The Human Eye and The Colourful World

Structure and Function of Human Eye (Questions 1-5)

1. Draw a labeled diagram of the human eye. Explain the function of each part including cornea, iris, pupil, lens, and retina.
2. How does the human eye adjust to see objects at different distances? Explain the process of accommodation with the role of ciliary muscles.
3. What is the range of vision for a normal human eye? Define near point and far point of the eye.
4. Explain how the eye controls the amount of light entering it. What happens to the pupil in bright light and dim light?
5. What are rods and cones? Explain their functions and distribution in the retina.

Defects of Vision (Questions 6-10)

6. What is myopia (short-sightedness)? What are its causes and how can it be corrected? Draw ray diagrams to illustrate.
7. Explain hypermetropia (long-sightedness). How does it differ from myopia? What type of lens is used for its correction?
8. What is presbyopia? Why does it occur with age? How is it different from hypermetropia?
9. What is astigmatism? What causes this defect and how can it be corrected?
10. A person can see objects clearly only between 50 cm and 200 cm from his eye. What defects of vision is he suffering from? What lenses should be used to correct his vision?

Dispersion and Spectrum (Questions 11-15)

11. What is dispersion of light? Why does white light split into different colors when passed through a prism?
12. Explain the formation of rainbow. Draw a diagram showing how rainbows are formed after rainfall.
13. What is a spectrum? How can you recombine the colors of the spectrum to get white light back?
14. Why does the sun appear red at sunrise and sunset? Explain the phenomenon responsible for this.

15. What is scattering of light? State Rayleigh's scattering law. Why is the sky blue and not violet?

Atmospheric Phenomena (Questions 16-20)

16. Explain why stars appear to twinkle while planets do not. What is the role of atmospheric refraction in this phenomenon?
17. What is atmospheric refraction? Explain how it causes the apparent flattening of the sun at sunrise and sunset.
18. Why do we see the sun a few minutes before actual sunrise and a few minutes after actual sunset?
19. Explain the formation of a mirage. Under what conditions does this phenomenon occur?
20. What is the Tyndall effect? Give examples of this phenomenon observed in daily life.

Additional Application-Based Questions:

Numerical Problems:

- A person with myopia can see clearly up to 80 cm. What power of lens is required to correct his vision for normal distant vision?
- The near point of a hypermetropic eye is 75 cm. Calculate the power of the lens required to correct this defect.
- A student uses a lens of power +2.0 D to correct his vision defect. What is the focal length of the lens and what defect is being corrected?

Conceptual Questions:

- Why can't we see clearly underwater without goggles? Explain in terms of refraction.
- How do bifocal lenses help people with presbyopia? Who invented bifocal lenses?
- Why do we have two eyes instead of one? What are the advantages of binocular vision?
- Explain why it is difficult to see immediately when we enter a dark room from bright sunlight.

Practical Applications:

- How do sunglasses protect our eyes? What is the principle behind polarized sunglasses?
- Why are traffic light signals red, yellow, and green? Explain the choice of these colors.

- How do night vision devices work? What property of light do they utilize?
- Why are headlights of vehicles yellow instead of white or blue?

Analytical Questions:

- If there were no atmosphere around Earth, what would be the color of the sky? Explain your answer.
- Why does smoke from a fire appear blue when seen against a dark background but appears whitish against a light background?
- How would vision be affected if the cornea becomes opaque? What medical procedure can restore vision in such cases?
- Why do different colors of light have different refractive indices in the same medium?

Environmental and Health Questions:

- What is cataract? How does it affect vision and how can it be treated?
- Why is looking directly at the sun harmful to eyes? What precautions should be taken during solar eclipse?
- How does prolonged screen time affect our eyes? What is computer vision syndrome?
- Why is vitamin A important for good vision? What happens in its deficiency?

Advanced Understanding:

- Explain why the danger signals are red in color. What property of red light makes it suitable for this purpose?
- How does the iris automatically adjust the pupil size? Is this a voluntary or involuntary action?
- Why do we see white light as a combination of seven colors? Are there really only seven colors in white light?