Magnetism

i current flowing in a conducter

↙ heating ↓ chemical ↘ MAGNETIC

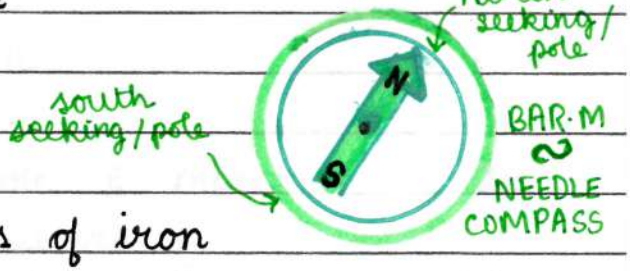
Magnet

Hans Oersted 1820

→ whenever a current flow through a conducter, magnetic field / effect is generated.

→ there is connection between MAGNETISM and ELECTRICITY.

→ any change in direction of current will show variation in deflection



MAGNET

→ any substance
- attracts small pieces of iron
- points in N-S direction when suspended freely.

→ NATURE

Natural	Artificial
LOAD STONE / MAGNETITE	↓
• naturally occuring iron ore	• permenant
• very weak magnet	• strong

→ Property:

1. 2 poles = N and S
2. always exist in pair of poles

3. attract - like, repel - unlike
4. REPULSION - true test for magnet

Magnetic field

MAGNETIC FIELD

★ region around a magnet where, force of attraction and repulsion can be detected.
★ MAGNETIC COMPASS - detect
★ vector quantity

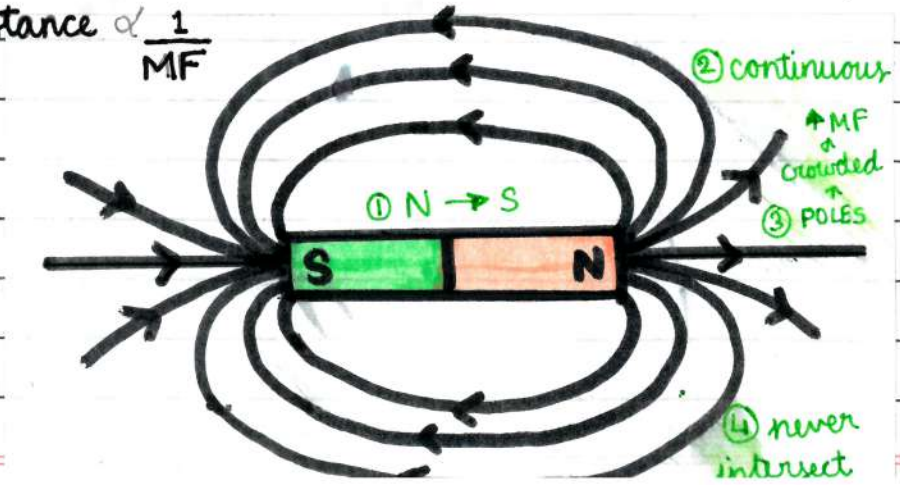
FIELD LINES

★ imaginery lines representing magnetic field around a magnet
★ detect
- iron filings - sprinkle
- compass - tracing line

★ PROPERTIES

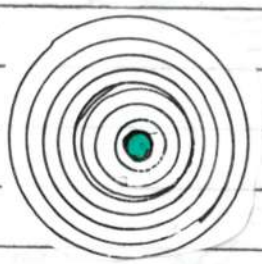
1. emerge at north pole & merge at south. N → S
2. closed continuous curves
3. crowded → POLES
   seperated → other areas
4. never intersect
   2 directions of magnetic field at 1 point of intersection - NOT POSSIBLE i.e

