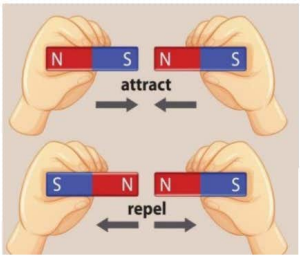
MAGNETIC EFFECTS OF ELECTRIC CURRENT

MAGNET :- An object which attracts pieces of iron, nickel and cobalt.

Two poles of a magnet - (1) North pole
(2) South pole



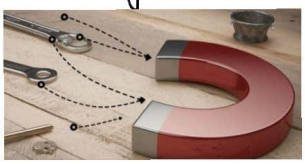
like poles → Repel
Unlike poles → Attract

Magnetic Compass :-

- A compass is a small magnet in shape of needle.
- it detects the presence of a magnet or magnetic field.
- When a magnet or magnetic field is around, it deflects.
- stronger the magnet / field, more is deflection.

Magnetic field (B) - Magnet ka Dabdaba :-

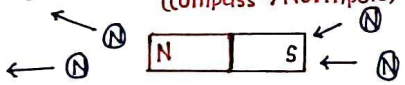
- The space surrounding a magnet in which other magnets or magnetic material feels a force.
- it is a quantity that has both directions and magnitude.



Direction of Magnetic field (B) :-

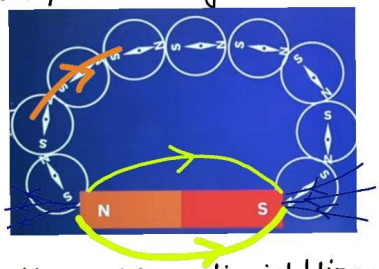
The path along which a free North pole moves

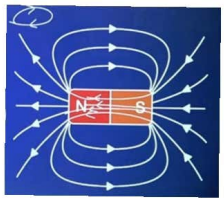
(Compass → Northpole)

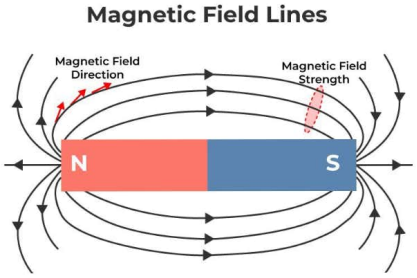


Magnetic field lines :- (MFL)

imaginary lines along which a free North pole moves.







Properties of Magnetic field lines -

- outside Magnet N → S
- Inside Magnet S → N
- closed curves
- Two field lines cannot cross / intersect each other

imp

Because if they do, at the point of intersection, North poles of Magnetic needles will point towards two directions which is impossible.

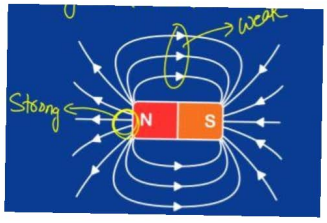
X 

if they cross ! 414 !

Magnetic field (B) → direction → MFL

Magnitude of Magnetic field :-

- field lines closer (Crowded) → Magnetic field strong.
- field lines far → Magnetic field Weak.

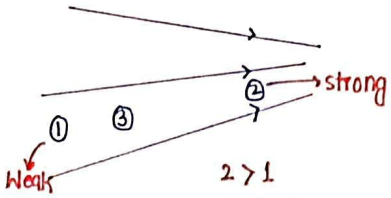


Uniform magnetic field :-

uniform MF

Parallel lines
Magnetic field lines
(MFL)
equal distance

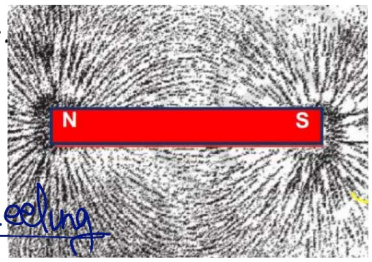
Non- uniform Magnetic field



2 > 1
MF(B)

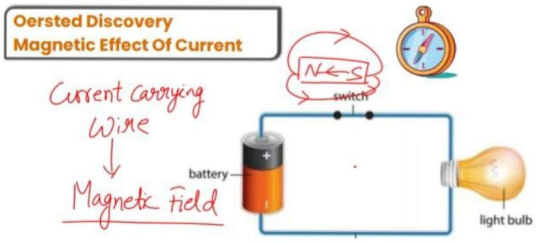
Activity 12.2 SAGH KI FIELD LINES

- Sprinkle some iron fillings uniformaly around the bar magnet.
  Tap → arrangement
- Iron fillings
  ↳ In the direction of Magnetic field lines.



