CBSE CLASS X

Science (086)

ANSWER KEY

From previous CBSE Board Exam questions

Code: MG8JFE	Questions: 65	Maximum Marks: 122	Generated: 2026-06-15 13:05

SELECTIONS USED

Source	Previous-year board
Subject	Science
Lessons	The Human Eye and the Colourful World
Year	2022-2026
Questions selected	65

Composition — Types: 25 Short · 18 MCQ · 14 Very short · 6 Assertion–reason · 2 source_based

Q1. § 10.3 REFRACTION OF LIGHT THROUGH A PRISM § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[1]**

The colour of light for which the refractive index of glass is minimum, is :

(A) Red
(B) Yellow
(C) Green
(D) Violet

Previously asked in: 2024 31/5/1 Q13

◆ The Human Eye and the Colourful World | Refractive index and colour of light (dispersion)

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Model Answer

(A) Red

Red light bends the least while passing through a glass prism, meaning it travels fastest in glass. Since refractive index $n = c/v$, higher speed means lower refractive index. Hence, refractive index of glass is minimum for red light.

Explanation

Key concept: Refractive index is inversely related to the speed of light in the medium. In dispersion, violet bends the most (highest refractive index) and red bends the least (lowest refractive index). Remember: VIBGYOR — refractive index decreases from Violet to Red.

Q2. § 10.1 THE HUMAN EYE **[1]**

In human eye the part which allows light to enter into the eye is –

(a) Retina
(b) Pupil
(c) Eye lens
(d) Cornea

Previously asked in: 2023 31/6/1 Q16

◆ The Human Eye and the Colourful World | Structure of the Human Eye – Cornea/Pupil (light entry)

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Model Answer

(b) Pupil

The pupil is the part of the human eye that allows light to enter into the eye by regulating and controlling the amount of light entering it.

Source: Chapter 10, Section 10.1 – The Human Eye

Explanation

Although light first touches the **cornea** (which is technically the entry point and where most refraction occurs), the question asks specifically about the part that **allows/regulates light entry** — and the textbook explicitly states: *"The pupil regulates and controls the amount of light entering the eye."* The cornea is described as where refraction happens, not as the regulator of light entry. CBSE expects answer **(b) Pupil** based on this exact textbook line.

Q3. § 10.1 THE HUMAN EYE **[1]**

The lens system of human eye forms an image on a light sensitive screen, which is called as :

(a) Cornea
(b) Ciliary muscles
(c) Optic nerves
(d) Retina

Previously asked in: 2024 31/1/1 Q13

◆ The Human Eye and the Colourful World | Structure of the Human Eye – Retina as the light-sensitive screen

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Model Answer

(d) Retina

The lens system of the human eye forms an image on the light-sensitive screen called the **retina**.

Source: Chapter 10, Section 10.1 – The Human Eye

Explanation

The passage directly states: *"Its lens system forms an image on a light-sensitive screen called the retina."* Cornea is the transparent front membrane, ciliary muscles adjust the lens, and optic nerves carry signals to the brain — none of these is the image-forming screen. Just name the correct option and optionally add one supporting line for a 1-mark MCQ.

Q4. § 10.1 THE HUMAN EYE **[1]**

The part of human eye which controls the amount of light entering into it.

(A) Iris
(B) Cornea
(C) Ciliary muscles
(D) Pupil

Previously asked in: 2025 31/6/1 Q14

◆ The Human Eye and the Colourful World | Iris and Pupil – Control of Light Entry

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Model Answer

(A) Iris

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

Source: The Human Eye, Chapter 10, Section 10.1

Explanation

Students often confuse **iris** and **pupil** here. The iris *controls* the pupil's size (it is the muscular structure doing the work), while the pupil is merely the opening through which light passes. The question asks what *controls* the amount of light — that is the **iris**. The pupil itself regulates light, but only because the iris changes its size. CBSE expects option **(A) Iris** as the answer based on the textbook wording.

Q5. § Chapter Introduction | § 10.1 THE HUMAN EYE **[1]**

The pair of eye parts responsible for admitting different amount of light in to the eyes is

(A) Iris and pupil
(B) Ciliary muscles and pupil
(C) Retina and Iris
(D) Ciliary muscles and cornea

Previously asked in: 2026 31/4/1 Q30

◆ The Human Eye and the Colourful World | Structure of the Human Eye (Iris and Pupil)

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Model Answer

(A) Iris and pupil

The iris controls the size of the pupil, and the pupil regulates the amount of light entering the eye.

Explanation

The textbook explicitly states: "Iris is a dark muscular diaphragm that controls the size of the pupil. The pupil regulates and controls the amount of light entering the eye." Together, iris and pupil are responsible for admitting different amounts of light. Ciliary muscles change focal length, not light admission — a common confusion to avoid.

Q6. § 10.1 THE HUMAN EYE | § 10.1.1 Power of Accommodation | § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[1]**

Consider the following statements in the context of human eye :
(a) The diameter of the eye ball is about 2.3 cm.
(b) Iris is a dark muscular diaphragm that controls the size of the pupil.
(c) Most of the refraction for the light rays entering the eye occurs at the crystalline lens.
(d) While focusing on the objects at different distances the distance between the crystalline lens and the retina is adjusted by ciliary muscles.
The correct statements are –

(A) (a) and (b)
(B) (a), (b) and (c)
(C) (b), (c) and (d)
(D) (a), (c) and (d)

Previously asked in: 2024 31/2/1 Q13

◆ **The Human Eye and the Colourful World** | Power of Accommodation and Ciliary Muscles | Refraction of Light in the Human Eye (role of cornea vs. crystalline lens) | Structure of the Human Eye (eye ball, iris, pupil, crystalline lens, retina)

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Model Answer

(A) (a) and (b)

Wait — re-checking: Statement (a) ✓ (diameter ~2.3 cm), (b) ✓ (iris is a dark muscular diaphragm), (c) ✗ (most refraction occurs at the **cornea**, not the crystalline lens), (d) ✗ (ciliary muscles change the **curvature/focal length** of the lens, not the distance between lens and retina).

Correct answer: (A) (a) and (b)

Explanation

- The passage explicitly states: *"Most of the refraction for the light rays entering the eye occurs at the outer surface of the cornea"* — so statement (c) is wrong.
- Statement (d) is wrong because in the human eye the lens-to-retina distance is fixed; it is the **focal length** (via curvature change by ciliary muscles) that adjusts, not the distance itself.
- Statements (a) and (b) are directly confirmed by the passage, making **(A)** the correct choice.

Q7. § 10.1.1 Power of Accommodation **[1]**

Assertion (A) : When ciliary muscles contract, eye lens becomes thin.
Reason (R) : Ciliary muscles control the power of the eye lens.

(a) Both, Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).
(b) Both, Assertion (A) and Reason (R) are true, and Reason (R) is not the correct explanation of Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2025 31/4/1 Q20

◆ The Human Eye and the Colourful World | Accommodation of the Eye – Role of Ciliary Muscles

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Model Answer

(d) Assertion (A) is false, but Reason (R) is true.

When ciliary muscles **contract**, the eye lens becomes **thicker** (not thin), decreasing focal length to focus nearby objects. However, Reason (R) is correct — ciliary muscles do control the power (focal length) of the eye lens.

Source: Chapter 10, Section 10.1.1 Power of Accommodation

Explanation

The passage clearly states: *"When you are looking at objects closer to the eye, the ciliary muscles contract. This increases the curvature of the eye lens. The eye lens then becomes thicker."* So the Assertion is **false** — contraction makes the lens **thick**, not thin (the lens becomes thin when muscles are **relaxed**). The Reason is **true** since ciliary muscles change the curvature and hence the focal length (power) of the lens. This makes option **(d)** correct.

Q8. § 10.1 THE HUMAN EYE § 10.1.1 Power of Accommodation **[3]**

Answer the following :

(a) State one important function of the following parts of the human eye : (i) Retina (ii) Pupil

(b) State the role of ciliary muscles in focussing objects at varying distances from the eye.

Previously asked in: 2023 31/5/1 Q31

◆ **The Human Eye and the Colourful World** | Accommodation – Role of ciliary muscles in focusing | Structure and function of the human eye – Retina and Pupil

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Model Answer

(a)

(i) Retina: It contains light-sensitive cells (rods and cones) that convert light into electrical signals, which are sent to the brain via the optic nerve, enabling vision.

(ii) Pupil: It controls the amount of light entering the eye by changing its size — it dilates in dim light and constricts in bright light.

(b) Ciliary muscles are attached to the eye lens. When viewing a nearby object, ciliary muscles contract, making the lens thicker (more convex) to increase its converging power. When viewing a distant object, the muscles relax, making the lens thinner (less convex) to decrease converging power. This adjustment of focal length is called **accommodation**.

Explanation

- The question is from the chapter **"The Human Eye and the Colourful World"** (Ch. 11, Science Class 10).
- For part (a), name the specific function — don't just say "it helps in vision."
- For part (b), the key terms examiners look for are: **contract/relax**, **thicker/thinner lens**, and **accommodation**. Always link muscle action to lens shape change to focal length change.
- The source passages provided were from unrelated chapters, but this answer is based on the NCERT Class 10 Science Ch. 11 content as prescribed.

Q9. § 10.1.1 Power of Accommodation **[2]**

How does the focal length of eye lens change as the distance of the object from the eyes is altered ? Explain.

Previously asked in: 2026 31/2/1 Q34 (a)

◆ **The Human Eye and the Colourful World** | Accommodation of the Eye – Change in Focal Length with Object Distance

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Model Answer

When an object is **far away**, the ciliary muscles are relaxed, making the eye lens thin. Its focal length **increases**, enabling clear vision of distant objects.

When an object is **close to the eye**, the ciliary muscles contract, increasing the curvature of the lens, making it thicker. Its focal length **decreases**, enabling clear vision of nearby objects.

This ability of the eye lens to adjust its focal length is called **accommodation**.

Source: Chapter 10, Section 10.1.1 — Power of Accommodation

Explanation

- Examiners expect two clear cases: distant object → relaxed muscles → thin lens → **increased** focal length; near object → contracted muscles → thick lens → **decreased** focal length.
- Always use the keyword **accommodation** — it fetches a mark.
- Keep it to 2–3 sentences covering both cases; no diagrams needed for 2 marks unless asked.

Q10. § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[3]**

State reasons for Myopia. With the help of ray diagrams, show the
(a) image formation by a myopic eye, and
(b) correction of myopia using an appropriate lens.

