CLASS-10th

MAGNETIC EFFECTS

OF ELECTRIC CURRENT

GUN SHOT

MAGNET

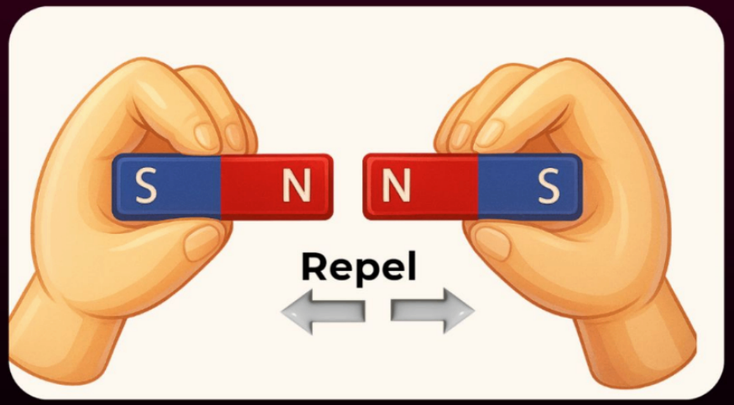
An object which attracts pieces of iron, nickel & cobalt.

Bar Magnet - Rectangular, permanent magnet with two poles

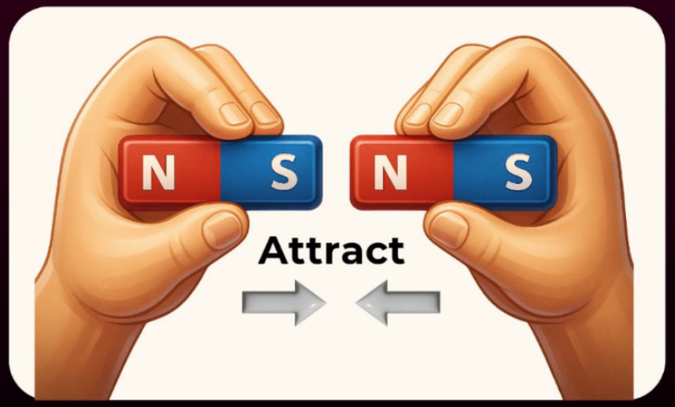
Two poles of a magnet : North pole & South pole.

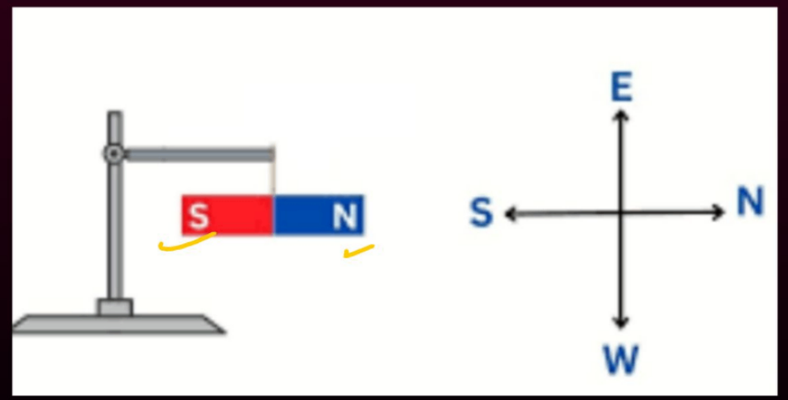
A freely suspended magnet rests in the north-south direction

Like Poles → REPEL



Unlike Poles → ATTRACT





MAGNETIC COMPASS

- A compass is a small magnet in shape of a 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.

When Free , the ends of the compass needle point nearly towards North and South directions .
End pointing towards North - North pole.
End pointing towards South - South pole.

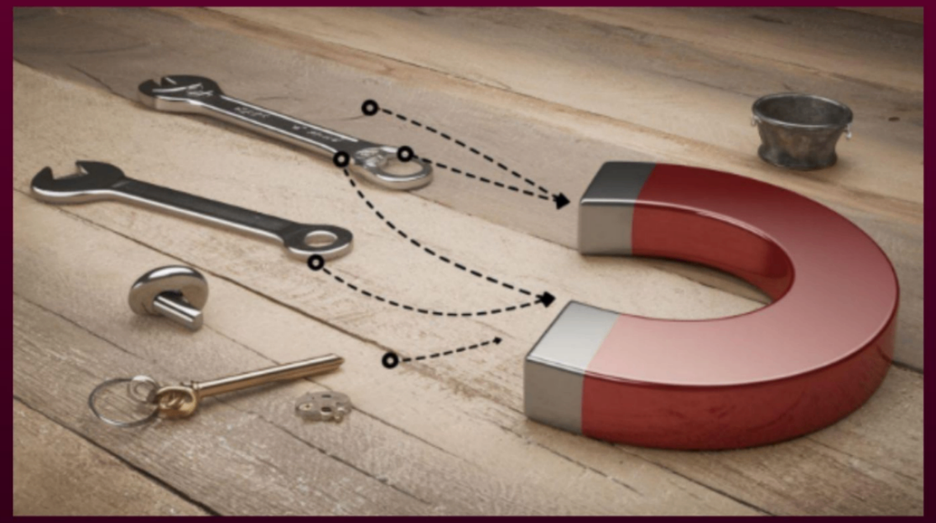
Magnetic Compass

MAGNETIC FIELD (B) - MAGNET KA DABDABA

The space surrounding a magnet in which other magnets or magnetic materials feels a force