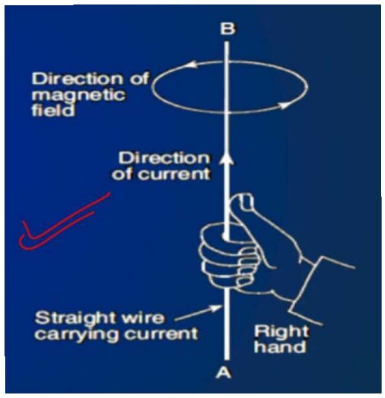
iron feeling

Oersted Discovery magnetic effect of current



Maxwell's Right hand thumb rule :-

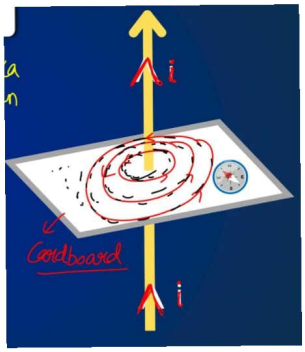
Imagine that you are grasping (or holding) the current carrying wire in your right hand so that your thumb points in the direction of current, then the direction in which your fingers wrap the wire will give the direction of magnetic field lines around the wire.



Activity 12.1 → Oersted Discovery

Iron filling ← Iron ka chooran

magnetic field concentric circle mein hota hai

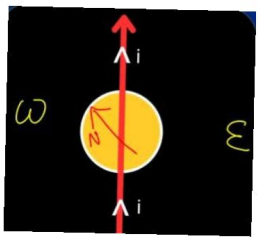


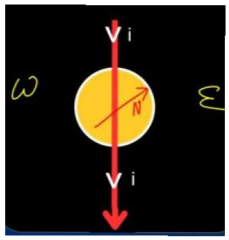
Factors on which Magnetic field due to straight wire depends

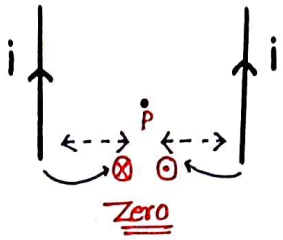
- current (i) → More current → Stronger magnetic fields
- Distance (d) → More Distance → Weaker magnetic fields
- change direction of current

  Reverse i direction → Magnetic field lines reverses

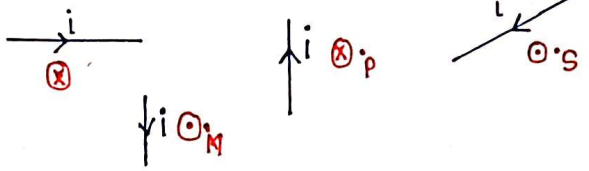
Activity 13.4 current wire placed over compass





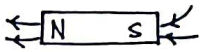


- inwards → ⊗
- outwards → ⊙

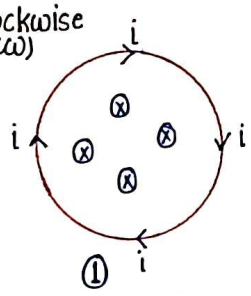


Magnetic field pattern due to a circular loop carrying current :-

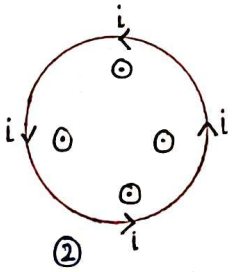
magnet



Clockwise (cw)

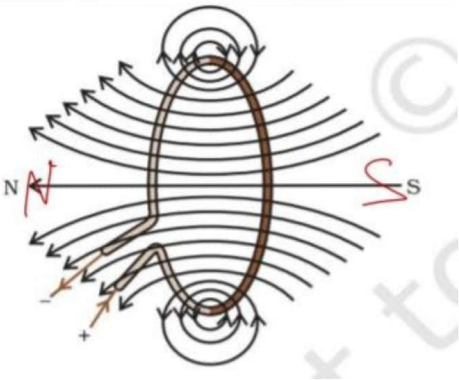


Southpole



Northpole

Anticlockwise (ACW)

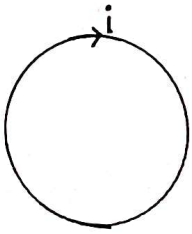


Trick

(i) current i ↑ ⇒ Magnetic field ↑ B↑

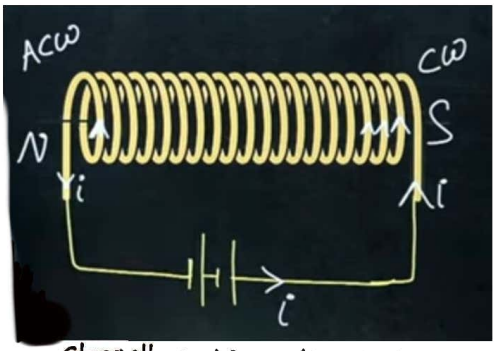
(ii) no. of turns n↑ ⇒ Magnetic field ↑B↑

(iii) Radius r↓ ⇒ Magnetic field ↑B↑



Magnetic field lines due to a Solenoid :-

A coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder.

