Very Short Answer Type Questions

[1 Mark]

Q. 1. What happens if a current carrying conductor is placed in the magnetic field?

Ans. The conductor experiences a force and the direction of this force is given by Fleming's left hand rule.

Q. 2. On what effect of an electric current does an electromagnet work?

Ans. electromagnet works on the magnetic effect of current.

Q. 3. Name the alloy which is mainly used for making permanent magnets.

Ans. The alloy 'Alnico' is used for making permanent magnets. It is an alloy of aluminium, nickel, cobalt and iron.

Q. 4. Why is electromagnetic induction so called?

Ans. This is due to the reason that electric current can be produced with the help of varying magnetic field without any physical contact of the source of magnetic field and the conductor.

Q. 5. Name an instrument in which the directive property of a magnet is used.

Ans. A compass needle.

Q. 6. What is a solenoid?

Ans. Solenoid is a coil of many turns of wire, wrapped in the shape of a cylinder.

Q. 7. Which effect of electric current is utilised in the working of an electric fuse?

Ans. An electric fuse works on the heating effect of current.

Q. 8. what is the frequency of A.C. (alternating current) in India?

Ans. It is 50 Hz.

Q. 9. What will you do if you see a person coming in contact with a live wire?

Ans. Such a person should be provided with an insulated support like wood, plastic or rubber in order to disconnect the person from wire.

Q. 10. How can it be proved that a magnetic field exists around a current carrying metallic wire?

Ans. When a magnetic compass needle is placed close to the current carrying wire, it will get deflected.

Q. 11. How is the strength of the magnetic field at a point near a wire related to the strength of the electric current flowing in the wire?

Ans. The magnitude of magnetic field is directly proportional to the strength of the electric current flowing in the wire.

Q. 12. How is the fuse connected in an electric circuit?

Ans. Fuse is connected in series in the circuit.

Q. 13. Why is a fuse usually made of tin or tin-copper alloy?

Ans. A fuse is usually made of tin or tin-copper alloy because it has low melting point.

Q. 14. What is the capacity of a fuse commonly used in domestic electrical fittings.

Ans. Fuses of capacity 5 ampere or 15 ampere are commonly used in domestic electrical fittings.

Q. 15. Name the device used to protect the electric circuits from overloading and short circuiting.

Ans. A fuses are used to protect circuits from overloading and short circuiting.

Q. 16. On which effect of electricity does fuse work?

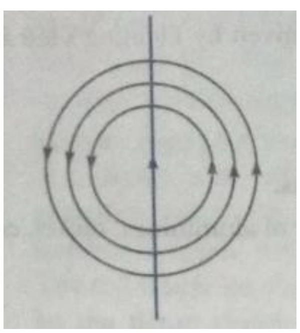
Ans. Heating effect of current.

Q. 17. What kind of magnetic field is produced by a current carrying solenoid?

Ans. The magnetic field produced by a current-carrying solenoid is similar to the magnetic field produced by a bar magnet.

Q. 18. Show, with the help of a diagram, the nature of field lines of magnetic field around a current carrying straight conductor.

Ans.



Q. 19. State Faraday's law of electromagnetic induction.

Ans. Whenever the magnetic field lines linked with a coil change due to relative motion of a magnet and the coil, an induced current is produced in the coil. The magnitude of induced current is directly proportional to the rate of change of magnetic field lines.

Q. 20. The frequency of alternating current in India is 50 Hz. What does it mean?

Ans. In India, the alternating current changes direction after every $\frac{1}{100}$ second, so the frequency of alternating current is 50 Hz.

Q. 21. Name the scientist who discovered the relationship between electric current and magnetic field.

Ans. Danish physicist, HC. Oersted established the relation between electricity and magnetism.

Q. 22. What does the closeness of field lines in a magnetic field signify?

Ans. The degree of closeness of the field lines in a magnetic field indicates the strength of magnetic field in the region.

Q. 23. Name the device which converts mechanical energy into electrical energy.

Ans. Electric generator**.**

Q. 24. Which type of generator is used at power stations?

Ans. AC generator.

Q. 25. Does the AC generator have any slip ring?

Ans. The AC generator has two slip rings.

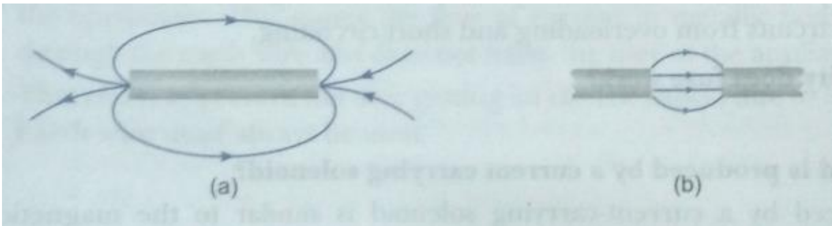
Q. 26. What is the frequency of DC?

Ans. Zero.

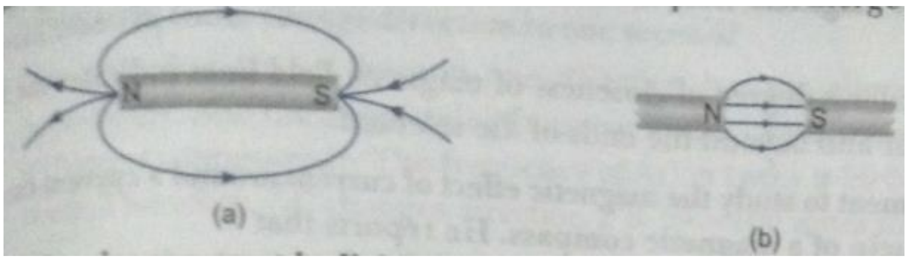
Short Answer Type Questions – I

[2 marks]

Q. 1. Identify the poles of the magnet in the figure (a) and (b) shown below.



Ans. The magnetic field lines emerge from north pole and merge at the south pole.