Previously asked in: 2023 31/6/1 Q31

◆ The Human Eye and the Colourful World | Correction of Myopia using a concave lens – Ray diagram | Myopia (Short-sightedness) – Causes | Ray diagram – Image formation by a myopic eye

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Model Answer

Causes of Myopia:
Myopia arises due to:

1. Excessive curvature of the eye lens, or
2. Elongation of the eyeball.

(a) Image formation by a myopic eye:

In a myopic eye, the image of a distant object is formed **in front of the retina** instead of on it.

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Distant object → Eye lens → Image (formed in front of retina) ✗ Retina
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(Ray diagram: parallel rays from distant object converge before the retina)

(b) Correction of myopia:

A **concave lens** of suitable power is used. It diverges the incoming rays so that they converge exactly on the retina.

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Distant object → Concave lens → Eye lens → Image (on retina) ✓
```

(Ray diagram: concave lens diverges rays; eye lens then focuses them onto the retina)

Source: The Human Eye and the Colourful World, Section 10.2

Explanation

- The question is 3 marks: ~1 mark for causes, ~1 mark for each diagram (described/drawn). Keep causes brief (2 points) and diagrams clearly labelled.
- Since this is a written exam, draw actual ray diagrams on paper with labels: "Retina," "Eye lens," "Image," and for correction — "Concave lens." The examiner specifically looks for the image forming **in front of the retina** (myopia) and **on the retina** (after correction).
- Never confuse myopia correction (concave lens) with hypermetropia correction (convex lens).

Q11. § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[2]**

When do we say that a particular person is suffering from hypermetropia ? List two causes of this defect. Name the type of lens used to correct this defect.

Previously asked in: 2024 31/3/1 Q24

◆ **The Human Eye and the Colourful World** | Hypermetropia – Definition, Causes, and Correction

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Model Answer

A person is said to suffer from hypermetropia when they can see distant objects clearly but **cannot see nearby objects distinctly** (near point is farther than 25 cm).

Two causes:

1. The focal length of the eye lens is too long.
2. The eyeball has become too small, so light from nearby objects is focused behind the retina.

Correction: A **convex lens** (converging lens) of appropriate power is used.

Source: Chapter 10, Section 10.2 – Defects of Vision and their Correction

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Explanation

- The question has three parts (condition, causes, correction) but is only 2 marks — keep it brief and avoid excess detail.
- Examiners look for: the key symptom (cannot see nearby clearly), exactly two causes (focal length too long / eyeball too small), and the correct lens type (convex/converging).
- Do not confuse with myopia (concave lens). Hypermetropia = far-sighted = convex lens.

Q12. § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[1]**

Assertion (A) : Myopic eye cannot see distant objects distinctly.
Reason (R) : For the correction of myopia converging lenses of appropriate power are prescribed by eye-surgeons.

(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true, but (R) is not the correct explanation of (A).
(C) (A) is true, but (R) is false.
(D) (A) is false, but (R) is true.

Previously asked in: 2024 31/2/1 Q19

◆ The Human Eye and the Colourful World | Myopia (Short-sightedness) – Cause and Correction

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Model Answer

(C) (A) is true, but (R) is false.

Assertion is correct — a myopic eye cannot see distant objects distinctly. However, myopia is corrected by a **concave (diverging)** lens, not a converging lens. Hence R is false.

Source: Chapter 10, Section 10.2(a)

Explanation

The key fact to remember: **Myopia → concave lens; Hypermetropia → convex (converging) lens.** The Reason incorrectly states converging lenses for myopia — that correction applies to hypermetropia. Since A is true but R is false, the answer is **(C)**. Do not confuse the two defects in assertion-reason questions.

Q13. § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[3]**

Study the diagram given below and answer the questions that follow :

(i) Name the defect of vision represented in the diagram. Give reason for your answer.

(ii) List two causes of this defect.

(iii) With the help of a diagram show how this defect of vision is corrected.

Previously asked in: 2024 31/1/1 Q31

◆ The Human Eye and the Colourful World | Causes of Defects of Vision | Correction of Myopia using Concave Lens | Defects of Vision – Myopia (Short-sightedness)

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Model Answer

(i) The defect is **Myopia (Short-sightedness).**
Reason: In the diagram, the image is formed in front of the retina instead of on it, which is the characteristic feature of myopia.

(ii) Two causes of myopia:

1. Excessive curvature (increased converging power) of the eye lens.
2. Elongation of the eyeball (increase in the length of the eyeball).

(iii) Myopia is corrected by using a **concave (diverging) lens** of suitable power. It diverges the incoming rays so that they finally converge on the retina.

Corrective diagram:

```
Object → [Concave lens] → Eye lens → Image forms ON retina
```

(Diagram shows diverging rays from concave lens entering the eye and converging exactly on the retina.)

Explanation

- The key visual clue is the image forming **before** the retina — this uniquely identifies **myopia**. Always state this reason explicitly.
- For causes, examiners expect the two standard textbook reasons: increased lens curvature AND elongated eyeball.
- For the correction diagram, draw the concave lens in front of the eye, show diverging rays, and label that the final image falls **on the retina**. Even a rough labelled sketch earns marks.
- Marks split: (i) 1 mark — name + reason; (ii) 1 mark — any two causes; (iii) 1 mark — correct lens named + diagram.

Q14. § 10.1.1 Power of Accommodation § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[1]**

The possible way to restore clear vision of those people whose eyeball has elongated is the use of suitable

A bifocal lens
B concave lens
C converging lens
D convex lens

Previously asked in: 2025 31/5/1 Q14

◆ The Human Eye and the Colourful World | Myopia (Short-sightedness) – Correction using Concave Lens

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Model Answer

Answer: B — Concave lens

Elongation of the eyeball causes myopia (near-sightedness). It is corrected by using a **concave lens** of suitable power.

Source: Chapter 10, Section 10.2(a) – Myopia

Explanation

The key link is: **elongated eyeball → myopia → concave lens**. The passage explicitly states myopia "may arise due to...elongation of the eyeball" and "can be corrected by using a concave lens of suitable power." Students often confuse this with convex lens (used for hypermetropia). Remember: **Myopia = concave; Hypermetropia = convex**.

Q15. § Chapter Introduction § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[2]**

Name the type of lenses required by the persons for the correction of their defect of vision called presbyopia. Write the structure of the lenses commonly used for the correction of this defect giving reason for such designs.

Previously asked in: 2025 31/4/1 Q25(B)

◆ The Human Eye and the Colourful World | Presbyopia – causes, correction, and bifocal lenses

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Model Answer

Persons with presbyopia require **bi-focal lenses**.

A common bi-focal lens consists of both concave and convex lenses. The **upper portion is a concave lens** (for distant vision) and the **lower portion is a convex lens** (for near vision). This design is used because presbyopia patients often suffer from both myopia and hypermetropia simultaneously.

Source: Chapter 10, Section 10.2(c) – Presbyopia

Explanation

- The key term examiners look for is **bi-focal lenses** — write it clearly.
- Mention **both parts** of the bi-focal lens with their positions (upper/lower) and functions (distant/near vision). These are two separate marking points.
- The reason (person suffers from both myopia and hypermetropia) earns the logic mark. Don't skip it.

Q16. § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[2]**

Observe the following diagram showing an image formation in an eye :
(a) Identify the defect of vision shown in the figure.
(b) List its two causes and suggest a suitable corrective lens to overcome this defect.

Previously asked in: 2023 31/5/1 Q25

◆ The Human Eye and the Colourful World | Corrective Lenses for Vision Defects | Defects of Vision – Myopia/Hypermetropia/Presbyopia

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Model Answer

(a) The defect shown is **Myopia (near-sightedness)**. The image of a distant object is formed in front of the retina instead of on it.

(b) Two causes:

1. Excessive curvature of the eye lens.
2. Elongation of the eyeball.

Corrective lens: A **concave lens** of suitable power is used to correct myopia, as it diverges light rays to bring the image back onto the retina.

Source: Chapter 10, Section 10.2 – Defects of Vision and their Correction

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Explanation

- The diagram clearly shows image forming **in front of** the retina → always Myopia.
- Examiners expect **both causes** listed separately for full marks.
- Name the corrective lens specifically as **concave lens** (diverging lens); just writing "lens" won't fetch marks.
- This is a 2-mark question but has three parts (identify + two causes + lens), so keep each point crisp — one line each.

Q17. § Chapter Introduction § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[2]**

(A) Observe the following diagram and answer the questions following it :
(i) Identify the defect of vision shown.
(ii) List its two causes.
(iii) Name the type of lens used for the correction of this defect.

Previously asked in: 2023 31/4/1 Q25 (A)

◆ **The Human Eye and the Colourful World** Correction of Defects of Vision using Lenses Defects of Vision – Myopia (Short-sightedness)

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Model Answer

(i) The defect shown is **Myopia (near-sightedness)**. The image is formed in front of the retina instead of on it.

(ii) Two causes:

1. Excessive curvature of the eye lens.
2. Elongation of the eyeball.

(iii) A **concave lens** (diverging lens) of suitable power is used to correct myopia.

Source: Chapter 10, Section 10.2(a) – Myopia

Explanation

- The diagram shows rays converging **in front of** the retina → this is the key identifier for myopia (not hypermetropia, where image forms behind the retina).
- Examiners specifically look for **both causes** stated clearly; missing one costs a mark.
- "Concave lens" must be named — writing only "diverging lens" may lose the mark if the term is not recognised as equivalent.
- This 2-mark question typically awards: 1 mark for defect + causes combined, 1 mark for corrective lens — so be concise and precise.

Q18. § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[1]**

Assertion (A) : A person suffering from myopia cannot see the distant objects clearly.
Reason (R) : A converging lens is used for the correction of myopic eye as it can form real as well as virtual images of the objects placed in front of it.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2023 31/2/1 Q19

◆ The Human Eye and the Colourful World | Correction of Myopia using Concave Lens | Myopia (Short-sightedness) – Cause and Correction

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Model Answer

(c) Assertion (A) is true, but Reason (R) is false.

Assertion is correct — a myopic person cannot see distant objects clearly. However, myopia is corrected by a **concave (diverging) lens**, not a converging lens.

Explanation

The textbook clearly states that myopia is corrected using a concave lens of suitable power. The Reason incorrectly states a converging lens is used, making R false. Since A is true and R is false, option (c) is correct. Remember: **myopia → concave lens; hypermetropia → convex lens.**

Q19. § Chapter Introduction § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[3]**

Study the diagram given below and answer the questions that follow :
(i) Name the defect of vision depicted in this diagram stating the part of the eye responsible for this condition.
(ii) List two causes of this defect.
(iii) Name the type of lens used to correct this defect and state its role in this case.

Previously asked in: 2024 31/5/1 Q31 (a)

◆ **The Human Eye and the Colourful World** Causes of Defects of Vision Corrective Lenses for Vision Defects Defects of Vision – Myopia or Hypermetropia

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Model Answer

(i) The defect shown is **Hypermetropia (Far-sightedness)**. The part responsible is the **eye lens** — either its focal length is too long, or the **eyeball is too small**, causing the image to form behind the retina.

(ii) Two causes:

1. The focal length of the eye lens is too long.
2. The eyeball has become too small.

(iii) A **convex (converging) lens** is used to correct this defect. It provides the additional converging power needed to bring the image forward onto the retina, enabling clear near vision.

Source: Chapter 10, Section 10.2 (b) Hypermetropia

Explanation

- The diagram shows rays focusing **behind** the retina → this is the key identifier for Hypermetropia (not Myopia, where rays focus in front).
- Examiners expect you to name the responsible part (eye lens/eyeball shape) and both causes explicitly.
- For the lens correction, say **convex/converging** and state its **role** (brings image onto retina) — both are needed for full marks.
- Do not confuse: Myopia → concave lens; Hypermetropia → convex lens.

Q20. § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[2]**

A student has difficulty in reading his textbooks but can read the blackboard clearly while sitting in the last row. Name the defect of vision the student is suffering from. List two reasons due to which this defect arises. Write the nature of the lenses required to correct this defect.

Previously asked in: 2025 31/3/1 Q25(a)

◆ **The Human Eye and the Colourful World** | Hypermetropia (Far-sightedness) – causes and correction

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Model Answer

Defect: Myopia (near-sightedness) — the student can read the nearby textbook... wait, the student *cannot* read the textbook but *can* see the distant blackboard clearly. This is **Hypermetropia (far-sightedness)**.

Two reasons:

1. The focal length of the eye lens is too long.
2. The eyeball has become too small.

Corrective lens: Convex (converging) lens of appropriate power.

Source: Chapter 10, Section 10.2 — Defects of Vision and Their Correction

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Explanation

- Re-read the clue carefully: difficulty reading **textbooks** (nearby) but sees **blackboard** (distant) clearly → **Hypermetropia**, not myopia. A common exam trap is to misread this.
- If the question said difficulty seeing the blackboard but can read the textbook, the answer would be Myopia + concave lens.
- Examiners expect the defect name, both causes (exactly as listed in the textbook), and the lens type — all three parts must be present for full marks.

Q21. § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[1]**

An old person is suffering from an eye defect caused by weakening of ciliary muscles and diminishing flexibility of the eye lens. If the defect of vision is 'a' which can be corrected by lens 'b', then 'a' and 'b' respectively are :

(A) hypermetropia and convex lens
(B) presbyopia and bifocal lens
(C) myopia and concave lens
(D) myopia and bifocal lens

Previously asked in: 2025 31/1/1 Q14

◆ The Human Eye and the Colourful World | Presbyopia and its correction

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Model Answer

(B) presbyopia and bifocal lens

Presbyopia is caused by gradual weakening of ciliary muscles and diminishing flexibility of the eye lens (in old age), and it is corrected using bifocal lenses.

Source: Chapter 10, Section 10.2(c) – Presbyopia

Explanation

The question directly describes the cause of **presbyopia** — weakening of ciliary muscles and reduced flexibility of the eye lens. The textbook states this defect is corrected by **bifocal lenses** (containing both concave and convex portions). Options A and C describe different defects entirely; Option D incorrectly pairs myopia with bifocal lenses.

Q22. § Chapter Introduction § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[2]**

Study the given diagram and answer the questions that follow :

(a) Write the name of the eye defect shown in the diagram. Where is the image formed in this eye defect with respect to the retina of the eye ?

(b) List two causes of this eye defect.

(c) With the help of a diagram, show how this eye defect of vision is corrected.

Previously asked in: 2026 31/3/1 Q35

♦ The Human Eye and the Colourful World | Defects of Vision and their Correction | Myopia (Near-sightedness) – causes, image formation, and correction

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Model Answer

(a) The eye defect shown is **Myopia (Near-sightedness)**. In this defect, the image is formed **in front of the retina** instead of on it.

(b) Two causes of myopia:

1. Excessive curvature (elongation) of the eye lens.
2. Elongation of the eyeball.

(c) Myopia is corrected using a **concave lens** of suitable focal length.

Diagram:

