

**CBSE CLASS X**  
**Science (086)**QUESTION PAPER  
*AI-generated question paper*

Code: LR6RS2

Questions: 48

Maximum Marks: 119

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**SELECTIONS USED**

Subject	Science
Lessons	12 Magnetic Effects of Electric Current
Level of understanding	Thorough understanding
Question selection	Curated chapter coverage (~5 questions per section + 8 synthesis)
Model	claude-sonnet-4-6

Composition — Difficulty: 1 straightforward · 30 medium · 17 deep | Types: 36 Short · 6 MCQ · 5 Very short · 1 Long

**Q1.** medium thorough-understanding § Introduction [3]

When a compass needle is placed near a current-carrying wire, it deflects. What does this deflection tell us about the nature of electric current, and what would you expect to happen to the deflection if the direction of the current in the wire is reversed? Justify your answer.

◆ Magnetic Effects of Electric Current**Q2.** medium thorough-understanding § Introduction [3]

A student sets up a circuit with a straight copper wire placed parallel to a compass needle. When current flows, the needle deflects. The student then moves the compass needle farther from the wire without changing the current. What change, if any, will occur in the deflection of the needle, and why?

◆ Magnetic Effects of Electric Current**Q3.** medium thorough-understanding § Introduction [1]

Before Oersted's experiment, electricity and magnetism were considered completely unrelated phenomena. What fundamental scientific insight did Oersted's experiment provide, and why is it considered a landmark discovery in physics?

◆ Magnetic Effects of Electric Current**Q4.** deep thorough-understanding § Introduction [3]

The discovery that a current-carrying conductor produces a magnetic field raises the question of whether the reverse is also possible — can a moving magnet produce an electric effect? Based on your study of this chapter, is this reverse effect real? Name the phenomenon and briefly describe one situation in which it occurs.

◆ Magnetic Effects of Electric Current**Q5.** medium thorough-understanding § 12.1 MAGNETIC FIELD AND FIELD LINES [3]

A student sprinkles iron filings around a bar magnet and taps the board gently. The filings arrange themselves in a curved pattern. What does this pattern reveal about the space around the magnet, and why do the filings align the way they do?

◆ Magnetic Effects of Electric Current

- Q6.** straightforward thorough-understanding § 12.1 MAGNETIC FIELD AND FIELD LINES [1]  
State the direction of magnetic field lines (a) outside a bar magnet, and (b) inside a bar magnet. How does this make the field lines form closed loops?  
◆ Magnetic Effects of Electric Current
- Q7.** medium thorough-understanding § 12.1 MAGNETIC FIELD AND FIELD LINES [2]  
Two magnetic field lines can never cross each other. If they did cross, what impossible situation would arise at the point of intersection? Use this to explain why the 'no crossing' rule must hold.  
◆ Magnetic Effects of Electric Current
- Q8.** medium thorough-understanding § 12.1 MAGNETIC FIELD AND FIELD LINES [2]  
Magnetic field lines near the poles of a bar magnet are much closer together than those far away from the poles. What does this difference in spacing tell you about the strength of the magnetic field at those two locations? How would this affect the force experienced by a small compass needle placed at each location?  
◆ Magnetic Effects of Electric Current
- Q9.** medium thorough-understanding § 12.1 MAGNETIC FIELD AND FIELD LINES [2]  
A compass needle is a small bar magnet. When it is placed near the north pole of a bar magnet, which pole of the compass needle points toward the bar magnet's north pole, and why?  
◆ Magnetic Effects of Electric Current
- Q10.** deep thorough-understanding § 12.1 MAGNETIC FIELD AND FIELD LINES [3]  
The magnetic field is described as a quantity that has both magnitude and direction. How does a magnetic field line diagram convey EACH of these two properties?  
◆ Magnetic Effects of Electric Current
- Q11.** medium thorough-understanding § 12.2 MAGNETIC FIELD DUE TO A CURRENT-CARRYING CONDUCTOR [3]  
A current-carrying straight wire is held vertically. A compass is placed at point P, close to the wire, and then moved to point Q, which is farther away, while the current remains unchanged. How does the deflection of the compass needle change, and why?  
◆ Magnetic Effects of Electric Current
- Q12.** medium thorough-understanding § 12.2 MAGNETIC FIELD DUE TO A CURRENT-CARRYING CONDUCTOR [3]  
A horizontal power line carries current from west to east. Determine the direction of the magnetic field at a point directly above the wire and at a point directly below it. Name the rule you used and explain your reasoning.  
◆ Magnetic Effects of Electric Current
- Q13.** deep thorough-understanding § 12.2 MAGNETIC FIELD DUE TO A CURRENT-CARRYING CONDUCTOR [3]  
A single circular loop and a coil of 50 turns carry the same current. (i) Explain why the coil produces a much stronger magnetic field at its centre than the single loop does. (ii) What do the magnetic field lines look like at the centre of a current-carrying circular loop, and why do they have this appearance?  
◆ Magnetic Effects of Electric Current
- Q14.** medium thorough-understanding § 12.2.1 Magnetic Field due to a Current through a Straight Conductor [3]  
When a compass is placed near a current-carrying straight wire, the deflection of its needle increases as the current is increased and decreases as the compass is moved farther away. What do these two observations tell us about the nature of the magnetic field produced by the wire?  
◆ Magnetic Effects of Electric Current

