Class 10 Science · Chapter 12: Magnetic Effects of Electric Current

Answer key and marking scheme · 20 marks · about 40 minutes · based on NCERT

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1. A straight wire runs under a glass table-top, and a compass on the table above it deflects by a small angle when the current flows. Which change will make the deflection larger? [1]

(a) adding one more cell in series to increase the current
(b) lifting the compass onto a thick book on the table
(c) reversing the battery connections
(d) removing one of the cells

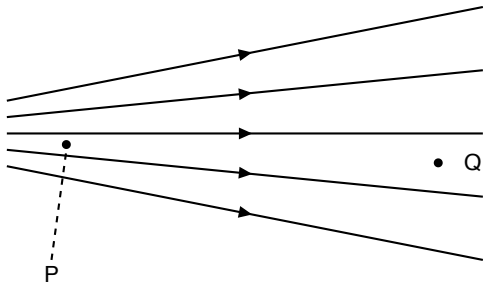
Answer: (a) The field at a point increases as the current increases, so an extra cell gives a larger deflection. Lifting the compass moves it farther from the wire, where the field is smaller; removing a cell lowers the current; reversing the battery only reverses the direction.

2. A compass needle near a current-carrying wire deflects towards the east. Mohan swaps the connections at the battery terminals. The needle now [1]

(a) deflects towards the east, more than before
(b) does not deflect at all
(c) deflects towards the west
(d) keeps swinging to and fro

Answer: (c) Reversing the current reverses the direction of the field it produces, so the needle deflects the opposite way, towards the west.

3. The figure shows part of the field-line pattern in a region. At which point is the magnetic field stronger, and why? [1]



(a) equal at P and Q, because the same lines pass both
(b) at Q, because the lines are farther apart there
(c) at P, because the lines are closer together there
(d) at Q, because the arrows point towards it

Answer: (c) The relative strength of the field is shown by how close the lines are: they are crowded near P and spread out near Q, so the field is stronger at P.

4. An iron pin on a table slides towards a magnet only when the magnet is brought within about 5 cm of it. The space around the magnet in which such a pull can be detected is the magnet's [1]

(a) north pole
(b) magnetic field
(c) field line
(d) solenoid

Answer: (b) The region surrounding a magnet in which its force can be detected is its magnetic field. A field line is only one path drawn in that region.

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5. The first observation that a current in a metal wire deflects a nearby compass needle was made by [1]

(a) Ampere, in 1820 (b) Oersted, in 1820

(c) Oersted, in 1920 (d) Fleming, in 1820

Answer: (b) Oersted saw the compass needle deflect when a current was passed through a nearby wire, in 1820. Ampere's contribution came later and concerned the force on the conductor.

6. A long straight wire hangs vertically, and the current in it flows downwards. (a) Name the rule that compares the wire with a corkscrew. (b) A corkscrew is driven downwards along the wire, in the direction of the current. Seen from above, in which sense do the magnetic field lines go round the wire? [2]

(a) Maxwell's corkscrew rule, another name for the right-hand thumb rule. (b) A corkscrew driven downwards turns clockwise as seen from above, so the field lines go round the wire clockwise when viewed from above.

- Maxwell's corkscrew rule (1)
- clockwise seen from above (1)

7. A small magnet is fixed on a trolley just below a long horizontal wire. When a current is passed, the field of the wire pushes the trolley along. (a) What force does the magnet exert on the wire? (b) Name the scientist who first suggested this. [2]

(a) An equal and opposite force: the magnet exerts on the current-carrying wire a force equal in size to the force on the magnet and opposite in direction. (b) Andre Marie Ampere.

- equal and opposite force on the wire (1)
- Ampere (1)

8. The electric supply reaches Farah's house on an overhead pole. Inside the house, at the meter-board, it passes through three things before it reaches the line wires of the separate circuits. Name them in order. [2]

The wires pass through the main fuse into the electricity meter, and then through the main switch to the line wires of the house.

- main fuse, then the electricity meter (1)
- main switch, before the line wires (1)

9. The fuse of a 5 A circuit in Meera's study melts when she plugs in a heater. (a) Explain how the fuse breaks the circuit. (b) Why must the fuse be connected in series and not across the appliances? (c) Why are the lamp, fan and heater of the room connected in parallel with each other? [3]

(a) The unduly high current produces Joule heating in the fuse wire, which melts it and breaks the circuit. (b) In series, all the current of the circuit passes through the fuse, so any excess current melts it; across the appliances it would not carry the whole current. (c) In parallel, each appliance is connected across the live and neutral wires, so every appliance gets the same potential difference and has its own switch.

- Joule heating melts the fuse and breaks the circuit (1)
- in series all the current passes through the fuse (1)
- parallel gives every appliance the same potential difference (1)

10. In a toy crane, a coil of many close turns of insulated copper wire is wound on a cardboard tube. With the current on, the coil picks up only one or two iron pins. When a soft-iron nail is pushed into the tube, it picks up a whole cluster. (a) Name the coil and describe the field inside it. (b) Explain the effect of the nail. (c) Name the device the coil and nail together make. [3]

(a) The coil is a solenoid; the field lines inside it are parallel straight lines, so the field inside is uniform. (b) The strong field inside the current-carrying solenoid magnetises the soft-iron nail placed in it, so the nail itself becomes a magnet and lifts many more pins. (c) An electromagnet, a soft-iron core wrapped with a coil of insulated copper wire.

- solenoid; uniform field of parallel straight lines inside (1)
- field inside magnetises the soft-iron nail (1)
- electromagnet (1)

11. Arjun hides an unknown magnetised object under a sheet of paper. He moves a small plotting compass about on the sheet, marks the ends of the needle at each position, and joins the marks into smooth lines. (a) What do the lines he obtains represent? (b) How will he mark the direction on each line? (c) How can he tell from the drawing where the field of the object is strongest? [3]

(a) Magnetic field lines: each is the path along which a free north pole would tend to move. (b) At each point the field is in the direction in which the north pole of the compass points, so he puts the arrow that way. (c) The field is strongest where the lines are most crowded, that is, closest together.

- magnetic field lines, the path of a free north pole (1)
- arrow in the direction the north pole of the compass points (1)
- strongest where the lines are closest together (1)