CBSE CLASS X

Science (086)

ANSWER KEY

AI-generated question paper

Code: 18MQ5L **Questions: 29** **Maximum Marks: 50** **Generated: 2026-06-25 17:53**

SELECTIONS USED

Subject	Science
Lessons	9 Light – Reflection and Refraction
Level of understanding	Initial understanding
Question selection	Curated chapter coverage (~3 questions per section)
Model	claude-sonnet-4-6

Composition — Difficulty: 17 straightforward · 12 medium | Types: 14 Short · 12 Very short · 3 MCQ

Q1. straightforward initial-understanding § Introduction **[1]**

A small source of light casts a sharp shadow of an opaque object. What does this observation tell us about how light travels?

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Model Answer

A small source of light casting a sharp shadow of an opaque object shows that **light travels in straight lines** (rectilinear propagation of light).

Source: Chapter 9, Introduction

Explanation

The examiner expects the key term "straight lines" or "rectilinear propagation." The textbook explicitly states this observation as evidence that light travels in a straight-line path, indicated as a ray of light. One clean sentence is sufficient for 1 mark.

Q2. straightforward | initial-understanding | § 9.1 REFLECTION OF LIGHT **[1]**

A plane mirror forms an image of an object placed 10 cm in front of it. State any two properties of the image formed.

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Model Answer

The image formed by a plane mirror is **virtual and erect**. The image is of the **same size** as the object and is formed **10 cm behind** the mirror (as far behind as the object is in front).

Source: Chapter 9, Section 9.1 Reflection of Light

Explanation

The question asks for **any two** properties, but since it's 1 mark, state two concisely in one line. The key properties from the textbook are: virtual, erect, same size, laterally inverted, and image distance = object distance. Mentioning "virtual and erect" with the image distance (10 cm behind) covers the mark neatly. Examiners typically award 1 mark for any two correct properties.

Q3. straightforward | initial-understanding | § 9.2 SPHERICAL MIRRORS **[2]**

What is the relationship between the focal length (f) and the radius of curvature (R) of a spherical mirror? Using this relationship, find the focal length of a concave mirror whose radius of curvature is 24 cm.

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Model Answer

The radius of curvature (R) of a spherical mirror is twice its focal length (f):

$$R = 2f \quad \text{or} \quad f = \frac{R}{2}$$

Given: R = 24 cm (concave mirror)

$$f = \frac{R}{2} = \frac{24}{2} = -12 \text{ cm}$$

The focal length of the concave mirror is **12 cm** (negative sign indicates concave mirror).

Source: Chapter 9, Section 9.2 – Spherical Mirrors

Explanation

- The key formula $R = 2f$ must be stated first — that fetches 1 mark.
- The calculation with correct answer fetches the second mark.
- For a concave mirror, focal length is negative by the New Cartesian Sign Convention; mention it briefly to show awareness.
- Don't confuse R/2 with 2R — a common slip.

Q4. medium · initial-understanding · § 9.2 SPHERICAL MIRRORS **[3]**

A small object is placed between the pole and the principal focus of a concave mirror. What will be the nature, position and relative size of the image formed?

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Model Answer

When a small object is placed between the pole (P) and the principal focus (F) of a concave mirror:

- **Nature of image:** Virtual and erect
- **Position of image:** Behind the mirror (same side as the object)
- **Relative size:** Enlarged (larger than the object)

The reflected rays diverge and do not actually meet in front of the mirror; they appear to meet behind it, forming a virtual image that cannot be caught on a screen.

Source: Chapter 9, Table 9.1 — Image formation by a concave mirror

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Explanation

- CBSE examiners look for all three aspects: **nature** (virtual/erect), **position** (behind the mirror), and **size** (enlarged) — one mark each.
- The key fact from Table 9.1: object "Between P and F" → image is **behind the mirror, enlarged, virtual and erect**.
- Mentioning that the image cannot be obtained on a screen is a good add-on but not strictly required for full marks.
- Do not confuse this with a convex lens or convex mirror — a concave mirror between P and F is the only mirror case giving a virtual, enlarged image.

