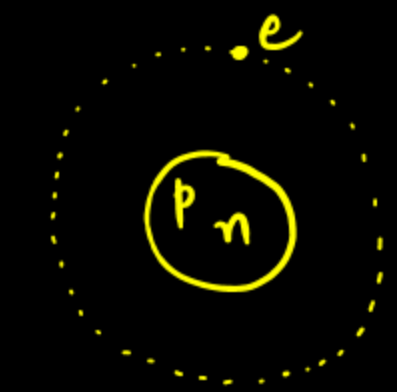
Electric and Magnetic Fields

Atom

no. of protons = no. of electrons

∴ atoms are neutral.



Oxygen atom has 8 protons in the nucleus and 8 electrons in the orbit around nucleus.

+8 charge in nucleus
−8 charge in orbit
} total charge on oxygen atom is +8 + (−8) = 0

1 proton = +1 unit charge

2 proton = +2 charge

3 protons = +3 units of charge

protons → +ve charge

electrons → −ve charge

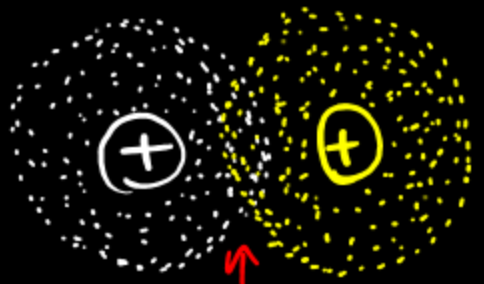
1 electron = −1 unit charge

2 electrons = −2 unit charge

3 electrons = −3 unit charge

Properties of charge: (electric charge)

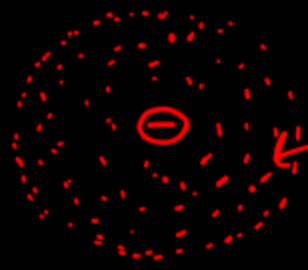
- Like charges repel each other.
- Unlike charges attract each other



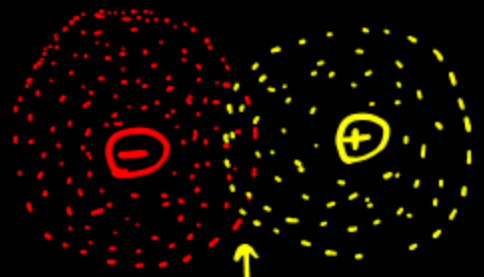
Point of overlap of influence of two positive charge

Zone of interaction of two positive charge.

They are repulsive in nature because charges are same



Space around a charge where its influence can be felt by another charge. This is called field of that charge



Zone of interaction of the influence of +ve and -ve charges.

They attract each other.

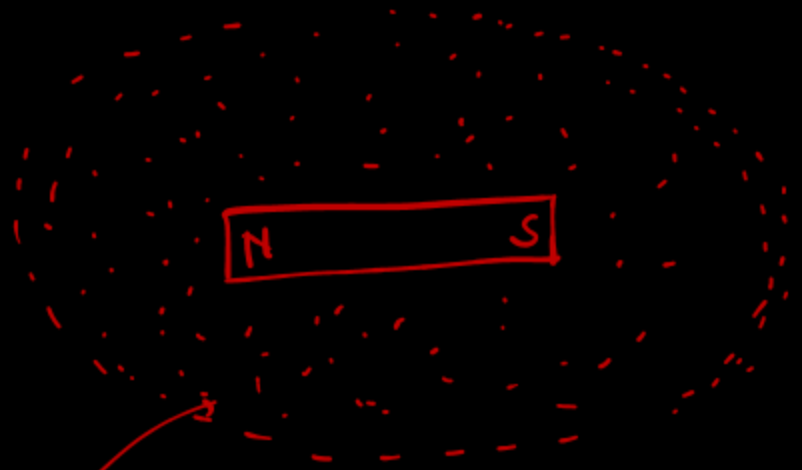
Electric field

⇒ Electric field is invisible force fields that are created around electric charges (+ve & -ve charge)

⇒ invisible force field of one charge can be felt by another charge and vice-versa.

