Question 1: What is meant by the power of accommodation of the eye?

Answer:
The ability of eye lens to focus nearby and faraway objects by adjusting its focal length with the help of ciliary muscles to form a clear image on the retina is known as the power of accommodation of the eye.

When the ciliary muscles are relaxed, the eye lens becomes thin, So the focal length increases. Hence, we can see distant objects are clearly.
When the ciliary muscles contract, the eye lens becomes thicker, and the focal length of the eye lens decreases, and we can see nearby objects clearly.

However, there is a limitation in adjusting the minimum focal length. To see a nearby object comfortably and distinctly, we must place the object at about 25 (for an adult) cm from the eyes.

Question 2: What is the far point and near point of the human eye with normal vision?

Answer: The minimum distance of an object our eye can focus, So that we can see the nearby object clearly without strain is known as the near point or least distance of distinct vision of the eye.

For a normal human eye, this distance is about 25 cm for an adult. The near-point distance changes with age. For babies, it is less than 25, and for an old-aged person, it is about 100 cm.

The far point of the eye is the maximum distance one eye can focus So that we can see the faraway object clearly without strain.

The far point of the normal human eye is infinity.

Question 3: 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?

Answer: A student has difficulty in reading the blackboard while sitting in the last row, which means the student is unable to focus on distant objects clearly. He is suffering from Myopia or Short Sightedness.
This defect of Myopia can be corrected by using a concave lens of suitable focal length.

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Question 1: The human eye can focus objects at different distances by adjusting the focal lengthof the eye lens. This is due to

(a) presbyopia
(b) accommodation
(c) near-sightedness
(d) far-sightedness

Answer: (b) accommodation

Explanation - The ability of eye lens to focus nearby and faraway objects by adjusting its focal length with the help of ciliary muscles to form a clear image on the retina is known as the power of accommodation of the eye.

When the ciliary muscles are relaxed, the eye lens becomes thin, So the focal length increases. Hence we can see distant objects are clearly.
When the ciliary muscles contract, the eye lens becomes thicker, and the focal length of the eye lens decreases, and we can see nearby objects clearly.

Question 2: The human eye forms the image of an object at its
(a) cornea
(b) iris
(c) pupil
(d) retina

Answer: (d) retina

Explanation – The function of the eye lenses is to focus the light ray passing through it on a light-sensitive screen called the retina. The retina consists of a large number of light-sensitive cells that helps to generate electrical signals when a light ray falls on it.

Question 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

Answer: (c) The least distance of distinct vision is the minimum distance of an object our eye can focus so that we can see the nearby object clearly without strain.

For a normal human eye, this distance is about 25 cm for an adult.
However, The near-point distance changes with age. For babies, it is less than 25, and for an old-aged person, it is about 100 cm.

Question 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.
Answer: (c) ciliary muscles

Explanations: When the ciliary muscles are relaxed, the eye lens becomes thin, So the focal length increases. Hence, we can see distant objects are clearly.
When the ciliary muscles contract, the eye lens becomes thicker, and the focal length of the eye lens decreases, and we can see nearby objects clearly.

Question 5: A person needs a lens of power −5.5 dioptres for correcting his distant vision. Forcorrecting his near vision, he needs a lens of power +1.5 dioptre. What is the focal length of thelens required for correcting (i) distant vision and (ii) near vision?

Answer: For distant vision = −0.181 m, for near vision = 0.667 m.
The power P of a lens is defined as the reciprocal of focal length f, is given by the relation

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

Power of the lens used in the problem for correcting distant vision = −5.5 D

i.e., Focal length of the required lens, f = 1/P

$$f = \frac{1}{-5.5} = -0.181 \text{ m}$$

Power of the lens used in the problem for correcting near vision = +1.5 D

Focal length of the required lens, f = 1/P

$$f = \frac{1}{1.5} = +0.667 \text{ m}$$

The focal length of the used lens for correcting near vision is 0.667 m.

Question 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?

Answer: The person is suffering from Myopia because the image of distant object is formed in front of the retina.
Hence, a concave lens of suitable focal length is needed to correct this defect of vision.
Object distance, u = infinity (∞)
Image distance, v = −80 cm, and Focal length = f cm.
According to the lens formula,

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

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

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

$$f = -80 \text{ cm} = -0.8 \text{ m}$$

We know, the power P of a lens is defined as the reciprocal of focal length f:

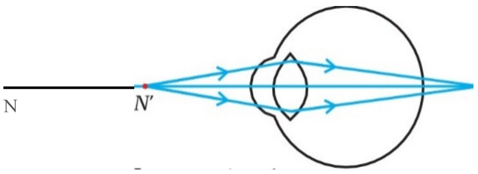
$$\text{Power}, P = \frac{1}{f(\text{in metres})} \qquad P = \frac{1}{-0.8} = -1.25 \text{ D}$$

So, the person needs a concave lens of power −1.25 D to correct his defect of vision.