distance ∝ $\frac{1}{MF}$



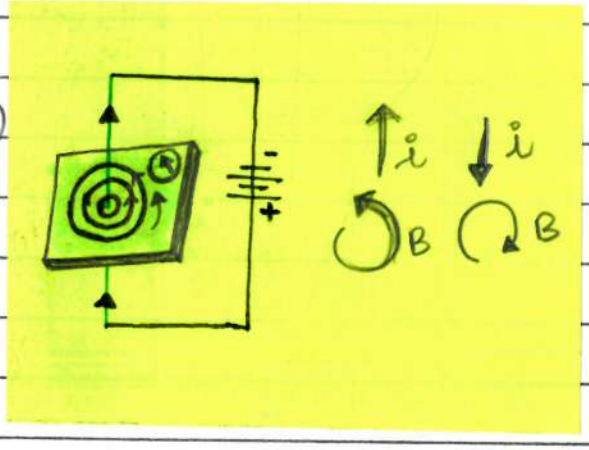
Current - Conducter

Straight

→ 

concentric circles

wire - centre of circles



→ Factors (strength of B)

① current

$B \propto i$

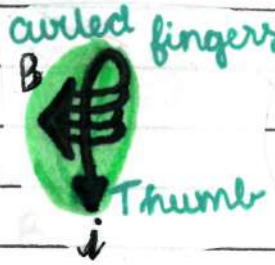
② distance r

$B \propto \frac{1}{r}$

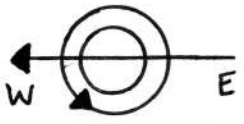
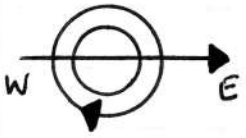
Maxwell's Right Hand Thumb Rule

↓

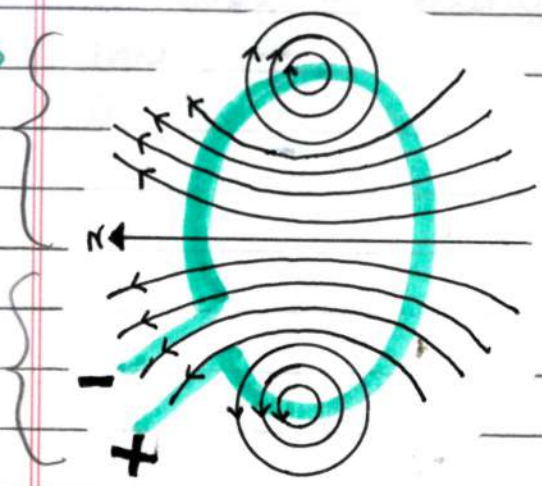
Find direction of MAGNETIC FIELD



Corkscrew rule

			
S → N	N → S	E → W	W → E
anti · C E → W	C W → E	anti · C S → N	C N → S

Circular loop



as we move away from the 2 chosen ents, the circles become larger and appears to be a straight line.

↓

at CENTRE

↓

↑ert MF

→ at every point

↓

magnetic field

↓

CONCENTRIC Oles

→ Factors

① Current

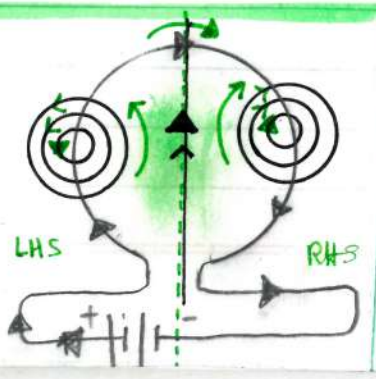
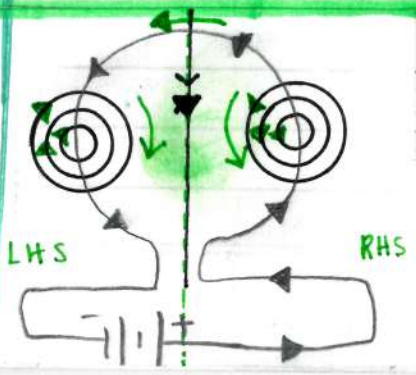
$B \propto i$

