Class10 CBSE Test paper Chapter: Reflection and Refraction of Light - 02

Q.1. The incident ray makes an angle of 90^0 with the surface. Find the angle of reflection.

Ans: Laws of reflection states that the angle of incidence is equal to the angle of reflection:

If incident ray makes 90^0 then the angle of reflection will also be 90^0

Q.2. The incident ray makes an angle of 30^0 with the surface of plane mirror . Find the angle of reflection.

Ans: the angle of incidence = $90^0 - 30^0 = 60^0$

The angle of incidence is equal to the angle of reflection = 60^0

Q3. A dentist mirror (concave) has a radius of curvature of 3 cm. How far must it be placed from a small dental cavity to give virtual image of cavity that is magnified 5 times?

Ans: Given: R = 2f = 3 cm ,u = ? Focal length of the concave mirror = -1.5 cm,

Magnification = -(v/u) $\Rightarrow$ $5 = \frac{-v}{u} \Rightarrow v = -5u$,

Using mirror formula:

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\Rightarrow \frac{1}{-1.5} = \frac{1}{-5u} + \frac{1}{u}$$

$$\Rightarrow \frac{1}{-1.5} = \frac{-1+5}{5u} = \frac{4}{5u}$$

$$\Rightarrow u = \frac{4x-1.5}{5} = -1.2\ cm$$

Q4. An object 5cm height is placed at a distance of 12cm. in front of a concave mirror it forms a real image 4times large than the image calculate the distance of the image from the mirror? Ans: ho = 5 cm , u = -12 cm Magnification, m = -4 [given real image]

Solution : Let the image distance be v.

So, $m = -\frac{v}{u} \Rightarrow -4 = -\frac{v}{-12} => v = -48\ cm$

Thus the image is at a distance 48 cm from the mirror on the same side of the object.

Q.6. radius of curvature of a convex mirror used on a moving automobile is 2m. A truck is coming behind it at a constant distance of 3m calculate the position, size, nature of the image formed?

Ans: u = -3 m , R = 2m

$Using, \quad \frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

$=> \frac{1}{1} = \frac{1}{v} - \frac{1}{3}$

$=> \frac{1}{v} = 1 + \frac{1}{3}$

$=> \frac{1}{v} = \frac{4}{3} \Rightarrow v = \frac{3}{4} = 0.75\, m$

The image is at a distance 0.75 m from the mirror on the side opposite to the object.

Size of the image $= m = \frac{hi}{ho} = -\frac{v}{u} = -\frac{0.75}{-3} = 0.25$

The size of the image is 0.25 times the object.

The image is virtual, diminished and erect

Q.7. An object is placed at 20 cm in front of a convex mirror of focal length 10 cm. Find the image distance and magnification.

Ans: u= - 20 cm , f = 10 cm

$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \Rightarrow \frac{1}{10} = \frac{1}{v} + \frac{1}{-20} = \frac{1}{10} + \frac{1}{20} = \frac{1}{v} \Rightarrow \frac{3}{20} = \frac{1}{v} \Rightarrow v = \frac{20}{3} \Rightarrow 6.67\ cm$

So image distance v= 6.67cm

Now magnification m $= -\frac{v}{u} = \frac{\frac{20}{3}}{-20} = \frac{20}{60} = \frac{1}{3} = 0.33\ cm$

Q.8. Write some applications of concave and convex lens

Ans: Some uses of concave lens:

1. In spectacles for eyes suffering from myopia.

2. In the lens combination of camera, telescope.

3. In door hole lenses.

Some uses of convex lens:

1. In spectacles for eyes suffering from hypermetropia.

2. In the lens combination of camera, telescope, microscope

3. It is also used as a magnifying lens.

Q.9. Object is placed at a distance 10 cm from a convex mirror of focal length 15 cm. what will be the nature the image? Ans: u = 10cm f = 15cm v = ?

Solution: For a convex mirror

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} = \frac{1}{15} = \frac{1}{v} + \frac{1}{-10} \quad \Rightarrow \frac{1}{v} = \frac{1}{15} + \frac{1}{10} \Rightarrow \frac{1}{v} = \frac{1}{6} \Rightarrow v = 6\,cm$$

So a virtual and erect image will be formed at a distance of 6cm from the optical center of the mirror on the right hand side of the mirror.

Q.10. A concave mirror form the image of the sun at 18 cm on a screen. When an object is placed at 24 cm from the pole of the mirror, the image forms on a screen. Without disturbing the position of the object, the mirror is moved by 3 cm towards the object. By what distance and in what direction, the screen is to be moved to catch the image on it again?

Ans: For Sun, u = ∞ (infinity) , v = - 18 cm (concave mirror)

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{f} \Rightarrow \frac{1}{f} = \frac{1}{-18} + \infty \quad \Rightarrow \text{ f = - 18cm}$$

Now, object is placed at 24 cm , u = -24cm, f = -18 cm

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{f} \Rightarrow \frac{1}{-18} = \frac{1}{v} + \frac{1}{-24} \Rightarrow \frac{1}{-18} + \frac{1}{24} = \frac{1}{v} \Rightarrow v = -72\,cm$$

So, screen is placed 72 cm front of mirror.

Now mirror is displaced 3 cm towards object,

So, u = - 21cm and screen distance = 72 – 3 = 69 cm (with negative sign)

Again by applying (1), and putting the values u = - 21 cm and f = -18 cm

$$\frac{1}{\text{f}} = \frac{1}{\text{v}} + \frac{1}{\text{f}} \Rightarrow \frac{1}{-18} = \frac{1}{\text{v}} + \frac{1}{-21} \Rightarrow \frac{1}{-18} + \frac{1}{21} = \frac{1}{\text{v}} \Rightarrow \text{ v} = -126\,\text{cm}$$

So, the screen has to move a distance of 126 – 69 = 57 cm away from the mirror.

Q.11. A convex mirror of focal length 20 cm forms image of magnification $\frac{3}{5}$ for one position of the object. The object is shifted by $\frac{16}{3}$ cm towards the mirror. By what distance and what direction the image will move .

f = 20 cm , m = $\frac{3}{5} = -\frac{v}{u} \Rightarrow u = -\frac{5v}{3}$

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\Rightarrow \frac{1}{20} = \frac{1}{v} + \frac{3}{-5v}$$

$$\Rightarrow \frac{1}{20} = \frac{5-3}{5v}$$

$$\Rightarrow \frac{1}{20} = \frac{2}{5v}$$

$$\Rightarrow v = \frac{40}{5} = 8\text{cm}$$

$u = \frac{-5 \, x \, 8}{3} = -\frac{40}{3} \, cm$

Now, the object is shifted by $\frac{16}{3}$ cm towards the mirror

New object distance = u = $-\left(\frac{40}{3} - \frac{16}{3}\right) = -8 \, cm$

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\Rightarrow \frac{1}{20} = \frac{1}{v} + \frac{3}{-8}$$

$$\Rightarrow \frac{1}{20} + \frac{1}{8} = \frac{1}{v} = \frac{2+5}{40}$$

$$\Rightarrow \frac{1}{v} = \frac{7}{40}$$

$$\Rightarrow v = \frac{40}{7} = 5.71 \, cm$$

Image will move towards mirror by 2.29 cm1