Magnet

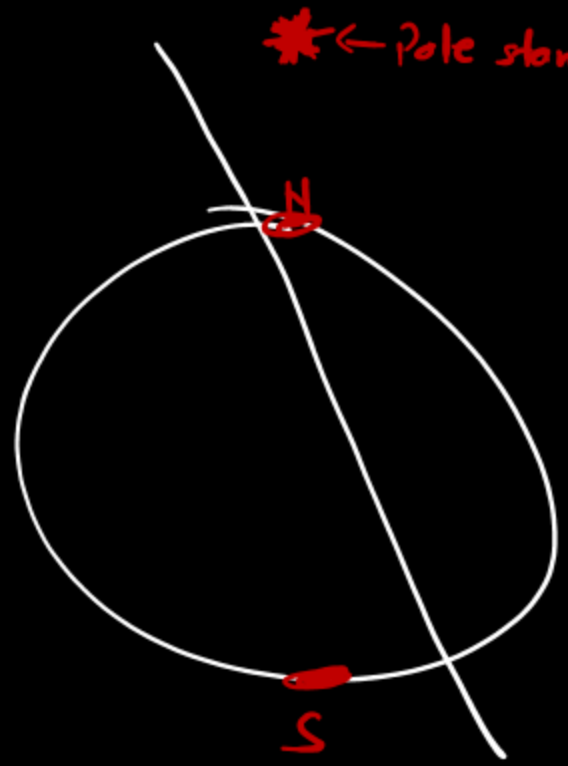
- They have poles (North and South pole)
- Polar material



Invisible Influence of magnet around it.

