Important question class x :
Magnetic Effect of Electric Currunt

Q: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.

Q:2 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.

Q:3 The device used for producing electric current is called a
(a) generator. (b) galvanometer.
(c) ammeter. (d) motor.

Q:4 The essential difference between an AC generator and a DC generator is that
(a) AC generator has an electromagnet while a DC generator has permanent magnet.
(b) DC generator will generate a higher voltage.
(c) AC generator will generate a higher voltage.
(d) AC generator has slip rings while the DC generator has a commutator.

Q:5 At the time of short circuit, the current in the circuit.
(a) reduces substantially. (b) does not change.
(c) increases heavily. (d) vary continuously.

Q:6 The rating of a fuse connected in the lighting circuit is_____.
(a) 5 A (b) 15 A (c) 0 A (d) 10 A

Q:7 The core of electromagnet is:
(a)Soft iron (b) Nickel (c) copper (d) Steel

Q:8 An electric charge in uniform motion produces:
(a) an electric field only (b) a magnetic field only
(c) both electric and magnetic fields (d) both electric and magnetic fields

Q:9 The magnetic field lines always begin from
(a) N-pole and end on S-pole.
(b) S-pole and end on N-pole.
(c) start from the middle and end at N-pole.
(d) start from the middle and end at S-pole.

Q:10 The magnetic field is the strongest at
(a) middle of the magnet. (b) north pole. (c) south pole. (d) both poles.

Q:11 A soft iron bar is introduced inside a current carrying solenoid. The magnetic field inside the solenoid
(a) will become zero. (b) will increase.
(c) will decrease. (d) will remain unaffected

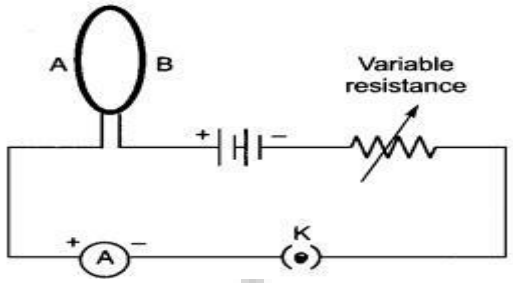
Q:12 A magnetic field directed in north direction acts on an electron moving in east direction. The magnetic force on the electron will act
(a) vertically upwards. (b) towards east.
(c) vertically downwards. (d) towards north

Q:13 The direction of force on a current carrying conductor in a magnetic field is given by
(a) Fleming's left-hand rule. (b) Fleming's right-hand rule.
(c) Right hand thumb rule. (d) Left hand thumb rule.

Q:14 Switches are connected to
(a) live wire. (b) neutral wire. (c) earth wire. (d) anyone.

Q:15 The most important safety method used for protecting home appliances from short-circuiting or Overloading is
(a) earthing (b) use of stabilizers
(c) use of fuse (d) use of electric meter

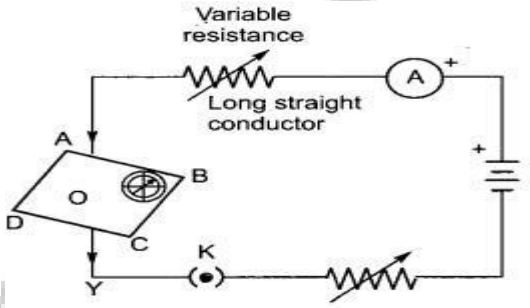
Q:16 A circular loop placed in a plane perpendicular to the plane of paper carries a current when the keys is ON. The current as seen from points A and B (in the plane of paper and on the axis of the coil) is anticlockwise and clockwise respectively. The magnetic field lines point from B to A. The N-pole of the resultant magnet is on the faces close to



(a) A
(b) B
(c) A if the current is small, and B if the current is large
(d) B if the current is small and A if the current is large.

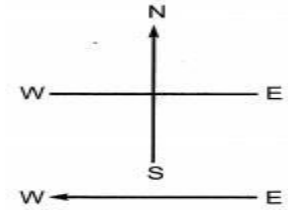
Q:17 Choose the incorrect statements from the following regarding magnetic lines of field.
(a) the direction of magnetic field at a point is taken to be the direction in which the north pole of a magnetic compass needle points
(b) magnetic field lines are closed curves
(c) if magnetic field lines are parallel and equidistant, they represent zero field strength
(d) relative strength of magnetic field is shown by the degree of closeness of the field lines.

