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Question 1: Why does a compass needle get deflected when brought near a bar magnet?

Answer: A compass needle is also one type of small bar magnet. So, if we bring a compass needle near a bar magnet, it will either attract or repel the compass needle. Hence, the compass needle will be deflected by the magnetic field of the bar magnet.

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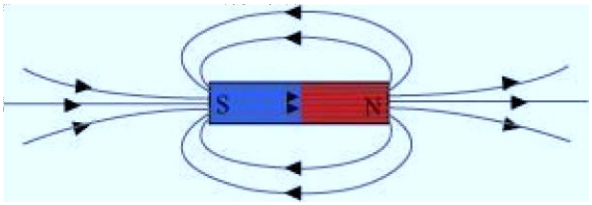
Question 1: Draw magnetic field lines around a bar magnet.

Answer: We know that Magnetic field lines of a bar magnet emerge from the north pole and terminate at the south pole outside of the magnet.
Inside the magnet, the field lines go from the south pole towards the northpole, as shown in the given figure.



Question 2: List the properties of magnetic lines of force. (what are the characteristics of the magnetic field line?)

Answer: The properties of magnetic lines are -

1. Magnetic field lines emerge from the north pole and terminate at the south pole outside of the magnet.
2. Inside the magnet, the field lines go from the south pole towards the northpole
3. Magnetic field lines are parallel inside the magnet.
4. Two magnetic field lines will never intersect each other because, at the intersecting point, we will get two directions of the magnetic field, which is practically impossible.
5. If we draw a tangent at any point of the magnetic field line, we will get the direction of the magnetic field at that point.

Question 3: Why don't two magnetic lines of force intersect each other?

Answer: Two magnetic field lines will never intersect each other because, at the intersecting point, we will get two directions of magnetic field, which is practically impossible.
Related information - [If we draw a tangent at any point of the magnetic field line, we will get the direction of the magnetic field at that point. }

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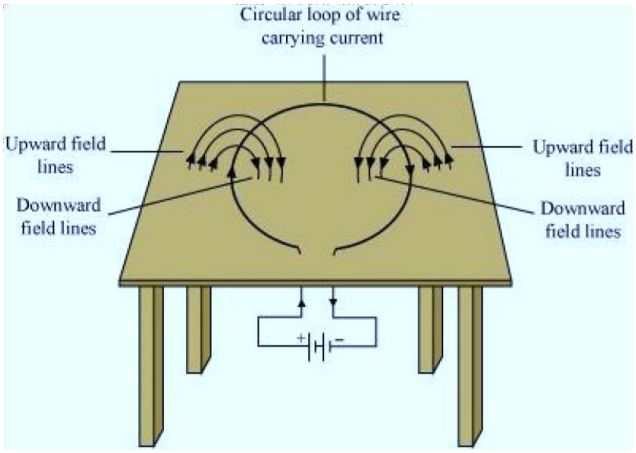
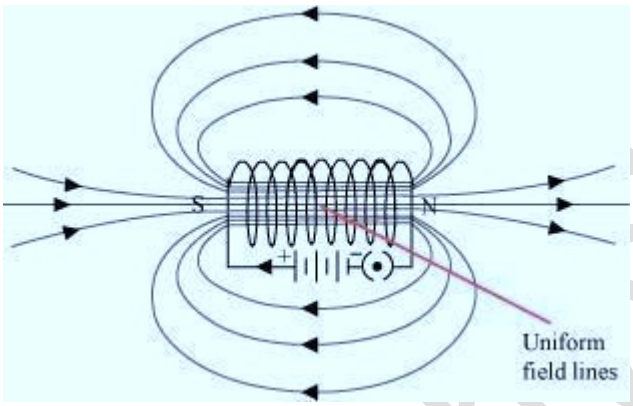
Question 1: Consider a circular loop of wire lying in the plane of the table. Let the current passing through the loop is clockwise. Apply the right-hand rule to find out the direction of the magnetic field inside and outside the loop.