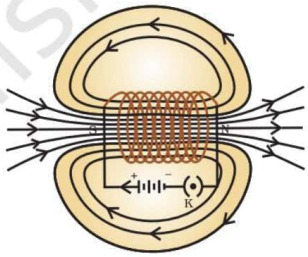


Parallel lines

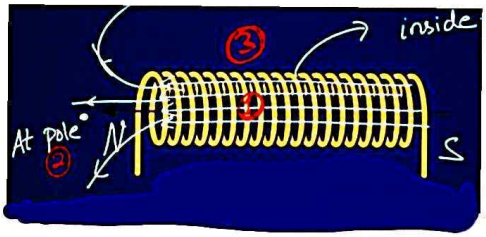
distance equal hoti hai

Uniform Magnetic field

✡ Yad karo Bar Magnet



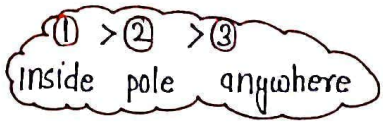
Strength of Magnetic field :-



inside → uniform magnetic field

↓

Andar har point pe equal(same) hai



strength of a magnetic field due to a solenoid depends on

(i) number of turns (nt) ⇒ Magnetic field ↑

(ii) current I↑ ⇒ Magnetic field ↑

(iii) The gap between the turns ↓ reduced ⇒ Magnetic field ↑

direction of current Reverse

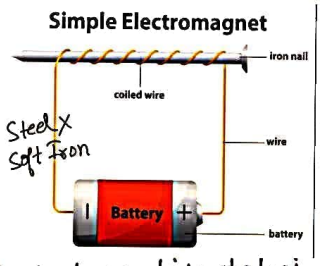
↓

polarity Reverse

Electromagnet :-

- A long coil of insulated copper wire wrapped around a soft iron core.
- Electromagnet is temporary magnet. Jabtak hai current Tab tak magnet
- ✡ An electromagnet works on magnetic effects of current.
- The poles of electromagnet can be reversed.

solenoid → core → soft iron



✡ steel use nhi karte hai kyuki ushe ek bar magnet banado to permanent magnet bann jata hai.

strength of Electromagnet :-

- (i) number of turns in the coil ↑ → magnetic field ↑
- (ii) The current flowing in the soil → i↑ → magnetic field ↑
- (iii) The length of air gap between turns reduced ↓ → magnetic field ↑

	Bar Magnet	Solenoid	Electromagnet
Definition	A permanent magnet with fixed poles.	A coil of wire wound in a cylindrical shape.	A solenoid with a soft iron core.
Source of Magnetism	Natural magnetic properties of the material.	Electric current flowing through the wire.	Electric current and soft iron core.
Magnetic Field	Permanent and fixed.	Temporary, exists only when current flows.	Temporary but Stronger than solenoid.
Polarity	Fixed, cannot be changed.	Can be reversed by changing current direction.	Can be reversed by changing current direction.

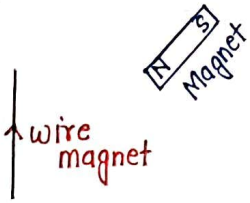
Force(F) on current - Carrying conductor placed in a magnetic field

- When a current - carrying conductor is placed in a magnetic field, a force is exerted on the conductor which can make the conductor move.

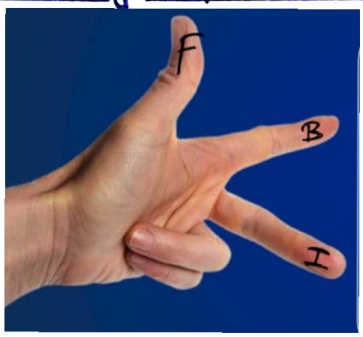
current carrying wire ⟶ Magnet → Magnetic field

↓

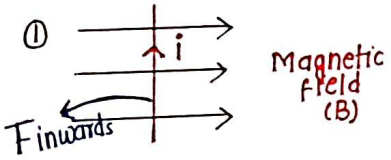
Experience force

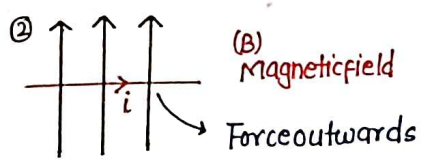


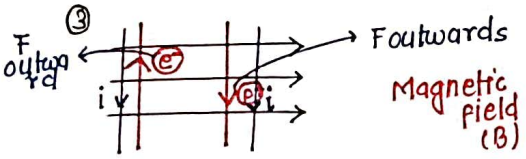
Fleming's left-Hand Rule for the Direction of force :-

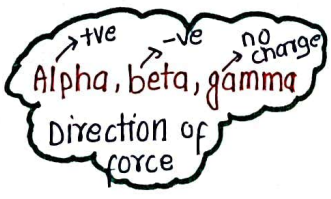


According to fleming's left hand rule :- Hold the forefinger, the centre finger and the thumb of your left hand at right angles to one another. Adjust your hand in such way that the forefinger points in the direction of magnetic field and the centre finger points in direction of current, then the direction in which thumb points, gives the direction of force acting on the conductor.









