CBSE Test Paper-04

Chapter 11 Human Eye and the Colourful World

1. A ray of light travelling in air fall obliquely on the surface of a calm pond. It will- **(1)**

   a. Turn back on its original path.
   b. Go into water without deviating from its path
   c. Deviate towards the normal
   d. Deviate away from the normal.

2. What is spectrum- **(1)**

   a. None of these
   b. The band of 5 colours
   c. The band of 6 colours
   d. The band of 7 colours

3. How long does the light from an event stay in our eye? **(1)**

   a. $\frac{1}{16}th$ of a second
   b. $\frac{1}{10}th$ of a second
   c. $\frac{1}{24}th$ of a second
   d. None of these

4. Danger signals are red in colour because **(1)**

   a. red colour is least scattered
   b. red colours is most scattered
   c. wavelength of red colour is less than that of other colour
   d. red colour looks attractive

5. The human eye can focus objects at different distances by adjusting the focal length of the eye lens. This is due to **(1)**

   a. Presbyopia
   b. Near-sightedness

c. Accommodation
d. Far-sightedness

6. What is colour blindness? **(1)**

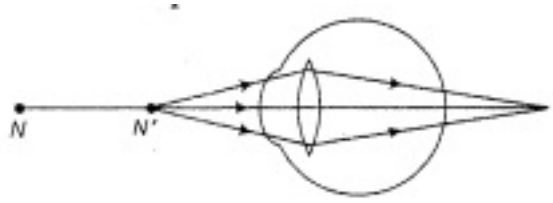
7. In a human eye, name the following parts. **(1)**

   i. A thin membrane which allows light to enter into the eye?
   ii. The muscles which help in changing the focal length of the eye lens?

8. Bees are able to see ultraviolet light. Comment. **(1)**

9. Which great scientist was colour blind? **(1)**

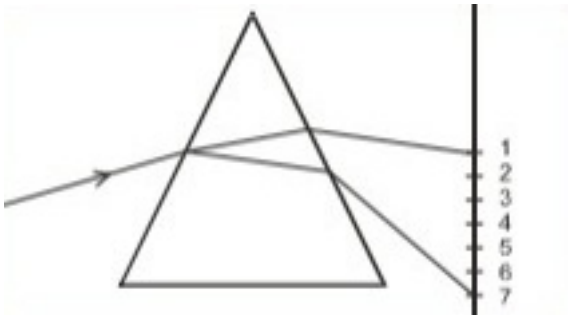
10. Study the diagram given below and answer the questions that follow: **(3)**



   i. Which defect of vision is represented in this case? Give reason for your answer.
   ii. What could be the two causes of this defect?
   iii. With the help of a diagram show how this defect can be corrected by the use of a suitable lens?

11. What is accommodation? **(3)**

12. A beam of white light falling on a glass prism gets split up into seven colours marked 1 to 7 as shown in the diagram. **(3)**



   i. The colour at position marked 3 and 5 are similar to the colour of the sky and the colour of gold metal, respectively. Is the above statement made by the student correct or incorrect justify?

ii. Which of the above shown positions corresponds approximately to the colour of
    a. a brinjal,
    b. danger signal,
    c. neel which is applied to clothes,
    d. orange.

13. What is the cause of dispersion? **(3)**

14. What is atmospheric refraction? Use this phenomenon to explain the following natural events. **(5)**
    i. Twinkling of stars.
    ii. Advanced sunrise and delayed sunset.
    Draw diagrams to illustrate your answers.

15. With the help of well labeled diagram, explain the construction and working of human eye. **(5)**

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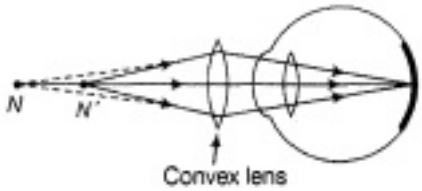
Answers

