Class 10th Science

Chapter - 10

Light-Reflection and Refraction

Textual Questions and Answers :

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Q.1. Define the principal focus of a concave mirror.

Ans :- The principal focus of a concave mirror is a point on its principal axis to which all the light rays which are parallel and close to the axis. Converge after reflection from the concave mirror.

Q.2. The radius of curvature of a spherical mirror is 20cm. What is its focal length?

Ans :- Here r = 20 cm.

f =?

$$\text{We have } f = \frac{r}{2}$$

$$= \frac{20}{2} \text{ cm.}$$

$$= 10 \text{ cm.}$$

Q.3. Name a mirror that can give an erect and enlarged image of an object.

Ans :- Concave mirror.

Q.4. Why do we prefer a convex mirror as a rear view mirror in vehicles?

Ans :- Convex mirrors are preferred because they always give an erect, though diminished, image. Also they have a wider field of view as they are curved outwards. Thus, convex mirrors enable the driver to view much larger area than would be possible with a plane mirror.

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Q.1. Find the focal length of a convex mirror whose radius of Curvature is 32 cm.

Ans :- Here r = 32 cm.

f = ?

$$\text{We have } f = \frac{r}{2}$$

$$= \frac{32}{2} \text{ cm.}$$

= 16 cm.

Q.2. A concave mirror produces three times magnified za (enlarged) real image of an object placed at 10 cm in Inati front of it. Where is the image located?

Ans :- Here $m = -3$

$u = -10\text{cm}$

$v = ?$

We have $m = -\frac{v}{u}$

$\Rightarrow -3 = -\frac{v}{u}$

$\Rightarrow 3u = V$

$\Rightarrow v = 3u$

$= 3x - 10$ cm.

$= -30$ cm.

Thus, the image is located at a distance of 30 cm. in front of the mirror.

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Q.1. A ray of light travelling in ai enters obliquely into water . Does the light ray bend towards the normal or away from the normal ? Why ?

Ans :- The light ray bend towards the normal because the ray entered from a rarer medium to a denser medium that is from air to water.

Q.2. Light enters from air to glass having refractive index 1.50 . What is the speed of light in the glass ? The speed of light in vacuum is $3x10^8$ ms^{-1}

Ans :- We know that ,

$$\text{Refractive index of glass} = \frac{\text{Speed of light in air}}{\text{Speed of light in glass}}$$

$$\Rightarrow \text{Speed of light in glass} = \frac{\text{Speed of light in air}}{\text{Refractive index of glass}}$$

$$= \frac{3x10^8}{1.50} \ ms^{-1}$$

$$= 2 \times 10^8 \ ms^{-1}$$

Q.3. Find out from table 10.3 the medium having highest optical density . Also find the medium with lowest optical density .

Ans :- The medium having highest refractive index has the highest optical density . Therefore diamond has the highest optical density .

The medium having lowest refractive index has the lowest optical density . Therefore air has the lowest optical density .

Q.4. You are given kerosene , turpentine and water . In which of these the light travels fastest ? Use the information given in Table on page 225 .

Ans :- The light travels fastest in that medium which has the lowest refractive index . Now the refractive index of kerosene is 1.44 , the refractive index of turpentine is 1.47 whereas the refractive index of water in 1.33 . Here water has the lowest refractive index . So light travels fastest in water .

Q.5. The refractive index of diamond is 2.42. What is the meaning of this statement ?

Ans :- The refractive index of diamond is 2.42. That means the ratio between the speed of light in air to the speed of light in diamond is 2.42.

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Q.1. Define 1 dioptre of power of a lens.

Ans :- 1 diopter is the power of a lens whose focal length is 1 meter.

Q.2. A convex lens forms a real and inverted image of a needle at a distance of 50 cm. from it. Where is the needle placed in front of the convex lens if the image is equal in size to the object? Also find the power of the lens.

Ans :- Here $v = +50$ cm.

$u = ?$

We have $m = \frac{v}{u} = -1$

$\Rightarrow \frac{v}{u} = -1$

$\Rightarrow u = -v$

$u = -50$ cm.

