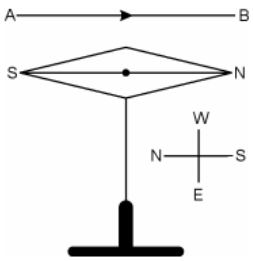
1. Diagram below shows a freely suspended magnetic needle. A copper wire is held parallel to the axis of magnetic needle.




(a) Describe the directions in which the north pole of the needle will move in the following situations.

(i) When conductor is above needle and the current flows from A to B.

(ii) When conductor is below needle and the current flows from B to A.

(b) Why does the needle move in the above situations?

(c) Name and state the law which will determine the direction of motion of magnetic needle.

**Answer:**

(a) (i) The north pole of needle will deflect towards west.

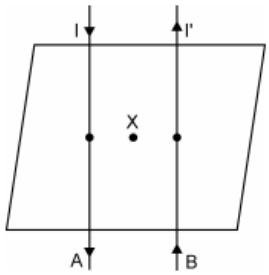
(ii) The north pole of needle will deflect towards west.

(b) The current flowing through conductor sets up a magnetic field, which is at right angles to the direction of flow of current. Thus, magnetic field due to the conductor is at right angles to the direction of magnetic field due to the magnetic needle. Thus, a couple acts, which deflects the freely suspended magnetic needle.

(c) **Ampere's Swimming Rule:** Imagine a swimmer (always looking towards magnetic needle), swimming in the direction of the current, such that current enters from his feet and leaves from his head. Then, the direction in which left hand of the swimmer points, gives the direction of the north pole of the magnetic needle.

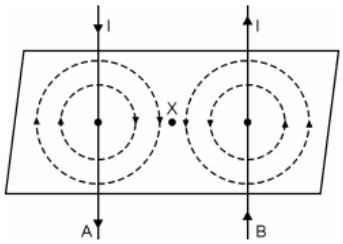
2. Two straight conductors A and B, carrying strong equal currents in opposite directions, pass through a cardboard, as shown in the diagram below. Copy the diagram and sketch separately the lines of force produced by each current. Show the direction of magnetic field at X. What will be the effect of

magnetic field at X, if the current in B is reversed? Explain why, the lines of force at distance may differ in shape from those in the immediate vicinity of conductors.




**Answer:**

The direction of magnetic field at X will be in the downward direction as is illustrated by diagram. If the direction of current in B is reversed, then no magnetic lines of force will pass through X. The lines of force at distance interacts with the earth's magnetic field and hence are elliptical in nature.




3. State three characteristics of the magnetic field produced by a straight current carrying conductor.

**Answer:**

(i) The magnetic lines of force are in the form of concentric circles near the conductor.

(ii) The plane of magnetic lines of force is at right angles to the straight conductor carrying current.

(iii) The magnetic intensity increases with the increase in the magnitude of current.

4. What is the direction of magnetic field at the centre of coil carrying current in :

(i) clockwise,

(ii) anticlockwise direction?

**Answer:**

(i) Magnetic field is inward and along the axis of the coil.

(ii) Magnetic field is outward and along the axis of the coil.

5. (a) What is a solenoid?

(b) Draw magnetic field around solenoid, showing clearly the magnetic polarities and the direction of magnetic lines of force.

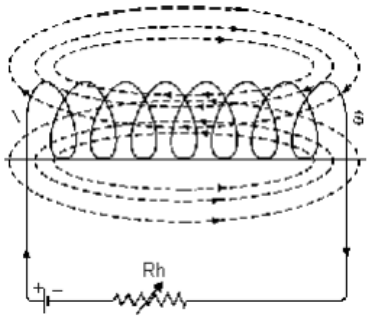
(c) If the solenoid is suspended freely, in which direction is it likely to point ?

(d) State three ways of increasing the magnetic strength of a solenoid.

**Answer:**

(a) Solenoid is an insulated copper coil, wound on cylindrical cardboard, such that its length is greater than its diameter and it behaves like a magnet when electric current is made to flow through it.

(b) Diagram drawn below.




(c) It will point in the North-South direction.

(d) The intensity of magnetic field of a solenoid can be increased by:

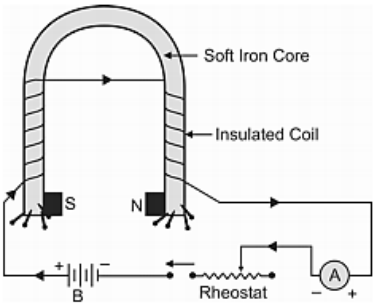
(i) Increasing number of turns in the solenoid.

(ii) By increasing strength of current flowing through solenoid.

(iii) By placing soft iron core along the axis of the solenoid.

(iv) By laminating soft iron core.

6. You are required to make an electromagnet from a U-shaped soft iron bar. Draw a circuit diagram to represent the process. In your diagram show the electric cell, insulted copper coil, U-shaped iron bar and switch. Label the poles of electromagnet.



(a) A magnet made by winding insulated copper coil over a piece of soft iron such that it behaves like a magnet only when current flows through the coil is called an electromagnet.

(b) (i) By increasing the number of turns in the coil.

(ii) By increasing the magnitude of current flowing through the coil.

(iii) By laminating the soft iron core.

(c) (i) Electromagnets are used in electric bell, electric relay; microphone, etc.

(ii) Electromagnets are used for separating ferromagnetic substances from ores.

(iii) Electromagnets are used in electric motors and electric generators.

7. A primary coil of 800 turns is connected to 220 V a.c. mains supply and the secondary coil has 8 turns. What will be the output voltage?

**Answer:**

$$\frac{N_s}{N_p} = \frac{V_s}{V_p}$$

$$\frac{8}{800} = \frac{V_s}{220V}$$

$$V_s = \frac{8 \times 220}{800} V = 2.2 \text{ Volts}$$

8. How does one increase the speed of rotation of a coil of a DC Motor?

**Answer:**

The Speed of the DC Motor Increases by:

(i) Increasing the number of turns in the coil

(ii) Increasing the strength of the current

(iii) Increasing the area of cross-section of the coil

(iv) Increasing the strength of the radial magnetic field

9. State the expression for force produced in a current carrying conductor when placed in magnetic field.

**Answer:**

Force on a current carrying wire, placed in a magnetic field,

$F = ILB \sin\theta$

Where,

I is current through the wire

B is magnetic field strength (magnetic induction) (unit of B is Tesla [T])

L is length of wire the magnetic field

θ is angle between the wire & the magnetic field

10. What is the principle behind working of an electric bell?

**Answer:**

Mechanical effect of electric current