Q:18 If the key in the arrangement figure given below is taken out (the circuit is made open) and magnetic. field lines are drawn over the horizontal plane ABCD, the lines are



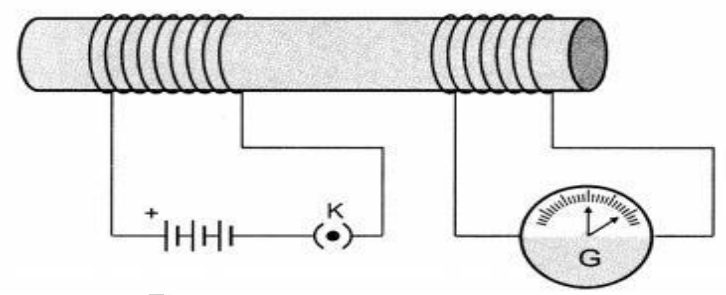
(a) concentric circles (b) elliptical in shape
(c) straight lines parallel to each other (Due to earth's magnetic field)
(d) concentric circles near the point O but of elliptical shapes as we go away from it.

Q:19 A constant current flow in a horizontal wire in the plane of the paper from east to west as shown in the figure. The direction of magnetic field at a point will be North to South



(a) directly above the wire
(b) directly below the wire
(c) at a point located in the plane of the paper, on the north side of the wire
(d) at a point located in the plane of the paper, on the south side of the wire

Q:20 In the arrangement shown in the figure there are two coils wound on a non-conducting cylindrical rod. Initially the key is not inserted. Then the key is inserted and later removed. Then



(a) the deflection in the galvanometer remains zero throughout.
(b) there is a momentary deflection in the galvanometer but it dies out shortly and there is no effect when the keys are removed.
(c) there are momentary galvanometer deflections that die out shortly; the deflections are in the same direction.
(d) there are momentary galvanometer deflections that die out shortly; the deflection are in opposite directions.

ANSWER 1) D 2) C 3) A 4) D 5) C 6) A 7) A 8) D 9) A 10) D 11) B 12) C
13) A 14) A 15) C 16) A 17) C 18) C 19) B 20) D

PART-II

Assertion-Reason Type Questions (1 Mark) For question numbers 6 and 10, two statements are given-one labelled as Assertion

(A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

(a) Both 'A' and 'R' are true and 'R' is correct explanation of the Assertion.

(b) Both 'A' and 'R' are true but 'R' is not correct explanation of the Assertion.

(c) 'A' is true but 'R' is false.

(d) 'A' is false but 'R' is true.

Q:1 **Assertion:** Magnetic field lines do not intersect.

Reason: Magnetic field lines are closed curves

Q:2 **Assertion:** A compass needle gets defected when electric current is passed through the nearly metallic wire.

Reason: The S.I unit of magnetic field strength is Oersted

Q:3 **Assertion:** A current carrying solenoid behaves like a bar magnet.

Reason: When soft iron is placed inside the solenoid it can also be magnetised.

Q:4 **Assertion:** Compass is a small magnet and gives direction of magnetic field lines. **Reason:** It gets deflected when brought near a bar magnet.

Q:5 **Assertion:** Galvanometer is used to detect current.

Reason: Ammeter is used measure current generated in A.C. generator

ANSWER 1) B 2) C 3) B 4) B 5) B

PART-III CASE STUDY BASED QUESTIONS

Answer the following questions 11 to 15 on the basis of your understanding of the following paragraph and the related studied concepts.

Paragraph I: the phenomenon of generation of an electric current in a circuit from magnetic effects, i.e., by changing the magnetic flux linked with it is called electromagnetic induction. This phenomenon is widely used to construct generation which produce large scale electric power for domestic and industrial use.