Q5. medium | initial-understanding | § 9.2 SPHERICAL MIRRORS **[3]**

A driver wants to watch traffic approaching from behind. Which type of spherical mirror — concave or convex — is more suitable as a rear-view mirror, and why?

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Model Answer

A **convex mirror** is more suitable as a rear-view mirror.

Reasons:

1. A convex mirror always forms a **virtual, erect, and diminished** image, regardless of the object's position.
2. It has a **wider field of view** because its reflecting surface is curved outwards, allowing the driver to see a much larger area of traffic behind.
3. The image is always formed **behind the mirror** between P and F, making it safe and convenient to view.

Thus, a convex mirror enables the driver to see more area in a single glance, ensuring safer driving.

Source: Chapter 9, Section 9.2.2 — Uses of convex mirrors

Explanation

Examiners expect two clear reasons: (1) erect and diminished image and (2) wider field of view. Simply naming the mirror without reasons will cost marks. The phrase "wider field of view" is the key technical term from the textbook — always use it. Do not confuse with concave mirror; concave gives magnified/inverted images for most object positions, making it unsuitable here.

Q6. straightforward | initial-understanding | § 9.2.1 Image Formation by Spherical Mirrors **[1]**

A burning candle is placed between the pole and the principal focus of a concave mirror. What is the nature of the image formed — is it real or virtual, erect or inverted, and larger or smaller than the object?

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Model Answer

When a burning candle is placed between the pole (P) and principal focus (F) of a concave mirror, the image formed is **virtual, erect, and enlarged** (larger than the object).

Source: Chapter 9, Table 9.1 — Image formation by a concave mirror

Explanation

Table 9.1 directly states that when the object is placed **between P and F**, the image forms **behind the mirror**, is **enlarged**, and is **virtual and erect**. Examiners expect all three characteristics in the answer. Missing even one (e.g., forgetting "virtual") will cost marks in a 1-mark question.

Q7. medium | initial-understanding | § 9.2.1 Image Formation by Spherical Mirrors **[3]**

A candle is moved from a point far beyond the centre of curvature of a concave mirror steadily toward its focus. How does the size of the image change during this movement? What is the nature of the image when the candle is placed exactly at the focus?

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Model Answer

Change in size of image:

As the candle moves from far beyond C toward F, the image size continuously **increases**. Specifically:

- Beyond C → image is diminished
- At C → image is the same size as object
- Between C and F → image is enlarged (larger than object)

Throughout this movement, the image remains **real and inverted**.

At the focus:

When the candle is placed exactly at the focus F, the reflected rays become parallel and do not meet. The image is formed **at infinity** and is **highly enlarged** (practically, no image is formed on a screen).

Source: Chapter 9, Section 9.2.1, Table 9.1

Explanation

- Examiners expect students to trace the image size through each position (beyond C → at C → between C and F → at F) using Table 9.1.
- The key phrase for "at F" is **"at infinity"** — state this clearly; some students incorrectly say "no image forms" without explaining why (rays emerge parallel).
- Mentioning that the image remains **real and inverted** throughout the movement earns an extra mark.
- Keep the answer structured: one part for the moving candle, one part for the candle at F.

Q8. medium | initial-understanding | § 9.2.2 Representation of Images Formed by Spherical Mirrors Using Ray Diagrams **[2]**

A ray of light is directed towards the centre of curvature of a concave mirror. Describe the path of this ray after reflection, and explain why it behaves this way.

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Model Answer

A ray directed towards the centre of curvature of a concave mirror is reflected **back along the same path** (it retraces its path).

Reason: The centre of curvature (C) lies on the principal axis, and any line joining C to the mirror surface is a **normal** (radius) to that surface. So the ray hits the mirror at 0° angle of incidence and is reflected straight back along the same path, in accordance with the laws of reflection.

