UNIQUE STUDY POINT

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Class: X	**Subject:** Science	**Session:** 2025-26
Chapter: 10 - The Human Eye and the Colourful World	**Time:** 1½ Hours	**Max. Marks:** 40

General Instructions:

1. All questions are compulsory.
2. This question paper contains 20 questions divided into five sections A, B, C, D and E.
3. Section A contains 10 MCQs of 1 mark each.
4. Section B contains 4 questions of 2 marks each.
5. Section C contains 3 questions of 3 marks each.
6. Section D contains 1 question of 5 marks.
7. Section E contains 2 Case Study Based questions of 4 marks each.

SECTION A - Multiple Choice Questions (1 mark each)

1. The light-sensitive layer in the eye is:
(a) Cornea
(b) Pupil
(c) Retina
(d) Iris

2. A person suffering from myopia can see:
(a) Distant objects clearly
(b) Nearby objects clearly
(c) Both near and far objects clearly
(d) Neither near nor far objects clearly

3. The range of vision for a normal human eye is:
(a) 0 to 25 cm
(b) 25 cm to infinity
(c) 25 cm to 250 cm
(d) 0 to infinity

4. The band of coloured components of light is called its:
(a) Wavelength
(b) Frequency
(c) Spectrum
(d) Intensity

5. Which colour of light has the longest wavelength?
(a) Violet
(b) Blue

(c) Yellow
(d) Red

6. The transparent front part of the eye is called:
(a) Retina
(b) Cornea
(c) Iris
(d) Lens

7. Danger signal lights are red because:
(a) Red light has maximum energy
(b) Red light is least scattered by fog
(c) Red light travels fastest
(d) Red light is brightest

8. The condition in which the crystalline lens becomes cloudy is called:
(a) Myopia
(b) Hypermetropia
(c) Presbyopia
(d) Cataract

9. The advance sunrise and delayed sunset is due to:
(a) Reflection of light
(b) Atmospheric refraction
(c) Scattering of light
(d) Dispersion of light

10. The human eye forms which type of image on the retina?
(a) Virtual and erect
(b) Real and inverted
(c) Virtual and inverted
(d) Real and erect

SECTION B - Short Answer Questions (2 marks each)

11. What is the role of the cornea in the human eye? How does it differ from the eye lens?

12. Why does the sky appear dark to astronauts flying at very high altitudes?

13. What happens to the eye lens when you shift your gaze from a distant tree to a book in your hand?

14. Explain why a rainbow is always formed in a direction opposite to that of the sun.

SECTION C - Short Answer Questions (3 marks each)

15. Draw a labeled diagram showing the structure of the human eye and mark: cornea, iris, lens, retina, and optic nerve.

16. What is hypermetropia? How is it corrected? Explain with the help of ray diagrams.

17. Why is the colour of the sky blue? Would the sky appear blue if we were on the moon? Justify your answer.

SECTION D - Long Answer Question (5 marks)

18. (a) Explain the phenomenon of dispersion of white light through a glass prism. What evidence did Newton provide to show that white light is composed of seven colours?
(b) What is the difference between a myopic eye and a hypermetropic eye? Compare their correction methods.

SECTION E - Case Study Based Questions (4 marks each)

19. Case Study 1:

Priya is a 14-year-old student who sits in the last row of her classroom. Recently, she has been facing difficulty in reading what is written on the blackboard. However, she can read books and notebooks without any problem. Her teacher noticed this and advised her parents to get her eyes checked. The eye specialist examined her eyes and found that her far point had shifted closer than infinity.

Based on the above information, answer the following questions:

(a) What defect of vision is Priya suffering from? (1 mark)

(b) Where is the image formed in Priya's eyes when she looks at distant objects? (1 mark)

(c) What type of lens should be prescribed to correct this defect? (1 mark)

(d) Name two possible causes of this defect. (1 mark)

20. Case Study 2:

During an early morning walk in winter, Rahul observed that the path of sunlight through the mist-covered trees became visible. He could clearly see the light beam traveling through the foggy atmosphere. His science teacher explained that this phenomenon is related to the scattering of light by fine particles. The teacher also mentioned that this same principle explains why the sky appears blue during the day.