B → vector

It is a quantity that has both Directions and Magnitude



DIRECTION OF MAGNETIC FIELD (B)

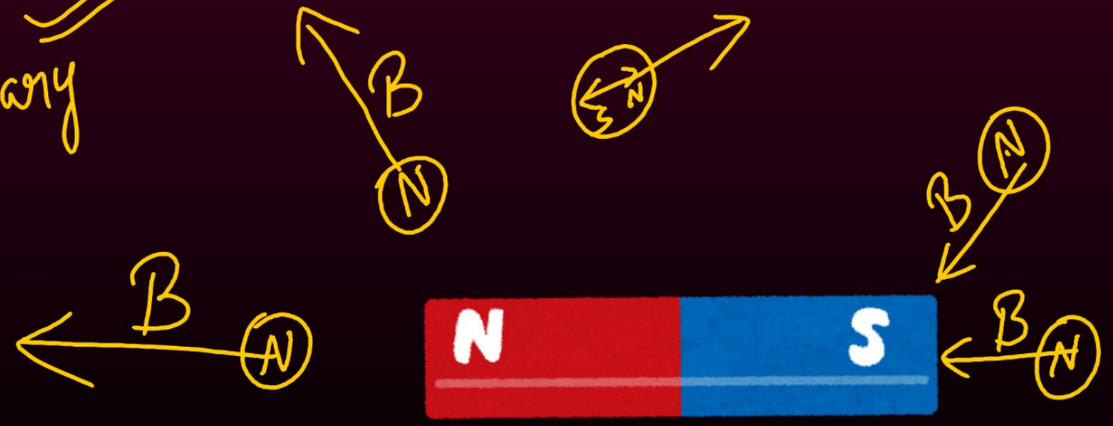
The path along which a free North Pole moves

imaginary

imp

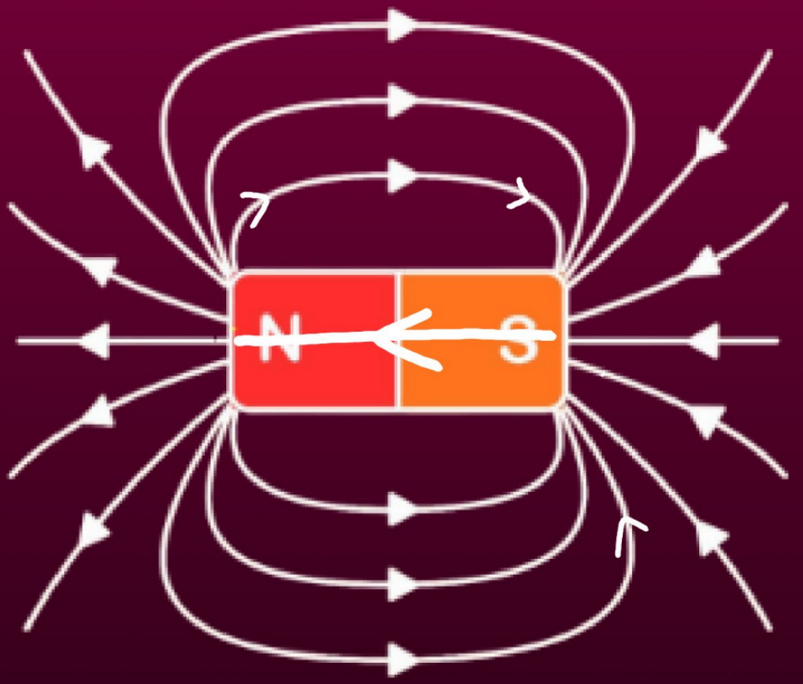
OR

Direction in which a North Pole of Compass Needle moves



MAGNETIC FIELD LINES

- Imaginary lines along which a free North Pole or North Pole of Compass Needle moves
- Gives the direction of Magnetic Field at a point.

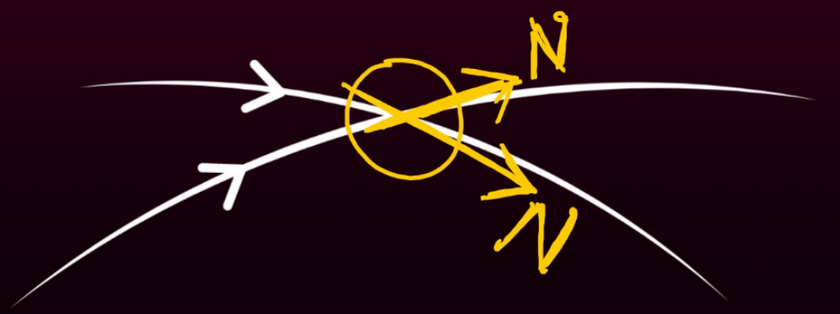


out → N → S

PROPERTIES OF MAGNETIC FIELD LINES

- Emerge from North Pole and Merge at South Pole
- Outside Magnet N→S ; Inside Magnet S→N
- Magnetic Field Lines are Closed Curves
- ***Two field lines cannot Cross/Intersect each other*** imp

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



Assertion (A): No two magnetic field lines are found to cross each other.
Reason (R): The compass needle cannot point towards two directions at the point of intersection of two magnetic field lines.