Explanation

Examiners look for two things: (1) the correct path — retraces itself / reflects back along the same direction — and (2) the reason — the ray strikes the mirror along the normal (radius of curvature), making the angle of incidence = 0°. Mentioning "normal" and linking it to the law of reflection earns full marks. Avoid vague answers like "it bends back."

Q9. straightforward | initial-understanding | § 9.2.2 Representation of Images Formed by Spherical Mirrors Using Ray Diagrams **[1]**

Which of the following correctly describes what happens to a ray of light that strikes a concave mirror after travelling parallel to its principal axis?
(A) It passes through the centre of curvature C.
(B) It reflects back along the same path.
(C) It passes through the principal focus F after reflection.
(D) It emerges parallel to the principal axis after reflection.

A It passes through the centre of curvature C.
B It reflects back along the same path.
C It passes through the principal focus F after reflection.
D It emerges parallel to the principal axis after reflection.

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Model Answer

(C) It passes through the principal focus F after reflection.

A ray parallel to the principal axis, after reflection from a concave mirror, passes through the principal focus F.

Explanation

This is a standard rule for ray diagrams of concave mirrors (Section 9.2.2, point i). Note that option (B) describes a ray through the centre of curvature C, and option (D) describes the reverse ray (through F → emerges parallel), so don't confuse them.

Source: Chapter 9, Section 9.2.2

Q10. straightforward | initial-understanding | § 9.2.2 Representation of Images Formed by Spherical Mirrors Using Ray Diagrams **[1]**

State what happens to a ray of light that is incident on a convex mirror and is directed towards its principal focus. How does the reflected ray emerge?

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Model Answer

A ray directed towards the principal focus of a convex mirror, after reflection, emerges parallel to the principal axis.

Explanation

This is a standard ray rule for convex mirrors (Fig. 9.4 b in the textbook). The examiner expects the key phrase "directed towards the principal focus" linked to "emerges parallel to the principal axis." One clean sentence is sufficient for 1 mark.

Q11. medium | initial-understanding | § 9.2.2 Representation of Images Formed by Spherical Mirrors Using Ray Diagrams **[3]**

An object is placed between the pole and the principal focus of a concave mirror. Using standard ray diagram rules, describe how the image is formed and state the nature, position, and size of the image obtained.

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Model Answer

When an object is placed between the pole (P) and the principal focus (F) of a concave mirror, two rays are used to locate the image:

1. A ray parallel to the principal axis, after reflection, passes through the principal focus F.
2. A ray directed towards the centre of curvature, after reflection, returns along the same path.

The two reflected rays diverge and do not meet in front of the mirror. When extended behind the mirror, they appear to meet at a point behind the mirror.

Nature, Position, and Size of Image:

- **Position:** Behind the mirror (beyond the pole)
- **Nature:** Virtual and erect
- **Size:** Enlarged (magnified)

(Refer to Table 9.1 — object between P and F)

Source: Chapter 9, Section 9.2.2 & Table 9.1

Explanation

- The key fact examiners want: reflected rays **diverge** → image forms **behind the mirror** by extending rays backward → hence **virtual**.
- Three properties must all be stated: position (behind mirror), nature (virtual and erect), size (enlarged). Missing any one loses a mark.
- Mentioning the two specific ray rules used in the diagram earns full credit for the "describe how image is formed" part.
- This is the **only case** where a concave mirror gives a virtual, erect, and magnified image — useful to remember for MCQs too (Exercise Q2 of the chapter).

Q12. straightforward | initial-understanding | § 9.2.3 Sign Convention for Reflection by Spherical Mirrors **[1]**

According to the New Cartesian Sign Convention used for mirrors, what does a negative sign for object distance and a negative sign for image distance each indicate about the positions of the object and image relative to the mirror?

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Model Answer

A negative object distance means the object is placed to the left of the mirror (in front of it); a negative image distance means the image is also formed to the left of the mirror (in front of it), i.e., it is a real image.

