PHYSICS

BOOKS - CHHAYA PHYSICS (BENGALI ENGLISH)

REFLECTION OF LIGHT

Example

1. An object is placed 60 cm away from a convex mirror. The size of the image is $\frac{1}{3}rd$

the size of the object. Determine the radius of curvature of the mirror.

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2. An object of size 5cm is placed on the principal axis of a convex mirror at a distance of 10cm from it . The focal length of the convex mirror is 20cm. Determine the nature, position and size of the image formed.

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3. The image of a object placed 50cm in front of a concave mirror is formed 2 m behind the mirror. Determine its principal focus and radius of curvature.

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4. An object of length 5cm is placed perpendicularly on the principal axis at a distance of 75cm from a conacave mirror. If the radius of curvature of the mirror is 60cm, calculate the image distance and its hieght.

5. A beam of converging rays is incident on a convex mirror of focal length 30cm. In the absence of the mirror the converging rays would meet at a distance of 20cm from the pole of the mirror. If the mirror is situated at the said position where will the converging rays meet?

6. An image of size $\dfrac{1}{n}$ times that of the object is formed in a convex mirror. If r is the radius of curvanture of the mirror, calculate the object distance.

7. An object of height 2.5cm is placed perpendicularly on the principal axis of a concave mirror of focal length f at a distance of $\dfrac{3}{4}f$. What will be the nature of the image of the object and its height?

8. The image of the flame of a candle due to a mirror is formed on a screen at a distance of 9cm from the candle. The image is magnified 4 times. Determine the nature, position and focal length of the mirror.

9. The focal length of a concave mirror is f. A point object is placed beyond the forcal length

at a distance xf from the focus. Prove that the image will be formed beyond the focal length at a distanfe $\dfrac{f}{x}$ from the focus and the magnification of the image will be $-\dfrac{1}{x}$.

10. A thin glass plate is placed in between a convex mirror of focal length 20cm and a point source. The distance between the glass plate and the mirror is 5cm. The image formed by the reflected rays from the front face of the

glass plate and that due to the reflected rays by the convex mirror coincide at the same point. What is the distance of the glass plate from the source? Draw the ray diagram.

11. The sum subtends an angle $0.5°$ at the center of a concave mirror having radius of curvature 1 m. What will be the diameter of the image of the sun formed by the mirror?

12. An object is placed at a distance of 25cm from a concave mirror and a real image is formed by the mirror at a distance of 37.5cm What is the length of the mirror? Now if the object is moved 15cm towards the mirror, what will be the image distance, its nature and magnification ?

13. An object is placed at a distance of 50cm is front of a convex mirror. Now a plane mirror is placed in between the object and the convex mirror, converting the lower half of the convex mirror. If the distance of the plane mirror from the object is 30cm, it is seen that there is no parallax of the images formed by the two mirrors. What is the radius of curvature of the convex mirror?

14. A concave mirror of focal length 10cm and a convex mirror of focal length 15 cm are held co-axially face to face at a distance 40 cm apart. An object of height 2 cm is placed perpendicularly on the common axis in between the two mirrors. The distance of the object from the concave mirror is 15 cm. Considering the first reflection occurs in the concave mirror and the second reflection in the convex mirror, calculate the position, nature and height of the final image.

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15. The focal length of a concave mirror is 30 cm. An object is placed at a distance of 45 cm in front of the mirror. A plane mirror is placed perpendicularly on the principal axis of the concave mirror in such a way that the object is situated in between the two mirrors. Light rays from the object at first are reflection from the concave mirror and then from the plane mirror. As a result the final image coincides with the object. What is the distance between the two mirros?

16. A concave mirros forms a real image magnified two times. If both the object and the screen are moved a real image magnified three times of the object is formed. If the screen is moved through a distance of 25 cm , then determine the displacement of the object and focal lenght of the mirror.

17. A cube of side 2 m is placed in front of a large concave mirror of focal length 1 m is such a way that the face A of the cube is at a distance of 3 m and the face B at a distance of 5 m form the mirror. (i) Calculate the distance between the images of the faces A and B. (ii) Determine the height of the images of the faces A and B. (iii) Will the image of the cube be a cube?

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18. A is a point object in a circular track. A light ray starting from the object A is reflected twice by the circular track and returns again to A. Angle of incidence is α. The distance of A from the center of the circular track is x and the diameter of the circular track from A intersects the path of the ray at a point D whose distance from the center of the circular track is y.

Show that, $\tan \alpha = \sqrt{\dfrac{x - y}{x + y}}$

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19. A concave mirror and a convex mirror are placed coaxially face to face. The focal length of each of them is f and distance between them is 4f. A point source is so placed on their common axis in between the two mirrors that if the first reflction is considered to take place on the convex mirror, the final coincides with teh point source. Determine the position of the source.

20. The diameter of the moon is 3450 km and its distance from the earth is $3.8 \times 10^5 km$. What will be the diameter of the image of the moon formed by a convex mirror of focal length 7.6 m ?

21. Three times magnified image of an object is formed on a screen placed at a distance of 8 cm from the object with the help of the

spherical mirror. Determine the nature of the mirror. Focal length and the distance the mirror from the object.

22. An object is placed just at the middle point between concave mirror of radius of curvature 40 cm and a convex mirror of radius of curvature 30 cm facing each other. The mirrors are situated 50 cm apart from each other. The mirrors are situated 50 cm apart from each

other. Considering the first reflection occurs in the concave mirror, determine the position and nature of the image formed by this mirror. Next find the position and nature of the image formed by the convex mirror considering the first image for concave mirror as its object.

