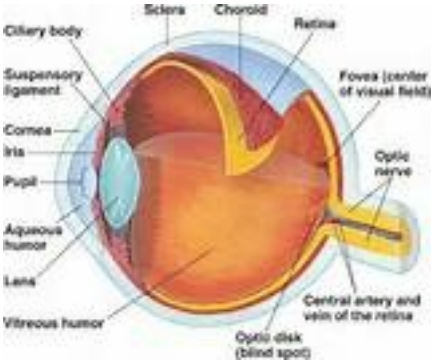
CBSE Class 10 Science
NCERT Exemplar Solutions
Chapter 11
Human Eye and Colourful World

Long Answer Questions

25. Explain the structure and functioning of Human eye. How are we able to see nearby as well as distant objects?

Ans. The human eye has following main parts:



Cornea: Human eye is spherical in shape. It has tough white coat which protects the interior of the eye. The front portion of this coat is transparent and is called cornea.

Iris: This is a dark muscular structure behind the cornea. Unique colour of a person's eye is because of colour of iris.

Pupil: The small opening in the iris is called pupil. Iris controls the size of the pupil and thus controls the amount of light entering the eye. Light enters the eye through pupil.

L**ens:** Lens is thicker at the middle and is made of transparent material. Lens focuses the light on the back of the eye; called retina.

Retina: The back of the eye is called retina. It works like a screen; on which image is formed. .**Rods** and **cones function** as photoreceptors in the retina of the eye, turning visible light into neuronal signals, which are sent to the brain. This process is called transduction.
These nerve cells are connected to optic nerve.

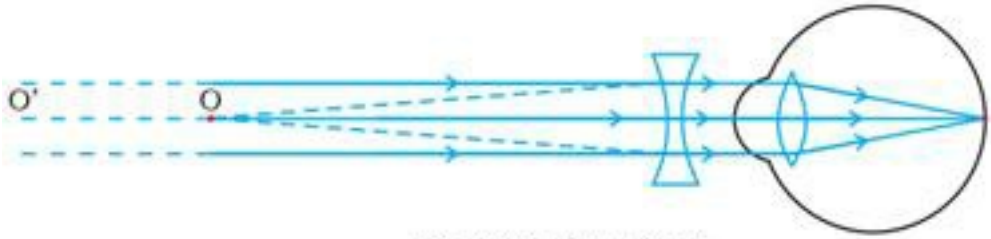
Formation of Image in Eye: Light rays enter the eye through pupil and pass through lens.

Lens focuses light rays on retina. Real, inverted and smaller image is formed on retina. Optic nerve carries the message to the brain. The brain interprets the message and we get the sense of vision.

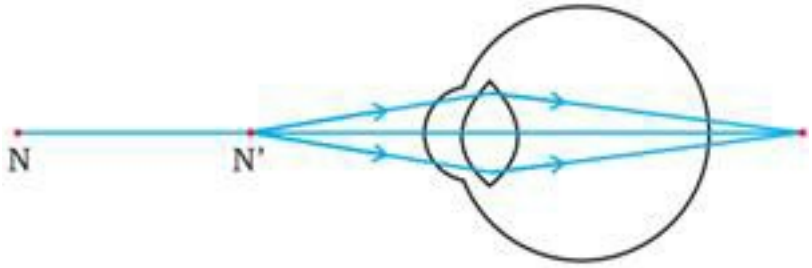
26. When do we consider a person to be myopic or hypermetropic? Explain using diagrams how the defects associated with myopic and hypermetropic eye can be corrected?

Ans. When a person is unable to clearly see distant objects, he is considered a myopic person. Such a person is suffering from myopia. This happens when image is formed in front of the retina.