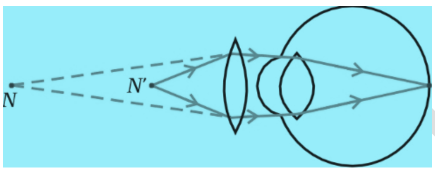
Question 7: Make a diagram to show how hypermetropia is corrected. The near point of a hypermetropic eye is 1 m. What is the power of the lens required to correct this defect? Assumethat the near point of the normal eye is 25 cm.

Answer:
Hypermetropia: A person suffering from hypermetropia can see faraway objects clearly but cannot see nearby objects. It happens because of defect in the eyeball, which forms an image of nearby object before the retina; as a result, the person sees a blurred image of a nearby object. That's why it is also called long-sightedness.
This defect of vision can be corrected by using a converging lens of suitable focal length.

Ray diagram of correction of hypermetropia:



(a) Hypermetropic eye



(b) Correction for Hypermetropic eye

Step by step solution:

To see the object clearly placed at 25 cm before the hypermetric eye, we have to use a convex lens of suitable focal length.
So, object distance, u = −25 cm
Image distance, v = −100 cm.
And, Focal length, f
Using the lens formula,

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

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

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

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

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

$$\text{Power, } P = \frac{1}{f\,(\text{in metres})} = \frac{1}{0.33 \text{ m}} = +3.0 \text{ D}$$

Therefore, a convex lens of power +3.0 D is required to correct the defect of the hypermetric eye.

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

Answer: If we place an object 25 cm before a normal eye, it is unable to see the objects clearly because the ciliary muscles of eyes are unable to contract beyond a certain limit.
Power of accommodation of an eye is limited. Hence, an object is placed at a distance less than 25 cm from the eye, appears blurred and causes strain in the eyes.

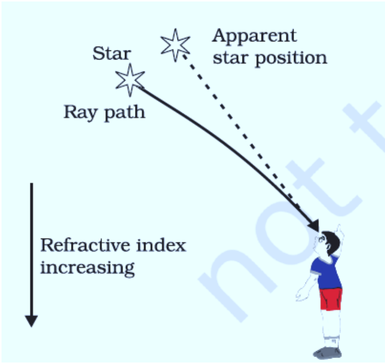
Question 9: What happens to the image distance in the eye when we increase the distance of an object from the eye?

Answer: The image distance remains constant because the size of the eyes cannot increase or decrease; with the help of power accommodation, we can see objects at any distance.
When we increase the distance of an object from the eye, the increase in the object distance is compensated by the change in the focal length of the eye lens. The focal length of eyeballs changes in such a way that the image will always form at the retina

of the eye.

Question 10: Why do stars twinkle?

Answer: Twinkling of stars happens because of atmospheric refraction**.**
Stars are very far away from the earth. Hence, they act as point sources of light. When the light rays coming from stars enters the earth's atmosphere, it gets refracted at different layers of the atmosphere. And the refractive index of those layers is changing continuously due to change in density, temperature, the flow of air in the atmosphere.
So, the path of the refracted light ray changes continuously, and the apparent position



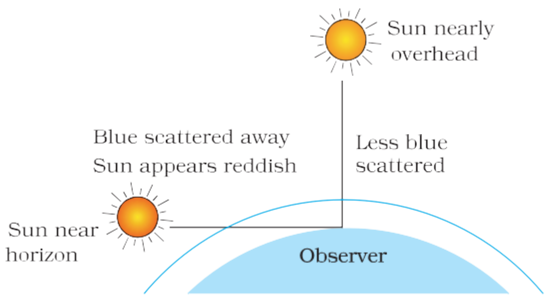
of the star fluctuates, and the amount of starlight entering the eye flickers – the star sometimes appears brighter, and at some other time, fainter, which is the main cause of twinkling of stars.

Question 11: Explain why the planets do not twinkle?

Answer: Planets do not twinkle because they are very close to our earth and appear larger in size than the stars. Planets act as a collection of a large number of point-size sources of light (extended source of light). The different parts of these planets produce twinkling effects in such a way that the average of brighter and dimmer effect is not recognizable. Hence, planets do not twinkle.

Question 12: Why does the Sun appear reddish early in the morning?

Answer: Reddish appearance of Sun in early morning happens due to the scattering of light. During sunrise, the light rays coming from the Sun have to travel a large distance in the earth's atmosphere before reaching our eyes.
We know that light rays are scattered by dust particles, gas molecules, water vapor, etc., presents in the atmosphere. The shorter wavelengths of lights rays are scattered more, so only longer wavelengths are able to reach our eyes. Since blue color has a shorter wavelength, the blue colour is scattered out, and the red colour has a longer wavelength, so it is able to reach our eyes. Therefore, the Sun appears reddish early in the morning.



Question 13: Why does the sky appear dark instead of blue to an astronaut?

Answer: The sky appears black instead of blue to an astronaut in outer space because there is no atmosphere. Hence no scattering happens. As no scattered light reaches the eyes of the astronauts, the sky appears black to them.