Q. 2. The given magnet is divided into three parts A, B and C.

A	B	C

Name the parts where the strength of the magnetic field is:

(i) maximum **(ii) minimum**

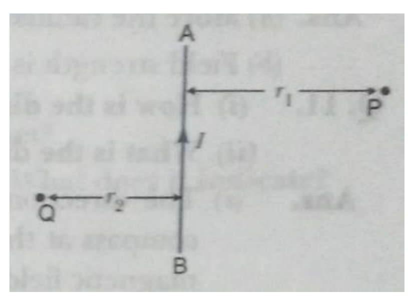
How will density of magnetic field lines differ at these parts.

Ans. (i) Maximum magnetic field is in the region A and C.

(ii) Minimum magnetic field is in the region B.

Reason: A and C are magnetic poles and have maximum number of magnetic field lines which determine the intensity of magnetic field while B is centre of the magnet has no magnetic field lines. So intensity of magnetic field near B is almost zero.

Q. 3. AB is a current-carrying conductor in the plane of the paper as shown in figure. What are the directions of magnetic fields produced by it at points P and Q? Given $r_1 > r_2$, where will the strength of the magnetic field be larger?



Ans. Magnetic field at P is into the plane of paper and at Q it is out of the plane of paper. The strength of the magnetic field at Q will be larger as strength of the field $\propto \frac{1}{r}$.

Q. 4. What is electromagnetic induction?

Ans. Whenever the magnetic flux linked with a circuit changes, an induced e.m.f. (electromotive force) and hence induced current is produced in the circuit. This phenomenon is known as electromagnetic induction and is used to generate electric current in a generator or a dynamo.

Q. 5. Write SI unit of magnetic field. Under what condition does a moving charge experience

(i) maximum force (ii) minimum force?

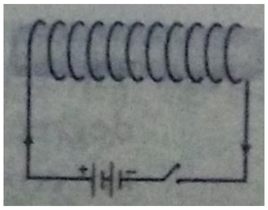
Ans. The SI unit of magnetic field is tesla.

(i) Maximum force: When the velocity of charge and the magnetic field are perpendicular to each other.

(ii) Minimum force: When this charge is moving in the direction of the magnetic field.

Q. 6. What is an electromagnet? Draw a circuit diagram to show how a soft iron piece can be transformed into an electromagnet.

Ans. The magnetic field produced due to current flowing in a coil or a solenoid can be used to magnetise a material like soft iron temporarily. The insulated copper wire is warpped on a soft iron piece. When current is passed through the coil using a battery and a key the iron piece behaves like a bar magnet as long as current is being passed. Such a magnet is called an electromagnet.



Q. 7. A magnetic compass shows a deflection when placed near a current-carrying wire. How will the deflection of the compass get affected if the current in the wire is increased? Support your answer with a reason.

Ans. In the current in the wire is increased, the deflection increases. The strength of magnetic field is directly proportional to the magnitude of current passing through the straight conductor.

Q. 8. What does the divergence of magnetic field lines near the ends of a current-carrying straight solenoid indicate?

Ans. The divergence, that is, the falling degree of closeness of magnetic field lines indicates the fall in strength of magnetic field near and beyond the ends of the solenoid.

Q. 9. A student performs an experiment to study the magnetic effect of current around a current carrying straight conductor with the help of a magnetic compass. He reports that

(i) the degree of deflection of the magnetic compass increases when the compass is moved away from the conductor.

(ii) the degree of deflection of the magnetic compass increases when the current through the conductor is increased.

Which of the above observations of the student appears to be wrong and why?

Ans. The first observation is wrong. Because as the distance from the conductor increases, the strength of the magnetic field will decrease. So the degree of deflection of the compass should decrease instead of increasing.

Q. 10. How does the strength of the Magnetic field at the centre of a circular coil of a wire depend on: (a) radius of the coil (b) number of turns in the coil.

Ans. (a) More the radius weaker the field.

(b) Field strength is directly proportional to the number of turns in the coil.

Q. 11. (i) How is the direction of magnetic field at a point determined?

(ii) What is the direction of magnetic field at the centre of a current- carrying circular loop?

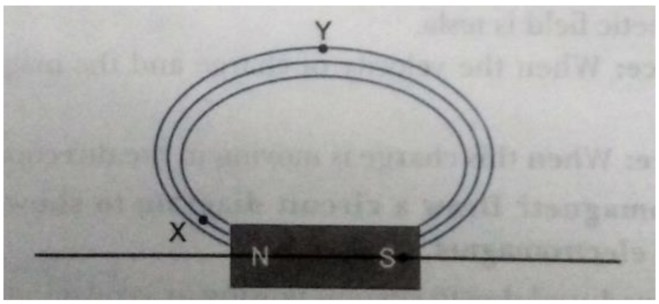
Ans. (i) The direction of the magnetic field at a point can be found by placing a small magnetic compass at that point. The north end of the needle of a compass indicates the direction of magnetic field at a point where it is placed.

(ii) The direction of magnetic field at the centre of a current-carrying circular loop is perpendicular to the plane of the loop.

