

UNIQUE STUDY POINT

By Sumeet Sahu

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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 part of the eye that controls the amount of light entering the eye is:
 - (a) Cornea
 - (b) Iris
 - (c) Retina
 - (d) Lens
2. The defect of vision in which a person cannot see distant objects clearly is called:
 - (a) Hypermetropia
 - (b) Presbyopia
 - (c) Myopia
 - (d) Astigmatism
3. The focal length of the eye lens is changed by:
 - (a) Pupil
 - (b) Retina
 - (c) Ciliary muscles
 - (d) Optic nerve
4. The splitting of white light into its constituent colours is called:
 - (a) Reflection
 - (b) Refraction
 - (c) Dispersion
 - (d) Scattering
5. The colour of light that bends the most while passing through a prism is:
 - (a) Red
 - (b) Yellow

- (c) Green
- (d) Violet

6. The least distance of distinct vision for a normal human eye is:
- (a) 2.5 cm
 - (b) 25 cm
 - (c) 250 cm
 - (d) 25 m
7. The phenomenon responsible for the blue colour of the sky is:
- (a) Reflection of light
 - (b) Refraction of light
 - (c) Dispersion of light
 - (d) Scattering of light
8. A person suffering from hypermetropia should use:
- (a) Concave lens
 - (b) Convex lens
 - (c) Cylindrical lens
 - (d) Bifocal lens
9. The twinkling of stars is due to:
- (a) Atmospheric reflection
 - (b) Atmospheric refraction
 - (c) Total internal reflection
 - (d) Atmospheric dispersion
10. The sequence of colours in the spectrum of white light is represented by the acronym:
- (a) ROYGBIV
 - (b) VIBGYOR
 - (c) BGYVIOR
 - (d) VIGBYOR

SECTION B - Short Answer Questions (2 marks each)

11. What is meant by power of accommodation of the eye? Why is it important for clear vision?
12. Why do we see a rainbow only after rainfall and when the sun is behind us? Explain briefly.
13. Differentiate between the near point and far point of the human eye.
14. What is Tyndall effect? Give one example where it can be observed in daily life.

SECTION C - Short Answer Questions (3 marks each)

15. Explain with the help of a diagram how myopia can be corrected using a suitable lens.
16. What causes the reddening of the sun at sunrise and sunset? Explain with scientific reasoning.
17. Describe an activity to demonstrate the dispersion of white light through a glass prism.

SECTION D - Long Answer Question (5 marks)

- 18.** (a) What is presbyopia? How does it differ from other defects of vision?
(b) Why do stars twinkle but planets do not? Explain in detail.

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

19. Case Study 1:

Ramesh is a 45-year-old teacher who recently started experiencing difficulty in reading books and newspapers. He has to hold the reading material at arm's length to see it clearly. His doctor examined his eyes and prescribed him corrective lenses. After using these lenses, he could read comfortably at the normal reading distance.

Based on the above information, answer the following questions:

- (a) What defect of vision is Ramesh suffering from? (1 mark)
- (b) What type of lens would the doctor have prescribed to Ramesh? (1 mark)
- (c) Explain the cause of this defect. (1 mark)
- (d) At what approximate age does this defect usually start appearing? (1 mark)

20. Case Study 2:

During a science exhibition, students set up an experiment with a glass prism and sunlight. They allowed a narrow beam of sunlight to pass through the prism and observed a beautiful band of seven colours on a white screen placed on the other side. They noticed that red light bent the least and violet light bent the most. They also tried to recombine these colours using another identical prism placed in an inverted position.

Based on the above information, answer the following questions:

- (a) What is the phenomenon observed called? (1 mark)
- (b) Which colour has the maximum wavelength in the visible spectrum? (1 mark)
- (c) What will happen when the split colours pass through the second inverted prism? (1 mark)
- (d) Name the scientist who first performed this experiment. (1 mark)

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SECTION A - Answers to MCQs

1. (b) Iris

The iris is a dark muscular diaphragm that controls the size of the pupil, which regulates and controls the amount of light entering the eye.

2. (c) Myopia

Myopia or near-sightedness is a defect in which a person can see nearby objects clearly but cannot see distant objects distinctly.

3. (c) Ciliary muscles

The ciliary muscles change the curvature of the eye lens, which in turn changes its focal length. This enables us to see objects at different distances clearly.

4. (c) Dispersion

The splitting of white light into its component colours is called dispersion. This occurs when light passes through a prism.

5. (d) Violet

Violet light bends the most while passing through a prism, while red light bends the least. This is why violet appears at one end of the spectrum and red at the other.

6. (b) 25 cm

The least distance of distinct vision, also called the near point of the eye, is about 25 cm for a young adult with normal vision.

7. (d) Scattering of light

The blue colour of the sky is due to the scattering of light. Fine particles in the atmosphere scatter blue light (shorter wavelength) more effectively than red light.

8. (b) Convex lens

A person suffering from hypermetropia (far-sightedness) should use a convex lens of appropriate power to correct the defect.

9. (b) Atmospheric refraction

The twinkling of stars is due to atmospheric refraction. The starlight undergoes continuous refraction while passing through the earth's atmosphere, causing the apparent position to fluctuate.

10. (b) VIBGYOR

VIBGYOR represents Violet, Indigo, Blue, Green, Yellow, Orange, and Red - the sequence of colours in the spectrum of white light.

