CBSE CLASS X

Science (086)

QUESTION PAPER

AI-generated question paper

Code: 510NHD	Questions: 17	Maximum Marks: 30	Generated: 2026-06-25 17:50

SELECTIONS USED

Subject	Science
Lessons	12 Magnetic Effects of Electric Current
Level of understanding	Initial understanding
Question selection	Curated chapter coverage (~3 questions per section)
Model	claude-sonnet-4-6

Composition — Difficulty: 8 straightforward · 9 medium | Types: 8 Very short · 8 Short · 1 MCQ

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

When a current-carrying wire is placed near a compass needle, the needle gets deflected. What does this observation tell us about electric current?

◆ **Magnetic Effects of Electric Current**

Q2. straightforward | initial-understanding | § 12.1 MAGNETIC FIELD AND FIELD LINES **[1]**

Define magnetic field. State its SI unit.

◆ **Magnetic Effects of Electric Current**

Q3. medium | initial-understanding | § 12.1 MAGNETIC FIELD AND FIELD LINES **[1]**

Two magnetic field lines can never cross each other. Why not?

◆ **Magnetic Effects of Electric Current**

Q4. straightforward | initial-understanding | § 12.2 MAGNETIC FIELD DUE TO A CURRENT-CARRYING CONDUCTOR **[1]**

State the right-hand thumb rule for finding the direction of the magnetic field around a straight current-carrying conductor.

◆ **Magnetic Effects of Electric Current**

Q5. straightforward | initial-understanding | § 12.2.1 Magnetic Field due to a Current through a Straight Conductor **[1]**

What is the shape of the magnetic field lines formed around a long straight current-carrying conductor?

◆ **Magnetic Effects of Electric Current**

Q6. medium | initial-understanding | § 12.2.1 Magnetic Field due to a Current through a Straight Conductor **[2]**

A student moves a compass needle closer to a straight current-carrying wire (without changing the current). How does the deflection of the compass needle change, and what does this tell us about the magnetic field?

◆ **Magnetic Effects of Electric Current**

Q7. medium | initial-understanding | § 12.2.1 Magnetic Field due to a Current through a Straight Conductor **[3]**

A vertical straight wire carries current flowing upward. What is the direction of the magnetic field lines at a point to the east of the wire (as seen from above)? State the rule you used and explain how you arrived at your answer.

◆ **Magnetic Effects of Electric Current**

Q8. straightforward | initial-understanding | § 12.2.2 Right-Hand Thumb Rule **[1]**

A vertical wire carries current flowing straight upward. Using the right-hand thumb rule, what is the direction of the magnetic field lines around this wire — clockwise or anticlockwise — when viewed from above?

◆ **Magnetic Effects of Electric Current**

Q9. medium | initial-understanding | § 12.2.3 Magnetic Field due to a Current through a Circular Loop **[2]**

A circular coil has 50 turns of wire. How does the magnetic field at its centre compare to that produced by a single-turn coil carrying the same current? Give a reason for your answer.

◆ **Magnetic Effects of Electric Current**

Q10. medium | initial-understanding | § 12.2.4 Magnetic Field due to a Current in a Solenoid **[3]**

Draw or describe the magnetic field pattern produced around a current-carrying solenoid. What do the two ends of the solenoid behave like, and how does the field pattern help you identify them?

◆ **Magnetic Effects of Electric Current**

Q11. straightforward | initial-understanding | § 12.3 FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD **[1]**

A current-carrying conductor is placed in a magnetic field. Under what condition is the force on the conductor the largest?

◆ **Magnetic Effects of Electric Current**

Q12. straightforward | initial-understanding | § 12.3 FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD **[3]**

State Fleming's left-hand rule. Name the physical quantities represented by the thumb and the two fingers used in this rule.

◆ **Magnetic Effects of Electric Current**

Q13. medium | initial-understanding | § 12.3 FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD **[2]**

An aluminium rod is suspended horizontally between the poles of a horseshoe magnet with the magnetic field directed vertically upward. When current is passed through the rod, it deflects to the left. What will happen to the direction of deflection if (i) the direction of current is reversed, and (ii) the poles of the magnet are interchanged (so the field is now directed downward)?

