The Human Eye and the Colourful World

CHAPTER 11

NCERT FOCUS

ANSWERS

Topic 1

1. Power of accommodation of eye is the ability of the eye to observe distinctly the objects situated at widely different distances from the eye, on account of change in focal length of eye lens by the action of ciliary muscles holding the lens.

2. The nearest point upto which an eye can see clearly is called its near point. For a normal eye, the near point is at a distance of 25 cm.

The farthest point upto which an eye can see clearly is called its far point. For a normal eye, the far point is at infinity.

3. **(d) :** The human eye forms the image of an object at its retina.

4. **(c) :** The least distance of distinct vision for a young adult with normal vision is 25 cm.

5. **(c) :** The ciliary muscles holding the eye lens changes the focal length of eye lens enabling the eye to focus the image of objects at varying distance.

6. For the near-sighted person, the power of the lens used for distant-viewing is –5.5 D.

So, for distance viewing, focal length

$$= \frac{1}{\text{power}} = \frac{1}{-5.5\,\text{D}} = \frac{1}{-5.5\,\text{m}^{-1}}$$

$= -0.18$ m $= -18$ cm

Since the near-viewing section of the lens is corrected by + 1.5 D,

∴ Focal length of near vision correction,

$$= \frac{1}{\text{power}} = \frac{1}{1.5} = 0.67\,\text{m} = 67\,\text{cm}$$

7. The least distance of distinct vision for a normal eye is 25 cm. So, a normal eye will not be able to see clearly any object placed closer than 25 cm.

8. For a normal eye, image distance in the eye is fixed and is equal to the distance of retina from the eye lens. When we increase the distance of the object from the eye, focal length of eye lens is changed on account of accommodating power of the eye so as to keep image distance constant.

Topic 2

1. The corrective lens should form the image of the far off object at the far point of the myopic person. So, by using the lens formula, we can write

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{-1.2\,\text{m}} - \frac{1}{\infty} = -\frac{1}{1.2\,\text{m}}$$

or, $f = -1.2$ m

So, power of the lens, $P = -\frac{1}{1.2}\,\text{D} = -0.83\,\text{D}$

The lens must be concave.

2. The student is suffering from myopia. Myopia can be corrected by using glasses made from concave lens of suitable focal length.

3. **(b) :** The property of the eye to adjust the focal length of eye lens is called accommodation.

4. Here, concave lens is required.

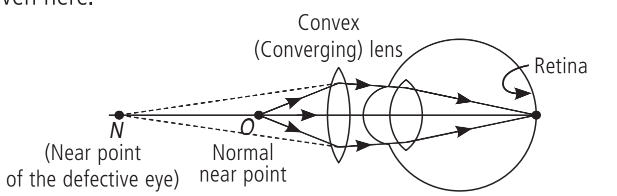
The corrective concave lens should form the image of the far off objects *i.e.* lying at infinity at the far point of the myopic person. So, using the lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{-80\,\text{cm}} - \frac{1}{\infty} = -\frac{1}{80\,\text{cm}}$$

So, $f = -80$ cm

So, power of the lens, $P = \frac{100}{-80}\,\text{D} = -1.25\,\text{D}$

5. The diagram to show the correction of hypermetropia is given here.



Given that the near point distance for a hypermetropic eye, D = 100 cm

Near point distance for a normal eye, D = 25 cm

So, $v = -100$ cm, $u = -25$ cm

Using the lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{-100\,\text{cm}} - \frac{1}{-25\,\text{cm}} = -\frac{-1+4}{100\,\text{cm}} = \frac{3}{100\,\text{cm}}$$

So, $f = \frac{100\,\text{cm}}{3} = 33.3\,\text{cm}$ ∴ $P = \frac{100}{33.3}\,\text{D} = +3.0\,\text{D}$

Topic 3

1. Since the stars are very distant, they appear point-sized sources of light. As the path of rays of light coming from the star goes on varying slightly, the apparent position of it fluctuates and the amount of starlight entering the eye flickers – the star sometimes appears brighter, and at some other time, fainter, which is the twinkling effect.

2. Planets do not emit light. However, they become visible due to reflection of light falling on them. The planets are much closer to the earth and thus can be considered as the extended source of light. The fluctuations in the light coming from various points of the planet due to atmospheric refraction get averaged out. As a result, no twinkling of planets is seen.

3. At sunrise and sunset, the sun is closer to the horizon. The sunlight near the horizon passes through denser layers of the air and covers larger distance before reaching our eyes. Most of the blue light gets scattered. The light that reaches our eyes is of longer wavelengths, mainly orange and red. That is why the sun appears red at the sunrise and at the sunset.

4. This is because in space, there is no atmosphere to scatter the sunlight. Therefore the sky appears dark.

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