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23. An arrow of height 2.5 cm is situated vertically at a distance of 10 cm from a convex mirror of focal length 20 cm . Where will be

image be formed? Determine its height. If the arrow is moved away from the mirror what will happen to its image?

24. A rod of length 10 cm lies along the principal axis of a concave mirror of focal length 10 cm in such a way that its end closer to the pole is 20 cm away from the mirror? What is the length of the image?

1. What is reflection of light ?

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2. How does the amount of reflected light depend on the direction of incident light ?

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3. How does the amount of reflected light depend on the nature of the medium ?
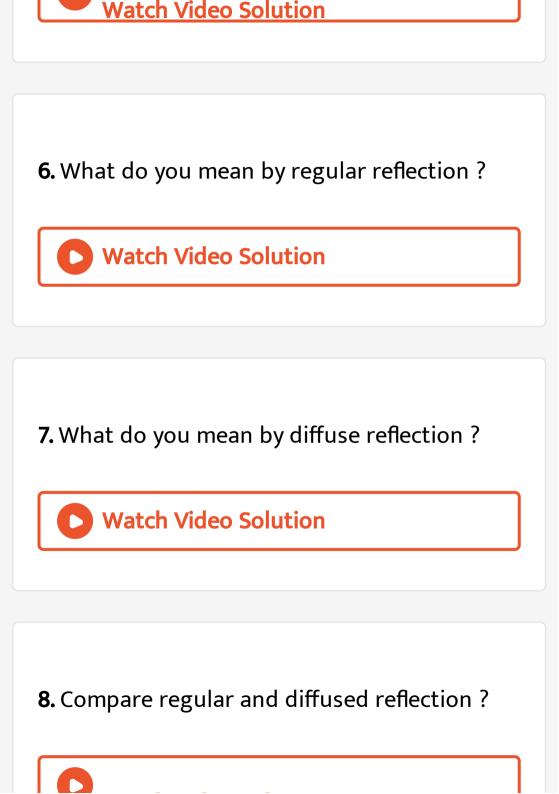
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4. State the laws of reflection of light.

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5. How many types of reflection are there ? What are these ?

▶

6. What do you mean by regular reflection ?

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7. What do you mean by diffuse reflection ?

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8. Compare regular and diffused reflection ?

9. What will be amount of deviation of light ray after reflection from a plane mirror ?

10. Show the difference a real image and a virtural image with the help of diagram .

11. Explain the formation of image of an extended object in a plane mirror with the help of a diagram.

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12. Among the letters C,D,H,M which ones will be laterally inverted due to reflection in a plane mirror ?

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13. Prove that in a plane mirror object distance is equal to the image distance.

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14. With the help of ray diagram explain what do marginal and paraxial rays mean.

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15. Define the following for a spherical mirror :

(i) principal axis, (ii) radius of curvature, (iii) principal focus, (iv) center of curvature, (v) aperture, (vi) pole.

16. Show by ray diagram the formation of image of an object placed at the focus of a concave mirror.

17. Show by ray diagram the formation of image of an object placed at the center of curvature of a concave mirror.

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18. State the nature and size of the image formed by a concave mirror of an object at infinity.

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19. Show by ray diagram the formation of image of by a concave mirror of an object placed at infinty.

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20. Show by ray diagram the formation of image of an object placed in between infinity and center of curvature.

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21. What do you mean by conjugate foci : If they are situated on the same side of the mirror, what is the nature of the mirror?

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22. An object is placed in front of a convex mirror on the principal axis. With the help of a ray diagram show the position of the image.

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23. When is areal magnification considered in spherical mirrors? What is the expression of areal magnification?

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24. In case of a spherical mirror show how magnification (m) depends on focal length (f) of the mirror and image distance (v).

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25. What do you mean by linear magnification of an image formed in a spherical mirror. Establish the expression of magnification.

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26. What is longitudinal or axial magnification ? Establish the relation between longitudinal and linear magnification.

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27. How do you determine a given mirror as plane, convex or concave with an experiment ?

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28. Write down two uses of spherical mirrors.

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29. What is spherical aberration ? How is the image affected in a concave mirror of large

aperture? How does a paraboloidal mirror function ?

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1. What are the differences in reflection by (i) a plane mirror, (ii) the wall of a building and (iii) a clean glass plate ?

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2. At night the objects situated outside a brightly illuminated room are not visible through the glass windows. But if the lights inside the room are off, external objects are visible. Explain the reason.

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3. What type of mirror is used as a rear-view mirror in motors cars and other vehicles and why ?

4. In the dial of a clock, lines are marked instead of numbers. Observing through a plane mirror the time appeared to bt 7.25. What was the actual time ?

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5. Can a plane mirror form a real image ?

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6. Why are paraboloidal mirrors used in car headlights and searchlights instead of using spherical concave mirrors?

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7. On the basis of the relation among u,v and f of a spherical mirror determine the nature, position and size of the image of an object formed by a plane mirror.

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8. Two persons of the same height are standing one inside a shop and another outside the shop, on either side of a glass window. The second man sees his image behind the glass window due to reflection in the glass and his own image appears larger than the other person. What is the type of glass on the windows?

9. If an object of height I is placed perpendicularly on the principal axis of a spherical mirror at a distance u from it, prove that the height of its image, $l' = l\left(\dfrac{f}{u-f}\right)$

10. Show that in a spherical mirror both the object and the image are situated on the same side of the focus.

11. Two concave mirrors are placed facing each other and have the same centre of curvature. Where will the images of the point source Kept at this common centre of curvature be formed?

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12. Show that a convex mirror always forms a virtual image of diminished size as compared to the object.

13. Explain under what conditions a real image of a virtual object and a virtual image of a virtual object are formed in a convex mirror.

