Chapter 6. Light: Spherical Mirrors

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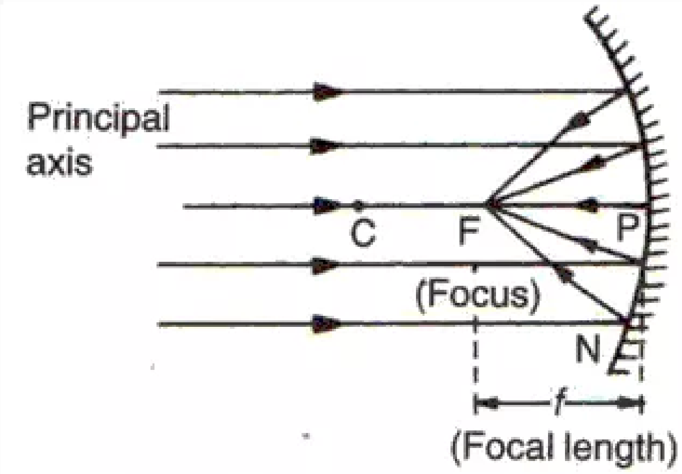
Solution 1:
A spherical mirror is a part of a hollow glass sphere silvered on one side.

Solution 2:



The parallel beam of light on reflection by a concave mirror converges at a point on the principal axis, midway between pole and the centre of curvature. This point is called principal focus

Solution 3:
Focal length = 1/2 of radius of curvature
= 1/2 x 30 = 15cm.

Solution 4:
Focal point is the principal focus of the mirror where a parallel beam of light meets(or appear to meet) after reflection from the mirror.

Solution 5:
difference between real and virtual images

Real images	Virtual images
it can be obtained on a screen	It can't be obtained on a screen
it is inverted(upside down with respect to the object)	It is erect with respect to the object
It is formed when two or more reflected rays intersect each other at a point in front of the mirror	It is formed when two or more reflected rays appear to intersect at a point behind the mirror

Solution 6:

- Pole is the centre of the reflecting surface, in this case spherical mirror.
- Centre of curvature is the centre of the imaginary sphere to which the mirror belongs

- Aperture is the distance between the extreme points on the periphery of the mirror.
- Principal axis is the straight line passing through the pole and the centre of curvature.
- The principle focus of a spherical mirror may be defined as a point on its principle axis where a beam of light parallel to the principle axis converges to or appears to diverge from after reflection from the spherical mirror.

Solution 7:
Convex mirror has a wider field of view.

Solution 8:
Concave mirrors are used in reflecting microscope, in shaving and make up glasses and in ophthalmoscope.

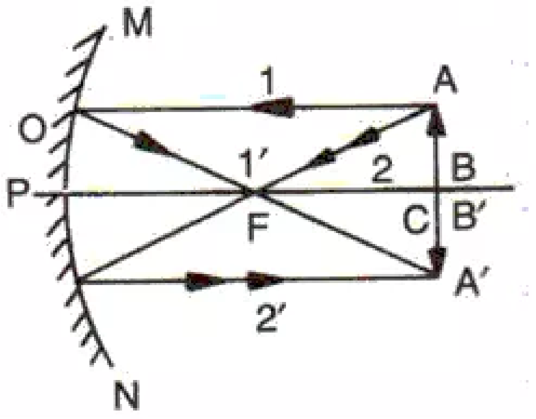
Solution 9:
Convex mirrors are used as a rear view mirror in automobiles as it provides a wider view of following traffic.

Solution 10:
Convex mirror is used in vehicles to see the traffic following it.

Solution 11:
The relationship between the focal length, f and radius of curvature, r is
f = 1/2 x r.

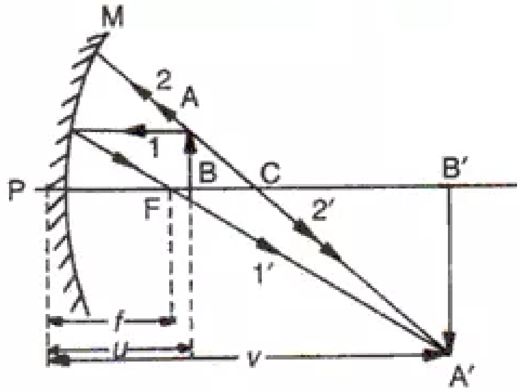
Solution 12:

A concave mirror forms a real image equal in size to the object when the object is kept at centre of curvature, C



Solution 13:

A concave mirror forms an enlarged virtual image when the object is kept between focus, F and pole, P

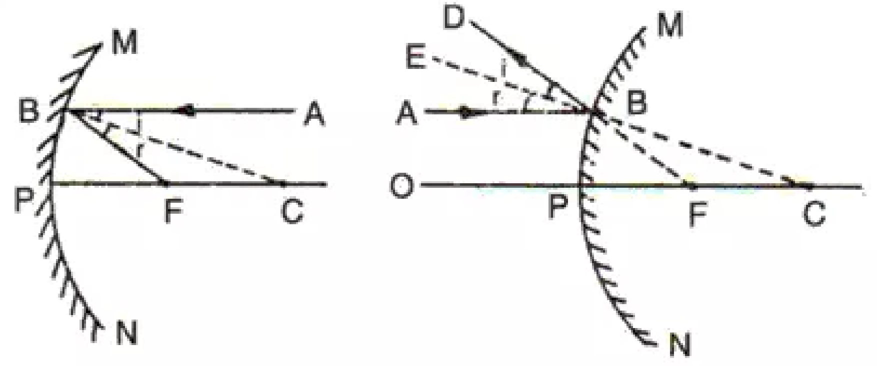


Solution 14:
Concave mirror can produce real and diminished image of the object.