◆ **Magnetic Effects of Electric Current**

Q14. medium | initial-understanding | § 12.3 FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD **[1]**

A positive charge moves vertically downward and enters a magnetic field directed horizontally from south to north. Using Fleming's left-hand rule, what is the direction of force on the charge?
(a) East
(b) West
(c) Vertically upward
(d) Vertically downward

A East
B West
C Vertically upward
D Vertically downward

◆ **Magnetic Effects of Electric Current**

Q15. straightforward | initial-understanding | § 12.4 DOMESTIC ELECTRIC CIRCUITS **[1]**

Name the colours of insulation used for the live wire, the neutral wire, and the earth wire in a household electric circuit in India.

◆ **Magnetic Effects of Electric Current**

Q16. medium | initial-understanding | § 12.4 DOMESTIC ELECTRIC CIRCUITS **[3]**

What is the purpose of an earth wire in a domestic circuit? Why is it essential for appliances like electric irons or refrigerators that have metallic bodies?

◆ **Magnetic Effects of Electric Current**

Q17. medium | initial-understanding | § 12.4 DOMESTIC ELECTRIC CIRCUITS **[3]**

What is short-circuiting in a domestic electric circuit, and how does an electric fuse protect the circuit when it occurs?

◆ **Magnetic Effects of Electric Current**

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CBSE CLASS X

Science (086)

ANSWER KEY

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

When a current-carrying wire is placed near a compass needle, the needle gets deflected. What does this observation tell us about electric current?

◆ Magnetic Effects of Electric Current

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Model Answer

This observation tells us that electric current produces a magnetic effect — a current-carrying wire behaves like a magnet and can exert force on a nearby compass needle, deflecting it.

Source: Chapter 12, Introduction

Explanation

The examiner expects you to state the **magnetic effect of electric current** as the key conclusion. Mention that electricity and magnetism are linked. Avoid over-explaining — one clear sentence is sufficient for 1 mark.

Q2. straightforward initial-understanding § 12.1 MAGNETIC FIELD AND FIELD LINES **[1]**

Define magnetic field. State its SI unit.

◆ Magnetic Effects of Electric Current

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Model Answer

A magnetic field is the region surrounding a magnet (or current-carrying conductor) where its magnetic force can be detected. Its SI unit is **Tesla (T)**.

Explanation

The question has two parts — definition and SI unit — both must be stated for full credit. The definition comes directly from the chapter. Note: "Oersted" is a CGS unit; the SI unit examiners expect is Tesla (T).

Q3. medium | initial-understanding | § 12.1 MAGNETIC FIELD AND FIELD LINES **[1]**

Two magnetic field lines can never cross each other. Why not?

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Model Answer

If two field lines crossed, the compass needle at that point would point in two directions simultaneously, which is impossible. Hence, magnetic field lines never cross each other.

Explanation

The key reason is from the textbook: at a point of intersection, the magnetic field would have two directions at once, which is physically impossible since a field has only one direction at any given point. Always state this reason clearly for full marks.

Q4. straightforward | initial-understanding | § 12.2 MAGNETIC FIELD DUE TO A CURRENT-CARRYING CONDUCTOR **[1]**

State the right-hand thumb rule for finding the direction of the magnetic field around a straight current-carrying conductor.

◆ **Magnetic Effects of Electric Current**

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Model Answer

If you hold a current-carrying straight conductor in your right hand with the **thumb pointing in the direction of current**, the **curled fingers give the direction of the magnetic field** around the conductor.

Source: Chapter 12, Section 12.2.2 Right-Hand Thumb Rule

Explanation

- Examiners look for two key elements: **thumb → direction of current** and **curled fingers → direction of magnetic field**.
- Mention "right hand" explicitly — it is part of the rule's name and essential for full marks.
- One crisp sentence is sufficient for 1 mark; no diagram is needed unless asked.

Q5. straightforward | initial-understanding | § 12.2.1 Magnetic Field due to a Current through a Straight Conductor **[1]**

What is the shape of the magnetic field lines formed around a long straight current-carrying conductor?

◆ **Magnetic Effects of Electric Current**

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Model Answer

The magnetic field lines around a long straight current-carrying conductor are **concentric circles** centred on the wire, lying in planes perpendicular to the conductor.

Source: Chapter 12, Section 12.2.2 / Exercises Q1(d)

Explanation

The key term examiners expect is **"concentric circles"**. The distractor options (straight lines parallel/perpendicular, or radial lines) are commonly tested, so be precise. Exercise Q1 directly tests this — the correct answer is (d), confirming the expected wording.