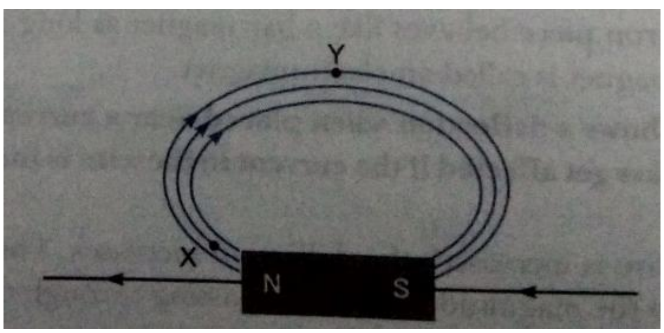
Short Answer Type Questions – II

[3 marks]

Q. 1. Magnetic field lines are shown in the given diagram. A student makes a statement that magnetic field at X is stronger than at Y. Justify this statement. Also redraw the diagram and mark the direction of magnetic field lines.



Ans. The relative strength of the magnetic field is shown by the degree of closeness of the field lines. The degree of closeness is more at X than at Y. Therefore, the field is stronger at X where the field lines are crowded.



Q. 2. What is the difference between a direct current and an alternating current? How many times does AC used in India change direction in one second?

Ans. Direct current always flows in one direction but the alternating current reverses its direction periodically. Also the magnitude of current in case of DC is same throughout whereas in case of AC, it changes continuously. The frequency of AC in India is 50 Hz and in each cycle it alters direction twice. Therefore, AC changes direction 2 x 50 = 100 times in one second.

Q.3. How can the magnitude of the induced current be increased?

Ans. The magnitude of the induced current can be increased by:

(i) Taking the conductor in the form of a coil of many turns of insulated wire.
(ii) Increasing the strength of the magnetic field used.
(iii) Increasing the rate of change of magnetic flux associated with the coil.

Q. 4. What is the role of fuse used in series with any electrical appliance? Why should a fuse with defined rating not be replaced by one with a larger rating?

Ans. Fuse is used for protecting appliances due to short-circuiting or overloading. The fuse is rated for a certain maximum current and blows off when a current more than the rated value flows through it. If a fuse is replaced by one with larger ratings, the appliances may get damaged while the protecting fuse does not burn off. This practice of using fuse of improper rating should always be avoided.

Q. 5. Answer the following questions:

(i) What is the direction of magnetic field lines outside a bar-magnet?
(ii) The magnetic field lines in a given region are getting crowded. What does it indicate?
(iii) State one advantage of AC over DC.

Ans. (i) North pole to south pole.
(ii) The strength of magnetic field is higher in this region.
(iii) A.C. voltage can be stepped up and transmitted over long distances without much loss of energy.

Q. 6. What are magnetic field lines? How is the direction of a magnetic field at a point determined? Mention two important properties of magnetic field lines.

Ans. The magnetic field lines of force are the lines drawn in a magnetic field along which a hypothetical north magnetic pole would move if it is free to do so.
The direction of a magnetic field at a point is the direction of the resultant force acting on a hypothetical north pole placed at that point. The tangent at any point on the magnetic field line gives the direction of magnetic field at that point. The direction of the magnetic field at a point can be found by placing a small magnetic compass at that point. The north end of the needle indicates the direction of the field.

Two important properties of the magnetic lines of force are:

(i) The magnetic lines of force start from north pole and terminate at south pole. Inside the magnet they travel from south pole to north pole. Thus, they are closed curves.
(ii) They do not intersect each other because at the point of intersection there will be two directions of same magnetic field which is impossible.

Q. 7. A copper coil is connected to a galvanometer. What would happen if a bar magnet is

(i) pushed into the coil with its north pole entering first

(ii) held at rest inside the coil

(iii) pulled out again?

Ans. (i) When north pole is pushed into the coil, a momentary deflection is observed in the galvanometer. This deflection indicates that a momentary current is produced in the coil. The direction of current in the coil is anticlockwise.

(ii) When the magnet is held at rest, there is no deflection in the galvanometer. It indicates that no current is produced in the coil in this use.

(iii) In pulling the magnet out of the coil, a deflection in opposite direction is observed. It indicates that the current produced in the coil is in opposite direction.

Q 8. Explain what is short circuiting and overloading in an electric supply.

Ans. Short circuiting: Whenever live and neutral wires come in contact with each other, the incident is called short circuiting. In this case, resistance of a circuit decreases to a very small value. The decreasing of resistance increases the current. Due to this increased current, the wires get heated. This extreme heat may cause fire in the building.

Overloading: Every supply has a capacity to bear a maximum load, i.e., the power that can be supplied has a limit. Sometimes, the number of appliances which are switched on at the same time have power more than the capacity of the line. This is called overloading. In this situation, wires of the supply get heated due to extremely large current flowing through them and the circuit may catch fire. To avoid this fire, we use an electric fuse in the circuit.

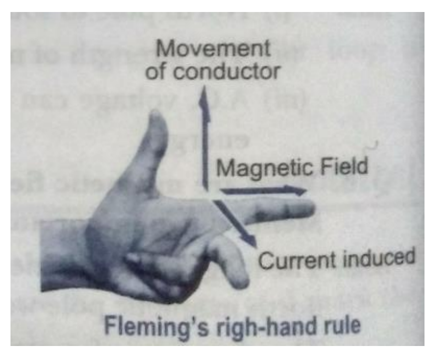
Q. 9. What change in the deflection of the compass needle placed at a point near current carrying straight conductor shall be observed if the (a) current through the conductor is increased? (b) direction of current in the conductor is reversed? (c) compass is moved away from the conductor?

Ans. (a) Deflection increases.

(b) Direction of deflection is reversed.

(c) Deflection decreases.

Q. 10. Name and state the rule used for determination of direction of induced current produced in a conductor due to a changing magnetic field and give one practical application of this phenomenon in everyday life.



