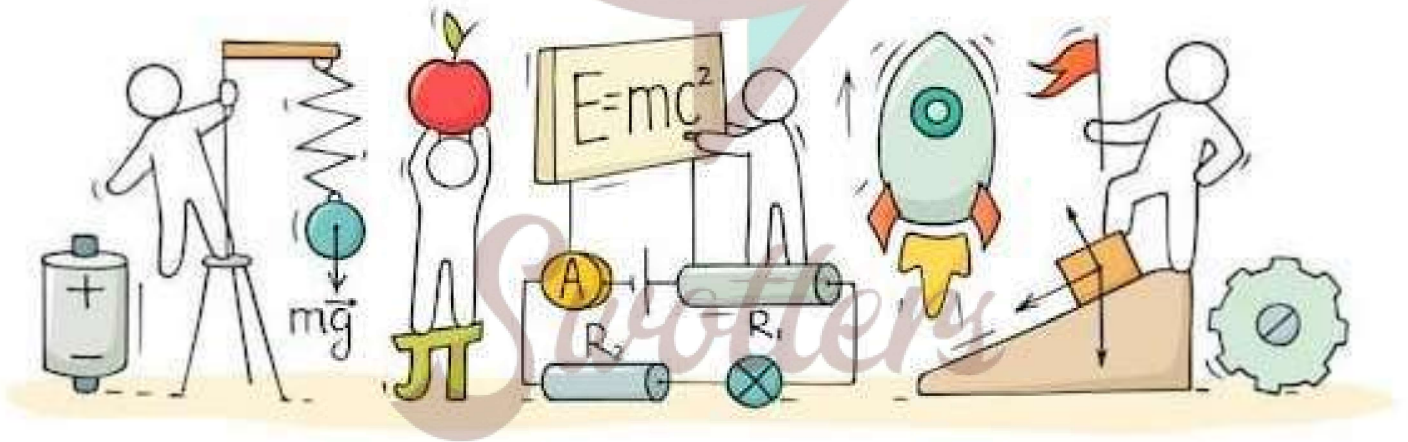
SCIENCE

(Physics)



Important Questions

➢ Multiple Choice Questions:

1. Which of the following can make a parallel beam of light when light from a point source is incident on it?

(a) Concave mirror as well as convex lens

(b) Convex mirror as well as concave lens

(c) Two plane mirrors placed at 90° to each other

(d) Concave mirror as well as concave lens

2. A 10 mm long awl pin is placed vertically in front of a concave mirror. A 5 mm long image of the awl pin is formed at 30 cm in front of the mirror. The focal length of this mirror is

(a) -30 cm

(b) -20 cm

(c) -40cm

(d) -60 cm

3. Under which of the following conditions a concave mirror can form an image larger than the actual object?

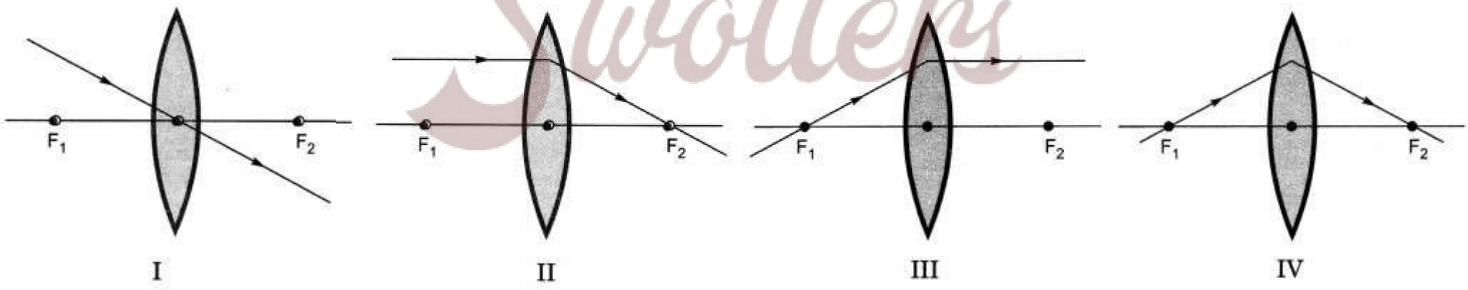
(a) When the object is kept at a distance equal to its radius of curvature