**Q15.** medium thorough-understanding § 12.2.1 Magnetic Field due to a Current through a Straight Conductor [3]

A current-carrying straight wire is held vertically and you look at it from the top. The current flows upward (towards you). Using the right-hand thumb rule, determine the direction of the magnetic field lines — are they clockwise or anti-clockwise as seen from the top? Justify your answer.

◆ Magnetic Effects of Electric Current

**Q16.** medium thorough-understanding § 12.2.1 Magnetic Field due to a Current through a Straight Conductor [1]

When iron filings are sprinkled on a cardboard through which a current-carrying wire passes vertically, they arrange themselves in a pattern around the wire. (i) What shape does this pattern take, and what does it indicate about the direction of the magnetic field? (ii) The spacing between adjacent rings increases as we move away from the wire — what does this tell you about the magnetic field at those points?

◆ Magnetic Effects of Electric Current

**Q17.** deep thorough-understanding § 12.2.1 Magnetic Field due to a Current through a Straight Conductor [1]

An overhead power line runs from east to west and carries current in the east-to-west direction. A compass is placed at a point directly below the wire. In which direction does the north pole of the compass needle point?

- A North
- B South
- C East
- D West

◆ Magnetic Effects of Electric Current

**Q18.** medium thorough-understanding § 12.2.1 Magnetic Field due to a Current through a Straight Conductor [3]

A student reverses the connections of the battery in a circuit containing a straight current-carrying wire placed above a compass. She notices that the compass needle deflects in the opposite direction compared to before. (i) Why does the needle deflect in the opposite direction? (ii) What does this experiment reveal about the relationship between the direction of current and the magnetic field it produces?

◆ Magnetic Effects of Electric Current

**Q19.** medium thorough-understanding § 12.2.2 Right-Hand Thumb Rule [3]

A vertical wire carries a current directed straight upward. Using the right-hand thumb rule, determine the direction of the magnetic field at a point (i) to the north of the wire, and (ii) to the east of the wire. Explain your reasoning in each case.

◆ Magnetic Effects of Electric Current

**Q20.** deep thorough-understanding § 12.2.2 Right-Hand Thumb Rule [3]

A current flows through a long straight wire from west to east. A compass is placed first directly above the wire and then directly below it. How does the direction of deflection of the compass needle differ between these two positions, and why?

◆ Magnetic Effects of Electric Current

**Q21.** medium thorough-understanding § 12.2.3 Magnetic Field due to a Current through a Circular Loop [3]

A circular loop carries a steady current. Describe how the nature and shape of the magnetic field lines change as you move from a point close to the wire of the loop towards the centre of the loop. What does the field look like at the centre, and in which direction does it point relative to the plane of the loop?

◆ Magnetic Effects of Electric Current

**Q22.** medium thorough-understanding § 12.2.3 Magnetic Field due to a Current through a Circular Loop [3]

A single circular loop and a coil of 50 turns of the same radius carry the same current. How does the magnetic field at the centre of the coil compare with that at the centre of the single loop? Justify your answer.