Explanation

Per the New Cartesian Sign Convention, distances measured to the left of the pole (origin) are negative. Since the object is always placed in front of (to the left of) the mirror, u is always negative. A negative v also means the image is on the same side (in front of the mirror), indicating a **real image**. Examiners expect both positions stated clearly in one line.

Q13. straightforward | initial-understanding | § 9.2.4 Mirror Formula and Magnification **[1]**

In the mirror formula 1/v + 1/u = 1/f, what do the symbols u, v, and f represent? Which of these quantities is fixed for a given mirror?

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Model Answer

u = object distance, **v** = image distance, **f** = focal length of the mirror. **f** is fixed for a given mirror.

Source: Chapter 9, Section 9.2.4

Explanation

The examiner expects all three symbols defined correctly in one line, plus identification of **f** as the fixed quantity. Focal length depends only on the mirror's geometry (f = R/2), so it does not change regardless of where the object is placed. u and v both vary with object position.

Q14. medium | initial-understanding | § 9.2.4 Mirror Formula and Magnification **[2]**

A concave mirror produces a real image of an object. What does a negative value of magnification tell you about the image?

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Model Answer

A negative value of magnification indicates that the image formed is **real and inverted**. It means the image is formed on the same side as the reflected rays (in front of the mirror) and is inverted with respect to the object, i.e., it is formed below the principal axis.

Source: Chapter 9, Image Formation by Spherical Mirrors / Sign Convention

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Explanation

- Magnification $m = h'/h$. A negative m means h' is negative, i.e., the image height is measured opposite to the object height → image is **inverted**.
- For a concave mirror, a real image is always inverted, so m is always negative for real images.
- Examiners expect both key words: **real** and **inverted** — missing either loses a mark.
- Do not confuse magnitude (size) with sign (orientation); the question asks about the *sign*, so focus on what negative tells you about nature and orientation.

Q15. straightforward | initial-understanding | § 9.3 REFRACTION OF LIGHT **[2]**

When a ray of light travels obliquely from air into water, does it bend towards or away from the normal? Give a reason for your answer.

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Model Answer

When a ray of light travels obliquely from air into water, it bends **towards the normal**.

Reason: Water is optically denser than air (refractive index of water = 1.33). When light travels from a rarer medium (air) to a denser medium (water), it slows down and bends towards the normal.

Source: Chapter 9, Section 9.3.2 – The Refractive Index

Explanation

- The key concept here is **rarer to denser = bends towards normal**; denser to rarer = bends away from normal.
- Always link the bending direction to the **change in speed**: slower speed in denser medium causes the ray to bend towards the normal.
- Mentioning the refractive index value (1.33 for water) adds a precise touch but is not compulsory for 2 marks.
- The examiner awards 1 mark for the correct direction and 1 mark for a valid reason.

Q16. straightforward | initial-understanding | § 9.3.1 Refraction through a Rectangular Glass Slab **[2]**

A ray of light enters a rectangular glass slab obliquely and exits from the opposite face. What can you say about the direction of the emergent ray compared to the incident ray? Why does this happen?

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Model Answer

The emergent ray is **parallel to the incident ray** but slightly shifted sidewards (laterally displaced).

This happens because the rectangular glass slab has two opposite parallel faces (AB and CD). The bending of light at the first surface (air to glass) and the bending at the second surface (glass to air) are equal and opposite, so the net change in direction cancels out.

Source: Chapter 9, Section 9.3.1 — Refraction through a Rectangular Glass Slab

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Explanation

- Examiners expect two things: (1) the emergent ray is **parallel** to the incident ray, and (2) a reason — equal and opposite bending at the two parallel faces.
- Mention **lateral displacement** for full credit; it shows you understand the ray is not on the same line, just the same direction.
- Do not write a long derivation — this is 2 marks, so two clear points are enough.

Q17. medium | initial-understanding | § 9.3.1 Refraction through a Rectangular Glass Slab **[1]**

A ray of light travels from air into glass (a denser medium) obliquely. Which direction does it bend at the air-glass boundary, and what happens to its direction when it exits back into air at the opposite face?

