Experiment 6

Reflection of light

Aim of experiment

To prove that image distance equals object distance in plane Mirror
To measure the angle of incidence and angle of reflection

Theory

When rays of light are incident on the plane mirror, some of the light is reflected and it follows a part as shown in Figure 1. The two rays are known as incident ray (op) and reflected ray (PQ). The line is drawn perpendicularly to the plane mirror at the point of incidence is normal. An angle between the incident ray and the normal is angle of incidence. An angle between the reflected ray and the normal is angle of reflection. The law of reflection states that the angle of incidence is equal to the angle of reflection.

Procedure (1) Line Method

1. Drew the mirror surface line on the paper. On it place the mirror strip upright vertically.
   2.Make an object point in front of a mirror at a certain distance and draw the reflected line.
   3.Line up the ruler with the image of the incident ray and draw a line the reflected line.
   4.Take away the mirror and draw the normal at the point of incidence on the mirror surface line.
   5.Measure the angle of incidence and angle of reflection.
   6.Repeat two times of the above procedure for step 2 to 5 by drawing other incident rays.
   7.Draw the three reflected rays produced backwards to meet at a point(image point).
   8.Measure the perpendicular distances of object point and image point from the mirror line.

9.Check whether these two distances are equal (or) not.(its mean-u=v=?)

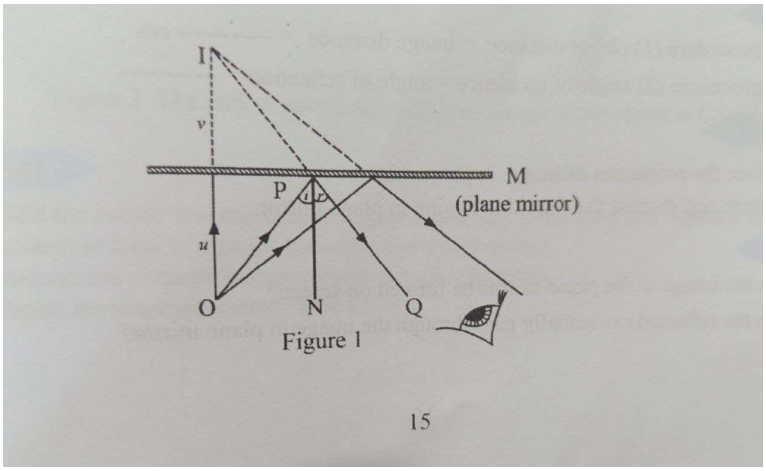


Figure 1

Result

For Procedure (1) object distance=image distance=____cm

Procedure (2) Pin Method

1. Draw the surface line on the paper and place the mirror strip upright on the surface line.

   2. Mark the object points and draw a line represented the incident ray.

   3. Place the two object pins (p, Q) on the incident ray and put two search pins(R,S)in straight line with the image (P',Q').The images (P',Q')and two search pins (R,S) should be on the mirror and all pins.

   4.Remove the mirror and all pins.

   5.Draw the reflected rays passing through the search pin points and normal line. 6.Measure the angle of incidence and angle of reflection.

   7. Check whether angle of incidence and reflection are equal (or) not.

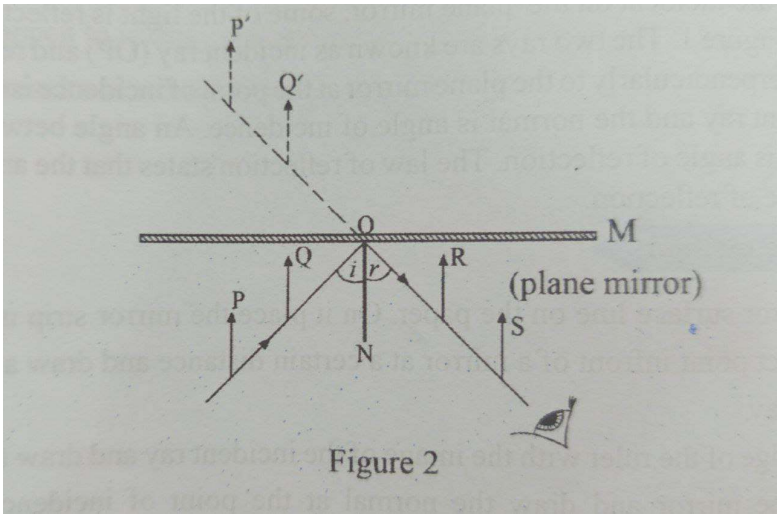


Figure 2

Precautions

-The observer's eye must be in the plane of the rays and not too close with the mirror.

-The hard-shape pencil must be used to get measurement of angle accurately.

-Parallax error must be avoided.

-Search pins R and S must not close one another.

Result

For Procedure (2) angle of incidence=angle of reflection=____cm.

Experiment 7

The Concave Mirror

Aim of experiment

To determine the focal length of a concave mirror by using the conjugate foci method

Theory

A concave mirror can produce a real image of a distant object (at infinity) as shown in Figure1.The position of image is approximately equal to focal length of the concave mirror and hence, the distance from the mirror to this image is approximately equal to focal length of the concave mirror. Therefore, it has a real focus. Hence, the focal length of a concave mirror

is positive. Further, a concave mirror can produce both types of images real as well as virtual, depending upon the object position .The position, nature and size of the image may be predicted by drawing ray diagrams .If the object is placed at the center of curvature of the concave mirror, its image is formed at the center of curvature as shown in Figure 2.The set of points on the principal axis of a concave mirror where the position of the object and the image can be interchanged are called conjugate foci.

