CBSE Test Paper-03

Chapter 11 Human Eye and the Colourful World

1. Which of the following phenomena is not the result of total internal reflection? **(1)**
   a. Looming
   b. Sparkles of the diamond
   c. Mirage
   d. Twinkling of stars
2. Match the following with correct response. **(1)**

(1) Power of accommodation	(A) Farthest point to which the eye see clearly
(2) Near point	(B) The ability of eye lens to focus near and far objects
(3) Far point	(C) Generally increases with age
(4) Least distance of distinct vision	(D) Nearest point which the eye can see clearly

   a. 1-A, 2-C, 3-B, 4-D
   b. 1-D, 2-A, 3-C, 4-B
   c. 1-B, 2-D, 3-A, 4-C
   d. 1-C, 2-B, 3-D, 4-A
3. Phenomenon responsible for twinkling of stars- **(1)**
   a. Atmospheric refraction
   b. Internal refraction
   c. None of these
   d. Regular refraction.
4. Optical fibre is used for **(1)**
   a. All of these
   b. biomedical engineering
   c. communication over long distance
   d. medical applications
5. Find the incorrect statement **(1)**

a. Large sized particles scatter light of longer wavelengths
b. Presbyopia occurs due to weakening of ciliary muscles
c. Sun is visible 2 minutes after sunrise and 2 minutes before sunset
d. Refractive index of glass for violet colour is more than that for red colour

6. A man is wearing glasses of focal length +1m, what can be defect in the eye? **(1)**
7. Which component of white light is least scattered by fog or smoke? **(1)**
8. Why are danger light signals red in color? **(1)**
9. Which liquid is filled in the space between eye lens and retina? **(1)**
10. A person needs a lens of power -5.5 diopters for correcting his distant vision. For correcting his near vision he needs a lens of power +1.5 diopter. What is the focal length of the lens required for correcting (i) distant vision, and (ii) near vision? **(5)**
11. What is meant by scattering of light? Mention the factor on which it depends. Explain, why the colour of the clear sky is blue? An astronaut in space finds sky to be dark. Explain reason for this observation. **(5)**
12. A person is unable to read a book properly. From which defect is he suffering? How to correct this defect? **(5)**
13. a. What is myopia? State the two causes of myopia. With the help of labelled ray diagrams show
    i. the eye defect myopia
    ii. correction of myopia using a lens.
    b. Why is the normal eye unable to focus on an object placed within 10 cm from the eye? **(5)**
14. Make a diagram to show how hypermetropia is corrected. The near point of hypermetropic eye is 1 m. What is the power of the lens required to correct this defect? Assume that the near point of normal eye is 25 cm. **(5)**
15. Describe Newton's disc experiment to show that white light is composed of seven spectrum colours.
    Why seven colours combine to give almost white but not perfectly white ? **(5)**

CBSE Test Paper-03

Chapter 11 Human Eye and the Colourful World

Answers

1. d. Twinkling of stars

   Explanation: Twinkling of stars is due to atmospheric refraction. Distant star acts like a point source of light. When the starlight enters the earth's atmosphere it undergoes refraction continuously, due to changing refractive index i.e. from Rarer to denser medium. It bends towards the normal successively, hence the amount of light enters our eyes fluctuates sometime bright and sometime faint.

2. c. 1-B, 2-D, 3-A, 4-C

   Explanation: Power of accommodation: The ability of the eye to focus both near and distant objects, by adjusting the focal length of the eye lens, is called the accommodation of the eye

   Near point: It is 25cm for normal eye. The minimum distance at which object can be seen most distinctly without strain.

   Far point: It is infinity for normal eye. It is the farthest point upto which the eye can see object clearly.

   Least distance of distinct vision in old people: As the person grows old, his ciliary muscle responsible for adjusting the eye lens gets weakened. As a result the power of accommodation reduces and hence the least distance of distinct vision for old people generally increases.

3. a. Atmospheric refraction

   Explanation: Twinkling of stars is due to atmospheric refraction. Distant star acts like a point source of light. When the starlight enters the earth's atmosphere it undergoes refraction continuously, due to changing refractive index i.e. from Rarer to denser medium. It bends towards the normal successively, hence the amount of light enters our eyes fluctuates sometime bright and sometime faint.

4. a. All of these

Explanation: Applications of optical fiber include:

i. Communication: Telephone transmissoin method usese fiber-optic cables. Optical fibres transmit energy in the form of light pulses.
ii. Medical uses: Optical fibres are well suited for medical use. They can be made in extremely thin, flexible stands for insertion into the blood vessels, lungs, and other hollow parts of the body. Optical fibers are used in a number of instruments that enable doctors to view internal body parts without having to perform surgery.
iii. Simple uses: The simplest application of optical fibers is the trnsmission of light to locations otherwise hard to reach.

5. c. Sun is visible 2 minutes after sunrise and 2 minutes before sunset

   Explanation: Advance Sunrise and delayed sunset: This is due to atmospheric refraction. Because of this sun is visible about 2 minutes earlier than actual sunrise and about 2 minutes after the actual sun set.