14. An object is approaching towards a convex mirror from a long distance. Will the image

move with the same velocity as the object? In which direction will be image move?

15. The image of a candle formed by a concave mirro is cast on a screen. If some parts of the mirror are covered then how will the image be affected ?

16. A small linear object of length I is placed along principal axis of a concave mirror. The neartest point the object is at a distance d from the mirror. If focal length of the mirrors is f then, prove that the size (length) of the image will be $l\left(\dfrac{f}{d-f}\right)^2$

17. The focal length of a concave mirror is f .

What will be the magnification of an object at

a distance x from the principal focus (given, object distance $>$ f)? For what value of x will the size of the object and the image be the same?

18. What will be the magnification of the image of an object placed in the mid-point between the focus and the pole of a concave mirror?

19. What is the minimum distance between the object and its real image formed by a concave mirror and when is it possible ?

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20. What sort of a reflector is used with a street bulb to light up streets in a better way ?

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21. A cube is placed in front of a large concave mirror. Will the image of the cube be a cube ?

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22. An object is placed at a distance of 20 cm in front of a concave mirror of focal length 10 cm. Determine the position of the image. What is the ratio of the size of the image to the size of the object ?

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23. The inside of optical instruments like camera and telescope are blackened. Explain.

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24. Light from a object is incident on a concave mirror and forms a real image of the object. If both the object and the mirror are immeresed in water, then does the position of the image change ?

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25. Can a plane mirror form an inverted image of an object?

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Ncrt Textbook Question With Answer Hint

1. Use the mirror equation to deduce that :

an object placed between f and 2f of a concave mirror produce a real image beyond 2f

2. Use the mirror equation to deduce that :

the virtual image produced by a convex mirror

is always diminished in size and is located

between the focus and the pole

3. Use the mirror equation to deduce that :

a convex mirror always produces a virtual

image indenpendent of the location of the object

4. Use the mirror equation to deduce that :

an object between the pole and focus of a concave mirror produces a virtual and enlarged image.

5. You have learned that plane and convex mirror produce virtual images of objects. Can they produce real image under some circumstances? Explain.

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6. Light incident normally on a plane mirror attched to a galvanometer coil retraces backwards as shown in Fig 1.55. A current in the coll produces a deflection of $3.5°$ of the

mirrror. What is the displacement of the reflected spot of light on a screen placed 1.5 m away.

7. A Cassegrain telescope is built with mirrors 20 mm apart. If the radius of curvature of the large mirror is 220 mm and the small mirror is 140 mm, then where will the final image of an object at infinty be?

Mcq 1 Single Option Correct

1. The phenomenon involved in the reflection of radio waves by ionosphere is similar to

    A. reflection of light by a plane mirror

    B. total internal reflection of light in air during mirage

C. dispersion of light by water molecules

during formation of a rainbow

D. scattering of light by particles of air

Answer: B

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2. A car is moving with a constant speed of 60 km. h^{-1} on a straight road. Looking at the rear view mirror, the driver finds that the car following him is at a distance of 100 m and is

approaching with a speed of 5 km. h^{-1}. In order of keep track of the car in the rear the driver begins to glance alternatively at the rear and side mirror of his car after every 2s till the other car overtakes. If the two cars were maintaining their speeds, which of the following statement is correct ?

A. the speed of the car in the rear is 65 km .

h^{-1}

B. in the side mirror, the car in the rear would appear to approach with a speed

of 5 km. h^{-1} to the driver of the leading

car

C. in the rear view mirror, the speed of the

apporaching car would apperar to

decrease as the distance between the

cars decreases

D. in the side mirror, the speed of the

approaching car would appear to

increase as their distance between the

cars decreases

Answer: D

Exericise Mcq

1. A ray of light is incident on a reflecting surface making an angle $50°$ with the surface. Due to reflection, the angle of deviation is

   A. $90°$

   B. $80°$

C. $100°$

D. $110°$

Answer: C

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2. To form three images of an object, the angle at which two plane mirrors should be inclined to each other is

A. $30°$

B. $60°$

C. $90°$

D. $120°$

Answer: C

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3. A man moves towards a plane mirror with a velocity $15 \cdot s^{-1}$. The velocity of the image with respect to the man is

A. $15m \cdot s^{-1}$

B. $30m \cdot s^{-1}$

C. $35m \cdot s^{-1}$

D. $20m \cdot s^{-1}$

Answer: B

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4. Two plane mirrors are at $45°$ to each other.

If an object is placed between them, then the

number of images will be

A. 7

B. 8

C. 14

D. 4

Answer: A

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5. A small object is situated at a distance of 10 cm in front of a plane mirror. If you stand behind the object at a distance of 30 cm from

the mirror and look at the image, then to you

the distance of the image will be

A. 60 cm

B. 20 cm

C. 40 cm

D. 80 cm

Answer: C

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6. The reflected rays at a plane mirror can form

a real image

    A. if the incident rays at the mirror are

       convergent

    B. if the incident rays at the mirror are

       divergent

    C. under no circumstances

    D. if the object is situated very close to the

       mirror

Answer: A

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7. Light waves coming from air are reflected at the surface of separation of air and glass. The phase change of the reflected wave is equal to

   A. zero

   B. $\dfrac{\pi}{2}$

   C. π

   D. 2π

Answer: A

8. In the dial of a clock there are marks instead of numbers. The reading of time appears $10:10$ when the clock is seen through a plane mirror. The real time of the clock is

A. $9:50$

B. $1:50$

C. $2:10$

D. $10:10$

Answer: B

9. A man of height 6 ft wants to see his full image in a plane mirror. The minimum length of the plane mirror required

A. 6 ft

B. 12 ft

C. 2 ft

D. 3 ft

Answer: D

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10. The focal lentht of a concave mirror is

