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Q1.

At the centre of curvature.

Q2.

Between pole and focus.

Q3.

Between focus and centre of curvature.

Q4.

At infinity.

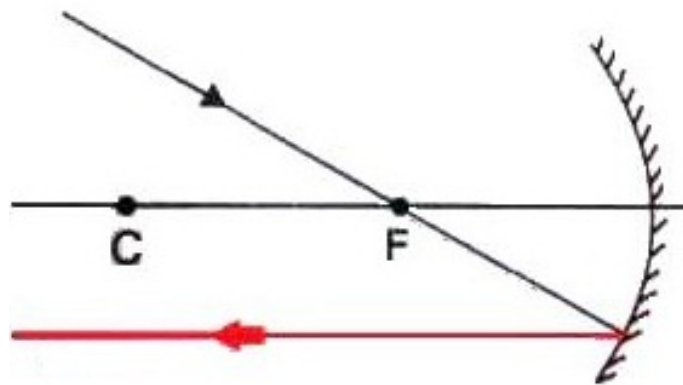
Q5.

At focus.

Q6.

Beyond the centre of curvature.

Q7.

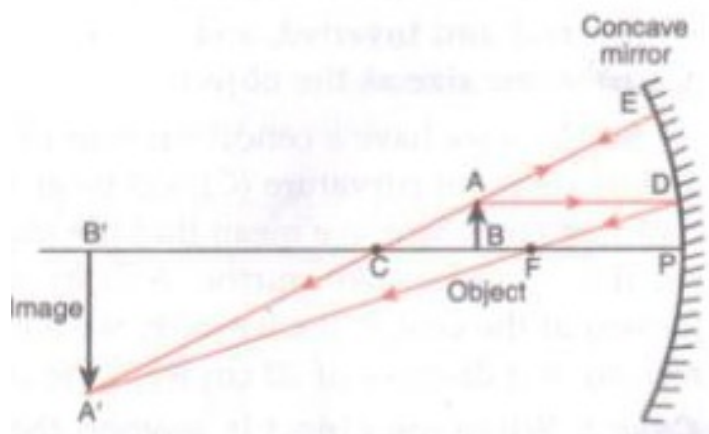


Direction of light ray after reflection.

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Direction of light ray after reflection.

Q8.



Q9.

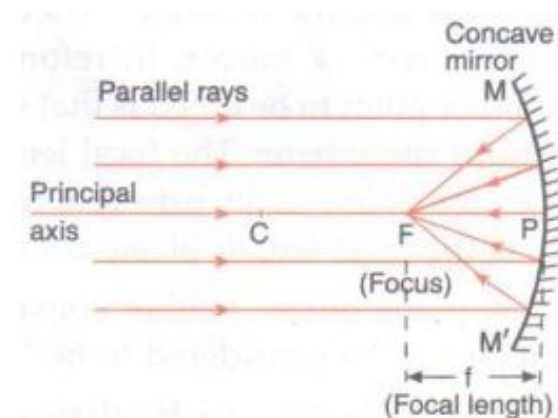


Fig. formation of image of AC.

Q10.

Concave mirror.

Q11.

Concave mirror is used in the headlights of a car. This is because when a lighted bulb is placed at the focus of a concave mirror reflector, then the diverging light rays of the bulb are collected by the concave reflector and then reflected to produce a strong, parallel-sided beam of light (which travels a considerable distance in the darkness of night).

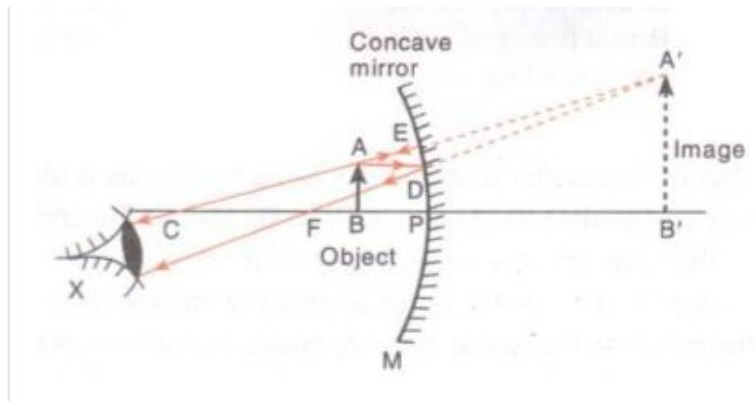
Q12.