(b) When object is kept at a distance less than its focal length

(c) When object is placed between the focus and center of curvature

(d) When object is kept at a distance greater than its radius of curvature

4. The diagrams showing the correct path of the ray after passing through the



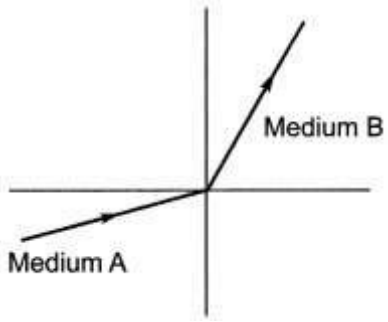
(a) II and III only

(b) I and II only

(c) I, II and III

(d) I, II and IV

5. A light ray enters from medium A to medium B as shown in figure. The refractive index of medium B relative to A will be



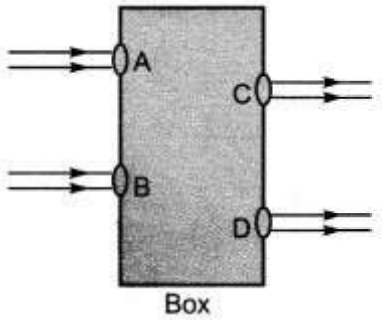
(a) greater than unity

(b) less than unity

(c) equal to unity

(d) zero

6. Beams of light are incident through the holes A and B and emerge out of box through the holes C and D respectively as shown in the figure. Which of the following could be inside the box?



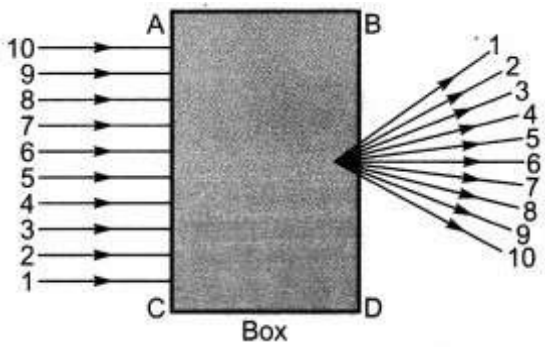
a) A rectangular glass slab

(b) A convex lens

(c) A concave lens

(d) A prism

7. A beam of light is incident through the holes on side A and emerges out of the holes on the other face of the box as show in the figure. Which of the following could be inside the box?



(a) Concave lens

(b) Rectangular glass slab

(c) Prism

(d) Convex lens

8. Which of the following statements is true?

(a) A convex lens has 4 dioptre power having a focal length 0.25 m

(b) A convex lens has -4 dioptre power having a focal length 0.25 m

(c) A concave lens has 4 dioptre power having a focal length 0.25 m

(d) A concave lens has -4 dioptre power having a focal length 0.25 m.

9. Magnification produced by a rear view mirror fitted in vehicles

(a) is less than one

(b) is more than one

(c) is equal to one

(d) can be more than or less than one depending upon the position of the object in front of it.

10. Rays from Sun converge at a point 15 cm in front of a concave mirror. Where should an object be placed so that size of its image is equal to the size of the object?

(a) 15 cm in front of the mirror

(b) 30 cm in front of the mirror

(c) between 15 cm and and 30 cm in front of the mirror

(d) more than 30 cm in front of the mirror

➢ Very Short Question:

1. Define reflection of light?

2. What is a reflector?

3. State laws of reflection.

4. What are the values of angle of incidence ∠i and angle of reflection ∠r for normal incidence of light on a plane mirror?