```
Incoming [Concave] EYE
light rays → lens → ____
\ → ( | → / \
\ → | →| image|
/ → | → \____/ ← on retina
```

A concave lens diverges the light rays so that they converge exactly on the retina.

Explanation

- The diagram in the question shows image forming **in front** of the retina → myopia. (If it were behind, it would be hypermetropia — read the diagram carefully in the exam.)
- For causes, always give **two distinct biological/structural reasons** — elongated eyeball and increased lens curvature are the standard NCERT answers.
- The correction diagram must show: parallel rays → concave lens → rays diverge → converge on retina. Draw and label clearly; examiners award 1 mark for the diagram alone.
- Part (a) is ~1 mark, (b) ~1 mark (½ each), (c) ~1 mark (diagram). Adjust if your paper allocates differently.

Q23. § 10.1 THE HUMAN EYE | § 10.1.1 Power of Accommodation | § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[2]**

Why is the concave lens used as a corrective lens for a myopic eye ?

Previously asked in: 2026 31/2/1 Q34 (b)

◆ **The Human Eye and the Colourful World** | Myopia (Short-sightedness) and correction using concave lens

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Model Answer

In a myopic eye, the image of a distant object is formed **in front of the retina** instead of on it, due to excessive curvature of the eye lens or elongation of the eyeball.

A concave lens is a **diverging lens**. It diverges the incoming light rays before they enter the eye, effectively shifting the image backward onto the retina, thus restoring clear distant vision.

Source: Defects of Vision and Their Correction, Chapter 10

Explanation

Examiners expect two clear points: **(1) what goes wrong in myopia** (image forms in front of retina) and **(2) how a concave lens fixes it** (diverges rays to push image back onto retina). Mentioning "diverging lens" earns terminology marks. Avoid lengthy diagrams unless asked — just state the cause and correction concisely.

Q24. § 10.1.1 Power of Accommodation | § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[1]**

To restore clear vision in persons whose size of the eye ball has reduced, he/she is suggested to use suitable

(A) Converging lens
(B) Diverging lens
(C) Bifocal lens
(D) Cylindrical lens

Previously asked in: 2026 31/5/1 Q31

◆ **The Human Eye and the Colourful World** | Hypermetropia (Far-sightedness) – correction using convex lens

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Model Answer

(A) Converging lens

When the eyeball becomes too small, light focuses behind the retina (hypermetropia). A converging (convex) lens corrects this by converging rays to form the image on the retina.

Source: The Human Eye and the Colourful World, Section 10.2(b)

Explanation

A reduced eyeball size causes hypermetropia (far-sightedness). The correction requires a **convex/converging lens**, not diverging. Bifocal is for presbyopia; cylindrical is for astigmatism. Examiners expect you to link "reduced eyeball → hypermetropia → converging lens."

Q25. § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[3]**

A person is unable to read a book placed closer than 1 meter from his eyes. Identify the defect of vision in his eyes. Draw the ray diagrams to show the defect of vision and its correction.

Previously asked in: 2026 31/1/1 Q35

◆ **The Human Eye and the Colourful World** | Hypermetropia (far-sightedness) and its correction using convex lens

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Model Answer

Defect: Hypermetropia (Far-sightedness)

The person cannot read a book closer than 1 m, meaning the near point has shifted beyond 25 cm. This is Hypermetropia.

Cause: The image of a nearby object is focused behind the retina because the focal length of the eye lens is too long or the eyeball is too small.

Ray Diagrams:

Defect:

```
Object → [Hypermetropic Eye Lens] → Image formed BEHIND retina
```

Correction: A **convex (converging) lens** of suitable power is used. It converges the incoming rays so that the image falls exactly on the retina.

```
Object → [Convex Lens] → [Eye Lens] → Image ON retina
```

The convex lens provides the additional focusing power needed to bring the image onto the retina.

Source: Chapter 10, Section 10.2(b) — Hypermetropia

Explanation

- The key clue is "cannot read closer than 1 m" — the near point is 1 m instead of the normal 25 cm. This directly indicates **Hypermetropia**, not myopia.
- Examiners award 1 mark for naming the defect, 1 mark for the defect diagram, and 1 mark for the correction diagram. Label diagrams clearly: show object, lens, retina, and where the image forms.
- Always state the corrective lens type and **why** it works (provides extra converging power).
- Do not confuse with Myopia (distant objects blurred, corrected by concave lens).

Q26. § 10.1.1 Power of Accommodation § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[1]**

The vision defect which arises due to gradual weakening of the ciliary muscles and diminishing flexibility of eye lens is :

(A) Myopia
(B) Hypermetropia
(C) Presbyopia
(D) Myopia and hypermetropia both

Previously asked in: 2026 31/4/1 Q31

◆ The Human Eye and the Colourful World | Presbyopia (Defects of Vision)

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Model Answer

(C) Presbyopia

This defect arises due to the gradual weakening of the ciliary muscles and diminishing flexibility of the eye lens, usually occurring with ageing.

Source: Chapter 10, Section 10.2(c) – Presbyopia

Explanation

The key phrase in the question — *"gradual weakening of ciliary muscles and diminishing flexibility of eye lens"* — is the textbook definition of **Presbyopia**. Myopia is caused by excessive curvature of the lens or elongation of the eyeball; Hypermetropia is caused by too long a focal length or a small eyeball. For a 1-mark MCQ, simply stating **(C) Presbyopia** with a one-line reason is sufficient.

Q27. § 10.3 REFRACTION OF LIGHT THROUGH A PRISM **[2]**

Draw a ray diagram to show the refraction of a ray of light passing through an equilateral glass prism. Mark the angle through which the emergent ray bends from the direction of the incident ray and also name it.

Previously asked in: 2025 31/4/1 Q25(A)

◆ **The Human Eye and the Colourful World** | Refraction through a glass prism – ray diagram and angle of deviation

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Model Answer

Ray Diagram:

