Experiment No. 1

Curved Mirrors

2.1 Aim:

Determination the power of a concave mirror.

2.2 Theory:

A spherical mirror has the shape of a section of a sphere. This type of mirror focuses incoming parallel rays to a point, as demonstrated in Figure 2-1. Figure 2-1a shows a cross section of a spherical mirror, with its surface represented by the solid, curved black line. Such a mirror, in which light is reflected from the inner, concave surface, is called a concave mirror. The mirror has a radius of curvature R, and its center of curvature is point C. Point V is the center of the spherical section, and a line through C and V is called the principal axis of the mirror.

Now consider a point source of light placed at point O in Figure 2-1b, where O is any point on the principal axis to the left of C. Two diverging rays that originate at O are shown. After reflecting from the mirror, these rays converge and cross at the image point I. They then continue to diverge from I as if an object were there. As a result, at point I we have a real image of the light source at O.

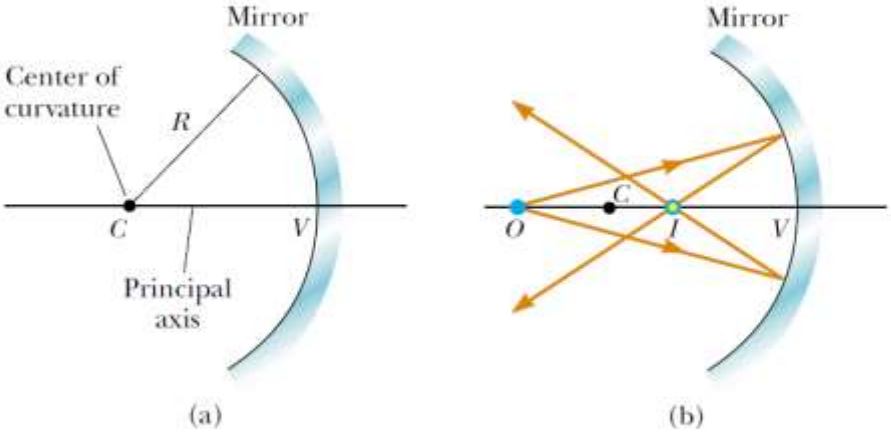

Fig. 2-1 A spherical mirror

Experiment and Requirement

- Optical Bench
- . Light Source
- . Mirror Holder
- . White Screen
- . Concave mirror

Method

1. **Determination of the power of a concave mirror by coincidence image on object method**

- Put the concave mirror in front of the light source and the white screen beside the source.
- Move the mirror to form a clear image on the screen to the source.

- Measure the distance from the mirror to the screen which equal to the center of curvature of the mirror (R).
- Calculate the focal lens of the mirror

$$f = R/2$$

- Calculate the power of the mirror from the relation

$$F = 100/f$$

R (cm)	$f = R/2$ (cm)	$F = 100/f$ (cm^{-1})

2. Determination of the power of a concave mirror using the general method

A. Put the concave mirror at a distance (x) from the source.

B. Move the white screen in front of the mirror to form a clear image for the source.

C. Measure the distance between the screen and the mirror (y).

D. Record another values for (y) corresponding to a different values of (x).

E. Plot a graph between $100/x$ and $100/y$.

F. Measure the intersection of the straight line with x-axis, which represent the power of the concave mirror F_1, and the intersection with y-axis which represent also the power of the concave mirror F_2.

G. Calculate the average power of the concave mirror from the relation : $F_{avg} = \frac{F_1+F_2}{2}$

No	x (cm)	y (cm)	$100/x$ (cm^{-1})	$100/y$ (cm^{-1})
1				
2				
3				
4				
5				

$F_1 =$	.... (cm^{-1})
$F_2 =$	.... (cm^{-1})
$F_{avg} =$	.... (cm^{-1})

Experiment No. 2

Verification of Lenses Laws

3.1 Aim:

Verification of the power law of convex/concave lens and the general law of lenses.

3.2 Theory:

Lenses are commonly used to form images by refraction in optical instruments, such as cameras, telescopes, and microscopes. We recognize that light passing through lens experiences refraction at two surfaces. The development we shall follow is based on the notion that the image formed by one refracting surface serves as the object for the second surface.

We shall analyze a thick lens first and then let the thickness of the lens be approximately zero. Consider a lens having an index of refraction n and two spherical surfaces with radii of curvature R_1 and R_2, as in Figure 3-1. (Note that R_1 is the radius of curvature of the lens surface that the light from the object reaches first and that R_2 is the radius of curvature of the other surface of the lens.)

An object is placed at point O at a distance p_1 in front of surface 1. Let us begin with the image formed by surface 1. We find that the image I_1 formed by surface 1 satisfies the equation 3-1 using $n_1 = 1$ we get equation 3-2

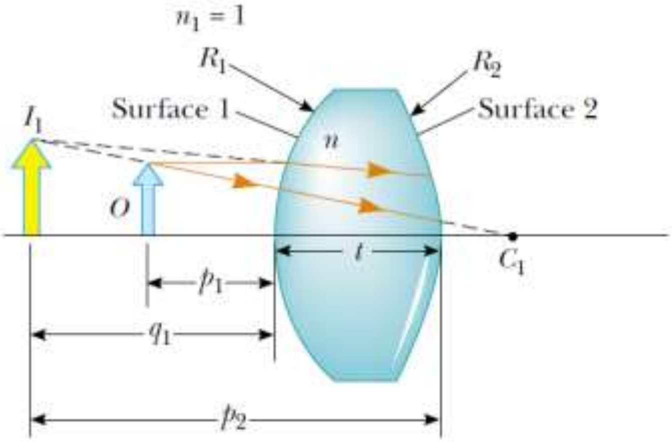

Fig. 3-1- A lens has q_1 negative

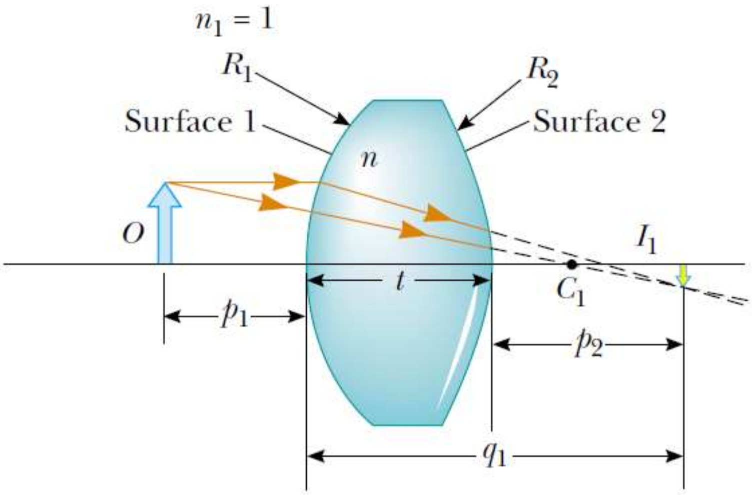

Fig. 3-2 A lens has q_1 positive

3.3 Experiment and Requirements

- Optical Bench
- Lens Holder
- Convex Lens
- Light Source
- White Screen
- Plane Mirror

3.4 Method

1. **Determination of the power of convex lens by parallel rays**

A. Place the lens on the lens holder between the screen and a distance object on the optical bench.

B. Move the lens to form a clear image of the distance illuminated object on the screen.

C. Measure the distance of the screen from the lens, which represents the focal lens (f)

D. Calculate the lens power from the relation

$$F = \frac{100}{f} \ m^{-1}$$

$f\ (m)$	$F = \frac{100}{f}\ (m^{-1})$