Based on the above information, answer the following questions:

(a) What is the name of the effect that makes the light beam visible in the mist? (1 mark)

(b) What determines the colour of scattered light? (1 mark)

(c) Why does the sky appear blue during the day? (1 mark)

(d) What would the sky look like if Earth had no atmosphere? (1 mark)

DETAILED ANSWER KEY - PAPER 02

SECTION A - Answers to MCQs

1. (c) Retina

The retina is the light-sensitive layer at the back of the eye. It is a delicate membrane having an enormous number of light-sensitive cells that get activated upon illumination and generate electrical signals.

2. (b) Nearby objects clearly

A person with myopia (near-sightedness) can see nearby objects clearly but cannot see distant objects distinctly. The far point is nearer than infinity for such a person.

3. (b) 25 cm to infinity

A normal eye can see objects clearly that are between 25 cm (near point) and infinity (far point). This is the range of vision for a normal human eye.

4. (c) Spectrum

The band of coloured components of a light beam is called its spectrum. When white light passes through a prism, it splits into seven colours forming a spectrum.

5. (d) Red

Red light has the longest wavelength in the visible spectrum, approximately 1.8 times greater than blue light. This is why red light bends the least when passing through a prism.

6. (b) Cornea

The cornea is a thin, transparent membrane that forms the transparent bulge on the front surface of the eyeball. Light enters the eye through the cornea.

7. (b) Red light is least scattered by fog

Danger signals are red because red light has the longest wavelength and is least scattered by fog or smoke. Therefore, it can be seen clearly at a distance even in foggy conditions.

8. (d) Cataract

Cataract is a condition in which the crystalline lens of the eye becomes milky and cloudy. This causes partial or complete loss of vision. It can be treated through cataract surgery.

9. (b) Atmospheric refraction

The sun is visible about 2 minutes before actual sunrise and about 2 minutes after actual sunset due to atmospheric refraction. The atmosphere bends the sunlight, making the sun visible even when it is below the horizon.

10. (b) Real and inverted

The eye lens forms a real and inverted image of the object on the retina. The brain interprets this image and we perceive objects as they are (erect).

SECTION B - Answers to Short Answer Questions

11. Role of Cornea

Role of Cornea: The cornea is the transparent front part of the eye through which light enters. Most of the refraction of light rays entering the eye occurs at the outer surface of the cornea.

Difference from Eye Lens: While the cornea provides most of the refractive power (fixed), the eye lens provides fine adjustment of focal length. The eye lens can change its curvature through ciliary muscles (accommodation), but the cornea cannot.

12. Dark Sky for Astronauts

The sky appears dark to astronauts flying at very high altitudes because scattering of light is not prominent at such heights. At high altitudes, the atmosphere is very thin with very few particles to scatter light. Since there is minimal scattering of sunlight, the sky appears dark instead of blue.

13. Change in Eye Lens

When you shift your gaze from a distant tree to a book in your hand:
• The ciliary muscles contract
• This increases the curvature of the eye lens
• The eye lens becomes thicker
• The focal length of the eye lens decreases
This enables you to see the nearby book clearly. This ability to adjust focal length is called power of accommodation.

14. Rainbow Formation Direction

A rainbow is always formed in a direction opposite to the sun because of the path light takes through water droplets. Sunlight enters the water droplet, gets refracted and dispersed, then reflects internally from the back surface of the droplet, and finally refracts again when emerging. This reflected and refracted light comes back towards the observer who must be positioned with the sun behind them to see the rainbow.

SECTION C - Answers to Short Answer Questions

15. Structure of Human Eye

[A labeled diagram should be drawn showing:]

• **Cornea:** Transparent front bulge where light enters
• **Iris:** Dark muscular diaphragm controlling pupil size
• **Pupil:** Opening in the iris
• **Crystalline Lens:** Behind the iris, focuses light
• **Ciliary Muscles:** Control lens curvature
• **Retina:** Light-sensitive screen at the back
• **Optic Nerve:** Carries signals to brain
• **Aqueous Humour:** Fluid between cornea and lens
• **Vitreous Humour:** Fluid filling the eyeball

The diagram should show the eyeball as approximately spherical with diameter 2.3 cm, with all parts properly labeled.