```
A
/\
/ \
/ \
P→ E →→→ F →S
/ \
B C
```

A ray PE is incident on face AB, refracts along EF inside the prism, and emerges as FS through face AC. The emergent ray FS bends towards the base of the prism compared to the original incident ray direction.

The angle between the incident ray (extended) and the emergent ray is called the **angle of deviation** (∠D).

(Diagram should show normals at E and F, angles ∠i, ∠r, ∠e, and ∠D marked clearly.)

Source: Chapter 10, Section 10.3 — Refraction of Light Through a Prism

---

Explanation

- Examiners expect a labelled diagram showing: incident ray (PE), refracted ray (EF), emergent ray (FS), normals at both surfaces, and the angle of deviation ∠D marked between the extended incident ray and the emergent ray.
- The **angle of deviation** is the key term — must be named explicitly for full marks.
- The ray always bends towards the **base** of the prism; mentioning this can earn credit.
- Two marks: 1 for correct diagram with labels, 1 for naming the angle of deviation.

Q28. § 10.3 REFRACTION OF LIGHT THROUGH A PRISM **[3]**

Answer the following:

(a) Draw the ray diagram for refraction of light through a glass prism and mark angle of refraction and angle of deviation.

(b) When the path of a light ray refracted through a glass prism is reversed how will the angle of deviation change ? Explain.

Previously asked in: 2026 31/5/1 Q35

◆ **The Human Eye and the Colourful World**

Refraction of light through a glass prism – ray diagram, angle of refraction, and angle of deviation

Reversibility of light path through a prism and its effect on angle of deviation

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Model Answer

(a) Ray diagram for refraction through a glass prism:

```
A
/\
/ \
i→ / \
————/————\————
r | | r'
| |
————\————/————
\ / →e
\ /
\/
B
```

Draw incident ray, refracted ray inside prism, and emergent ray.

- **Angle of refraction (r):** angle between the refracted ray inside the prism and the normal at the first surface.
- **Angle of deviation (D):** angle between the original direction of the incident ray and the direction of the emergent ray.

(b) When the path of the light ray is reversed, **the angle of deviation remains the same.**

This is because refraction is a reversible process. The reversed ray retraces the original path — it enters at the second surface and exits at the first — but the angle between the incident and emergent directions remains unchanged. The angle of deviation depends only on the angle of incidence and the prism, not on the direction of travel.

Explanation

- Part (a) carries ~2 marks: draw a clear labelled diagram showing the incident ray, normal at both surfaces, refracted ray inside the prism, emergent ray, and mark **r** (angle of refraction at first surface) and **D** (angle of deviation). Label the prism clearly.
- Part (b) carries ~1 mark: the key fact is that the angle of deviation **does not change** because refraction is reversible. State the reason briefly.

- Examiners look for the correct labelling in the diagram and the correct conclusion (unchanged) with a one-line reason in part (b).

Q29. § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[1]**

In the following diagram showing dispersion of white light by a glass prism, the colours 'P' and 'Q' respectively are –

(a) Red and Violet
(b) Violet and Red
(c) Red and Blue
(d) Orange and Green

Previously asked in: 2023 31/6/1 Q13

◆ **The Human Eye and the Colourful World** | Dispersion of White Light by a Glass Prism

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Model Answer

(b) Violet and Red

In dispersion by a prism, violet light bends the most and red light bends the least. The lower ray (P) is deviated more, so P is **Violet**; the upper ray (Q) is deviated less, so Q is **Red**.

Source: Light – Reflection and Refraction, Section 10.4 Dispersion of White Light by a Glass Prism

Explanation

The key principle: violet deviates the most → appears at the bottom of the spectrum (lower emergent ray = P); red deviates the least → appears at the top (upper emergent ray = Q). The order from bottom to top is VIBGYOR. Examiners look for correct identification of both colours mapped to their positions in the diagram.

Q30. § 10.3 REFRACTION OF LIGHT THROUGH A PRISM § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[2]**

A narrow beam XY of white light is passing through a glass prism ABC as shown in the diagram. Trace it on your answer sheet and show the path of the emergent beam as observed on the screen PQ. Name the phenomenon observed and state its cause.

Previously asked in: 2023 31/1/1 Q25(a)

◆ **The Human Eye and the Colourful World** Cause of dispersion – different refractive indices for different colours (wavelengths) Dispersion of white light through a glass prism

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Model Answer

Path of emergent beam: The white light entering the prism splits into a band of seven colours — Violet, Indigo, Blue, Green, Yellow, Orange, Red (VIBGYOR) — on the screen PQ. Violet deviates the most and appears at the top (near P), red deviates the least and appears at the bottom (near Q).

Phenomenon: Dispersion of white light.

Cause: Different colours of white light bend through different angles while passing through the prism, because each colour travels at a different speed in glass. Violet bends the most and red the least.

Source: Chapter 10, Section 10.4 – Dispersion of White Light by a Glass Prism

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Explanation

- Examiners expect: (1) a correctly labelled diagram/trace showing the spectrum with VIBGYOR order, (2) the name "dispersion," and (3) the cause (different colours bend by different amounts / travel at different speeds in glass).
- A common mistake is reversing the order — remember violet is most deviated (bends toward the base more), so it appears lower on the screen if the prism apex points up. In the standard diagram with apex at top and screen to the right, violet is at the bottom (toward Q) and red at the top (toward P) — check the prism orientation in your diagram carefully before drawing.
- "VIBGYOR" must appear in your answer to show you know the colour sequence.

Q31. § Chapter Introduction § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[3]**

Draw a ray diagram to show the formation of a rainbow in the sky. On this diagram mark A – where dispersion of light occurs, B – where internal reflection of light occurs and C – where refraction of light occurs. List two necessary conditions to observe a rainbow.

Previously asked in: 2024 31/2/1 Q31(b)

◆ The Human Eye and the Colourful World | Conditions necessary to observe a rainbow | Formation of a Rainbow – ray diagram showing dispersion, internal reflection, and refraction

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Model Answer

Ray Diagram:

```
Sunlight → [Enter droplet]
A (Dispersion - refraction at entry)
↘
B (Internal reflection at back of droplet)
↙
C (Refraction at exit)
→ Dispersed colours to observer's eye
```

Draw a circular water droplet. Mark:

- **A** – at the point where sunlight enters the droplet (dispersion occurs here)
- **B** – at the back surface inside the droplet (total internal reflection)
- **C** – at the point where light exits the droplet (second refraction)

Two necessary conditions to observe a rainbow:

1. The Sun should be behind the observer (rainbow forms in the direction opposite to the Sun).
2. Rain/water droplets must be present in the atmosphere in front of the observer.

Source: Chapter 10, Section 10.4 – Dispersion of White Light by a Glass Prism

---

Explanation

- The textbook states that water droplets **refract and disperse** (A) → **internally reflect** (B) → **refract again** (C). Examiners expect all three labels correctly placed on the droplet diagram.
- The two conditions come directly from the text: Sun behind you, and water droplets (rain) in front. Many students forget to mention the Sun's position — this is a common mark-losing error.
- Since this is a diagram-based question, even a rough but correctly labelled sketch earns marks. Neatness and correct labelling of A, B, C are key.

Q32. § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[1]**

Assertion (A) : The rainbow is a natural spectrum of sunlight in the sky.
Reason (R) : Rainbow is formed in the sky when the sun is overhead and water droplets are also present in air.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2024 31/1/1 Q20

◆ The Human Eye and the Colourful World | Formation of rainbow – conditions and mechanism | Rainbow as a natural spectrum of sunlight

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Model Answer

(c) Assertion (A) is true, but Reason (R) is false.

The Assertion is correct — rainbow is a natural spectrum of sunlight. However, the Reason is false because a rainbow is formed **opposite** to the Sun (not when the Sun is overhead) after a rain shower.

Source: Chapter 10, Section 10.4 — Dispersion of White Light by a Glass Prism

---

Explanation

The key error in Reason (R) is the phrase "sun is overhead." The textbook clearly states that a rainbow is **always formed in a direction opposite to that of the Sun**. The sun being overhead is incorrect — the observer must have the Sun **behind** them. The presence of water droplets is correct, but since one part of the Reason is wrong, the whole Reason is false, making option (c) the right choice.

Q33. § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[2]**

What is a rainbow ? "We see a rainbow in the sky only after the rainfall." Why ?

Previously asked in: 2025 31/6/1 Q25(b)

◆ **The Human Eye and the Colourful World** | Rainbow – formation and explanation

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Model Answer

A **rainbow** is a natural spectrum of colours appearing in the sky, caused by **dispersion of sunlight by tiny water droplets** present in the atmosphere.

After rainfall, tiny water droplets remain suspended in the atmosphere. These droplets act like small prisms — they **refract, internally reflect, and refract** the sunlight again, dispersing it into its seven colours (VIBGYOR). Hence, a rainbow is seen only after rainfall.

Source: Chapter 10, Section 10.4 Dispersion of White Light by a Glass Prism

---

Explanation

- The question has two parts: define rainbow + explain why only after rainfall. Address both.
- Key terms examiners look for: **dispersion**, **water droplets act as prisms**, **refraction + internal reflection + refraction**.
- Mentioning VIBGYOR or "seven colours" adds value but is not compulsory for 2 marks.
- Keep it concise — 2 marks = ~2 key points, no elaborate diagrams needed unless asked.

Q34. § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[4]**

> The students in a class took a thick sheet of cardboard and made a small hole in its centre. Sunlight was allowed to fall on this small hole and they obtained a narrow beam of white light. A glass prism was taken and this white light was allowed to fall on one of its faces. The prism was turned slowly until the light that comes out of the opposite face of the prism appeared on the nearby screen. They studied this beautiful band of light and concluded that it is a spectrum of white light.

Read the source and answer the questions that follow.

(i) Give any one more instance in which this type of spectrum is observed. [1]

(ii) What happens to white light in the above case? [1]

(iii) List two conditions necessary to observe a rainbow. [2]

Previously asked in: 2025 31/4/1 Q39

◆ The Human Eye and the Colourful World | Atmospheric refraction and natural spectrum instances | Dispersion of white light through a glass prism | Rainbow formation and conditions for observing a rainbow

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Model Answer

(i) A rainbow formed in the sky after rain is one natural instance where a spectrum of white light (dispersion) is observed.

(ii) White light splits into its seven constituent colours — Violet, Indigo, Blue, Green, Yellow, Orange, and Red (VIBGYOR) — on passing through the prism. This phenomenon is called **dispersion of light**.

(iii) Two conditions necessary to observe a rainbow:

1. The sun should be shining (presence of sunlight) and it should be at the observer's back.
2. Rain should be falling (water droplets must be present in the atmosphere) in front of the observer.

Source: Light – Reflection and Refraction / Human Eye and the Colourful World, NCERT Science Class 10

Explanation

- **(i)** Any valid natural example of dispersion counts — rainbow is the most expected answer.
- **(ii)** Examiners want the term **dispersion** and the mention of VIBGYOR. Both together earn the mark.
- **(iii)** Two distinct, correctly stated conditions are needed for full 2 marks. The key points are: sunlight behind the observer + rain/water droplets in front. Avoid vague answers like "it should rain and be sunny."

Q35. § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[2]**

(a) When and where does a rainbow appear in the sky ? Draw a labelled ray diagram to show its formation.

Previously asked in: 2023 31/2/1 Q24 (a)

◆ **The Human Eye and the Colourful World** | Formation of Rainbow

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Model Answer

A rainbow appears in the sky **after a rain shower**, always in the **direction opposite to the Sun**.

It is caused by dispersion of sunlight by tiny water droplets in the atmosphere. The droplets refract and disperse sunlight, internally reflect it, and refract it again on exit, producing the VIBGYOR spectrum.

Ray Diagram:

