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1. Why does a compass needle get deflected when brought near a bar magnet?
Solution:
The compass needle itself is a tiny magnet. When placed near a bar magnet, the magnetic field lines from the compass interact with those of the bar magnet, causing the needle to change direction or deflect.

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1. Draw magnetic field lines around a bar magnet.
Solution:
Field lines emerge from the North Pole of the magnet and curve around to end at the South Pole.

2. List the properties of magnetic field lines.
Solution:
Magnetic field lines never cross. They flow from the North Pole to the South Pole outside the magnet and from South to North inside.

3. Why don't two magnetic field lines intersect?
Solution:
If they did, a compass placed there would point in two directions simultaneously, which is impossible. So, field lines do not intersect.

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1. Consider a circular loop of wire on a table with current flowing clockwise. What is the direction of the magnetic field inside and outside the loop?
Solution:
For current downward, the magnetic field emerges from outside the loop and enters back inside, following the right-hand rule.

2. How is a uniform magnetic field represented?
Solution:
It is shown by equally spaced, parallel magnetic field lines.

3. What describes the magnetic field inside a long current-carrying solenoid?
Solution:
It is uniform and the same at all points inside the solenoid.

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1. Which properties of a proton can change when it moves in a magnetic field?
Solution:

Velocity and momentum change because the proton's path curves due to magnetic force.

2. How does increasing current, magnet strength, or rod length affect displacement in a magnetic field (Activity 13.7)?
Solution:
Increasing any of these increases the magnetic force on the rod, causing greater displacement.

3. A positively charged alpha particle moving west deflects north in a magnetic field. What is the magnetic field's direction?
Solution:
Using Fleming's left-hand rule, the magnetic field points upward.

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1. Name two safety measures commonly used in electric circuits and appliances.
Solution:

- **Fuse:** A fuse is connected in the circuit to prevent excessive current flow. If the current exceeds a safe limit, the fuse element melts and breaks the circuit, protecting the appliances.
- **Earthing:** Earthing provides a safe path to the ground for any leakage current, thus protecting users from electric shocks by preventing electric current from passing through the body.

2. An electric oven of 2 kW power rating is operated in a domestic electric circuit (220 V) that has a current rating of 5 A. What result do you expect? Explain.
Solution:
The current drawn by the oven is calculated by the formula:

$$I = \frac{P}{V} = \frac{2000\ \text{W}}{220\ \text{V}} = 9.09\ \text{A}$$

Since 9.09 A is greater than the safe current rating of 5 A for the circuit, the fuse will blow, breaking the circuit to prevent damage or fire hazard.

3. What precaution should be taken to avoid the overloading of domestic electric circuits?
Solution:

- Avoid plugging too many devices into one socket.
- Do not operate multiple high-power appliances simultaneously on the same circuit.

- Ensure faulty appliances are repaired or removed from the circuit promptly.
  These precautions help keep the current within safe limits and prevent overheating or short circuits.

EXERCISE

1. Which of the following correctly describes the magnetic field near a long straight wire?
(d) The field consists of concentric circles centred on the wire.
The magnetic field lines around a long straight wire form concentric circles with the wire at the center.

2. At the time of short circuit, the current in the circuit
(c) increases heavily.
During a short circuit, the current surges significantly due to a sudden drop in resistance.

3. State whether the following statements are true or false.
(a) The field at the centre of a long circular coil carrying current will be parallel straight lines. — True
(b) A wire with green insulation is usually the live wire of an electric supply. — False (Green insulation usually indicates the earth wire.)

4. List two methods of producing magnetic fields.

- Using a permanent magnet.
- Passing electric current through a conductor, such as a straight wire or coil.

5. When is the force experienced by a current–carrying conductor placed in a magnetic field largest?
The force is greatest when the current direction is perpendicular to the magnetic field.

6. Imagine that you are sitting in a chamber with your back to one wall. An electron beam, moving horizontally from back wall towards the front wall, is deflected by a strong magnetic field to your right side. What is the direction of magnetic field?
Using Fleming's left-hand rule, the magnetic field points downward inside the chamber.

7. State the rule to determine the direction of a:
(i) magnetic field produced around a straight current-carrying

conductor — Maxwell's right-hand thumb rule.
(ii) force on a current-carrying conductor in a magnetic field perpendicular to it — Fleming's left-hand rule.
(iii) current induced in a coil due to rotation in magnetic field — Fleming's right-hand rule.

8. When does an electric short circuit occur?
A short circuit happens when low resistance path forms due to contact between live wires or overloading by connecting too many high-power appliances on one circuit, causing excessive current.

9. What is the function of an earth wire? Why is it necessary to earth metallic appliances?
The earth wire safely channels leakage current to the ground, preventing electric shocks. Metallic appliances are earthed to protect users from electrocution by ensuring any faulty current bypasses the user and flows safely to earth.