Again $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$= \frac{1}{50} - \frac{1}{-50}$

$= \frac{1}{50} + \frac{1}{50}$

$$\frac{50}{50}$$

$$= \frac{2}{50}$$

$$= \frac{1}{25}$$

$\therefore \quad f = 25$ cm.

$= 0.25$m.

$$\therefore \quad P = \frac{1}{f}$$

$$= \frac{1}{0.25\text{m}}$$

$= +4$D

Q.3. Find the power of a concave lens of focal length 2m.

Ans :- Here $f = -2$m [For concave lens)

$$\text{Power (P)} = \frac{1}{f}$$

$$= \frac{1}{-2m}$$

$$= -0.5\ D$$

EXERCISES SS

Q.1. Which one of the following materials cannot be used to make a lens ?

(a) Water.

(b) Glass.

(c) Plastic.

(d) Clay.

Ans :- (d) Clay.

Q.2. The image formed by a concave mirror is observed to the virtual , erect and larger than the object . Where should be the position of the object ?

(a) Between the principal focus and the centre of curvature .

(b) At the centre of curvature .

(c) Beyond the centre of curvature .

(d) Between the pole of the mirror and its principal focus .

Ans :- (d) Between the pole of the mirror and its principal focus .

Q.3. Where should an object be placed in front of a convex lens to get a real image of the size of the object?

(a) At the principal focus of the lens.

(b) At twice the focal length .

(c) At infinity .

(d) Between the optical centre of the lens and its principal focus .

Ans :- (b) At twice the focal length .

Q.4. A spherical mirror and a thin spherical lens have each a focal length of -15 cm . The mirror and the lens are likely to be

(a) Both concave .

(b) Both convex .

(c) The mirror is concave and the lens is convex .

(d) The mirror is convex , but the lens is concve .

Ans :- (a) Both concave .

Q.5. No matter how far you stand from a mirror your image appears erect . The mirror is likely to be

(a) Plane .

(b) Concave .

(c) Convex .

(d) Either plane or convex .

Ans :- (d) Either plane or convex .

Q.6. Which of the following lenses would you prefer to use To which reading small letters found in a dictionary?

(a) A convex lens of focal length 50 cm .

(b) A concave lens of focal length 50 cm .

(c) A convex lens of focal length of 5 cm .

(d) A concave lens of focal length of 5 cm .

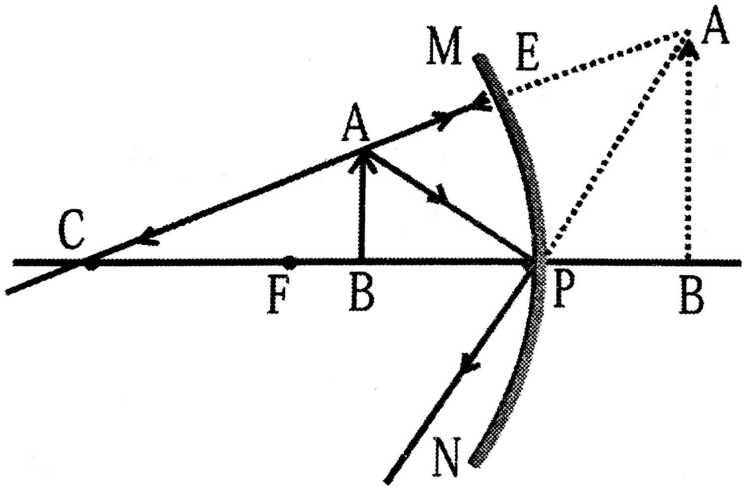
Ans :- (c) A convex lens of focal length of 5 cm .

Q.7. We wish to obtain an erect image of an object , using a concave mirror of focal length 15 cm . What should be the range of distance of the object from the mirror ? What is the nature of the image ? Is the image

larger or The smaller than the object ? Draw a ray diagram to show the image formation in this case .

