Date: 25/9/2021

Q1. The magnetic field in a given region is uniform. Draw a diagram to represent it.

Q2. 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.

Q3. 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.

Q4. 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

Q5. 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

Q6. State Fleming's left-hand rule.

Q7. The phenomenon of electromagnetic induction is
(a) the process of charging a body.
(b) the process of generating magnetic field due to a current passing through a coil.
(c) producing induced current in a coil due to relative motion between a magnet and the coil.
(d) the process of rotating a coil of an electric motor.

Q8. Name some sources of direct current (d.c.).

Q9. Which sources produce alternating current (a.c.)?

Q10. 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) on-fourth revolution

Q11. The device used for producing electric current is called a
(a) generator (b) galvanometer (c) ammeter (d) motor

Q12. Name two safety measures commonly used in electric circuits and appliances.

Q13. At the time of short circuit, the current in the circuit
(a) reduces substantially (b) does not change (c) increases heavily (d) vary continously

Q14. Why does a compass needle get deflected when brought near a bar magnet?

Q15. Draw magnetic field lines around a bar magnet.

Q16. List the properties of magnetic lines of force.

Q17. Why don't two magnetic lines of force intersect each other?

Q18. 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.

Q19. When is the force experienced by a current-carrying conductor placed in a magnetic field largest?

Q20. What is the principle of an electric motor?

Q21. Name some devices in which electric motors are used.

Q22. Explain different ways to induce current in a coil.

Q23. 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?

Q24. Two circular coils *A* and *B* are placed close to each other. If the current in the coil *A* is changed, will some current be induced in the coil *B*? Give reason.

Q25. State the principle of an electric generator.

Q26. 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.

Q27. When does an electric short circuit occur?

Q28. State whether the following statements are true or false.

(a) An electric motor converts machenical energy into electrical energy.

(b) An electric generator works on the principle of electromagnetic induction.

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

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

Q29. List three methods of producing magnetic fields.

Q30. How does a solenoid behave like a magnet? Can you determine the North and South poles of a current-carrying solenoid with the help of a bar magnet? Explain.

Q31. A coil of insulated copper wire is connected to a galvanometer. What will happen if a bar magnet is (a) pushed into the coil, (b) withdrawn from inside the coil, (c) held stationary inside the coil?

Q32. State the rule to determine the direction of a (a) magnetic field produced around a straight conductor-carrying current, (b) force experienced by a current-carryig straight conductor placed in a magnetic field which is perpendicular to it, and (c) current induced in a coil due to its rotation in a magnetic field.

Q33. What precaution should be taken to avoid the overloading of domestic electric circuits?

Q34. What is the function of an earth wire? Why is it necessary to earth metallic appliances?

Q35. Draw a labelled diagram of an electric motor. Explain its principle and working. What is the function of a split ring in an electric motor?

Q36. Explain the underlying principle and working of an electric generator by drawing a labelled diagram. What is the function of brushes?

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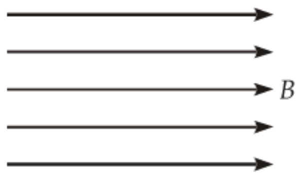
S1. The uniform magnetic field is represented by parallel, equispaced lines of equal length as shown in figure.



S2. **(d)** The magnetic field inside a long straight solenoid-carrying current is the same at all points.

S3. **(d)** The field consists of concentric circles centred on the wire.

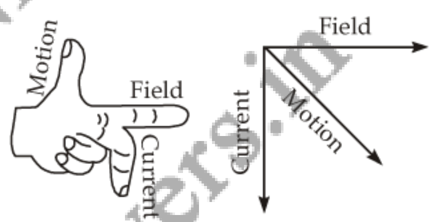
[***Hint:*** On a applying right-hand thumb rule we find the direction of magnetic field. The field is in the form of concentric circles centred on the wire carrying current.]

S4. (c), (d).

If a proton moves freely in a magnetic field in a direction perpendicular to that of magnetic field, its velocity as well as momentum will change but mass and speed will remain unchanged. However, if proton is moving along the direction magnetic field, then there is no change even in velocity or momentum etc.

S5. **(d)** In accordance with Fleming's left-hand rule, the direction of magnetic field is vertically upward.

