LESSON 3 - REFLECTION AND PLANE MIRRORS

Overview:
Students will consider everyday examples of reflection to determine the law of reflection. They will then discover the characteristics of images formed in a plane mirror through a laboratory investigation.

Suggested Timeline: 1 hour

Materials:
- Reflection and Plane Mirrors (Teacher Support Material)
- Reflection and Plane Mirrors (Student Handout)
- basketball
- overhead transparency of photo of front of ambulance
- long mirror (approx 3' x 1')
- small plane mirrors (1 per group of 2 students)

Method:

INDIVIDUAL FORMAT:
1. Using textbooks, a computer or other available resources, have students complete 'Reflection and Plane Mirrors' (Student Handout). When completed, the handout can be submitted for grading.

GROUP FORMAT:
1. Introduce reflection using the demonstrations and key questions provided in 'Reflection and Plane Mirrors' (Teacher Support Material). Sum up key terms and concepts introduced through the use of a diagram.
2. Have students complete their vocabulary list on 'Reflection and Plane Mirrors' (Student Handout) through the use of their handout and other available resources.
3. Introduce the four image characteristics and basic set-up for the activity using the student handout.
4. Have students work in groups of two to complete the activity. When completed, the handout can be submitted for grading.

Assessment and Evaluation:
- Assessment of student understanding of key concepts through their response to key questions.
- Student grade on lab.

REFLECTION AND PLANE MIRRORS

Demonstration: Have one student come to the front of the class in an open area. Tell him/her that we are going to be practicing our bounce passes. Stand a few metres apart. Bounce pass the ball to the student and have the student return it to you. Do this a number of times, asking the other students in the class to try to watch for a pattern in the way in which the ball hits the floor and comes up from the floor. Decrease the distance between you and the student and have the student bounce pass the ball to you. How did he/she know where to bounce the ball so that it should get to you? Draw the following picture on the board:
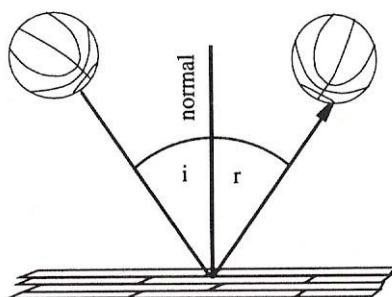
Define the term 'normal' (line drawn perpendicular to the reflecting surface).
Note that angle of incidence = angle of reflection OR $\theta_i = \theta_r$

KEY Q: What other examples can you think of where the law of reflection applies? (e.g., playing pool, racquetball, tennis)

KEY Q: Show students the photo below of the front of an ambulance. Why are the letters written this way?

Demonstration: Mount a large mirror (approx 3' x 1') at eye level at the centre of a wall. Review the definition of the 'normal'. Using chalk or masking tape, draw the normal perpendicular to the wall and mirror on the floor (from the centre of the mirror). Arrange six students in a row, equidistance apart and facing the mirror, with three on either side of the normal. Attach a small piece of tape to the centre of the mirror. Ask each student to focus on the piece of tape and report the name of the student that they see in the mirror. If the angle of incidence is equal to the angle of reflection, than pairs of students should be mutually visible (e.g., student 1 sees student 6 and student 6 sees student 1). Extend a string from a student to the mirror where the normal intersects to the student that they see. The law of reflection should hold true!
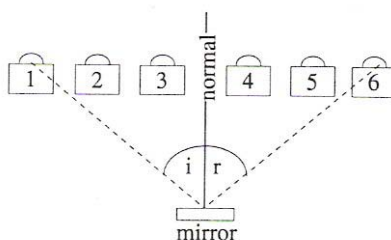
Review the following diagram:
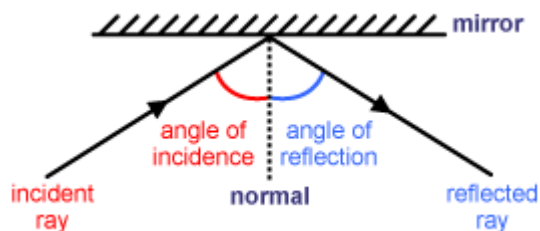
Answers to lab questions:
1. a) measurement in cm
    b) measurement in cm similar or identical to a)
    c) location of object = location of image (or very similar in the activity)