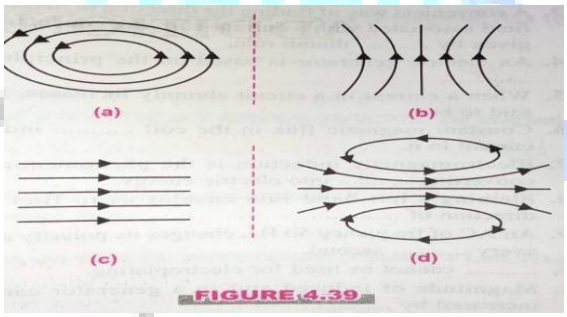


FIGURE 4.39

Q:1 The magnetic field reparented by Fig. 4.39 (a) is due to:
(a) A source of uniform magnetic field
(b) A source of non-uniform magnetic field
(c) A bar magnet
(d) A straight current-carrying conductor

Q:2 The magnetic field represented by Fig. 4.39 (b) is/due to:
(a) A circular coil
(b) A solenoid
(c) Uniform

(d) A straight conductor

The magnetic field represented by Fig. 4.39 (c) is/due to:
(a) A bar magnet
(b) Non-uniform magnetic field
(c) A straight current-carrying conductor
Q:3 (d) Uniform magnetic field

Q:4 The magnetic field lines Fig. 4.39 (d) represented the magnetic field due to:
(a) A straight current-carrying conductor
(b) A circular coil
(c) A solenoid

(d) A source of uniform magnetic field

Q:5 Two organs where magnetic field is produced are

(a) Heart and lungs

(b) Heart and brain

(c) Brain and lungs

(d) Heart and Liver

ANSWER 1) D 2) A 3) D 4) C 5) B

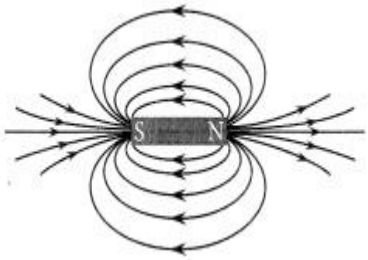
PART-IV VSA

Q:1 What is meant by magnetic field?

ANS: Magnetic field: It is defined as the space surrounding the magnet in which magnetic force can be experienced.

Q:2 Draw magnetic field lines around a bar magnet. Name the device which is used to draw magnetic field lines.

ANS:



Compass needle is used to draw magnetic field lines.

Q:3 Write one application of Flemings left hand rule.

ANS: Flemings left hand rule is used to find the direction of force on a current carrying conductor placed in a magnetic field acting perpendicular to the direction of current.

Q:4 What is the function of a galvanometer in a circuit?

ANS: Galvanometer is an instrument that can detect the presence of electric current in a circuit

Q:5 Why does a compass needle get deflected when brought near a bar magnet?

ANS: A compass needle behaves like a small bar magnet when it is brought near a bar magnet. Its magnetic field lines interact with that of bar magnet. Hence compass needle gets deflected.

Q:6 Explain why magnetic field lines are closed curves?

ANS: They are continuous closed curves because they diverge from the north pole of a bar magnet and converge to its south pole.

Q:7 Why don't two magnetic lines of force intersect each other?

No two magnetic field lines intersect each other because if they did, it would mean that at the

ANS: point of intersection, the compass needle would point towards two directions, which is not possible.

Q:8 What type of core is used to make electromagnets?

ANS: Soft Iron

Q:9 When is the force experienced by a current carrying conductor placed in a magnetic field greatest?

ANS: When the current in the conductor flows perpendicular (90°) to the direction of the magnetic field, maximum force is generated.

Q:10 A beam of alpha particles enters a chamber moving along the magnetic field. What is the magnetic force experienced by the beam?

ANS: Zero, it is because beam is moving parallel to the magnetic field.

Q:11 What is the pattern of field lines inside a solenoid? What do they indicate?

ANS: The magnetic field is in the form of parallel lines. It indicates a uniform magnetic field because magnetic field lines are parallel.

Q:12 How is magnetic field produced in a solenoid used?

ANS: It is used to magnetise a soft iron bar to form an electromagnet.

Q:13 What does the direction of thumb indicate in the right-hand thumb rule?

ANS: The thumb indicates the direction of current in the straight conductor held by curved fingers of our hand.

Q:14 Suggest one way to distinguish a wire carrying current from a wire carrying no current.

ANS: The magnetic compass needle will get deflected near the wire current carrying but not near the wire with no current

Q:15 Imagine that you are sitting in a chamber with your back to one wall. An electron beam, moving horizontally from the back wall towards the front wall, is deflected by a strong magnetic field to your right side. What is the direction of the magnetic field?

ANS: The direction is vertically downwards

SHORT ANSWER

Q:1 The given magnet is divided into three parts A, B and C as: A B C Name the part when the strength of magnetic field is:

A	B	C

(i)maximum, (ii) minimum. How will the density of magnetic field lines differ at these parts?