Ans. Rule: Fleming's right-hand rule.
It states that if we stretch the thumb, forefinger and middle finger of our right hand such that they are mutually perpendicular to each other. If forefinger indicates direction of magnetic field and the thumb shows the direction of motion of conductor, then middle finger will show direction of induced current.

Application: Electrical generator.

Q. 11. A coil made of insulated copper wire is connected to a galvanometer. What will happen to the deflection of the galvanometer if this coil is moved towards a stationary bar magnet and then moved away from it? Give reason for your answer and name the phenomenon involved.

Ans. When coil is moved towards a stationary magnet, the magnetic field associated with the coil will change and so current will be induced in the coil. This causes galvanometer to show deflection in one direction. Now when coil is moved away, the magnetic field will decrease and so current induces in the opposite direction causing galvanometer to show deflection in opposite direction. The phenomenon is electromagnetic induction.

Q. 12. In what respect does the construction of an AC generator differ from that of a DC generator?

Ans. The only difference between a DC generator and an AC generator is in the way the two ends of the generator coil are connected to the outer circuit. In a DC generator, the two ends of the generator coil are connected to a split ring type commutator consisting of two half rings of copper. In an AC generator, the ends of the coil are connected to two full rings of copper called slip rings. There is no commutator in an AC generator.

Long Answer Type Questions

[5 marks]

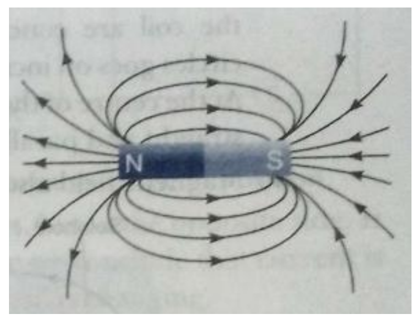
Q. 1. Briefly explain an activity to plot the magnetic field lines around a bar magnet. Sketch the field pattern for the same specifying field directions.
A region A has magnetic field lines relatively closer than another region B. Which region has stronger magnetic field. Give reason to support your answer.

Ans. 1. Take a drawing sheet and fix it on a smooth table with adhesive tape.

2. Place a bar magnet in the middle of the drawing sheet and draw its boundary with a sharp pencil.

3. Place a magnetic compass near one end of the magnet (N-pole) and mark the positions of the two ends (N and S-poles) of the compass needle using a sharp pencil.

4. Shift the compass from this position and place it in such a way that S-pole of its needle is on the point you marked in previous step for N-pole.



5. Again mark the position of the other end (N-pole) of the compass needle.

6. Repeat the steps 4 and 5, till you reach the other end (S-pole) of the bar magnet.

7. Join all the points with a sharp pencil to get a smooth curve.

8. Put the compass at some other points near the N-pole of the magnet and draw another magnetic field lines. Similarly, draw many field lines on both the sides of the bar magnet as shown in figure.

9. Observe the pattern of the magnetic field lines.

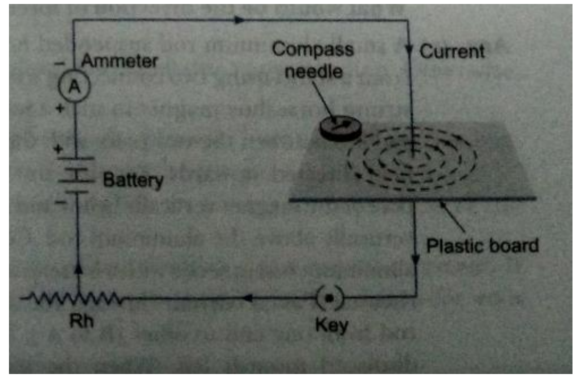
Result: Magnetic field lines can be drawn around a bar magnet using a magnetic compass. The field lines do not cross each other.

Region A has stronger magnetic field. This is due to the strength of the field is proportional to the relative closeness of field lines.

Q.2. Briefly explain an activity to plot the magnetic field lines around a straight current carrying conductor. Sketch the field pattern for the same, specifying current and field directions. What happens to the field,

(a) if the strength of the current is decreased?
(b) if the direction of the current is reversed?

Ans. The pattern of magnetic field lines around a straight conductor carrying current can be described by the following activity.



(i) Insert vertically a long straight wire carrying an electric current so that it passes through the centre of a horizontal piece of plastic board as shown in figure.

(ii) Take care that the plastic board is fixed and does not move up and down. Now, sprinkle some iron filings onto the plastic board to show the shape of the field.

(iii) You will notice that the iron filings get arranged round the wires in the shape of circles. This is due to the reason that the magnetic field lines around the curren carrying straight conductor are circular The iron filings align along these field lines.

(iv) On reversing the direction of flow of current, we observe that the iron filing arrange themselves in circles around the wire showing that the magnetic field lines are still circular in nature.

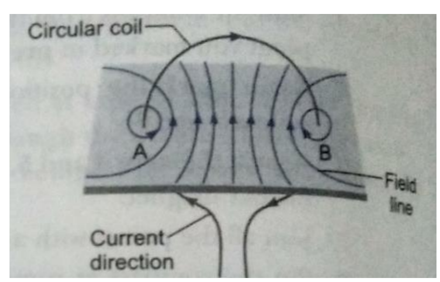
The direction of the magnetic field can be obtained by using a compass. If the current direction is reversed, the direction of the magnetic field is also reversed.

(a) When current through the wire is decreased, field also gets reduced.
(b) When the current is reversed, field also gets reversed in direction.