(CBSE 2025, 2022, 2020, 2015)

A Both (A) and (R) are true and (R) is the correct explanation of (A).

B Both (A) and (R) are true, but (R) is the not correct explanation of (A).

C (A) is true, but (R) is false.

D (A) is false, but (R) is true.

Which one of the following statements is not true about a bar magnet?

(CBSE 2025, 2017, 2020)

A It sets itself in north-south direction when suspended freely.

B It has attractive power for iron filings.

C It produces magnetic field lines.

D The direction of magnetic field lines inside a bar magnet is from its north pole to its south pole.

Assertion (A): Magnetic field lines around a bar magnet never intersect each other.
Reason (R): Magnetic field produced by a bar magnet is a quantity that has both magnitude and direction.

(CBSE 2025, 2015, 2021, 2020

A Both (A) and (R) are true and (R) is the correct explanation of (A).

B Both (A) and (R) are true, but (R) is the not correct explanation of (A).

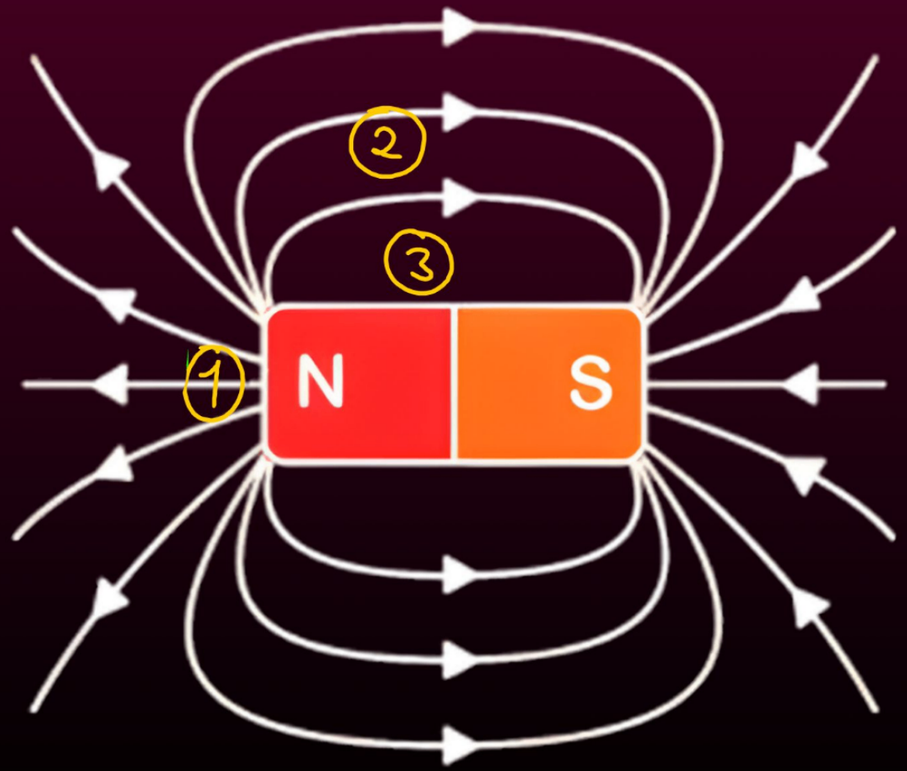
C (A) is true, but (R) is false.

D (A) is false, but (R) is true.

MAGITUDE OF MAGNETIC FIELD (B)

Field Lines Closer (more Crowded) → Strong Magnetic Field

Field Lines Far (less Crowded) → Weak Magnetic Field

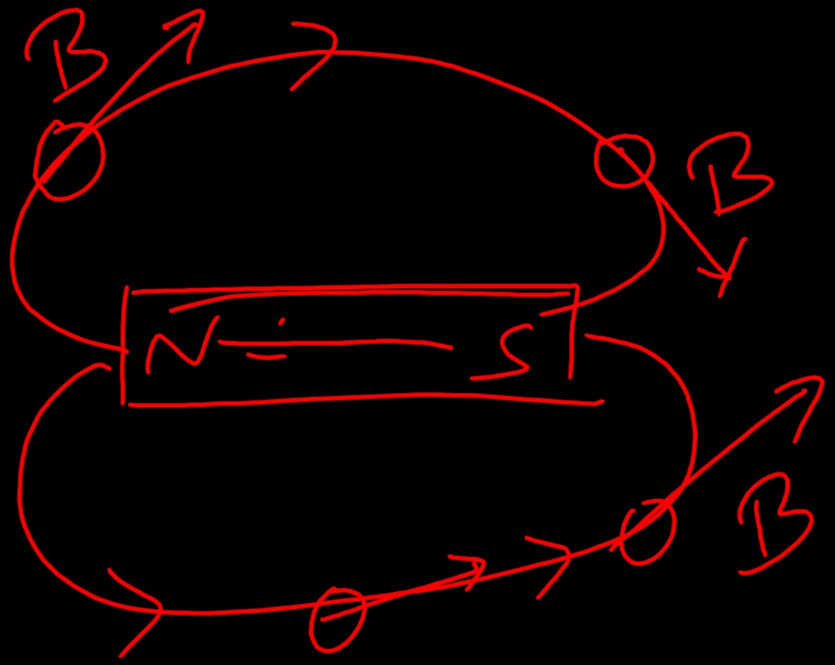


Strength Of Magnetic Field (B)