16. Hypermetropia and its Correction

Hypermetropia (Far-sightedness):
A person with hypermetropia can see distant objects clearly but cannot see nearby objects distinctly. The near point is farther away from the normal near point (25 cm).

Cause:

• The focal length of the eye lens is too long, or
• The eyeball has become too small
• Light rays from nearby objects focus at a point behind the retina

Correction:
Hypermetropia is corrected by using a convex lens of appropriate power. The convex lens converges the light rays before they enter the eye, providing additional focusing power so the image forms on the retina.

[Ray diagrams should show: (1) Hypermetropic eye - image forming behind retina, (2) Corrected eye with convex lens - image forming at retina]

17. Blue Colour of Sky

Why sky is blue:
The molecules of air and fine particles in the atmosphere have sizes smaller than the wavelength of visible light. These particles scatter blue light (shorter wavelength) more strongly than red light (longer wavelength). When sunlight passes through the atmosphere, blue light is scattered in all directions and reaches our eyes from all parts of the sky, making it appear blue.

Sky on the Moon:
No, the sky would not appear blue on the moon. The moon has no atmosphere, so there would be no particles to scatter sunlight. Without scattering, the sky would appear dark or black even during the daytime. Astronauts on the moon see a dark sky with stars visible even when the sun is up.

SECTION D - Answer to Long Answer Question

18. (a) Dispersion and Newton's Experiment; (b) Myopia vs Hypermetropia

(a) Dispersion of White Light:
When white light passes through a glass prism, it splits into seven constituent colours - Violet, Indigo, Blue, Green, Yellow, Orange, and Red (VIBGYOR). This phenomenon is called dispersion.

Reason for Dispersion:
Different colours of light bend through different angles with respect to the incident ray as they pass through the prism. Red light bends the least while violet bends the most. Thus, each colour emerges along a different path and becomes distinct.

Newton's Evidence:
Isaac Newton provided two key pieces of evidence:
1. He tried to split the spectrum colours further using another prism but could not get any more colours
2. He placed a second identical prism in an inverted position with respect to the first prism, allowing all spectrum colours to pass through it. A beam of white light emerged from the second prism, proving that white light is composed of seven colours

(b) Myopia vs Hypermetropia:

Aspect	Myopia	Hypermetropia
Vision problem	Cannot see distant objects clearly	Cannot see nearby objects clearly
Image formation	In front of retina	Behind retina
	• Excessive curvature of lens	• Focal length too long

Causes	• Elongation of eyeball	• Eyeball too small
Correction	Concave lens (diverging)	Convex lens (converging)
Effect of lens	Diverges light before entry	Converges light before entry

SECTION E - Answers to Case Study Based Questions

19. Case Study 1 - Answers

(a) Priya is suffering from **Myopia** (near-sightedness).

(b) When Priya looks at distant objects, the image is formed **in front of the retina** instead of at the retina.

(c) A **concave lens** (diverging lens) of suitable power should be prescribed to correct this defect.

(d) Two possible causes of myopia are:
1. Excessive curvature of the eye lens
2. Elongation of the eyeball

20. Case Study 2 - Answers

(a) The effect that makes the light beam visible in the mist is called **Tyndall effect**.

(b) The **size of the scattering particles** determines the colour of scattered light. Very fine particles scatter mainly blue light, while larger particles scatter light of longer wavelengths.

(c) The sky appears blue during the day because the fine particles in the atmosphere scatter **blue light (shorter wavelength) more strongly than red light (longer wavelength)**. The scattered blue light enters our eyes from all directions, making the sky appear blue.

(d) If Earth had no atmosphere, the sky would appear **dark or black** even during daytime, similar to what astronauts see from space. There would be no particles to scatter sunlight.