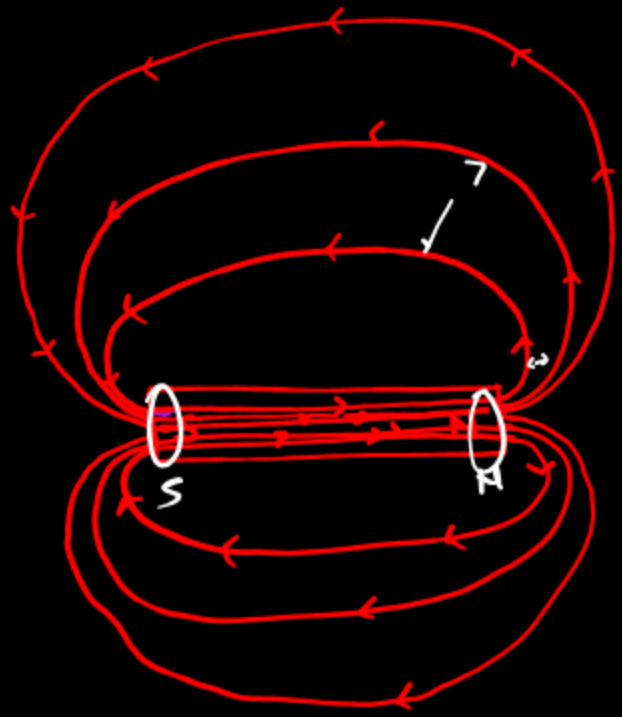
- Magnetic field

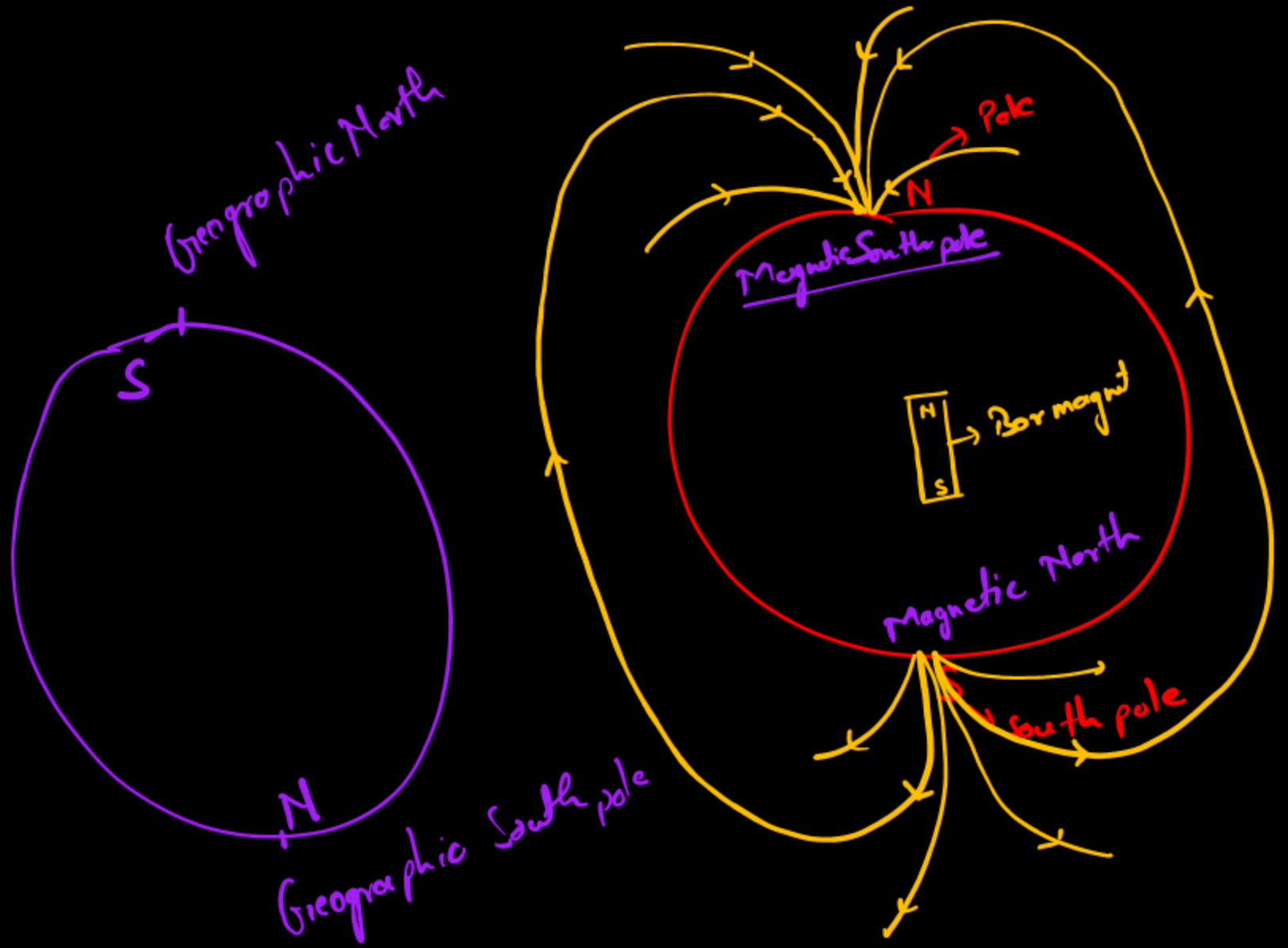
Bar Magnet



Direction of field line

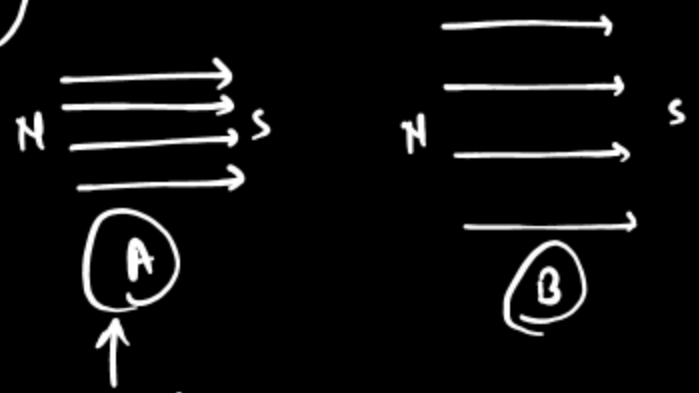
- Outside magnet → From N to S pole.
- Inside magnet → From S to N pole.