Ans :- The object should be placed between the focus F and the pole P of the concave mirror . That is between 0 and 15 cm from the mirror .

The image will be virtual , erect and larger than the object .



Q.8. Name the type of mirror used is the following situations :

(a) Head lights of a car .

(b) Side / rear - view mirror of a vehicle .

(c) Solar furnace Support your answer with reason .

Ans :- (a) A concave mirror is used in the headlights of a car . This is because when , a lighted bulb is placed at the focus of the concave reflector , then the concave reflector produces a powerful beam of parallel light rays.

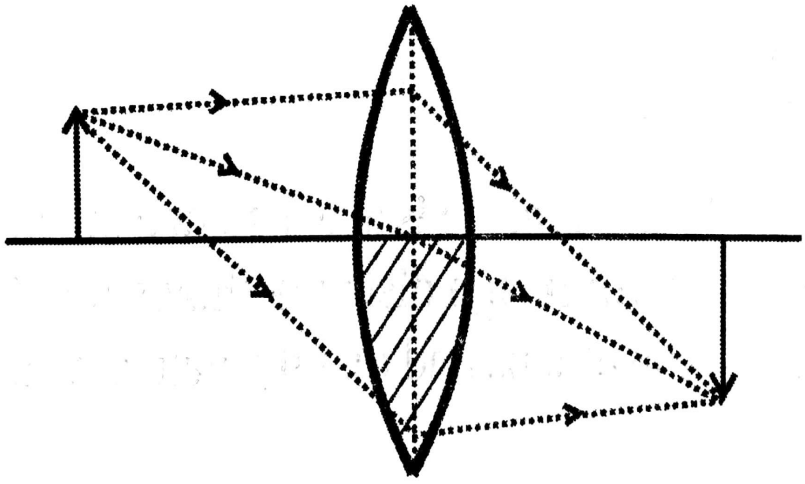
This beam of light helps us to see things up to a considerable distance in the darkness of night .

(b) A convex mirror is used as a side / rear - view mirror of a vehicle because a convex mirror always forms an erect , virtual and diminished image of an object placed any where in front of it and a convex mirror has a wider field of view than a plane mirror of the same size .

(c) Large concave mirrors are used to concentrate sunlight to produce heat in solar furnaces .

Q.9. One - half of a convex lens is covered with a black paper . Will this lens produce a complete image of the object ? Verify your answer experimentally . Explain your observations .

Ans :- When the lower half the convex lens is covered with a black paper , it still forms the complete image of the object as that with uncovered lens .



But the intensity of the image is reduced when one half of the convex lens of covered with a black paper .

Q.10. An object 5 cm . in length is held 25 cm away from a converging lens of focal length 10 cm . Draw the ray diagram and find the position , size and nature of the image formed .

Ans :- A converging lens means a convex lens . Now first we will find the position of image .

Here $u = -25$ cm

$f = +10$ cm

$v = ?$

We have $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\Rightarrow \frac{1}{v} - \frac{1}{-25} = \frac{1}{10}$

$\Rightarrow \frac{1}{v} + \frac{1}{25} = \frac{1}{10}$

$\Rightarrow \frac{1}{v} = \frac{1}{10} - \frac{1}{25}$

$$\frac{1}{v} \quad \frac{1}{10} \quad \frac{1}{25}$$

$$= \frac{5-2}{50}$$

$$= \frac{3}{50}$$

$$\therefore \quad v = + \frac{50}{3}$$

$$= + 16.67\text{cm.}$$

Thus , the position of image is at a distance of 16.67 cm from the lens . The plus sign for image distance shows that the image is formed on the right side of lens and that the nature of image is real and inverted .

$$\text{Now , Magnification , } m = \frac{v}{u}$$

$$= \frac{16.67}{-25}$$

$$= -0.66$$

Now calculating the size of image $h_2$we have ,

$$m = \frac{h_2}{h_1}$$

$$\Rightarrow h_2 = m \times h_1$$

$$= -0.66 \times 5$$

$$= -3.3 \text{cm.}$$

This the size of image is 3.3 cm. The negative sign of the size of image shows that the image is inverted .

