NATIONAL MODEL SENIOR SECONDARY SCHOOL

COIMBATORE

CHAPTER 13

MAGNETIC EEFECTS OF ELECTRIC CURRENT

CASE STUDY QUESTIONS

Q1. CURRENT THROUGH A STRAIGHT WIRE:

The pattern of the magnetic field generated by a current through a conductor depends on the shape of the conductor. The pattern of the magnetic field around a straight conductor carrying current is shown in the Figure.

The deflection of the compass needle placed at a given point increase as current increases and increases as distance from the wire is reduced. The force acting on needle can be also reversed by reversing the direction of current.

A convenient way of finding the direction of magnetic field associated with a current-carrying conductor is Right hand thumb rule.

1. The pattern of the magnetic field around a straight conductor carrying current is

(a) Straight lines (b) Circular lines

(c) Concentric circles (d) Elliptical lines

2. The force acting on the magnetic field is directly proportional to _______ and inversely proportional to __________

(a) Distance and current (b) current and distance

(c) Voltage and distance (d) distance and voltage

3. The direction of magnetic field around a straight wire can be reversed by

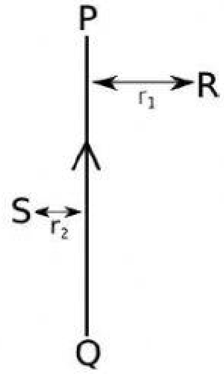
(a) Changing the direction of applied current

(b) reducing the current to zero

(c) Increasing the resistance value of the circuit

(d) Increasing the current value

4. The direction of magnetic field at the point R and S is



(a) into the paper and out of the paper (b) out of the paper and into the paper

(c) out of the paper at both points (d) into the paper at both points

Q2. CURRENT CARRYING CIRCULAR LOOP

At every point of a current-carrying circular loop, the concentric circles representing the magnetic field around it would become larger and larger as we move away from the wire. By the time we reach at the centre of the circular loop, the arcs of these big circles would appear as straight lines. Every point on the wire carrying current would give rise to the magnetic field appearing as straight lines at the center of the loop. By applying the right hand rule, it is easy to check that every section of the wire contributes to the magnetic field lines in the same direction within the loop.

We know that the magnetic field produced by a current-carrying wire at a given point depends directly on the current passing through it. Therefore, if there is a circular coil having n turns, the field produced is n times as large as that produced by a single turn. This is because the current in each circular turn has the same direction, and the field due to each turn then just adds up.

1. The pattern of the magnetic field at the centre of circular current carrying loop is

(a) Straight lines (b) Circular lines

(c) Concentric circles (d) Elliptical lines

2. The strength of magnetic field produced along the circular loop can be increased by

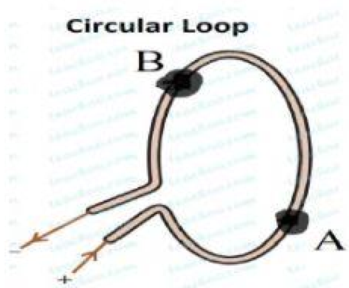
(a) increasing current and decreasing number of turns

(b) decreasing current and increasing number of turns

(c) increasing both current and number of turns

(d) decreasing both current and number of turns

3. The direction of magnetic field around the current carrying circular loop shown below at point A and B will be



(a) Clockwise at both the points (b) Anti Clockwise at both the points

(c) Clockwise at A and Anti clockwise at B

(d) Anti - Clockwise at A and Clockwise at B

Q3. Solenoid

A coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder is called a solenoid. In fact, one end of the solenoid behaves as a magnetic north pole, while the other behaves as the south pole. The field lines inside the solenoid are in the form of parallel straight lines.

A strong magnetic field produced inside a solenoid can be used to magnetize a piece of magnetic material, like soft iron, when placed inside the coil. The magnet so formed is called an electromagnet.