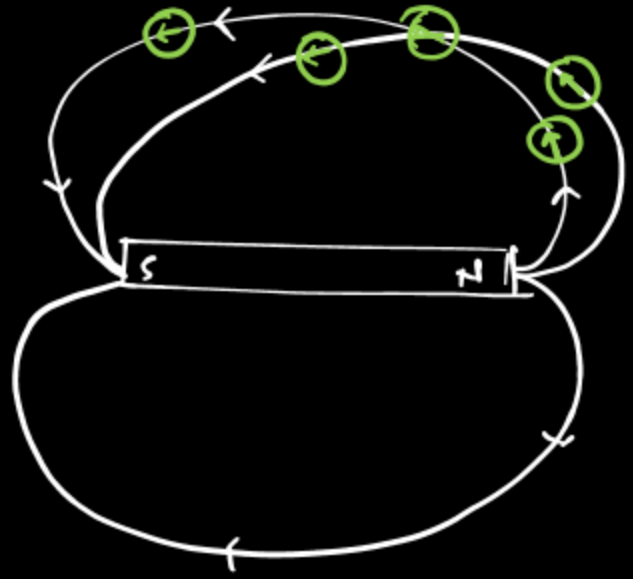
Properties of field line

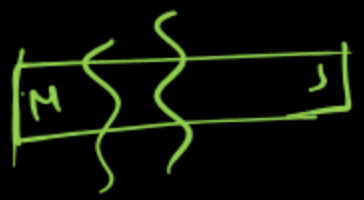
(I) Strength of magnetic field depends on the distance between field lines (Directly proportional)



(II) Field lines are directional (N → S)

(III) Field lines never cross each other.





N/S

We can demagnetise a magnetic material by:

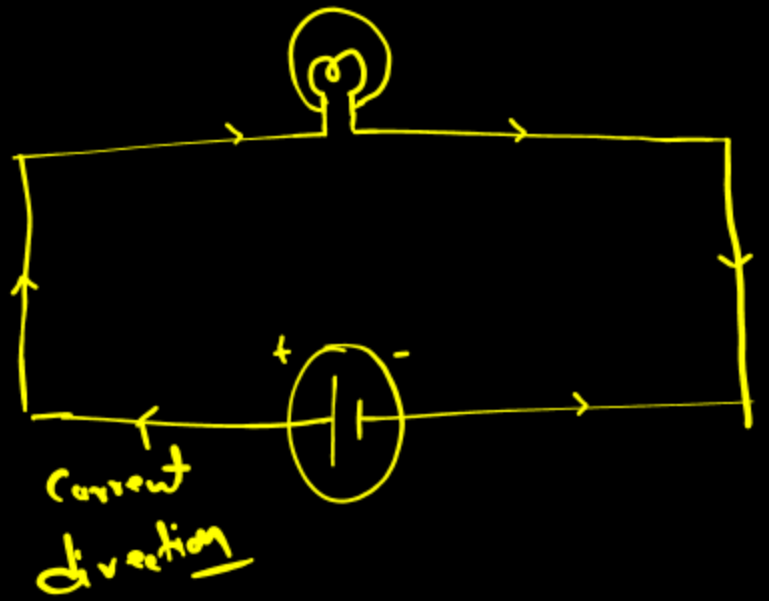
(I) Heating.

(II) Hammering.

(III) Self-demagnetisation (if magnet is not used for long time)

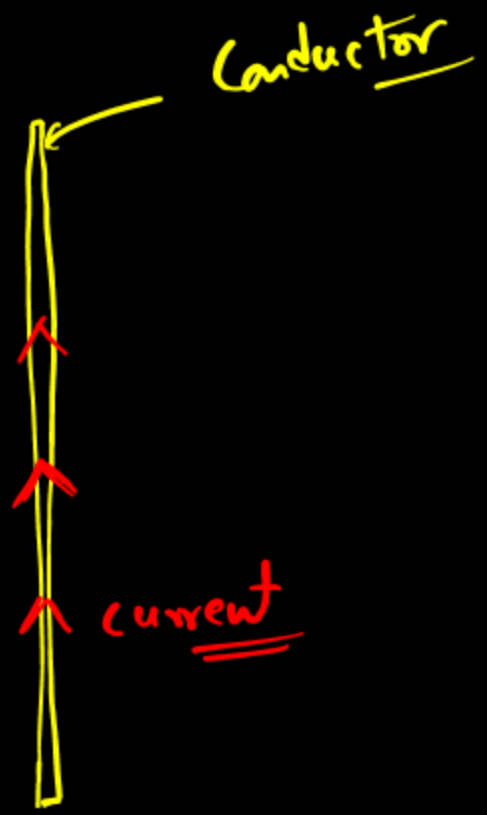
(IV) Passing AC (alternating current)

(V) Rough handling.