1. c. Deviate towards the normal
   Explanation: When ray of light enters from a rarer medium (air) into a denser medium (water), it bends towards normal at the point of incidence.
2. d. The band of 7 colours
   Explanation: When a white light is passed through a prism it gets split into combination of seven colours which is known as the spectrum. The colors of the spectrum of white light are those seen in a rainbow. They are usually named in order as: red, orange, yellow, green, blue, indigo and violet.
3. a. $1/16^{\text{th}}$ of a second
   Explanation: The image of an object seen persists on the retina for 1/16 second even after the removal of the object. This continuance of sensation of eye for some time is called persistence of vision.
4. a. red colour is least scattered
   Explanation: Red colour scattered the least when strikes by the small particle of fog and smoke because it has the maximum wavelength (visible spectrum). Hence at large distance also, we can see the red colour clearly.
5. c. Accommodation
   Explanation: The ability of the eye to focus both near and distant objects, by adjusting the focal length with the help of ciliary muscles, is called the accommodation of the eye.
6. Colour-blindness is the inability to distinguish the differences between certain primary colours. This condition results from an absence of color-sensitive pigment in the cone cells of the retina, the nerve layer at the back of the eye.
7. i. Cornea is the thin transparent membrane.
   ii. Ciliary muscles help in changing the focal length of the eye lens.
8. The bees are able to see ultraviolet light becuase the retina of bees contains cone cells that are sensitive to ultraviolet light.

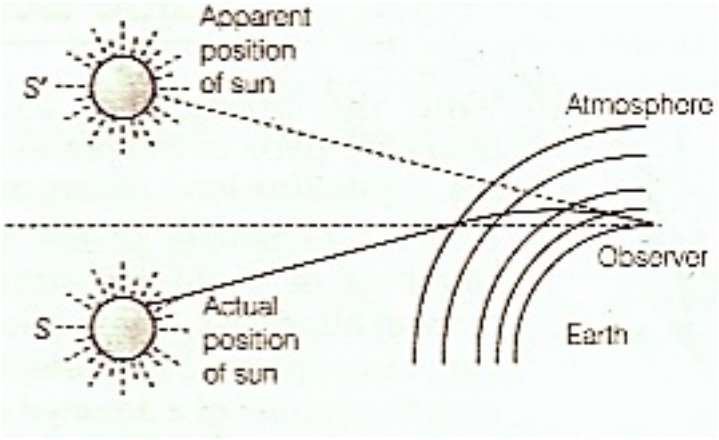
9. Dalton was colour blind.
10. i. This defect is hypermetropia (Far- sightedness) as the image of a near point is formed beyond the retina.
    ii. The two possible causes of the defect are (a) Size of eyeball become smaller. (b) The focal length of the lens increases.
    iii. This defect can be corrected by using a convex lens of suitable focal length. The diagram showing correction of this defect by using convex lens of suitable focal length is shown below.



11. Accommodation is the distance between near point and far point. The eye is able to adjust its focal length in such a way that it is able to focus any of the objects between near point and far point.
12. i. No the satement made by the student is incorrect as because 3 refers to yellow which is the colour of gold metal and 5 refers to blue colours of the spectrum which is the colour of sky.
    ii. a. 7 which is violet
        b. 1 which it red
        c. 6 which is indigo
        d. 2 which is orange

13. All colours of light travel at the same speed in a vacuum. A light ray is refracted (bent) 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 (colors) 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. Because white light is made up of all visible wavelengths, its colors are be separated (dispersed) by this difference in behavior.

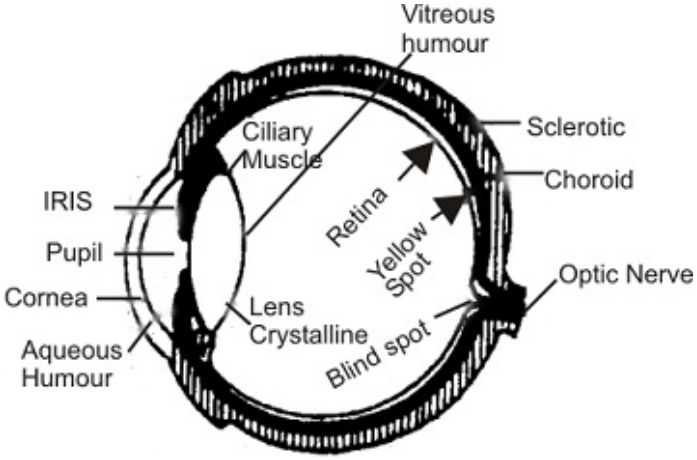
14. The density of the atmosphere, as we know goes on decreasing as the distance above the sea level increases. Hence, the refractive index of a layer of air level goes on changing with distance. Due to this refraction takes place when light passes through the earth's atmosphere. This phenomenon is called as atmospheric refraction.
    i. Twinkling of stars: It is due to atmospheric refraction of star light. Due to variations in the refractive indices of the various layers of air, the light from a star passing through the atmosphere changes its path from time to time and therefore the amount of light reaching the eye is not always the same. This increase or decrease in the intensity of light reaching the eye results in the change in apparent position of the star. Hence, the stars appear to be twinkling.
    ii. Advanced sunrise and delayed sunset: The figure below shows the actual position of the sun S at the time of sunrise and S' the apparent position of sun. The advanced sunrise and delayed sunset is because of atmospheric refraction.



