Chapter 2
Human Eye and Colorful World

In Text Questions-Pg-190

Q.1 What is meant by the power of accommodation of the eye?

Ans.: The ability of an eye to focus the distant objects as well as the nearby objects and forming the images on the retina by changing the focal length of the eye lens is called accommodation.

Q.2 A person with a myopic eye cannot see objects beyond 1.2m distinctly. What should be the type of the corrective lens used to restore proper vision?

Ans.: The person can use concave lens (negative power) to improve the vision.

Q.3 What are the far point and near point of the human eye with normal vision?

Ans.: The far point of human eye with normal vision is at infinity and the near point is 25 cm distance from the eye.

Q.4 A student has difficulty in reading the blackboard while sitting in the last row. What could be the defect the child is suffering from? How can it be corrected?

Ans.: Since the child cannot see the blackboard writing clearly, he is suffering from 'myopia' or 'short-sightedness' i.e. he can see closer things with naked eye but not distant things. Myopia can be corrected by using spectacles with concave lenses of appropriate power.

Exercise-Pg-197

Q.1 he 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.: Accommodation is the property of human eye to adjust the focal length of our eyes at different distances. Thus, option (b) is correct.

Q.2 The human eye forms the image of an object at its:

A. cornea

B. iris

C. pupil

D. retina

Ans. The image formation spot in our eye is retina. Thus, option (d) is correct.

Q.3 The least distance of distinct vision for a young adult with normal vision is about:

A. 25m

B. 2.5 cm

C. 25 cm

D. 2.5 m

Ans.: 25 cm is the least distance of distinct vision for a young adult with normal vision.

Q.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

Ans.: ciliary muscles cause the change in focal length in our eyes.

Q.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 dioptres. What is the focal length of the lens required for correcting

(i) distant vision, and

(ii) near vision?

Ans.: (i) For distant vision:

Power of lens, P = -5.5 D

Power in D = $\frac{1}{f(m)}$

$\Rightarrow$ f = $\frac{100}{-5.5}$ = -18.8cm.

Thus, the focal length of the lens required for correcting distant vision is, -18.2 cm.

Note: The negative sign of the length tells us that it is a concave lens.

(ii) For near vision:

Power of lens, P = + 1.5 D

Power in D = $\frac{1}{f(m)}$

$\Longrightarrow$ f = $\frac{100cm}{1.5}$ = 66.66cm

So, Focal length, f = + 66.66 cm (or + 66.7 cm)

Thus, the focal length of the lens required for correcting near vision is + 66.7 cm.

Note: The positive sign of focal length tells us that it is a convex lens.

Q.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?

Ans.: The defect called myopia is corrected by using a concave lens. We will now calculate the focal length of the concave lens required in this case. The far point of the myopic person is 80 cm. This means that this person can see the distant object (kept at infinity) clearly if the image of this distant object is formed at his far point.

Object distance, u = ∞ (infinity)

Image distance, v = -80 cm (Far point, in front of lens)

And, Focal length, f=? (To be calculated)

Putting these values in the lens formula:

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

We get

$$\frac{1}{-80} - \frac{1}{\infty} = \frac{1}{f}$$

Or $\frac{1}{f} = \frac{1}{-80}$

or f = -80 cm

Thus, the focal length of the required concave lens is 80 cm. We will now calculate its power. Please note that the focal length, f= -80 cm = -0.8 m.