```
Sunlight → [Water Droplet]
/ Refraction (dispersion)
/ Internal Reflection
/ Refraction (exit)
↓
Observer's Eye
(Violet at bottom, Red at top)
```

(Label: incident sunlight, refraction, internal reflection, dispersed colours — Red, Orange, Yellow, Green, Blue, Indigo, Violet)

Source: Chapter 10, Section 10.4 — Dispersion of White Light by a Glass Prism

---

Explanation

- Examiners expect **two facts**: *when* (after rain shower) and *where* (opposite to the Sun) — both needed.
- The ray diagram must show a **water droplet** with labelled steps: refraction → internal reflection → refraction, and the emerging colour band (VIBGYOR). A neat labelled sketch earns the diagram mark.
- Avoid writing lengthy explanations; state the cause (dispersion by water droplets) briefly.

Q36. § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[3]**

What is dispersion of white light ? State its cause. Draw a diagram to show dispersion of a beam of white light by a glass prism.

Previously asked in: 2024 31/5/1 Q31 (b)

◆ The Human Eye and the Colourful World | Dispersion of White Light by a Glass Prism

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Model Answer

Dispersion of White Light:
The splitting of white light into its seven constituent colours (VIBGYOR) on passing through a prism is called dispersion.

Cause:
Different colours of light have different speeds in glass, so they bend through different angles on refraction. Violet bends the most and red bends the least, causing them to separate.

Diagram:

```
White light
|
_____________\_____________
| \ Glass Prism |
| \ |
|_________\_________________|
\
\——— Violet
\—— Indigo
\— Blue
\- Green
```

- Yellow

```
Orange
Red
(Screen — VIBGYOR)
```

Source: Chapter 10, Section 10.4 — Dispersion of White Light by a Glass Prism

---

Explanation

- **Definition (1 mark):** State that splitting of white light into VIBGYOR is called dispersion.
- **Cause (1 mark):** Different colours travel at different speeds in glass → different degrees of bending. Violet bends most, red bends least.
- **Diagram (1 mark):** Draw a triangular prism with a single white ray entering one face and seven colours (VIBGYOR order) emerging from the other face, fanning out onto a screen. Label "White light," the prism, and at least "Violet" and "Red" at the two ends of the spectrum.

Q37. § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[1]**

The phenomena of light involved in the formation of rainbow are :

(A) Refraction, reflection and dispersion
(B) Refraction, dispersion and internal reflection
(C) Reflection, dispersion and internal reflection
(D) Refraction, dispersion, scattering and total internal reflection

Previously asked in: 2024 31/5/1 Q12

◆ **The Human Eye and the Colourful World** Formation of Rainbow – Dispersion, Refraction, and Total Internal Reflection

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Model Answer

(B) Refraction, dispersion and internal reflection

Water droplets refract and disperse sunlight, then internally reflect it, and refract it again on exit, forming the rainbow.

Source: Chapter 10, Section 10.4 Dispersion of White Light by a Glass Prism

---

Explanation

The textbook explicitly states: "They refract and disperse the incident sunlight, then reflect it internally, and finally refract it again when it comes out of the raindrop." The key word is **internal reflection** (not *total* internal reflection — option D also wrongly adds scattering). Option (A) says plain "reflection" which is incorrect. The correct phenomena are **refraction + dispersion + internal reflection → Option (B)**.

Q38. § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[3]**

What is a rainbow ? Draw a labelled diagram to show its formation.

Previously asked in: 2025 31/3/1 Q31

◆ The Human Eye and the Colourful World | Rainbow – Formation and Diagram

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Model Answer

Rainbow: A rainbow is a natural spectrum of light appearing in the sky after a rain shower. It is caused by **dispersion of sunlight by tiny water droplets** in the atmosphere. The water droplets act like small prisms — they refract and disperse sunlight, reflect it internally, and refract it again on exit. It is always formed in the direction **opposite to the Sun**.

Diagram:

```
Sunlight
   │
   ▼
 ┌─────────┐
 │ Water   │ ← Refraction + Dispersion
 │ Droplet │ ← Internal Reflection
 └─────────┘
   │
   ▼
V I B G Y O R → Observer's Eye
(Violet bends most, Red bends least)
```

Labels: Sunlight (incident), Water droplet, Internal reflection, Dispersed colours (VIBGYOR), Observer's eye.

Source: Chapter 10, Section 10.4 (Dispersion of White Light by a Glass Prism)

Explanation

- **Definition (1 mark):** Mention natural spectrum, rain shower, dispersion by water droplets.
- **Mechanism (1 mark):** Three steps — refraction + dispersion → internal reflection → refraction again on exit. Also note it forms opposite to the Sun.
- **Diagram (1 mark):** Show sunlight entering a circular droplet, internal reflection inside, colours emerging with VIBGYOR labelled. Violet at top (bends most), Red at bottom (bends least) in the actual rainbow arc.
- Examiners look for the word **dispersion**, **internal reflection**, and a neat labelled diagram. Don't skip any of the three optical steps.

Q39. § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[4]**

> A person allowed a narrow beam of white light from the sun to enter a dark room through a small aperture and placed a glass prism in its path in such a manner that the beam falls on the face AB of the prism as shown in the figure. A screen S is placed on the other side of the prism, facing AC. On turning the prism slowly, a beautiful band of colours is obtained on the screen. It is the spectrum of sunlight.

Read the case carefully and answer the questions that follow.

(a) Name the phenomenon due to which a prism splits the incident white light into a band of colours. [1]

(b) State the reason of getting a band of seven colours in the above case. [1]

(c) (i) Explain with the help of a labelled ray diagram, an experimental arrangement to show the recombination of the spectrum of white light. [2]

Previously asked in: 2025 31/2/1 Q39

◆ The Human Eye and the Colourful World | Dispersion of white light through a prism | Formation of spectrum – different refractive indices for different colours | Recombination of spectrum of white light – ray diagram

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Model Answer

(a) The phenomenon is called **dispersion of light**.

(b) White light is composed of seven colours (VIBGYOR). Each colour has a different wavelength and travels at a different speed in glass, so the prism bends (refracts) each colour by a different angle, splitting them into a band of seven colours.

(c)(i)

Experimental arrangement for recombination:

Two identical glass prisms P_1 and P_2 are placed with their bases in opposite directions (inverted with respect to each other).

- Prism P_1 disperses white light into seven colours (VIBGYOR).
- Prism P_2 acts as the recombining prism; it refracts each colour in the opposite direction.
- The colours recombine to give back **white light** on the screen.

Labelled Ray Diagram:

```
White light → [P1] → VIBGYOR (spectrum) → [P2 inverted] → White light → Screen
```

(P_1: dispersing prism; P_2: inverted prism; arrows show direction of rays)

Source: Light – Reflection and Refraction / Human Eye and the Colourful World, NCERT Class 10 Science

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Explanation

- **(a)** "Dispersion" is the one-word answer examiners expect. Do not write "refraction" alone.
- **(b)** Mention two things: white light has 7 colours + each colour refracts differently due to different wavelength/speed. Both points are needed for full credit.
- **(c)(i)** The key is the **inverted second prism** — this is the standard NCERT experiment. Draw a clear diagram with P_1, P_2 (inverted), spectrum between them, and white light emerging. Even a neat schematic diagram with labels earns marks; a missing diagram loses marks.

Q40. § Chapter Introduction § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM § 10.6 SCATTERING OF LIGHT **[2]**

With the help of a ray diagram, explain any phenomenon of formation of spectrum in nature.

Previously asked in: 2026 31/3/1 Q34 (b)

◆ **The Human Eye and the Colourful World** Formation of Rainbow – Dispersion of Light in Nature

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Model Answer

Rainbow is a natural spectrum formed in the sky after rain. Tiny water droplets in the atmosphere act as small prisms. Sunlight entering a droplet gets **refracted**, **internally reflected**, and **refracted again** on exit, causing dispersion into VIBGYOR (Violet to Red). Red bends least and appears at the top; Violet bends most and appears at the bottom.

Ray Diagram:

```
Sunlight → [Water Droplet]
Refraction → Internal Reflection → Refraction
→ Violet (bends most)
→ ...
→ Red (bends least)
```

(Diagram shows sunlight entering droplet, undergoing internal reflection, and emerging as a colour band.)

Source: Chapter 10, Section 10.4

Explanation

- The question asks for **any** natural spectrum phenomenon — Rainbow is the best choice as it is directly explained in the textbook.
- Examiners expect: name of phenomenon + cause (water droplets acting as prisms) + sequence of events (refraction → internal reflection → refraction) + mention of VIBGYOR.
- Draw a neat labelled diagram showing a raindrop with an incoming white ray, internal reflection, and emerging coloured rays. Even a rough sketch earns the diagram mark.
- Key point: Rainbow is always seen **opposite to the Sun**.

Q41. § 10.3 REFRACTION OF LIGHT THROUGH A PRISM § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[1]**

Observe the given ray diagram showing refraction through a prism and choose the correct option for colour of rays 1 and 2 :

(A) Colour of ray 1: Blue; Colour of ray 2: Red
(B) Colour of ray 1: Green; Colour of ray 2: Yellow
(C) Colour of ray 1: Red; Colour of ray 2: Violet
(D) Colour of ray 1: Violet; Colour of ray 2: Red

Previously asked in: 2026 31/3/1 Q31

◆ The Human Eye and the Colourful World | Dispersion of light through a prism – identifying colours by angle of deviation

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Model Answer

(C) Colour of ray 1: Red; Colour of ray 2: Violet

Red light bends the least and violet bends the most while passing through a prism. So Ray 1 (less deviated) is red and Ray 2 (more deviated) is violet.

Explanation

The key fact from the textbook (Section 10.4) is: *"The red light bends the least while the violet the most."* In a prism dispersion diagram, the ray closest to the original direction of white light is red, and the most deviated ray is violet. Examiners expect you to directly apply VIBGYOR and the deviation rule.

Q42. § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[1]**

A thin beam of white light falls on a face of a glass prism and a spectrum is obtained on a screen. Which of the following options is the correct sequence of colours from top to bottom on the screen ?

(A) Red, Green, Yellow, Violet, Blue
(B) Red, Yellow, Green, Blue, Violet
(C) Violet, Blue, Green, Yellow, Red
(D) Violet, Red, Green, Yellow, Blue

Previously asked in: 2026 31/2/1 Q31

◆ The Human Eye and the Colourful World | Dispersion of white light through a prism – sequence of colours in spectrum

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Model Answer

(B) Red, Yellow, Green, Blue, Violet

The correct sequence from top to bottom is: **Red, Yellow, Green, Blue, Violet** — since violet bends the most and red bends the least while passing through the prism.

Source: Chapter 10, Section 10.4 – Dispersion of White Light by a Glass Prism

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Explanation

The full spectrum is VIBGYOR (Violet, Indigo, Blue, Green, Yellow, Orange, Red). Violet deviates the most, so it appears at the bottom; Red deviates the least, so it appears at the top. Option (B) follows this order (a condensed ROYGBV sequence), making it correct. Students often confuse top/bottom — remember: least deviation = top (Red), most deviation = bottom (Violet).

Q43. § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[1]**

Assertion (A) : When rays of white light pass through a prism, on emerging they give spectrum of seven colours.
Reason (R) : It is due to the scattering of light that red light bends minimum and violet light bends the maximum.

A Both, Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
B Both, Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
C Assertion (A) is true, but Reason (R) is false.
D Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2026 31/1/1 Q32

◆ The Human Eye and the Colourful World | Dispersion of white light by a prism

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Model Answer

Answer: C

Assertion (A) is true, but Reason (R) is false. The spectrum is produced due to **dispersion** (different colours bend by different angles through refraction), not scattering. Red bends least and violet bends most because of dispersion by the prism.

Explanation

- The Assertion is correct — white light splits into VIBGYOR on passing through a prism.
- The Reason is **false** because the cause is **dispersion of light** (different refractive indices for different colours), NOT scattering. Scattering explains phenomena like the blue sky, not the prism spectrum. Since the Reason is false, option **C** is correct.

Q44. § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[3]**

Explain the phenomenon of rainbow formation in the sky. Draw the labelled ray diagram in support of your explanation.

Previously asked in: 2026 31/4/1 Q36

◆ **The Human Eye and the Colourful World** | Rainbow Formation (Dispersion of Light by Water Droplets)

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Model Answer

A rainbow is a natural spectrum formed in the sky after a rain shower. It is caused by **dispersion of sunlight by tiny water droplets** in the atmosphere. The water droplets act as small prisms. Sunlight entering a droplet is **refracted and dispersed**, then undergoes **total internal reflection** inside the droplet, and is **refracted again** while emerging. Due to dispersion, different colours (VIBGYOR) reach the observer's eye at different angles. A rainbow is always formed in the direction **opposite to the Sun**.

Ray Diagram:

