AcadPrime
ACADEMY OF EXCELLENCE

Chapter – 10 LIGHT – Reflection and Refraction

Q1. Which one of the following materials cannot be used to make a lens?

a) **Water**
b) **Glass**
c) **Plastic**
d) **Clay**

Answer: Option d)

Explanation:

Clay being the opaque substance, so the light cannot be transmitted into it also clay cannot be used to create the lens. Whereas the water, glass and certain amount of plastic is transparent, hence light can be passed through it, hence it is used to create lens.

Q2. The image formed by a concave mirror is observed to be 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.**

Answer: Option d)

Since, a concave mirror forms a virtual, erect and larger than the object, when the object is placed between the pole of the mirror and its principal focus.

Q3. 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**

Answer: Option b)

When the object is placed at twice the focal length, an inverted, equal sized and real image is formed at $2F_1$ by a convex lens.

Q4. A spherical mirror and a thin 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 and the lens is convex**
d) **The mirror is convex but the lens is concave.**

Answer: Option a)

Both concave

Q5. No matter how far you stand from a mirror, your image appears erect. The mirror is likely to be

a) **Only plane**
b) **Only concave**
c) **Only convex**
d) **Either plane or convex**

Answer: Option d)

The mirrors are plane or convex.

Q6. Which of the following lenses would you prefer to use while 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 5 cm.**
d) **A concave of focal length 5 cm.**

Answer: Option c)

A convex lens of focal length 5 cm is used for reading small letters in a dictionary.

Q7. 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 smaller than the object? Draw a ray diagram to show the image formation in this case.

Answer:

the distance of the object = 0 to 15 cm from the pole.

Nature of the image = virtual, erect and larger than the object.

Q8. Name the type of mirror used in the following situations.

a) **Headlight of a car**
b) **Side/rear-view mirror of a vehicle**
c) **Solar furnace**

Support your answer with reasons.

Answer:

a) Concave Mirror: concave mirrors can produce parallel beam of light when light source is at principal focus.
b) Convex mirrors: its largest field of view.
c) Concave Mirror: it concentrates the parallel rays of sun at principal focus.

Q9. 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.

Answer:

Yes, it produce an image of the object which is verified by observing the image of a distance object like tree, when lower half of the lens is covered with a black paper and intensity or brightness of image reduces.

Q10. 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 the nature of the image formed.

Answer:

Given: - Height of the object, $h_o = 5\ cm$

Distance of the object from converging lens, $u = -25\ cm$

Focal length of converging lens, $f = 10\ cm$

Using the lens formula,

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

$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{10} - \frac{1}{25} = \frac{15}{250}$$

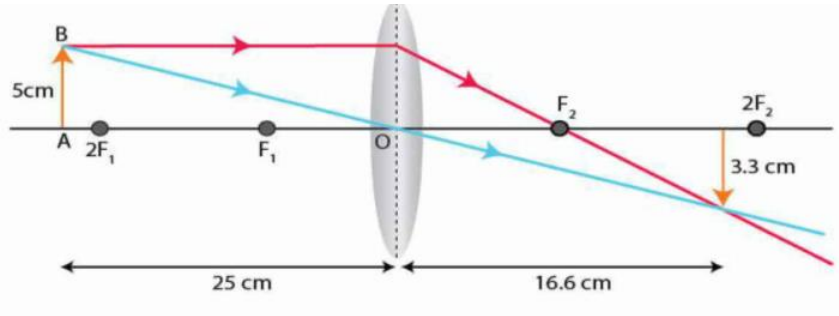
$$v = \frac{250}{15} = 16.66\ cm$$

For converging lens,

$$\frac{h_i}{h_o} = \frac{v}{u}$$

$$h_i = \frac{v}{u} \times h_o$$

$$= \frac{50 \times 5}{3 \times (-25)} = \frac{10}{-3} = -3.3\ cm$$



Q11. A concave lens of focal length 15 cm forms an image 10 cm from the lens. How far is the object placed from the lens? Draw the ray diagram.

