CBSE Test Paper-05

Chapter 11 Human Eye and the Colourful World

1. The deviation in the path of ray of light can be produced- **(1)**
   a. By a glass prism but not by rectangular glass slab.
   b. By a glass prism as well as a rectangular glass slab.
   c. By a rectangular glass slab but not by a glass prism.
   d. Neither by a glass prism nor by rectangular glass slab.
2. When a person is myopic, he/ she can clearly see **(1)**
   a. Only nearby objects
   b. both nearby and far off objects
   c. only far off objects
   d. Neither nearby nor far off objects
3. The values of f and u for a concave lens are always **(1)**
   a. Negative
   b. None of these
   c. Positive
   d. Sometimes negative sometimes positive
4. Important defect of vision are- **(1)**
   a. Presbyobia
   b. Hypermetropia
   c. Myopia
   d. All of these
5. Rainbow is formed due to combination of? **(1)**

   A. Refraction

   B. Absorption

   C. Dispersion

   D. Total internal reflection
   a. A and B
   b. A and C
   c. C and D
   d. A, B and C

6. On which factor does the color of the scattered light depends? **(1)**

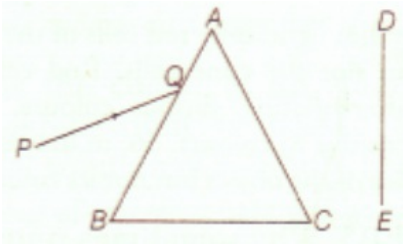
7. Is focal length of eye lens fixed? **(1)**

8. Which part of the human eye provides most of the refraction for the light rays entering the eye? **(1)**

9. What is the far point and near point of the human eye with normal vision? **(1)**

10. We are able to see everything with one eye, then why do we have two eyes? **(3)**

11. A narrow beam PQ of white light is passing through a glass prism ABC as shown in the diagram.



Trace it on your answer sheet and show the path of the emergent beam as observed on the screen DE. **(3)**

   i. Write the name and cause of the phenomenon observed.
   ii. Where else in nature is this phenomenon observed?
   iii. Based on this observation, state the conclusion which can be draw about the constituents of white light.

12. i. State two main causes of a person developing near-sightedness. With the help of a ray diagram, suggest how he can be helped to overcome his disability?
    ii. The far point of myopic person is 100 cm in front of the eye. Calculate the focal length and power of a lens required to enable him to see distant objects clearly. **(3)**

13. Why do different rays deviate differently in the prism? **(3)**

14. How do eye focus objects at different distances ? **(5)**

15. A person is not able to see far off objects clearly. From which defect of the eye the person is suffering ? How to correct this defect ? **(5)**

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Answers

1. a. By a glass prism but not by rectangular glass slab.
   Explanation: The angle of deviation through a triangular prism is the angle between the incident ray and the emerging ray (angle δ). However, in glass slab, the incident ray and the emergent ray are parallel to each other thus angle of incidence is equal to angle of emergence.
2. a. Only nearby objects
   Explanation: It is also known as nearsightedness. Image is formed in front of the retina. The Reason of defect are: 1. Excessive curvature of eye lens 2. Elongation of the eye ball.
3. a. Negative
   Explanation: By convention,
   i. The focal length (f) of concave lens is always taken as negative.
   ii. The object distance (u) from optical centre is always taken as negative.
4. d. All of these
   Explanation: In **myopia** or nearsightedness, a person can see nearby object clearly, but cannot see distant object distinctly. Image formed in front of the retina.
   In **hypermetropia** also known as farsightedness, a person cannot see nearby object clearly, but can see distant object distinctly. Image formed at a point behind the retina.
   As we become old, the power of accommodation of the eye usually decreases, the near point gradually recedes away. This defect is called **presbyopia**.
   Person may suffer from both myopia and hypermetropia.
5. c. C and D
   Explanation: The rainbow is a natural spectrum of sunlight appearing in the sky after a rain shower. It is formed due to the **dispersion** of sunlight by the

tiny water droplet, present in atmosphere. Water droplet act like prism. It refract and disperse the incident sunlight, then reflect it internally (**total internal reflection**) and finally refract it again, when it emerges out of the water droplet. Red colour appear on top & violet at the bottom of rainbow.

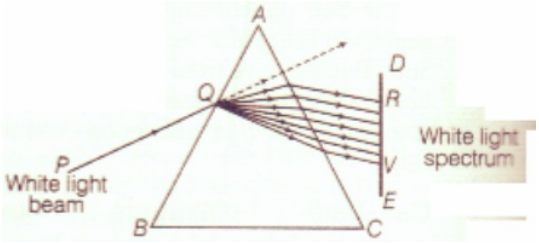
6. Size of the particles of the medium is the factor on which the color of the scattered light depends.

7. Focal length varies due to action of ciliary muscles. Hence, Eye lens has variable focal length.

8. Cornea and Aqueous humour refract most of the light entering the eye.

9. For a human eye with normal vision the far point of the eye is the location of the farthest object on which the fully relaxed eye can focus. For a normal eye the far point is at infinity and the near point is at 25 cm from the eye.

10. A human beings has a horizontal field of view of about 150^0 with one eye and of about 180^0 with two eyes. Hence two eyes gives us a wider field of view. With one eye the world will appear to us to be a flat one but two eyes open, the world would takes on third dimension of depth. With two eyes, we are able to judge the distance of the object.

