NCERT Solutions for Class 10 Science

Chapter 10 Human Eye and Colourful World

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Question 1

What is meant by power of accommodation of the eye ?

Answer:

The power of accommodation of the eye is the maximum variation of its power for focusing on near and far (distant) objects.

Question 2

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 ?

Answer:

Concave lens.

Question 3

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

Answer:

For a human eye with normal vision the far point is at infinity and near point is 25 cm from the eye.

Question 4

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

Answer:

The child is suffering from myopia. The child should use concave lens of suitable focal length.

Question 1

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

Answer:

(b) Accommodation

Question 2

The human eye forms the image of an object at its

(a) cornea

(b) iris

(c) pupil

(d) retina

Answer:

(d) Retina

Question 3

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

Answer:

(c) 25 cm

Question 4

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

Answer:

(c) Ciliary muscles

Question 5

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 ?

Solution:

(i) ∵ Power of distant viewing part of the lens, P_1 = -5.5 D

∴ Focal length of this part, $f_1 = \frac{1}{p_1} = \frac{1}{-5.5}$ m = -0.182 m = -18.2 cm

(ii) For near vision,

∴ Focal length of this part, $f_1 = \frac{1}{P_1} = \frac{1}{-5.5}$ m = –0.182 m = **–18.2 cm**

Question 6

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 ?

Solution:

The remedial lens should make the objects at infinity appear at the far point.

Therefore, for object at infinity, u = ∞

Far point distance of the defected eye, v = – 80 cm

By lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{-80} - \frac{1}{\infty} = -\frac{1}{80} - 0 = -\frac{1}{80} \Rightarrow f = -80$ cm

Now power, $P = \frac{100}{f \text{ (in cm)}} = \frac{100}{-80} =$ **–1.25 D**

Negative sign shows that the remedial lens is a concave lens.

Question 7

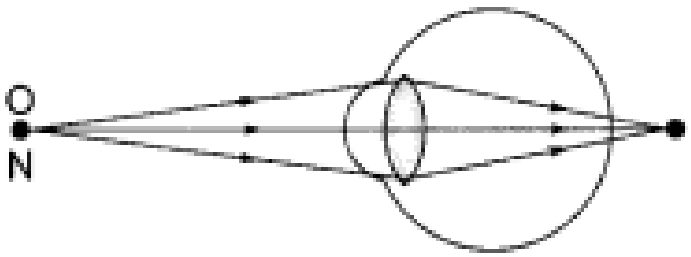
Make a diagram to show how hypermetropia is corrected. The near point of a hypermetropic eye is 1 m. What is the power of the lens required to correct the defect ? Assume that the near point of the normal eye is 25 cm.

Solution:

(i) The near point N of hypermetropic eye is farther away from the normal near point N.

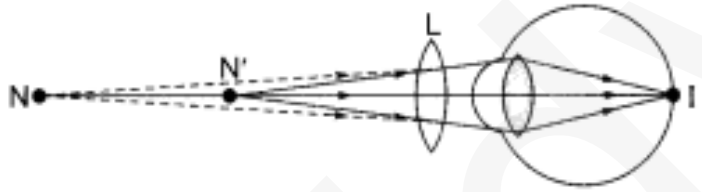
Near point of a hypermetropic eye

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



Hypermetropic eye

(iii) 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 this eye.



Correction for hypermetropic eye

The object placed at 25 cm from the correcting lens must produce a virtual image at 1 m or 100 cm.
Therefore, u = – 25 cm, v = 100 cm

By lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{-100} - \frac{1}{-25} = -\frac{1}{100} + \frac{1}{25} = \frac{3}{100}$

or $f = \frac{100}{+3}\text{ cm} = +\frac{1}{3}\text{ m}$

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

The positive sign shows that it is a convex lens.

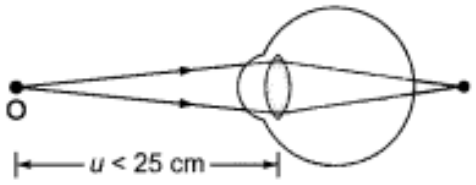
Question 8

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

Answer:

At distance less than 25 cm, the ciliary muscles cannot bulge the eye lens any more, the object cannot be

focused on the retina and it appears blurred to the eye, as shown in the given figure.



Object O closer than 25 cm from the eye is not focused on retina and seen blurred.

Question 9

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

Answer:

The eye lens of a normal eye forms the images of objects at various distances on the same retina. Therefore, the image distance in the eye remains the same.

Question 10

Why do stars twinkle ?

Answer:

Stars appear to twinkle due to atmospheric refraction. The light of star after the entry of light in earth's atmosphere undergoes refraction continuously till it reaches the surface of the earth. Stars are far away. So, they are the point source of light. As the path of light coming from stars keep changing, thus the apparent position of stars keep changing and amount of light from stars entering the eye keeps twinkling. Due to which a star sometimes appear bright and sometimes dim, which is the effect of twinkling.

Question 11

Explain why the planets do not twinkle ?

Answer:

The planets are much nearer to the earth than stars and because of this they can be considered as large source of light. If a planet is considered to be a collection of a very large number of point sources of light, then the average value of change in the amount of light entering the eye from all point size light sources is zero. Due to this the effect of twinkling is nullified.

Question 12

Why does the sun appear reddish early in the morning ?

Answer:

The light coming from the sun passes through various denser layers of air in the earth's atmosphere before reaching our eyes near the horizon. Most of the part of blue light and light of small wavelength gets scattered by dust particles near the horizon. So, the light reaching our eyes is of large wavelength. Due to this the sun appears reddish at the time of sunrise and sunset.

Question 13

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

Answer:

As an astronaut moves away from the atmosphere of earth, the atmosphere becomes thin. Due to the absence of molecules (or dust particles) in air, the scattering of light does not take place. Thus, sky appears dark in the absence of scattering.