When a person is unable to clearly see a nearby object, he is considered a hypermetropic person. Such a person is suffering from hypermetropia. This happen when image is formed behind the retina

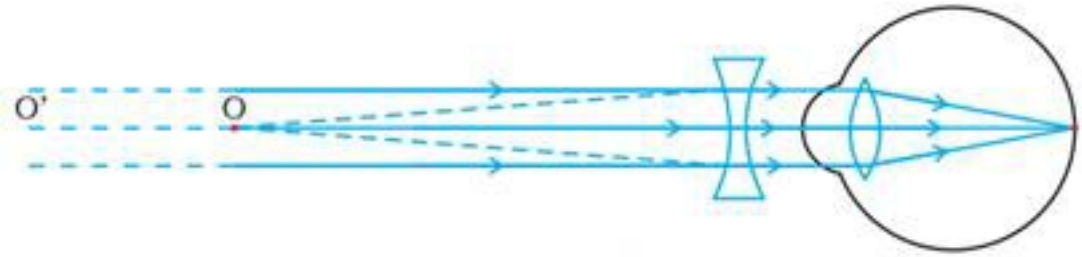


Correction for myopia



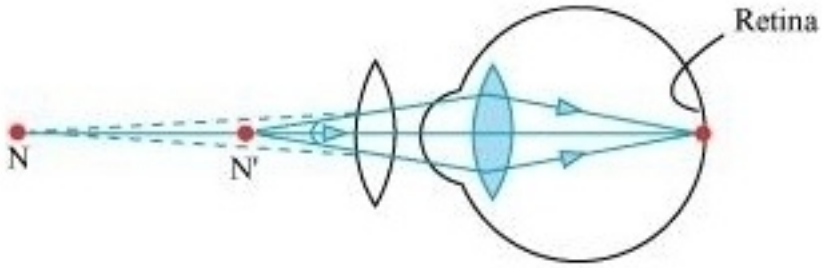
Hypermetropic eye

Correction of Myopia: A person suffering from myopia needs to use a concave lens of suitable focal length. The concave lens diverges the rays coming from infinity. After refraction from the concave lens, the rays appear to be coming from the far point of this person's eye. Due to this, a clear image of distant object is made on the retina of that person. That is how a myopic person is able to clearly see distant objects; with the help of suitable concave lens.



Correction for myopia

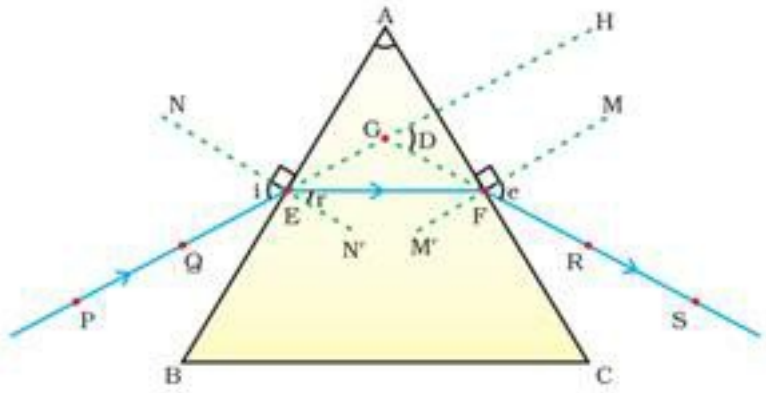
Correction of Hypermetropia: A hypermetropic person needs to use a convex lens of suitable focal length. The convex lens converges the light rays coming from a nearby object. As a result, these light rays appear to be coming from the near point of this person's eyes. Due to this, a clear image of nearby object is made on the retina of that person. That is how a hypermetropic person is able to clearly see nearby objects; with the help of suitable convex lens.



Correction for hypermetropic eye

27. Explain the refraction of light through a triangular glass prism using a labelled ray diagram. Hence define the angle of deviation.

Ans.



