CLASS X: SCIENCE
Chapter 12: Magnetic Effects of Electrcic Current

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Q1. Why does a compass needle get deflected when brought near a bar magnet ?

Ans. Compass needle is a small magnet which experiences a force in the magnetic field of a bar magnet. Due to this force, it gets deflected.

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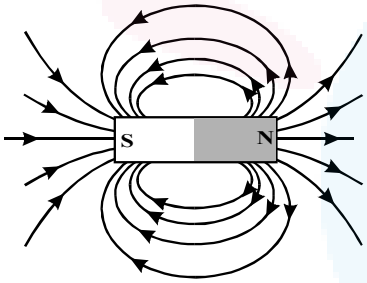
Q1. Draw magnetic field lines around a bar magnet.

Ans.



Q2. List the properties of magnetic field lines .

Ans. (i) Magnetic lines of force are closed continuous curves.
(ii) The tangent at any point on the magnetic line of force gives the direction of the magnetic field at that point.
(iii) Two magnetic lines of force never cross each other.

Q3. Why do no two magnetic lines of force intersect each other ?

Ans. The tangent at any point on a magnetic field line gives the direction of magnetic field at that point. If two magnetic field lines cross each other, then at the point of intersection, there will be two tangents. Hence, there will be two directions of the magnetic field at the point of intersection. This is not possible. Hence, no two magnetic field lines can cross each other.

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Q1. Consider a circular loop of wire lying in the plane of the table. Let the current pass through the loop clockwise. Apply the right hand rule to find out the direction of magnetic field inside and outside the loop.

Ans. Magnetic field inside the loop is perpendicular to the plane of table and in the downward direction. Outside the loop, magnetic field is perpendicular to the plane of the table and in the upward direction.

Q2. The magnetic field in a given region is uniform. Draw a diagram to represent it.

Ans.

Q3. Choose the correct option. The magnetic field inside a long straight solenoid carrying current

(1) is zero
(2) decreases as we move towards its ends
(3) increases as we move towards its ends
(4) is the same at all points

Ans. The magnetic field inside a long straight solenoid carrying current decreases as we move towards its ends. At the ends of solenoid, the strength of the magnetic field is almost the half that in the middle of the solenoid. Thus, the correct option is (2).

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Q1. Which of the following property a proton can change when it moves freely in a magnetic field ? (There may be more than one correct answer)

(1) mass
(2) speed
(3) velocity
(4) momentum

Ans. Motion of a charged particle like proton in a magnetic field is a circular path. Hence, its velocity and momentum can change. Thus, option (3) and (4) are correct.

Q2. In activity 13.7, how do we think the displacement of rod PQ will be affected if (i) current in rod PQ is increased (ii) a stronger horseshoe magnet is inserted (iii) length of the rod PQ is increased.

Ans. (i) When current in rod increases, force on the rod also increases. Hence, the displacement of the rod increases.

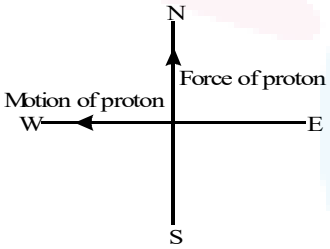
(ii) When a stronger horseshoe magnet is inserted, magnetic field increases. Thus, force on the rod also increases. Hence, displacement of the rod increases.

(iii) When length of the rod increases, force on the rod also increases and hence, displacement increases.

Q3. A positively charged particle (alpha particle), projected towards west, is deflected towards north by a magnetic field. The direction of magnetic field is

(1) towards south (2) towards east (3) downward (4) upward

Ans.



By applying Fleming's left hand rule, we find that the magnetic field is in upward direction. Thus, option (4) is correct.

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Q1. Name two safety measures commonly used in electric circuit and appliances.

Ans. (i) Electric fuse (ii) Earthing (or grounding).

Q2. 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.

Ans. Power, P = 2 kW = 2000 W ; V = 220 V
Now, P = V × I or I = P/V
or I = (2000)/220 = 9.09 A.
This shows that current flowing through the oven is more than the current rating (5 A). Hence, the fuse in the circuit melts i.e., the circuit breaks preventing the oven from damage.

Q3. What precautions should be taken to avoid the overloading of domestic electric circuit ?

Ans. (i) We should not connect many appliances in the same socket.
(ii) Electrical appliances of high power rating should not be switched on simultaneously.
(iii) Electric wires with good quality insulating covers should be used to prevent the short-circuiting.

EXERCISES

Q1. Which of the following correctly describes the magnetic field near a long straight wire?g wire ?
(1) The field consists of straight lines perpendicular to the wire.
(2) The field consists of straight lines parallel to the wire.
(3) The field consists of radial lines originating from the wire.
(4) The field consists of concentric circles centered on the wire.

Ans. The magnetic field lines around a long straight current-carrying conductor are concentric circles with the conductor located at their centre. Thus, the option (4) is correct.

Q2. At the time of short-circuit, the current in the circuit
(1) Reduces substantially (2) Does not change
(3) Increases heavily (4) Varies continuously

Ans. Short-circuit takes place when the live wire and the neutral wire come into direct contact, the resistance in the circuit becomes very low and the current in the circuit abruptly increases. Thus, option (3) is correct.

Q3. State whether the following statements are true or false.
(1) An electric motor converts mechanical energy into electrical energy.
(2) An electric generator works on the principle of electromagnetic induction.
(3) The field at the centre of a long circular coil carrying current will be parallel straight lines.
(4) A wire with a green insulation is usually the live wire.

Ans. (1) False. It converts electrical energy into mechanical energy.
(2) True.
(3) True.
(4) False. Live wire has red insulation cover.

Q4. List three sources of magnetic fields.

Ans. (i) A permanent magnet.
(ii) A current-carrying conductor.
(iii) A current-carrying solenoid.

Q5. When is the force experienced by a current-carrying conductor placed in magnetic field the largest?

Ans. When current-carrying conductor is placed perpendicular to the magnetic field.

Q6. Imagine that you are sitting in a chamber with youre back to one wall. An electron beam, moving horizontally from back wall, is the deflected by a strong magnetic field to youre right side. What is the direction of magnetic field?

Ans. "Fleming's Left Hand Rule provides a means to ascertain the orientation of the magnetic field. This magnetic field will be at a right angle to both the direction of the current and the direction of deflection, which can be either upward or downward. Since negatively charged electrons move from the rear wall to the front wall, the current flows from the front wall to the rear wall. Consequently, the magnetic force is directed to the right. By applying Fleming's Left Hand Rule, we can conclude that the magnetic field within the chamber is directed downward."

Q7. State the rule to determine the direction of a
(i) magnetic field produced around a straight conductor carrying current,
(ii) force experienced by a current-carrying straight conductor placed in a magnetic field which is perpendicular to it, and
(iii) current induced in a coil due to its rotation in a magnetic field.

Ans. (i) Right hand thumb rule.
(ii) Fleming's left hand rule.
(iii) Fleming's right hand rule.

Q8. When does an electric short-circuit occur ?

Ans. When live wire and neutral wire touch each other (i.e. come in direct contact).

Q9. What is the function of an earth wire ? Why is it necessary to earth metallic casings of electric appliances.

Ans. Earth wire acts as a safety measure. When the live wire touches the metallic casing of an electric appliance, the electric current flows from the casing of the appliance to the earth through the copper wire. An electric current flows along the path of low resistance thus, current passes through the copper wire instead of human body. Thus, the human body is saved from electric shock.