1 > 2 > 3

For a bar Magnet,

- Around the poles - field lines crowde B → Strongest
- Far away - B → Weak → lines separated


B
B
N
S
B

UNIFORM & NON-UNIFORM MAGNETIC FIELD

Uniform Magnetic Field

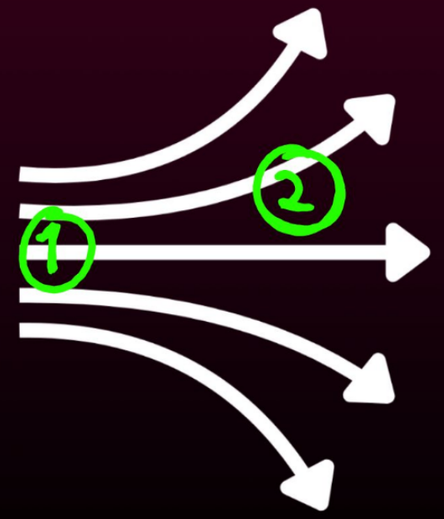
- Field is same everywhere
- Field Lines are Parallel
- Field lines are at equal distance

① = ② = ③

Non -Uniform Magnetic Field

- Field is different at different places
- Field Lines are Not Parallel
- Field lines are at Unequal distance

① > ②



(a) By convention, the field lines emerge from the north pole and merge at the south pole. Why? Give reason.
(b) State the relationship between the strength of the magnetic field and the degree of closeness of the field lines.
(c) The magnetic field in a given region is uniform. Draw a diagram to represent it.

(CBSE 2025, 2015, 2024, 2018, 2021, 2022

ANS

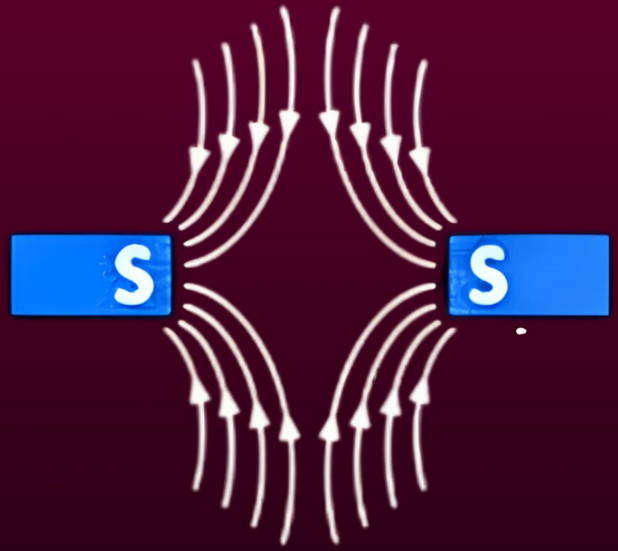
(a) Reason - Field lines are drawn along the direction in which a North Pole of a compass needle moves.

(b) The closer the magnetic field lines , the stronger the magnetic field.

(c)

MAGNETIC FIELD LINES DUE TO TWO BAR MAGNETS

2 magnets



Lines are dense between opposite Poles → Attraction between opposite Poles

Lines are repelling from two same Poles → Repulsion between Same Poles

a. Name the poles P, Q, R and S of the magnets in the following figures 'a' and 'b'.

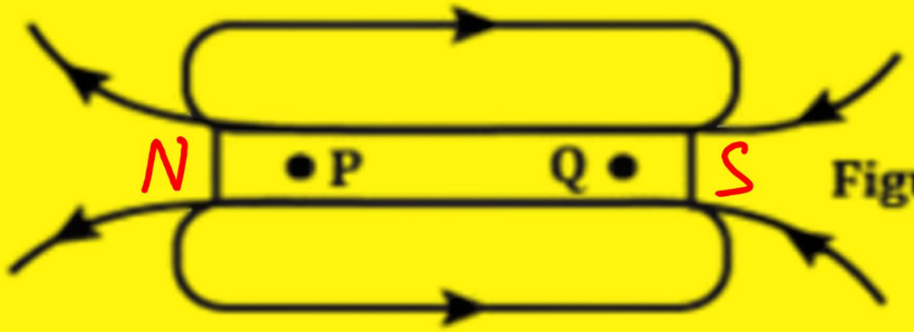


Figure 'a'

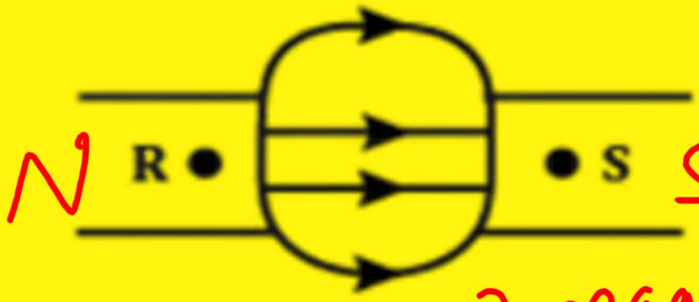


Figure 'b'

2 magnets

b. State the inference drawn about the direction of the magnetic field lines on the basis of these diagram.