② Number of turns = n

$B \propto n$

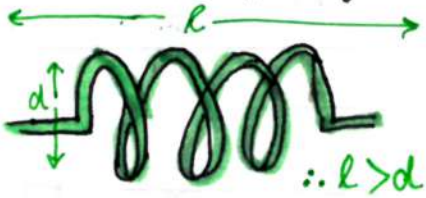
③ Radius

$B \propto \frac{1}{r}$

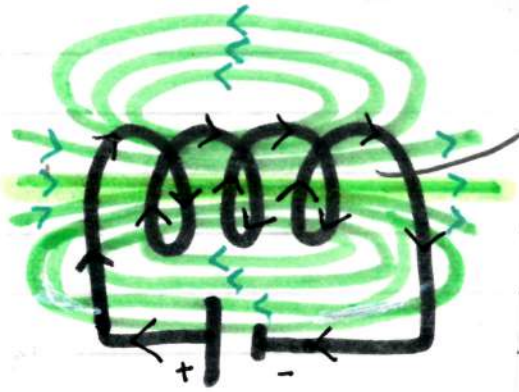
	out N . in S	out S . in N
	CASE 1 CLOCK..	CASE 2 ANTI CLOCK.
B_1^{LHS}	anticlockwise	clockwise
B_2^{RHS}	clockwise	anticlockwise
		

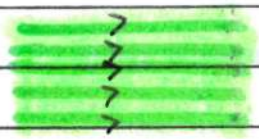
Solenoid detect = BAR MAGNET

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

→ 

≈ BAR MAGNET

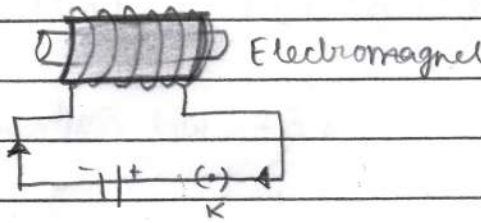
→ 



At CENTRE

↳ parallel, uniform
↳ straight lines
↳ MF = same at all points

detect → → If i = CLOCKWISE in one end → SOUTH POLE
If i = ANTICLOCKWISE in one end → NORTH POLE
↳ compass
↳ bar magnet



→ Factors:

① current
$B \propto i$ →

② number of coils = n
$B \propto n$ → 

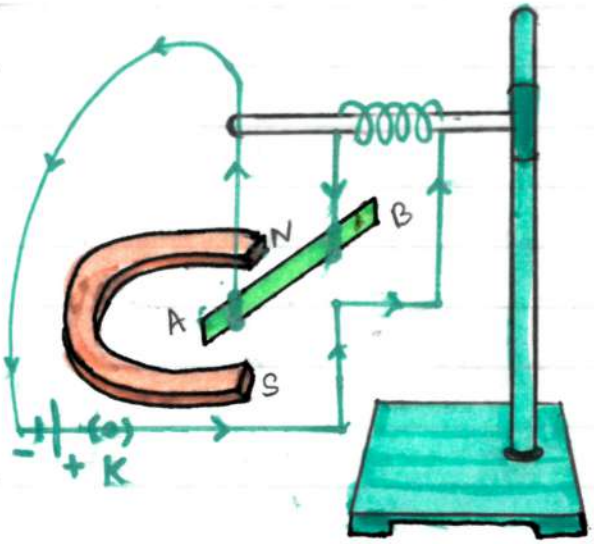
③ length
$B \propto l$ → 

④ inserting a soft core ∝ MF ↑

March

store 67 /

Force on conducter



MAX. force F when,
B ⊥ i

MIN. force F when,
B || i

→ **Andre Marie Ampere**
magnet must also excerts an equal and opposite force on the current carrying conducter.

→ When i carrying conducter is kept near a magnet, displacement or movement of conducter is absorbed.

2B = B(generated on i conducter) + B(magnet)

displacement = attration / repustion b/w 2B's.