S6. Fleming's left-hand rule states that stretch the forefinger, the central finger and the thumb of your left-hand mutualy perpendicular to each other. If the forefinger shows the direction of the magnetic field and the central finger that of the current, then the thumb will point towards the direction of motion of the conductor (*i.e.*, the thumb will point in the direction of force *F*).



S7. **(c)** producing induced current in a coil due to relative motion between a magnet and the coil.

S8. Some sources of direct current are a cell, a battery and a d.c. generator.

S9. A.C. generator and common inverter used in houses for emergency power supply produce alternating current.

S10. **(c)** When a rectangular coil of copper wire is rotated in a magnetic field, the direction of the induced current changes once in each half revolution.

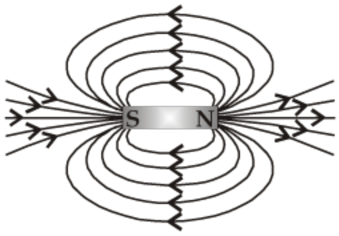
S11. **(a)** Generator. [*Hint:* An electric generator is the device used for producing an electric current]

S12. Two safety measures are (a) use of earth wire and proper earthing, and (b) use of fuse.

S13. **(c)** Increases heavily.

S14. The compass needle is a small bar magnet. We know that like magnetic poles repel but unlike poles attract. When a compass needle is brought near a bar magnet then due to repulsive force between like poles and attraction between unlike poles, the compass needle is deflected. Finally, the compass needle comes to rest in the direction of net magnetic field.

S15. Magnetic field lines are shown in figure.



S16. Properties of magnetic lines of force (also known as magnetic field lines) are listed below:

(a) Outside a 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 are closed curves.

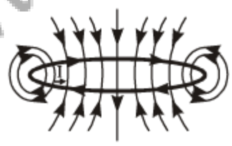
(b) The magnetic field line at any point points in the direction of magnetic field at that point.

(c) The relative strength of magnetic field lines is given by degree of closeness of the field lines. The magnetic field is stronger in the region where the field lines are crowded.

(d) No, two magnetic field lines can ever intersect with each other.

S17. No, two magnetic field lines can ever intersect each other. If they do, then it would mean that at the point of intersection there are two directions of magnetic field, which is not possible.

S18. The magnetic field lines have been shown in the figure. As per rignt-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.



S19. 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.

S20. An electric motor is based on the principle that a current-carrying conductor experiences a force when placed in a magnetic field. If the direction of the magnetic field and that of the current are mutually perpendicular then the direction of the force is given by Fleming's left-hand rule.

S21. Electric motors are used in all such devices where we want to convert electrical energy into mechanical energy so as to drive that device/machine. In our houses, electric motors are being fitted in electric fans, coolers, air conditioners, mixer grinders, washing machines, refrigerators, juicers, computers, MP-3 players etc. In factories, motors are used in almost all machines.

S22. Different ways to induce current in a coil are as given below:

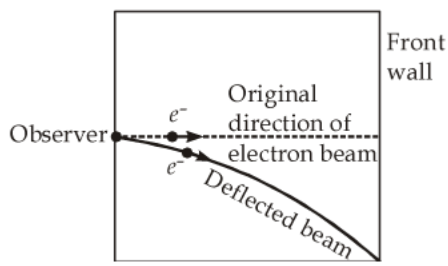
(a) If a magnetic field is changed around a coil then an induced current is set up in th coil. It can be done by taking a bar magnet and bringing it closer to the coil or taking it away from the coil.

(b) If a coil is moved in a magnetic field, then again an induced current is set up in the coil.

(c) If a coil is rotated in a uniform magnetic field, it may also produce an induced current in the coil.

(d) If we take two coils and insert them over a non-conducting cylindrical roll then on changing current flowing in one coil, an induced current is obtained in the other coil.

S23. An electron beam moving horizontally from back wall towards the front wall 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 the observer is to his right side and is shown in figure. On applying Fleming's left-hand rule we find th magnetic field is acting in vertically downward direction.



S24. Yes, a current is induced in the coil *B*.