Q6. medium | initial-understanding | § 12.2.1 Magnetic Field due to a Current through a Straight Conductor **[2]**

A student moves a compass needle closer to a straight current-carrying wire (without changing the current). How does the deflection of the compass needle change, and what does this tell us about the magnetic field?

◆ **Magnetic Effects of Electric Current**

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Model Answer

When the compass is moved **closer** to the current-carrying wire, the deflection of the needle **increases**. This tells us that the magnetic field produced by the current is **stronger at points closer to the wire**. Thus, the magnetic field due to a straight current-carrying conductor is **stronger near the wire and decreases with distance**.

Source: Chapter 12, Section 12.2 — Magnetic Field due to a Current-Carrying Conductor

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Explanation

- Examiners expect two clear points: (1) deflection increases, (2) this means field strength increases closer to the wire.
- The source (Activity 12.1 & 12.4) shows that the compass needle deflects due to the magnetic field of the current. Field lines being closer together = stronger field (from Section 12.1). Bringing the compass nearer = entering a region of denser field lines = greater deflection.
- Avoid vague phrases like "it changes" — state **increases** explicitly.

Q7. medium | initial-understanding | § 12.2.1 Magnetic Field due to a Current through a Straight Conductor **[3]**

A vertical straight wire carries current flowing upward. What is the direction of the magnetic field lines at a point to the east of the wire (as seen from above)? State the rule you used and explain how you arrived at your answer.

◆ Magnetic Effects of Electric Current

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Model Answer

Rule Used: Right-Hand Thumb Rule

If we hold the wire in the right hand with the **thumb pointing upward** (direction of current), the fingers curl around the wire showing the direction of magnetic field lines.

As seen from above, the field lines form **concentric circles** around the wire in the **anticlockwise direction**. At a point to the **east** of the wire, the tangent to this anticlockwise circle points **toward the south**.

∴ The direction of the magnetic field at a point to the east of the wire is **toward the south**.

Source: Chapter 12, Section 12.2.2 — Right-Hand Thumb Rule

Explanation

- Examiners expect: (1) naming the rule, (2) applying it correctly, (3) stating the final direction clearly.
- Visualise looking down from above: current comes upward (out of the page). By the right-hand thumb rule, fingers curl **anticlockwise**. At the east side of the wire, the anticlockwise tangent points **south**.
- A common mistake is saying "north" — remember anticlockwise rotation means the east point has a southward tangent.
- Always state the rule by name and briefly explain the hand orientation for full marks.

Q8. straightforward | initial-understanding | § 12.2.2 Right-Hand Thumb Rule **[1]**

A vertical wire carries current flowing straight upward. Using the right-hand thumb rule, what is the direction of the magnetic field lines around this wire — clockwise or anticlockwise — when viewed from above?

◆ Magnetic Effects of Electric Current

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Model Answer

When current flows upward, by the right-hand thumb rule (thumb pointing up), the fingers curl **anticlockwise** when viewed from above.

Explanation

Point the right thumb upward (direction of current); the fingers wrap anticlockwise as seen from the top. Clockwise would apply when viewed from below. Examiners expect the rule to be named and the direction stated clearly.

Q9. medium | initial-understanding | § 12.2.3 Magnetic Field due to a Current through a Circular Loop **[2]**

A circular coil has 50 turns of wire. How does the magnetic field at its centre compare to that produced by a single-turn coil carrying the same current? Give a reason for your answer.

◆ Magnetic Effects of Electric Current

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Model Answer

The magnetic field at the centre of the 50-turn coil is **50 times** greater than that produced by a single-turn coil carrying the same current.

Reason: The current in each turn flows in the same direction, so the magnetic field due to each turn adds up. Therefore, the total field is n times that of a single turn, where $n = 50$.

Source: Chapter 12, Section 12.2.3 – Magnetic Field due to a Current through a Circular Loop

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Explanation

The key statement from the textbook is: *"If there is a circular coil having n turns, the field produced is n times as large as that produced by a single turn, because the current in each circular turn has the same direction, and the field due to each turn just adds up."* Examiners expect you to state the multiplying factor (50×) **and** give the reason (same direction → fields add up). Both parts are needed for full marks.