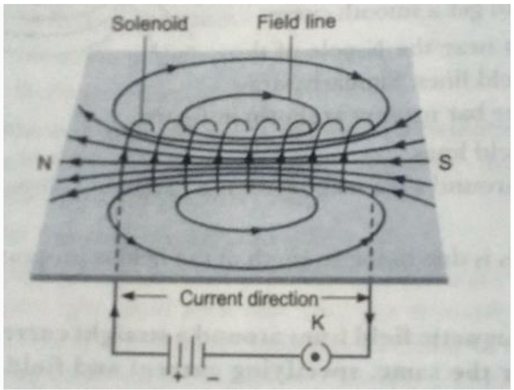
'Q. 3. (a) With the help of a labelled diagram, explain the distribution of magnetic field due to a current through a circular loop. Why is it that if a current carrying coil has turns the field produced at any point is n times as large as that produced by a single turn?

(b) Draw a pattern of magnetic field formed around a current carrying solenoid. What happens to the magnetic field when the current through the solenoid is reversed?

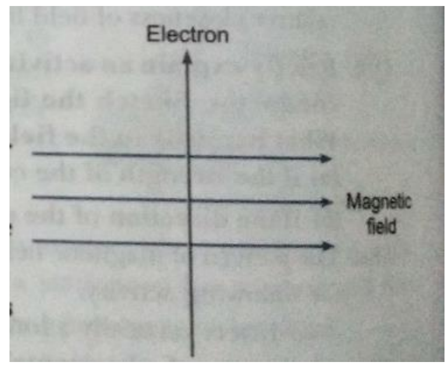
Ans. (a) The pattern of the magnetic field lines near the wires of the coil are concentric circles. The diameter of these circles goes on increasing as we move away from the wire. At the centre of the circular loop, the field lines are nearly straight and parallel.



(b) Magnetic field also gets reversed.



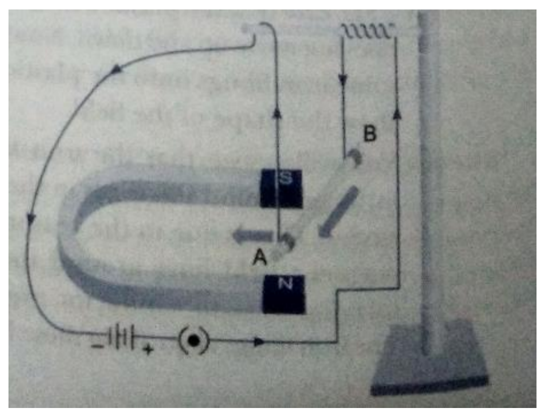
Q.4. (a) Explain an activity to show that a current-carrying conductor experiences a force when placed in a magnetic field field.



(b) State the rule which gives the direction of force acting on the conductor..

(c) An electron moves perpendicular to a magnetic field as shown in the figure.

What would be the direction of force experienced on the electron?



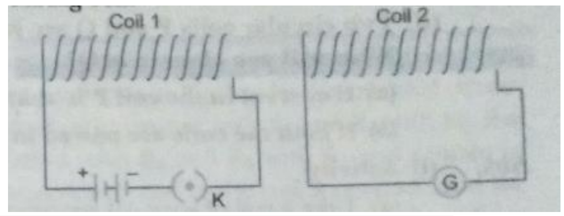
Ans. (a) A small aluminium rod suspended horizontally from a stand using two connecting wires. Place a strong horseshoe magnet in such a way that the rod lies between the two poles with the magnetic field directed upwards. For this, put the north pole of the magnet vertically below and south pole vertically above the aluminium rod. Connect the aluminium rod in series with a battery, a key and a rheostat. Pass a current through the aluminium rod from one end to other (B to A). The rod is displaced towards left. When the direction of current flowing through the rod is reversed, the displacement of rod across towards right.

(b) Fleming's left- hand rule.

Stretch the thumb, forefinger and middle finger of your left hand such that they are mutually perpendicular to one another. If the forefinger points in the direction of magnetic field and the middle finger in the direction of current, then the thumb will points in the direction of motion or the force acting on the conductor.

(c) According to Fleming's left hand rule, the direction of force is perpendicular to the direction of magnetic field and current. We know that the direction of current is taken opposite to the direction of motion of electrons. Therefore, the force is directed upwards from the plane of the paper.

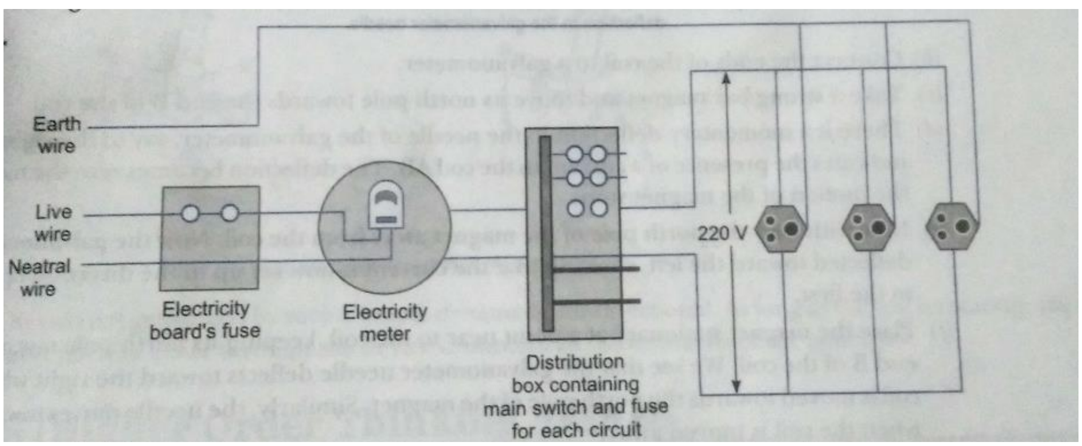
Q. 5. With the help of a diagram, describe an experiment to show that a change in current flowing through a coil induces an electric current in a neighbouring coil.