Answer:

Given: - Focal length of concave lens, $f = -15\ cm$

Image distance, $v = -10\ cm$

the lens formula,

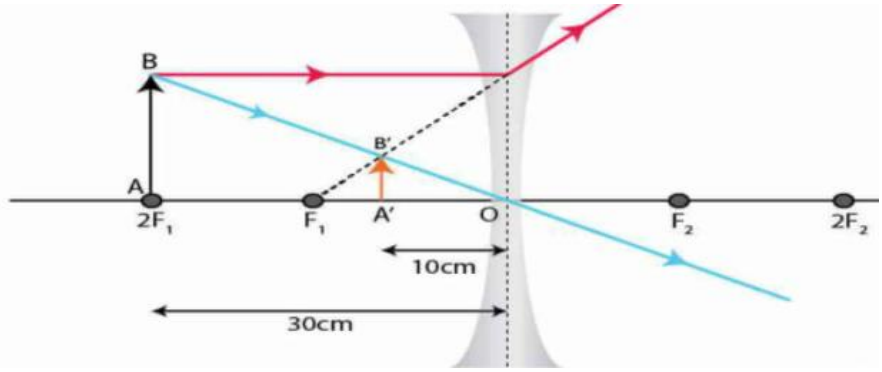
$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

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

$$= \frac{1}{-10} - \frac{1}{-15} = -\frac{1}{10} + \frac{1}{15}$$

$$v = -\frac{5}{150} = -30\ cm$$

The negative value of u indicates that the object is placed 30 cm in front of the lens.



Q12. An object is placed at a distance of 10 cm from a convex mirror of focal length 15 cm. Find the position and nature of the image.

Answer:

Focal length of convex mirror (f) = + 15 cm

Object distance (u) = - 10 cm

mirror formula,

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

$$\frac{1}{v} = \frac{1}{15} - \frac{1}{-10} = \frac{2+3}{30}$$

$$v = \frac{5}{30} = 6\ cm$$

Magnification,

$$\frac{-v}{u} = \frac{-6}{-10} = 0.6$$

The image is located at a distance of 6 cm from the mirror. The positive and a value less than 1 of magnification indicates the image formed is virtual, erect and diminished.

Q13. The magnification produced by a plane mirror is +1. What does this mean?

Answer:

The positive sign means image formed by a plane mirror is virtual and erect as the magnification is 1 that is, the size the image is equal to the size of the object.

Q14. An object 5 cm is placed at a distance of 20 cm in front of a convex mirror of radius of curvature 30 cm. Find the position of the image, its nature and size.

Answer:

Given: -

Object distance (u) = - 20 cm

Object height (h) = 5 cm

Radius of curvature (R) = 30 cm

Radius of curvature = 2 × Focal length

R = 2f

F = 15 cm

Using the mirror formula,

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

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

$$= \frac{1}{15} + \frac{1}{20} = \frac{4+3}{60} = \frac{7}{60}$$

$$v = 8.57\ cm$$

The positive value of v indicates that the image is formed behind the mirror

Magnification,

$$m = -\frac{Image\ Distance}{Object\ Distance} = \frac{-8.57}{-20} = 0.428$$

The positive value of magnification that the image formed virtual

Magnification,

$$m = \frac{Height\ of\ the\ image}{Height\ of\ the\ object} = \frac{h^1}{h}$$

$$h^1 = m \times h = 0.428 \times 5 = 2.14\ cm$$

The positive value of image height indicates that the image formed is erect.

So, the image is erect, virtual and smaller in size.

Q15. 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 the mirror should be placed, so that a sharp focused can be obtained? Find the size and the nature of the image.

Answer:

Given: -

Object distance (u) = - 27 cm

Object height (h) = 7 cm

Focal length (f) = - 18 cm

Using mirror formula,

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

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

$$= -\frac{1}{18} + \frac{1}{27} = -\frac{1}{54}$$

$$v = -54\ cm$$

The screen should be placed at a distance of 54 cm in front of the given mirror.

Magnification,

$$m = -\frac{Image\ distance}{Object\ distance} = \frac{-54}{27} = -2$$

The negative value of magnification indicates the image formed is real

Magnification,

$$m = \frac{Height\ of\ the\ image}{Height\ of\ the\ object} = \frac{h^1}{h}$$

$$h^1 = m \times h = 7 \times -2 = -14\ cm$$

Q16. Find the focal length of a lens of power -2.0 D. What type of lens is this?

Answer:

Given: -

Power of lens,

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

$$P = -2D$$

$$f = -\frac{1}{2} = -0.5\ m$$

A concave lens has a negative focal length. So, it is a concave lens.

Q17. A doctor has prescribed a corrective lens of power +1.5 D. Find the focal length of the lens. Is the prescribed lens diverging or converging?

Answer:

Given: -

Power of lens,

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

$$P = 1.5\ D$$

$$f = \frac{1}{1.5} = \frac{10}{15} = 0.66\ m$$

A convex lens has a positive focal length. So, it is a convex lens or a converging lens.