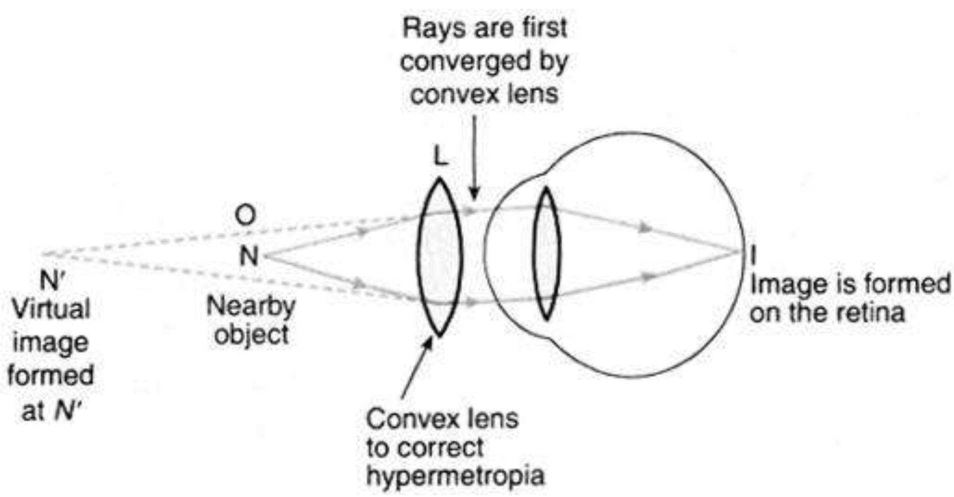
Power, p = $\frac{1}{f(meter)}$

Power, p = $\frac{1}{-0.8}$ = -1.25D

So, the power of concave lens required is -1.25D

Q.7A Make a diagram to show how hypermetropia is corrected.

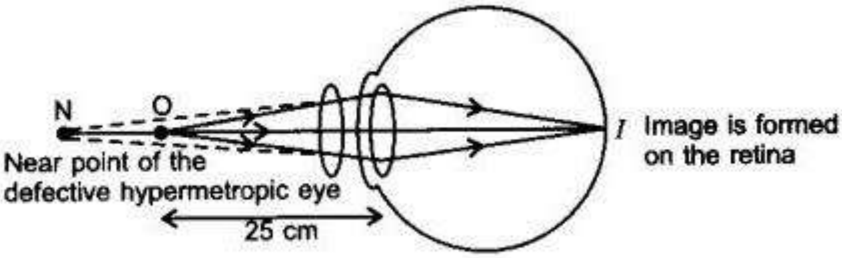
Ans.: (a) The hyper-metropic correction is shown below by using convex lens correction.



Q.7B The near point of a hypermetropic eye is 1m. What is the nature and power of the lens required to correct this defect? Assume that the near point of the normal eye is 25 cm.

Ans.: The eye defect called Hypermetropia is corrected by using convex lens spectacles.

We will first calculate the focal length of the convex lens required in this case. For hypermetropic eye can see the nearby object kept at 25 cm (at the near point if normal eye) clearly if the image of this object is formed at its own near the point which is 1 meter here. So, in this case :



Object distance, u = -25 cm (Normal near point)

Image distance, v = -1 m (Near point of this defective eye) = -100 cm

Focal length, f = ? (To be calculated)

Putting these values in the lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

By putting in values

We get :

$$\frac{1}{-100} - \frac{1}{(-25)} = \frac{1}{f}$$

Or, $\left(-\frac{1}{100}\right) + \frac{1}{25} = \frac{1}{f}$

$\frac{-1+4}{100} = \frac{1}{f}$

$\frac{3}{100} = \frac{1}{f}$

f = $\frac{100}{3}$

f = 33.3 cm.

Power of Lens needs to be calculated, Given by P= $\frac{1}{f(in\ meters)}$

∴ We convert 33.3 cm into meter i.e 0.33mP= $\frac{1}{+0.33}$

= +3.0 DThus, the power of the convex lens required is +3.0 diopters.

Q.8 Why is a normal eye not able to see clearly the objects placed closer than 25 cm?

Ans.: A normal eye sees objects with the help of converging eye lens. The ciliary muscles contact and expand thereby changing the converging power of the lens. The near point of our eyes is 25 cm i.e. our eyes can see clearly with minimum distance of 25 cm. But, when the distance between the object and our eyes is less than 25 cm, the ciliary muscles are unable to focus sharply. Thus, we cannot see with naked eye and need the support of any external device to see the object with distance less than 25 cm

Q.9 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 so there is no scattering of light. And because there is no scattering of light so no color is scattered. Thus, the sky appears dark to the astronaut.