

Board – CBSE

Class – 10th

Topic – Human Eye and Colorful World

1. The Human Eye

It is a natural optical instrument that is used to see objects by human beings. It is like a camera which has a lens and screen system.

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

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

(iii) Aqueous humour: It is fluid which fills the space between the 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: A hole in the middle of the iris through which light enters the eye. It appears black because the light falling on it goes into the eye and does not come back.

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

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

(viii) Optical nerve: These are the nerves that take the image to the brain in electrical signals.

2. Accommodation power :

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

3. Colour blindness:

Some people do not possess cone cells that respond to certain specific colours due to genetic disorders.

4. Myopia (Short-sightedness):

It is a kind of defect in the human eye due to which a person can see near objects clearly, but he cannot see the distant objects. Myopia is due to

- (i) Excessive curvature of the cornea.
- (ii) Elongation of the eye ball.

5. Hypermetropia (Long sightedness) :

It is a kind of defect in the human eye due to which a person can see distant objects properly but cannot see the nearby objects. It happens due to

- (i) Decrease in the power of eye lens, i.e., increase in focal length of the eye lens.
- (ii) Shortening of the eye ball.

6. Presbyopia :

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

- (i) Decrease in the flexibility of eye lenses.
- (ii) Gradual weakening of ciliary muscles.

7. Astigmatism:

It is a kind of defect in the human eye. A person cannot see (focus) simultaneously horizontal and vertical lines.

8. Cataract :

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

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

9. Dispersion of white light by a glass prism:

The phenomenon of splitting 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 sequences of colours remember as VIBGYOR. The band of seven colours is called a spectrum.

10. Composition of white light :

White light consists of seven colours, i.e., violet, indigo, blue, green, yellow, orange & 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 is placed in the path of dispersed light, they recombine to form white light after passing through a prism.

14. Formation of the rainbow :

The water droplets act like small prisms. They refract and disperse the incident sunlight, then reflect it internally, & 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 day becomes approximately 4 minutes shorter if there is no atmosphere on earth :

Actual sunrise 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 the refraction of light. Similarly, the sun can be seen about a few minutes after the actual sunset. Thus day time will increase by 4 minutes.

17. Scattering of light :

According to Rayleigh's law of scattering, the amount of scattered light $\frac{\alpha}{(\text{Wavelength})^4}$

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

18. Colour of the Sun at sunrise and sunset:

At noon, the sun's light travels a relatively shorter distance through the earth's atmosphere, thus appearing white as only a little blue and violet colours are scattered.

Most of the blue light and shorter wavelengths are scattered near the horizon, and the sun appears red.