Solution 15:
The focal length of plane mirror is infinity.

Solution 16:
The object should be placed between F and P to obtain its magnified and erect image.

Solution 17:



Let's assume the aperture of the mirror to be very small. Let a ray AB of light parallel to the principal axis be incident on the concave mirror at B. the ray makes the angle of incidence, i with the normal BC at B, C being the centre of curvature of the mirror. The ray is reflected along BF with angle of reflection, r so that

$< i = < r$

In accordance with the laws of reflection. As the incident ray AB is parallel to the principal axis PC, so the reflected ray Bf passes through the principal focus, F. in figure (i)

$< ABC = < CBF$

But $< ABC$ = alternate $< BCF$

Therefore $< CBF = < BCF$

And the ΔFBC is isosceles

BF = FC ...(i)

Since the aperture is assumed to be very small, so the point of incidence B is close to P

And BF =PF (approx.) ...(ii)

From (i) and (ii)

PF = FC

Adding PF to both sides

PF + PF= PF + FC

2PF = PC

Now since PF = f, the focal length of the mirror

And PC = R, the radius of curvature of the mirror

Therefore 2f = R

From here we can determine the focal length of the concave mirror i.e. half of radius of curvature

Solution 18:

Linear magnification is defined as the ratio of the height of the image to the height of the

object. It is taken to be positive for an image to be virtual and erect and negative when image is real and inverted.
Magnification = height of image / height of object.

Solution 19:
SI unit of focal length is meter.

Solution 20:
The top mirror is convex mirror, the middle mirror is concave mirror and bottom mirror is a plane mirror.

Solution 21:
The mirror having +15 cm as its focal length is a convex mirror because focal length is taken positive only in case of convex mirror.

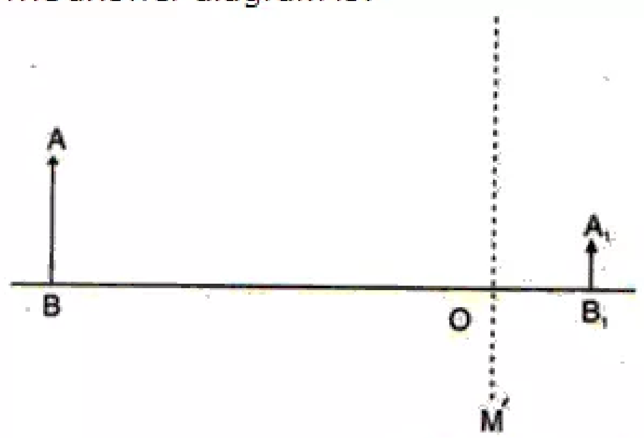
Solution 22:
The mirror having -20 cm as its focal length is a concave mirror because focal length is taken negative only in case of concave mirror.

Solution 23:
When we look into a plane mirror, the image of our face is virtual because the image cannot be obtained on a screen.

Solution 24:
When an object is brought towards the concave mirror, the position of the image moves away from the mirror and the size increases and it remains inverted but at object position between F and P, the image is virtual, magnified and erect.

Solution 25:

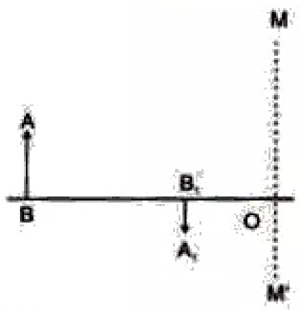
The answer diagram is:-



A light ray coming from a point on object AB is reflected from the surface of the mirror. When this ray is produced backwards, it passes through the principal focus and the ray which traces its incident path after reflection, when produced backwards, passes through the centre of curvature. These two reflected rays coincide at a point where the image is formed. The image, A'B' is virtual, erect, and diminished in size
The focal length was found to be 24 mm

Solution 26:

