Chap 10: The Human Eye and the Colourful World

1. Write any 6 parts of human eye, and their main function

Cornea is the transparent front surface that refracts the light inwards.

Iris defines the colour of our eye and controls the size of the pupil.

Pupil is the opening in the iris, and it controls the amount of light entering the eye.

Lens - Flexible biconvex lens whose focal length can be changed by changing its shape.

Retina is the screen present at the back of the eye containing light sensitive cells.

Optic nerve carries signals from retina to brain.

2. What is the power of accommodation of the eye?

The ability of the eye's lens to change its focal length (by changing its shape) to focus objects at different distances — from very far to very close — is called the power of accommodation.

To view distant objects, ciliary muscles relax, making the lens thin and flat, producing longer focal length.

To view nearby objects, ciliary muscles contract, making the lens thick and curved, producing shorter focal length.

3. What is the near point and far point of a normal human eye?

The minimum distance at which the eye can see an object clearly is called the near point. For a normal eye, it is 25 cm.

The maximum distance up to which the eye can see clearly is called the far point. For a normal eye, it is infinity

4. What is myopia? What is its cause and correction?

A person with myopia can see nearby objects clearly but distant objects are blurred. It is caused due to elongated eyeball or excessive curvature of the eye lens. It causes the image of distant objects to form in front of the retina. A concave (diverging) lens of appropriate power can correct myopia.

5. What is hypermetropia? What is its cause and correction?

A person with hypermetropia can see distant objects clearly but nearby objects are blurred. It is caused due to eyeball becoming small or eye lens becoming flat. It causes the image of nearer objects to form behind the retina. A convex (converging) lens of appropriate power can correct hypermetropia.

6. What is presbyopia? What is its correction?

Presbyopia is an old age related defect in which the eye loses its power of accommodation — the ciliary muscles weaken and the lens becomes less flexible. As a result, cannot see clearly both near and far distances. It can be fixed with a bifocal lens. The upper part (concave) for far vision and the lower part (convex) for near vision.

7. What is dispersion of light? What causes it?

Dispersion is the splitting of white light into its constituent colours (spectrum), when it passes through a prism, or any medium where different colours travel at different speeds.

Different colours of light have different wavelengths and travel at slightly different speeds in glass. Violet light has shortest wavelength and bends the most. It has highest refractive index. Red light has longest wavelength and bends the least. It has lowest refractive index. This difference in bending, separates the VIBGYOR colour.

8. How is a rainbow formed?

A rainbow is formed by dispersion and total internal reflection of sunlight by water droplets in the atmosphere after rain.

Sunlight enters a spherical water droplet and refracts (disperses into VIBGYOR). Light undergoes total internal reflection at the back of the droplet. Light refracts again as it exits the droplet causing further dispersion. Each colour exits at a slightly different angle. Red at top and violet at bottom. The sun must be behind the observer, and the rain in front.

9. Why is the sky blue?

When sunlight passes through the atmosphere, gas molecules (N_2, O_2) scatter light. Blue light has a shorter wavelength, scatters much more than red or yellow. When you look at any part of the sky (not the sun), you see scattered light, which is predominantly blue.

10. Why does the sun appear red at sunrise and sunset?

At sunrise and sunset, the sun is near the horizon, and sunlight travels a much longer path through the atmosphere to reach the observer. Red light(long wavelength) is least scattered,

passes through the atmosphere and reaches the eye. During midday, light path is short, blue is still present, and sun appears white/yellow.

11. What is atmospheric refraction?

The refraction of light due to the variation in the density of air at different heights in the atmosphere is called atmospheric refraction.

12. Why do stars twinkle?

Stars are very far away, and they appear as point sources of light. Due to the variation in the density of air, the refracted rays from stars shifts position rapidly, causing the twinkle effect.

13. Write a note on Advance Sunrise and Delayed Sunset

When the Sun is still below the horizon, its rays bend through the atmosphere and reach our eyes. Therefore, the Sun appears to have risen earlier than it actually has. We can see the Sun about 2 minutes before its actual sunrise.

Even after the Sun has gone below the horizon, atmospheric refraction bends its rays toward our eyes. Hence, the Sun appears to set later than it actually does. We can see the Sun about 2 minutes after its actual sunset.

14. What is the Tyndall effect?

When a beam of light passes through a colloidal solution(suspension of fine particles), the particles scatter light in all directions — making the beam visible from the side. This is called Tyndall effect. Eg: blue colour of the sky, beam of headlights visible in fog/mist.