Q.11. A concave lens of focal length 15 cm . forms an image 10 cm . from the lens . How far is the object from the lens ? Draw the ray diagram .

Ans :- Here $f = -15$ cm.

$v = -10$ cm.

$u = ?$

Now , $$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{-10} - \frac{1}{u} = \frac{1}{-15}$$

$$\Rightarrow \quad \frac{1}{u} = \frac{1}{15} - \frac{1}{10}$$

$$= \frac{2-3}{30}$$

$$= \frac{-1}{30}$$

$$\therefore \quad u = -30\text{cm}.$$

The position of image is at behind the mirror. The nature of image is virtual and erect.

We have, $m = \frac{-v}{u} = \frac{\text{hight of image}}{\text{hight of object}}$

$$\Rightarrow \quad \frac{-v}{u} = \frac{h^i}{h}$$

$$\Rightarrow \quad \frac{-8.57}{-20} = \frac{h^i}{5}$$

$$\Rightarrow h^i = \frac{8.57}{20} \times 5$$

$$= \frac{8.57}{4}$$

$$= 2.14$$

∴ Height of the image = 2.14 cm.

∴ Size of image is 2.14 cm.

Q.15. An object of size 7.0 cm is placed at 27 cm. in front of a concave mirror of focal length 18 cm. At what distance from the mirror should a screen be placed so that a sharp focussed image can be obtained? Find the size and nature of the image.

Ans :- Here, size of the object (h) = 7.0 cm.

u = 27 cm.

f = 18 cm.

Size of image (h^{i}) = ?

We have, $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$

$$\Rightarrow \frac{1}{v} = \frac{1}{f} - \frac{1}{u}$$

$$\frac{v}{f} \qquad \frac{u}{}$$

$$= \frac{1}{18} - \frac{1}{27}$$

$$= \frac{3-2}{54}$$

$$= \frac{1}{54}$$

$$\therefore \quad v = 54\text{cm.}$$

Again, $$m = - \frac{v}{u}$$

$$\Rightarrow \qquad m = - \frac{54}{27}$$

$$= - 2\text{cm.}$$

$\therefore$ Size of image (h^{i}) = m x h

$$= -2 \times 7$$

$$= -14 \text{ cm.}$$

∴ Size of image is 14 cm.

The image is read and inverted.

Q.16. Find the focal length of a lens of power,-2.0D. What type of lens is this?

Ans :- Here $P = -2.0\ D$

$f = ?$

We have, $P = \frac{1}{P}$

$\Rightarrow f = \frac{1}{p}$

$= \frac{1}{-2D}$

$= -\frac{1}{2}\ m$

$= -\frac{1}{2} \times 100cm.$

$= -50cm.$

Since the power of the lens is negative therefore the lens is concave.

Q.17. A doctor has prescribed a corrective lines of power +1.5 D. Find the focal length of the lens. Is the prescribed lens diverging or converging?

Ans :- Here, P = + 1.5 D

f = ?

$$\text{We have, } P = \frac{1}{f}$$

$$\Rightarrow f = \frac{1}{p}$$

$$= \frac{1}{+1.5D}$$

$$= \frac{1}{+1.5}\text{m}$$

$$= \frac{1}{+1.5} \times 100\text{cm.}$$

= + 66.7cm.

Multiple Choice Questions :

Q.1. The angle of reflection is equal to the angle of incidence

(a) Always.

(b) Sometimes.

(c) Under special conditions.

(d) Never.

Ans :- (a) Always.

Q.2. The angle between and incident ray and the plane mirror is 30°. The total angle between the incident ray and reflected ray will be :

(a) 30°

(b) 60°

(c) 90°

(d) 120°

Ans :- (d) 120°

Q.3. A ray of light is incident on a plane mirror making an angle of 90° with the mirror surface. The angle of reflection for this ray of light will be.

(a) 45°

(b) 90°

(c) O°

(d) 60°

Ans :- (c) O°

Q.4. The image of an object formed by a plane mirror is-

(a) Virtual.