A. maximum for red colour

B. maximum for violet colour

C. maximum for yellow colour

D. equal for all colours

Answer: D

11. Which mirror is to be used to obtain a parallel beam of light from a small lamp ?

A. plane mirror

B. convex mirror

C. concave mirror

D. any one of these

Answer: C

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12. A concave mirror has radius of curvature r

and focal length f . The condition under which

a diminished inverted image will be formed is

A. $u = r$

B. $u > r$

C. $f < u < r$

D. $0 < u < f$

Answer: B

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13. A concave mirror has radius of curvature r and focal length f. An object is placed at a distance u from the mirror. The condition under which an inverted image of the same size of the object will be formed is

A. $u = r$

B. $u > r$

C. $f < u < r$

D. $0 < u < f$

Answer: A

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14. A concave mirror has radius of curvature r

and focal length f. An object is placed at a

distance u from the mirror. The condition under which a virtual image will be formed is

A. u = f

B. $u > r$

C. $f < u < r$

D. $0 < u < f$

Answer: D

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15. A concave mirror has radius of curvature r and focal length f. An object is placed at a distance x from the mirror. The condition under which a magnified erect image will be formed is

   A. x = f

   B. $u > r$

   C. $f < u < r$

   D. $0 < u < f$

Answer: D

16. A mirror forms a real image of unit magnification. Nature of the mirror is

A. plane

B. paraboloidal

C. convex

D. concave

Answer: D

▶

17. If an object is placed at a distance of 40 cm

from a concave mirror of focal length 20 cm ,

them the image wil be

    A. virtual and inverted

    B. real and erect

    C. real, inverted and diminished

    D. real, inverted and same size as the

       object

Answer: D

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18. A person standing in fornt of a mirror finds his image larger than himself. This implies that the mirror is

   A. convex

   B. parabolic

   C. plane

   D. concave

Answer: D

19. A convex mirror has focal length f. An object is placed at a distance u from the mirror. The condition under which diminished image will be formed is

A. u = 0

B. $0 < u < \infty$

C. $u < 0$ and $|u| < |f|$

D. diminished image will not be formed, in

any way

Answer: B

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20. An object is placed at a distance of 20 cm

from a concave mirror of focal lenght 10 cm.

What is the image distance?

A. 20 cm

B. 6.67 cm

C. 10 cm

D. 30 cm

Answer: A

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21. An radius of curvature of a convex mirror is 40 cm and the size of the object is twice the size of the image. The image distance will be

A. 10 cm

B. 20 cm

C. 40 cm

D. 30 cm

Answer: A

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22. A concave mirror of focal length f (in air) is immersed in water $\left(\mu = \dfrac{4}{3}\right)$. The focal

length of the concave mirror in water will be

A. f

B. $\dfrac{4}{3}f$

C. $\dfrac{3}{4}f$

D. $\dfrac{7}{3}f$

Answer: A

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23. A concave mirror of focal length 15 cm forms an image twice the size of the object. If the image is virtual, the distance of object is

A. 45 cm

B. 30 cm

C. 7.5 cm

D. 22.5 cm

Answer: C

24. The image of a point object placed at 10 cm from a concave mirror, is formed at a distance of 20 cm from the mirror. If the object is moved towards the mirror by 0.1 cm then the image

    A. will move another 0.41 cm away from the mirror

    B. will move another 0.81 cm away from the mirror

C. will move towards the mirror by another

0.41 cm

D. will move towards the mirror by another

0.81 cm

Answer: A

25. A small linear object of length b is situated

along the axis of a concave mirror at a

distance x. If the focal lenght of the mirror is f, the length of the image will be

A. $\left(\dfrac{f}{u-f}\right)b$

B. $\left(\dfrac{f}{u-f}\right)^2 b$

C. $\left(\dfrac{f}{u-f}\right)b^2$

D. $\left(\dfrac{f}{u-f}\right)$

Answer: B

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26. If the object distance and image distance from the focus of a spherical mirror of focal length f be x and y respectively, then

    A. xy = f

    B. $xy = f^2$

    C. $\dfrac{x}{y} = f$

    D. $xy = f^3$

Answer: B

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27. An object is placed at a distance x from the principal focus of a spherical mirror of focal length f. The magnification of the image will be

A. $\dfrac{x}{y}$

B. $\dfrac{f}{x}$

C. $1 + \dfrac{f}{x}$

D. $1 - \dfrac{f}{x}$

Answer: B

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28. If a graph is drawn taking x and y as the object distance and the image distance respectively from the focus of a spherical mirror, the graph will be a

   A. rectangular hyperbola

   B. parabola

   C. circle

   D. ellipse

Answer: A

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29. A rod is standing in front of a mirror on its axis. The virtual image formed by the mirror is smaller in size than the object. The nature of the mirror is

A. plane

B. concave

C. convex

D. concave or convex

Answer: C

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30. Image that indicate positive magnification

is

A. erect

B. inverted

C. larger than the size of the object

D. smaller than the size of the object

Answer: B

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31. An object is approaching a convex mirror. The ratio of the velocity of the object and that of the object image which is m times magnified is

A. $\dfrac{1}{m^2}$

B. m^2

C. $-m$

D. $\dfrac{1}{m}$

Answer: A

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32. A car is fitted with a convex side-view mirror of focal length 20 cm. A second car 2.8 m behind the first car is overtaking the first car at relative speed $15m \cdot s^{-1}$. The speed of

the image of the second car as seen in the

mirror of the first one is

A. $\dfrac{1}{15}m \cdot s^{-1}$

B. $10m \cdot s^{-1}$

C. $15m \cdot s^{-1}$

D. $\dfrac{1}{10} \cdot s^{-1}$

Answer: A

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Very Short Answer Type Question

1. Can an image be formed due to diffused reflection ?

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2. Can a plane mirror form a real image ?

