Class 10 Science · Chapter 10: The Human Eye and the Colourful World

Answer key and marking scheme · 20 marks · about 40 minutes · based on NCERT

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1. Most of the refraction of light entering the human eye takes place at the [1]

(a) crystalline eye lens
(b) outer surface of the cornea
(c) pupil
(d) vitreous humour

Answer: (b) Most refraction occurs at the outer surface of the cornea; the eye lens only provides the finer adjustment of focal length.

2. Rohan looks up from his book at a hill far away. To see the hill clearly, his ciliary muscles [1]

(a) relax, the lens becomes thinner and its focal length increases
(b) contract, the lens becomes thicker and its focal length decreases
(c) relax, the lens becomes thicker and its focal length increases
(d) contract, the lens becomes thinner and its focal length increases

Answer: (a) For a distant object the ciliary muscles relax, the lens becomes thin and its focal length increases. Option (b) is the state for a near object; (c) pairs a thicker lens with a longer focal length; (d) pairs contracted muscles with a thinner lens.

3. In a hypermetropic eye, light from a nearby object is focussed behind the retina. One reason for this is that the [1]

(a) eyeball has become elongated
(b) eye lens is too strongly curved
(c) eyeball has become too small
(d) pupil has become too large

Answer: (c) Hypermetropia arises when the focal length of the eye lens is too long or the eyeball has become too small. Excess curvature and an elongated eyeball cause myopia.

4. The part of the human eye that controls the size of the pupil is the [1]

(a) cornea
(b) iris
(c) ciliary muscles
(d) retina

Answer: (b) The iris is a dark muscular diaphragm that controls the size of the pupil; the ciliary muscles change the curvature of the lens, not the pupil.

5. In a myopic eye, the image of a distant object is formed [1]

(a) on the retina
(b) behind the retina
(c) in front of the retina
(d) on the cornea

Answer: (c) In myopia the image of a distant object forms in front of the retina, not on it. Behind the retina is the case of hypermetropia for a near object.

6. Objects seen through the air just above a bonfire appear to waver. Explain why. [2]

Air just above the fire is hotter and lighter and has a slightly lower refractive index than the cooler air above it. These conditions keep changing, so light from the object is refracted by varying amounts and its apparent position fluctuates.

- hot air has a lower refractive index than the cooler air above (1)
- the conditions are not steady, so the apparent position keeps changing (1)

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7. State the function of the ciliary muscles. Name the ability of the eye that results from it. [2]

The ciliary muscles modify the curvature of the eye lens and so change its focal length. This ability of the eye lens to adjust its focal length is called accommodation.

- ciliary muscles change the curvature, and so the focal length, of the eye lens (1)
- names accommodation (1)

8. Name (i) the transparent membrane through which light enters the eye, and (ii) the watery fluid between it and the eye lens. [2]

(i) The cornea, the thin transparent membrane that forms the bulge on the front of the eyeball. (ii) The aqueous humour.

- cornea (1)
- aqueous humour (1)

9. Distinguish between myopia and hypermetropia on the basis of (i) the point of vision that shifts from its normal position, (ii) where the image forms, and (iii) the lens used for correction. [3]

(i) Myopia: the far point comes nearer than infinity. Hypermetropia: the near point moves farther than 25 cm. (ii) Myopia: the image of a distant object forms in front of the retina. Hypermetropia: light from a near object is focussed behind the retina. (iii) Myopia: concave lens. Hypermetropia: convex lens.

- far point nearer than infinity in myopia; near point beyond 25 cm in hypermetropia (1)
- image in front of the retina in myopia; behind the retina in hypermetropia (1)
- concave lens for myopia; convex lens for hypermetropia (1)

10. A narrow beam of white light falls on one face of a glass prism held with its base down, and the emergent light is caught on a white screen. (i) Name the phenomenon. (ii) Which colour appears nearest the base end of the band, and which nearest the top? (iii) Why do the colours separate? [3]

(i) Dispersion of white light. (ii) Violet bends the most, so it is nearest the base; red bends the least, so it is at the top. (iii) Different colours bend through different angles with respect to the incident ray, so they emerge along different paths and become distinct.

- dispersion (1)
- violet nearest the base, red at the top, because violet bends most and red least (1)
- different colours bend through different angles and emerge along different paths (1)

11. (i) Why does a clear sky look blue while clouds look white? (ii) Name the phenomenon that also gives the water of the deep sea its colour. [3]

(i) Very fine particles and air molecules scatter mainly the shorter blue wavelengths, so the clear sky looks blue. Cloud droplets are much larger; when particles are large enough the scattered light appears white. (ii) Scattering of light.

- fine particles and molecules scatter mainly blue (1)
- large particles scatter all colours, so the light appears white (1)
- scattering of light (1)