Ch: Light - Reflection and Refraction

Reflection of light

The laws of reflection are:-
(i) Angle of incidence = Angle of reflection
(ii) The incident ray, reflected ray and the normal, all lie on the same place.

Spherical Mirrors

A spherical mirror whose reflecting surface is curved inward is called a concave mirror. A spherical mirror whose reflecting surface curved outward is called a convex mirror. (Draw Figure 10.1 pg 161 beside this)

Terms commonly used in spherical mirror

1. **Pole:** The center of the reflecting surface of a spherical mirror is a point. Which is called the Pole. Pole is represented as ‘P’.
2. **Center of curvature:** The reflecting surface of a spherical mirror forms a part of a sphere, this sphere has a center, which is called the center of curvature. Center of curvature is not a part of a spherical mirror. It is represented as ‘C’.
3. **Radius of curvature:** The radius of the sphere of which the reflecting surface of a spherical region forms a part, is called the radius of curvature. It is represented as ‘R’.
4. **Principal axis:** Its an imaginary straight line passing through the pole and the center of curvature of a spherical mirror. Principal axis is normal to the mirror at the pole.
5. **Focus:** The reflected rays from a spherical mirror meet at a point or it appears to come from a point on the principal axis. This point is called Focus. It is represented as ‘F’.
6. **Focal Length:** The distance between the pole and the principal focus of a spherical mirror is called Focal length. It is represented as ‘f’.
7. **Aperture:** The diameter of the reflecting surface of a spherical mirror is called Aperture.

For a spherical mirror, the radius of curvature is found to be twice the Focal length. **2f = R**

Q. The radius of curvature of a spherical mirror is 20 cm. Find its focal length.
Sol: Given R = 20 cm

$2f = R$

$2f = 20$

$f = 20/2$

$f = 10$ cm

Q. Find the focal length of a convex mirror whose radius of curvature is 32cm.
Sol:- Given R = 32cm

$2f = R$

$2f = 32$

$f = 32/2$

$f = 16$cm

<u>Rules for drawing ray diagrams</u>

(i) A ray parallel to the principal axis, after reflection, will pass through the principal focus in case of a concave mirror or appear to diverge from the principal focus in case of a convex mirror. (Fig 10.3)

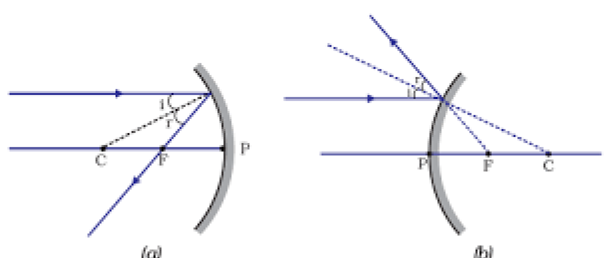


Figure 10.3

(ii) A ray passing through the principal focus of a concave mirror or a ray which is directed towards the principal focus of a convex mirror, after reflection, will emerge parallel to the principal axis. (Fig 10.4)

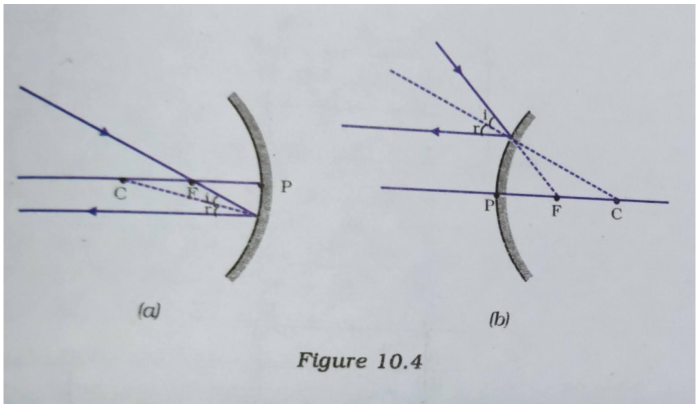
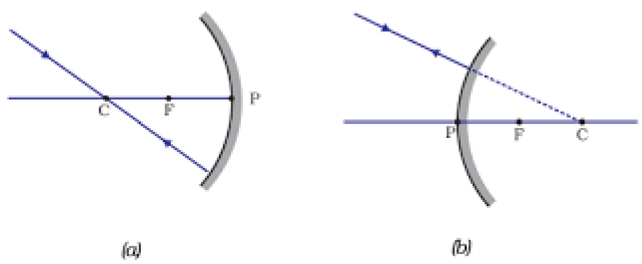
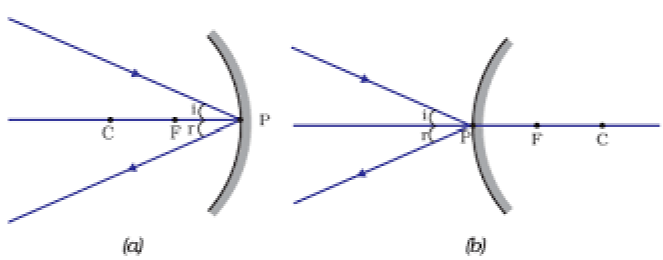


Figure 10.4

(iii) A ray passing through the center of curvature of a concave mirror or directed in the direction of the center of curvature of a convex mirror, after reflection, is reflected back along the same path. This is illustrated in Fig 10.5. The light rays come back along the same path because the incident rays fall on the mirror along the normal to the reflecting surface.



(iv) A ray incident obliquely to the principal axis, towards point P (pole of the mirror) on a concave mirror or a convex mirror is reflected obliquely. The incident ray and reflected rays follow the laws of the reflection at the point of incidence (point P), making equal angles with the principal axis. (Fig 10.6)



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14. An object 5.0 cm in length is placed at a distance of 20 cm in front of a convex mirror of radius of curvature 30 cm. Find the position of the image, its nature and size.

Sol:-

h = 5 cm
u = -20 cm
R = 30 cm
f = $R/2$
f = 30/2
f = 15 cm

1/v + 1/u = 1/f
1/v = 1/f - 1/u
1/v = 1/15 - 1/(-20)
1/v = 4/60 + 3/60 = 7/60
v = 60/7 = **8.57 cm**
∴ Image is formed 8.5 cm behind the mirror
Nature of Image: Virtual and erect

Size of image formed = Height of image (h')/Height of object (h)
h'/5 = 8.57/20 = 0.428
h' = 0.428 X 5 = **2.14 cm**
∴ Height of the image formed = 2.14 cm