	INDIAN SCHOOL AL WADI AL KABIR	
Class: X	**Department: SCIENCE 2022-23**	**DATE OF SUBMISSION 13.11.2022**
HANDOUTS	**Topic: MAGNETIC EFFECTS OF ELECTRIC CURRENT**	**NOTE: A4 FILE FORMAT**

- <u>Magnetic effects of electric current</u>

The production of magnetic field due to the passage of electric current in a conductor is called magnetic effect of electric current.

- <u>List some properties of magnets</u>

a) A freely suspended magnet always points in the north- south direction.
b) A magnet attracts substances like iron, steel, cobalt, nickel etc.
c) Like magnetic poles repel each other and unlike magnetic poles attract each other.
d) Magnetic poles always exist in pairs.

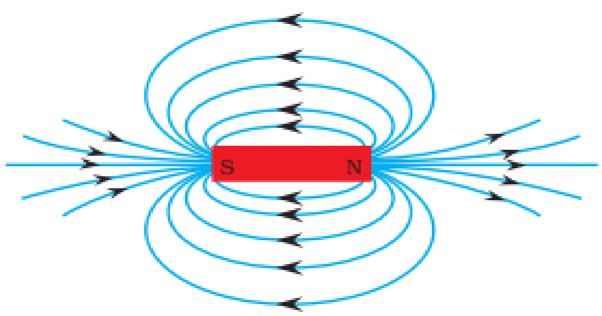
- <u>MAGNETIC FIELD</u>

The region surrounding the magnet in which the force of magnet can be experienced is called magnetic field.

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

A. Both the magnet and magnetic compass have a magnetic field surrounding it. When brought nearer these two magnetic fields interfere each other and exert a force on each other. This force makes the compass needle deflect.

- <u>PROPERTIES OF MAGNETIC FIELD LINES AROUND A BAR MAGNET</u>



a) Each magnetic field line forms a closed curve
b) The relative strength of the magnetic field is shown by the degree of closeness of the field lines.
c) No two magnetic field lines can intersect each other. This is because if they do so at the point of intersection the north pole of the compass needle point in two different directions showing two directions of magnetic field at a given point, which is not possible.
d) The magnetic field lines emerge from north pole and merge at south pole outside the magnet.
e) The magnetic field lines move from South Pole to the North Pole inside the magnet.

- MAGNETIC FIELD LINES/ MAGNETIC LINES OF FORCE

It is the path or the direction along which a unit north pole will move in a magnetic field if it is free to do so.

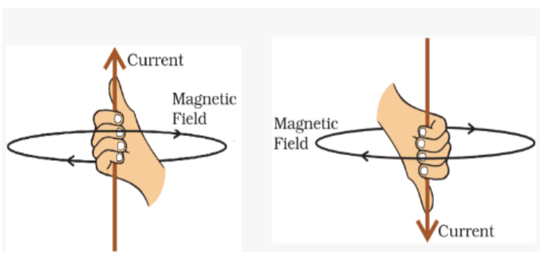
- PROPERTIES OF MAGNETIC FIELD LINES AROUND A STRAIGHT CURRENT CARRYING CONDUCTOR
- Magnetic field lines are concentric circles surrounding the straight current carrying conductor.
- If the direction of the current in the wire is reversed the direction of the magnetic field lines also get reversed.
- When the direction of the current is downwards the direction of the magnetic field is clockwise.
- When the direction of the current is upwards the direction of the magnetic field is anti-clockwise.

FACTORS ON WHICH THE STRENGTH OF THE MAGNETIC FIELD DUE TO CURRENT CARRYING STRAIGHT CONDUCTOR DEPEND ON

- Depends directly on the current passing through the conductor.
- Depends inversely on the distance from the conductor.

RULE TO FIND THE DIRECTION OF MAGNETIC FIELD DUE TO A CURRENT CARRYING STRAIGHT CONDUCTOR

RIGHT HAND THUMB RULE



Imagine that you are holding a current carrying straight conductor in your right hand such that the thumb points towards the direction of the current. Then your fingers will wrap around the conductor in the direction of the field lines of the magnetic field.

PROPERTIES OF MAGNETIC FIELD LINES AROUND A CURRENT CARRYING CIRCULAR LOOP

- The magnetic field lines are nearly circular near the wire.
- They are in the same direction within the space enclosed by the wire.
- Near the centre of the loop the magnetic field lines are nearly parallel and straight, showing that the magnetic field is uniform.

FACTORS ON WHICH THE STRENGTH OF THE MAGNETIC FIELD DUE TO CURRENT CARRYING CIRCULAR LOOP DEPEND ON

- Strength of the magnetic field increases with increase in the strength of the current.
- Strength of the magnetic field decreases with Strength increase in the radius of the loop.

SOLENOID

A solenoid is a coil of insulated copper wire wound closely in the form of a cylinder. When current is passed through this it acts like a magnet.

FACTORS ON WHICH THE STRENGTH OF THE MAGNETIC FIELD DUE TO CURRENT CARRYING SOLENOID DEPEND ON.

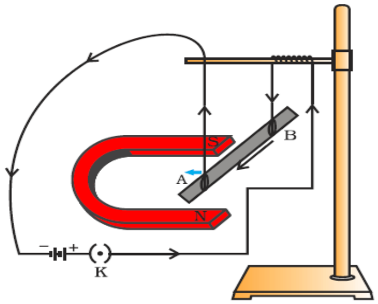
- Strength of the magnetic field increases with increase in the strength of the current.
- Strength of the magnetic field decreases with increase in the radius of the loop.
- Strength of the magnetic field increases with increase in the number of turns of the coil.
- Strength of the magnetic field depends on the nature of the core material inserted along the axis of the solenoid.

Force on a current carrying conductor

A current carrying conductor kept in a magnetic field produces a force on the conductor.

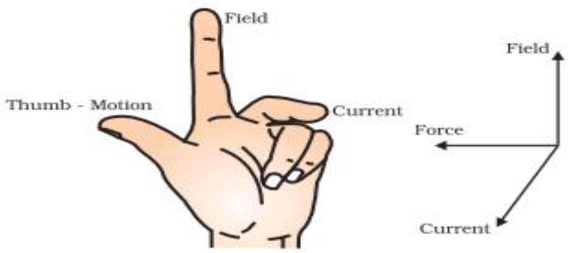
Activity to prove that a force is exerted on a current carrying conductor kept in a magnetic field

An Aluminium rod AB is suspended horizontally from a stand as shown in the figure. Place a horse shoe magnet near it as shown in the figure. When the current flows through this conductor it is observed that the rod gets displaced towards one side and when the polarity of the current is reversed, or the poles of the magnet is changed, the displacement of the rod also gets reversed.



- The direction of displacement or the direction of force depends on the direction of current or the direction of magnetic field.
- The magnitude of the force is highest when the direction of electric field and magnetic field is perpendicular to each other.

Fleming's left-hand rule: -



Fleming's left-hand rule is used to determine the direction of force acting on a current carrying conductor kept in a magnetic field or the direction of motion of the conductor.

- It is used to the find the direction of force when the direction of current and the direction of magnetic field acting on the conductor is known.
- According to this rule, stretch the thumb, forefinger and middle finger of your left hand such that they are mutually perpendicular, then if the forefinger points in the direction of magnetic field and the middle finger in the direction of current, then the thumb will point in the direction of motion or the force acting on the conductor.

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