SECTION B - Answers to Short Answer Questions

11. Power of Accommodation

The ability of the eye lens to adjust its focal length is called accommodation. The ciliary muscles can

change the curvature of the eye lens, making it thinner or thicker. This changes the focal length, enabling us to see objects clearly at different distances - both near and far. Without this ability, we would only be able to see clearly at one specific distance.

12. Rainbow Formation

A rainbow is formed when sunlight is dispersed by tiny water droplets present in the atmosphere after rainfall. The water droplets act like small prisms - they refract, disperse, and internally reflect the sunlight. A rainbow is always formed in a direction opposite to the sun because the light must enter the water droplet, reflect internally, and then emerge back towards the observer.

13. Near Point and Far Point

Near Point: The minimum distance at which objects can be seen most distinctly without strain is called the near point of the eye. For a normal eye, it is about 25 cm.

Far Point: The farthest point up to which the eye can see objects clearly is called the far point of the eye. For a normal eye, it is at infinity.

14. Tyndall Effect

The phenomenon of scattering of light by colloidal particles is called Tyndall effect. When a beam of light strikes fine particles, the path of the beam becomes visible.

Example: When a fine beam of sunlight enters a smoke-filled room through a small hole, the path of light becomes visible due to scattering by smoke particles. This is Tyndall effect.

SECTION C - Answers to Short Answer Questions

15. Correction of Myopia

Myopia (Near-sightedness): In myopia, the image of a distant object is formed in front of the retina instead of at the retina. This occurs due to:

- Excessive curvature of the eye lens, or
- Elongation of the eyeball

Correction: Myopia can be corrected by using a concave lens of suitable power. The concave lens diverges the light rays before they enter the eye, so that after refraction by the eye lens, the image is formed at the retina.

[Diagram would show: Eye with myopia - image forming before retina, and corrected eye with concave lens - image forming at retina]

16. Reddening of Sun at Sunrise and Sunset

At sunrise and sunset, the sun is near the horizon. The sunlight has to travel a much longer distance through the earth's atmosphere to reach our eyes compared to when the sun is overhead.

During this long journey:

- Blue light (shorter wavelength) gets scattered away by atmospheric particles
- Red light (longer wavelength) is least scattered and reaches our eyes
- Therefore, the sun appears reddish

This is why the sun appears white at noon (shorter path, less scattering) but appears red during sunrise and sunset (longer path, more scattering of blue light).

17. Activity to Demonstrate Dispersion

Materials Required: Glass prism, white screen, cardboard with narrow slit, sunlight

Procedure:

1. Take a thick cardboard sheet and make a small narrow slit in its middle
2. Allow sunlight to fall on the slit to obtain a narrow beam of white light
3. Place a glass prism in the path of this light beam
4. Turn the prism slowly until the light emerging from it falls on a white screen
5. Observe the band of colours on the screen

Observation: A beautiful band of seven colours (VIBGYOR) appears on the screen. This shows that white light is composed of seven colours.

Conclusion: The prism splits white light into its constituent colours through dispersion.

SECTION D - Answer to Long Answer Question

18. (a) Presbyopia and (b) Twinkling of Stars

(a) Presbyopia:

Presbyopia is a defect of vision that occurs with aging. The power of accommodation of the eye decreases, and the near point gradually recedes away. People find it difficult to see nearby objects comfortably and distinctly without corrective eye-glasses.

Cause: It arises due to:

- Gradual weakening of ciliary muscles
- Diminishing flexibility of the eye lens

Difference from other defects:

- Unlike myopia and hypermetropia which can occur at any age, presbyopia is specifically age-related
- It affects the ability to see nearby objects, similar to hypermetropia, but the cause is different
- Often requires bifocal lenses (combination of concave and convex lenses)

(b) Twinkling of Stars vs. Non-twinkling of Planets:

Why Stars Twinkle:

- Stars are very distant and appear as point-sized sources of light
- Starlight undergoes continuous refraction through the earth's atmosphere
- The physical conditions of the atmosphere keep changing
- This causes the apparent position of the star to fluctuate
- The amount of starlight entering our eyes keeps changing, making the star appear to twinkle

Why Planets Don't Twinkle:

- Planets are much closer to earth than stars
- They appear as extended sources of light (not point-sized)
- A planet can be considered as a collection of many point-sized sources
- The variations in light from different points average out to zero
- Therefore, the twinkling effect is nullified and planets appear steady

SECTION E - Answers to Case Study Based Questions

19. Case Study 1 - Answers

(a) Ramesh is suffering from **Presbyopia**.

(b) The doctor would have prescribed a **convex lens** (converging lens) to Ramesh.

(c) The cause of presbyopia is the **gradual weakening of ciliary muscles and diminishing flexibility of the eye lens** with age. This reduces the eye's power of accommodation.

(d) This defect usually starts appearing around **40-45 years of age** or in old age.

20. Case Study 2 - Answers

(a) The phenomenon observed is called **Dispersion of white light**.

(b) **Red colour** has the maximum wavelength in the visible spectrum (approximately 1.8 times that of blue light).

(c) When the split colours pass through the second inverted prism, they will **recombine to form white light** again. This demonstrates that white light is composed of seven colours.

(d) **Isaac Newton** was the first scientist to perform this experiment and demonstrate the dispersion and recombination of white light.

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