(b) Real.

(c) Diminished.

(d) Upside-down.

Ans :- (a) Virtual.

Q.5. The image formed by a plane mirror is :

(a) Virtual, behind the mirror and enlarged.

(b) Virtual, behind the mirror and of the same size as the object.

(c) Real, behind the mirror and of the same size with object.

(d) Real, at the surface of the mirror and enlarged.

Ans :- (b) Virtual, behind the mirror and of the same size as the object.

Q.6. In a convex spherical mirror, reflection of light takes place at :

(a) A flat surface.

(b) A bent in surface.

(c) A bulging surface.

(d) An uneven surface.

Ans :- (c) A bulging surface.

Q.7. A diverging mirror is :

(a) A plane mirror.

(b) A convex mirror.

(c) A concave mirror.

(d) A shaving mirror.

Ans :- (b) A convex mirror.

Q.8. If R is the radius of curvature of a spherical mirror and f is its focal length, then :

(a) R = f

(b) R = 2f

$$(c)\ R = \frac{f}{2}$$

(d) R = 3f

Ans :- (b) R = 2f

Q.9. The focal length of a spherical mirror of radius of carvature 30 cm. is :

(a) 10 cm

(b) 15 cm

(c) 20 cm

(d) 30 cm

Ans :- (b) 15 cm.

Q.10. If the focal length of a spherical mirror is 12.5 less cm. its radius of curvature will be :

(a) 25 cm

(b) 15cm

(c) 20cm

(d) 35cm

Ans :- 25 cm.

Q.11. The real image formed by a concave mirror is larger than the object when the object is :

(a) At a distance equal to radius of curvature.

(b) At a distance less than the focal length.

(c) Between focus and centre of curvature.

(d) At a distance greater than radius of curvature.

Ans :- (c) Between focus and centre of curvature.

Q.12. The real image formed by a concave mirror is smaller than the object if the object is :

(a) Between centre of curvature and focus.

(b) At a distance greater than radius of curvature.

(c) At a distance equal to radius of curvature.

(d) At a distance equal to focal length.

Ans :- (b) At a distance greater than radius of curvature.

Q.13. The image formed by a concave mirror is virtual, erect and magnified. The position of object is :

(a) At focus.

(b) Between focus and centre of curvature.

(c) At pole.

(d) Between pole and focus.

Ans :- (d) Between pole and focus.

Q.14. The image formed by a concave mirror is real, inverted and of the same size as the object. The position of the object must then be :

(a) At the focus.

(b) Between the centre of curvature and focus.

(c) At the centre of curvature.

(d) Beyond the centre of curvature.

Ans :- (c) At the centre of curvature.

Q.15. The image formed by a concave mirror is real, inverted and highly diminished. The object must be :

(a) Between pole and focus.

(b) At focus.

(c) At the centre of curvature.

(d) At infinity.

Ans :- (d) At infinity.

Q.16. The angle of incidence for a ray of light passing through the centre of curvation of a concave mirror is

(a) 45°

(b) 90°

(c) O°

(d) 180°

Ans :- (c) O°

Q.17. One of the following does not apply to a concave mirror, This is :

(a) Focal length is negative.

(b) Image distance can be positive or negative.

(c) Image distance is always positive.

(d) Height of image can be positive or negative.

Ans :- (c) Image distance is always positive.

Q.18. Linear magnification produced by a concave mirror may be :

(a) Less than 1 or equal to 1

(b) More than 1 or equal to 1

(c) Less than 1, more than 1 or equal to 1

(d) Less than 1 or more than 1

Ans :- (c) Less than 1, more than 1 or equal to 1

Q.19. Magnification produced by a convex mirror is always :

(a) More than 1

(b) Less than 1

(c) Equal to 1

(d) More or less than 1

Ans :- (b) Less than 1

Q.20. Magnification produced by a plane mirror is

(a) Less than one.

(b) Greater then one.

(c) Zero.

(d) Equal to one.

Ans :- (d) Equal to one.

