The Human Eye and Colorful World: Exercise Questions

Q.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**

Sol. (b) Accommodation

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

(a) cornea **(b) iris**

(c) pupil **(d) retina**

Sol. (d) retina

Q.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.**

Sol. 25cm.

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**

Sol. (c) Ciliary muscles

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 dioptre. What is the focal length of the lens required for correcting (i) distant vision, and (ii) near vision?

Sol. Given: Power of lens, corresponding to distant vision = -5.5 dioptres

Power of lens, corresponding to near vision= +5.5 dioptres

(i) focal length, corresponding to distant vision:

$$f(meter) = \frac{1}{P(dioptre)} = \frac{1}{-5.5} = -0.1818 \text{ m}$$

Or

f = −18.18cm.

(ii) Focal length, corresponding to near vision, $f(meter) = \frac{1}{P(dioptre)} = \frac{1}{1.5} = 0.666\text{m.}$

f = 66.6cm.

Q.6 The far point of a myopic person is 80cm in front of the eye. What is the nature and power of the lens required to correct the problem?

Sol. Given: The far point of a myopic person = 80 cm

Object distance, u = infinity = ∞

Image distance, v = -80cm

So, from the lens formula:

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

$$\frac{1}{f}=-\frac{1}{80}-\left(\frac{1}{\infty}\right)$$

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

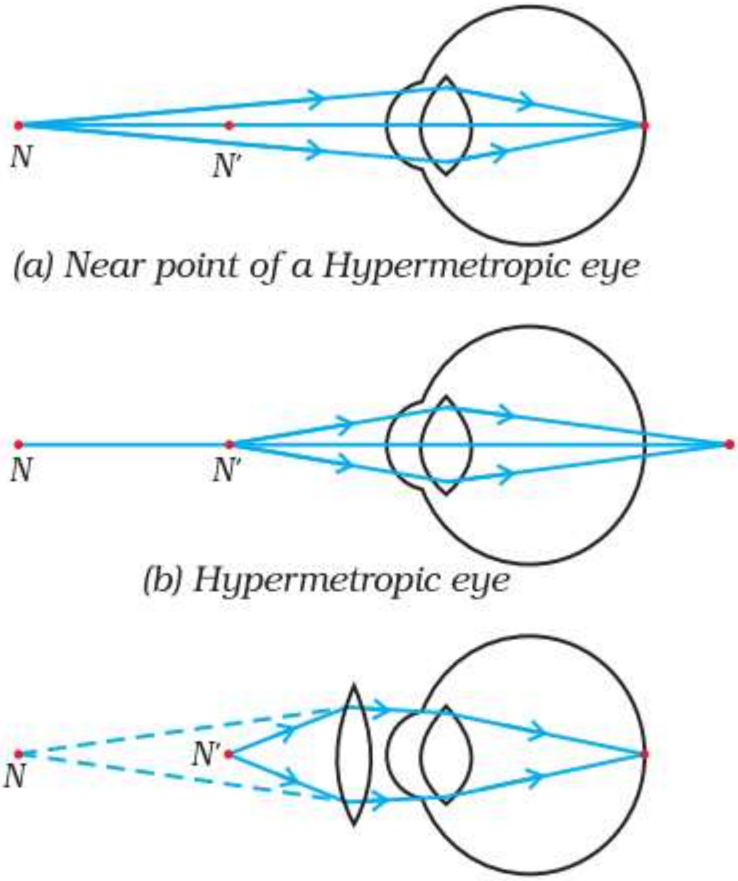
$$f=-80cm=-0.8m$$

Lens should be concave.

Power, P = 1/f = – (100 / 80) = −1.25D

Q.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 this defect? Assume that the near point of the normal eye is 25 cm.

Sol. Diagram of correction for Hypermetropic eye:



Object distance, u = −25cm.
Image distance, v = −100 cm.
So, from the lens formula:

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

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

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

$$\frac{1}{f}=\frac{4-1}{100}=\frac{3}{100}$$

$$f=\frac{100}{3}cm=0.33m$$

So, the power of the lens, P

$$f(meter)=\frac{1}{P(dioptre)}=\frac{1}{0.33}=+3D$$

Convex lens of power +3D is needed

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

Sol. A normal eye is not able to see clearly the objects placed closer than 25 cm because the ciliary muscles have to make the focal length of eye lens too smaller by putting strain on it. So, they cannot make the focal length too small. Hence, we are unable to see the closest object below the distance of 25 cm.

Q.9 What happens to the image distance in the eye when we increase the distance of an object from the eye?

Sol. The image is always formed on the retina. So, the image distance does not change.

Q.10 Why do stars twinkle?

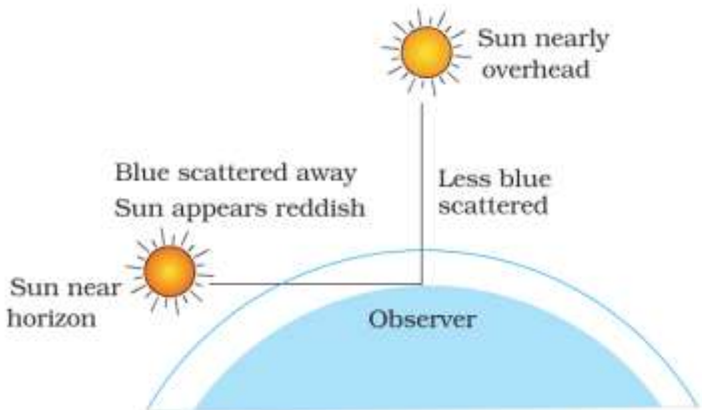
Sol. The stars twinkle due to atmospheric refraction. Starlight reaches to our by crossing the different layers of atmosphere. Due to continuously change in atmosphere, starlight varies and continuously change. Due this reason, we seems that star is twinkling.

Q.11 Explain why the planets do not twinkle.

Sol. Planets are much closer to the earth and larger in size. A planet can be considered as a collection of large number of point sources of light. If some amount of light from plant is refracted by the atmosphere, the effect is negligible and thus, planets do not twinkle.

Q.12 Why does the Sun appear reddish early in the morning?

Sol. At the time of sunrise, the sunlight has to travel a thicker layer of atmosphere. Blue colour light is scattered the most in the atmosphere. Mainly red colour light reaches our eyes. Hence sky appears reddish.



Q.13 Why does the sky appear dark instead of blue to an astronaut?

Sol. **The sky appears dark instead of blue to an astronaut** because outside the earth, there is no atmosphere for scattering the sunlight. Therefore, the sky appears dark or black to an astronaut in outer space.