

11.The Human Eye and the Colourful World

1. The Human Eye It is a natural optical instrument which is used to see the objects by human beings. It is like a camera which has lens and screen system.

(i) **Retina** : It is a light sensitive screen inside the eye on which image is formed. It contains rods and cones.

(ii) **Cornea** : It is a thin membrane which covers the eye ball. It acts like a lens which refracts the light entering the eye.

(iii) **Aqueous humour** : It is fluid which fills the space between cornea and eye lens.

(iv) **Eye lens** : It is a Convex lens made of transparent and flexible jelly like material. Its curvature can be adjusted with the help of ciliary muscles.

(v) **Pupil** : It is a hole in the middle of iris through which light enters the eye. It appears black because light falling on it goes into the eye and does not come back.

(vi) **Ciliary muscles** : These are the muscles which are attached to eye lens and can modify the shape of eye lens which leads to the variation in focal lengths.

(vii) **Iris** : It controls the amount of light entering the eye by changing the size of pupil.

(viii) **Optical nerve** : These are the nerves which take the image to the brain in the form of electrical signals.

2. **Accommodation power** : The ability of eye to change the focal length of eye lens with the help of ciliary muscles to get the clear view of nearby objects (about 25 cm) and far distant objects (at infinity).

3. **Colour blindness** : Some people do not possess some cone cells that respond to certain specific colours due to genetic disorder.

4. **Myopia (Short sightedness)** : It is a kind of defect in human eye due to which a person can see near objects clearly but he can not see the distant objects clearly. Myopia is due to

- (i) excessive curvature of cornea.
- (ii) elongation of eye ball.

5. **Hypermetropia (Long sightedness)** : It is a kind of defect in human eye due to which a person can see distant objects properly but cannot see the nearby objects clearly. It happens due to

(i) decrease in power of eye lens i.e., increase in focal length of eye lens.

(ii) shortening of eye ball.

6. Presbyopia : It is a kind of defect in human eye which occurs due to ageing. It happens due to

(i) decrease in flexibility of eye lens.

(ii) gradual weakening of ciliary muscles.

7. Astigmatism : It is a kind of defect in human eye due to which a person cannot see (focus) simultaneously horizontal and vertical lines both.

8. Cataract : Due to the membrane growth over eye lens, the eye lens becomes hazy or even opaque. This leads to decrease or loss of vision.

The problem is called cataract. It can be corrected only by surgery.

9. Dispersion of white light by a glass prism : The phenomenon of splitting of white light into its seven constituent colours when it passes through a glass prism is called dispersion of white light. The various colours seen are Violet, Indigo, Blue, Green, Yellow, Orange and Red. The sequence of colours remember as •VIBGYOR. The band of seven colours is called spectrum.

10. Composition of white light : White light consists of seven colours i.e., violet, indigo, blue, green, yellow, orange and red.

11. Monochromatic light: Light consisting of single colour or wavelength is called monochromatic light, e.g., sodium light

12. Polychromatic light : Light consisting of more than two colours or wavelengths is called polychromatic light, e.g. white light.

13. Recombination of white light : Newton found that when an inverted prism be placed in the path of dispersed light then after passing through prism, they recombine to form white light.

14. Formation of rainbow : The water droplets act like small prisms. They refract and disperse the incident sunlight, then reflect it internally, and finally refract it again when it comes out of the raindrop. Due to the dispersion of light and internal reflection, different colours reach the observer's eye.

15. Atmospheric Refraction : The refraction of light caused by the earth's atmosphere (having air layers of varying optical densities) is called atmospheric refraction.

16. Why, the duration of day becomes approximately 4 minutes shorter if there is no atmosphere on earth : Actual sun rise happens when it is below

the horizon in the morning. The rays of light from the sun below the horizon reach our eyes because of refraction of light. Similarly, the sun can be seen about few minutes after the actual sun set. Thus the duration of, day time will increase by 4 minutes.

17. Scattering of light : According to Rayleigh's law of scattering the amount of scattered light $\propto 1/(\text{wavelength})^4$

So that the wavelength of violet, blue and indigo is small as compared to the rest of the colours. So sky appears blue in colour.

18. Colour of the Sun at sunrise and sunset : At noon, the light of sun travels relatively shorter distance through earth's atmosphere thus appears white as only a little of blue and violet colours are scattered. Near the horizon, most of the blue light and shorter wavelengths are scattered and sun appears red.