CBSE Term 2 (2021-2022)

ANS

(a) P→N Q→S, R→N, S→S

(b) 1-Magnetic field lines always emerge from the North pole and enter the South pole.

2- Inside the magnet, they move from South to North,

3-Filed Lines form closed loops.

Activity 12.2 - Field lines By Iron Filings

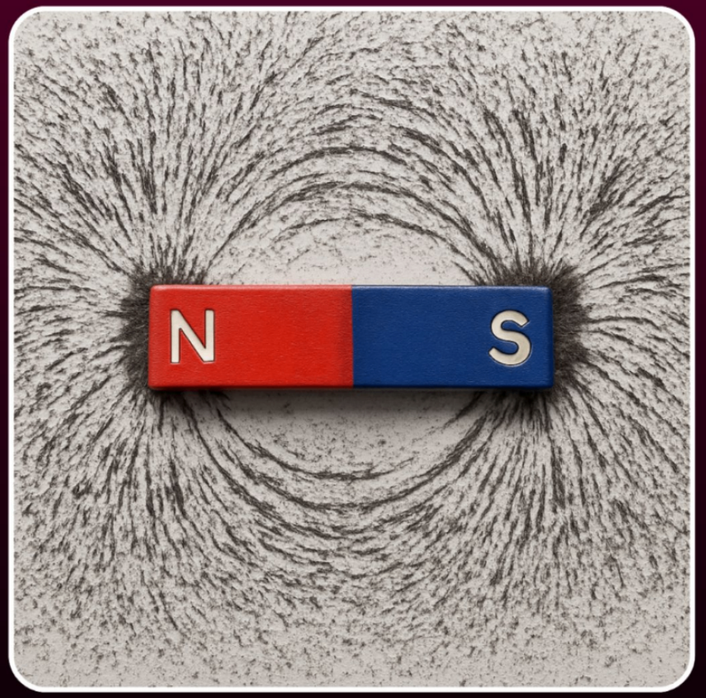
Chooran

Steps:

1. Place a bar magnet on a white paper & Sprinkle iron filings evenly around it
2. Tap the board gently and observe the pattern formed.

Observation:

- Iron filings arrange themselves in curved lines around the magnet.
- The lines are dense near the poles and spread out in the middle.



Conclusion:

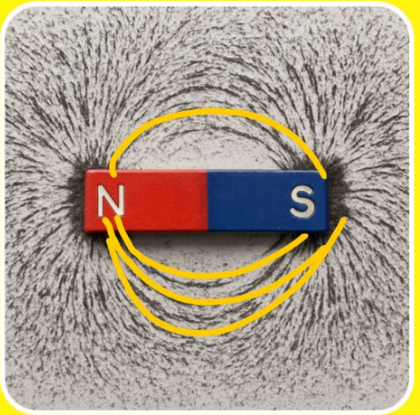
- Iron filings show magnetic field lines.
- The field is strongest at the poles

(a) Why do iron filings arrange in a particular pattern?

(b) What does the crowding of iron filings at the ends of the magnet indicate?

(c) What do the lines, along which the iron filings align, represent?

(2024, 2025, 2015, 2022)



ANS

(a) Iron filings are attracted by magnet and arrange themselves along the direction of magnetic field created by magnet.

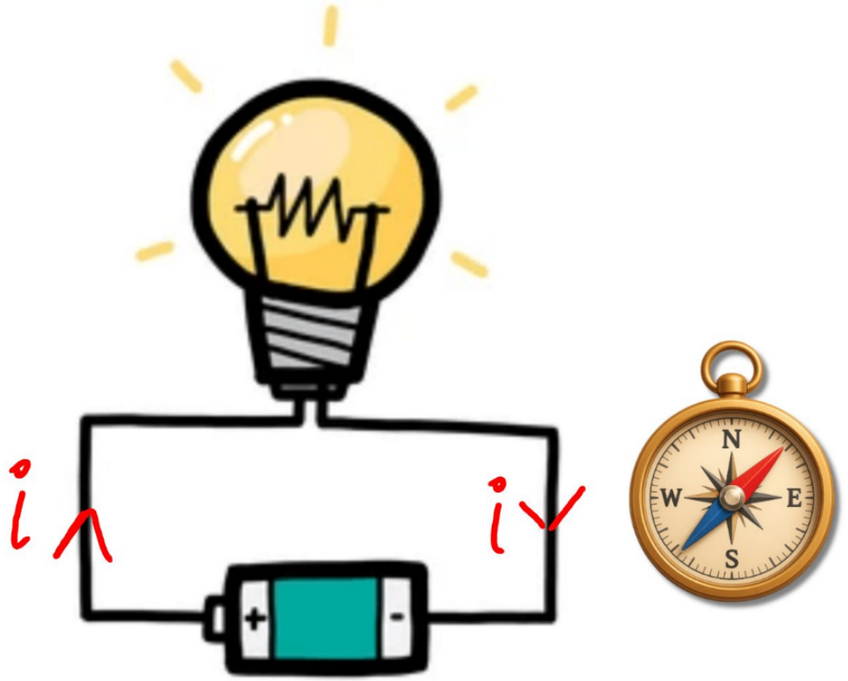
(b) Magnetic Field is strongest at poles.

