SAINT JOSEPH'S PREPARATORY SCHOOL
PHYSICS LAB EXERCISE
Reflection of Light

NAME: ____ DATE:____________ PERIODS: ___________

COLLABORATORS:____

DATE REPORT IS DUE:____

Introduction

When a light ray strikes a reflecting surface, the angle of reflection is equal to the angle of incidence. Both angles are measured from the normal, an imaginary line perpendicular to the surface at the point where the ray is reflected. In this laboratory activity, you will investigate and measure light rays reflected from the smooth, flat surface of a plane mirror in order to determine the apparent location of an image. This type of reflection is called regular reflection. The image of an object viewed in a plane mirror is a virtual image. By tracing the direction of the incident rays of light, you will be able to construct a ray diagram that locates the image formed by a plane mirror.

Materials

thin plane mirror	2 straight pins or dissecting pins	4 thumbtacks or pieces of masking tape
small wooden block	rubber bands	cork board
metric ruler	2 sheets blank paper	protractor

A. The Law of Reflection

1. Attach a sheet of paper to the cork board with the tacks or tape. Draw a line, **ML**, across the width of the paper. Attach the small block of wood to the back of the mirror with a rubber band, so that the mirror is perpendicular to the surface of the paper. Center the silvered surface (normally the back side) of the mirror along the line, **ML**, as shown in Figure 1.
2. About 4 cm in front of the mirror, make a dot on the paper with a pencil and label it point **P**. Place a pin, representing the object, upright (<u>normal to the plane of the paper</u>) at point **P**.
3. Place your ruler on the paper about 5 cm to the left of the pin. Sight along the edge of the ruler at the image of the pin in the mirror. When the edge of the ruler is lined up on the image, draw a line along it toward, but not touching, the mirror. Label this line **A**.
4. Move the ruler another 3 or 4 cm to the left and sight along it at the image of the pin in the mirror. Draw a line along the edge of the ruler toward, but not touching, the mirror. Label it line **B**.
5. Remove the pin and the mirror from the paper. Extend lines A and B to line **ML**. Using dotted lines, extend each of these lines beyond line ML until they intersect. Label the point of intersection point I. This is the position of the image. Measure the object distance from point P to line **ML** and the image distance from point **I** to line **ML**. Record these distances.
6. Draw a line from point **P** to point **X**, where line **A** meets line **ML**, as shown in *Figure 2*. Using your protractor, construct a normal at this point and measure the angle of incidence, θ_{i1}, and the angle of reflection, θ_{r1}. Record the values of these angles. In a similar manner, draw line **PY** from point **P** to point **Y** where line **B** meets line **ML**. Construct the normal at point **Y**. Measure the angle of incidence, θ_{i2}, and the angle of reflection, θ_{r2}. Record the values of these angles. A line such as **PXA** or **PYB** is the path followed by a ray of light as it is transmitted from the pin (object) to the mirror, and reflected from the mirror to your eye. Drawing many such rays enables you to locate and recognize images in a mirror.

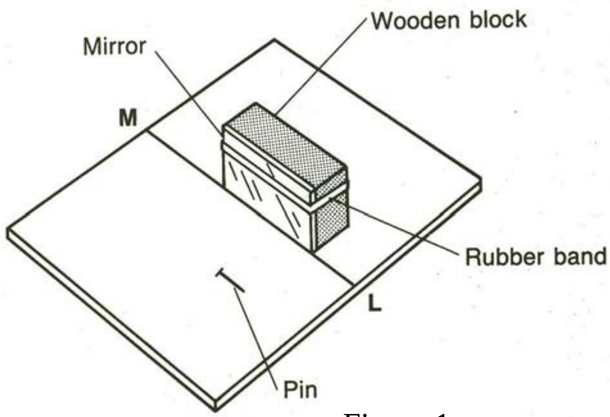

Figure 1.

