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ACADEMY OF EXCELLENCE

Chapter – 11 Human Eye and the Colourful World

Q1. The human eye can focus on 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: Option b)

Due to accommodation human eye can focus on objects at different distances by adjusting the focal length of the eye lens.

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

a) **Cornea**
b) **Iris**
c) **Pupil**
d) **Retina**

Answer: Option d)

The retina is the layer of nerve cells lining wall inside the eye which senses light and sends signals to the brain and we are able to see.

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**

Answer: Option c)

25 cm is the least distance of distinct vision for a young adult with 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**

Answer: Option c)

The action of the ciliary muscles changes the focal length of an 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?

Answer:

the power (P) of a lens of focal length f is

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

(i) Power of the lens for correcting distant vision $= -5.5\ D$

Focal length of the lens,

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

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

$$f = -0.181\ m$$

The focal length of the lens for correcting distant vision is $-0.181\ m$

(ii) Power of the lens for correcting near vision is $= +1.5\ D$

Focal length of the lens,

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

$$f = \frac{1}{1.5}$$

$$f = +0.667\ m$$

The focal length of the lens for correcting near vision is $0.667\ m$

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?

Answer:

The person is suffering from myopia, the image is formed in front of the retina and concave lens is used.

Object distance (u) $= \infty$

Image distance (v) $= -80\ cm$

Focal length $= f$

lens formula,

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

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

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

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

Power,

$$P = \frac{1}{f\,(in\ metres)}$$

$$P = \frac{1}{-0.8} = -1.25\ D$$

A concave lens of power $-1.25\ D$ is required by the person to correct his defect.

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

Answer:

The person is able to see the object at 25 cm, if the image of the object is formed at near point, which is 1 m.

Object distance, $u = -25\ cm$

Image distance, $v = -1\ m = \ -100\ m$

Focal length, f

lens formula,

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

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

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

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

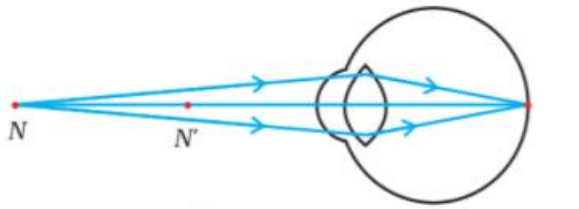
$$f = \frac{100}{3} = 33.3\ cm = 0.33\ m$$

Power,

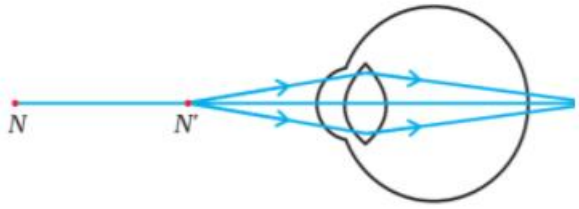
$$P = \frac{1}{f\ (in\ metres)}$$

$$P = \frac{1}{0.33} = +3.0\ D$$

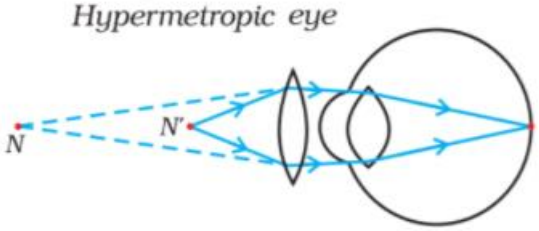
A convex lens of power $+3.0\ D$ is required to correct the defect.



Near point of a Hypermetropic eye



Hypermetropic eye



Correction for Hypermetropic eye

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

Answer:

A normal eye is not able to see the objects placed closer than 25 cm clearly because the ciliary muscles of eyes are unable to contract beyond a certain limit.

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

Answer:

The image formed on the retina by increasing the distance of an object from the eye, for this type of eye lens becomes thinner and its focal length increases as the object is moved away from the eye.

Q10. Why do stars twinkle?

Answer:

The stars twinkle due to the atmospheric refraction of the star light. The star light, entering the earth's atmosphere undergoes refraction as atmospheric refraction occurs in a medium of changing refractive index.

Q11. Explain why the planets do not twinkle?

Answer:

Planets do not twinkle, unlike stars. Stars are at distance so they appear as pinpoints of light in the night sky, when viewed through a telescope. The light coming from a single point, its path is highly liable to atmospheric interference.

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Q12. Why does the Sun appear reddish early in the morning?

Answer:

The light coming from the sun needs to travel more distance in the air before reaching the eye of the observer. During this period, the scattering of all coloured lights except the light corresponding to red colour takes place and so the red coloured light reaches to the observer. So, the sun appears reddish at sunrise and sunset.

Q13. Why does the sky appear dark instead of blue to an astronaut?

Answer:

The sky appears dark instead to blue to an astronaut, as scattering of light does not take place outside the earth's atmosphere.