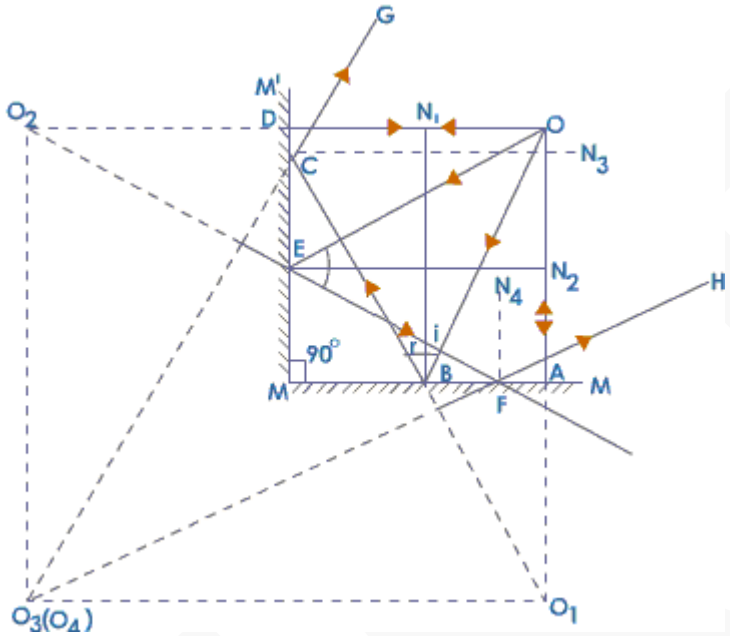
Class10 CBSE Test paper Chapter: Reflection and Refraction of Light - 05

1. An object is placed between two plane mirrors inclined at an angle of 45° to each other. How many images do you expect to see?

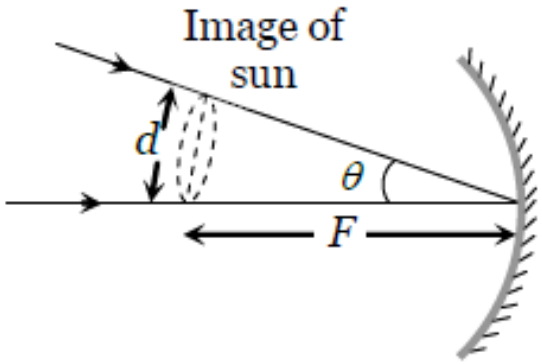
Ans : Here , $\theta = 90^0 \Rightarrow 360/\theta - 1 = 4-1 = 3$



2. A convex mirror is held in water. What should be the change in its focal length?

Ans: The focal length of the mirror would not change as it is independent of the medium it placed in. This is because the medium that the light rays travel through stays the same.

3. If the light from the Sun subtend an angle Q at the pole of a concave mirror of focal length f, where will it converge? Also find the diameter of the image. Draw the necessary ray diagram.



Ans: Diameter of image of sun $= d = f\theta$

4. A concave mirror of focal length 100 cm is used to obtain the image of the sun which subtends an angle of 30'. The diameter of the image of the sun will be (a)1.74 cm (b) 0.87 cm (c) 0.435 cm (d) 100 cm

Solution: $\theta = 30' = (30/60)^0$

Diameter of image of sun $d = f\theta = 100 \times \frac{1}{2} \times \frac{\pi}{180} = 0.87cm$

5. How does the frequency of a beam of ultraviolet light changes when it goes from air to glass?

Ans: No change.

6. State two conditions under which a ray of light suffering refraction from medium 1 to medium 2 does not undergo any change in direction.

Ans: two conditions under which a ray of light suffering refraction from medium 1 to medium 2 does not undergo any change in direction are:

a. Both medium have same density. b. If light fall perpendicular to refracting surface

c. When ray passes from denser to rare medium and angle of refraction is 90^0

7. Which phenomenon establishes wave nature of light?

Ans: Diffraction, Interference and Polarization.

8. A glass lens is immersed in water. How is the power of the lens affected?

Ans: focal length 'f' of a convex lens is related to its refractive index as $f \propto 1/(\mu - 1)$

As ${}^{w}\mu_g < {}^{a}\mu_g$, so focal length of a lens will increase when it is immersed in water.

Since, power is reciprocal of focal length, Power decreases.