ANS: (i) Maximum of magnetic field strength is at 'A' and 'C'

(ii) Minimum of magnetic field strength is at 'B'.

At 'A' and 'C' magnetic field lines are crowded whereas these are spread out at 'B'.

Q:2 A compass needle is placed near a current-carrying wire. State your observation for the following cases, and give reason for the same in each case.

(a) Magnitude of electric current in the wire is increased. (b) The compass needle is displaced away from the wire.

ANS:

(a) Observation: The compass needle is deflected more. Reason: Current carrying wire produces magnetic field, (B α I). (b) Observation: The deflection of magnetic needle decreases. Reason: The strength of magnetic field decreases with increase in distance from the wire. (Ba 1/d)

Q:3 The magnetic field associated with a current carrying straight conductor is in anticlockwise direction. If the conductor was held along the east-west direction, what will be the direction of current through it? Name and state the rule applied to determine the direction of current.

ANS:

When the observer observes the direction of magnetic field from west then the direction of current is from east to west and if observer is at east side then the direction of current is from west to east. Right hand thumb rule: If we hold a current carrying conductor in our right hand in a such a way that stretched thumb is along the direction of the current, then curls of fingers around the conductor represents the direction of magnetic field lines.

Q:4 (a) In a pattern of magnetic field lines due to bar magnet, how can the regions of relative strength be identified?

(b) Compare the strength of magnetic field near the poles and the middle of a bar magnet.

ANS:

(a) The closeness of lines measures the relative strength of magnetic field.

(b) The strength of magnetic field is highest near the poles whereas minimum in the middle of bar magnet.

Q:5 Why and when does a current carrying conductor kept in magnetic field experiences force? List the factors on which direction of force will depend.

ANS:

The movement of electrons takes place in the conductor in a particular direction when current is passed through it. These charged particles are moving in the magnetic field which experiences force. The current carrying conductor has its own magnetic field, when it superimposes the magnetic field of magnet. Due to this, current carrying conductor experiences a force. Thus, conductor experiences a force when placed in a uniform magnetic field.

Factors on which direction of force depends: (i) The direction of force depends upon the direction of magnetic field.

(ii) It also depends upon the direction of current flowing through the conductor.

(iii) The strength of magnetic field is directly proportional to the strength of current.

Q:6 State how the magnetic field produced by a straight current carrying conductor at a point depends on:
(a) current through the conductor.

(b) distance of point from conductor.

ANS: Strength of magnetic field produced by a straight current-carrying wire at a given point is
(a) directly proportional to the current passing through it.
(b) inversely proportional to the distance of that point from the wire.

$$i.e.,\ B \propto \frac{I}{r}\begin{cases} B \rightarrow \text{magnetic field} \\ I \rightarrow \text{current} \\ r \rightarrow \text{distance between wire and point of observation} \end{cases}$$

Q:7 Distinguish between a bar magnet and an electromagnet.

ANS:

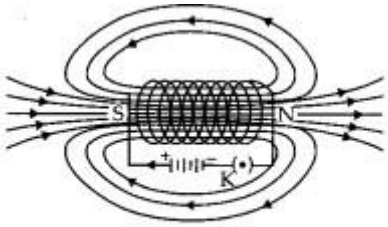
Q:8 Find the direction of magnetic field due to a current carrying circular coil held:
(i) vertically in North – South plane and an observer looking it from east sees the current to flow in anticlockwise direction,
(ii) vertically in East – West plane and an observer looking it from south sees the current to flow in anticlockwise direction,
(iii) horizontally and an observer looking at it from below sees current to flow in clockwise direction.

ANS:
According to right hand rule, the direction of magnetic field is
(i) west to east
(ii) north to south
(iii) into the paper.

Q:9 What is solenoid? Draw the pattern of magnetic field lines of
(i) a current carrying solenoid and
(ii) a bar magnet.
List two distinguishing features between the two fields.

ANS

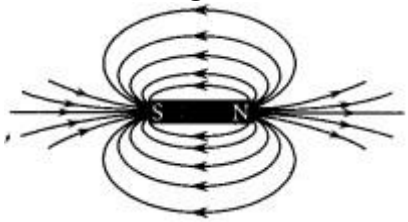
(i) Solenoid: A coil of many circular turns of insulated copper wire wrapped in the shape of cylinder is called solenoid.