→ **Factors**: affection Force of conducter (F) & (d) displacement

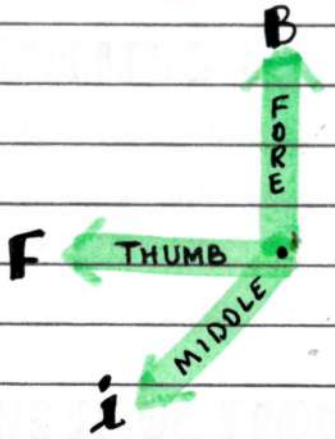
① current strength
$F \propto i_{(\Rightarrow)} \propto d$

② current direction
i changes ∝ F changes ∝ d changes

③ gnitude & direction of B of permenant magnet.
$B \propto F$

④ nath of conducter

Fleming's left hand rule



!! flow of e^- is always opposite to conventional direction of current.

When the 3 fingers (thumb, fore finger and middle finger are stretched much as possible so that all 3 fingers are ⊥r to each other then if, index finger indicates the direction of magnetic field, middle finger indicates the direction of current then the thumb finger gives direction of force or motion.

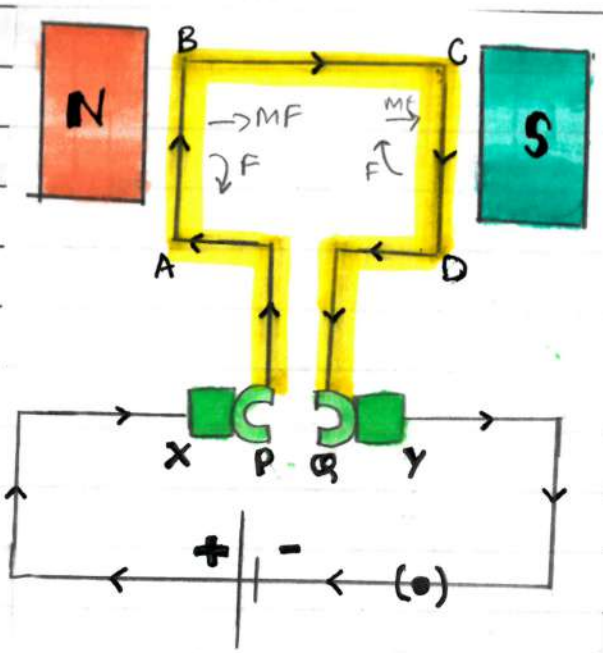
Electric Motor

PRINCIPLE :

When a current carrying conducter kept in a M·F, conducter experiences a force, that is responsible for the movement of the current carrying conducter.

CONSTRUCTION :

ARMATURE
1. 2 permanant magnets
2. rectangular coil = ABCD
3. 2 split rings
4. 2 commutators / brushes (C)
5. 1 battery
6. 1 key



WORKING :

1. Current starts flowing from (+) terminal to B 'x' → S·'P' → ABCD → S·'Q' → Y → batt
2. When current is passed into the coil ABCD, AB side bends down due to magnetic force experienced by it and CD side comes up due to magnetic force experienced by it, so the coil starts moving in ANTICLOCKWISE direction.
3. After half rotation, split ring Q comes & contacts X and split ring P contacts Y
4. direction of current in a coil has changed. When rotating in vertical positon, brushes loose contact with rings & i stops. But coil doesn't stop due to inertia of motion

No force of BC & AD ∵ ∥ to MF

SPLIT RINGS / COMMUTATOR :

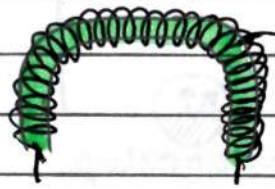
★ changes direction of current

BRUSHES (carbon brushes)

★ maintains constant contact between source of current and split rings.