Answer: If we place a current-carrying circular loop over a table carrying current in the clockwise direction, then -
Inside the loop, the direction of the magnetic field is downward.
And, outside the loop, the direction of the magnetic field is upward.



Question 2: The magnetic field in a given region is uniform. Draw a diagram to represent it.
Answer:



The magnetic field line inside a current-carrying solenoid is parallel. Hence, The magnetic field inside a long, straight, current-carrying solenoid is uniform and same at all points inside the solenoid.

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: (d) The magnetic field line inside a current-carrying solenoid is parallel. Hence, The magnetic field inside a long, straight, current-carrying solenoid is uniform and same at all points inside the solenoid.

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: (c) and (d)
When a proton enters in a magnetic field, it experiences a magnetic force. As a result, it starts rotating in a circular way. Therefore, its velocity and momentum will be changed.

Question 1: State Fleming's left-hand rule.

Answer: According to Fleming's left-hand rule, if we stretch our thumb finger, the center finger, and the forefinger in such a way that they make an angle of 90 degrees (Perpendicular to each other), with the forefinger in the direction of the field and the center finger in the direction of the current then the thumb indicates the direction of force.

Question 2: What is the principle of an electric motor?

Answer: The working principle of an electric motor is based on the magnetic effect of a current-carrying loop. If we place a current-carrying loop in a magnetic field, It will start rotating. The direction of rotation of the loop can be determined by Fleming's left-hand rule.

Question 3: What is the role of the split ring in an electric motor?

Answer: The split ring in an electric motor acts as a commutator. The commutator reverses the direction of current flowing through the coil after each half rotation of the coil. It helps the coil to rotate continuously in the same direction.
If the commutator is not used, the direction of current in an arm of the coil will always remain the same. So the direction of the force on the arm will not change, and the coil will not be able to complete one rotation.

Question 1: Explain different ways to induce current in a coil.

Answer: There are many ways to induce current in a coil. The most effective ways are -
1. If a coil is moved rapidly in a strong magnetic field, then an electric current is induced in the coil.
2. If there is a relative velocity between a magnet and a coil, then an electric current is induced in the coil.

Question 1: State the principle of an electric generator.

Answer: An electric generator works on the principle of electromagnetic induction. It converts mechanical energy to electricity by rotating a coil in a magnetic field.

Question 16: Name some sources of direct current.

Answer: Some sources of direct current are Dry Cell, DC generators, Solar cells, Car batteries, etc.

Question 17: Which sources produce alternating current?

Answer: Some sources of direct current are AC generators, coal power plants, nuclear power plants, etc.

Question 18: Choose the correct option.

A rectangular coil of copper wires is rotated in a magnetic field. The direction of the induced current changes once in each

(a) two revolutions (b) one revolution

(c) half revolution (d) one-fourth revolution

Answer: (c) When a rectangular coil of copper is rotated in a magnetic field, the direction of the induced current in the coil changes once in each half revolution. Therefore, the direction of current in the coil remains the same for half revolutions only.

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

Answer:

1. Use of electric fuse to prevent excessive flow of current through appliances.
2. Use of earthing to prevent electric shocks in case any leakage of current in an electric appliance happens.

Question 2: An electric oven of 2 kW is operated in a domestic electric circuit (220 V) that has a current rating of 5 A. What result do you expect? Explain.

Answer: Power of the oven, P = 2 kW = 2000 W.

Supply Voltage V = 220 V

Current drawn by the electric oven can be obtained by the expression, I = P / V = 2000 / 220 = 9.09 A.

Hence, 9.09 A current is drawn by the electric oven, which exceeds the safe limit of the circuit.

The fuse wire of the circuit will melt and break the circuit.

Question 3: What precautions should be taken to avoid the overloading of domestic electriccircuits?