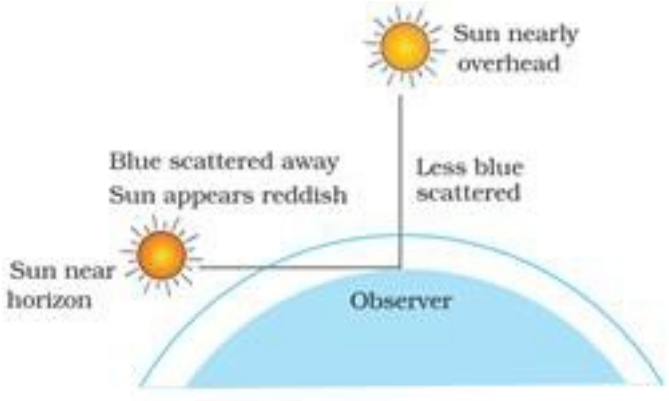
- ABC is prism with base BC
- PE is incident ray on surface AB. It makes $\angle PEN$ with the normal NE. This angle is angle of incidence.
- After entering the prism, the light ray bends towards normal. In this case, EF is refracted ray. $\angle N'EF$ is angle of refraction.
- Once the refracted ray emerges from prism into air, it bends away from normal. In this firgure, FS is emergent ray. $\angle SFM$ is angle of emergence.

Angle of Deviation: The angle between incident ray and emergent ray is called angle of deviation. Here, $\angle SGH$ is angle of deviation or $\angle D$.

28. How can we explain the reddish appearance of sun at sunrise or sunset? Why does it not appear red at noon?

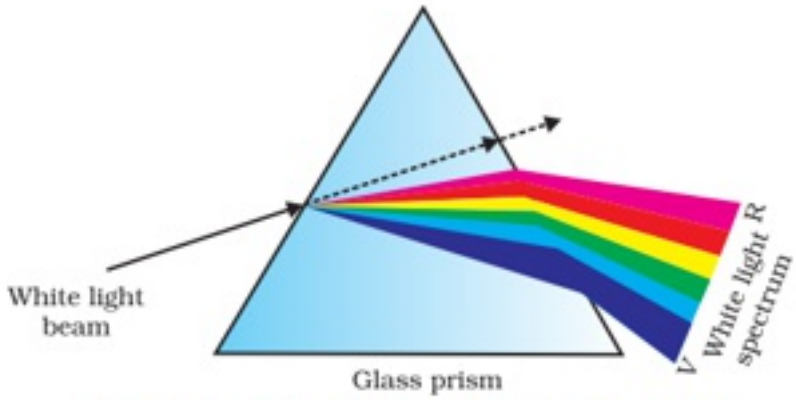
Ans. Colours near the red end of the spectrum scatter the least. This happens because of short wavelength of reddish colours. During sunset and sunrise, sunlight needs to travel more distance to reach us. Red colour is able to reach us because it is scattered the least. Hence, sky appears reddish during sunrise/sunset.

The sky appears reddish during sunrise/sunset but it appears white at noon. During noon, the sunlight has to travel less distance to reach us. Most of the colours reaching us get scattered. Due to this, sky appears white at noon.



29. Explain the phenomenon of dispersion of white light through a glass prism, using suitable ray diagram.

Ans.



Dispersion of white light by the glass prism

When ray of light enters a prism, it bends because of refraction of light. When the ray of light finally emerges out of the prism, it deviates drastically from its original path. This happens because of unique shape of prism.

Different colours in the visible spectrum have different speeds. Due to this, different colours bend at different angles of deviation. As a result, the emergent light appears as a band of seven colours; the colours which are the components of white light. These colours are Violet, Indigo, Blue, Green, Yellow, Orange and Red.

Segregation of white light into its different components is called dispersion of light.

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30. How does refraction take place in the atmosphere? Why do stars twinkle but not the planets?

Ans. Atmosphere is made up of several layers. The layer at the top is optically rare, while the layer at the bottom is optically denser. Due to this, when light travels through different layers of the atmosphere, refraction takes place. Since light passes through denser and denser layer as it moves through atmosphere, it tends to bend towards the normal.
Stars are very far from us; compared to planet. Due to this, stars serve as point source of light. As a result, even a slightest change in their apparent position in the sky is clearly perceived by us. Hence, stars appear to twinkle.
Planets on the other hand, are near to us. Hence, they do not serve as point source of light. Hence, minor changes in their apparent position are not perceived by us. Hence, planets do not appear to twinkle.