The light rays starting from the Sun travel from rarer to denser layers. They bend more and more towards the normal as it moves in denser medium.
However, an observer on earth sees an object in the direction of the rays reaching his eyes. The Sun which is actually in a position S below the horizon appears in the position S' above the horizon for him. Thus, the Sun appears to rise early by about 2 min. Similarly, during sunset due to atmospheric refraction, the observer on earth sees the sunset than it would be without atmosphere. Thus, sunset late by about 2 min than its actual timings. These phenomena together increases the length of the day by about 4 min.

15. Human eye is the most remarkable and most delicate optical instrument.
Though in principle, it is similar to a photographic camera, it is far most delicate and perfect than the finest camera ever designed by human ingenuity.

Structure : The human eye consists of nearly spherical ball of about 2.5 cm diameter. Its outermost coating is made of a tough and opaque white substance known as SCLEROTIC. Sclerotic preserve the shape of eye and protects it against external injury.



Front portion of sclerotic is transparent and slightly bulged outwards and known as CORNEA.

There is a layer of black tissues, below sclerotic and is called CHOROID. It serves to absorb any stray light and thus avoids blurring of the image by reflection from the eye-ball.

In font of eye, choroids merge into a coloured diaphragm known as iris which a hole in the middle called PUPIL. When we refer to the colour of eyes of a person, we refer to the colour of iris of the person. This iris corresponds to the stop in the camera. By means of involuntary muscle control, it regulates the amount of light entering the eye. In strong light, the pupil contracts so as to admit less light whereas in dim light, it expands so as to admit as much light as required.

Behind iris is a crystalline lens with jelly-like layers. The lens is held in position with the help of *ciliary muscles*. The lens divides the eye ball into two chambers – the front chamber called anterior chamber and other between lens and the retina called posterior chamber. Anterior chamber is filled with a fluid called *aqueous humour* while the posterior chamber is filled with a jelly like substance called *vitreous humour*.

The innermost coating of the eye, covering the rear of inner surface, is a very delicate membrane called the retina. It is richly supplied with blood vessels and nerve fibres and serves as a light-sensitive screen to receive the image. The sensation of vision in the retina is carried to the brain by a nerve called *optic nerve*. The most sensitive part of retina is known as the yellow spot. It is a slightly raised portion with a slight

depression known as the fovea centralis. The point where the optic nerve enters the eye is totally insensitive to light and is known as the blind spot.

Eye Lids are provided to control the amount of light falling on the eye. Lids also protect the eyes from dust etc.

How does the eye focus: 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 or 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 objects such as distant tree, the eye lens becomes thinner and flatter so as to increase its focal length. To see the objects 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*.

Range of vision : The most distant point upto which a fully relaxed eye can see is called the far point. For normal eye, far point is infinity. The point at the shortest distance from the eye upto which the eye can accommodate itself and therefore, can see clearly is known as the near point. It is about 15 cm for a normal eye. The distance between far and near points is called range of vision or accommodation. Within the range of vision, there is a certain distance where the object is most clearly seen. The distance for a normal eye is about 25 cm and is known as the least distance of distinct vision.

Persistence of vision: Time for which the impression of the object seen by the eye remains on the retina even after the removal of the object is called the persistence of vision.