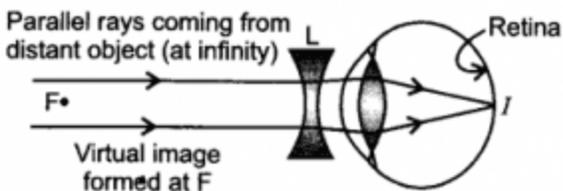


Chapter 11: Human Eye and Colorful World

Short Question

(Question 1) *what advice will a doctor give to a student sitting at the back of the classroom who cannot read clearly the letters written on the blackboard draw ray diagram for the correction of this defect*

Ans. The doctor will advise the student to wear a concave lens having a suitable power for correcting the vision. Since the student is suffering from short-sightedness.



(Question 2) *How we are able to see nearby as well as the distance object clearly?*

Ans. Due to accommodation we are able to see the nearby as well as the distance object clearly. Accommodation is the ability of the ciliary muscles to adjust the curvature and thereby the focal length to get a clear view of the objects. There is always a limit up to which ciliary muscles can increase or decrease the focal length of the eye lens. This change enables us to see near and far objects clearly.

(Question 3) *If a person needs power of -4.5 D in the lens for correction of her vision.*

a) *what is the focal length of the corrective lens?*

b) *What kind of vision defect she is suffering from?*

c) *what is the nature of corrective lens?*

Ans.

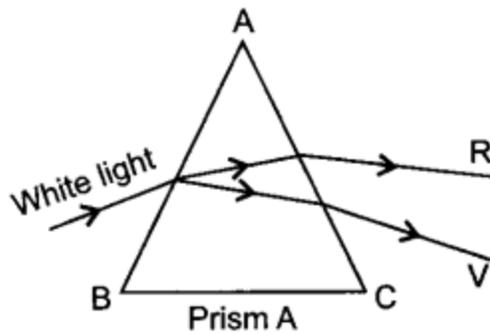
a) The defect is myopia (short-sightedness)

b) Focal length = $\frac{1}{\text{Power}} = \frac{1}{-4.5} = -22.2\text{ cm}$

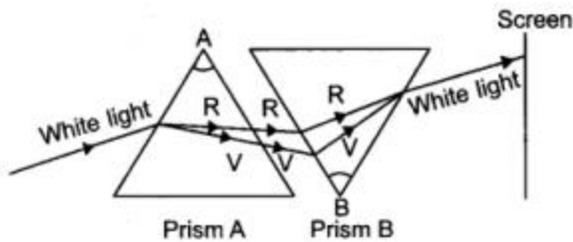
c) The lens is a concave lens.

(Question 4) *Use two identical prisms in such a way that a narrow beam of white light incident on one prism emerges out of the second prism as white light? Draw the figure.*

Ans. Consider a Prism A. It splits into 7 constituent colors when white light Falls on it. The red colour deviates the least and the violet colour deviates most as shown in the figure.



If another prism B is placed such that they are shown below the light that emerges out of A will be made to merge together to come out as white light.



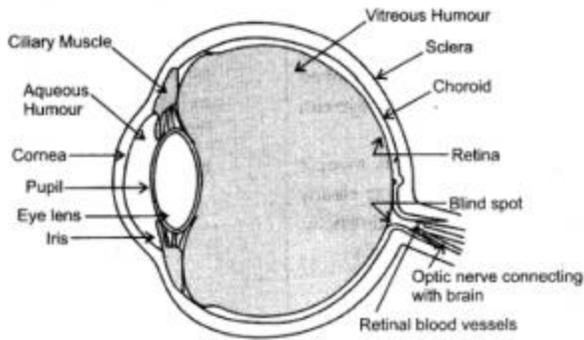
(Question 5) is the stars position seen by us is it's true position. Describe your answer.

Ans. Due to change in the refractive index of different layers of atmosphere light bends when it passes through it and appears as if it comes from a higher level than they are actually. So the stars appears slightly higher than they are actually.

Long Question

(Question 1) Explain the function and structure of human eye how we can see the nearby as well as the distant object.

Ans. Human eye- The natural optical device through which one could see objects around him. It forms and inverted and real image on a light sensitive surface called the retina.