Cell ⇒ ⊣|—

Battery ⇒ ⊣|||—



Electric Current:

→ flow of charge (electrons) in a conductor constitutes electric current.

3 types of material

Good Conductors

→ Materials that allow easy flow of charge/electrons

⇒ Gold, silver, copper, aluminium.

Resistors / Bad conductors

⇒ Material in which charges cannot flow that easily.

eg: Lead, alloy of metals. (Nichrome) → heating element

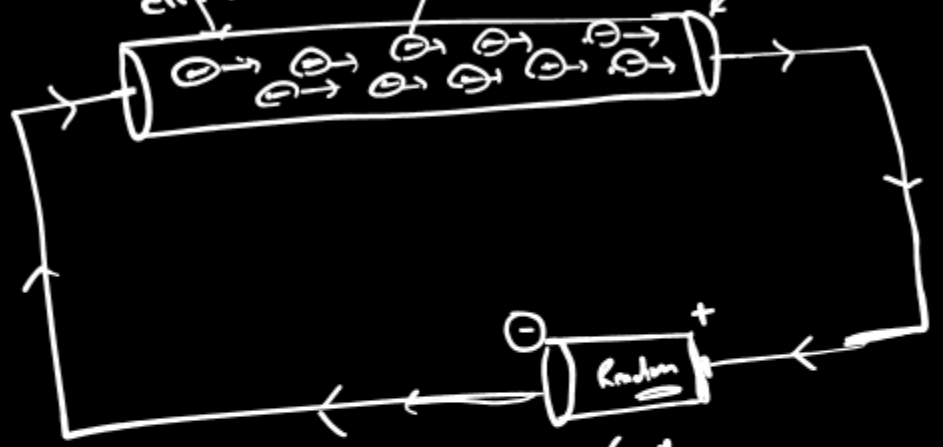
Insulators (electrical insulators)

⇒ Materials that do not allow charges to flow through them.

This flow of electrons constitutes electric current.

charge/electrons

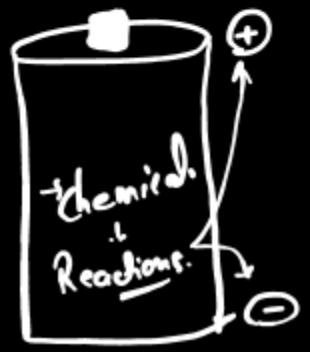
metal wire / conductor.



Cell

Battery.

Cell:



Effects of electric current

1. Heating effect of electric current
2. Magnetic effect of electric current

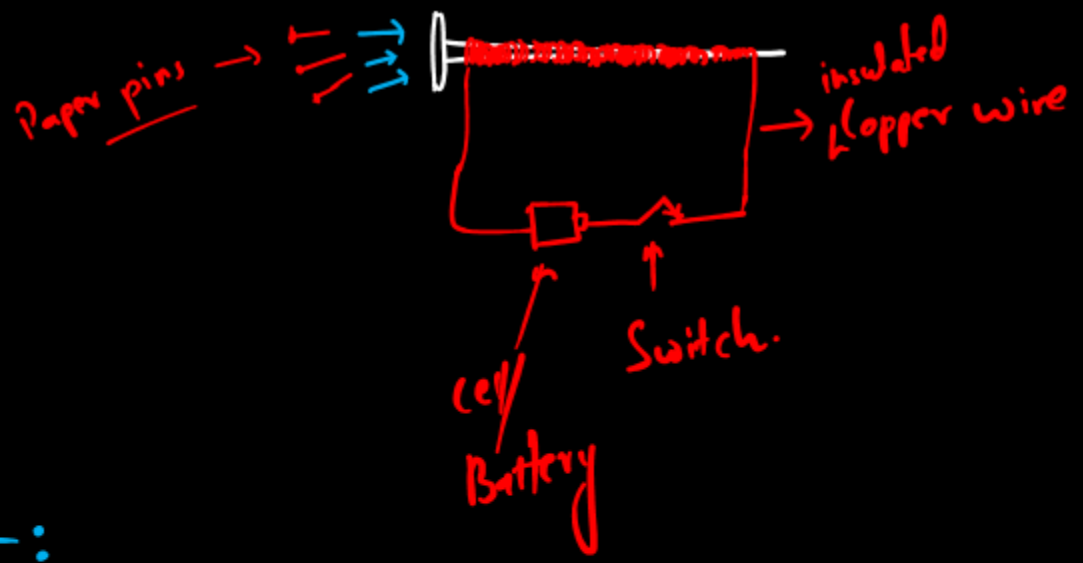
~1800

It was first observed that a conducting wire (Current carrying wire) behaves like a magnet till the time electric current is flowing through

H C Oersted

⇒ Current carrying wire has magnetic field around it and hence it behaves like a magnet.