★ prevents wires from messing up

ARMATURE



→ iron rod wrapped with conducting copper wire

↳ ELECTROMAGNET

To increase speed of rotation :

1. ↑ strength i
2. ↑ no of turns of coil
3. ↑ area of coil
4. ↑ strength of B

Comercial uses

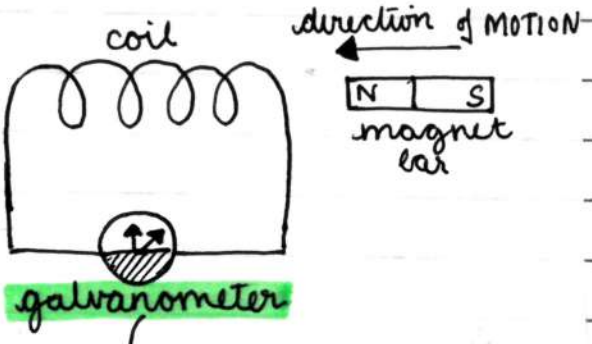
1. electromagnet ← permenant magnet
2. armature
3. large number of turns of conducting wire in i carrying coil

Electromagnetic Induction

→ Production of an electric current in a closed circuit by a changing magnetic field. is Induced current.

→ This phenomenon is Electromagnetic Induction.

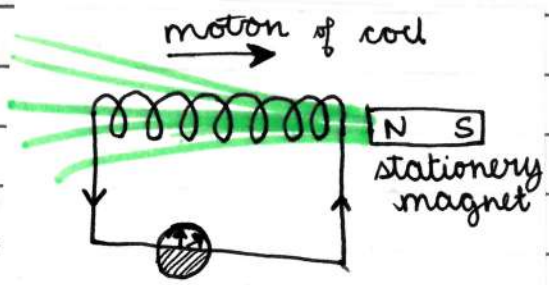
→ Discover - Michael Faraday



detects precense of current → deflects = ✓current
→ 0 = no current

WAYS

- Relative movement between MAGNET & COIL



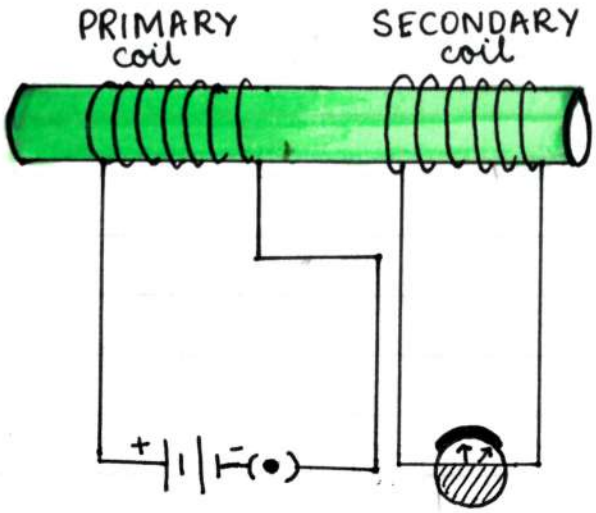
ii Max = d motion ⊥ B

direction (d) of ii reversed

↓

reversing direction of B

Changing B in one coil & getting i i in other coil



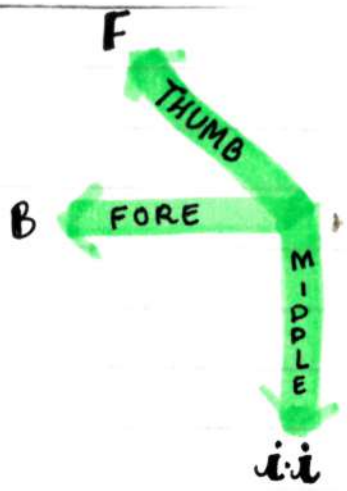
1. $i_{primary}$ takes little time to rise from 0 → min. value
2. ∴ momentary change in B around coil
3. ∴ induces a momentary i in seconary.
4. i is indused in cod 2 when current in coil 1 is changed which is indicated by deflection in galvanometer needle.

B changes → induced current
↑ PC ↓ SC

Electromagnetic Induction

Process by which changing magnetic field in a conductor induces a current in another conducter.

Flemings right hand rule



If the forefinger, middle finger and thumb finger of the right hand are placed mutually ⊥r to each other with, the forefinger in the direction of the magnetic field and the thumb in the direction of the motion of the wire, then the induced current in the wire is in the direction of the middle finger.