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3. If a light ray is incident on a horizontal plane mirror making an angle $30°$ with the mirror, what angle will the reflected ray make with the mirror ?

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4. What type of reflection takes place on the screen of a cinema hall ?

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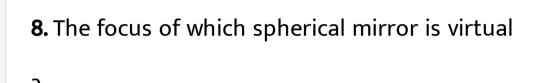**5.** What is the angle of deviation of a ray incident perpendicularly on a reflecting surface ?

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6. The reflected surface from which regular reflection of light takes place is called _____ [Fill in the blanks].

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7. A plane mirror can form a real image of a

_____ object [Fill in blanks].

8. The focus of which spherical mirror is virtual

?

9. Two concave mirrors have from an image of

the sun on a screen. For which image

formation will the temperature of the screen become higher?

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10. The secondary focus of a concave mirror is a fixed point. Is this statement correct ?

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11. The principal focus of a concave mirror is a fixed point. Is this statement correct ?

12. Two concave mirrors have same aperture but different focal lenghts. Both form image of the sun on a screen. For which image formation will the tempertaure of the screen be higher ?

13. The radius of curvature of a concave mirror is 30 cm. What is its focal length ?

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14. Which spherical mirror is called a divergent mirror-concave or convex?

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15. The focal leght of a spherical mirror is 40 cm. What is its radius of curvature ?

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16. What is the value of focal leght of a plane mirror?

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17. What is the power of a plane mirror?

18. What is the relation between radius of curvature (r) and focal length (f) of a spherical mirror ?

19. Does the size of mirror affect the nature of the image ?

20. The focal length of a concave mirror is equal for all colours of light. Is the statement true or false?

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21. What type of mirror is to be used for getting parallel rays from a small source of light ?

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22. What will happen to the focal length of concave mirror when it is immersed in water ?

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23. Where should an object be placed in front of a concave mirror to get a magnified image ?

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24. Why do we sometimes use a concave mirror instead of a plane mirror as a common mirror ?

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25. What is the magnification of the image of an object placed at the centre of curvature of a concave mirror ?

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26. What is the magnification of an object placed at the focus of a concave mirror?

▶ **Watch Video Solution**

27. Can a convex mirror ever form a real image of a real object?

▶ **View Text Solution**

28. What will be the image of an object placed before a convex mirror-erect or inverted?

View Text Solution

29. Two concave mirrors are placed face to face and they have the same centre of curvature. Where will the image be formed?

View Text Solution

30. If an object is placed between the pole and the focus of a concave mirror, will the size of the image be magnified with respect to the size of the object?

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31. Smaller virtual image is formed by _____ mirror. [Fill in the blanks]

▶ View Text Solution

32. What is the minimum distance between an object and its image formed by a concave mirror?

▶ **View Text Solution**

33. If a concave mirror is immersed in water will its focal length change?

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34. In case of a concave mirror what is the shape of the u~v graph?

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35. In case of concave mirror what is the shape of $\dfrac{1}{u}$~$\dfrac{1}{v}$ graph?

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36. The focal length of a concave mirror in vacum is 2 m. What will be the focal length of the concave mirror in a medium of refractive index 2.76?

37. At what distance in front of a concave mirror $(f = 10m)$ an object is to be placed so that the size of the image will be halved of the size of the object?

38. If the conjugate foci of a spherical mirror lie of the same side of the mirror then, what is the nature of the mirror?

39. What is the magnification produced in a plane mirror ?

40. A cube is placed in front of a large concave mirror. Will the image of the cube be a cube?

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41. Can a convex mirror form a real image?

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42. For a spherical mirror if the linear magnification of the image be m what will be

its lateral magnification ?

43. The image of a candle formed by a concave mirror is cast on a screen. What will happen if the mirror is covered partly?

44. An object is moving towards a convex mirror from large distance. The image will

move with _____ velocity than the object _____ the mirror [Fill in the blanks].

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45. Will the focal lenth of a spherical mirror be affected if the wavelenght of the light used is increased?

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46. What type of mirror do car-drives use to view the traffic at the back of the car?

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47. What type of mirror do dentists use ?

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48. What type of mirror is used in search lights and head lights of vehicles?

Short Answer Type Question I

1. What is the focal length and the power of a plane mirror?

2. Why are convex mirros used as side view mirrors in cars?

3. Can a virtual image be photographed? Explain.

4. Explain the formation of dusk

5. Why do ornaments made of gold look bright?

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6. Why the screen of a cinema hall made rough and white?

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7. Why is the inside portion of the optical instruments like camera, telescope etc. made black?

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8. The image of a lamp is cast on a screen by a concave mirror. If some portion of the mirror is covered, what change in the image will be noticed?

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9. Can we apply spherical mirror formula to a plane mirror?

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Short Answer Type Question Ii

1. What are the differences in the reflection of light from (i) a plane mirror, (ii) wall of a building and (iii) a clean glass plate?

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2. Show that a convex mirror always forms a virtual image of diminished size as compared to object.

3. What are the conditions under which a convex mirror can form a real image of a virtual object and virtual image of a virtual object? Explain.

4. An object is placed at a distance of x form a concave mirror of radius of curvature r. prove that its image distance will be $v = \dfrac{rx}{2x - r}$.

5. For the formation fo the following images which type of mirror is required and where should the object be placed ? (i) real image of same of the object, (ii) virtual image of same

size of the object, (iii) real image smaller than the object, (iv) virtual image smaller than the object, (v) magnified real image, (vi) magnified virtual image.