Answer: The precautions we should take to avoid the overloading -

1. Too many appliances should not be connected to a single socket at the same time.
2. Faulty appliances should not be connected to the circuit.
3. Fuse should be connected in the circuit.
4. We should not use too heavy loads in our domestic circuit.

Question 1: Which of the following correctly describes the magnetic field near a long straightwire?

Answer:

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

Answer: (d) The field consists of concentric circles centered on the wire.

We know that the magnetic field lines, produced by a straight current-carrying conductor, are concentric circles. Whose center lies on the wire.

Question 2: The phenomenon of electromagnetic induction is -

1. the process of charging a body

2. the process of generating magnetic field due to current passing through a coil

3. producing induced current in a coil due to relative motion between a magnet and the coil

4. the process of rotating a coil of an electric motor

Answer: (c) producing induced current in a coil due to relative motion between a magnet and the coil

When there is a relative velocity between a current-carrying wire and a magnetic, a current is induced in the coil. This phenomenon is known as electromagnetic induction.

Question 3: The device used for producing electric current is called a -

1. generator

2. galvanometer

3. ammeter

4. motor

Answer: (a) generator

The device used for producing electric current is known as a generator with help of electromagnetic induction. It converts mechanical energy into electricity.

Question 4: The essential difference between an AC generator and a DC generator is that

1. AC generator has an electromagnet while a DC generator has a permanent magnet.

2. DC generator will generate a higher voltage.

3. AC generator will generate a higher voltage.

4. AC generator has slip rings while the DC generator has a commutator.

Answer: (d) AC generator has slip rings while the DC generator has a commutator.

An AC generator has slip rings while a DC generator has split rings called a commutator. This is the main difference between AC and DC generators.

Question 5: At the time of short circuit, the current in the circuit

1. reduces substantially

2. does not change

3. increases heavily

4. vary continuously

Answer: (c) increases heavily.

When positive and negative wires of an electric circuit directly touch each other, the amount of current that is flowing in the circuit increases abruptly as there is no load. This condition is known as short-circuit.

Question 6: 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 green insulation is usually the live wire of an electric supply.

Answer: (1) False - An electric motor converts electrical energy into mechanical energy.

(2) True - A generator is an electric device that generates electricity by rotating a coil in a magnetic field (Electromagnetic Induction).

(3) True - A long circular coil can be considered as a long solenoid. The magnetic field lines inside the solenoid are parallel and uniform.

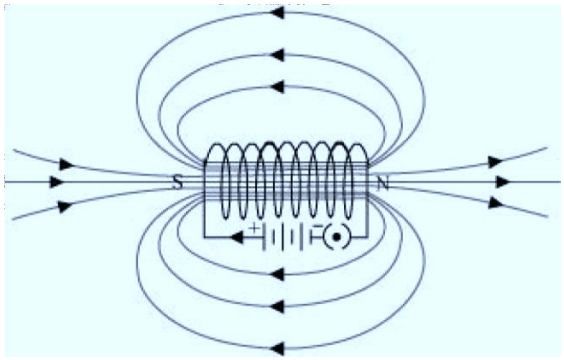
(4) False - Live wire has a red insulation cover, whereas earth wire has green insulation colour in the domesticcircuits.

Question 7: List two methods of producing magnetic fields.
Answer: Following methods suitable for producing magnetic fields:

1. Different types of conductors such as solenoid and circular loop produces magnetic field.
2. A permanent magnet produces magnetic field.
3. A current-carrying straight conductor produces magnetic field.

Question 8: How does a solenoid behave like a magnet? Can you determine the north and southpoles of a current-carrying solenoid with the help of a bar magnet? Explain.

Answer: The field lines produced by a current-carrying solenoid is shown in the following figure.



Hence, we can see that when the north pole of a bar magnet is brought near the end connected to the negative terminal of the battery, the solenoid repels the bar magnet. Since like poles repel each other, the right end connected to the negative terminal of the battery behaves as the north pole of the solenoid.
Similarly, the other end behaves as a south pole. Therefore it behaves like an electromagnet.

