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1. What is meant by power of accommodation of the eye?
Answer-

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

2. A person with a myopic eye cannot see objects beyond 1.2 m distinctly. What should be the type of corrective lens used to restore proper vision?
Answer-

An individual with a myopic eye should use a concave lens of focal length 1.2 m so that he or she can restore proper vision.

3. What is the far point and near point of the human eye with normal vision?
Answer-

The minimum distance of the object from the eye, which can be seen distinctly without strain is called the near point of the eye is. For a normal person's eye, this distance is 25 cm.
The far point of the eye is the maximum distance to which the eye can see objects clearly. The far point of a normal person's eye is infinity.

4. 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-

The student is suffering from short-sightedness or myopia. Myopia can be corrected by the use of concave or diverging lens of an appropriate power.

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Exercise

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

Answer-

(b) accommodation

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

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

(a) cornea

(b) iris

(c) pupil

(d) retina

Answer –

(d) retina

The retina is the layer of nerve cells lining the back wall inside the eye. This layer senses light and sends signals to the brain so you can see.

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) 25 cm

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

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
The action of the ciliary muscles changes the focal length of an eye lens

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?
Answer-

The power (*P)* of a lens of focal length f is given by the relation
Power (P) = 1/*f*

(i) Power of the lens (used for correcting distant vision) = - 5.5 D
Focal length of the lens (*f)* = 1/*Pf*= 1/-5.5 = -0.181 m
The focal length of the lens (for correcting distant vision) is - 0.181 m.

(ii) Power of the lens (used for correcting near vision) = +1.5 D
Focal length of the required lens (*f)* = 1/*P*
f = 1/1.5 = +0.667 m
The focal length of the lens (for correcting near vision) is 0.667 m.

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 individual is suffering from myopia. In this defect, the image is formed in front of the retina. Therefore, a concave lens is used to correct this defect of vision.

Object distance (u) **=** infinity **=** ∞

Image distance (v) = - 80 cm
Focal length = f
According to the lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$
$$-\frac{1}{80} - \frac{1}{\varpi} = \frac{1}{f}$$
$$\frac{1}{f} = -\frac{1}{80}$$
$$f = -80cm = -0.8cm$$

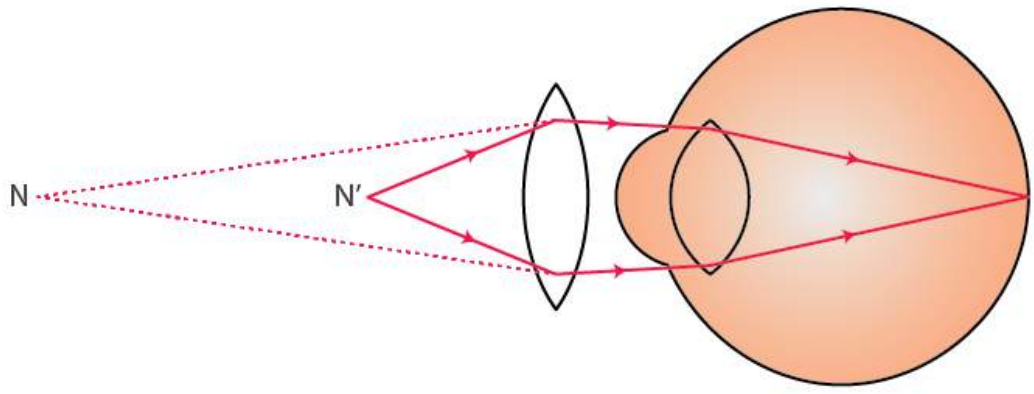
$We\ know,$

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

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

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.
Answer-

An individual suffering from hypermetropia can see distinct objects clearly but he or she will face difficulty in clearly seeing objects nearby. This happens because the eye lens focuses the incoming divergent rays beyond the retina. This is corrected by using a convex lens. A convex lens of a suitable power converges the incoming light in such a way that the image is formed on the retina, as shown in the following figure.



Correction for hypermetropic eye

The convex lens creates a virtual image of a nearby object (N' in the above figure) at the near point of vision (N) of the individual suffering from hypermetropia.
The given individual will be able to clearly see the object kept at 25 cm (near point of the normal eye), if the image of the object is formed at his near point, which is given as 1 m.
Object distance, *u*= - 25 cm
Image distance, *v*= - 1 m = - 100 m
Focal length, *f*
Using the lens formula,

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

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

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

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

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

$$We\ know,$$

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

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

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

8. 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 the eyes are unable to contract beyond a certain limit.

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

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

10. Why do stars twinkle?
Answer-

The twinkling of a star is due to atmospheric refraction of starlight. The starlight, on entering the earth's atmosphere, undergoes refraction continuously before it reaches the earth. The atmospheric refraction occurs in a medium of gradually changing refractive index.

11. Explain why the planets do not twinkle?
Answer-

Unlike stars, planets don't twinkle. Stars are so distant that they appear as pinpoints of light in the night sky, even when viewed through a telescope. Because all the light is coming from a single point, its path is highly susceptible to atmospheric interference (i.e. their light is easily diffracted).

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

White light coming from the sun has to travel more distance in the atmosphere before reaching the observer. During this, the scattering of all colored lights except the light corresponding to red color takes place and so only the red colored light reaches to the observer. Therefore the sun appears reddish at sunrise and sunset.

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

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