Q10. medium | initial-understanding | § 12.2.4 Magnetic Field due to a Current in a Solenoid **[3]**

Draw or describe the magnetic field pattern produced around a current-carrying solenoid. What do the two ends of the solenoid behave like, and how does the field pattern help you identify them?

◆ Magnetic Effects of Electric Current

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Model Answer

A current-carrying solenoid produces a magnetic field pattern similar to that of a bar magnet. Inside the solenoid, field lines are parallel and straight, indicating a **uniform magnetic field**. Outside, the field lines emerge from one end, curve around, and re-enter the other end — just like a bar magnet.

One end of the solenoid behaves as the **North pole** (field lines emerge) and the other as the **South pole** (field lines enter). By observing which end the field lines come out of, we can identify the North pole, and the other end is automatically the South pole.

Source: Chapter 12, Section 12.2.4

Explanation

- Examiners expect three points: (1) field pattern description — parallel lines inside, bar-magnet-like outside; (2) the two ends act as N and S poles; (3) how to identify them via direction of field lines.
- Saying "uniform field inside" (parallel straight lines) is a key scoring point.
- You may sketch Fig. 12.10-style diagram instead of describing — a neat labelled diagram with arrows earns full credit.
- The comparison to a bar magnet is explicitly stated in the textbook and should be included.

Q11. straightforward | initial-understanding | § 12.3 FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD **[1]**

A current-carrying conductor is placed in a magnetic field. Under what condition is the force on the conductor the largest?

◆ **Magnetic Effects of Electric Current**

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Model Answer

The force on a current-carrying conductor is largest when the direction of current is **perpendicular (at right angles)** to the direction of the magnetic field.

Explanation

The textbook explicitly states: *"the displacement of the rod is largest when the direction of current is at right angles to the direction of the magnetic field."* Examiners expect the key phrase **"at right angles"** or **"perpendicular"** — either wording earns full marks. No additional explanation is needed for a 1-mark answer.

Source: Chapter 12, Section 12.3 – Force on a Current-Carrying Conductor in a Magnetic Field

Q12. straightforward | initial-understanding | § 12.3 FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD **[3]**

State Fleming's left-hand rule. Name the physical quantities represented by the thumb and the two fingers used in this rule.

◆ **Magnetic Effects of Electric Current**

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Model Answer

Fleming's Left-Hand Rule: Stretch the thumb, forefinger, and middle finger of the left hand mutually perpendicular to each other. If the **forefinger** points in the direction of the magnetic field and the **middle finger** points in the direction of the current, then the **thumb** points in the direction of the force (motion) acting on the current-carrying conductor.

Physical quantities represented:

- **Thumb** → Direction of **force (motion)** on the conductor
- **Forefinger** → Direction of **magnetic field (B)**
- **Middle finger** → Direction of **current (I)**

Source: Chapter 12, Magnetic Effects of Electric Current

Explanation

- The examiner expects the rule stated in one clear sentence describing the mutual perpendicular arrangement of the three fingers, followed by what each finger represents.
- The three quantities (force, field, current) are the key scorers — one mark each or collectively 2 marks with 1 for the statement.
- Avoid confusing **left-hand rule** (motor effect / force on conductor) with the **right-hand thumb rule** (direction of magnetic field around a wire). Fleming's left-hand rule is always about the **force experienced by a conductor**.
- The words "mutually perpendicular" are important and should appear in your answer.

Q13. medium | initial-understanding | § 12.3 FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD **[2]**

An aluminium rod is suspended horizontally between the poles of a horseshoe magnet with the magnetic field directed vertically upward. When current is passed through the rod, it deflects to the left. What will happen to the direction of deflection if (i) the direction of current is reversed, and (ii) the poles of the magnet are interchanged (so the field is now directed downward)?

◆ **Magnetic Effects of Electric Current**

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Model Answer

Using Fleming's Left-Hand Rule:

(i) Current reversed: The direction of deflection reverses — the rod now deflects to the **right** (opposite to the original left deflection), since reversing the current reverses the direction of force.

(ii) Poles interchanged (field now downward): The direction of deflection again reverses — the rod deflects to the **right**, since reversing the magnetic field direction also reverses the force on the conductor.