Parts of human eye are:

(i) Iris: It is a dark muscular diaphragm that controls the size of the pupil.

(ii) Pupil : The black opening between the aqueous humour and the lens. Since light does not get reflected from it so its appearance is dark.

(iii) Aqueous Humour and Cornea: Acting as lens, they provide the refraction for light rays entering the eye. Cornea is a thin membrane covering the surface of eyeball, through which light enters. Aqueous humour is a transparent gelatinous fluid filled between cornea and eye lens.

(iv) Retina: The light sensitive surface of eye on which image is formed. It is equivalent of the photographic film in a camera. It contains rods and cones.

(v) Ciliary Muscles: These muscles hold the eye lens in vertical position and change the focal length of eye lens to form the sharp image of objects located at different distances on the retina.

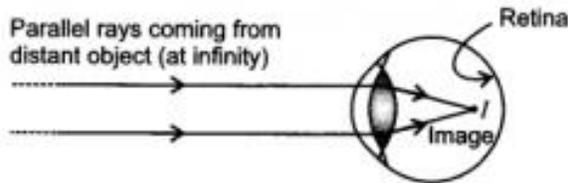
(vi) Rods and cones: The cells in retina, which are light and colour sensitive. Rods respond to the intensity of light. Cones respond to the colour. There are around 125 million rods and cones. The cells generate signals which are transmitted to the brain through optical nerves. The brain process the information via these electric signals and give the impression of erect image to us.

To see objects that are nearby as well as at distant, the curvature of eye lens is modified by the ciliary muscles. In this way there is a variation in the focal length. When the muscles are relaxed, the focal length of the lens has its maximum value, equal to the distance from the retina. So, parallel rays coming into eye get focused on the retina. When the eye looks at nearby objects, the ciliary muscles are strained and focal length decreases. So, the sharp image again forms on the retina.

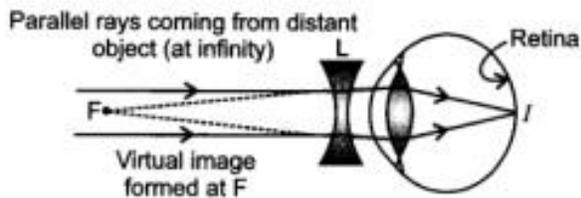
(Question 2) When can we categorize a person to be myopic or hypermetropic? Explain using diagrams how the defects associated with myopic and hypermetropic eye can be corrected?

Ans. When a person is able to see nearby objects clearly but he is unable see distant objects distinctly, then the person can be treated as myopic. This defect of eye is called **myopia**.

Myopia:



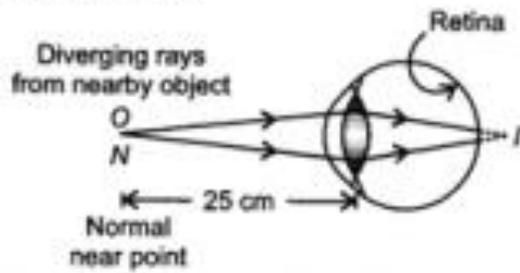
In a myopic eye, image of distant object is formed in front of the eye (and not on the retina).



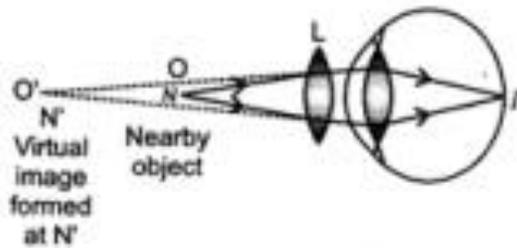
Correction of Myopia: The concave lens placed in front of eye lens forms a virtual image of distant object at far point (F) of the myopic eye.

When a person is unable to see nearby objects clearly but able to see distant objects clearly, then the person can be treated as hypermetropic. The eye defect is called **hypermetropia**.

Hypermetropia:



In a hypermetropic eye, the image of nearby object lying at normal near point N (at 25 cm) is formed behind the retina.



Correction of Hypermetropia: The convex lens forms a virtual image of the object (lying at normal near point N) at the near point N' of the defective eye. It helps the eye to form the image on the retina.