Ans. Take two different coils of insulated copper wire having large number of turns (50 or even more). Insert the coils over a non-conducting cylindrical thick paper roll as shown in figure. Connect a battery of 6V, a plug key K in series of coil-1. With coil-2. connect a sensitive galvanometer. Now put the plug in key K. Galvanometer joined with coil-2 also gives a momentary deflection and then pointer quickly returns to its mean position. On removing plug from key K in coil-1 the needle momentarily moves, but to the opposite side. It means that now the current flows in the opposite direction in coil 2. So we conclude that current is produced in coil-2 whenever the current flowing in the neighoring coil is changing.

Q. 6. Draw an appropriate schematic diagram showing common domestic circuits and discuss the importance of fuse. Why is it that a burnt out fuse should be replaced by another fuse of identical rating?

Ans.



A fuse in a circuit prevents damage to the appliances and the circuit due to overloading. Otherwise, the appliances or the circuit may be damaged.

When current in the circuit exceeds the value of fuse rating, the fuse wire burns due to overloading. This causes a gap in the circuit and the current stops flowing in the circuit. This is done due to the reason so that the circuit or the appliances to be connected in the circuit continue functioning without any damage in future.

Q. 7. (i) Two circular coils P and Q are kept close to each other, of which coil P carries a current. If coil P is moved towards Q, will some current be induced in coil Q? Give reason for your answer and name the phenomenon involved.

(ii) What happens if coil P is moved away from Q?

(iii) State any two methods of inducing current in a coil.

Ans. (i) When coil P is moved towards Q, current will be induced in coil Q. This is because on moving P the magnetic field associated with Q increases and so a current is induced. The Phenomenon is electromagnetic induction.

(ii) If P is moved away from Q, the field associated with Q will decrease and a current will be induced but in the opposite direction

(iii) Current can be induced in a coil by (a) moving a magnet towards or away from the coil (b) moving a coil towards or away from a magnet (c) rotating a coil within a magnetic field.

Q. 8. (i) With the help of an activity, explain the method of inducing electric current in a coil with a moving magnet. State the rule used to find the direction of electric current thus generated in the coil.

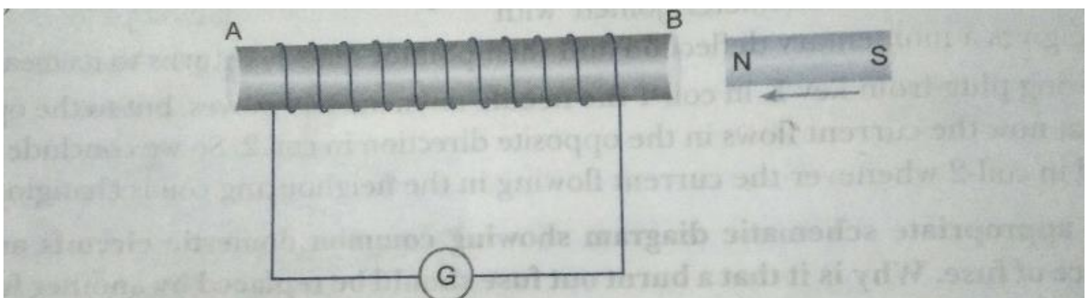
(ii) Two circular coils P and Q are kept close to each other, of which coil P carries a current. What will you observe in Q?

(a) If current in the coil P is changed?

(b) If both the coils are moved in the same direction with the same speed? Give reason.

Ans. (i) Activity:

(a) Take a coil of wire AB having a large number of turns.



Moving a magnet towards a coil sets up a current in the coil circuit, as indicated by deflection in the galvanometer needle.

(b) Connect the ends of the coil to a galvanometer

(c) Take a strong bar magnet and move its north pole towards the end B of the coil.

(d) There is a momentary deflection in the needle of the galvanometer, say to the right. This indicates the presence of a current in the coil AB. The deflection becomes zero the moment the motion of the magnet stops.

(e) Now withdraw the north pole of the magnet away from the coil. Now the galvanometer is deflected toward the left, showing that the current is now set up in the direction opposite to the first.

(f) Place the magnet stationary at a point near to the coil, keeping its north pole towards the end B of the coil. We see that the galvanometer needle deflects toward the right when the coil is moved towards the north pole of the magnet. Similarly, the needle moves toward left when the coil is moved away.
When the coil is kept stationary with respect to the magnet, the deflection of the galvanometer drops to zero.
To find the direction of electric current Fleming's right hand rule is applied. According to it, if we stretch the forefinger, middle finger and thumb of our right hand mutually perpendicular in such a way that thumb points along the direction of motion of conductor, forefinger along the direction of magnetic field; then the middle finger points along the direction of induced current.