6. Show that if a plane mirror is shifted throught a distance 'p' from a fixed object then the image of the object will be shifted throught the distance 2p.

7. Light from an object falls on a concave mirror forming real image of the object. If both the object and the mirror are immersed in water, will there be any change in the position of the image? Explain with reason.

8. At night it is difficult to see through a closed glass window from a well-lighted room,

but it is relatively easy when the room lights are switched off. Why?

9. One of the two persons of same height is standing inside a shop and the other person beside a glass window outside the shop. The second man observes his magnified image due to reflection in the glass of the window. What is the nature of the glass of the window?

10. How can you distinguish between a plane mirror, a concave mirror and convex mirror just by looking at them?

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11. A concave mirror of small aperture forms a shaper image. Why?

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1. The sun subtends an angle $\frac{1}{2}^{\circ}$ at the pole of a concave mirror. If the radius of curvature of the mirror is 15 m , what will be the size of the sun's image formed by the mirror?

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2. A concave mirror forms an erect and there times magnified image on the axis of the

mirror at a distance of 32 cm from the object. What is the focal length of the mirror?

3. An arrow of length 15 cm is placed along the axis of a concave mirror. Its sharp end is at a distance of 30 cm from the mirror and the radius of curvature of the mirror is 20 cm . Calculate the magnification of the image of the arrow.

4. A beam of converging rays from a point source would meet behind spherical mirror at a distance of 40 cm from it. But after reflection from the mirror the beam most at a point 20 cm from mirror. Is the mirror concave or convex? What is its focal length?

5. The focal length of a concave mirror is 20 cm . Where should an object be placed to get

an image magnified twice?

6. What type of a spherical mirror is required to project the image of the flame of a candle on a wall 9 ft away from the flame? Determine the position of the mirror and its focal length.

7. At what distance from a concave mirror an object should be placed to get an image half the size of the object?

8. The diameter of the moon is about 2160 km . When the moon's distance from a concave mirror is $43.2 \times 10^4 km$, an image of diameter 1.5 cm of the moon is formed. What is the radius of the mirror?

9. A planet subtends an angle $\dfrac{6}{\pi}$ min at the pole of a concave mirror. The diameter of the image of the planet formed by the mirror is 4 mm. Calculate the radius of curvature of the concave mirror

10. An object is kept at a distance of 0.3 m from a concave mirror. If magnification is $\dfrac{1}{2}$,

then determine the focal length of the concave mirror.

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11. A man wants to observe his own eye with the help of a concave mirror of raidius of curvature of 40 cm. If the person has normal eyesight what should be the distance between his eye and the mirror?

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12. An object of size 5 cm is placed at a distance of 2 m from a concave mirror of radius of curvature 40 cm. Determine the size of the image formed.

13. An object is placed at a distance x from the principal focus of a spherical mirror of focal length f. Calculate the magnification of the image.

14. The sun (diameter d) subtends an angle θ radian at the pole of a concave mirror of focal length f. Determine the diameter of the image of the sun formed by the mirror.

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15. A narrow rod of length $\dfrac{f}{3}$ is placed along the axis of a concave mirror of focal length f. The image of the rod is real, magnified and

just touches the rod. Determine the magnification.

16. A square plate of side 4 cm is situated at a distance of 20 cm from a concave mirror of radius of curvature 30 cm. Calculate the area of the image of the square plate.

17. An object is kept in front of a concave mirror of focal length 15 cm. The image formed is three times the size of the object. Calculate two possible distances of the object from the mirror.

18. Find the position of an object which when placed in front of a concave mirror of focal

length 20 cm, produces a virtual image which is twice the size of the object.

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19. The image formed by a convex mirror is one third of the object. If the focal length of the mirror is 30 cm, calculate the image distance.

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20. A virtual image of half the size of the object is formed by a convex mirror at a distance of 30 cm from the object. What is the radius of curvature of the mirror?

21. What will be the magnification of an object placed at 2f from the pole of the of the convex mirror?

22. When an object is placed at a distance of 60 cm from a convex spherical mirror, the magnification produced is $\dfrac{1}{2}$. Where should the object be placed to get a magnification of $\dfrac{1}{3}$?

Problem Set Ii

1. A concave mirror forms a virtual image of twice the size of the object placed at a distance of 10 cm from the mirror. If the object is placed at a distance of 30 cm from the mirror where will the image be formed? Formed? What will be the nature of the image formed?

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2. An object is placed perpendicularly on the principal axis of a concave mirror of focal length 25 cm and an image is formed at a distance of 100 cm in front of the mirror. Determine the position of the object and mangnification of the image.

3. A spherical mirror is hung in a wall of a room. A candle is placed at a distance of 4 cm

in front fo the mirror and an image is formed on the opposite wall of the room. If the distance of the opposite wall is 12 cm, determine the focal length and nature of the mirror.

4. At what distance from a concave mirror of focal length f an object is to be placed so that a real image of n times magnified will be formed?

5. Two object A and B are kept one after another in front of a concave mirror of focal length 7.5 cm . Both the mirrors form images of the same size. Now, if A is thrice the length of B and kept at a distance of 30 cm from the mirror, then what is the distance at which B is kept?

6. An object is placed at a distance of 60 cm in front of a concave mirror of focal length 30 cm. Where will the image be formed? If the object apporoaches d cm towards the mirror, then how far will the image be shifted?

7. A rectangular glass slab of thickness 3 cm and of refractive index 1.5 is placed in front of a concave mirror perpendicularly on its axis.