Procedure

1.Hold the mirror towards distant object, a tree (or) a building and adjust a white paper(screen) in front of it to get a sharp image on the screen.

2. Measure the distance between the mirror and the screen.

3. Repeat the procedure three times.

The distance between the mirror and the screen (1) ____cm

(2) ____cm

(3) ____cm

The average approximate focal length of concave mirror=_____cm

4. place the mirror on the optical bench and put the object pin twice the approximate focal length in front of the mirror.

5. Adjust the position of the object pin, so that the image in the mirror was on parallax with object pin (object pin is also used as search pin and object pin and its image in the mirror are coincided each other).

6. Measure the distance of the pin from the mirror.

7. Repeat that experiment three times.

8. The distance of the pin from the mirror (1) ____cm

(2) ____cm

(3) _____cm

The average distance of the pin from the concave mirror=_____cm.

The radius of the curvature of the concave mirror R=_____cm.

The focal length of a concave mirror, f=R/2 =_____cm

9. Compare the focal length obtained from conjugate foci method and the focal approximate length.

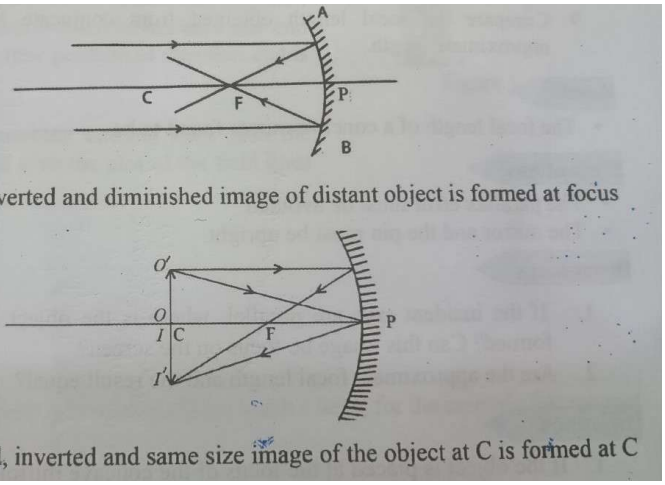


Figure 1 The real, inverted and diminished image of distant object is formed at focus

Figure 2 The real, inverted and same size image of the object at C is formed at C

Result

The focal length of a concave mirror found to be___.

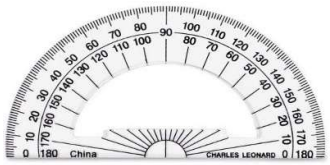
Precautions

-The parallax error must be avoided.

-The mirror and pin must be upright.

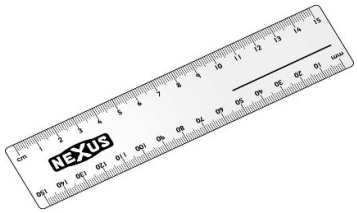
Apparatus: Experiment 6

Protractor



measure the angle between the ray and the normal (angles of incidence and reflection). Use its center on the point where the ray meets the mirror.

Ruler



draw straight rays and the normal line, and measure distances (to place protractor correctly or position pins/marks).

Paper

workspace on which you draw the incident ray, normal, reflected ray, and mark points; tape the paper to the board so it doesn't move

Mirror strip

(a small, narrow plane mirror) — the reflecting surface. Easy to rotate to change the angle; good when you want to show a clean, flat reflection in a small area.

Clip

(paper clip / bulldog clip) — hold the mirror or paper in place on the drawing board (or clip the paper to the board so it doesn't slide).

Color pencil

(different colors) — mark the incident ray, normal, reflected ray, and measured angles in different colours so the diagram is clear.

Plane mirror (7cm by 15cm)

(larger flat mirror) — same function as mirror strip; better if you want a bigger visible reflected beam or to show image formation. Use whichever you have — both are plane mirrors (flat).

Drawing board

flat, firm base to fix the paper and do accurate drawing and measurements. It keeps everything steady.

Apparatus: Experiment 7

Optical Bench

Place all the apparatus (mirror, pins, etc.) along the bench so they lie on the same straight line (optical axis). Use its scale to measure distances between objects and images accurately.

Search Pin

Stick one pin (object pin) in front of the mirror at a measured distance. Move another pin (search pin) along the bench to locate where the image forms by removing parallax (no relative motion between pins seen through the mirror).

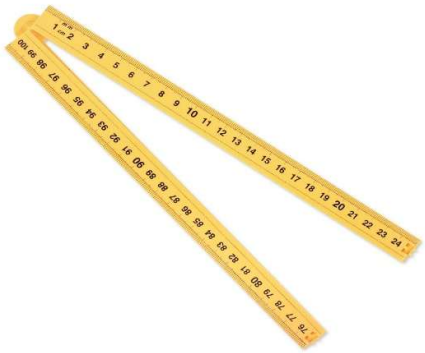
Concave mirror stand

Mount the mirror on its stand and place it vertically on the optical bench. The reflecting surface should face the object pin. Used to reflect light and form a real or virtual image of the object.
Mirror stand is to holds the concave mirror firmly in an upright position on the optical bench.

White paper(screen)

Place it behind or under the optical bench to help see the pin positions clearly and mark points for measurement.

Meterstick



Use it to measure distances between the mirror, object pin, and image pin (along the optical axis).