5. What is real image?

6. What is virtual image?

7. Mention the nature of image produced by a plane mirror.

8. Define center of curvature of a spherical mirror.

9. Define radius of curvature of a spherical mirror.

10. Define aperture of a spherical mirror.

➢ Short Questions:

1. List two differences between real and virtual images.

2. State the laws of reflection of light.

3. With the ray diagram show that angle of incidence is equal to the angle of reflection when a ray is incident on the concave mirror.

4. An object is placed at the following distances from a concave mirror of focal length 15 cm.

(a) 10 cm

(b) 20 cm

(c) 30 cm

(d) 40 cm

Which position of the object will produce

- Virtual image
- A diminished real image
- An enlarged real image
- An image of same size.

5. Draw ray diagram to show the formation of images when the object is placed in front of a concave mirror

(i) between its pole and focus point,

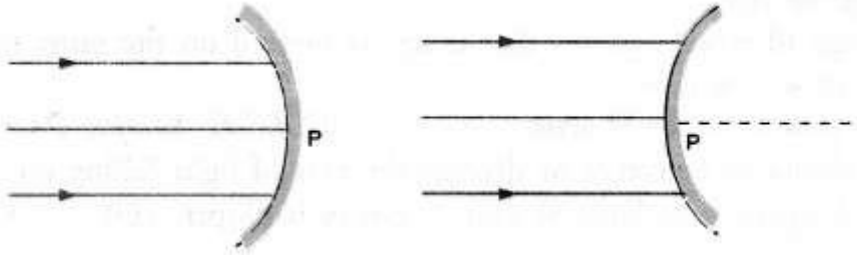
6. State three uses of a concave mirror.

7. State two uses of a convex mirror.

8. Parallel rays of light incident on a concave mirror and a convex mirror as shown in figure,

(i) Redraw the reflected rays in both the cases,

(ii) Name the points where the reflected rays meet or appear to meet on the principal axis.



➢ Long Questions:

1. A thin converging lens forms a:

(i) real magnified image

(ii) virtual magnified image of an object placed in front of it.

(a) Write the positions of the objects in each case.

(b) Draw labelled diagrams to show the image formation in each case.

(c) How will the following be affected on cutting this lens into two halves along the principal axis?

- focal length,
- intensity of the image formed by half lens.

2. For the given data showing object distance and focal length of three concave mirrors, answer the following questions:

S.No.	Object distance (cm)	Focal length (cm)
1.	30	20
2.	10	15
3.	20	10

- Out of the three in which case the mirror will form the image having same size as the object?
- Which mirror is being used as a make-up-mirror?
- Draw the ray diagram for part (1) and part (2)

➢ Assertion Reason Questions:

1. For two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Sele the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:
   a. Both A and R are true, and R is correct explanation of the assertion.
   b. Both A and R are true, but R is not the correct explanation of the assertion.
   c. A is true, but R is false.
   d. A is false, but R is true.

Assertion: Keeping a point object fixed, if a plane mirror is moved, the image will also move.

Reason: In case of a plane mirror, distance of object and its image is equal from any point on the mirror.

2. For two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Sele the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:
   a. Both A and R are true, and R is correct explanation of the assertion.
   b. Both A and R are true, but R is not the correct explanation of the assertion.
   c. A is true, but R is false.

d. A is false, but R is true.