A ray of light passing through the centre of curvature of a concave mirror is reflected back along the same path because it strikes the concave mirror at right angles to its surface due to which the angle of incidence and angle of reflection both are  $0^\circ$ .

Q13.

Minimum two rays are required for locating the image formed by a concave mirror for an object.

Ray diagram for the formation of a virtual image by a concave mirror:



Q14.

When an object is placed at the centre of curvature (C) of a concave mirror, the image formed is:

- (i) at the centre of curvature (C),
- (ii) real and inverted,
- (iii) of same size as the object.

Q15.

When an object is placed beyond the centre of curvature (C) of a concave mirror, the image is:

- (i) between the focus and centre of curvature,
- (ii) real and inverted,
- (iii) smaller than the object (or diminished).

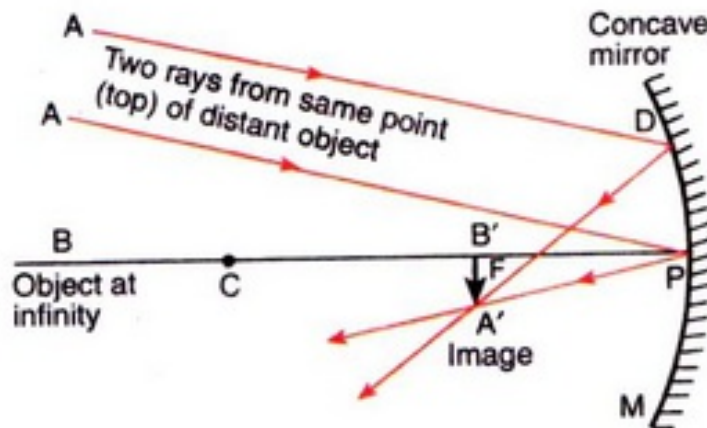
Q16.

The focal length of the mirror is  $PF = 10$  cm.

The object is placed at B such that  $PB = 8$  cm. This means that the object lies between the pole and focus of the concave mirror.

The image formed is virtual, erect and magnified.

Q17.



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Q18.

Concave mirror is used for a torch reflector.

Diagram:

Bulb is placed at the focus of the torch reflector.

Q19.

- (a) Between pole and focus of the mirror.
- (b) At the focus of the mirror.
- (c) At the centre of curvature of the mirror.

Q20.

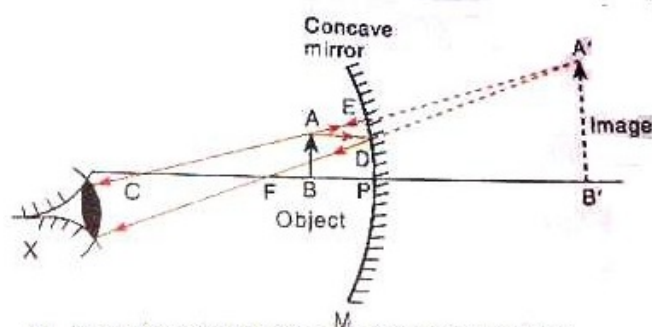


fig. formation of virtual image by concave mirror

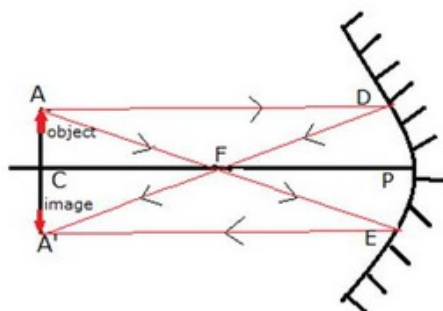
For obtaining an enlarged upright image of an object, the object is placed between focus (F) and pole (P) of the concave mirror.