Q.21.The image formed by a spherical mirror is virtual. The mirror will be :

(a) Concave.

(b) Convex.

(c) Either concave or convex.

(d) Metallic.

Ans :- (c) Either concave or convex.

Q.22. The mirror used by a dentist to examine the teeth of person is :

(a) Convex.

(b) Concave.

(c) Plane.

(d) Any one of the above.

Ans :- (b) Concave.

Q.23. If the image formed is always virtual, the mirror can be

(a) Concave or convex.

(b) Concave or plane.

(c) Convex or plane.

(d) Only convex.

Ans :- (c) Convex or plane.

Q.24. The mirror which can form a magnified image of an object is :

(a) Convex mirror.

(b) Plane mirror.

(c) Concave mirror.

(d) Both convex and concave mirrors.

Ans :- (c) Concave mirror.

Q.25. Tight travelling from a denser medium to rarer medium along a normal to the boundary.

(a) Is refracted towards the normal.

(b) Is refracted away from the normal.

(c) Goes along the boundary.

(d) Is not refracted.

Ans :- (d) Is not refracted.

Q.26. A ray of light travelling in air goes into water. The angle of refraction will be :

(a) 90°

(b) Smaller than the angle of incidence.

(c) Equal to the angle of incidence.

(d) Greater than the angle of incidence.

Ans :- (b) Smaller than the angle of incidence.

Q.27. The speed of light in air is

(a) $3x10^8$ cm/s

(b) $3x10^8$ mm/s

(c) $3x10^8$ km/s

(d) $3x10^8$ m/s

Ans :- (d) $3x10^8$ m/s

Q.28. A ray of light passes from medium X to another medium Y. No refraction of light occurs if the of light with the boundary of medium Y at an angle of

(a) 0°

(b) 45°

(c) 90°

(d) 120°

Ans :- (c) 90°

Q.29. The speed of light in substance X is $1.25x10^8$ m/s and that in air is $3x10^8$m/s. The refractive index of this substance will be :

(a) 2.4

(b) 0.4

(c) 4.2

(d) 3.75

Ans :- (a) 2.4

Q.30. The refractive index of water is

(a) 1.33

(b) 1.50

(c) 2.42

(d) 1.36

Ans :- (a) 1.33

Q.31. The refractive index of water with respect to air is 4/3 The refractive index of air with respect to water will be :

(a) 1.75

(b) 0.50

(c) 0.75

(d) 0.25

Ans :- (c) 0.75

Q.32. Which one of the following materials cannot be used to make a lens?

(a) Water.

(b) Glass.

(c) Plastic.

(d) Clay.

Ans :- (d) Clay.

Q.33. An object is placed between f and 2f of a convex lens. Which of the following statements correct describes its image?

(a) Real, larger than the object.

(b) Erect, smaller than the object.

(c) Inverted, same size as object.

(d) Virtual, larger than the object.

Ans :- (a) Real, larger than the object.

Q.34. A spherical mirror and a spherical lens each have a focal length of -15 cm. The mirror and the lens are likely to be :

(a) Both concave.

(b) Both convex.

(c) The mirror is concave but the lens is convex.

(d) The mirror is convex but the lens is concave.

Ans :- (a) Both concave.

Q.35. Magnification produced by a concave lens is always :

(a) More than 1

(b) Equal to 1

(c) Less than 1

(d) More than 1 or less than 1

Ans :- (c) Less than 1

Q.36. A convex lens produces a magnification of +5. The object is placed :

(a) At focus.

(b) Between f and 2f

(c) At less than f

(d) Beyond 2f

Ans :- (c) At less than f

Q.37. An object is 0.09 m from a magnifying lens and the image is formed 36cm. from the lens. The magnification produced is :

(a) 0.4

(b) 1.4

(c) 4.0

(d) 4.5

Ans :- (c) 4.0

Q.38. A diverging lens is used in :

(a) A magnifying glass.

(b) A car to see objects on rear side.

(c) Spectacles for the correction of short sight.

(d) A simple camera.