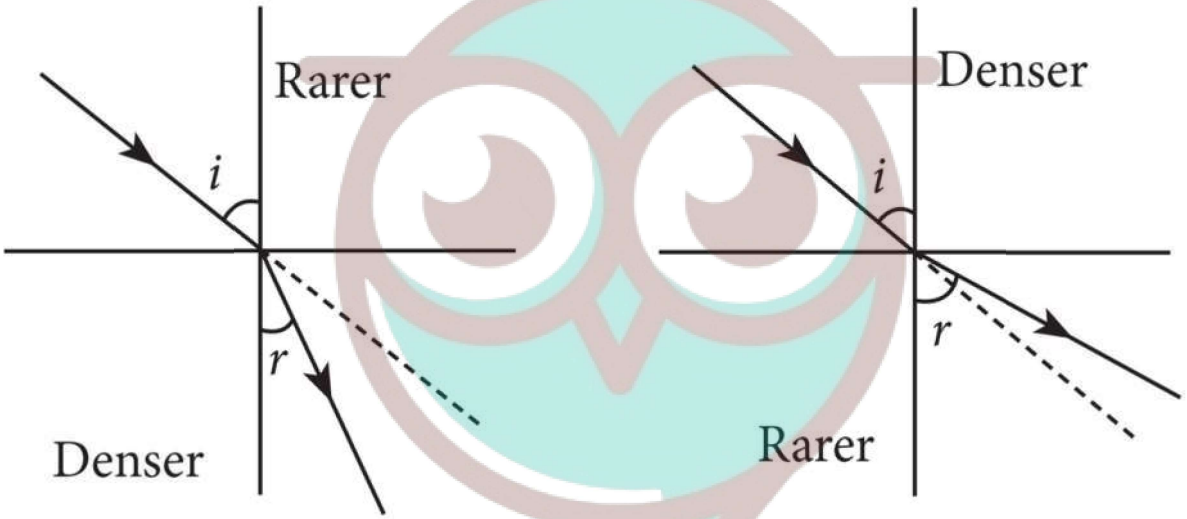
Assertion: The size of the mirror affects the nature of the image.

Reason: Small mirrors always form virtual images.

➢ Case Study Questions:

1. Read the following and answer any four questions from (i) to (v).

When the rays of light travels from one transparent medium to another, the path of light is deviated. This phenomenon is called refraction of light. The bending of light depends on the optical density of medium through which the light pass.



This speed of light varies from medium to medium. A medium in which the speed of light is mo is optically rarer medium whereas in which the speed of light is less is optically denser medium Whenever light goes from one medium to another, the frequency of light does not change however, speed and wavelength change. It concluded that change in speed of light is the basic cause of refraction.

i. When light travels from air to glass, the ray of light bends:
   a. Towards the normal.
   b. Away from normal.
   c. Anywhere.
   d. None of these.

ii. A ray of light passes from a medium A to another medium B. No bending of light occurs if the ray of light hits the boundary of medium B at an angle of:
   a. 0º
   b. 45º
   c. 90º

d. 120º

iii. When light passes from one medium to another, the frequency of light:

a. Increases
b. Decreases
c. Remains same
d. None of these

iv. When light passes from glass to water, the speed of light:

a. Increases.
b. Decreases.
c. Remains same.
d. First increases then decrease.

v. The bottom of pool filled with water appears to be due to refraction of light:

a. Shallower
b. Deeper
c. At same depth
d. Empty

2. The lenses form different types of images when object placed at different locations. When a ray is incident parallel to the principal axis, then after refraction, it passes through the focus or appears t come from the focus. When a ray goes through the optical centre of the lens, it passes without any deviation. If the object is placed between focus and optical canter of the convex lens, erect and magnified image is fanned. As the object is brought closer to the convex lens from infinity to focus, the image moves away from the convex lens from focus to infinity. Also, the size of image goes on increasing and the image is always real and inverted. A concave lens always gives a virtual, erect, a diminished image irrespective to the position of the object.

i. The location of image fanned by a convex lens when the object is placed at infinity is

a. At focus
b. At 2F
c. At optical center
d. Between F and 2F

ii. When the object is placed at the focus of concave lens, the image formed is:

a. Real and smaller
b. Virtual and inverted

c. Virtual and smaller

d. Real and erect

iii. The size of image formed by a convex lens when the object is placed at the focus of conve lens is:

a. Small

b. Point in size

c. Highly magnified

d. Same as that of object

iv. When the object is placed at 2F in front of convex lens, the location of image is:

a. At F

b. At 2 F on the other side

c. At infinity

d. Between F and optical center

v. At which location of object in front of concave lens, the image between focus and optical centre is formed:

a. Anywhere between centre and infinity

b. At F

c. At 2F

d. Infinity

✓ Answer Key-

➢ Multiple Choice Answers:

1. (a) Concave mirror as well as convex lens
2. (b) -20 cm
3. (c) When object is placed between the focus and centre of curvature
4. (c) I, II and III
5. (a) greater than unity
6. (a) A rectangular glass slab
7. (d) Convex lens
8. (a) A convex lens has 4 dioptre power having a focal length 0.25 m
9. (a) is less than one

10. (b) 30 cm in front of the mirror

➢ Very Short Answers:

1. Answer: The process of returning or bouncing back the light to the same medium after striking the surface is called reflection of light.
2. Answer: A surface which reflects the light is called reflector.
3. Answer: Angle of incidence is equal to the angle of reflection. That is, $\angle i = \angle r$.

   Incident ray, reflected ray and normal to the reflecting surface at the point of incidence lie in the same plane.
4. Answer: For normal incidence, $\angle i = 0$. Therefore, according to law of reflection $\angle r = \angle i = 0$.
5. Answer: When rays of light from an object actually meet at a point after refraction, then image formed is real.
6. Answer: When rays of light from an object do not meet at a point but appears to meet at a point, then image formed is virtual.
7. Answer: Image is virtual, erect and of the same size as that of the object.
8. Answer: The center of a hollow sphere of which the spherical mirror forms a part is called the center of curvature of the spherical mirror.
9. Answer: The radius of a hollow sphere of which the spherical mirror forms a part is called radius of curvature of the spherical mirror.
10. Answer: The part of spherical mirror exposed to the incident light is called the aperture of the spherical mirror.

➢ Short Answers:

1. Answer:

Real Image	Virtual Image
Real images are formed by a concave mirror	Convex mirror form a virtual image
Real images are formed due to the actual intersection of light rays	Virtual images are formed due to the imaginary intersection of light rays

2. Answer:

   Angle of incidence is equal to the angle of reflection. That is, $\angle i = \angle r$.

   Incident ray, reflected ray and normal to the reflecting surface at the point of incidence lie in the same plane.
3. Answer:

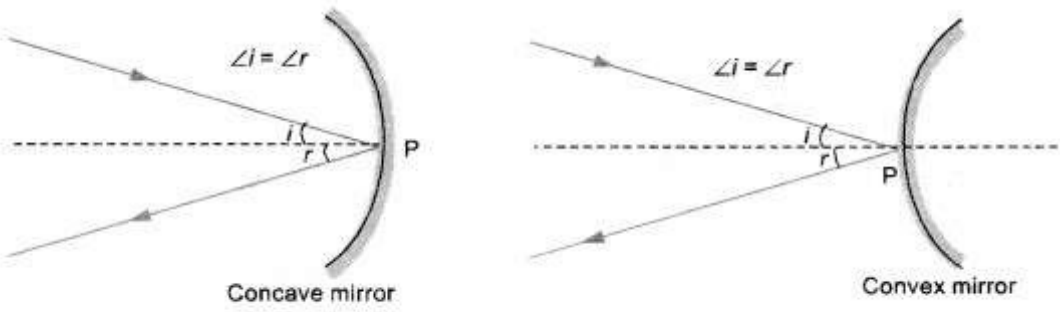


FIGURE 17

4. Answer:

   Concave mirror forms virtual image if object is placed between the focus and pole of the mirror. Therefore, for the position of object at 10 cm mirror forms the required image.

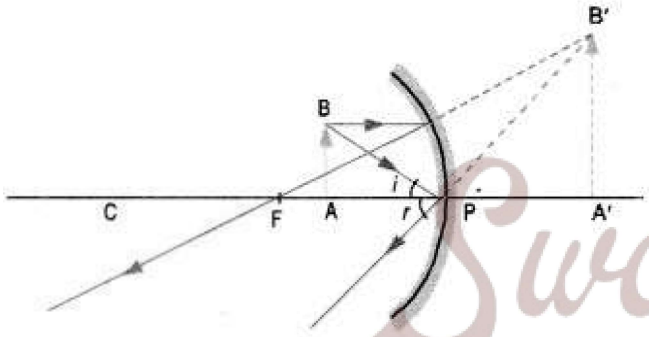
   A real and diminished image is formed when object lies beyond C i.e., beyond 2F. So, for the position of object at 40 cm, mirror forms the required image.