(A) Bends towards the normal entering glass; bends towards the normal exiting into air
(B) Bends towards the normal entering glass; bends away from the normal exiting into air
(C) Bends away from the normal entering glass; bends towards the normal exiting into air
(D) Bends away from the normal entering glass; bends away from the normal exiting into air

A Bends towards the normal entering glass; bends towards the normal exiting into air
B Bends towards the normal entering glass; bends away from the normal exiting into air
C Bends away from the normal entering glass; bends towards the normal exiting into air
D Bends away from the normal entering glass; bends away from the normal exiting into air

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Model Answer

(B)

When light travels from air (rarer) to glass (denser), it slows down and **bends towards the normal**. When it exits from glass (denser) back into air (rarer), it speeds up and **bends away from the normal**.

Explanation

The key rule from the textbook: rarer → denser = bends **towards** normal; denser → rarer = bends **away** from normal. This is directly stated in Section 9.3.2 and demonstrated in Activity 9.10 (Section 9.3.1). Don't confuse the two transitions — entry and exit are opposites. Option B captures both correctly.

Source: Chapter 9, Sections 9.3.1 and 9.3.2

Q18. straightforward | initial-understanding | § 9.3.2 The Refractive Index **[1]**

[very_short_answer] Light travels at 3 × 10⁸ m/s in air and at 2 × 10⁸ m/s in a certain liquid. Calculate the refractive index of the liquid with respect to air.

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Model Answer

$$n_{\text{liquid}} = \frac{\text{Speed of light in air}}{\text{Speed of light in liquid}} = \frac{3 \times 10^8}{2 \times 10^8} = 1.5$$

The refractive index of the liquid with respect to air is **1.5**.

Source: Chapter 9, Section 9.3.2 — The Refractive Index

Explanation

Use formula $n = \frac{c}{v}$ (Eq. 9.7). Examiners expect the formula, substitution, and final value. No unit for refractive index (it is dimensionless). One mark: write formula + answer in one step.

Q19. medium | initial-understanding | § 9.3.2 The Refractive Index **[2]**

The refractive index of kerosene is 1.44 and that of water is 1.33, yet kerosene is less dense than water in terms of mass. What does this tell us about the relationship between optical density and mass density?

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Model Answer

Optical density and mass density are two different properties and are **not related** to each other.

Optical density refers to the ability of a medium to refract light, which depends on the **speed of light** in that medium (higher refractive index = lower speed of light = optically denser). Mass density refers to mass per unit volume.

Kerosene (n = 1.44) is optically denser than water (n = 1.33) because light travels slower in kerosene, yet kerosene has lower mass density than water. Thus, **an optically denser medium may not have greater mass density**.

Source: Chapter 9, Section 9.3.2 (The Refractive Index)

Explanation

- Examiners want students to clearly distinguish between the two types of density — this is a conceptual question.
- Key terms to use: "optical density," "refractive index," "speed of light," and the explicit statement that the two densities are **not the same**.
- The textbook's exact note — *"an optically denser medium may not possess greater mass density"* — is the core of the answer. Quoting or paraphrasing it directly scores well.
- Avoid confusing optical density with mass density; that confusion is exactly what the question tests.

Q20. medium | initial-understanding | § 9.3.2 The Refractive Index **[3]**

[short_answer] A light ray travels obliquely from glass (refractive index 1.52) into water (refractive index 1.33). In which direction does the ray bend at the interface — towards the normal or away from it? Justify your answer.

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Model Answer

The ray bends **away from the normal**.

Glass has a refractive index of 1.52 and water has a refractive index of 1.33. Since glass has a higher refractive index, it is optically **denser**; water is optically **rarer**. The light ray is therefore travelling from a denser medium to a rarer medium. As stated in the textbook: *"When light travels from a denser medium to a rarer medium, it speeds up and bends away from the normal."* Hence, at the glass-water interface, the refracted ray bends away from the normal.