Factors on which force on current wire depends :-

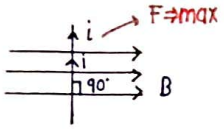
(i) current (i)↑ ⇒ F↑

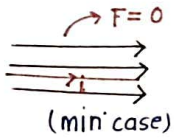
(ii) Magnetic fields (B)↑ ⇒ F↑

(iii) length (l)↑ ⇒ F↑

(iv) Angle (imp)

$F \rightarrow \underset{\uparrow}{B}\,\underset{\uparrow}{i}\,\underset{\uparrow}{l}$





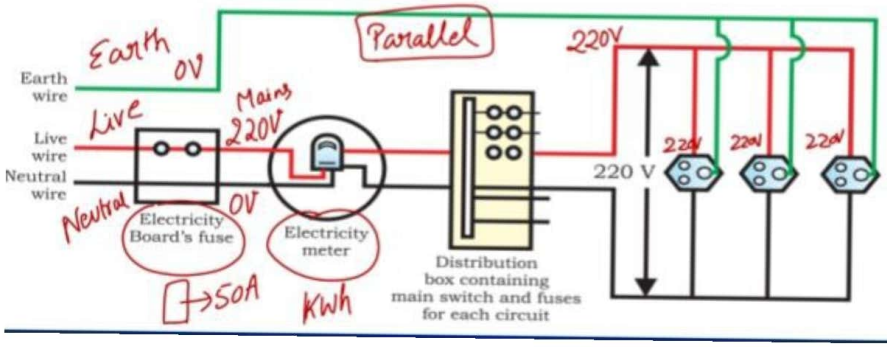
D.C
Direct Current

(1) Do not change its direction.
(2) obtained from cell battery.
(3) Repulsive.
(4) Voltage can not be changed
(5) More power loss over long transmission.

A.C
Alternating current

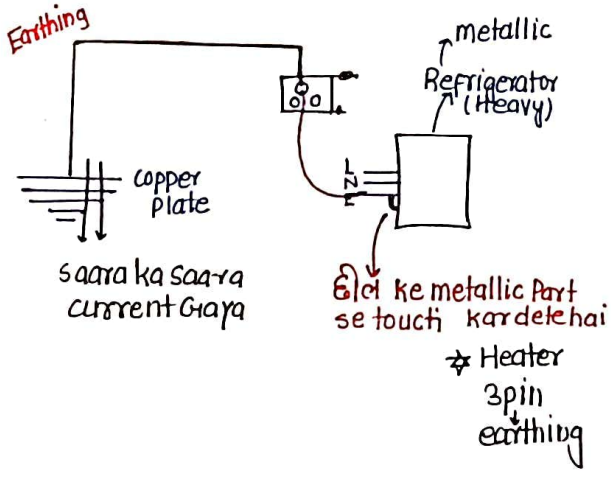
(1) change its direction
(2) obtained from electric power plants with A.C Generators.
(3) Attractive.
(4) Voltage can be changed.
(5) less power loss over long transmission.

Domestic Electric circuits (or Domestic wiring) :-

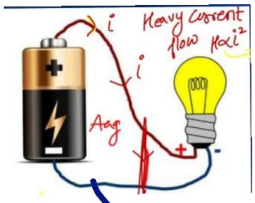


Parallel → Advantage
↓
different device different current
+
different devices same voltage 220V
+
1 device fail no effect on other device

Earthing of electrical Appliances



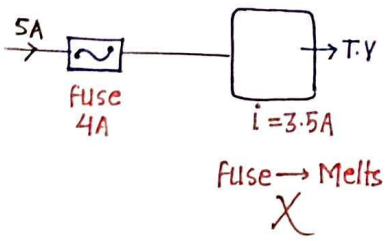
Overloading - shortcircuit



shortcircuit → current → lowest Resistance

$\uparrow\uparrow i = \frac{V}{R \downarrow\downarrow}$ $V = iR$

Safety device → Fuse



Fuse melts ✗

Fuse → cut Tin
→ Pbt Tin
→ low M.P
→ High Resistance

- fuse wires are made of tin plated copper with a low melting point to melt easily durning a short circuit. pure copper is unsuitable due to its high melting point.

A 15A fuse → heavy appliances like irons, geysers and toasters.
A 5A fuse → bulbs, fans, etc

IRON

TOASTER

GEYSERS

OVERLOADING

Metallic devices

lot of current in
How ?
Joule's Law

Sudden spike in Voltage