Ans :- (c) Spectacles for the correction of short sight.

Q.39. When an object is kept at any distance in front of a concave lens, the image formed is always :

(a) Virtual, erect and magnified.

(b) Virtual, inverted and diminished.

(c) Virtual, erect and diminished.

(d) Virtual, erect and same size as object.

Ans :- (c) Virtual, erect and diminished.

Q 40. A concave lens produces an image 20cm from the lens of an object planed 30 cm form the lens. The focal length of the lens is :

(a) 50 cm.

(b) 40 cm.

(c) 60 cm.

(d) 30 cm.

Ans :- (c) 60 cm.

Q.41. Only one of the following applies to a concave lens. This is

(a) Focal length is positive.

(b) Image distance can be positive or negative.

(c) Height of image can be positive or negative.

(d) Image distance is always negative.

Ans :- (d) Image distance is always negative.

Q.42. The magnification produced by a spherical mirror and a spherical lens is +0.8.

(a) The mirror and lens are both convex.

(b) The mirror and lens are both concave.

(c) The mirror is concave but the lens is convex.

(d) The mirror is convex but the lens is concave.

Ans :- (d) The mirror is convex but the lens is concave.

Q.43. The focal lengths of four convex lenses P, Q, R and S are 20cm, 15cm, 5 cm and 10 cm respectively. The lens having greatest power is :

(a) P

(b) Q

(c) R

(S) S

Ans :- (c) R

Q.44. A converging lens has a focal length of 50 cm. The power of this lens is :

(a) +0.2 D

(b) –2.OD

(c) +2.0 D

(d) –0.2 D

Ans :- (c) +2.0 D

Q.45. A diverging lens has a focal length of 0.10 m. The power of this lens will be :

(a) +10.0 D

(b) +1.0 D

(c) –1.0 D

(d) –10.0 D

Ans :- (d) –10.0 D

Q.46. The power of a lens is +2.0 D. Its focal length should be :

(a) 100 cm.

(b) 50 cm.

(c) 25 cm.

(d) 40 cm.

Ans :- (b) 50 cm.

Q.46. If a spherical lens has a power of -0.25 D, the focal length of this lens will be :

(a) –4 cm.

(b) –400 mm

(c) –4m

(d) –40m

Ans :- (c) –4m.

Q.48. The power of a concave lens is 10 D and that of a convex le lens is D. When these two lenses are placed in contract with each other, the power of their combination will be :

(a) +16 D

(b) +4 D

(c) –16 D

(d) –4 D

Ans :- (d) –4 D.

Q.49. The powre of a converging lens is 4.5 D and that of a diverging lens is D. The power of this combination of lenses placed close together is :

(a) +1.5 D

(b) +7.5 D

(c) –7.5 D

(d) –1.5 D

Ans :- (a) +1.5 D.

Q.50. A convex lens of focal length 10 cm. is placed in contact with a concave lens of focal length 20 cm. The focal m length of this combination of lenses will be :

(a) +10 cm

(b) +20 cm

(c) –10 cm

(d) –20 cm

Ans :- (b) +20 cm

Additional Questions and Answers :

Q.1. Define luminous objects.

Ans :- The objects like the sun, other stars, electric bulb, tube light, torch, candle and fire etc., which emit their own light are called luminous objects.

Q.2. Define non-luminous objects. Give example.

Ans :- Those objects which do not emit light themselves but only reflect or scatter the light which falls on them are called non-luminous objects.

Examples :- Chair, table, book, human bings, mirror etc.

Q.3. Write the laws of reflection.

Ans :- The laws of reflection are :-

(i) The incident ray, the reflected ray and the normal at the point miler of incidence all lie in the same plane.

(ii) The angle of reflection is always equal to the angle of incidence.

Q.4. What do you mean by lateral inversion?

Ans :- When an object is placed in front of a plane mirror, then the right side of object appears to become the left side of image and the left side of object appears to become the right side of image. This change of sides of an object and its mirror image is called lateral inversion.

Q.5. What are the characteristics of an image formed by a plane mirror?