```
Sunlight → [Water Droplet]
↗ Refraction (dispersion)
↘ Internal Reflection
↘ Refraction (exit)
→ Violet (inner arc) to Red (outer arc) → Observer's Eye
```

(Labelled diagram should show: incident sunlight, refraction at entry, internal reflection, refraction at exit, and emergent colours R, O, Y, G, B, I, V)

Source: Chapter 10, Section 10.4 Dispersion of White Light by a Glass Prism

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Explanation

- **3 marks** = definition/cause (1 mark) + process inside droplet (1 mark) + diagram (1 mark).
- Key terms examiners look for: *dispersion*, *refraction*, *internal reflection*, *water droplets act as prisms*, *opposite direction to Sun*, *VIBGYOR*.
- The diagram must be labelled with at least: incident ray, refraction, internal reflection, emergent colours. A neat, labelled sketch earns the diagram mark even if not perfectly drawn.
- Do **not** confuse the order: Red is on the **outer** arc, Violet on the **inner** arc of the rainbow.

Q45. § 10.5 ATMOSPHERIC REFRACTION § 10.6 SCATTERING OF LIGHT

Give reasons for the following : The sky appears dark to the passengers flying at very high altitudes.

Previously asked in: 2023 31/1/1 Q31 (b)

◆ **The Human Eye and the Colourful World** Scattering of Light and Appearance of the Sky

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Model Answer

At very high altitudes, the atmosphere is very thin and there are very few particles present to scatter sunlight. Since scattering of light is not prominent at such heights, the blue colour (which is scattered by atmospheric particles near the earth's surface) does not reach the passengers' eyes. Hence, the sky appears dark to them.

Source: Chapter 10, Section 10.6.2 – Why is the colour of the clear Sky Blue?

Explanation

- The key concept is **scattering of light**: fine atmospheric particles near the earth's surface scatter shorter (blue) wavelengths, making the sky appear blue.
- At very high altitudes, the atmosphere is very thin, so **scattering is negligible** → sky looks dark.
- The textbook directly states: *"The sky appears dark to passengers flying at very high altitudes, as scattering is not prominent at such heights."* Always use this line as the concluding statement.
- Examiners look for: mention of scattering, thin atmosphere/fewer particles, and the result (sky appears dark). Don't write about blue colour in detail — just connect its **absence** to why the sky looks dark.

Q46. § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM § 10.5 ATMOSPHERIC REFRACTION

Give reasons for the following : Danger signals installed at airports and at the top of tall buildings are of red colour.

Previously asked in: 2023 31/1/1 Q31 (a)

◆ **The Human Eye and the Colourful World** Scattering of Light – Red colour has least scattering and maximum visibility

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Model Answer

Red light has the longest wavelength among all colours of visible light. Due to its long wavelength, red light is **least scattered** by fog, smoke, or dust particles in the atmosphere. Therefore, red light can travel the longest distance without significant loss of intensity and is visible clearly from far away. This makes red colour ideal for danger signals at airports and tall buildings, ensuring they are visible even in poor weather conditions.

Source: Chapter 10, Section 10.6 – Scattering of Light

Explanation

The key concept here is **scattering of light** — shorter wavelengths (violet, blue) scatter more, longer wavelengths (red) scatter least. Examiners expect you to explicitly state: (1) red has the longest wavelength, (2) it is least scattered by fog/smoke, and (3) therefore visible from the greatest distance. Don't just say "red is not scattered" — say *least scattered* and link it to visibility from a distance. The textbook itself uses this example directly in Section 10.6.

Q47. § 10.6 SCATTERING OF LIGHT **[3]**

Name and explain the phenomenon of light due to which the path of a beam of light becomes visible when it enters a smoke filled room through a small hole. Also state the dependence of colour of the light we receive on the size of the particle of the medium through which the beam of light passes.

Previously asked in: 2024 31/3/1 Q31

◆ The Human Eye and the Colourful World | Dependence of scattered light colour on particle size | Scattering of Light (Tyndall Effect)

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Model Answer

Tyndall Effect: When a beam of light passes through a smoke-filled room through a small hole, its path becomes visible due to **scattering of light by colloidal particles**. This phenomenon is called the **Tyndall Effect**. The smoke particles (colloidal size) scatter the light falling on them, making the beam's path visible to an observer on the side.

Dependence of colour on particle size:

- Very fine (small) particles scatter mainly **blue light** (shorter wavelengths).
- Particles of **larger size** scatter light of longer wavelengths (like red/yellow).
- If particles are very large, the scattered light may appear **white**.

Source: Chapter 10, Section 10.6.1 Tyndall Effect

Explanation

- The question has two parts — name + explain the phenomenon (2 marks) and state colour dependence (1 mark). Allocate your writing accordingly.
- Always name the phenomenon first (**Tyndall Effect**), then explain it using key terms: scattering, colloidal particles, beam visibility.
- For colour dependence, examiners expect the three-point progression: fine particles → blue; larger particles → longer wavelengths; very large → white. Don't skip any.
- Avoid mixing up scattering with refraction or reflection — these are common errors.

Q48. § Chapter Introduction § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM § 10.6 SCATTERING OF LIGHT **[1]**

Assertion (A) : Red light signals are used to stop the vehicles on the road. Reason (R) : Red coloured light is scattered the most so as to be visible from a large distance.

A Both (A) and (R) are true and (R) is the correct explanation of (A).
B Both (A) and (R) are true and (R) is not correct explanation of (A).
C (A) is true, but (R) is false.
D (A) is false, but (R) is true.

Previously asked in: 2024 31/3/1 Q19

◆ The Human Eye and the Colourful World | Scattering of Light and Use of Red Light for Danger Signals

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Model Answer

Option C — (A) is true, but (R) is false.

Assertion is correct, but the Reason is wrong: red light is **least** scattered (not most), so it travels farthest without losing intensity, making it visible from a large distance.

Explanation

The textbook explicitly states: *"The red is least scattered by fog or smoke. Therefore, it can be seen in the same colour at a distance."* Blue light (shorter wavelength) is scattered the most. Students often confuse "visible from far" with "scattered the most" — actually the opposite is true. Least scattering = least loss of intensity = visible over greater distances.

Q49. § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM **[1]**

The Phenomena of light involved in the formation of a rainbow in the sky are

A Refraction, dispersion and reflection
B Refraction, dispersion and total internal reflection
C Dispersion, scattering and reflection
D Dispersion, refraction and internal reflection

Previously asked in: 2024 31/3/1 Q13

◆ The Human Eye and the Colourful World | Dispersion of Light | Formation of Rainbow | Total Internal Reflection and Refraction in Rainbow

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Model Answer

The correct answer is **(A) Refraction, dispersion and reflection.**

Water droplets refract and disperse sunlight into its colours, then internally reflect it, and refract it again as it exits — forming a rainbow.

Source: Chapter 10, Section 10.4 Dispersion of White Light by a Glass Prism

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Explanation

The textbook explicitly states: "They refract and disperse the incident sunlight, then **reflect it internally**, and finally refract it again." The key word is **internal reflection**, not **total internal reflection** (which rules out option B). Option A uses the general term "reflection," matching the textbook language. Scattering (option C/D) plays no role in rainbow formation. Remember: the three phenomena are **refraction + dispersion + (internal) reflection**.

Q50. § 10.4 DISPERSION OF WHITE LIGHT BY A GLASS PRISM § 10.5 ATMOSPHERIC REFRACTION § 10.6 SCATTERING OF LIGHT **[2]**

Give reasons :
(i) The sky appears dark to passengers flying at very high altitude.
(ii) 'Danger' signal lights are red in colour.

Previously asked in: 2025 31/6/1 Q25(a)

◆ **The Human Eye and the Colourful World** Scattering of light – Red colour for danger signals (least scattered colour) Scattering of light – Tyndall effect and blue sky/dark sky at high altitude

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Model Answer

(i) At very high altitudes, there are very few air molecules and fine particles to scatter sunlight. Since scattering is not prominent at such heights, the sky appears dark to passengers flying at very high altitudes.

(ii) Red light has the longest wavelength among visible colours and is least scattered by fog or smoke. Therefore, red danger signals can be seen clearly from a long distance without losing their colour.

Source: Chapter 10, Section 10.6 – Scattering of Light

Explanation

- Both answers come directly from Section 10.6.2 of the textbook — quote those lines closely in the exam.
- For (i), the key phrase is **"scattering is not prominent at very high altitudes"** — no particles = no blue scattered light = dark sky.
- For (ii), the key idea is **"red is least scattered"**, so it travels farther without being diffused, making it ideal for danger/warning signals.
- Examiners look for the word **"scattering"** in both answers — don't omit it.

Q51. § 10.6 SCATTERING OF LIGHT **[2]**

(B) The colour of clear sky from the earth appears blue but from the space it appears black. Why ?

Previously asked in: 2023 31/4/1 Q25 (B)

◆ The Human Eye and the Colourful World | Scattering of Light – Blue colour of sky and black appearance from space

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Model Answer

From Earth, sunlight passes through the atmosphere where fine particles and air molecules scatter blue light (shorter wavelength) more strongly. This scattered blue light reaches our eyes, making the sky appear **blue**.

From space, there is no atmosphere to scatter sunlight. In the absence of scattering, the sky appears **black**.

Source: Chapter 10, Section 10.6.2 – Why is the colour of the clear Sky Blue?

Explanation

- The key concept is **scattering of light** — fine atmospheric particles scatter shorter wavelengths (blue) more effectively.
- Two contrasting situations are asked: from Earth (atmosphere present → scattering → blue) and from space (no atmosphere → no scattering → black/dark).
- The passage directly states: *"If the earth had no atmosphere, there would not have been any scattering. Then, the sky would have looked dark."*
- Always mention **shorter wavelength** to justify why blue is scattered more — this earns the second mark.

Q52. § 10.6 SCATTERING OF LIGHT **[2]**

(b) What is scattering of light ? Why does the clear sky appear blue ?

Previously asked in: 2023 31/2/1 Q24 (b)

◆ The Human Eye and the Colourful World | Blue Colour of the Sky (Rayleigh Scattering) | Scattering of Light

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Model Answer

Scattering of light: When sunlight strikes fine particles in the atmosphere, the light gets redirected in different directions. This phenomenon is called scattering of light.

Blue sky: The fine particles and air molecules in the atmosphere are smaller than the wavelength of visible light. They scatter blue light (shorter wavelength) much more strongly than red light. This scattered blue light enters our eyes, making the sky appear blue.

Source: Chapter 10, Section 10.6.2

Explanation

- Define scattering briefly (1 mark), then explain blue sky using the concept of wavelength-dependent scattering (1 mark).
- Key phrase: "shorter wavelengths (blue) are scattered more strongly."
- Avoid writing about Tyndall effect in detail — it wastes words here.
- Remember: red light has wavelength ~1.8 times greater than blue, so it scatters least — this is why the sky is blue, not red.

Q53. § 10.6 SCATTERING OF LIGHT **[1]**

When a beam of white light passes through a region having very fine dust particles, the colour of light mainly scattered in that region is :

A Red
B Orange
C Blue
D Yellow

Previously asked in: 2024 31/4/1 Q12

◆ The Human Eye and the Colourful World | Scattering of Light by Fine Particles

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Model Answer

Answer: C — Blue

Very fine dust particles scatter mainly blue light (shorter wavelength) more strongly than light of longer wavelengths, as per the Tyndall effect.

Source: Chapter 10, Section 10.6.1 – Scattering of Light / Tyndall Effect

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Explanation

The key line from the textbook is: *"Very fine particles scatter mainly blue light while particles of larger size scatter light of longer wavelengths."* Since the question specifies **very fine** dust particles, the answer is blue. For MCQs, no explanation is needed in the exam — just the correct option letter and a one-line reason to be safe.

Q54. § 10.6 SCATTERING OF LIGHT **[1]**

When a beam of white light passes through a region of very fine dust particles, the colour of light that scatters the most in that region is :

(A) red
(B) orange
(C) blue
(D) yellow

Previously asked in: 2025 31/3/1 Q12

◆ The Human Eye and the Colourful World | Scattering of Light – Tyndall Effect and colour scattering by fine particles

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Model Answer

(C) blue

Very fine dust particles scatter light of shorter wavelengths most. Blue light has the shortest wavelength among the given options, so it is scattered the most.

Source: Chapter 10, Section 10.6.1 – Tyndall Effect

Explanation

The key principle from the textbook: **"Very fine particles scatter mainly blue light"** (shorter wavelengths scatter more). This is the basis of the Tyndall effect. Red is scattered the least (which is why danger signals are red). In MCQs, eliminate red, orange, and yellow as they have longer wavelengths and scatter less.

Q55. § 10.6 SCATTERING OF LIGHT **[2]**

What happens when light is scattered from (i) very fine particles and (ii) very large size particles of medium ? Justify your answer in each case.

Previously asked in: 2026 31/3/1 Q34 (a)

◆ **The Human Eye and the Colourful World** | Scattering of light – dependence on particle size (Tyndall effect and large particle scattering)

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Model Answer

(i) Very fine particles: They scatter mainly blue light (shorter wavelengths) more strongly. This is why the sky appears blue, as fine atmospheric particles scatter blue light towards our eyes.

(ii) Very large size particles: They scatter light of longer wavelengths. If the particles are large enough, the scattered light may even appear **white**.

Source: Chapter 10, Section 10.6.1 – Scattering of Light / Tyndall Effect

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Explanation

- The key line from the textbook is: *"Very fine particles scatter mainly blue light while particles of larger size scatter light of longer wavelengths. If the size of the scattering particles is large enough, then, the scattered light may even appear white."*
- Examiners expect both parts answered clearly with the colour/wavelength detail and a brief justification (e.g., sky appears blue / scattered light appears white).
- Avoid writing lengthy explanations — two crisp points with justification are sufficient for 2 marks.

Q56. § 10.6 SCATTERING OF LIGHT **[3]**

What is scattering of light ? How is scattering of light different from reflection of light ? Explain.

Previously asked in: 2026 31/2/1 Q36

◆ The Human Eye and the Colourful World | Difference between Scattering and Reflection of Light | Scattering of Light

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Model Answer

Scattering of Light: When light falls on fine particles (like dust, smoke, or air molecules), it is redirected in different directions. This phenomenon is called **scattering of light**. The colour of scattered light depends on the size of the particles; fine particles scatter blue light more strongly.

Difference from Reflection:

Scattering	Reflection
Light is redirected in **all directions** by tiny particles	Light bounces back in a **definite direction** from a smooth surface
Occurs due to particles of **various sizes** (dust, molecules)	Occurs at a **polished/smooth** surface like a mirror
Does **not** follow strict laws	Follows the **two laws of reflection** strictly

Source: Chapter 10, Section 10.6 Scattering of Light; Chapter 9, Section 9.1 Reflection of Light

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Explanation

- Examiners expect a **definition** of scattering followed by a **clear comparison** with reflection — either as a table or as labelled points.
- Key contrast: scattering = multidirectional, caused by particles; reflection = directional, caused by smooth surfaces following fixed laws.
- Mentioning the **Tyndall effect** or examples (blue sky, sunlight through smoke) can earn you extra credit but is not strictly required for 3 marks.
- Do **not** confuse scattering with diffuse reflection — scattering involves particles in a medium, not a rough surface.

Q57. § Chapter Introduction § 10.1.1 Power of Accommodation § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[3]**

Define the term power of accommodation of human eye. Write the name of the part of eye which plays a major role in the process of accommodation and explain what happens when human eye focuses (i) nearby objects and (ii) distant objects.

Previously asked in: 2024 31/2/1 Q31(a)

◆ **The Human Eye and the Colourful World** Focusing Nearby and Distant Objects – Mechanism of Accommodation Power of Accommodation of the Human Eye Role of Ciliary Muscles in Accommodation

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Model Answer

Power of Accommodation: The ability of the eye lens to adjust its focal length to clearly see objects at different distances is called the power of accommodation.

Part responsible: The **ciliary muscles** play a major role in accommodation.

(i) Nearby objects: When focusing on nearby objects, the ciliary muscles **contract**, increasing the curvature of the eye lens. The lens becomes **thicker**, decreasing its focal length, thus forming a clear image on the retina.

(ii) Distant objects: When focusing on distant objects, the ciliary muscles **relax**, decreasing the curvature of the eye lens. The lens becomes **thinner**, increasing its focal length, thus forming a clear image on the retina.

Source: Chapter 10, Section 10.1.1 – Power of Accommodation

Explanation

- **Definition (1 mark):** Must include "adjust focal length" and "different distances."
- **Part named (½ mark):** Ciliary muscles — not cornea, iris, or retina.
- **Nearby & distant (1½ marks):** Examiners look for the paired contrasts — contract/relax, thicker/thinner, focal length decreases/increases. All four terms should appear. Missing any pair costs marks.
- Keep sentences crisp; avoid repeating the definition when explaining each case.

Q58. § 10.1.1 Power of Accommodation § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[3]**

Define the term power of accommodation of human eye. What happens to the image distance in the eye when we increase the distance of an object from the eye ? Name and explain the role of the part of human eye responsible for it in this case.

Previously asked in: 2024 31/4/1 Q31

◆ **The Human Eye and the Colourful World** Power of Accommodation of the Human Eye Role of the Ciliary Muscles and Crystalline Lens in Accommodation

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Model Answer

Power of Accommodation: The ability of the eye lens to adjust its focal length to see objects clearly at different distances is called the power of accommodation.

Image distance: The image distance in the eye **remains constant** (image always forms on the retina). When the object distance increases, the eye lens adjusts its focal length so that the image is still formed on the retina.

Part responsible — Ciliary Muscles: When the distance of an object increases, the ciliary muscles **relax**, causing the eye lens to become **thinner**. This **increases the focal length** of the lens, allowing the distant object to be focused clearly on the retina.

Source: Chapter 10, Section 10.1.1 – Power of Accommodation

Explanation

- Examiners expect three clear parts: definition, image distance behaviour, and explanation of ciliary muscles' role.
- A common mistake is saying image distance changes — it does NOT; it stays fixed at the retina. The focal length changes instead.
- Use key terms: *relax, thinner, focal length increases* — these fetch marks directly.

Q59. § 10.1.1 Power of Accommodation **[2]**

Answer the following:

(i) How does the change in curvature of the eye lens helps us in the process of seeing the nearby objects clearly ?

(ii) State the range of the power of accommodation of a normal human eye.

Previously asked in: 2026 31/5/1 Q34 ((A))

◆ The Human Eye and the Colourful World | Accommodation of the eye lens – change in curvature for near vision | Power of accommodation of the normal human eye

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Model Answer

(i) To see nearby objects, the ciliary muscles contract, increasing the curvature (and thus the converging power) of the eye lens. This decreases the focal length of the lens, allowing a sharp image to be formed on the retina.

(ii) The power of accommodation of a normal human eye is approximately **4 dioptres**. The near point is 25 cm and the far point is infinity.

Explanation

- For (i), examiners expect mention of: ciliary muscles contracting → increased curvature → decreased focal length → clear image on retina.
- For (ii), the standard value is ~4 D (some texts state the range as 0 to 4 D). Mentioning near point (25 cm) and far point (infinity) adds completeness.
- Note: The source passages provided are from unrelated chapters; this answer is based on standard NCERT Class 10 Science Chapter 11 (Human Eye) content, as the question clearly belongs there.

Q60. § 10.1 THE HUMAN EYE | § 10.1.1 Power of Accommodation | § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[1]**

When you look at an object very close to your eyes, the :

A Ciliary muscles of your eye contract and the eye lens becomes thick.
B Ciliary muscles of your eye get relaxed and the eye lens becomes thick.
C Ciliary muscles of your eye contract and the eye lens becomes thin.
D Ciliary muscles of your eye get relaxed and the eye lens becomes thin.

Previously asked in: 2026 31/1/1 Q31

◆ The Human Eye and the Colourful World | Accommodation and Power of the Eye

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Model Answer

Option A — Ciliary muscles of your eye contract and the eye lens becomes thick.

Explanation

From section 10.1.1: when looking at nearby objects, ciliary muscles **contract**, increasing lens curvature, making it **thicker**, and decreasing focal length. "Relaxed" muscles make the lens thin (for distant vision) — eliminate B and D. Thin lens is for distant objects — eliminate C.

Q61. § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[2]**

It is observed that the power of an eye to see nearby objects as well as far off objects diminishes with age.

(i) Give reason for the above statement.

(ii) Name the defect that is likely to arise in the eyes in such a condition.

(iii) Draw a labelled ray diagram to show the type of corrective lens used for restoring the vision of such an eye.

Previously asked in: 2023 31/1/1 Q25(b)

◆ **The Human Eye and the Colourful World** | Correction of presbyopia using bifocal lens – ray diagram | Presbyopia – causes and age-related loss of accommodation | Presbyopia – defect of vision in old age

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Model Answer

(i) With age, the ciliary muscles weaken and the flexibility of the eye lens diminishes. This reduces the eye's ability to adjust its focal length (power of accommodation decreases), making it difficult to see both nearby and distant objects clearly.

(ii) The defect is called **Presbyopia**.

(iii) Such a person requires **bi-focal lenses** — upper part concave (for distant vision) and lower part convex (for near vision).

Ray diagram (Convex lens correcting near vision):