Source: Chapter 9, Section 9.3.2 — The Refractive Index

Explanation

- The key rule to remember: **denser → rarer = bends away from normal; rarer → denser = bends towards normal**.
- Identify which medium is denser by comparing refractive indices — higher refractive index = optically denser.
- Examiners expect: (1) correct direction stated upfront, (2) identification of glass as denser and water as rarer, (3) the rule applied as justification. All three earn the 3 marks.

Q21. medium | initial-understanding | § 9.3.3 Refraction by Spherical Lenses **[3]**

A double convex lens converges a parallel beam of light, while a double concave lens diverges it. How does the shape of each lens explain this difference in behaviour?

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Model Answer

A **double convex lens** is thicker at the middle than at the edges. When parallel rays of light pass through it, both curved surfaces refract the rays inward, bending them toward the principal axis. They converge at a point called the principal focus on the other side. Hence it is called a **converging lens**.

A **double concave lens** is thicker at the edges than at the middle. Its inward-curved surfaces refract parallel rays outward, away from the principal axis. The rays appear to diverge from a principal focus on the same side as the incident light. Hence it is called a **diverging lens**.

Source: Chapter 9, Section 9.3.3 — Refraction by Spherical Lenses

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Explanation

- Examiners look for: (1) correct description of shape for each lens (where it is thicker), (2) how refraction at the curved surfaces causes convergence or divergence, (3) correct use of terms — converging/diverging, principal focus.
- Avoid just saying "convex converges, concave diverges" — you must **explain why** using the shape.
- The answer links physical shape → refraction behaviour → naming of lens type, which covers all 3 marks.

Q22. straightforward | initial-understanding | § 9.3.3 Refraction by Spherical Lenses **[1]**

Where is the principal focus of a concave lens located relative to the lens, when parallel rays of light fall on it?

A On the opposite side of the lens from the incoming light, where the rays actually meet
B On the same side as the incoming light, where the diverging rays appear to come from
C At the optical centre of the lens
D At the centre of curvature on the opposite side of the lens

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Model Answer

Answer: B

The principal focus of a concave lens is located on the **same side as the incoming light**, where the diverging rays appear to come from (virtual focus).

Source: Chapter 9, Section 9.3.5

Explanation

- A concave lens is a **diverging lens**; it never actually converges rays, so its focus is **virtual**.
- The textbook states: "In case of a concave lens, the ray appears to **diverge from** the principal focus located on the **same side of the lens**" as the incoming light.
- Option A describes a **convex** (converging) lens where rays actually meet on the other side — wrong.
- Option C (optical centre) and D (centre of curvature, opposite side) are both incorrect locations for the principal focus.
- Remember: virtual focus = same side as object; real focus = opposite side.

Q23. medium | initial-understanding | § 9.3.3 Refraction by Spherical Lenses **[2]**

A ray of light passes through the optical centre of a lens. What happens to its direction after passing through the lens?

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Model Answer

A ray of light passing through the **optical centre** of a lens passes **without any deviation** — its direction remains unchanged after passing through the lens. This is true for both convex and concave lenses.

Source: Chapter 9, Section 9.3.3 & 9.3.5

Explanation

- The key phrase examiners look for is **"without any deviation"** (or "without suffering any deviation") — use this exact textbook language.
- State that this applies to **both** convex and concave lenses to show complete understanding.
- Do not confuse this with other standard rays (parallel ray → passes through focus; ray through focus → emerges parallel).

Q24. straightforward | initial-understanding | § 9.3.4 Image Formation by Lenses **[1]**

A concave lens always forms the same type of image for any position of the object. State the nature of this image in terms of: (i) real or virtual, (ii) erect or inverted, and (iii) enlarged or diminished.

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Model Answer

A concave lens always forms an image that is (i) **virtual**, (ii) **erect**, and (iii) **diminished**, irrespective of the position of the object.

Source: Light – Reflection and Refraction, Table 9.5

Explanation

The textbook explicitly states: *"A concave lens will always give a virtual, erect and diminished image, irrespective of the position of the object."* (Table 9.5). Examiners expect all three terms — virtual, erect, diminished — for full marks. Missing even one term may cost the mark.