(c) They represent magnetic field lines.

OERSTED DISCOVERY - MAGNETIC EFFECT OF CURRENT

A Compass Needle Deflects when Placed near a Current Carrying Wire

Current carrying wire
Produces
Magnetic Field



MAXWELL'S RIGHT HAND THUMB RULE

Finding the direction of Magnetic Field

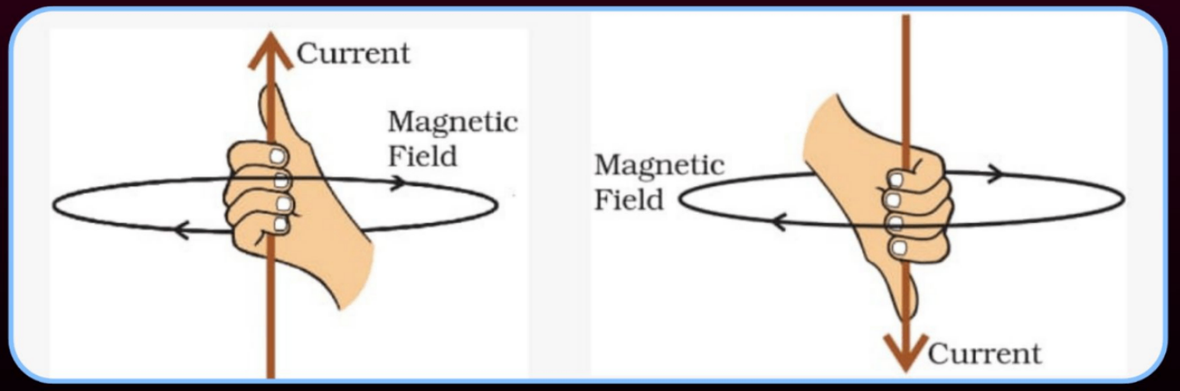
Hold a current-carrying wire in your right hand.

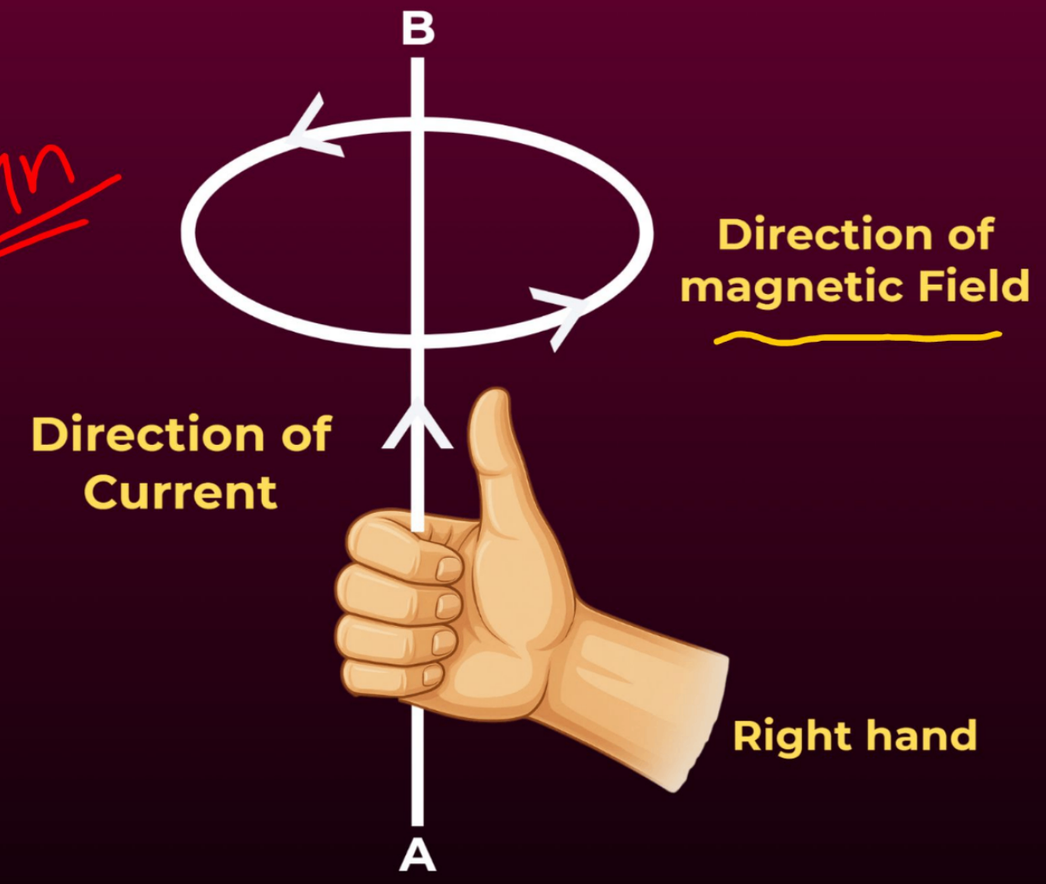
Keep your thumb pointing in the direction of current.

