Date: 18/11/2025

Q1. What is meant by power of accommodation of the eye?

Q2. What is the far point and near point of the human eye with normal vision?

Q3. 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

Q4. The human eye forms the image of an object at its

(a) cornea (b) iris (c) pupil (d) retina

Q5. The least distance of distinct vision for a young adult with normal vision is about:

(a) 25 m (b) 2.5 m (c) 25 cm (d) 2.5 m

Q6. 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

Q7. Why is a normal eye not able to see clearly the objects placed closer than 25 cm?

Q8. What happens to the image distance in the eye when we increase the distance of an object from the eye?

Q9. 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?

Q10. 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?

Q11. 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 (a) distant vision, and (b) near vision?

Q12. 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?

Q13. 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.

Q14. Why do stars twinkle?

Q15. Explain why the planets do not twinkle.

Q16. Why does the Sun appear reddish early in the morning?

Q17. Why does the sky appear dark instead of blue to an astronaut?

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S1. The ability of the eye lens to adjust its focal length, so as to clearly focus rays coming from distant as well as near objects on the retina, is called the power of accommodation of the eye.

S2. For a human eye with normal vision the far point is at infinity and the near point is at 25 cm from the eye.

S3. (b) Accommodation

[*Hint:* While seeing distant objects eye lens is thinner and its focal length is more. While looking near objects eye lens thickens due to contraction of ciliary muscles. Hence, its focal length decreases and nearby objects are clearly focussed on the retina.]

S4. (d) retina

[*Hint:* Retina is photosensitive and human eye lens forms the image of an object on the retina.]

S5. (c) 25 cm

[*Hint:* For a young adult having normal vision the least distance of distinct vision (distance of near point) is about 25 cm.]

S6. (c) Ciliary muscles.

[*Hint:* While seeing distant object the ciliary muscles are relaxed and focal length of eye lens is maximum. At the time of looking at nearby objects the ciliary muscles contract and focal length of eye lens decreases.]

S7. Due to a limit of power of accommodation, the focal length of the eye lens cannot be decreased below a certain minimum limit. Consequently, a normal eye cannot see clearly the objects placed closer than a minimum distance, called near point of eye. For a young adult value of near point is 25 cm. So, we cannot see clearly objects placed closer than 25 cm.

S8. The image is formed on the retina even on increasing the distance of an object from the eye. In fact, the eye lens becomes thinner and its focal length increases as the object is moved away from the eye and consequently image is formed on the retina.

S9. A person with a myopic eye should use a concave lens of focal length 1.2 m so as to restore proper vision.

S10. The student is suffering from myopia or short-sightedness. The defect can be corrected by the use of concave (diverging) lens of an appropiate power.

S11. (a) Power of lens needed for correcting distant vision of the person $P_1 = -5.5\,\text{D}$

$\therefore$ Focal length of lens required for correcting distant vision.

$$f_1 = \frac{1}{P_1} = \frac{1}{-5.5}\,\text{m} = -0.18\,\text{m} \quad \text{or} -18\,\text{cm}.$$

(b) For correcting near vision the power of lens required $P_2 = +1.5\,\text{D}$

$\therefore$ Focal length of lens required for correcting near vision

$$f_2 = \frac{1}{P_2} = \frac{1}{1.5}\,\text{m} = -0.67\,\text{m} \quad \text{or} \quad 66.7\,\text{cm}.$$

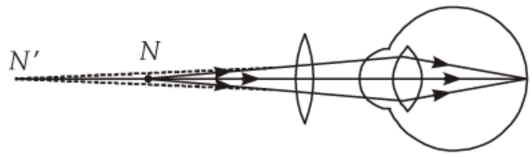
S12. To correct the myopia the person concerned should use concave lens (diverging lens) of focal length $f = -80\,\text{cm}$.

$\therefore$ Power of the lens $P = \dfrac{1}{f \text{ in m}} = \dfrac{100}{f \text{ in cm}} = \dfrac{100}{-80} = -1.25\,\text{D}.$

S13. The relevant diagram has been shown in the figure. Here the convex lens used forms virtual image of object placed at N (near point of normal eye *i.e.*, 25 cm from eye) at N', the near point of defective eye (at a distance x). Now, the defective eye can focus the rays from N at the retina.

In the problem, it is given that the near point of defective eye is 1 m and that of a normal eye is 25 cm. Hence, $u = -25$ cm. The lens used forms its virtual image at near point of hypermetropic eye *i.e.*, $v = -1\text{ m} = -100\text{ cm}$.

Using lens formula, we have



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

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

$$\Rightarrow \quad \frac{1}{f} = -\frac{1}{100} + \frac{1}{25} = \frac{-1+4}{100} = \frac{3}{100}$$

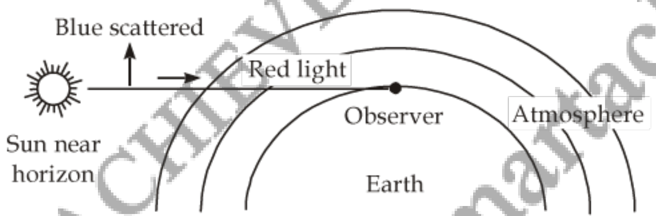
$$\therefore \quad f = +\frac{100}{3}\text{ cm} = \frac{100}{3} \times \frac{1}{100} = \frac{1}{3}\text{ m}$$

$$\therefore \quad \text{Power of correcting lens } P = \frac{1}{f\text{ in m}} = \frac{1}{(1/3)} = +3\text{ D}.$$

S14. Stars twinkle due to atmospheric refraction of starlight. As the stars are very far away, they behave as almost point sources of light. As on account of atmospheric refraction, the path of rays of light coming from the star goes on varying slightly, the apparent position of the star fluctuates and the amount of starlight entering the eye flickers. So, sometimes, the star appears brighter and at some other time fainter. Thus, the stars twinkle.

S15. Planets are much closer to the earth and are seen as extended light source. So, a planet may be considered as a collection of a large number of point-sized light sources. Although light coming from individual point-sized sources flickers but the total amount of light entering our eye from all the individual point-sized sources average out to be constant. Thereby, planets appear equally bright and there is no twinkling of planets.

S16. In the early morning, the Sun is situated near the horizon. Light from the Sun passes through thicker layers of air and covers a larger distance in the Earth's atmosphere before reaching our eyes. While passing through atmosphere blue light is mostly scattered away and the Sun appear reddish as shown in the figure.



S17. Blue colour of the sky is on account of scattering of light of shorter wavelengths by particles in the atmosphere of Earth. If the Earth had no atmosphere, there would not have been any scattering and the sky would have looked dark. When an astronaut in his spacecraft goes above the atmosphere of Earth, sky appears dark to him because there is no scattering of light.