6. As the focal length of glasses is positive, so the power of the lens is also positive which indicates the use of a convex lens. Hence, he is suffering from hypermetropia.

7. The component of white light which is least scattered by fog or smoke is **red color.**

8. As red light is scattered the least and it covers longer distances. That's why it is used in danger signal.

9. The liquid present between the eye lens and retina is **vitreous humour.**

10. i. Power, P = -5.5 D, Focal length, f = ?

    p = $\frac{1}{f(in\mathrm{m})}$

    or -5.5 = $\frac{1}{f}$

    or f = $\frac{1}{-5.5}$

    = -0.18 m for correcting the ditant vision.

    The negative (-) sign indicates that the lens is concave.

    ii. Power, P = + 1.5 D

    Focal length, f = ?

    p = $\frac{1}{f(in\mathrm{m})}$

or f = $\frac{1}{+1.5}$

or f = +0.67 m for correcting the near vision.

The positive sign indicates that the lens is convex.

11. i. Scattering occurs when a light ray passes through an imperfect medium (medium which have particles in it, which act as scatterer) and get deflected from its straight path and scatters in many directions.

The colour of scattered light depends on the size of scattering particles and wavelength of light.

i.e. Scattering $\propto d^6$

[where, d = diameter of particle]

and scattering $\propto \frac{1}{\lambda^4}$

[where, λ= wavelength of particle]

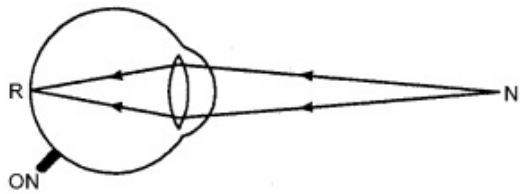
ii. The size of particles in the atmosphere is smaller than the wavelength of visible light, so they are more effective in scattering the light of shorter wavelengths, i.e. blue light. Thus, sky appears blue during the day.

iii. For an astronaut, sky appears dark because there is no scattering of light in space due to absence of particles.

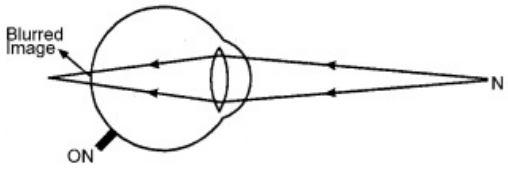
12. The person is suffering from hypermetropia or long-sightedness.

A long sighted person can see distant objects clearly, but cannot see distinctly objects lying closer than a certain distance. Thus, he cannot see clearly an object lying at 25 cm which is the least distance of distinct vision for a normal eye. His far point is farther from the eye than 25 cm, say at 75 cm or so.

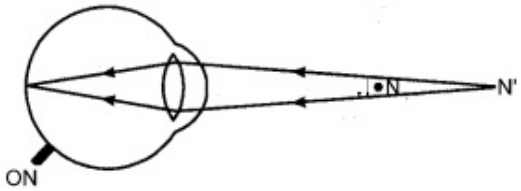
Causes of the defect: This defect is due to either :



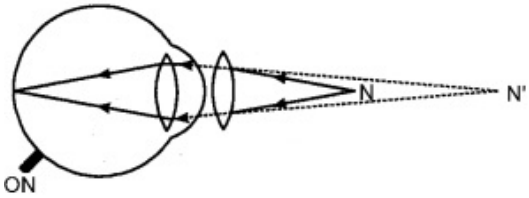
Normal eye : It is able to focus the rays from normal near point (25 cm from eyes)



Defective eye: Due to eye ball getting short or an increase in focal length of eye lens, the rays do not focus on retina.



Defective eye: is able to form image at retina when object is moved from N to N' the near point of defective eye.



Corrected eye : A convex (or any convergent) lens of suitable focal length converges the rays to match those coming from N'. Hypermetropic eye.

Normal eye is able to focus on retina the rays emerging out from N.

However, the defective eye is not able to focus the rays from near point of normal eye i.e. N.

It can focus the rays from near point of defective eye. i.e. N'.

From fig. we conclude that more inclined rays are not focused on retina whereas less inclined rays from N' get focused on retina.

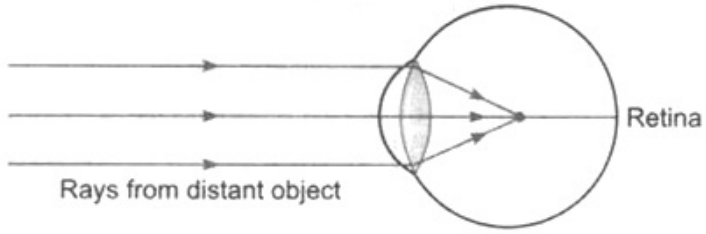
Correction of this Defect: Such a defect is corrected by placing a convex or converging lens of suitable focal length before the eye so that the rays diverging from N appear to come, after refraction, from the near point N'.

i. the size of the eye ball becoming too short.
ii. the lens becoming too thin, so that its focal length becomes abnormally large.