   An enlarged real image is formed when object lies between F and 2 F. So, for the position of object at 20 cm, mirror forms the required image.

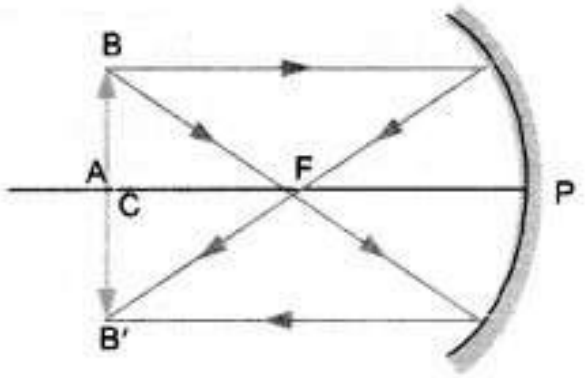
   An image of same size of the object is formed when object lies at C or 2F. So, for the position of object at 30 cm, mirror forms the required image.

5. Answer:

   (i)



   (ii)



6. Answer:

Reflector: Concave mirrors are used in motor head lights, search lights and torches etc. to produce an intense parallel beam of light. A bulb is placed at the focus of concave mirror or concave reflecting surface. The beam of light from the bulb after reflecting from the concave mirror goes as a parallel beam (figure 24).

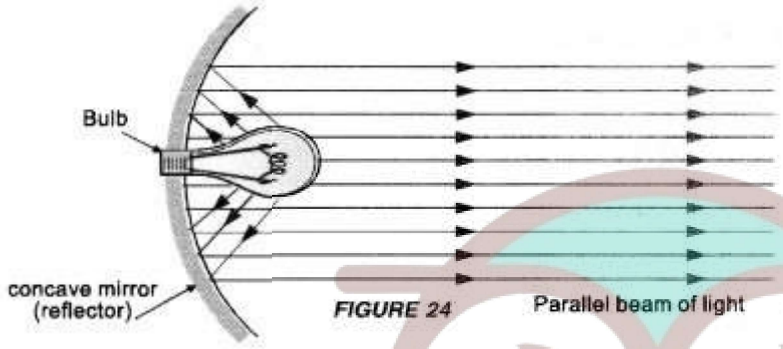


FIGURE 24

This parallel beam of – light illuminates the road ahead of the vehicle.

Shaving and make up mirror: When an object is placed close to a concave mirror (i.e between the pole and focus of the concave mirror), an erect and enlarged (large in

size) image of the object is formed. Because of this fact, concave mirror is used by men to see their enlarged faces while shaving. Similarly, a lady can see her face better with the help of a concave mirror while doing make up.

In solar cookers: When a parallel beam of sun light falls on a concave mirror, this beam is brought to the focus of the concave mirror. As a result of this, the temperature of an object (say a container containing un-cooked food) placed at this focus increases considerably. Hence the food in the container is cooked (figure 25).

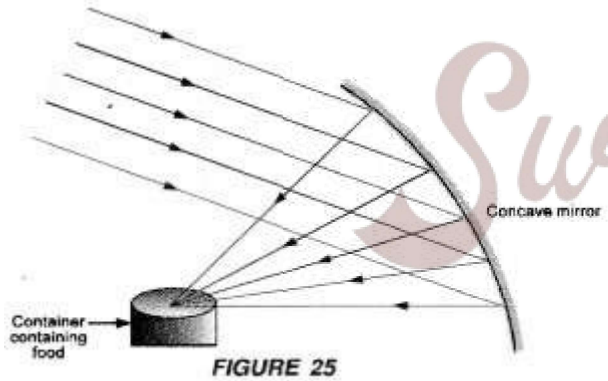


FIGURE 25

7. Answer:

Rear view or driver's mirror. Convex mirror is used as a rear view mirror in vehicles because this mirror forms an erect and diminished image of an object behind the vehicle. Since the image of the object formed is small in size, so the field of view is increased. It means, the driver of a vehicle can see the traffic over large area behind his vehicle. This mirror is also known as driver's mirror.