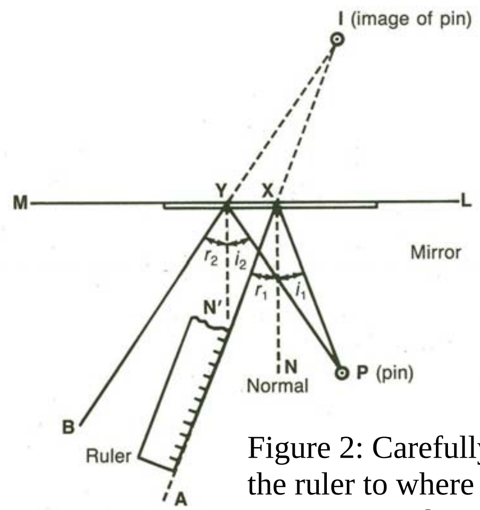

Figure 2: Carefully sight along the ruler to where the pin's image meets the paper.

B. Image Formation

1. Draw a line, **ML**, across the width of another sheet of paper. Draw an object triangle in front of the line, as shown in Figure 3, and label the vertices **A**, **B**, and C**.** Attach the paper to the cork board and place the mirror and block along line **ML**, as you did in *Part A*.

2. Place a pin in vertex **A**. Sight twice along the ruler to obtain two different sketched lines from the location of the pin at vertex **A** to line **ML**, as you did in Part **A**. Label these lines **A**, and **A2**

3. Remove the pin from vertex **A** and place it at vertex **B**. Again, sight along the ruler to obtain two lines from the location of the pin at **B** to **ML** and label these lines **B**, and **B2**.

4. Remove the pin from vertex **B** and place it at vertex **C**. Repeat the procedure and draw lines **C**, and **C2**.

5. Remove the mirror and the pin. Extend the pairs of lines, **A**, and **A2**, **B**, and **B2**, and **C**, and **C2**, beyond the mirror and locate points **A'**, **B'**, and **C'**, as shown in Figure 3. Construct the image of the triangle. Measure and record the distances from points **A**, **B**, **C**, **A'**, **B'**, and **C'** perpendicular to the mirror line **ML**.

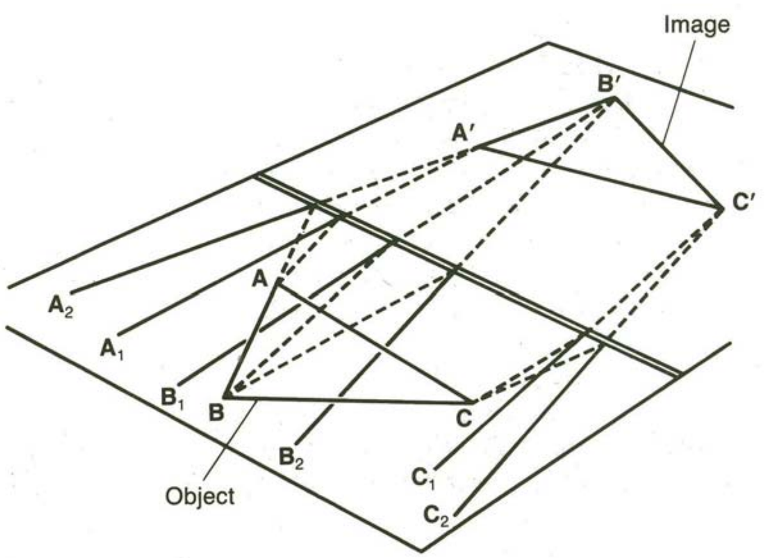

Figure 3: Finding the images of three pins.

Analysis:

1. Using your observations from Part A, what can you conclude about the angle of incidence and the angle of reflection?

2. How far behind a plane mirror is the image of an object that is located in front of the mirror?

3. Using your observations from Part B, compare the size and orientation of your constructed image with those of the triangle object.

4. From your observations in this experiment, summarize the general characteristics of images formed by plane mirrors.

5. Why is the image formed by a plane mirror is called virtual rather than real?