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Q1. Define the principal focus of a concave mirror.

Q2. The radius of curvature of a spherical mirror is 20 cm. What is its focal length?

Q3. Name a mirror that can give an erect and enlarged image of an object.

Q4. Why do we prefer a convex mirror as a rear-view mirror in vehicles?

Q5. Find the focal length of a convex mirror whose radius of curvature is 32 cm.

Q6. 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.

Q7. 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

Q8. A ray of light travelling in air enters obliquely into water. Does the light ray bend towards the normal or away from the normal? Why?

Q9. Define 1 dioptre of power of lens.

Q10. Find the power of a concave lens of focal length 2 m.

Q11. Which one of the following materials cannot be used to make a lens?

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

Q12. Where should an object be placed in front of a convex lens to get a real image of the size of 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.

Q13. 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 concave

Q14. 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 lens of focal length 5 cm.

Q15. 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?

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

Q17. The refractive index of diamond is 2.42. What is the meaning of this statement?

Q18. You are given kerosene, alcohol and water. In which of these does the light travel fastest? Use the information given in Table.

Medium	Air	Ice	Water	Alcohol	Kerosene	Rubby	Sapphire	Diamond
Refractive index	1.0003	1.31	1.33	1.36	1.44	1.71	1.77	2.42

Q19. Find out from below table, the mediums having highest and lowest optical density.

Medium	Air	Ice	Water	Alcohol	Kerosene	Rubby	Sapphire	Diamond
Refractive index	1.0003	1.31	1.33	1.36	1.44	1.71	1.77	2.42

Q20. The magnification produced by a plane mirror is +1. What does this mean?

Q21. 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.

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S1. Principal focus of a concave mirror is the point on its principal axis, where light rays coming parallel to the principal axis actually converge after reflection from the mirror.

S2. Given that radius of curvature of the mirror

$$R = 20 \text{ cm}$$

$$\therefore \quad \text{Focal length } f = \frac{R}{2} = \frac{20 \text{ cm}}{2} = 10 \text{ cm}.$$

S3 Only a concave mirror can give an erect and enlarged image of an object.

S4. We prefer a convex mirror as a rear-view mirror in vehicles because a convex mirror gives an erect and diminished image. As a result, convex mirror helps the driver to have a much wider field of view.

S5. Given that radius of curvature of convex mirror

$$R = 32 \text{ cm}$$

$$\therefore \quad \text{Focal length of convex mirror } f = \frac{R}{2} = \frac{32 \text{ cm}}{2} = 16 \text{ cm}.$$

S6. **(d)** Between the pole of the mirror and its principal focus.

[**Hint:** A concave mirror forms virtual, erect and larger size image of an object when the object is situated between the pole of the mirror and its principal focus.]

S7. (d) Either plane or convex.

[**Hint:** Both plane and convex mirrors form erect image of an object placed in front of them irrespective of the position of the object.]

S8. The light bends towards the normal on entry into water. It is due to the fact that as compared to air, the water is an optically denser medium.

S9 1 dioptre power is defined as the power of a lens having a focal length of 1 m.

S10. Given that focal length of concave lens $f = -2\,\text{m}$

$$\therefore \quad \text{Power of concave lens } P = \frac{1}{f} = \frac{1}{(-2\,\text{m})} = -0.5\,\text{D}.$$

S11. **(d)** Clay.

[**Hint:** Clay is opaque for light. Refraction of light is not possible in clay.]

S12. **(b)** At twice the focal length.

[**Hint:** When object is placed in front of a convex lens at $2F_1$, its real, inverted and same sized image is formed at $2F_2$.]

S13. **(a)** Both concave

[**Hint:** Focal length of a concave lens and a concave mirror are taken negative as per sign convention followed.]

S14. **(c)** A convex lens of focal length 5 cm.

[**Hint:** A convex lens is preferred because it can form a magnified image. Morever, we prefer lens of lower focal length ($f = 5$ cm), so that its power is large.]

S15. Given that power of the prescribed lens $P = +1.5\,\text{D}$ and $P = \frac{1}{f}$.

$\therefore$ Focal length of the lens $f = \frac{1}{P} = \frac{1}{+1.5\,\text{D}} = +0.67\,\text{m}.$

As the power of the lens is + ve, the lens is a converging (convex) lens.

S16. Given that power of lens $P = -2.0\,\text{D}$.

As power $P = \frac{1}{f}$, hence focal length of lens $f = \frac{1}{P} = \frac{1}{-2.0\,\text{D}} = -0.5\,\text{m}.$

The – ve sign of focal length means that the lens is a concave lens.

S17. When we say that refractive index of diamond is 2.43, it means that speed of light in diamond

$$= \frac{\text{Speed of the light in vacuum}}{2.42} = \frac{3 \times 10^8\,\text{m/s}}{2.42} = 1.24 \times 10^8\,\text{m/s}.$$

S18. From given table, we find the values of refractive index of given substances as:

For kerosene $n = 1.44$

For alcohol $n = 1.36$

and for water $n = 1.33$

As refractive index of water is least out of three substances, hence as per relation $v = \frac{c}{n}$, it is clear that speed of light is maximum in water. So, light travels fastest in water.

S19. As per table, diamond has highest optical density ($n = 2.42$).

Medium with lowest optical density is air ($n = 1.0003$).

S20. We know that magnification produced by a mirror is given by

$$m = \frac{h'}{h} = -\frac{v}{u}$$

As magnification produced by a plane mirror m = +1, hence we have

$$+1 = \frac{h'}{h} = -\frac{v}{u}$$

Thus, $h' = h$ and $v = -u$.

It means that the size of image formed by a plane mirror is exactly equal to the size of the object placed in front of it. Moreover, the image is formed as much behind the mirror as the object is in front of it.

S21. As per sign convention $f = +15$ cm and $u = -10$ cm.

As $$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \Rightarrow \frac{1}{+15} = \frac{1}{v} + \frac{1}{(-10)} \Rightarrow \frac{1}{v} = \frac{1}{15} + \frac{1}{10} \Rightarrow \frac{1}{v} = \frac{5}{30}$$

$\therefore$ $v = +6$ cm. The image is formed 6 cm behind the mirror, it is a virtual and erect image.