A ray AD parallel to the principal axis, gets reflected at D and then passes through the focus F. A second ray AE passing through the centre of curvature C strikes the mirror normally at point E and gets reflected back along the same path.

Now, two reflected rays DF and EC are diverging rays and, therefore, do not intersect each other on the left side. The reflected rays DF and EC are produced backwards (as shown by dotted lines). On producing backwards, they appear to intersect at point A' behind the concave mirror. Thus, A' is the virtual image of point A of the object. To get the complete image of the object we draw A'B' perpendicular to the axis. Thus, A'B' is the image of the object AB formed by the concave mirror. The image is bigger in size than the object, hence it is an enlarged image.

Q21.

(a) A real image by a converging mirror



(b) A virtual image by a converging mirror

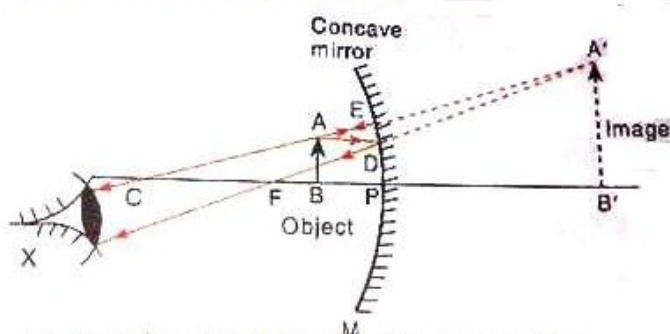


fig. formation of virtual image by concave mirror

Q22.

When the object is at a considerable distance (or at infinity) from a concave mirror, then its image is formed at the focus. This fact can be used to find out the focal length of a concave mirror quickly but approximately.

We focus a distant object (several metres away) like a window or tree on a screen by using a concave mirror whose focal length is to be determined. The sharp image of window or tree will be formed at the focus of the concave mirror. That is, the distance of image (or screen) from the concave mirror will be equal to the focal length

of concave mirror. This distance can be measured with a scale. It will give us the approximate focal length of the concave mirror.

Q23.

Concave mirror is used in a solar furnace.

The solar furnace is placed at the focus of a large concave reflector. When parallel rays of light from the sun fall on the surface of the concave mirror, rays get reflected and meet at the focus of the mirror due to the converging nature of concave mirror. Thus, the furnace kept at the focus becomes very hot. Even steel can be melted in this furnace.

Q24.

Concave mirror is used by dentists.

The dentist holds a small concave mirror in such a way that the tooth lies within its focus. A magnified image of the tooth is then seen by the dentist in the concave mirror. Since the tooth looks much bigger, it becomes easy to examine the defect in the tooth.

Q25.

Concave mirrors are used as shaving mirrors. This is because when the face is placed close to a concave mirror (so that the face is within its focus) the concave mirror produces a magnified and erect image of the face. Since a large image of the face is seen in the concave mirror, it becomes easier to make a smooth shave.

Q26.

Uses of concave mirror:

- (i) Concave mirrors are used as shaving mirrors. This is because when the face is placed close to a concave mirror (so that the face is within its focus) the concave mirror produces a magnified and erect image of the face. Since a large image of the face is seen in the concave mirror, it becomes easier to make a smooth shave.
- (ii) Concave mirrors are used by dentists to see the large images of the teeth of patients. This is because when a tooth is within the focus of a concave mirror, then an enlarged image of the tooth is seen in the mirror. Due to this, it becomes easier to locate the defect in the tooth.

Q27.