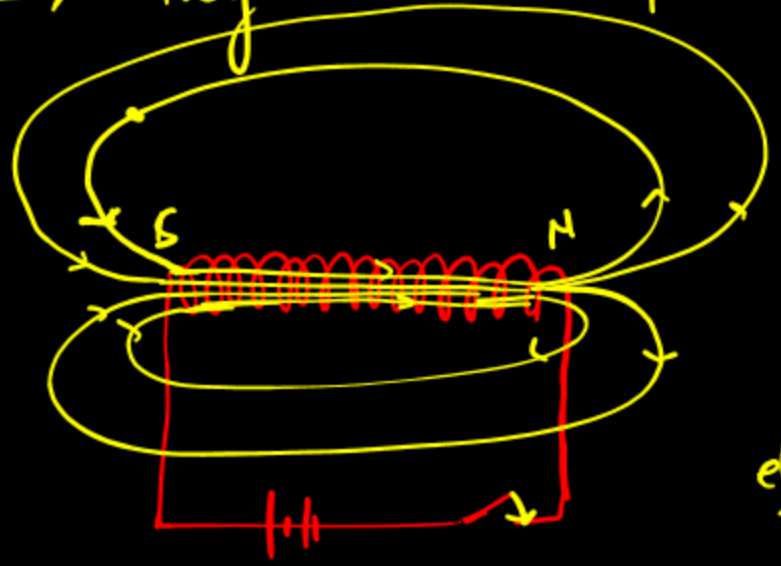
Electromagnet:

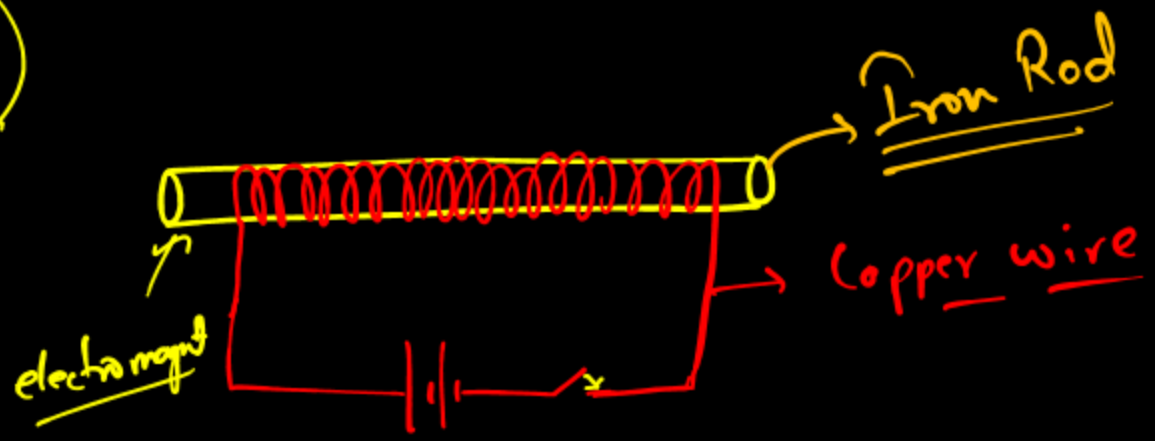


- Till the time current flows in the wire, iron nail behaves like a magnet
- The moment current is switched off, iron nail looses its magnetic property.

Electromagnets

- Temporary magnet.
- They can produce very strong magnetic field.





Uses of Electromagnets

⇒ Electromagnetic cranes → lift heavy load

⇒ Magnetic materials (→ iron) can be separated from junk with the help of electromagnets

⇒ Electromagnets are used to build imp. household devices like:

- ⇒ Electric bell
- ⇒ fan
- ⇒ Speakers / sound system.
- ⇒ TMCB.

End of the chapter