In street lights. Convex mirror is used in street lights to diverge light over a large area (figure 28).

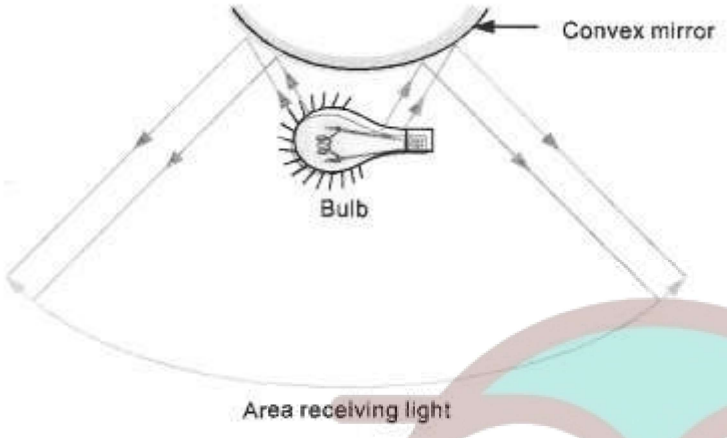
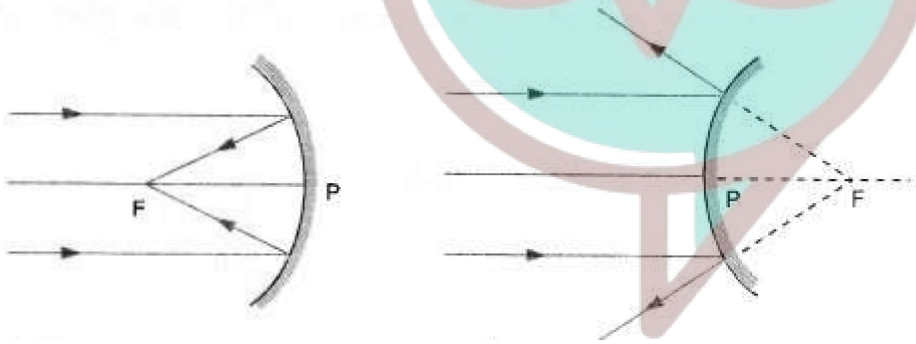


FIGURE 28

8. Answer:

(i) Reflected rays are shown in figures.



(ii) The point where the reflected rays of light meet or appear to meet on the principal axis is known as principal focus F of the concave mirror or convex mirror.

➢ Long Answers:

1. Answer:

(a)

- A converging or convex lens forms real and magnified image of an object, when the object is placed between F1 and 2F1
- A converging lens forms a virtual magnified image of an object, when the object is placed between the focus and optical center of the converging lens.

(b)

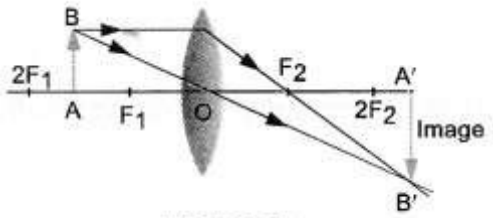


FIGURE 54

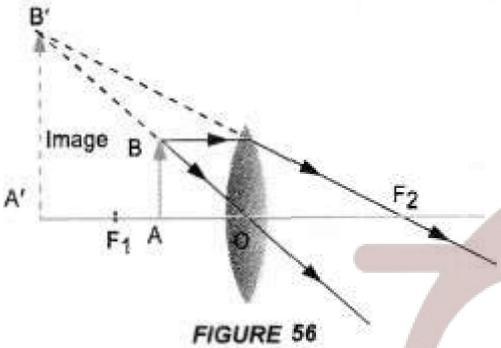


FIGURE 56

(c)

Focal length of each half will be equal to the focal length of the lens. If converging lens of focal length f is cut into two equal halves as shown in figure

then the focal length of each half = f.