Field lines of the magnetic field through and around a current-carrying solenoid

The pattern of magnetic field lines inside the solenoid indicates that the magnetic field is the same at all points inside the solenoid. That is, the field is uniform inside the solenoid.

(ii) Magnetic field lines around a bar magnet.



Following are the distinguishing features between the two fields.
(a) A bar magnet is a permanent magnet whereas solenoid is an electromagnet, therefore field produced by solenoid is temporary and stay till current flows through it.
(b) Magnetic field produced by solenoid is stronger than magnetic field of a bar magnet.

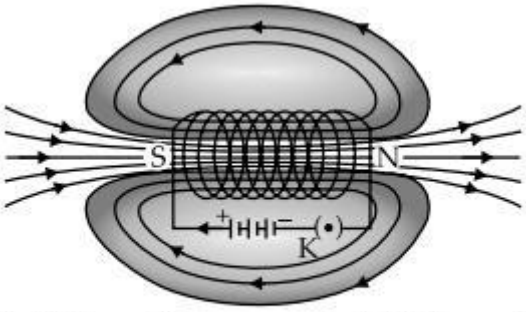
Q:10 (a) Fuse acts like a watchman in an electric circuit. Justify this statement.
(b) Mention the usual current rating of the fuse wire in the line to (i) lights and fans (ii) appliance of 2 kW or more power.

ANS: (a)
When an unduly high electric current flows through the circuit, the fuse wire melts due to joule heating effect and breaks the circuit. Hence, it keeps an eye on the amount of current flowing and also stops the current if exceeds the maximum value. So, fuse acts like a watchman in an electric circuit. (b) (i) A fuse of rating 5A is usually used for lights and fans.
(ii) A fuse of rating 15 A is usually used for appliance of 2 kW or more power.

LONG ANSWERS

Q:1 What is a solenoid? Draw a diagram to show field lines of the magnetic field through and around a current carrying solenoid. State the use of magnetic field produced inside a solenoid. List two properties of magnetic lines of force.

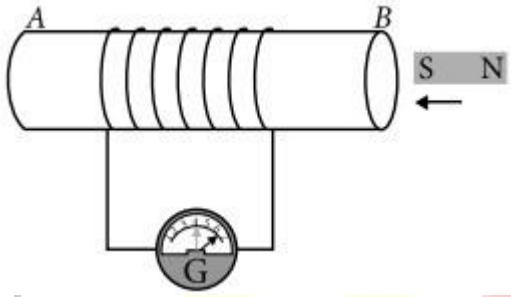
ANS: Solenoid: A coil of many circular turns of insulated copper wire wrapped in the shape of cylinder is called solenoid. The pattern of magnetic field lines inside the solenoid indicates that the magnetic field is the same at all points inside the solenoid. That is, the field is uniform inside the solenoid. Solenoid is used to form strong but temporary magnet called electromagnets. These electromagnets are used in wide variety of instruments and used to lift heavy iron objects. (a) Two magnetic field lines never intersect each other. (b) Magnetic field are closed curves.



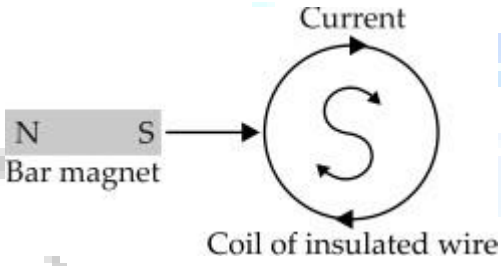
Field lines of the magnetic field through and around a current-carrying solenoid

Q:2 (a) A coil of insulated copper wire is connected to a galvanometer. With the help of a labelled diagram state what would be seen if a bar magnet with its south pole towards one face of this coil is
(i) moved quickly towards it,
(ii) moved quickly away from it,
(iii) placed near its one face?
(b) Name the phenomena involved in the above cases.
(c) State Fleming's right-hand rule.

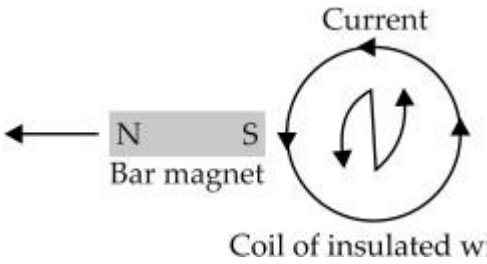
ANS: (a) If a coil of insulated wire is connected to a galvanometer and a bar magnet with south pole is moved towards one face of the coil then, given situation is shown in the figure.