Ans :- The characteristics are

(i) The image formed in a plane mirror is virtual.

(ii) The image formed in a plane mirror is erect. It is the same side up as the object.

(iii) The image in a plane mirror is of the same size as the object.

(iv) The image formed by a plane mirror is at the same distance behind the mirror as the object is in front of the mirror.

(v) The image formed in a plane mirror is laterally inverted.

Q.6. What happens when a ray of light falls normally or perpendicularly on the surface of a plane mirror?

Ans :- A ray of light falls normally or perpendicularly on a plane mirror is reflected back along the same path because the angle of incidence as well as the angle of reflection for such a ray of light are zero.

Q.7. A ray of light is incident normally on a plane mirror. What will be the :

(a) Angle of incidence?

(b) Angle of reflection?

Ans :- (a) 0°

(b) 0°

Q.8. Define the following for a spherical mirror :

(a) Pole.

(b) Principal axis.

(c) Focal length.

Ans :- (a) Pole :- The centre of a spherical mirror is called its pole.

Principal axis :- The straight line passing through the centre of curvature and pole of a spherical mirror is called its principal axis.

(c) Focal length :- The focal length of a concave mirror is the distance between its pole and principal focus.

Q.9. Name the spherical mirror which has :

(a) Virtual principal focus.

(b) Real principal focus.

Ans :- (a) Convex mirror.

(b) Concave mirror.

Q.10. Define refraction of light. Write the laws of refraction.

Ans :- The change in direction of light when it passes from one medium to another obliquely, is called refraction of light.

Laws of refraction are :-

(i) The incident ray, the refracted ray and the normal at the point of incidence, all lie in the same plane.

(ii) The ratio of sign of angle of incidence to the sine of angle of refraction is constant for a given pair of media.

Numerical Problems :-

Q.1. A burning candle is placed 20 cm in front of a concave mirror of focal length 10 cm. Find the nature and position of the image formed.

Ans :- Here $u = 20$ cm.

$f = 10$ cm.

$v = ?$

We have, $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

u v f

$$\Rightarrow \quad \frac{1}{v} = \frac{1}{f} - \frac{1}{u}$$

$$= \frac{1}{10} - \frac{1}{20}$$

$$= \frac{2-1}{20}$$

$$= \frac{1}{20}$$

$\therefore$ V = 20 cm.

The image is real and inverted.

Q.2. An object is kept at a distance of 5 cm. front of a convex mirror of focal length 10 cm. Calculate the position and magnification of the image and state its nature.

Ans :- Here u = 5 cm

f = – 10 cm

V = ?

$$\text{We have, } \frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{v} = \frac{1}{f} - \frac{1}{u}$$

$$= \frac{1}{-10} - \frac{1}{6}$$

$$= \frac{-1-2}{10}$$

$$= \frac{-3}{10}$$

$$\therefore \quad V = \frac{-10}{3}$$

$$= -3.3\text{cm}$$

Hence the image is formed 3.3 cm. behind the mirror.

The image is virtual and erect.

$$\text{We have} \quad m = \frac{-v}{u}$$

$$= \frac{-(-3.3)}{5}$$

$$= 0.66$$

Q.3. What is the speed of light in a medium of refractive index 6/5 if its speed in air is 300000 km/s?

Ans :- Here,

$$\text{Refractive index} = \frac{6}{5}$$

$$\text{Speed of air} = 300000 \text{ km/s}$$

$$= 3 \times 10^8 \text{m/s}$$

We have,

Speed of light in air Speed of light in the medium

Refractive index of the medium

$$= \frac{\text{Speed of light in air}}{\text{Speed of light in the medium}}$$

$$\Rightarrow \text{Speed of light in the medium}$$

$$= \frac{\text{Speed of light in air}}{\text{Refractive index of the medium}}$$

$$= \frac{3\times10^{8}\text{m/s}}{6/5}$$

$$= \frac{3\times5\times10^{8}\text{m/s}}{6}$$

$$= 2.5\times10^{8}\text{m/s}$$