The radius of curvature of the mirror is 10 cm. At what point should an object be placed on the principal axis so that its image will be formed on the object?

8. A converging beam of rays meets at a point 15 cm in front of a convex mirror of radius of curvature 20 cm. In absence of the mirror where would the beam of rays meet?

9. An object is placed at a distance of 20 cm in front of a convex mirror. Now a plane mirror is placed in between the object and the convex mirror, convering the lower half of the convex mirror, If the distance of the plane mirror from the object is 15 cm, it is seen that the images formed by the two mirrors coincide. Determine the radius of curvature of the convex mirror.

10. In a car a convex mirror of focal length 1 cm is being used as rear view mirror. A car of height 5 m and width 2.5 m behind this car, (i) what will be the size and position of the image of the second car on the viewfinder of the first car? (ii) If the second car tries to overtake the first car with a relative velocity $20m \cdot s^{-1}$ what will be the magnitude and direction of the velocity of the image?

1. An Object is placed at a distance of 90 cm from a screen. To cast an image of magnification 2 on the screen, what type of spherical mirror is required ? Determine the position of the mirror and its focal length.

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2. An object is placed in front of a concave mirror, a three times magnified image is

formed. If the object is moved through a distance 20 cm towards the mirror, a virtual image of same magnification is formed. What is the focal length of the mirror?

3. A concave mirror forms a real image of height twice the size of the object. Now the object and the screen are so moved that a real image of height three times the size of the object is formed. If the displacement of the

screen is 18 cm, determine the displacement of the object and the focal lenght of the mirror.

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4. A concave mirror forms an image of an object, magnified 4 times. When the object is moved through 5 cm along the axis of the mirror, the magnification of the image is 5. What is the focal length of the mirror?

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5. An object is placed at a distance of 36 cm in front of a convex mirror of radius of curvature 24 cm. To move the image through a distance of 3 cm towards the mirror, what should be the corresponding displacement of the object?

6. A convex mirror of radius of curvature 70 cm and a plane mirror are placed face. The distance of separation between the mirrors is

28 cm. If a point source is placed on the principal axis in between the mirrors, two images are formed in the plane mirror. Determine the distance of the two images from the plane mirror.

7. An object is placed exactly mid-way between a concave mirror and a convex mirror. The radius of curvature for each of them is 0.2 m. The mirrors are placed face to face and are 0.3

m apart. Find the position of the image formed by two successive reflections, the first one taking place at the concave mirror and then at the convex mirror.

8. A concave mirror of focal length 36 cm and a convex mirror of focal length 20 cm are placed face to face on the same axis at a distance of separation 80 cm. An object is placed at a distance 20 cm in front of the convex mirror.

Determine the position of the images (i) first by the reflection in convex mirror and then in the concave mirror and (ii) first by the reflection in concave mirror and then in the convex mirror.

9. The image of an object at a distance of 40 cm from a convex mirror is formed at a distance of 10 cm from the mirror . If the object begins to move towards the mirror with

a velocity of $8cm \cdot s^{-1}$ what will be the velocity of the image?

10. A point source of light is placed at the midpoint of two concave mirror (facing each other) of focal length f , What should be the magnitude of the distance of separation d between the two mirrors for a single image to be formed?

11. The reflecting surfaces of a concave mirror and a convex mirror are separated by a distance of 35 cm. The radius of curvature of the tow mirrors are 15 cm and 25 cm respectively. An object of height 3 cm is placed vertically on the principal axis 10 cm from the concave mirror. If the first reflection takes place in the concave mirror and then in the convex mirror, determine the position , nature and size of the final image formed.

12. A perticular spherical mirror forms images of the same size when the objects are placed 8 cm and 16 cm from the pole of the mirror. Determine the nature and focal length of the mirror. Also determine the magnification of the image.

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13. An objects is placed in front of a concave mirror. The mirror forms an image of

magnification 2 on a screen. Now the object is moved such that on shifting the screen another 20 cm from the mirror, the image formed on the screen is magnified three times. Determine the displacement of the object and the focal length of the mirror.

14. Two spherical mirrors, one concave and other convex are placed coaxially facing each othe. The values of the focal leghts of the two

mirrors is 2 m. A small coaxial circle of radius 6 mm is drawn in the convex mirror at centering the pole of the mirror. Determine the radius of the image of the circle formed by two successive reflection first at concav and then at convex mirror.

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15. A point object O is placed on the axis of a concave mirror of radius of curvature 6 cm. Rays of light coming from O after reflection

from concave mirror M are incident on a small mirror M. After reflection from M the reflected rays meet at the pole P of the concave mirror. If OP = 9cm, PM = 3 cm, then determine the nature of the mirror M and its focal length.

16. Image of an object apporoaching a convex mirror of radius of curvature 20 m along its optical axis is observed to move from

$\frac{25}{3}m \rightarrow \frac{50}{7}$ m in 30 seconds. What is the speed of the object in km per hour?

17. A short linear object of length L lies on the axis of a spherical mirror of focal length f at a distance K from the mirror. Calculate the axial length of the image.

18. A thin rod of length $\dfrac{f}{3}$ is placed along the principal axis of a concave mirror of focal length f, such that its image which is real and elongated, just touches the rod. Calculate the magnification.

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Entrance Conner

1. **Statement I** : The formula connecting u,v and f for a spherical mirror is valid only for mirrors whose sizes are very small compared to their radii of curvature.

Statement II : Laws of reflection are strictly valid for plane surfaces but not for large spherical surfaces.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I .

B. Statement I is true, statement II is true,

   statement II is not a correct explanation

   for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: C

2. Statement I : A concave mirror is preferred to a plane mirror for shaving.

Statement II : When a man keep face between pole and focus of mirror, an erect and highly magnified virtual image is formed.