Question 9: When is the force experienced by a current-carrying conductor placed in a magnetic field largest?

Answer: If the direction of current is perpendicular to the direction of the magnetic field then, the force experienced by a current-currying conductor becomes maximum.

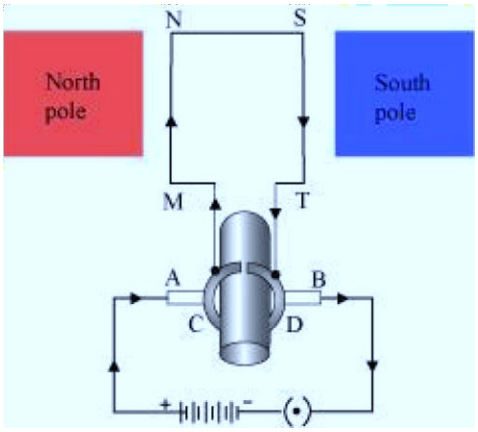
Question 10: Imagine that you are sitting in a chamber with your back to one wall. An electron beam, moving horizontally from back wall towards the front wall, is deflected by a strong magnetic field to your right side. What is the direction of magnetic field?

Answer: The direction of magnetic field is given by Fleming's left-hand rule. Magnetic field inside the chamber will be perpendicular to the direction of current (opposite to the direction of electron) and direction of deflection/force i.e., either upward or downward. The direction of current is from the front wall to the back wall because negatively charged electrons are moving

from back wall to the front wall. The direction of magnetic force is rightward. Hence, usingFleming's left-hand rule, it can be concluded that the direction of the magnetic field inside the chamber is downward.

Question 11: Draw a labeled diagram of an electric motor. Explain its principle and working.
What is the function of a split ring in an electric motor?

Answer: An electrical motor works on the principle of the magnetic effect of electric current. In motor, a current-carrying coil rotates in amagnetic field. The internal structure of an electric motor is shown below-



When a current is flowing through the coil MNST, according to Flemings left-hand rule, a downward force acts on the MN side of the coil and at the same time, an upward force acts on ST side of the coil. As a result, the coil rotates anti-clockwise.
After half a rotation, the direction of the current in coil is reversed due to split ring and the position of MN and ST interchange. Now, a downward force acts on ST side of coil and at the same time, an upward force acts on MN side of the coil. Hence, the direction of rotation of the coil remains the same.
This is how a coil can rotate continuously in a particular direction.

Use of split ring in DC motor:

The split ring in an electric motor acts as a commutator. The commutator reverses the direction of current flowing through the coil after each half rotation of the coil. It helps the coil to rotate continuously in the same direction.
If the commutator is not used, the direction of current in an arm of the coil will always remain the same. So the direction of the force on the arm will not change, and the coil will not be able to complete one rotation.

Question 12: Name some devices in which electric motors are used?

Answer: Electric motors are used widely in - Water pumps, Electric fans, Electric mixers, Washing machines

Question 13: A coil of insulated copper wire is connected to a galvanometer. What will happen if a bar magnet is
(i) pushed into the coil.
(ii) withdrawn from inside the coil.
(iii) held stationary inside the coil.

Answer:

(i) When a bar magnet is pushed towards a coil of a galvanometer, a current is induced immediately in the coil. As a result, the needle of the galvanometer deflects in a particular direction.

(ii) When the bar magnet is withdrawn from inside the coil of a galvanometer, a current is again induced in the coil but in opposite direction. As a result, the needle of the galvanometer deflects in the opposite direction.

(iii) When a bar magnet is held stationary inside the coil, There is no relative velocity between the coil and the magnet. Hence, no current will be induced in the coil. Therefore, there will be no deflection.