◆ Magnetic Effects of Electric Current

**Q23.** medium thorough-understanding § 12.2.3 Magnetic Field due to a Current through a Circular Loop [1]

The magnetic field at the centre of a current-carrying circular loop is directed perpendicularly into the plane of the loop. If you reverse the direction of the current in the loop, which of the following correctly describes the resulting field at the centre?

- (A) It remains directed into the plane of the loop, but doubles in magnitude.
- (B) It is directed perpendicularly out of the plane of the loop.
- (C) It becomes zero because the contributions from opposite sides cancel.
- (D) It rotates to lie within the plane of the loop.

A It remains directed into the plane of the loop, but doubles in magnitude.

B It is directed perpendicularly out of the plane of the loop.

C It becomes zero because the contributions from opposite sides cancel.

D It rotates to lie within the plane of the loop.

◆ Magnetic Effects of Electric Current

**Q24.** deep thorough-understanding § 12.2.3 Magnetic Field due to a Current through a Circular Loop [3]

State one similarity and one important difference in the nature of the magnetic field produced by (i) a long straight current-carrying conductor and (ii) a current-carrying circular loop at its centre. Why does the circular geometry produce a uniform, unidirectional field at the centre, unlike the field around a straight wire?

◆ Magnetic Effects of Electric Current

**Q25.** medium thorough-understanding § 12.2.4 Magnetic Field due to a Current in a Solenoid [3]

A current-carrying solenoid is often described as equivalent to a bar magnet. (i) What does the pattern of magnetic field lines inside a solenoid tell you about the nature of the field there? (ii) Why is this property particularly useful when a solenoid is used to make an electromagnet?

◆ Magnetic Effects of Electric Current

**Q26.** deep thorough-understanding § 12.2.4 Magnetic Field due to a Current in a Solenoid [3]

A solenoid has 200 turns of wire. A student argues that replacing it with a single-turn circular loop carrying the same current would produce the same magnetic field at the centre, since the current value is unchanged. Is the student correct? Explain why or why not.

◆ Magnetic Effects of Electric Current

**Q27.** medium thorough-understanding § 12.2.4 Magnetic Field due to a Current in a Solenoid [1]

Which of the following best explains why one end of a current-carrying solenoid behaves as a north pole and the other as a south pole?

- (A) The copper wire conducts current better at one end than the other, creating an asymmetry.
- (B) The direction of current flow as seen from each end of the solenoid is opposite (clockwise at one end, anticlockwise at the other), producing opposite magnetic poles.
- (C) The combined magnetic fields of all the turns reinforce each other along the axis, producing a net field that exits from one end and enters the other, just as in a bar magnet.
- (D) The solenoid develops poles only when a soft-iron core is inserted inside it.

A The insulation on the copper wire creates a charge separation at each end.

B Current flows in opposite directions at the two ends of the solenoid, creating opposite poles.

C The combined magnetic fields of all the turns reinforce each other, producing a net field that exits from one end and enters the other, just as in a bar magnet.

D The solenoid develops poles only when a magnetic material is placed inside it.

◆ Magnetic Effects of Electric Current

**Q28.** deep thorough-understanding § 12.3 FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD [3]

A current-carrying aluminium rod is suspended horizontally between the poles of a horseshoe magnet with the magnetic field directed vertically upward. When current flows through the rod from end B to end A, the rod is displaced to the left. What will happen to the direction of displacement if both the direction of the current AND the direction of the magnetic field are simultaneously reversed? Justify your answer.

◆ Magnetic Effects of Electric Current

**Q29.** medium thorough-understanding § 12.3 FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD [2]

A straight current-carrying conductor is placed in a uniform magnetic field. Under what condition is the force experienced by the conductor the greatest? What is the force when the conductor is placed parallel to the magnetic field?

◆ Magnetic Effects of Electric Current

**Q30.** deep thorough-understanding § 12.3 FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD [3]

An alpha particle (positively charged) moves horizontally towards the east and enters a magnetic field directed vertically downward. Using Fleming's left-hand rule, determine the direction of force acting on the alpha particle.

◆ Magnetic Effects of Electric Current

**Q31.** medium thorough-understanding § 12.3 FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD [1]

A current-carrying conductor is placed near a magnet. The magnet exerts a force on the conductor. What does Newton's third law imply about the force the conductor exerts on the magnet? How does this relate to the principle behind the working of an electric motor?

