Science

(Chapter - 12)(**Magnetic Effects of Electric Current**)

Class - 10

Exercises

Question 1:

Which of the following correctly describes the magnetic field near a long straight wire?

(a) The field consists of straight lines perpendicular to the wire.

(b) The field consists of straight lines parallel to the wire.

(c) The field consists of radial lines originating from the wire.

(d) The field consists of concentric circles centred on the wire.

Answer 1:

(d) The field consists of concentric circles centred on the wire.

On applying right-hand thumb rule, we find the direction of magnetic field. The field is in the form of concentric circles centred on the wire carrying current.

Hence, the option (d) is correct.

Question 2:

At the time of short circuit, the current in the circuit

(a) reduces substantially.

(b) does not change.

(c) increases heavily.

(d) vary continuously.

Answer 2:

(c) increases heavily.

At the time of short circuiting the live wire and the neutral wire come into direct contact. As a result, the current in the circuit abruptly increases.

Hence, the option (c) is correct.

Question 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.

(b) A wire with a green insulation is usually the live wire of an electric supply.

Answer 3:

(a) The field at the centre of a long circular coil carrying current will be parallel straight lines. (**True**)

(b) A wire with a green insulation is usually the live wire of an electric supply. (**False**)

Question 4:

List two methods of producing magnetic fields.

Answer 4:

Two methods of producing magnetic field are as follows:

- Magnetic field can be produced by placing a permanent bar magnet or a horse-shoe magnet at the place, where magnetic field is required.
- Magnetic field is produced around a current-carrying straight conductor or a current carrying circular coil.

Question 5:

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

Answer 5:

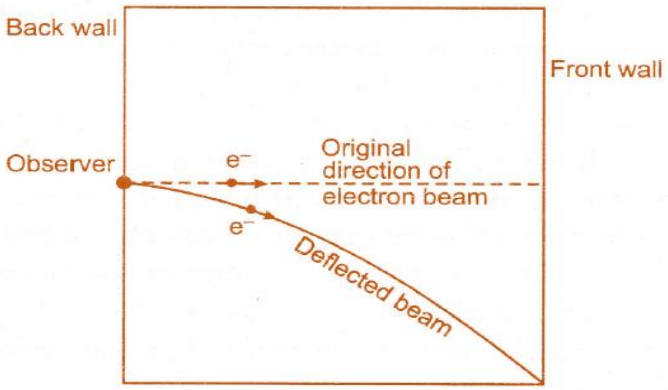
The force experienced by a current-carrying conductor placed in a magnetic field is largest when the current-carrying conductor is placed in a direction perpendicular to that of magnetic field.

Question 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?

Answer 6:

An electron beam moving horizontally from back wall towards the front wail is equivalent to a current flowing in the opposite direction (i.e., from front wall towards the back wall). The deflection of electron beam as seen by observer is to his right side and is shown in Figure. On applying Fleming's left-hand rule we find that the magnetic field is acting in vertically downward direction.



Question 7:

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.

Answer 7:

(i) Maxwell's right hand thumb rule
(ii) Fleming's left hand rule
(iii) Fleming's right hand rule

Question 8:

When does an electric short circuit occur?

Answer 8:

If either the insulation of wires used in an electrical circuit is damaged or there is a fault in the appliance, live wire and neutral wire may come in direct contact. As a result, the current in the circuit abruptly rises and short-circuiting occurs.

Question 9:

What is the function of an earth wire? Why is it necessary to earth metallic appliances?

Answer 9:

The metallic body of electric appliances is connected to the earth by means of earth wire so that any leakage of electric current is transferred to the ground. This prevents any electric shock to the user. That is why earthing of the electrical appliances is necessary.

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Question 1:

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

Answer 1:

Magnetic compass needle and bar magnet both have magnetic field. When they brought near to each other, these magnetic fields interact each other giving deflection in needle.

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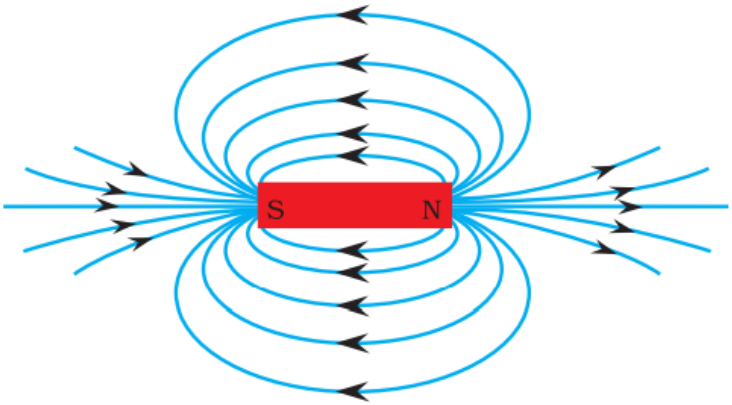
Question 1:

Draw magnetic field lines around a bar magnet.