Question 14: Two circular coils A and B are placed closed to each other. If the current in coil A is changed, will some current be induced in coil B? Give a reason.

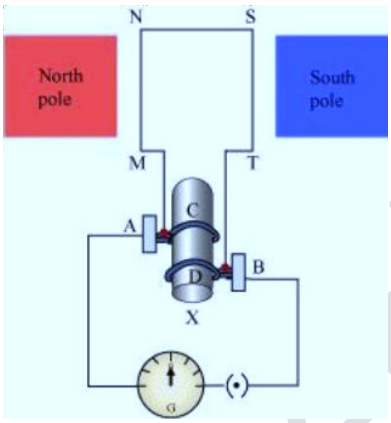
Answer: When the current in coil A is changed, the magnetic field associated with it also changes. Due to electromagnetic induction, some amount of current will be induced in the B,

Question 15: 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 conductorplaced in a magnetic field which is perpendicular to it.
(iii) Current induced in a coil due to itsrotation in a magnetic field.

Answer: (i) Direction of a magnetic field produced around a straight conductor carrying current can be determined by - Maxwell's right-hand thumb rule.
(ii) Direction of force experienced by a current-carrying straight conductorplaced in a magnetic field which is perpendicular to it can be determined by - Fleming's left-hand rule
(iii) Direction of current induced in a coil due to its rotation in a magnetic field can be determined by Fleming's right-hand rule

Question 16: Explain the underlying principle and working of an electric generator by drawing a labeled diagram. What is the function of brushes?

Answer: An electric generator can produce electricity from mechanical energy. It generates electricity by rotating a coil in a magnetic field. The principle of working of an electric generator is that when a coil is moved in a magnetic field, an electric current is induced in the coil. The figure of an AC generator is shown below:



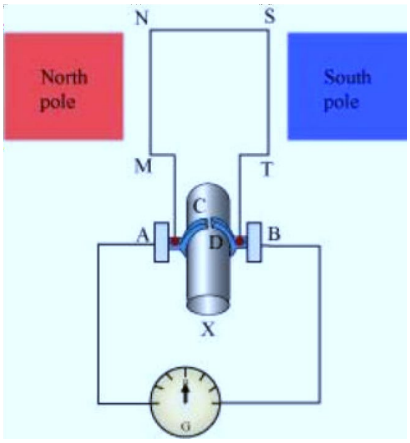
MNST → Rectangular coil
C and D → Two slip rings
A and B → Brushes
X → Axle, G → Galvanometer

If axle X is rotated clockwise, then the length MN moves upwards while length ST moves downwards. Since the lengths MN and ST are moving in a magnetic field, a current will be

induced in both of them due to electromagnetic induction. Hence, according to Fleming's right-hand rule, the directionof induced current will be from M to N. Similarly, the direction of induced current in the length ST will be from S to T.

After half a rotation, length MN starts moving down whereas length ST starts moving upward. The direction of the induced current in the coil gets reversed as TSNM. As the direction of current gets reversed after each half rotation, the produced current is called an alternating current (AC).

To get a unidirectional current, instead of two slip rings, two split rings are used, as shown in the following figure.



The function of brushes:

In this arrangement, brush A always remains in contact with the length of the coil that is moving up whereas brush B always remains in contact with the length that is moving down. Here, the brushes connect the coil with slip rings or split rings.

Question 17: When does an electric short circuit occur?

Answer: When positive and negative wires of an electric circuit directly touch each other, the amount of current that is flowing in the circuit increases abruptly as there is no resistance. This condition is known as short-circuit.

Question 18: What is the function of an earth wire? Why is it necessary to earth metallic appliances?

Answer: The earth wire is mainly used to avoid getting electric shock in metallic appliances. Due to any fault in electric circuit in metallic appliances, In this case, the earth wire passes the excess amount of current to the ground. This causes a high amount of current to flow through the fuse wire also. Hence, the fuse wire burns and cuts the circuit.