```
Object  Convex lens  Eye
  |        | |  \   |
  ---- rays ----( )-----> [Retina]
  |        | |  /   |
```

(Convex lens converges rays so image forms on retina instead of behind it.)

Source: Chapter 10, Section 10.2(c) — Presbyopia

Explanation

- **(i)** Always link the cause to **ciliary muscles** weakening + **lens flexibility** reducing — both points may be needed for full credit.
- **(ii)** The specific name **Presbyopia** is expected; writing only "old age defect" is insufficient.
- **(iii)** For the ray diagram, examiners look for: a convex lens, rays converging onto the retina, and labelling. Since the question says "type of corrective lens," a single clear diagram of the convex lens (near vision correction) with labels is acceptable. Mention bi-focal if space permits.

Q62. § Chapter Introduction § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[3]**

A person uses lenses of +2.0 D power in his spectacles for the correction of his vision.
(a) Name the defect of vision the person is suffering from.
(b) List two causes of this defect.
(c) Determine the focal length of the lenses used in the spectacles.

Previously asked in: 2025 31/6/1 Q32

◆ **The Human Eye and the Colourful World** Hypermetropia (Far-sightedness) – defect, causes, and correction Power of a lens and focal length relationship (P = 1/f)

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Model Answer

(a) The person is suffering from **Hypermetropia** (far-sightedness). A positive (+) power lens is a convex lens, used to correct this defect.

(b) Two causes of Hypermetropia:

1. The focal length of the eye lens is too long.
2. The eyeball has become too small.

(c) Given: Power, P = +2.0 D

Using $P = \frac{1}{f}$:

$$f = \frac{1}{P} = \frac{1}{+2.0} = +0.5 \text{ m}$$

The focal length of the lens is **+0.5 m**.

Source: Chapter 10, Section 10.2 (Hypermetropia); Chapter 9, Section 9.3.8 (Power of a Lens)

Explanation

- The **positive power** directly tells you the lens is **convex**, which is used for hypermetropia — this is the key clue for part (a).
- For causes, use the exact two points from the textbook: eyeball too small OR focal length too long. Examiners award marks for these specific phrases.
- For part (c), the formula $f = 1/P$ is straightforward. Always state the unit (metres). Showing the substitution step earns full method marks even if you make an arithmetic slip.

Q63. § Chapter Introduction § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[3]**

The power of a lens is −0.25 D. Based on this information, find out

(a) The type of lens and its focal length.

(b) The eye defect for which it may be used as a corrective lens.

(c) The nature and size of the image formed by this lens when an object is placed between F and 2F from the optical centre of this lens.

Previously asked in: 2025 31/5/1 Q31

♦ The Human Eye and the Colourful World | Defects of vision – Myopia and corrective lens | Image formation by a concave lens (object between F and 2F) | Power of a lens and focal length calculation

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Model Answer

(a) Since power P = −0.25 D (negative), the lens is a **concave (diverging) lens**.

Focal length: $f = \frac{1}{P} = \frac{1}{-0.25} = -4$ **m**

(b) A concave lens is used to correct **myopia (near-sightedness)**. A myopic eye can see near objects clearly but cannot focus on distant objects.

(c) For a concave lens, the image is always **virtual, erect, and diminished**, regardless of the object's position. So when the object is placed between F and 2F, the image formed is **virtual, erect, and smaller than the object**.

Source: Chapter 9, Sections 9.3.6, 9.3.8; Chapter 10

Explanation

- **Part (a):** Negative power → concave lens. Use $f = 1/P$ directly; keep the negative sign.
- **Part (b):** Concave lenses diverge light, helping myopic eyes focus distant objects on the retina.
- **Part (c):** A concave lens *always* forms a virtual, erect, diminished image on the same side as the object, no matter where the object is placed — this is a key fact examiners test.
- Write the focal length with its unit (metres) and include the negative sign — both are award-worthy details.

Q64. § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[2]**

A person suffering from presbyopia needs bifocal lens. If he needs two lens of power −4·0 dioptre and +2·0 dioptre, which one of these two lenses is for the correction of distant vision and what is its focal length ?

Previously asked in: 2024 31/4/1 Q25

◆ **The Human Eye and the Colourful World** | Correction of defects of vision – myopia (concave lens for distant vision) | Power of a lens and focal length relationship (P = 1/f) | Presbyopia and bifocal lenses

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Model Answer

The lens of power **−4.0 D** is for the correction of **distant vision** (myopia), as it is a concave lens (negative power).

Its focal length:

$$f = \frac{1}{P} = \frac{1}{-4.0} = -0.25 \text{ m}$$

The focal length of the lens for distant vision is **−0.25 m**.

Explanation

- In bifocal lenses for presbyopia, the concave (negative power) lens corrects distant vision (myopia) and occupies the upper portion; the convex (positive power) lens corrects near vision (hypermetropia) and occupies the lower portion.
- Use $f = \frac{1}{P}$ with P in dioptres to get f in metres. Don't forget the negative sign — examiners check it.

Q65. § 10.2 DEFECTS OF VISION AND THEIR CORRECTION **[2]**

Draw a ray diagram to show the correction of eye defect of an old man who can not see an object placed closer than 1 m from his eye, clearly.

Previously asked in: 2026 31/5/1 Q34 ((B))

◆ The Human Eye and the Colourful World | Presbyopia – correction using convex lens (ray diagram)

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Model Answer

The old man cannot see objects closer than 1 m — his near point has receded. This is **Presbyopia** (or Hypermetropia). It is corrected by a **convex (converging) lens**.

Ray Diagram:

```
Object Convex Lens Eye
  |      |    |
  O ---rays----[( )]----------→ Retina
               (lens refracts (image
               rays to formed
               converge) here)
```

The convex lens converges the rays from the nearby object so that they appear to come from a point farther away (≥ 1 m), allowing the eye to focus them on the retina.

Source: Chapter 10, Section 10.2 – Defects of Vision and their Correction

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Explanation

- The examiner expects you to **identify the defect** (Presbyopia/Hypermetropia) and **name the corrective lens** (convex lens) — 1 mark.
- A clear, labelled ray diagram showing the convex lens bending rays so the image falls on the retina — 1 mark.
- Key point: the lens virtually shifts the near object to the person's near point (1 m here), making it visible. Mention this briefly.
- Since diagrams are hard to draw in text, in the actual exam draw a proper eye diagram with the convex lens in front, showing diverging rays being converged onto the retina.

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