Intensity of the image formed ∝ (aperture of the lens)2. Aperture of each cut half of the lens is ½ times aperture of the lens. Hence, intensity of the image formed by half lens will decrease.

2. Answer:

i. Concave mirror forms the image having same size as the object if object is placed at the center of curvature

of the mirror i.e. object distance = 2 f Therefore, for S.No. 3, concave mirror forms the required image.

ii. Concave mirror is used as a make-up mirror if the image of the face is magnified. This happens if the face or object is placed between F and 2 F. Therefore, for S. No. 2, concave mirror is used as a make-up mirror.

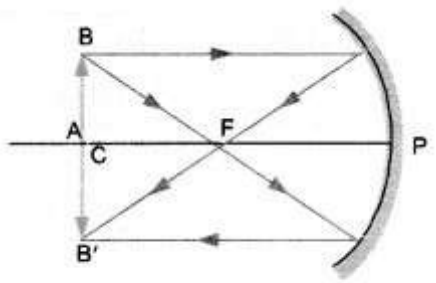


FIGURE 20

iii.

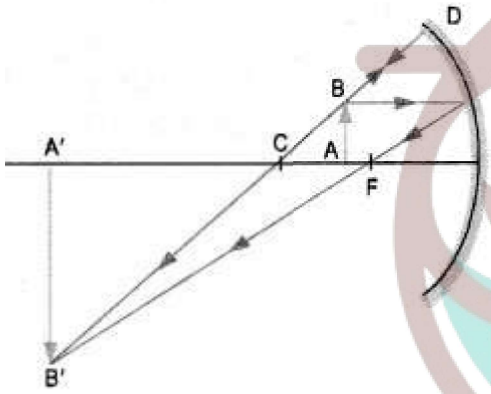


FIGURE 21

➢ Assertion Reason Answer:

1. (a) Both A and R are true, and R is correct explanation of the assertion.

Explanation:

The image formed in a plane mirror is at the same distance behind the mirror as the object is in the front of the mirror. Image and the object are at equal distances from a plane mirror.

2. (d) A is false, but R is true.

Explanation:

The size of the image does not affect the nature of the image, except that a bigger image as it gathers more tight rays due to wider aperture.

➢ Case Study Answer:

1. i (a) Towards the normal.

Explanation:

When, a ray of light travels from air to glass, it bends towards the normal.

ii. (c) 90º

Explanation:

No bending of light occurs when light is incident normally or perpendicularly on a boundary two media since angle of incidence and angle of refraction both are zero.

iii. (c) Remains same

Explanation:

When light goes from one medium to other medium, its frequency does not change.

iv. (a) Increases.

Explanation:

The speed to light increases when light passes from glass to water as water is optically rarer medium.

v. (a) Shallower

Explanation:

The bottom of a pool of water appears to be less deep than it actually is due to refraction.

2. i (a) At focus

Explanation:

When an object is placed at infinity of convex lens, image will be formed at focus F.

ii. (b)Virtual and inverted

Explanation:

Virtual and inverted image is formed, when object is placed at focus of the concave lens.

iii. (c) Highly magnified

Explanation:

When object is placed at focus of a convex lens, highly enlarged or magnified image is formed.

iv. (b) At 2 F on the other side

Explanation:

When an object is placed at distance 2F in front of a convex lens, then the image formed is at a distance 2F on the other of the lens.

v. (a) Anywhere between centre and infinity

Explanation:

Image if formed between focus and optical centre when the object is placed anywhere between optical centre and infinity.