Q25. straightforward | initial-understanding | § 9.3.5 Image Formation in Lenses Using Ray Diagrams **[1]**

When drawing a ray diagram for a lens, what happens to a ray of light that passes through the optical centre of the lens?

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Model Answer

A ray of light passing through the optical centre of a lens emerges without any deviation (i.e., it continues straight without bending).

Source: Chapter 9, Section 9.3.5

Explanation

Examiners look for the key phrase **"without any deviation"**. This is one of the three standard rays used in lens ray diagrams. Simply stating the ray "goes straight" is acceptable but using the textbook phrase scores full marks reliably.

Q26. straightforward | initial-understanding | § 9.3.6 Sign Convention for Spherical Lenses **[1]**

A spherical lens has a focal length of –12 cm. What type of lens is it?

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Model Answer

It is a **concave lens** (diverging lens). According to the sign convention, a negative focal length indicates a concave lens.

Source: Chapter 9, Section 9.3.6 Sign Convention for Spherical Lenses

Explanation

The key rule: focal length of a **convex lens is positive** and that of a **concave lens is negative**. Since –12 cm is negative, the lens is concave. Examiners expect you to state the type and give the sign convention reason in one line.

Q27. medium | initial-understanding | § 9.3.7 Lens Formula and Magnification **[3]**

A convex lens has a focal length of 10 cm. An object is placed 30 cm in front of the lens. Find the image distance and state whether the image formed is real or virtual.

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Model Answer

Given: f = +10 cm (convex lens), u = −30 cm

Using the lens formula:

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v} - \frac{1}{-30} = \frac{1}{10}$$

$$\frac{1}{v} = \frac{1}{10} - \frac{1}{30} = \frac{3-1}{30} = \frac{2}{30}$$

$$v = +15 \text{ cm}$$

The image is formed **15 cm on the other side of the lens**.

Since v is positive, the image is **real and inverted**. (The object is placed between F_1 and $2F_1$, so the image is beyond $2F_2$.)

Source: Light – Reflection and Refraction, Chapter 9, Section 9.3.6

Explanation

- Always apply sign convention: u is negative (object on left), f is positive for convex lens.
- The lens formula is $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$; do not mix it up with the mirror formula.
- A positive v means image is on the opposite side of the object → **real and inverted** for a convex lens.
- Examiners award marks for: correct formula (1), correct substitution with signs (1), correct answer with nature of image (1).

Q28. straightforward | initial-understanding | § 9.3.7 Lens Formula and Magnification **[1]**

For a lens, magnification m = +0.5 is obtained. What does the positive sign tell you about the image, and is the image larger or smaller than the object?

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Model Answer

The positive sign indicates that the image is **virtual and erect**. Since |m| = 0.5 < 1, the image is **smaller** than the object.

Source: Chapter 9, Section 9.3.7 (Magnification)

Explanation

Examiners look for two things: (1) what the positive sign means — virtual and erect image — and (2) comparison of image size with object. Since m = +0.5, the magnitude (0.5) is less than 1, so the image is diminished. A common mistake is saying "erect" alone and forgetting "virtual," or confusing magnitude with sign.

Q29. straightforward | initial-understanding | § 9.3.8 Power of a Lens **[1]**

A convex lens has a focal length of 25 cm. Calculate its power and state its SI unit.

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Model Answer

$f = +25 \text{ cm} = +0.25 \text{ m}$

$$P = \frac{1}{f} = \frac{1}{0.25} = +4 \text{ D}$$

The SI unit of power of a lens is **dioptre (D)**.

Source: Light – Reflection and Refraction, Section 9.3.8

Explanation

- Convert focal length to metres before applying $P = 1/f$.
- A convex lens has a **positive** focal length, so its power is positive (+4 D).
- Always state the unit (dioptre, D) since the question asks for it — in a 1-mark question, both the value and the unit are expected on one line or two very short lines.

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