathematics.) In this Investigation, you will study how light reflects off a plane mirror.

You will use a protractor to measure angles in this Investigation. Whenever you measure an angle, always estimate its value first. Then, you can check that the result of your measurement makes sense.

Question

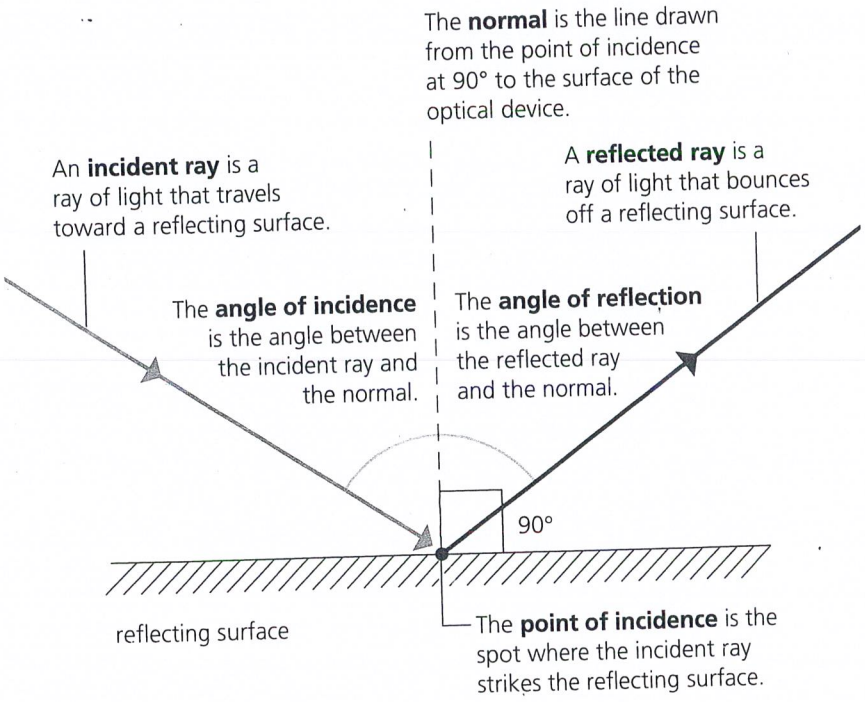
(a) Write a question that will be answered in this Investigation.

Prediction

(b) Look at **Figure 1.** Make a prediction about the relationship between the angle of incidence and the angle of reflection.

LEARNING TIP

For help with writing a question and a prediction, see "Questioning" and "Predicting" in the Skills Handbook section **Conducting an Investigation**.



LEARNING TIP

Figure 1 contains important vocabulary. Take your time looking at **Figure 1** and making connections between the labels and what the diagram shows.

Figure 1
Vocabulary related to the reflection of light: Light travels in straight lines and can be represented using rays.

Experimental Design

You will trace the path of a ray from a ray box as the ray reflects off a plane mirror.

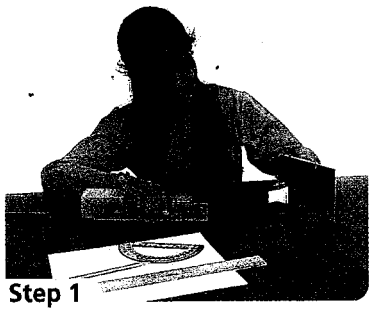
Do not touch the light bulb in the ray box or look directly into the light. Handle mirrors carefully to avoid breakage.

Materials

- ray box with single-slit window
- plane mirror that can stand by itself
- ruler
- sharp pencil
- plain paper
- protractor

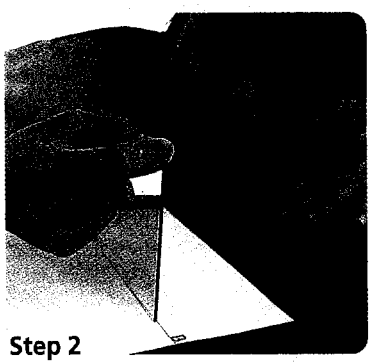
Procedure

1. Aim a narrow ray of light from the ray box toward the mirror. Move the ray box so that the incident ray hits the mirror at the same point but with different angles of incidence. Observe the reflected ray each time you move the ray box. Record your observations.



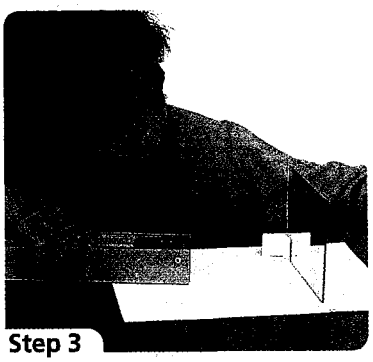
Step 1

2. Draw a straight line, AB, on a piece of paper. The line should be longer than the mirror. Mark a point near the middle of AB. This will be your point of incidence. Place the plane mirror so that its reflecting surface (not the glass surface) lies along AB.



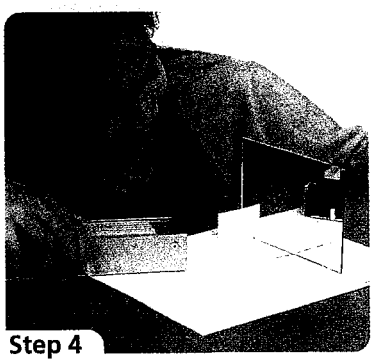
Step 2

3. Aim a light ray at the point of incidence. Move the ray box until the reflected ray is lined up with the incident ray. Draw three small dots along the middle of the light ray. Remove the ray box and the mirror. Use a ruler to connect the dots to the point of incidence with a broken line. What is this line? Label it.



Step 3

4. Return the mirror to its original position. Aim a light ray toward the point of incidence. Make sure that the angle of incidence is large. Mark small dots along the middle of the incident ray and reflected ray.



Step 4

Procedure (continued)

5. Remove the mirror and the ray box. Use a ruler to join the dots for each ray to the point of incidence. Label the rays, and show their directions with arrows. Use your protractor to measure the angle of incidence and the angle of reflection in your diagram. Record the sizes of the angles in your diagram.
6. Repeat steps 4 and 5 on a new piece of paper for several different angles of incidence.

Analysis

(c) Summarize your results in a table.

(d) Where is the reflected ray when the incident ray travels along the normal to a plane mirror?

(e) What are the angles of incidence and reflection in this Investigation?

(f) Scientists use two laws to describe how light reflects from a plane mirror. The first law of reflection compares the angle of incidence with the angle of reflection for light rays hitting a mirror. Based on your observations, write your version of the first law of reflection.

Evaluation

(g) Did your evidence support your prediction? Explain.

(h) Did your observations provide evidence that allowed you to answer the question you wrote at the beginning of this Investigation? If so, write the answer. If not, revise the question.

(i) Where might errors occur in this Investigation? How would these errors affect your conclusion?

(j) When conducting this Investigation, did you and your partner share the recording and physical work equally? How might you work differently with a partner or a group in upcoming Investigations?

PERFORMANCE TASK

Knowing the laws of reflection means that mathematics can be used in the design of optical devices. Are there features of your chosen optical device that can be described mathematically?