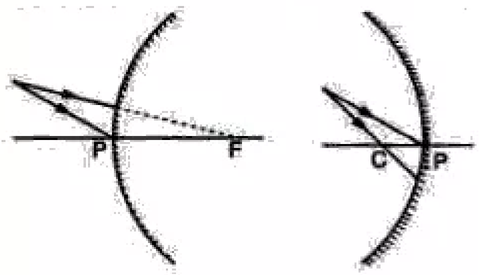
The answer diagram is:-



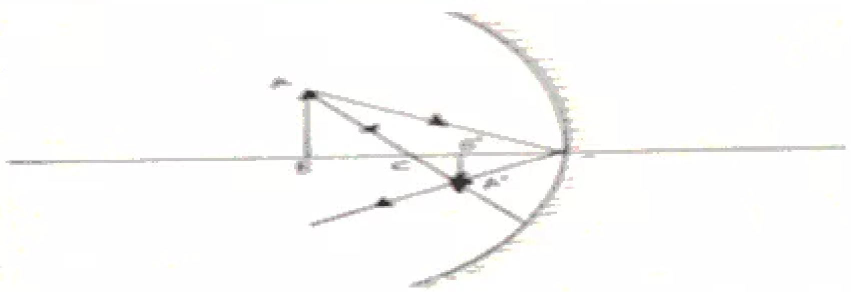
A light ray coming from a point on object AB is reflected from the surface of the mirror, it passes through the principal focus and the other ray passing through the centre of curvature strikes the mirror normally i.e. 90 degree. Hence it will reflect back. These two reflected rays coincide at a point where the image is formed. The image, A'B' is real, inverted, and diminished in size. The focal length was found to be 16 mm

Solution 27:

The answer diagram is:-



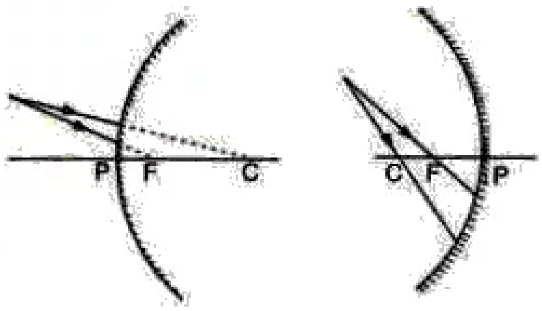
A light ray when produced backwards passes through principal focus as shown in the problem figure. We draw the normal through centre of curvature at the point of incidence and draw the reflected ray at an angle equal to the angle of incidence thus following the laws of reflection. The reflected ray is parallel to the principal axis. The other ray is reflected at the pole by an angle in accordance with the laws of reflection. These two reflected rays when produced backwards coincide at a point where the image is formed. The image, A'B' is virtual, erect, and diminished in size



A light ray coming from a point on object AB is reflected from the surface of the mirror, it passes through the principal focus and the other ray passing through the centre of curvature strikes the mirror normally i.e. 90 degree. Hence it will reflect back. These two reflected rays coincide at a point where the image is formed. The image, A'B' is real, inverted, and diminished in size.

Solution 28:

The answer diagram is:-

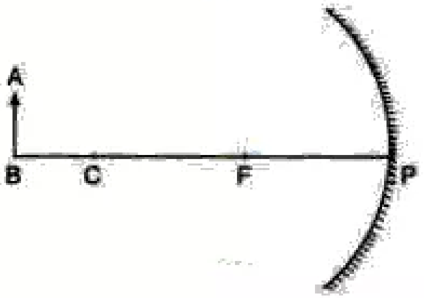


A light ray when produced backwards passes through principal focus as shown in the problem figure. We draw the normal through centre of curvature at the point of incidence and draw the reflected ray at an angle equal to the angle of incidence thus following the laws of reflection. The reflected ray is parallel to the principal axis. The other ray is passing through the centre of curvature as shown in problem figure. This ray retraces its incident path because it strikes the mirror normally i.e. 90 degrees. These two reflected rays when produced backwards coincide at a point where the image is formed. The image, A'B' is virtual, erect, and diminished in size

A light ray coming from a point on object AB passes through the principal focus and after reflection, it becomes parallel to the principal axis in accordance with laws of reflection and the other ray passing through the centre of curvature strikes the mirror normally i.e. 90 degree. Hence it will reflect back. These two reflected rays coincide at a point where the image is formed. The image, A'B' is real, inverted, and diminished in size.

Solution 29:

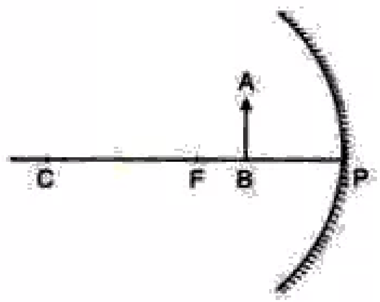
The answer diagram is:-



A light ray, parallel to the principal axis, coming from a point on object AB is reflected from the surface of the mirror, it passes through the principal focus and the other ray passing through the centre of curvature strikes the mirror normally i.e. 90 degree. Hence it will reflect back. These two reflected rays coincide at a point between F and C, where the image is formed. The image, A'B' is real, inverted, and diminished in size.

Solution 30:

The answer figure is:-



A light ray, parallel to the principal axis, coming from a point on object AB is reflected from the surface of the mirror, it passes through the principal focus and the other ray striking normally to the mirror reflects back and passes through the centre of curvature. These two reflected rays, when produced backwards, coincide at a point where the image is formed. The image, A’B’ is virtual, erect, and magnified in size.