2. a) measurement in mm
    b) measurement in mm similar or identical to a)
    c) size of object = size of image (or very similar in the activity)

3. a) virtual

4. a) attitude is upright
    b) yes, the image is laterally inverted - the student should describe how right and left are flipped

Name: _____ Date: _____ Period: _____

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REFLECTION AND PLANE MIRRORS

VOCABULARY: (11 x 1 mark each = 11 marks)

plane mirror –

normal –

incident ray –

reflected ray -
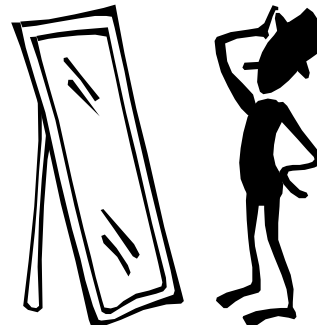
angle of incidence –

angle of reflection –

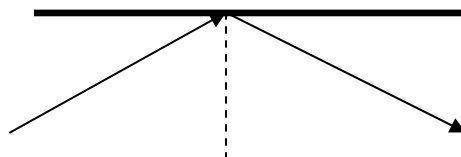attitude of the image –

size or magnification of image –

real image –

virtual image –

type of image -

Student
Handout

In the diagram below, label the following: plane mirror, normal, incident ray, reflected ray, angle of incidence, angle of reflection. (6 labels x 0.5 mark each = 3 marks)

When examining how light reflects from a plane (flat) mirror, there are **four image characteristics** to be considered:
1. **location** – where the image is in relation to the mirror
2. **magnification or size** – if the image is bigger or smaller than the object
3. **type** – if the image is real (in front of the mirror) or virtual (behind the mirror)
4. **attitude** – if the image is upright or inverted (flipped upside down) - if the right and left sides are flipped (**lateral inversion**)

In this activity, you will investigate the characteristics of an image that is formed in a plane mirror. The answers will be *plane* to see! ☺

Materials:
*   small plane mirror
*   flat surface
*   15 cm ruler

Procedure:

1. In the diagram below, 'X' will be your object. Hold your mirror so that its edge rests on the mirror line that is shown below. The shiny side should be facing the object (the X).

X
object

mirror line
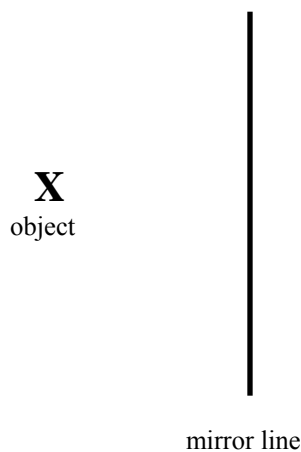
2. Turn your head slightly so that you are looking into the mirror from the side with the object on it. You should still be able to see behind the mirror with your other eye.

Student
Handout

3. Move your head slowly back and forth until you see an image of the X behind the mirror. Draw the image of the X in on the paper where you see it.

Questions: Marks given to each question are indicated.

1. **Location of the image:**
   a. Measure the distance between the centre of the object (the centre of the X) and the mirror in cm. _____

   b. Measure the distance between the centre of image (the centre of the X that you drew) and the mirror in cm. _____

   c. How does the location of the object compare to the location of the image?

   _____

   | 3 |

2. **Magnification or Size:**
   a. Measure the height of the object in mm. ____

   | 3 |

   b. Measure the height of the image in mm. ____

   c. How does the size of the object compare to the size of the image?

   _____

3. **Type:** Is the image real or virtual? (HINT: Review the definitions of these words!)

   _____

   | 1 |

4. **Attitude:** Look into your mirror.
   a. Is the image in a plane mirror upright or inverted? _____

   b. Is the image laterally inverted? (HINT: Review your given definitions!) _____

   | 3 |

   How can you tell? _____