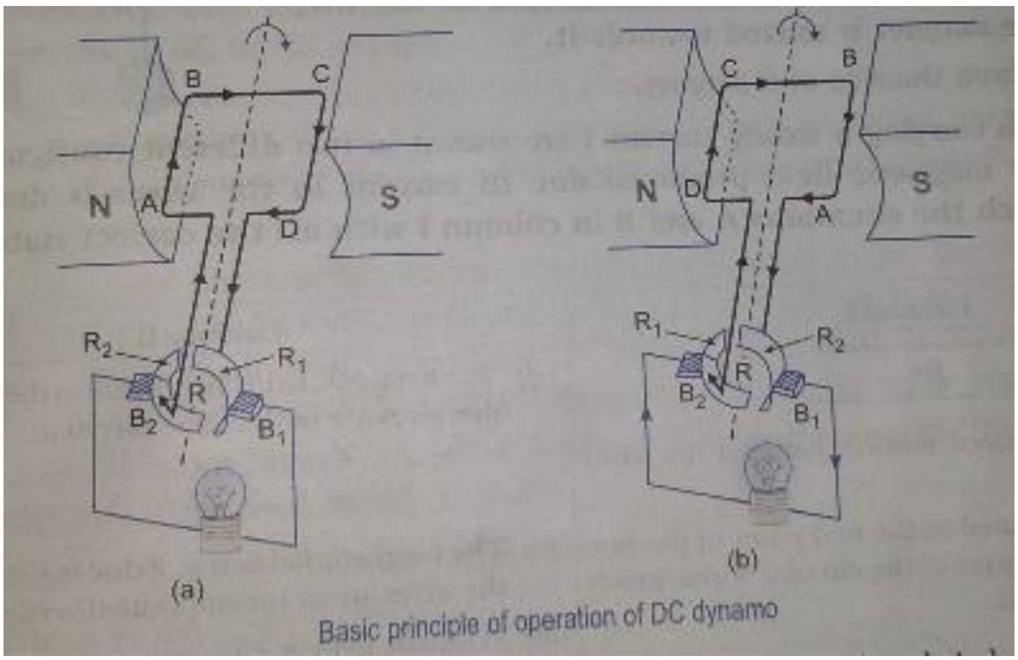
(ii) (a) When current in P is changed, the field associated with Q will vary causing an induced current in Q.

(b) If both the coils are moved in the same direction with same speed, there will not be any change in the field associated with Q. Hence no current will be induced in Q.

Q. 9. Explain the underlying principle and working of direct current generator (or DC dynamo) by drawing a labelled diagram.

Ans. A device used to convert mechanical energy into electrical energy is called an electric generator. An armature-coil rotating in a magnetic field develops an alternating emf and sends alternating current in an external circuit. If, however, the connections of the ends of the coil to the external circuit are interchanged every time the emf in the coil reverses, the current in the external circuit flows always in the same direction. This is the principle of a DC dynamo.

The working of a single-coil DC dynamo is shown in the figure. The ends of the armature-coil ABCD are connected to the two separated segments R_1 of a single copper ring R, which is called the 'split-ring commutator'. R_I and R_2 rotate along with the armature between two brushes B_1 and B_2 to which the external circuit is connected.
When the armature-coil ABCD is rotated clockwise (say), an emf is induced in the coil and a current flows in the direction ABCD (Fleming's right-hand rule), as shown in Fig (a). In the external circuit, the current flows from B_1 to B_2. For half the revolution, R_1 is in contact with B_1 and R_2 with B_2. But as soon as the coil passes the vertical, R_1 comes in contact with B_2 and R_2 with Bi and remain so during the next half revolution [Fig. (b)]. Although the induced emf in the coil is reversed and the current in the coil flows in the direction DCBA, but in the external circuit the current still flows from B_1 to B_2.



Basic principle of operation of DC dynamo

The current generated by such a simple dynamo is uni-directional. As long as the coil is rotating, the direct current flows through the device connected to the terminals of the generator.

HOTS (Higher Order Thinking Skills)

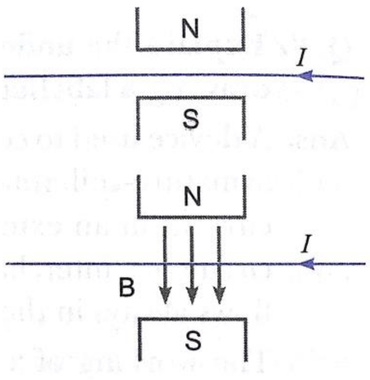
Q.1. Meena draws magnetic field lines of field close to the axis of a current – carrying circular loop. As she moves away from the centre of the circular loop she observes that the lines keep on diverging. How will you explain her observation?

Ans. Strength of the magnetic field falls as distance increases. This is indicated by the decrease in degree of closeness of the lines of field.

Q.2. Why does a magnetic compass need le pointing North and south in the absence of a nearby magnet get deflected when a bar magnet or a current carrying loop is brought near it?

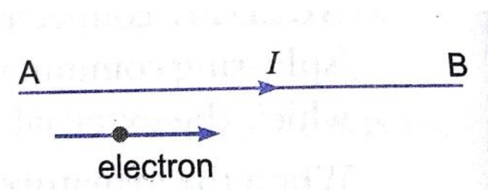
Ans. Current – carrying loops behave like bar magnets and both have their associated field lines. This modifies the already existing earth's magnetic field and a deflection results.

Q.3. A wire is placed between N and S poles of a magnet as shown in figure. If current flows in the wire as shown, in which direction does the wire tend to move?



Ans. The direction of magnetic field is from N-pole to S-pole; on applying Fleming's left-hand rule, the wire tends to move perpendicular to plane of paper upward.

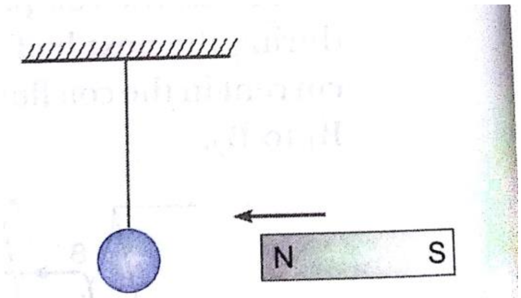
Q.4. A fixed wire AB carries current I. An electron is moving parallel to the wire, in which direction does the electron tend to move?