When the current in the coil *A* changed, the magnetic field associated with it also changes. As coil *B* is placed close to *A*, hence magnetic field lines around this coil also change. Due to change in magnetic field lines associated with coil *B*, an induced current is also induced in it.

S25. An electric generator is based on the principle of electromagnetic induction. When a rectangular coil is rotated in a uniform magnetic field, an induced voltage is generated between the ends of the coil.

S26. As power rating of electric oven $P = 2\,\text{kW} = 200\,\text{W}$ and supply voltage $V = 200\,\text{V}$

Hence, the electric oven will draw a current

$$I = \frac{P}{V} = \frac{2000\ \text{W}}{220\ \text{V}} = 9\,\text{A}.$$

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.

S27. If either the insulation of wires used in an electrical circuit is damaged or there is a fault in the appliance, live wire and netural wire may come in direct contact. As a result, the current in the circuit abruptly rises and shortcircuiting occurs.

S28. (a) **False:** In fact an electric motor converts electrical energy into mechanical energy.

(b) True: Yes, an electric generator works on the principle of electromagnetic induction.

(c) True: Yes, the magnetic field at the centre of a long circular coil carrying current will be parallel straight lines passing along the axis of coil.

(d) Fals: A wire with a green insulation is usually the earth wire.

S29. Three methods of producing magnetic field are as follows:

(a) Magnetic field can be produced by placing a permanent bar magnet or a horse-shoe magnet at the place, where magnetic field is required.

(b) Magnetic field is produced around a current-carrying straight conductor or a current-carrying circular coil.

(c) A very good method to produce magnetic field is due to flow of current in a solenoid.

S30. When current is passed through a solenoid coil, magnetic field produced due to each turn of solenoid coil is in the same direction. As a result, the resultant magnetic field is very strong and uniform. The field lines inside the solenoid are in the form of parallel straight lines along the axis of solenoid. Thus, the solenoid behaves like a bar magnet. One end of solenoid behaves as a magnetic north pole while the other end behaves as the south pole.

We can determine the magnetic poles formed in a solenoid. The end of the current-carrying solenoid, which attracts north pole but repels south pole of a bar magnet, is behaving as south magnetic pole. The other end, which attracts south pole of a bar magnet but repels the north pole, is behaving as north magnetic pole. It is because like poles repel but unlike poles attract each other.

S31. (a) When a bar magnet is pushed into the coil of insulated copper wire connected to a galvanometer, an induced current is set up in the coil. As a result, galvanometer gives a deflection (say towards left).

(b) When the bar magnet is withdraw from inside the coil, again an induced current is set up in the coil. Hence, deflection in galvanometer is in reverse direction (say towards right).

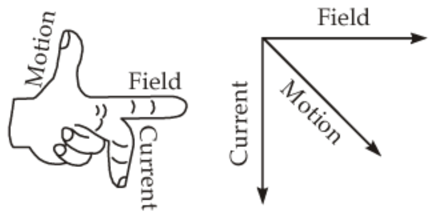
(c) If the bar magnet is held stationary inside the coil, then there is no induced current in the coil. As a result, galvanometer does not show any deflection.

S32. (a) To know the direction of magnetic field produced around a straigh conductor carrying current we use "right-hand thumb rule".

The direction of magnetic field associated with a current-carrying wire can be easily found by applying the "right-hand thumb rule". According to this rule, hold the current-carrying wire in your right hand such that the thumb is stretched along the direction of current, then, the fingers will wrap around the wire in the direction of the magnetic field.

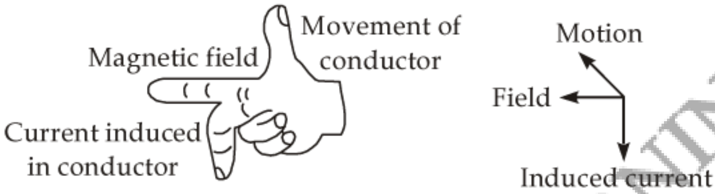
(b) To find the direction of force experienced by a current-carying straight conductor placed in a magnetic field which is perpendicular to it, we make use of "Fleming's left-hand rule".