(a)  
(i)

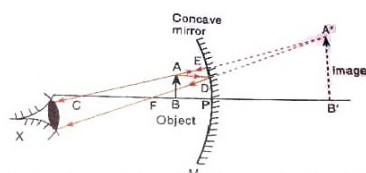
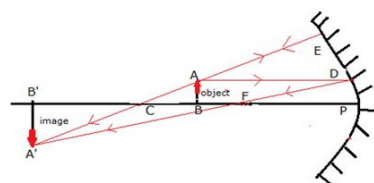


Fig. Formation of image by the concave mirror when the object is placed between its pole and focus.

When object is placed between the pole and focus of a concave mirror, the image is formed behind the mirror, it is virtual, erect and larger than the object.

(ii)



When object is placed between the centre of curvature and focus of a concave mirror, the image is formed beyond the centre of curvature, it is real, inverted and larger than the object.

(b) One use of concave mirror based on the formation of image as in case (i) above: As a shaving mirror.

Q28.

(a) (i) When the object is placed between the pole and focus of a concave mirror, a magnified image is formed.

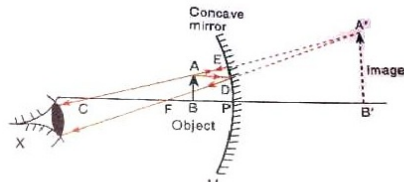
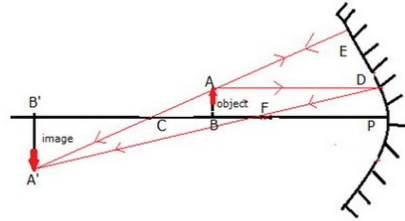


Fig. formation of image by the concave mirror when the object is placed between its pole and focus.

(ii) When the object is placed between the focus and the centre of curvature of a concave mirror, a magnified image is formed.



(b) A concave mirror can be used as a shaving mirror when the object is placed between the pole and focus of a concave mirror.

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Q37.

Since the image formed is upright, the object lies within the focus of the concave mirror.

So,  $f > 100 \text{ mm}$

We know  $R = 2f$

So,  $R > 200 \text{ mm}$

i.e. Radius of curvature is more than 200 mm.

Q38.

10 cm, because if the object is placed between the pole and focus of the concave mirror only then the image formed is virtual, erect and magnified.

Q39.

20 cm, because if the object is placed between the pole and focus of the concave mirror only then the image formed is erect and magnified.

Q40.

(i) A magnified real image - When the object is placed at a distance of 20 cm from the mirror i.e., between focus and centre of curvature.

(ii) A magnified virtual image - When the object is placed at a distance of 10 cm from the mirror i.e., within its focus.

(iii) A diminished real image - When the object is placed at a distance of 35 cm from the mirror i.e. beyond the centre of curvature.

(iv) An image of same size as the object - When the object is placed at a distance of 30 cm from the mirror i.e., at the centre of curvature.

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Q1.

(i) Negative

(ii) Positive

Q2.

(a) Convex mirror.

(b) Concave mirror.

Q3.

Convex mirror (since focal length is positive).

Q4.

Concave mirror (since focal length is negative).

Q5.

Pole

Q6.

(a) Negative.

(b) Positive.

Q7.

According to the New Cartesian Sign Convention:

- (i) All the distances are measured from pole of the mirror as origin.
- (ii) Distances measured in the same direction as that of incident light are taken as positive.
- (iii) Distances measured against the direction of incident light are taken as negative.
- (iv) Distances measured upward and perpendicular to the principal axis are taken as positive.
- (v) Distance measured downward and perpendicular to the principal axis are taken as negative.

Q8.

- (a) Object distance ( $u$ ) for a concave mirror or convex mirror is always negative because an object is always placed to the left side of the mirror and the distances towards the left of the mirror are always negative.
- (b) In case of a concave mirror, if the image is formed on the left side of the mirror, then the image distance ( $v$ ) will be negative and if the image is formed on the right side of the mirror, then the image distance ( $v$ ) will be positive. This is because distances measured to the left of the mirror are negative and to the right of the mirror is positive.
- (c) Image distances ( $v$ ) for a convex mirror is always positive because the image is always formed behind the mirror.

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