Ans. By right-hand thumb rule, the magnetic field in the vicinity of wire is downward perpendicular to plane of paper. The conventional direction of electric current is opposite to the direction of motion of electron. By Fleming's left-hand rule, the force on electron is away from wire in the plane of paper; therefore, the electron will be deflected downward (away from wire) in the plane of paper.

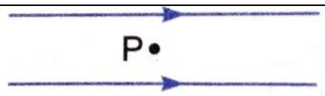
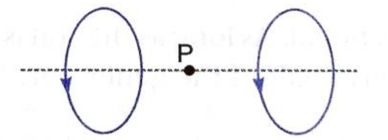
Q.5. A metallic wire loop is suspended freely and a bar magnet is brought near it as shown in the diagram.

What will be the direction of induced current in the wire loop when the magnet is moved towards it.



Ans. Anticlockwise from the side of a magnet.

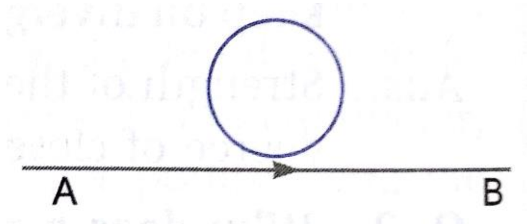
Q.6. Two wires each carrying a steady current i are shown in two different configurations in column I. The magnetic field produced due to current in the wires is described in column II. Match the situations A and B in column I with all the correct statements in column II.

Column I	Column II
 A. Point P is situated midway between the wires above.	(i) The magnetic fields B at P due to the current in the wires are in the same direction.
B. Point P is situated at the mid point of the line joining the centres of the circular wires, which have same radii. 	(ii) The magnetic fields B at P due to the current in the wires are in the opposite directions. (iii) Magnetic field at P is zero.

Ans. (i) A matches with (i) and (i), Applying Fleming's Left Hand Rule, the magnetic field at P due to the current will be equal and in opposite direction.
(ii) B match with only (i) in column II. Applying Fleming's Left Hand Rule, the magnetic field at P due to two currents in opposite directions will be in directions.

Q.7. A circular metallic loop is kept above the wire AB as shown here. What is the direction of induced current produced in the loop, if any, when the current flowing in the straight wire
(i) is steady, i.e., does not vary.
(ii) is increasing in magnitude.

Justify your answer in each case.



Ans. (i) No induced current will be produced in the loop since the constant current flowing in the straight wire produces a constant magnetic field. Hence no induced current is produced in the loop.

(ii) Since current in the straight wire is changing, the magnetic flux associated with the loop will change and hence induced current will be produced in it.
Applying Fleming's Right Hand Rule, the current flowing in the loop will be in clockwise direction.

Q.8. An electron and a proton, using parallel to each other, enter a uniform magnetic field with same velocity. The direction of magnetic field and their motion coincides (is same). How will the direction of their paths be affected when they are travelling in

(a) same direction (b) opposite direction.

Justify your answer.

Ans. A magnetic field does not exert any force on a charge moving parallel or antiparallel to the field direction. Since they are travelling in the direction of the magnetic field, there will be no force acting on them. Hence their paths will remain the same after entering the magnetic field

Q.9. You are given a galvanometer, an electroplating equipment, a key and two sources of electricity. Give two different experimental set ups to find whether any of the given sources is AC or DC source.

Ans. (a) We can connect the galvanometer to any one of the sources using a key in the circuit. If the galvanometer shows definite deflection in a given direction, the source taken is d.c. source. If the given source is a.c. source, the average deflection shown by the galvanometer will be zero.

(b) We can also connect the electroplating equipment to any one of the source using a key in the circuit. If electroplating takes place, the source used is d.c. source. In case of AC source, since the direction of current changes in direction periodically and alternatively, there is no definite shifting of the ions of the electrolyte and hence no electroplating takes place.

Q.10. A circuit has a fuse of 5 A. What is the maximum number of 100 watt (220 V) bulbs which can be safely used in the circuit?

Ans. Suppose X number of such bulbs can be used.
Power of one bulb = 100 watt
Power of x bulbs (P) = 100x watts
Potential difference (V) = 220 volts
I = 5 ampere

We know P = VI

⇒ $100 \times 220 \times 5$

∴ $x = \frac{220 \times 5}{100} = 11\ bulbs$

Q. 11. It is established that an electric current through a metallic conductor produces a magnetic field around it. Is there a similar magnetic field produced around a thin beam of moving (i) alpha particles, (ii) neutrons? Justify your answer.

Ans. (i) Yes, Alpha particles being positively charged constitute a current in the direction of motion.

(ii) No. The neutrons being electrically neutral constitute no current.

Value Based Questions

Q. 1. Mr. Sharma, a property dealer, had many expensive appliances at his home like refrigerator, air conditioners, geyser, etc. but he forgot to put earth wire connections to these appliances. One day his younger daughter opened the fridge and suffered a severe electric shock though, she was saved.

Answer the following questions based on the situation given above.

(i) Why did it happen?
(ii) How can one save himself/herself from electric shocks by these electrical appliances?
(ii) What values are being neglected by Mr. Sharma?

Ans. **(i)** This happened because earth wire was not used in the electric appliances. The purpose of earthing is that in case of an insulation failure in some appliance, this wire connected to the metal body will provide a path for the current to flow in the ground.

(ii) By providing proper earthing in all electrical appliances, connecting electric fuse in circuits, never touch an electric switch or appliance with wet hands.

(iii) Carefulness and vigilance while handling electric gadgets.