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1. Define the principal focus of a concave mirror.

Answer:
The principal focus of a concave mirror is the point on its principal axis where all light rays, parallel to the axis, meet after being reflected from the mirror.

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

Answer:
Given: Radius of curvature (R) = 20 cm
We know that,
(R = 2f)
So,
(f = R/2 = 20/2 = 10)
Therefore, the focal length of the mirror is **10 cm**.

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

Answer:
A **concave mirror** can give an erect and enlarged image of an object.

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

Answer:
A convex mirror gives a **wider field of view**, allowing the driver to see more area behind the vehicle. It always forms **erect, virtual, and diminished** images, making it ideal for rear-view mirrors.

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

Answer:
Given: (R = 32 cm)
We know (R = 2f)
So, (f = R/2 = 32/2 = 16 "{ cm})
Hence, the focal length is **16 cm**.

2. A concave mirror produces three times magnified real image of an object placed 10 cm in front of it. Find the image position.

Answer:

$Given$:
$Object distance, (u = -10 \text{ cm})$
$Magnification, (m = -3)(negative for real image)$
$(v = m \times u = -3 \times (-10) = 30 \text{ cm})$

Hence, the image is formed **30 cm in front of the mirror** and is **inverted**.

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

Answer:

It bends **towards the normal** because light slows down when it moves from a rarer medium (air) to a denser medium (water).

2. Light enters from air to glass with refractive index 1.50. What is the speed of light in glass?

Answer:

Refractive index, $\left(n = \frac{c}{v}\right)$

$$\left(v = \frac{c}{n} = \frac{3 \times 10^8}{1.5} = 2 \times 10^8, \text{m/s}\right)$$

Hence, the speed of light in glass is **2×10^8 m/s**.

3. Find the medium with highest and lowest optical density.

Answer:

From the table:

- **Lowest optical density:** Air (n = 1.0003)
- **Highest optical density:** Diamond (n = 2.42)

The higher the refractive index, the greater the optical density.

4. You are given kerosene, turpentine and water. In which does light travel fastest?

Answer:
Light travels fastest in **water** because its refractive index (1.33) is lower than that of kerosene (1.44) and turpentine (1.47).

5. The refractive index of diamond is 2.42. What does it mean?

Answer:
It means that light travels **2.42 times slower in diamond** than in air or vacuum.
In other words, speed of light in diamond = (\ \$frac{1}{2.42}\ ) times its speed in air.

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1. Define 1 dioptre of power of a lens.

Answer:
One dioptre is the power of a lens with a focal length of **1 metre**.
$(1D = 1/f$ (in Metres)$)$

2. A convex lens forms a real and inverted image of a needle at 50 cm. Where is the needle placed if image is same size? Find the power.

Answer:
When image size = object size → object is at **2F**.
So, object distance = image distance = 50 cm.
Hence, focal length (f = 25 cm = 0.25 m).
Power, (P = 1/f = 1/0.25 = +4D).

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

Answer:
(P = 1/f = 1/(-2) = -0.5D)
So, the power is **–0.5 dioptres**.

EXERCISE

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

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

Answer: (d) **Clay**, because light cannot pass through it.

2. The image formed by a concave mirror is virtual, erect and larger. Where is the object placed?

Answer: (d) **Between the pole and the principal focus.**

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

Answer: (b) **At twice the focal length (2F).**

4. A spherical mirror and a thin spherical lens have focal length –15 cm. What are they?

Answer: (a) **Both concave.**

5. No matter how far you stand, your image is erect. The mirror is likely to be—

Answer: (d) **Either plane or convex.**

6. Which lens is used to read small letters in a dictionary?

Answer: (c) **Convex lens of focal length 5 cm.**

7. We wish to get an erect image using a concave mirror of focal length 15 cm.

Answer:
Object distance: **0 to 15 cm** from the pole.
Nature: **Virtual, erect, and enlarged image.**

8. Name the type of mirror used in these cases:

(a) Headlights of a car → **Concave mirror** (focuses light into a beam)
(b) Rear-view mirror → **Convex mirror** (gives a wide view)
(c) Solar furnace → **Concave mirror** (concentrates sunlight at focus)

9. Half of a convex lens is covered with paper. Will it form a complete image?

Answer:
Yes, a complete image will form, but it will be **less bright** because fewer light rays pass through.

10. An object 5 cm tall is placed 25 cm from a convex lens (f = 10 cm).

Answer:
Using lens formula,
Image distance ($v = 16.7$ cm).
The image is **real, inverted, and 3.3 cm tall**, formed on the other side of the lens.

11. A concave lens of focal length 15 cm forms an image 10 cm away.

Answer:
Using lens formula, object distance($u = -30$ cm).
Hence, object is **30 cm in front** of the lens.

12. An object 10 cm from a convex mirror (f = +15 cm).

Answer:
Image distance ($v = +6$ cm).
Hence, the image is **virtual, erect, and diminished**.

13. The magnification of a plane mirror is +1. What does it mean?

Answer:
It means the **image is virtual, erect, and of the same size** as the object.

14. An object 5 cm high is placed 20 cm in front of a convex mirror (R = 30 cm).

Answer:
Focal length ($f = 15$ cm).
Image distance ($v = +8.6$ cm).
Hence, image is **virtual, erect, and smaller in size.**

15. An object 7 cm tall is placed 27 cm from a concave mirror (f = 18 cm).

Answer:
Image distance ($v = -54$ cm).
Image is **real, inverted, and smaller**, formed on the same side as the object.

16. Find the focal length of a lens of power –2.0 D.

Answer:

$$(f = 1/P = 1/(-2) = -0.5 \text{ m})$$

It is a **concave lens** because focal length is negative.

17. A doctor prescribes a lens of power +1.5 D. Find focal length and type.

Answer:

$$(f = 1/P = 1/1.5 = 0.66 \text{ m})$$

It is a **convex (converging)** lens because power is positive.