



Class - X

2023-24

Board: CBSE

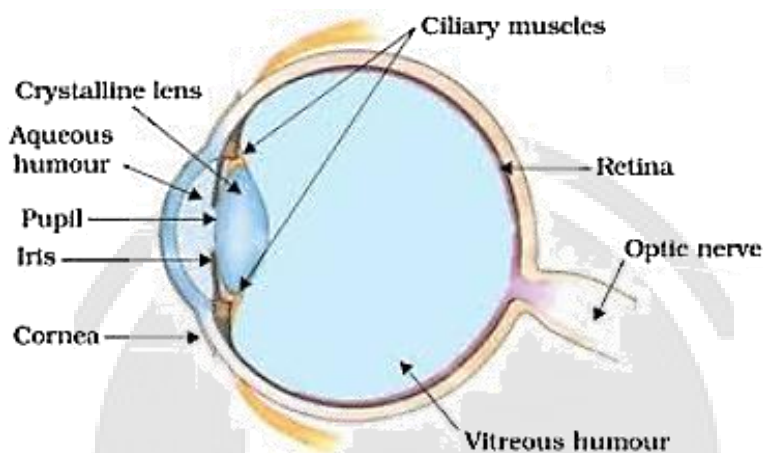
HUMAN EYE AND COLORFUL WORLD

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Human eye and colorful world"

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 a lens and screen system.

Parts of Human Eye:



Cornea: It is the protective and front layer of the eye. It is made by a transparent membrane. Light enters the eye through the cornea.

Iris: Dark and a colorful muscular diaphragm is called iris. It is responsible for colour of the eye.

Pupil: Small circular hole in the centre of iris. It regulates the amount of light entering the eye by adjusting the size of the iris.

Ciliary Muscles: It holds the eye lens at its proper position. It changes the size of the eye lens.

Eye lens: The eye lens is a convex lens made of transparent jelly like material.

Retina: It is the screen of the eye. A real and inverted image forms on the retina.

Rods and Cones: These are color sensitive rods and cones shaped cells. Rods are responsible for the vision in dim light while cones are responsible for color.

Optic Nerve: It converts information of the image into a corresponding electric signal and passes it to the brain.

Blind Spot: The junction of the optic nerve and retina, where no rods and cones cells are present is called the blind spot. It is insensitive to light.

Persistence of vision of the eye: The image of an object persists on the retina for $\frac{1}{16}$ second, even after the removal of the object. The sequence of still pictures taken by a movie camera is projected on a screen at a rate of about 24 images or more per second. The successive impressions of images on the screen appear to merge smoothly into one another to give us the feeling of moving images.

Near Point: The nearest point from the eye at which the eye can see clearly without strain is called near point. For a normal eye it is 25 cm.

Far Point: The farthest point, upto which the eye can see the object clearly is called far point. For a normal eye it is infinity.



The range of Vision: Distance between near point and far point of eye is called range of vision.

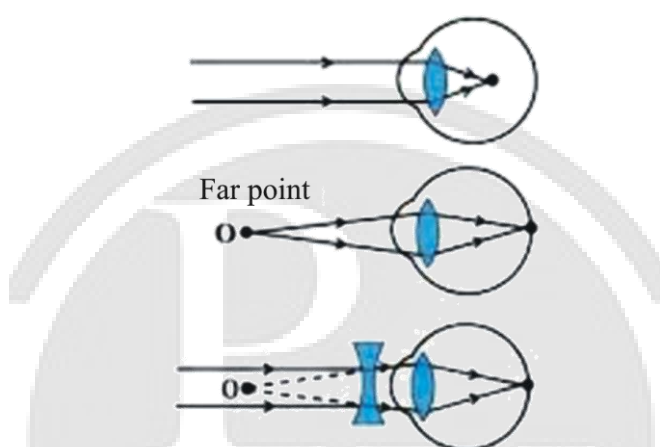
Power of Accommodation: The ability of the eye to see near as well as far objects clearly is called Power of Accommodation.

Least distance of distinct vision: The minimum distance upto which an eye can see clearly is called the least distance of distinct vision ; it is normally denoted by D. The least distance of distinct vision is equal to the distance between the eye and its near point. For a normal human eye, this distance is around 25 cm.

Defects of the Eye

Myopia or short sightedness or near sightedness: A person suffering from myopia or short sightedness can see nearby objects clearly but cannot see the far away objects clearly. Myopia (short sightedness — the image of distant objects is focussed before the retina) is corrected by using a concave lens of suitable power.