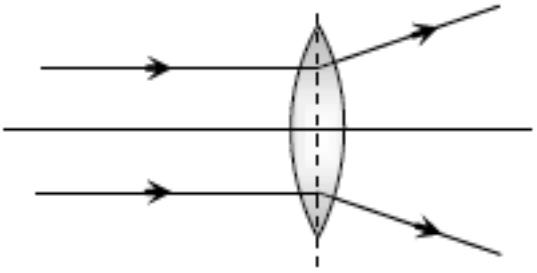
Note: If the lens is held in water in place of air, the focal length of the water increases 4 times

9. Why is the power of a lens is measured as reciprocal of focal length? Give reason.

Ans: A lens is said to have more power if it can focus the rays of light close to the lens. Thus larger the power smaller will be focal length of the lens. Thus, power of the lens is measured as reciprocal of the focal length.

10. A convex lens is made of a material of refractive index m1 when placed in a medium of refractive index m2, behaves as a diverging lens. How are m1 and m2 related?

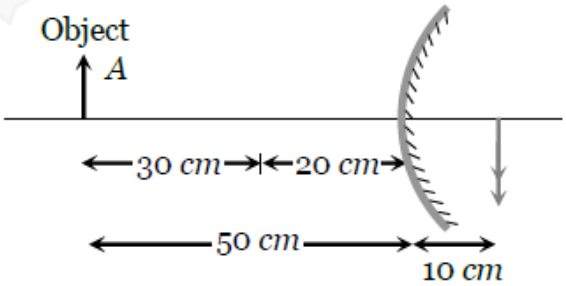
Ans: m1 < m2



11. An object is placed infront of a convex mirror at a distance of 50 *cm*. A plane mirror is introduced covering the lower half of the convex mirror. If the distance between the object and plane mirror is 30 *cm,* it is found that there is no parallel between the images formed by two mirrors. Find the Radius of curvature of mirror?

Solution: Since there is no parallel, it means that both images (By plane mirror and convex mirror) coinciding each other.

According to property of plane mirror it will form image at a distance of 30 *cm* behind it.



Hence for convex mirror

$u = -50\ cm,\ v = +10\ cm$

$1/f = 1/v + 1/u \Rightarrow 1/f = 1/10 + 1/-50 \Rightarrow$

$1/f = 4/50 \Rightarrow f = 12.5\ cm \Rightarrow R = 2f = 25cm$

12. How do you find the rough focal length of a convex lens? Is the same method applicable to a concave lens?

Hold a convex lens in your hand. Direct it towards the Sun. Focus the light from the Sun on a sheet of paper. Obtain a sharp bright image of the Sun. This point on the principal axis is called the principal focus of the lens. The distance of the principal focus from the optical centre of a lens is called its focal length.

Yes same method applicable to a concave lens.

13. Which factors determine the focal length of a lens?

Ans: The focal length, f, of a lens is determined by two factors: (i) the **refractive index** of the **material** that the lens is made up of. (ii) Thickness of lens or, the **curvature** of the two surfaces of the lens (iii) refractive index of the surrounding medium

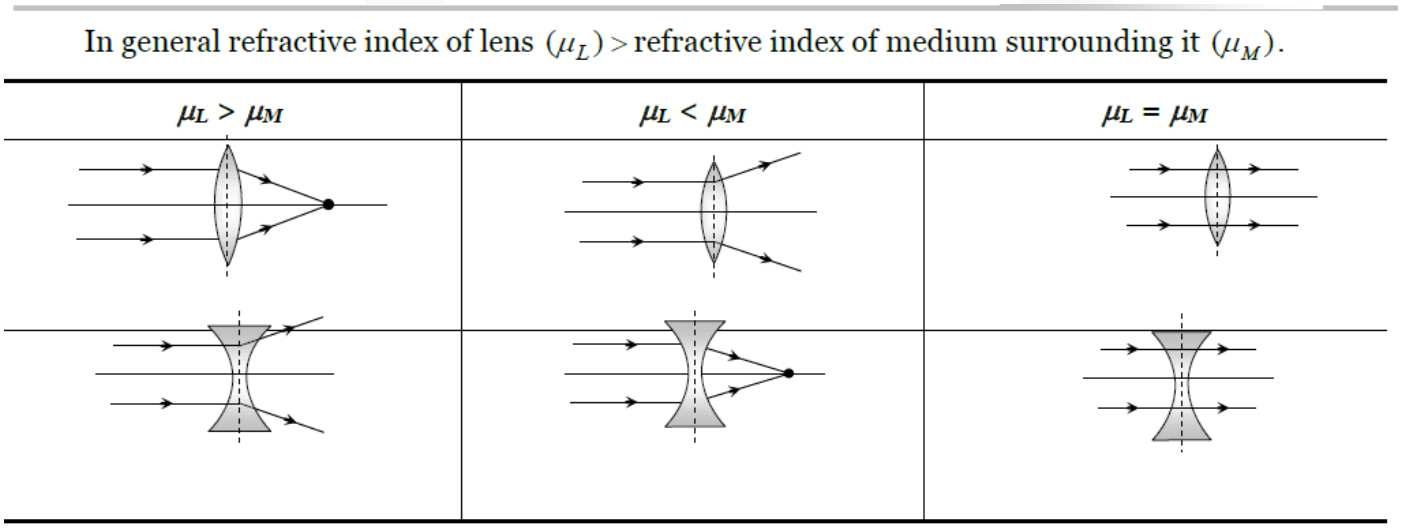
Note: The thicker the lens is, the shorter the focal length will be, and the bigger the image produced will be