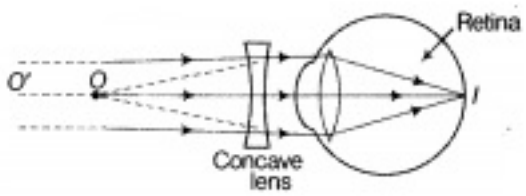
11. 

    i. The phenomenon of splitting of white light into its constituent colours is called dipersion of light. It is caused due to difference in speed of constituent colours of light travel in the medium other than air/vacuum because of different speed they bend at different angles.
    ii. In nature, this Phenomenon is observed in formation of rainbow where all the seven colours constituting white light is visible.
    iii. Based on phenomenon of dispersion, we can conclude that

a. White light consists of seven colours. Violet, indigo, blue, green, yellow, orange and red.
b. Violet light suffers maximum deviation and red light suffers minimum deviation.

12. i. Near sightedness (myopia) defect arises either because of :
(a) decrease in focal length of eye lens.(b) elongation of the eye ball

ii. To correct this defect of vision, he must use a concave lens of suitable focal length. The concave lens of suitable focal length will bring the image back to the retina as shown in the given figure.



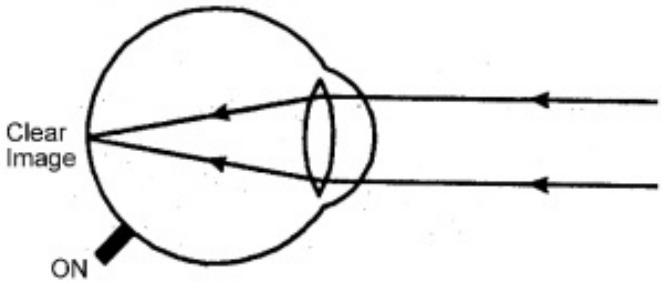
iii. Given, v = -100 cm , u = ∞
Using lens formula,
$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{-100} - \frac{1}{\infty} = \frac{1}{f}$
f = -100 cm = -1 m.
$\therefore$ Power of lens,
P = $\frac{1}{f(m)} = \frac{1}{-1}$ = -1D.

13. Different wavelengths deviate differently in the prism because the angle of refraction for different colours having different wavelengths is different while passing through the glass prism (medium). A light ray is refracted when it passes from one medium to another at an angle and its speed changes. At the interface, it is bent in one direction if the material it enters is denser (when light slows down) and in the other direction if the material is less dense (when light speeds up). Because different wavelengths (colours) of light travel through a medium at different speeds, the amount of bending is different for different wavelengths. Violet is bent the most and red the least because violet light has a shorter wavelength, and short wavelengths travel more slowly through a medium than longer ones do.

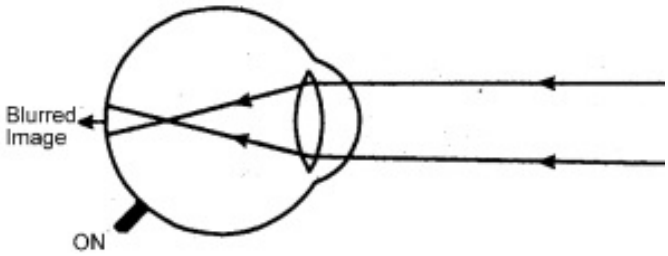
14. In eye, the distance between lens and the retina remains the same, while crystalline lens automatically changes its focal length (by changing its curvature due to pull of push of ciliary muscles) according to the distance of the object so as to bring the image

to a sharp focus upon the retina. While seeing the far off objects such as distant tree, the eye lens becomes thinner and flatter so as to increase its focal length. To see the object close to the eyes such as printed page, the lens becomes thicker so as to decrease its focal length. The process by which the eye can adapt itself to see objects at different distances is called accommodation.

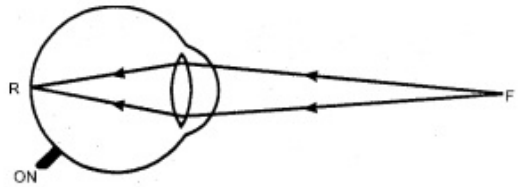
15. The person is suffering from myopia or short-sightedness.
Myopia or short-sightedness: In normal eye, the far point is at infinity. The rays coming from distant object (at infinity) gets focused on retina. In turn, the retina conveys the message to brain via optic nerve.



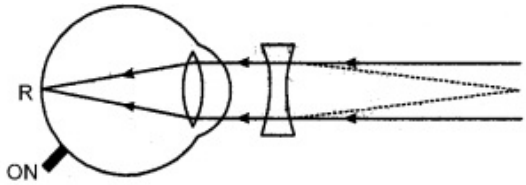
Normal eye: Far point at infinity. Rays from distant object meet at retina.



Defective eye: Eye ball is enlarged, or focal length decreased, cannot focus rays from infinity at focus.



Defective eye: Far point is nearer than infinity when at far point F.



Corrected eye: Concave (or any divergent) lens diverges the parallel rays from infinity to an extent that they appear to diverge from F. They get focused at retina.
Causes of defect in defective eye: The defect arise due to either :

Due to either or both the causes, the eye is not able to focus the rays from distant object at retina. Focusing is there at a point O in front of retina. Image formed on retina is blurred.
The defective eye is however able to focus the object upto its far point.
Correct of defect: We have observed that the defective eye has not been able to focus less inclined rays but has been able to focus more inclined rays.
To correct this defect, a concave or a divergent lens of appropriate focal length is placed in front of the eye so that parallel rays coming from infinity appear, after refraction through the lens, to come from the far point when eye is unaccommodated. These parallel rays from a distant object shall be brought to focus upon the retina. Obviously, the focal length of such a lens is equal to the distance of the far point from the eye.

i. the length of eyeball of eye lens has decreased.
ii. the focal length of eye lens has decreased.