The direction in which your fingers wraps (curl) around the wire gives the direction of magnetic field lines.

(CBSE 2025, 2022,2020)

Learn

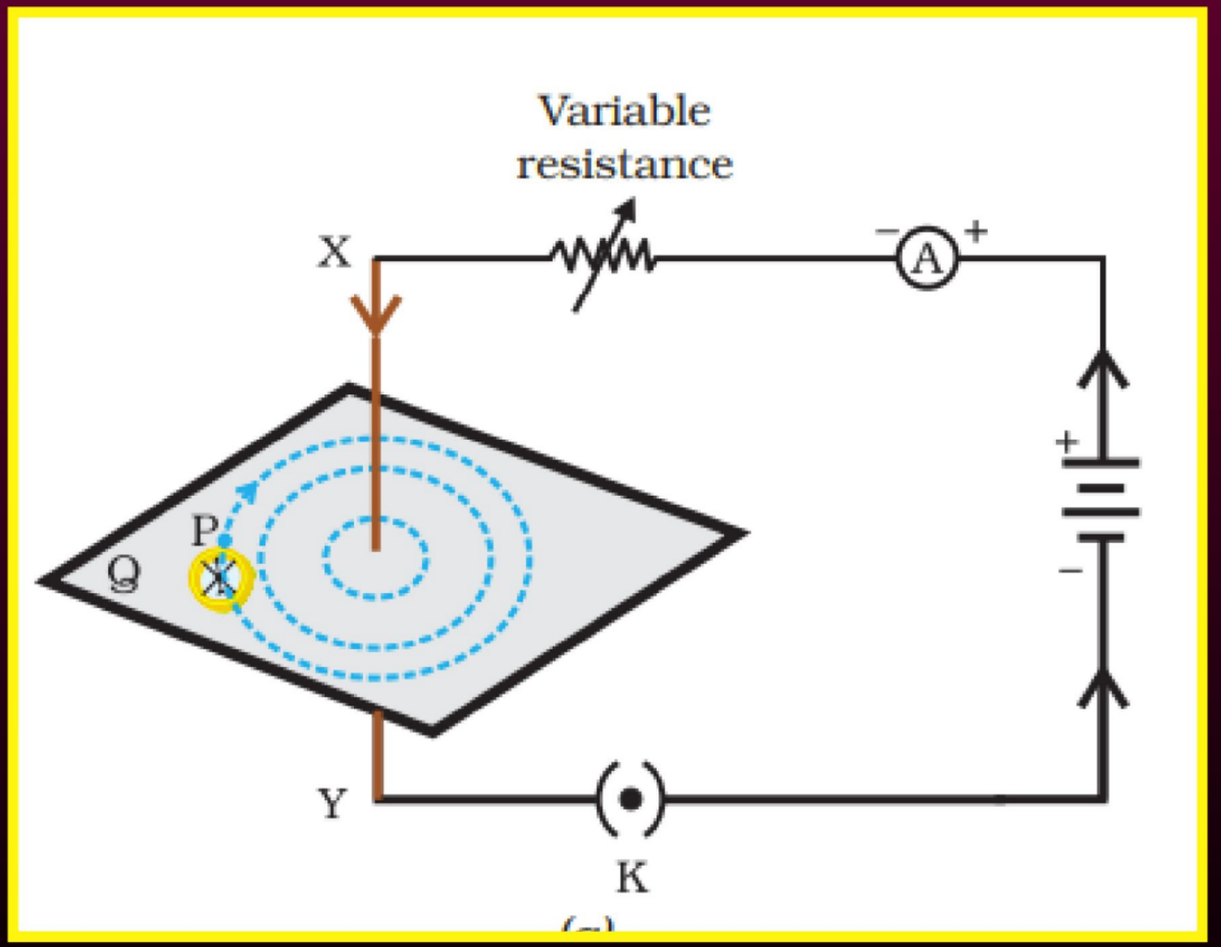


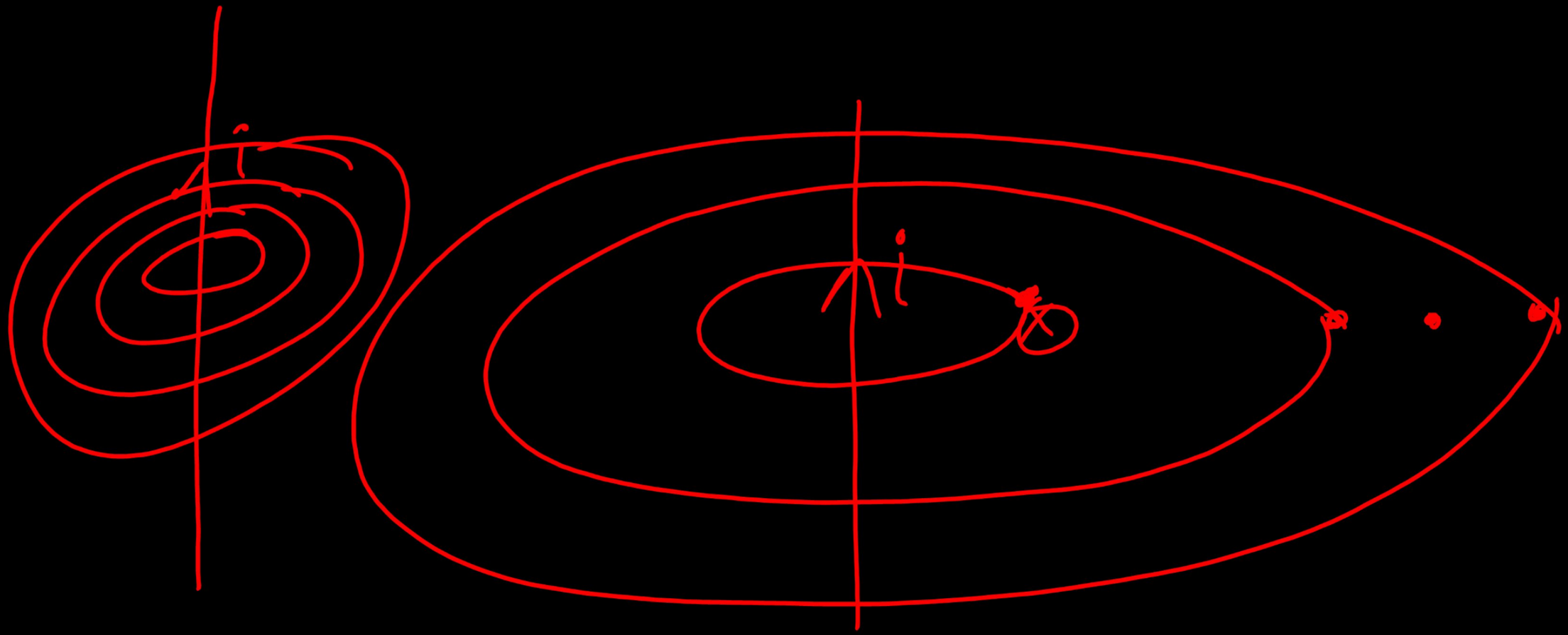


Straight wire carrying current

MAGNETIC FIELD DUE TO A CURRENT THROUGH A STRAIGHT CONDUCTOR

1. A straight current-carrying wire passes perpendicularly through