14. The formula for linear magnification of a spherical mirror is m =hi/ho = - v/u. What determines the sign of m? What is the significance of this sign?

Ans: Nature of image determine the sign of m. Real inverted image give - ve sign and Virtual erect image give +ve sign .

15. A convex lens made of material of refractive index n_2 is kept in a medium of refractive index n_1. A parallel beam of light is incident on the lens. Compare the path of rays of light emerging from the convex lens if (i) $n_1<n_2$ (ii) $n_1=n_2$ (iii) $n_1>n_2$

Ans:



16. A concave lens of focal length 25 cm and a convex lens of focal length 20 cm are placed in contact with each other. What is the power of this combination? Also, calculate focal length of this combination.

Ans: focal length of convex lens = f_1 = +25, focal length of concave lens = f_2 = - 20cm

I/F = 1/25 + 1/-20 = -1/100cm $\Rightarrow$ f = - 100cm= - 1m

17. A convergent lens of power 8D is combined with a divergent lens of power -10 D. Calculate focal length of the combination.

Solution: $P = P_1 + P_2 = 8 - 10 = -2D$

$p = 1/f \Rightarrow f = 1/p = 1/-2 = -0.5m$

18. A concave lens has a focal length of 15 cm. At what distance should an object from the lens be placed so that it forms an image at 10 cm from the lens? Also find the magnification of the lens.

Ans: Given: $f = -15cm$ $v = -10cm$ $u = ?$

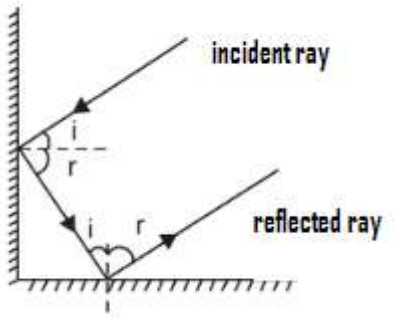
$1/f = 1/v - 1/u \quad \Rightarrow \quad 1/-15 = 1/-10 - 1/u$

$1/u = -1/-10 + 1/15 \quad \Rightarrow \quad 1/u = -1/30 \quad \Rightarrow \quad u = -30cm$

The magnification of the lens = $m = v/u = -10/-30 = 0.33$

19. Under what condition in an arrangement of two plane mirrors, incident ray and reflected ray will always be parallel to each other, whatever be the angle of incidence? Show the same with the help of diagram.

Ans: When the mirrors are kept at right angles to each other, the incident ray and the reflected rays are parallel to each other.



20. How much time will light take to cross 2 mm thick glass pane if refractive index of glass is $\frac{3}{2}$?

Ans: $\text{Speed of light in glass} = \frac{c}{\text{refractive index of glass}} = \frac{\frac{3 \times 10^8}{3}}{2} = 2 \times 10^8 \text{ m/s}$

$\text{Time} = \frac{\text{Distance}}{\text{speed}} = \frac{2 \times 10^{-3} \text{ m}}{2 \times 10^8 \text{ m/s}} = 10^{-11} \text{ sec.}$