Answer 1:



Field lines around a bar magnet

Question 2:

List the properties of magnetic field lines.

Answer 2:

Properties of magnetic lines of force (also known as magnetic field lines) are listed below:

- Outside the magnet, the magnetic field lines are directed from N-pole of magnet towards S-pole. However, inside a magnet the field lines are directed from S-pole to N-pole. Thus magnetic field lines form a close loop.
- The magnetic field line at any point points in the direction of magnetic field at that point.
- The relative strength of magnetic fields is given by degree of closeness of the field lines. The magnetic field is strong in the region where the field lines are crowded.
- No two magnetic field lines can ever intersect with each other.

Question 3:

Why don’t two magnetic field lines intersect each other?

Answer 3:

No two field-lines are found to cross each other. If they did, it would mean that at the point of intersection, the compass needle would point towards two directions, which is not possible.

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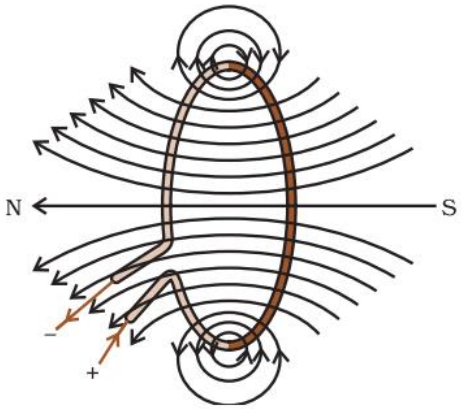
Question 1:

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 the magnetic field inside and outside the loop.

Answer 1:

The magnetic field lines have been shown in Figure given below. As per right-hand rule, we find that inside the loop, the magnetic field lines are directed perpendicular to the plane of paper in the inward direction. Outside the loop magnetic field lines are directed out of the plane of paper.



Magnetic field lines of the field produced by a current-carrying circular loop

Question 2:

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

Answer 2:

The uniform magnetic field is represented by parallel, equidistant lines of equal length as shown in Figure.

Uniform Magnetic Field Lines

Question 3:

Choose the correct option.

The magnetic field inside a long straight solenoid-carrying current

(a) is zero.

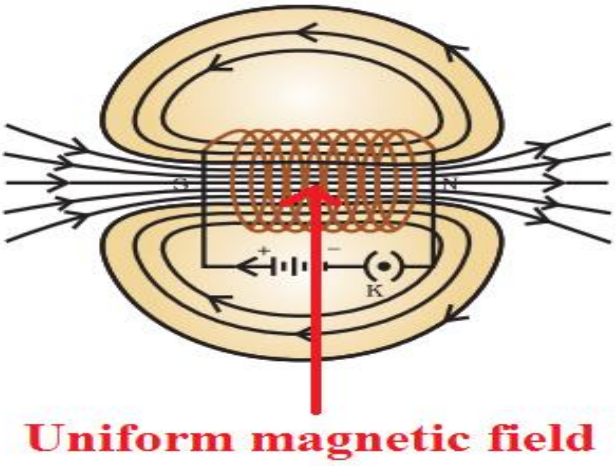
(b) decreases as we move towards its end.

(c) increases as we move towards its end.

(d) is the same at all points.

Answer 3:

(d) is the same at all points.



Question 1:

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

(a) Mass (b) Speed

(c) Velocity (d) Momentum

Answer 1:

(c) Velocity and (d) Momentum

Question 2:

In Activity 12.7, how do we think the displacement of rod AB will be affected if (i) current in rod AB is increased; (ii) a stronger horse-shoe magnet is used; and (iii) length of the rod AB is increased?

Answer 2:

(i) If current in rod AB is increased, the displacement will also increase.

(ii) If we use a stronger horse-shoe magnet then the displacement of rod AB will increase.

(iii) lf length of the rod is increased, force acting on it will increase and, hence, displacement of the rod increases.

Question 3:

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

(a) towards south (b) towards east

(c) downward (d) upward

Answer 3:

(d) upward

In accordance with Fleming's left-hand rule, the direction of magnetic field is vertically upward.

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Question 1:

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

Answer 1:

Two safety measures are:

- Use of earth wire and proper earthing.
- Use of fuse (now a days fuse wire is replaced by MCB).

Question 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.

Answer 2:

Power rating of electric oven P = 2 kW = 2000 W

Supply voltage V = 220 V

So, the current drawn by electric oven $I = \frac{P}{V} = \frac{2000\ W}{220\ V} = 9\ A$

As the current rating of domestic electric circuit is only 5 A and the oven draws a current 9 A, which is more than the current rating, hence the circuit will be damaged due to overheating/overloading.

Question 3:

What precaution should be taken to avoid the overloading of domestic electric circuits?

Answer 3:

The precautions that should be taken to avoid the overloading of domestic circuits are as follows:

- Too many appliances should not be connected to a single socket.
- Too many appliances should not be used at the same time.
- Faulty appliances should not be connected in the circuit.
- Fuse should be connected in the circuit.