Fleming's left-hand rule state that stretch the forefinger, the central finger and the thumb of your left-hand mutually perpendicular to each other. If the forefinger shows the direction of the magnetic field and the central finger that of current, then the thumb will point towards the direction of motion of the conductor (*i.e.*, the thumb will point in the direction of force *F*).



(c) For finding the direction of current induced in a coil due to its rotation in a magnetic field we use Fleming's right-hand rule.

Fleming's right-hand rule states that hold the forefinger, the central finger and the thumb of the righ-hand mutually perpendicular to each other such that the forefinger indicates the direction of magnetic field and the thumb is in the direction of motion of a conductor. Then, the central finger shows the direction of current induced in the conductor.



S33. We should take following precautions to avoid the overloading of domestic electric circuits:

(a) Two separate circuits should be used, one of 5 A current rating for bulbs, fans, tubes etc. and the other of 15 A current rating for appliances with higher current ratings such as geysers, air coolers, electric iron, electric stove etc.

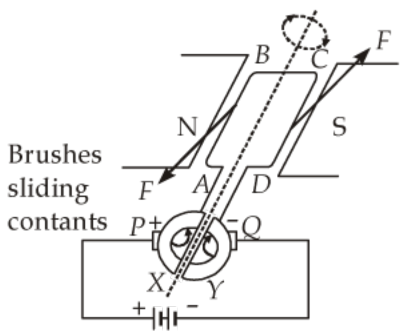
(b) Too many appliances never be connected to a single socket.

(c) A fuse of appropriate current rating should be used with the electric circuit.

S34. The earth wire functions as a safety measure, specialy for those appliances that have a metallic body *e.g.*, electric press, toaster, table fan, room cooler etc.

The metallic body of the appliance is connected to the earth wire, which provides a low resistance conducting path for electric current. It ensures that any leakage of current to the metallic body of an appliance keeps its potential same as of earth. As a result, the user would not get a severe electric shock, even if he touches the body of appliance.

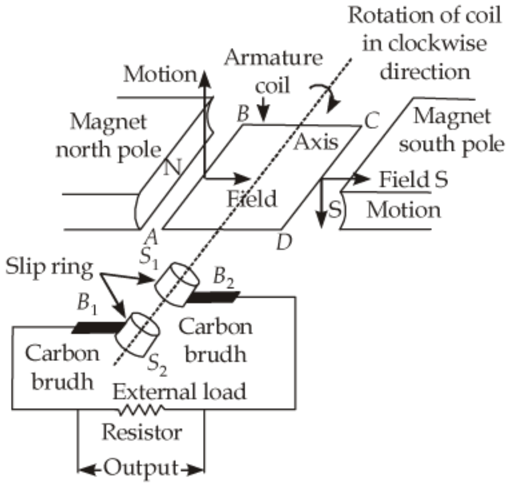
S35. Principle: A current-carrying conductor, when placed in a magnetic field, experiences a force. If the direction of the field and that of the current are mutually perpendicular then force acting on the conductor will be perpendicular to both and will be given by Fleming's left-hand rule. Due to this force the conductor begins to move, if it is free to do so.



Working: *

Function of a split ring: *

S36. Principle: An electric generator works on the principle of electromagnetic induction phenomenon. According to it, whenever a coil is rotated between the poles of a magnet, an induced current is set up in the coil, whose direction is given by Fleming's right-hand rule.



Working: Initially, suppose the plane of the coil is horizontal. The split ring S_1 touches the brush B_1 and split ring S_2 touches the brush B_2. The current in coil flows in the direction *ABCD*, as shown in figure. The currents in arms *AB* and *CD* are in opposite directions. The magnetic force acting on arm *AB* pushes it downwards while the force acting on th arm *CD* pushes it upwards. Thus, the armature coil along with the axle rotates anticlockwise. After half a rotation, the split ring S_1 comes in contact with brush B_2 and S_2 in contact with brush B_1. Therefore, the current flows along the path *DCBA*. Thus, the arm *AB* is now pushed up and the arm *CD* is pushed down. Therefore, the coil and the axle rotate half a turn more in the same direction. The reversing of the current is repeated at each half rotation, giving rise to a continuous rotation of the coil and to the axle.

Function of brushes: Two graphite or flexible metal rods maintain a sliding contact with split rings S_1 and S_2, alternately..