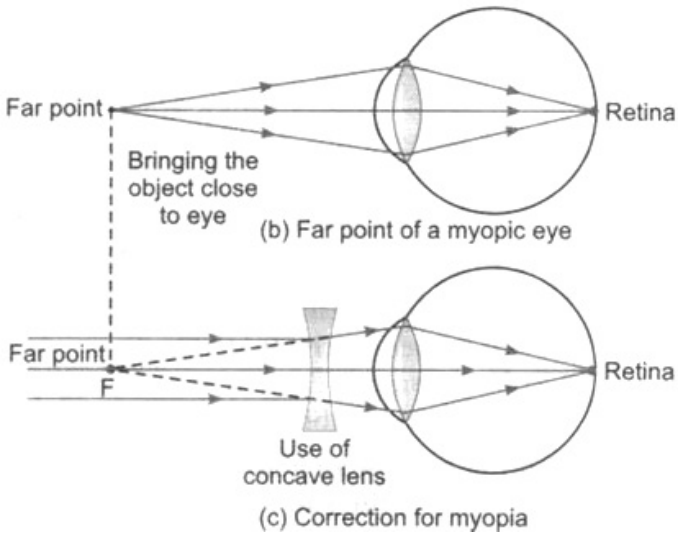
13. a. Myopia is the defect of the eye vision due to which a person can see the near by objects clearly but cannot see the far objects so distinctly.

Causes of myopia: Myopia is caused due to:

i. the elongation of the eyeball.
ii. decrease in the focal length of the eye lens.



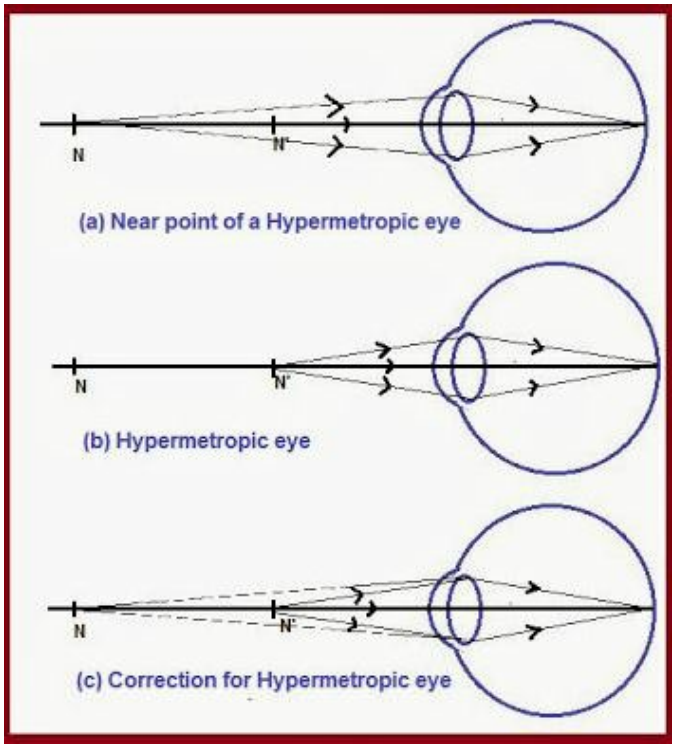
(a) Myopic eye



Myopia can be corrected by using a **concave lens** of suitable focal length in the spectacles of such a person.

b. The ability of the eye lens to adjust its focal length is called power of accommodation. However, the focal length of the eye lens cannot be decreased below a certain limit. The maximum accommodation of a normal eye is reached when the object is at a distance of 25 cm from the eyes. Thus, the normal eye is unable to focus an object placed within 10 cm from the eye because the nearest distance of distinct vison for a normal eye is 25cm.

14. For diagram of correction of hypermetropia,



Numerical

u = –25 cm, v = –1 m = –100 cm

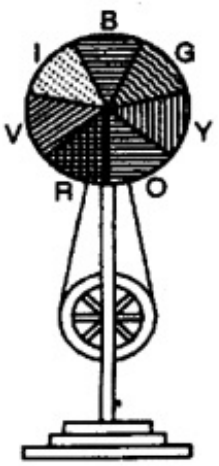
$\frac{1}{7} = \frac{1}{v} - \frac{1}{u} = \frac{1}{-100} - \frac{1}{(-25)} = -\frac{1}{100} + \frac{1}{25} = \frac{-1+4}{100} = \frac{3}{100}$

f = $\frac{100}{3}$ cm = $\frac{1}{3}$ m

P = $\frac{1}{f}$ = $\frac{1}{\frac{1}{3}}$ = 3 D

Power = +3D convex / converging lens of +3 D.

15. Newton's colour disc: White light consists of seven colours. This can easily be proved byNewton's colour disc. A circular disc of cardboard is painted with coloured radial bands. Order of these colours and their relative widths are the same as in the spectrum of sunlight. On rotating disc rapidly about its centre, all the colours blend and a sensation of almost white light is produced on the retina due to persistence of vision.



Since we have used pigment colours instead of spectrum colours, the disc will not appear pure white but will give a dull appearance. Pigment colours are not pure colours and hence due to impurities, the appearance of the disc is grayish instead of perfectly white.