    A. Statement I is true, statement II is true, statement II is a correct explanation for statement I .

    B. Statement I is true, statement II is true, statement II is not a correct explanation

for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: A

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3. Statement I : A virtual image can not be directly photographed.

Statement II : Virtual image can produced by using convex mirror.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I .

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: B

4. Statement I : In the absence of diffuse reflection an object would appear either dazzlingly bright or quite dark.

Statement II :Angle of incidence is not equal to angle of reflection in this case.

   A. Statement I is true, statement II is true, statement II is a correct explanation for statement I .

B. Statement I is true, statement II is true,

statement II is not a correct explanation

for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: C

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5. Statement 1: Convex mirror is used as driver's mirror.

Statement 2: Convex mirror gives a index wider field of view of the traffic.

A. Statement 1 is true, statement 2 is true, statement 2 is a correct explanation for statement 1.

B. Statement 1 is true, statement 2 is true, statement 2 is not a correct explanation for statement 1.

C. Statement 1 is true, statement 2 is false.

D. Statement 1 is false, statement 2 is true.

Answer: A

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Multiple Correct Answer Type

1. The image of an extended object, placed perpendicular to the principal axis of a mirror will be erect if

A. the object and the image are both real

B. the object and the image are both

   virtual

C. the object is real but the image in virtual

D. the object is virtual but the image is real

Answer: C::D

2. If the light moving in a straight line bends by a small but fixed angle, it may be a case of

A. reflection of light by a plane mirror

B. refraction

C. diffraction

D. dispersion

Answer: A::C

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3. If a converging beam of light is incident on a concave mirror, the reflected light

    A. may form a real image

    B. must form a real image

    C. may form a virtual image

    D. may be a parallel beam

Answer: A::B

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4. A point object P moves towards a convex mirror with a constant speed V along its optic axis. The speed of the image

A. is always $< V$

B. may be $>$, $=$ or $< V$ depending on the position of P

C. increases as P comes closer to the mirror

D. decreases as P comes closer to the mirror

Answer: A::C::D

Comprehension Type

1. An object is placed at a distance of 25 cm from a concave mirror and a real image a formed by the mirror at a distance of 37.5 cm. The focal length of the mirror is

2. An object is placed at a distance of 25 cm from a concave mirror and a real image a formed by the mirror at a distance of 37.5 cm. If the object is moved 15 cm towards the mirror the image distance will be

    A. 20 cm

    B. 25 cm

    C. 30 cm

    D. 45 cm

Answer: C

3. An object is placed at a distance of 25 cm from a concave mirror and a real image a formed by the mirror at a distance of 37.5 cm. The magnification of the image will be

A. 2 times

B. 4 times

C. 5 times

D. 1.5 times

Answer: D

4. The focal length of a concave mirror is f. A point object is placed at a distance of xf on the right side of the focus.

The image will be formed on the right side of the focus at a distance of

5. The focal length of a concave mirror is f. A point object is placed at a distance of xf on the right side of the focus.

The magnification of the image will be

A. x

B. 2x

C. $\dfrac{1}{x}$

D. 3x

Answer: C

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6. A cube of side 2 m is placed in fornt of a large concave mirror of focal length 1 m is such a way that the face of the cube A is at a distance of 3 m and the face B at a distance of 5 m from the mirror.

The distance between the images of the faces A and B will be

A. 1.5 m

B. 1.75 m

C. 0.5 m

D. 0.25 m

Answer: D

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7. A cube of side 2 m is placed in fornt of a

large concave mirror of focal length 1 m is

such a way that the face of the cube A is at a

distance of 3 m and the face B at a distance of

5 m from the mirror.

The height of the image of the face A will be

A. 1 m

B. 1.5 m

C. 2 m

D. 3 m

Answer: A

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8. A cube of side 2 m is placed in fornt of a large concave mirror of focal length 1 m is such a way that the face of the cube A is at a distance of 3 m and the face B at a distance of 5 m from the mirror.

The height of the image face B will be

A. 1 m

B. 0.5 m

C. 1.5 m

D. 3 m

Answer: B

9. A concave mirror of radius of curvature 20 cm and a convex mirror of radius of curvature 30 cm are held coaxially face to face at a distance of 40 cm apart. An object of height 5 cm is placed perpendicularly on the common axis at a distance of 15 cm from the concave mirror.

If the first reflection occurs in the concave

mirror, the final image will be formed at a distance of

A. 6 cm behind the convex mirror

B. 10 cm behind the convex mirror

C. 4 cm in front of the convex mirror

D. 5 cm in front of the convex mirror

Answer: A

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10. A concave mirror of radius of curvature 20 cm and a convex mirror of radius of curvature 30 cm are held coaxially face to face at a distance of 40 cm apart. An object of height 5 cm is placed perpendicularly on the common axis at a distance of 15 cm from the concave mirror.

The height of the final image will be

    A. 4 cm

    B. 5 cm

    C. 10 cm

D. 6 cm

Answer: C

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Integer Answer Type

1. The image of an object placed at a distance of 40 cm from a convex mirror is formed at a distance of 10 cm from the mirror. If object approaches the mirror with a velocity of

$32 cm \cdot s^{-1}$, what will be the velocity of the image $(in cm \cdot s^{-1})$

2. A beam of converging rays is incident on a convex mirror of radius of curvature 30 cm and after reflection meet at a distance of 10 cm in front of the mirror. Where in absence of the mirror would the converiging rays meet? (in cm)

3. At what distance (in m) from a concave mirror of focal length 3 m is a candle to be placed so that a sharp image would be cast on a screen placed at a distance of 8 m from the candle?