◆ Magnetic Effects of Electric Current

**Q32.** deep thorough-understanding § 12.3 FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD [3]

An electron moves into a magnetic field directed into the page, travelling vertically upward. In which direction will the electron be deflected? Show your reasoning using Fleming's left-hand rule. (Recall that conventional current is opposite to the direction of electron motion.)

◆ Magnetic Effects of Electric Current

**Q33.** medium thorough-understanding § 12.3 FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD [1]

A current-carrying rod is placed in a magnetic field. When the current in the rod is doubled and the strength of the magnetic field is also doubled, how does the force on the rod change compared to the original force?

◆ Magnetic Effects of Electric Current

**Q34.** medium thorough-understanding § 12.3 FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD [1]

Which of the following changes will NOT increase the displacement (force) of a current-carrying rod suspended in a magnetic field?

- (A) Increasing the current through the rod
- (B) Using a stronger magnet
- (C) Increasing the length of the rod
- (D) Reversing the direction of the current

A Increasing the current through the rod

B Using a stronger magnet

C Increasing the length of the rod

D Reversing the direction of the current

◆ Magnetic Effects of Electric Current

**Q35.** deep thorough-understanding § 12.3 FORCE ON A CURRENT-CARRYING CONDUCTOR IN A MAGNETIC FIELD [3]

A student claims that a stationary charged particle placed in a magnetic field will always experience a force due to that field. Do you agree? Explain your answer, and state the condition under which a charged particle actually experiences a force in a magnetic field.

◆ Magnetic Effects of Electric Current

**Q36.** medium thorough-understanding § 12.4 DOMESTIC ELECTRIC CIRCUITS [3]

In a domestic electric circuit, all the appliances — bulbs, fans, electric press — are connected in parallel with each other. Why is this arrangement used instead of a series connection?

◆ Magnetic Effects of Electric Current

**Q37.** deep thorough-understanding § 12.4 DOMESTIC ELECTRIC CIRCUITS [3]

A household has a 15 A circuit for high-power appliances and a 5 A circuit for lights and fans. A student suggests connecting a 2 kW electric geyser (operating at 220 V) to the 5 A circuit since a socket is available there. Calculate whether this is safe and explain what would happen if the student went ahead.

◆ Magnetic Effects of Electric Current

**Q38.** medium thorough-understanding § 12.4 DOMESTIC ELECTRIC CIRCUITS [3]

What is the difference between overloading and short-circuiting in a domestic circuit? Can both situations blow the same fuse? Justify your answer.

◆ Magnetic Effects of Electric Current

**Q39.** deep thorough-understanding § 12.4 DOMESTIC ELECTRIC CIRCUITS [2]

The metallic casing of an electric iron is connected to the earth wire, but a plastic-bodied electric kettle is not provided with an earth connection. Explain the reasoning behind this difference in treatment.

◆ Magnetic Effects of Electric Current

**Q40.** medium thorough-understanding § 12.4 DOMESTIC ELECTRIC CIRCUITS [1]

Which of the following correctly describes what happens inside a fuse wire when a short circuit occurs?

- (A) The fuse wire increases its resistance, reducing the current to a safe level.
- (B) The high current causes Joule heating in the fuse wire, melting it and breaking the circuit.
- (C) The fuse wire deflects the excess current to the earth wire, protecting the appliance.
- (D) The fuse wire expands and disconnects the live wire from the neutral wire mechanically.

A The fuse wire increases its resistance, reducing the current to a safe level.

B The high current causes Joule heating in the fuse wire, melting it and breaking the circuit.

C The fuse wire deflects the excess current to the earth wire, protecting the appliance.

D The fuse wire expands and disconnects the live wire from the neutral wire mechanically.

◆ Magnetic Effects of Electric Current

**Q41.** deep thorough-understanding § 12.4 DOMESTIC ELECTRIC CIRCUITS [3]

In a domestic supply, the live wire is at 220 V and the neutral wire is at approximately 0 V (earth potential). The earth wire is also at 0 V. If the neutral and earth wires are both at the same potential, why is the earth wire still considered a critical safety feature for appliances with metallic bodies?