Source: Chapter 12, Section 12.3 — Force on a Current-Carrying Conductor in a Magnetic Field

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Explanation

- The examiner expects you to apply **Fleming's Left-Hand Rule** (or cite the textbook activity) and state the new direction clearly for each case.
- Key principle: **force direction reverses if either current OR magnetic field is reversed** — both cases give deflection to the right here.
- Don't just say "reverses" — name the direction (right/left) for full marks.
- One mark per correct sub-part.

Q14. medium | initial-understanding | § 12.3 FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD **[1]**

A positive charge moves vertically downward and enters a magnetic field directed horizontally from south to north. Using Fleming's left-hand rule, what is the direction of force on the charge?
(a) East
(b) West
(c) Vertically upward
(d) Vertically downward

A East
B West
C Vertically upward
D Vertically downward

◆ **Magnetic Effects of Electric Current**

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Model Answer

(b) West

Using Fleming's left-hand rule: middle finger (current/charge motion) → downward; forefinger (magnetic field) → north; thumb points → **West**.

Explanation

Fleming's left-hand rule: forefinger = field direction (South→North), middle finger = current direction (positive charge moving down = current downward), thumb = force direction. The thumb points **West**. Note: for a positive charge, current direction = direction of motion.

Q15. straightforward | initial-understanding | § 12.4 DOMESTIC ELECTRIC CIRCUITS **[1]**

Name the colours of insulation used for the live wire, the neutral wire, and the earth wire in a household electric circuit in India.

◆ **Magnetic Effects of Electric Current**

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Model Answer

Live wire — **red**; Neutral wire — **black**; Earth wire — **green**.

Source: Chapter 12, Section 12.4 Domestic Electric Circuits

Explanation

This is a direct recall question. Examiners expect all three colours stated correctly in one line. Missing even one colour will cost marks. Remember: **R**ed = **L**ive, **B**lack = **N**eutral, **G**reen = **E**arth (RBG trick).

Q16. medium | initial-understanding | § 12.4 DOMESTIC ELECTRIC CIRCUITS **[3]**

What is the purpose of an earth wire in a domestic circuit? Why is it essential for appliances like electric irons or refrigerators that have metallic bodies?

◆ **Magnetic Effects of Electric Current**

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Model Answer

The earth wire (green insulation) is connected to a metal plate buried deep in the earth. Its purpose is to provide a low-resistance conducting path for any leakage current.

For appliances like electric irons or refrigerators that have metallic bodies, the body is connected to the earth wire. If any live wire accidentally touches the metallic body due to damaged insulation or a fault, the leakage current flows safely into the earth. This keeps the potential of the metallic body equal to earth's potential, preventing the user from receiving a severe electric shock.

Source: Chapter 12, Section 12.4 — Domestic Electric Circuits

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Explanation

- **3 marks breakdown:** 1 mark for defining the earth wire and its connection, 1 mark for how it works (low-resistance path), 1 mark for why it is essential for metallic-bodied appliances (prevents severe shock).
- Always mention **green insulation** and **low-resistance conducting path** — these are key terms examiners look for.
- Conclude with the safety outcome: user does not get a severe electric shock.

Q17. medium | initial-understanding | § 12.4 DOMESTIC ELECTRIC CIRCUITS **[3]**

What is short-circuiting in a domestic electric circuit, and how does an electric fuse protect the circuit when it occurs?

◆ **Magnetic Effects of Electric Current**

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Model Answer

Short-circuiting occurs when the live wire and the neutral wire come into direct contact (due to damaged insulation or a fault in an appliance). This causes the resistance in the circuit to drop drastically, and the current increases abruptly to a very high value.

Protection by fuse: An electric fuse is connected in series in the circuit. When the excessive current flows due to short-circuiting, the Joule heating effect melts the fuse wire, breaking the circuit. This stops the flow of unduly high current and prevents damage to appliances and wiring.

Source: Chapter 12, Section 12.4 — Domestic Electric Circuits

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Explanation

- **3 marks** are typically split: 1 mark for defining short-circuiting (direct contact of live and neutral → sudden rise in current), and 2 marks for explaining the fuse's role (series connection → Joule heating → fuse melts → circuit breaks → appliances protected).
- Always mention that the fuse is connected **in series** — examiners specifically look for this.
- The phrase "Joule heating melts the fuse" is key terminology from the textbook; use it exactly.
- Do not confuse short-circuiting (direct wire contact) with overloading (too many appliances or high supply voltage) — the question asks specifically about short-circuiting.

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