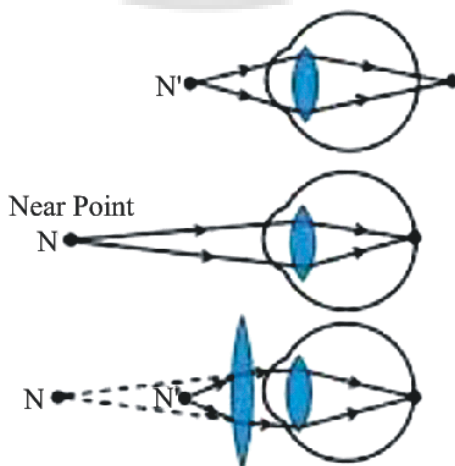
Myopia (Near-sightedness)



Reasons :

Either the eyeball is longer than normal or The maximum focal length (due to excessive curvature of the cornea) of the lens is insufficient to produce a clearly formed image on the retina.

Hypermetropia or long sightedness : A person suffering from this defect can see distant objects clearly but cannot see nearby objects clearly. In this defect, the near point lies farther away than 25 cm. Hypermetropia (farsightedness — the image of nearby objects is focussed beyond the retina) is corrected by using a convex lens of suitable power. The eye loses its power of accommodation at old age.



Reasons :

Either the hyperopia eyeball is too short or the ciliary muscle is unable to change the shape of the lens enough to properly focus the image i.e. the focal length of the eye lens increases.



Presbyopia:

Presbyopia is that defect of the human eye, due to which an old person cannot read and write comfortably. That is why Presbyopia is also called old-sighted.

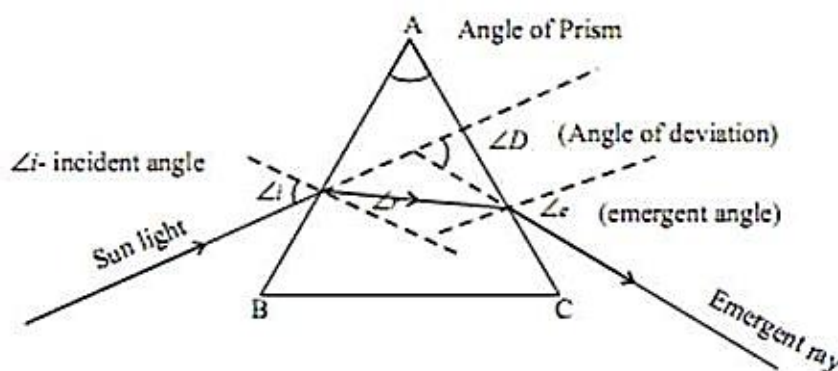
To correct Presbyopia, an old person has to use spectacles with a convex lens of suitable focal length or power.

Astigmatism:

A person may also have an eye defect known as astigmatism, in which light from a point-source produces a line image on the retina. A person suffering from this defect cannot see in all directions equally well i.e., he cannot see the vertical and horizontal lines simultaneously. This condition arises either when the cornea or the crystalline lens or both are not perfectly spherical. Astigmatism can be corrected with lenses having different curvatures in two mutually perpendicular directions i.e., cylindrical lens.

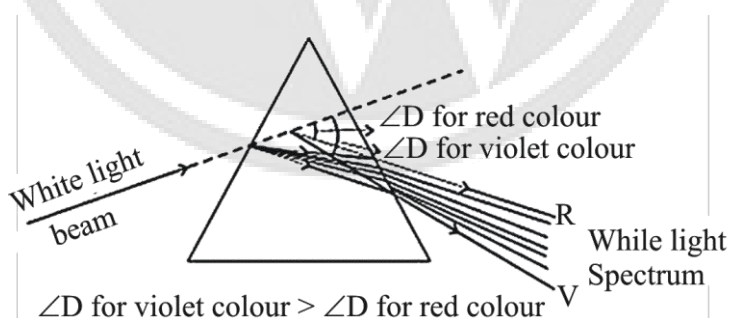
- When a person suffers from both, myopia as well as Hypermetropia, his spectacles for correction have bifocal lenses. The upper half is a concave lens for distant vision and the lower half is a convex lens for reading.

Refraction through glass prism:



Dispersion of light:

A prism splits the incident white light into a band of seven colours. The band of the coloured components of a light beam is called its spectrum. Isaac Newton was the first to use a glass prism to obtain the sunlight spectrum. Different colours of light bend through different angles with respect to the incident ray as they pass through a prism. The red light bends the least while the violet the most.



- A rainbow is formed due to dispersion of light by tiny droplets of water which act as prisms.
- Atmospheric refraction is the cause of twinkling of stars, advance sunrise and delayed sunset.
- Scattering of light causes the blue color of sky and the reddening of the Sun at sunrise and sunset.

