CLASS X: SCIENCE
Chapter 10: The Human Eye and the Colourful World

Questions and Solutions | Page No. 164 - NCERT Books

Q1. What is meant by power of accommodation of the eye ?

Ans. The ability of the eye lens to adjust its focal length is called power of accommodation.

Q2. A person with a myopic eye cannot see objects beyond 1.2 m distinctly. What should be the type of the corrective lens used to restore proper vision ?

Ans. To correct this defect of vision, he must use a concave lens.

Q3. What is the far point and near point of the human eye with normal vision ?

Ans. The far point of a human eye with normal vision is at infinity while the near point is at 25 cm from the eye.

Q4. A student has difficulty reading the blackboard while sitting in the last row. What could be the defect the student is suffering from? How can it be corrected ?

Ans. The student is suffering from eye defect 'myopia'. This defect can be corrected by using concave lens.

EXERCISES

Q1. The human eye can focus objects at different distances by adjusting the focal length of the eye lens. This is due to

(a) presbyopia.

(b) accommodation.

(c) near-sightedness.

(d) far-sightedness.

Ans. Option (b) is correct. Human eye can change the focal length of the eye lens to see the objects situated at various distances from the eye. This ability of eye is called accommodation.

Q2. The human eye forms the image of an object at its

(a) cornea (b) iris

(c) pupil (d) retina

Ans. Option (d) is correct. The human eye is like a camera. Its lens system forms an image on a light-sensitive screen called the retina.

Q3. The least distance of distinct vision for a young adult with normal vision is about

(a) 25 m (b) 2.5 cm

(c) 25 cm (d) 2.5 m

Ans. Option (c) is correct.

The least distance of distinct vision is the minimum distance of an object to see clear image. It is 25 cm for a young adult with a normal vision.

Q4. The change in focal length of an eye lens is caused by the action of the

(a) pupil (b) retina

(c) ciliary muscles (d) iris

Ans. Option (c) is correct.

By relaxation or contraction of ciliary muscles, the curvature of the eye lens changes which eventually changes the focal length of eye lens.

Q5. A person needs a lens of power –5.5 dioptres for correcting his distant vision. For correcting his near vision he needs a lens of power +1.5 dioptre. What is the focal length of the lens required for correcting (i) distant vision, and (ii) near vision ?

Ans. (i) Focal length f is given by,

$$f = \frac{1}{P}$$

$$\text{or } f = \frac{1}{-5.5}$$

$$= -0.1818 \text{ m}$$

$$= \mathbf{-18.18 \text{ cm}}$$

(ii) Focal length f is given by,

$$f = \frac{1}{P}$$

$$\text{or } f = \frac{1}{+1.5}$$

$$= +0.6667 \text{ m}$$

$$= \mathbf{+66.67 \text{ cm}}$$

Q6. The far point of a myopic person is 80 cm in front of the eye. What is the nature and power of the lens required to correct the problem ?

Ans. For myopia, focal length is given by,

$f = -x = -80 \text{ cm} = \mathbf{-0.8\ m}$

Power, $P = \frac{1}{f} = \frac{1}{-0.8}$

$= \mathbf{-1.25\ dioptres}$.

The lens is a concave lens.

Q7. Make a diagram to show how hypermetropia is corrected. The near point of a hypermetropic eye is 1 m. What is the power of the lens required to correct this defect ? Assume that the near point of the normal eye is 25 cm.

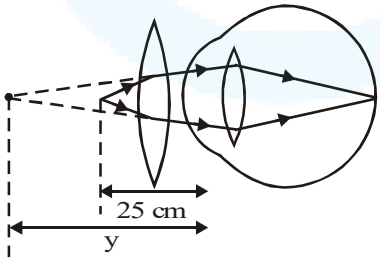
Ans. Here, y = 1 m

$$\frac{1}{f} = \frac{1}{0.25} - \frac{1}{y} = \frac{1}{0.25} - \frac{1}{1}$$

$$= \frac{100}{25} - 1 = 4 - 1 = +3$$

or $f = +(1/3) = \mathbf{+0.3333\ m = +33.33\ cm}$

Power, $P = \frac{1}{f} = \mathbf{+3\ dioptres}$.



Q8. Why is a normal eye not able to see clearly the objects placed closer than 25 cm ?

Ans. A normal eye is unable to clearly see the objects placed closer than 25 cm because the ciliary muscles of eyes are unable to contract beyond a certain limit. If the object is placed at a distance less than 25 cm from the eye, then the object appears blurred and produces strain in the eyes.

Q9. What happens to the image distance in the eye when we increase the distance of an object from the eye ?

Ans. The size of eye cannot be increased or decreased. Therefore, the image distance remains constant. When we increase the distance of an object from the eye, the image distance in the eye does not change. The increase in the object distance is compensated by the change (increase) in the focal length of the eye lens such that the image is formed at the retina of the eye.

Q10. Why do stars twinkle ?

Ans. Twinkling of stars can be seen on a clear night. This is due to atmospheric refraction of light coming from the stars (star light). As the star light enters into the earth's atmosphere, atmospheric refraction takes place due to gradually changing refractive index of the air. Since the physical conditions of the refracting medium (earth's atmospheric) are not stationary, star light flux (luminous flux) entering the eye of an observer continuously fluctuates. This means luminous energy entering the eyes per second from the star increases and decreases with time. Thus, the star sometimes appear brighter and at some other time fainter, causing the 'twinkling of stars'.

Q11. Explain why the planets do not twinkle.

Ans. The apparent size of stars is very small as compared to apparent size of planets. Thus, the star may be considered as a 'point sized' source of light and the planet as an 'extended source' of light. So, the planet can be considered as a collection of large number of 'point sized' sources of light, such that the dimming effect of some 'point sources' is nullified by the brighter effect of the other 'point sources'. The variable atmospheric conditions are unable to create variations in light flux from the planet entering our eye and thus, planets do not twinkle.

Q12. Why does the sky appear dark instead of blue to an astronaut ?

Ans. The sky appears dark instead of blue to an astronaut because there is no atmosphere in the outer space that can scatter the sunlight. As the sunlight is not scattered, no scattered light reaches the eyes of the astronauts and the sky appears black to them.