◆ Magnetic Effects of Electric Current

**Q42.** medium thorough-understanding § (whole-chapter synthesis) [3]

A solenoid carrying current behaves like a bar magnet, yet the magnetic field inside a solenoid is described as uniform, while the field near the poles of a bar magnet is not. Explain why the field lines inside a solenoid are parallel and straight, and identify ONE way in which the field pattern outside both a solenoid and a bar magnet is similar.

◆ Magnetic Effects of Electric Current

**Q43.** deep thorough-understanding § (whole-chapter synthesis) [3]

An aluminium rod suspended horizontally between the poles of a horseshoe magnet experiences a sideways force when current is passed through it. A student claims that this force arises because the rod is in a magnetic field and carries current, and that the same principle must apply to every part of a circular coil placed in an external magnetic field. (i) Name and state the rule that gives the direction of force on the straight rod. (ii) Using the same principle, explain why a rectangular coil carrying current in a uniform magnetic field tends to rotate rather than translate sideways.

◆ Magnetic Effects of Electric Current

**Q44.** medium thorough-understanding § (whole-chapter synthesis) [3]

In a domestic circuit, the earth wire does not carry current during normal operation, yet it is considered a critical safety component. Using your understanding of both domestic wiring and the behaviour of current-carrying conductors, explain what happens inside a faulty appliance whose metallic body becomes live, and how the earth wire prevents a dangerous electric shock.

◆ Magnetic Effects of Electric Current

**Q45.** medium thorough-understanding § (whole-chapter synthesis) [5]

Two safety devices used in domestic electric circuits are the electric fuse and the earth wire. Answer the following: (i) State the specific hazard each device is designed to protect against. (ii) Explain the physical principle by which each device operates when the hazard occurs. (iii) A student argues that if a circuit has a fuse, an earth wire is unnecessary. Do you agree? Justify your answer with a specific scenario in which the fuse alone would fail to prevent an electric shock.

◆ Magnetic Effects of Electric Current

**Q46.** deep thorough-understanding § (whole-chapter synthesis) [3]

A horizontal power line carries current from west to east. A current-carrying aluminium rod is held directly below this power line, parallel to it, also carrying current from west to east. Using the right-hand thumb rule to determine the direction of the power line's magnetic field at the rod's location, and then Fleming's left-hand rule to determine the force on the rod, predict whether the rod is attracted towards or repelled away from the power line.

◆ Magnetic Effects of Electric Current

**Q47.** medium thorough-understanding § (whole-chapter synthesis) [1]

Which of the following statements correctly links the direction conventions used for magnetic fields and forces on current-carrying conductors?

- (A) The right-hand thumb rule gives the direction of force on a conductor, while Fleming's left-hand rule gives the direction of the field around it.
- (B) Both the right-hand thumb rule and Fleming's left-hand rule can independently give the direction of the magnetic field around a straight wire.
- (C) The right-hand thumb rule gives the direction of the magnetic field around a current-carrying straight conductor, while Fleming's left-hand rule gives the direction of force on a current-carrying conductor placed in an external magnetic field.
- (D) Fleming's left-hand rule applies only to circular loops and solenoids, not to straight conductors.

A The right-hand thumb rule gives the direction of force on a conductor, while Fleming's left-hand rule gives the direction of the field around it.

B Both the right-hand thumb rule and Fleming's left-hand rule can independently give the direction of the magnetic field around a straight wire.

C The right-hand thumb rule gives the direction of the magnetic field around a current-carrying straight conductor, while Fleming's left-hand rule gives the direction of force on a current-carrying conductor placed in an external magnetic field.

D Fleming's left-hand rule applies only to circular loops and solenoids, not to straight conductors.

◆ Magnetic Effects of Electric Current

**Q48.** deep thorough-understanding § (whole-chapter synthesis) [3]

Oersted demonstrated that a current-carrying conductor deflects a nearby compass needle. A student tries to repeat this observation at home by placing a compass near a live wire in the wall but observes no noticeable deflection. Give TWO reasons, based on principles studied in this chapter, why the deflection is not easily observed in this domestic setting. (Hint: Consider how the magnetic field of a straight conductor depends on current and distance.)

◆ Magnetic Effects of Electric Current

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