1. The pattern of the magnetic field around in a solenoid is uniform

(a) near the ends (b) outside solenoid

(c) inside solenoid (d) throughout the solenoid

2. The current entering side will act as __________ pole and leaving side will act as ____________ pole.

(a) N and N (b) N and S

(c) S and S (d) S and N

3. The magnetic field produced by a solenoid is equivalent to ___________

(a) circular loop (b) straight wire

(c) bar magnet (d) None of the above

4. Solenoid is used to convert a soft iron to

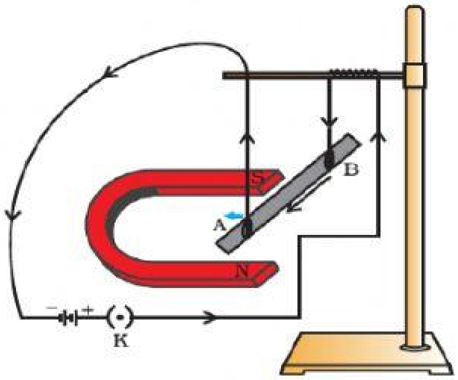
(a) bar magnet (b) permanent magnet

(c) electromagnet (d) iron piece

Q4. FORCE ON CURRENT CARRYING CONDUCTOR PLACED IN A MAGNETIC FIELD:

French scientist Andre Marie Ampere (1775–1836) suggested that force will be acting on a current-carrying conductor when placed in a magnetic field which is demonstrated through the simple activity shown below.

The displacement of the rod in the above activity suggests that a force is exerted on the current-carrying aluminium rod when it is placed in a magnetic field. It also suggests that the direction of force is also reversed when the direction of current through the conductor is reversed. Now change the direction of field to vertically downwards by interchanging the two poles of the magnet. It is once again observed that the direction of force acting on the current-carrying rod gets reversed. It shows that the direction of the force on the conductor depends upon the direction of current and the direction of the magnetic field. Experiments have shown that the displacement of the rod is largest (or the magnitude of the force is the highest) when the direction of current is at right angles to the direction of the magnetic field. In such a condition we can use Fleming's left hand rule to find the direction of the force on the conductor.



1. The produce force on the rod, the rod should be ________ and should be placed in ___________

(a) conductor and electric field (b) current carrying conductor and electric field

(c) conductor and magnetic field (d) current carrying conductor and magnetic field

2. The force acting on the conductor can be increased by

(a) Increasing the magnitude of current

(b) Increasing the magnetic field strength

(c) Increasing the length of the rod

(d) All the above

3. The displacement of the rod is largest when the direction of current is at ___________ to the direction of the magnetic field.

(a) Parallel (b) perpendicular

(c) making angle 60 degree (d) making angle 30 degree

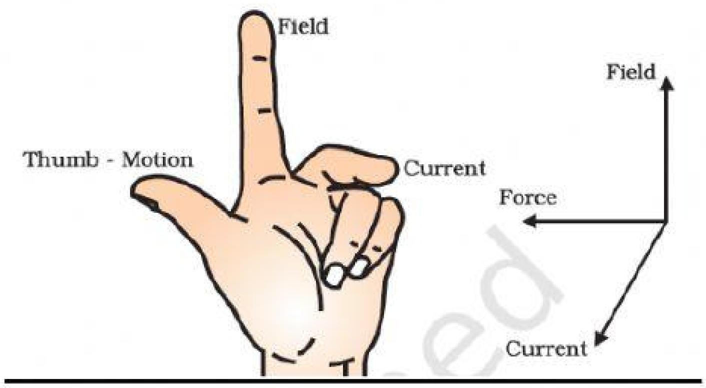
4. The direction of force can be changed by changing direction of

(a) current (b) magnetic field

(c) both current and magnetic field simultaneously

(d) either current or magnetic field

Q5. FLEMING'S LEFT HAND RULE:



1. Fleming's left hand rule is used to find the direction of

(a) electric field (b) current

(c) magnetic field (d) force

2. The direction of force is given by

(a) Index finger (b) fore finger

(c) middle finger (d) thumb

3. If the direction of electric current is along east, the direction of magnetic field along north direction, and then the direction of force will be along ________

(a) south (b) west

(c) downward (d) upward

4. If the direction of electric current is along downward direction, the direction of magnetic field along west direction, and then the direction of force will be along ________

(a) south (b) north

(c) downward (d) upward

5. If the direction of electric current is along upward direction, the direction of force is along north direction, and then the direction of magnetic field will be along ________

(a) south (b) east

(c) downward (d) west