(i) Moved quickly towards the coil: A current is induced in clockwise direction in the coil with respect to the side facing the north pole of the magnet and needle of galvanometer will deflect in one direction from zero position.



(ii) Moved quickly away from coil: A current is induced in anti-clockwise direction in the coil with respect to the side facing the north pole of the magnet and the needle of the galvanometer will deflect in opposite direction from (i).



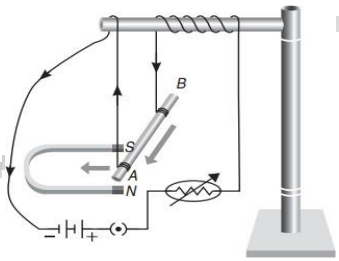
(iii) Placed near its one face : No deflection of the needle of galvanometer is observed.
(b) The phenomena involved is called electromagnetic induction.
(c) Fleming's right-hand rule: Stretch the right hand such that the first finger, the central finger and the thumb are mutually perpendicular to each other. If the first finger points along the direction of the field (magnetic field) and the thumb points along the direction of motion of the conductor, then the direction of induced current is given by the direction of the central finger.

Q:3 A current carrying conductor is placed in a magnetic field now answer the following.
(i) List the factors on which the magnitude of force experienced by conductor depends.
(ii) When is the magnitude of this force maximum?
(iii) State the rule which helps in finding the direction of motion of conductor. (iv) If initially this force was acting from right to left, how will the direction of force change if: (a) direction of magnetic field is reversed?
(b) direction of current is reversed?

ANS: (i) When a current carrying wire is placed in a magnetic field, it experiences a magnetic force that depends on (a) current flowing in the conductor (b) strength of magnetic field (c) length of the conductor (d) angle between the element of length and the magnetic field. (ii) Force experienced by a current carrying conductor placed in a magnetic field is largest when the direction of current is perpendicular to the direction of magnetic field. (iii) The rule used in finding the direction of motion of the conductor placed in a magnetic field is Fleming's left-handrule.
Fleming's left-hand rule is as follows: Stretch out the thumb, the forefinger, and the second (middle) finger of the left hand so that these are at right angles to each other. If the forefinger gives the direction of the magnetic field (N to S), the second (middle) finger the direction of current then the thumb gives the direction of the force acting on the conductor. (iv) (a) Direction of force will be reversed when direction of magnetic field is reversed, i.e., now force on conductor will act from left to right. (b) Direction of force will be reversed, if the direction of current is reversed, i.e., the force on the conductor will act from left to right.

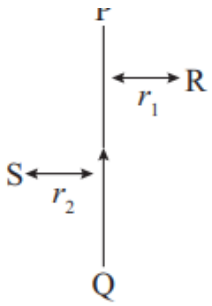
Q:4 Describe an activity with labelled diagram to show that a force acts on current carrying conductor placed in a magnetic field and its direction of current through conductor. Name the rule which determines the direction of this force.
A small aluminium rod suspended horizontally from a stand using 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.

ANS:



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 will be towards right. Direction of force on a current carrying conductor is determined by Fleming's left-hand rule.

Q:5 PQ is a current carrying conductor in the plane of the paper as shown in the figure below.



(i) Find the directions of the magnetic fields produced by it at points R and S?

(ii) Given r1 > r2, where will the strength of the magnetic field be larger? Give reasons.

ANS: (iii) If the polarity of the battery connected to the wire is reversed, how would the direction of the magnetic field be changed?

(iv) Explain the rule that is used to find the direction of the magnetic field for a straight current carrying conductor.

(i) The Magnetic field lines produced is into the plane of the paper at R and out of it at S.

(ii) Field at S > Field at P. Magnetic field strength for a straight current carrying conductor is inversely proportional to the distance from the wire.

(iii) The current will be going from top to bottom in the wire shown and the magnetic field lines are now in the clockwise direction on the plane which is perpendicular to the wire carrying current.

(iv) Right hand thumb rule. The thumb is aligned to the direction of the current and the direction in which the fingers are wrapped around in wire will give the direction of the magnetic field.