Light- Reflection and Refraction

Basic Concepts of Light (Questions 1-4)

1. What is light? State the laws of reflection of light. How do these laws apply to both regular and diffused reflection?
2. Define the following terms related to spherical mirrors: pole, principal axis, center of curvature, radius of curvature, and focal length.
3. What is the relationship between radius of curvature and focal length of a spherical mirror? Derive this relationship.
4. Differentiate between real and virtual images. Give two examples of each type of image formation.

Spherical Mirrors (Questions 5-10)

5. Draw ray diagrams to show image formation by a concave mirror when the object is placed: (a) at infinity (b) beyond center of curvature (c) at the focus.
6. An object is placed 20 cm from a concave mirror of focal length 15 cm. Find the position, nature, and magnification of the image formed.
7. Explain why a concave mirror is used in solar cookers and by dentists. What are the advantages in each case?
8. Draw ray diagrams for image formation by a convex mirror for different object positions. Why does a convex mirror always form virtual images?
9. Why are convex mirrors used as rear-view mirrors in vehicles? What are the advantages and disadvantages of using convex mirrors for this purpose?
10. The magnification of a spherical mirror is -2. What type of mirror is it and what does the negative sign indicate? If the image height is 6 cm, find the object height.

Refraction of Light (Questions 11-15)

11. What is refraction of light? State the laws of refraction. Define refractive index and write its formula.
12. Explain why a pencil appears bent when placed in a glass of water. Draw a ray diagram to illustrate this phenomenon.
13. A ray of light travels from air to glass. If the angle of incidence is 30° and angle of refraction is 20°, calculate the refractive index of glass.
14. What is total internal reflection? State the conditions necessary for total internal reflection to occur.

15. Explain the working of optical fibers based on total internal reflection. Mention their applications.

Spherical Lenses (Questions 16-20)

16. Draw ray diagrams to show image formation by a convex lens when the object is placed: (a) at $2F_1$ (b) between F_1 and $2F_1$ (c) at F_1.
17. An object 4 cm high is placed at a distance of 12 cm from a convex lens of focal length 8 cm. Find the position, size, and nature of the image.
18. Why do we prefer a convex lens as a magnifying glass? What is the condition for getting maximum magnification?
19. A person suffering from myopia can see clearly up to 2 meters. What type of lens and what power of lens is required to correct this defect?
20. Explain how the human eye works. What are the common defects of vision and how are they corrected?

Additional Application-Based Questions:

Numerical Problems:

- The focal length of a concave mirror is 30 cm. Where should an object be placed to get an image twice the size of the object?
- A convex lens of focal length 20 cm forms an image at a distance of 30 cm. Find the object distance and magnification.
- Calculate the power of a lens of focal length 25 cm. What type of lens is it?
- A ray of light passes from water to air. If the refractive index of water is 1.33, find the critical angle.

Conceptual Questions:

- Why does a swimming pool appear shallower than it actually is?
- Explain why stars twinkle but planets do not twinkle.
- What happens to the focal length of a lens when it is immersed in water?
- Why is the convex side of a spoon used as a convex mirror and concave side as a concave mirror?

Practical Applications:

- How does a periscope work? Draw a ray diagram to explain.

- Explain the working principle of a compound microscope and astronomical telescope.
- Why are street lights fitted with concave reflectors?
- How do contact lenses correct vision defects?

Higher Order Questions:

- A student cannot see clearly beyond 3 meters. Is the student suffering from myopia or hypermetropia? What power of lens is needed if the distance of normal vision is 25 cm?
- Why does refraction occur? What would happen if light traveled at the same speed in all media?
- Compare the image formation by concave and convex mirrors. Under what conditions do they form similar types of images?
- Explain why the bottom of a thick glass slab appears raised when viewed from the top.