a white cardboard sheet. Iron filings are spread evenly on the cardboard.
2. On gently tapping, the filings form ***Concentric Circles*** around the wire, showing magnetic field lines.



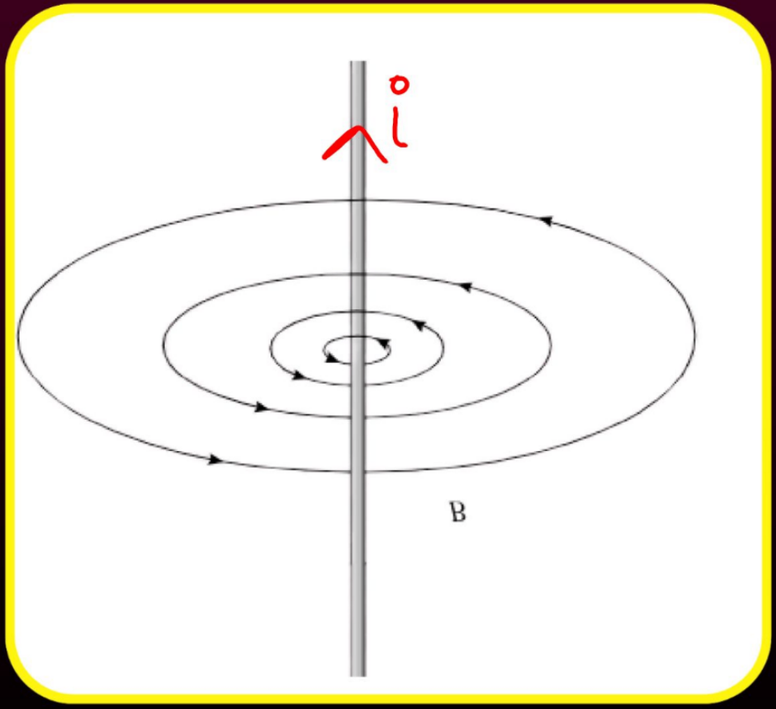

i
i

FACTORS ON WHICH MAGNETIC FIELD DUE TO STRAIGHT WIRE DEPENDS

1 . Current (i) → Current Increases → Stronger Magnetic Field → Deflection increases

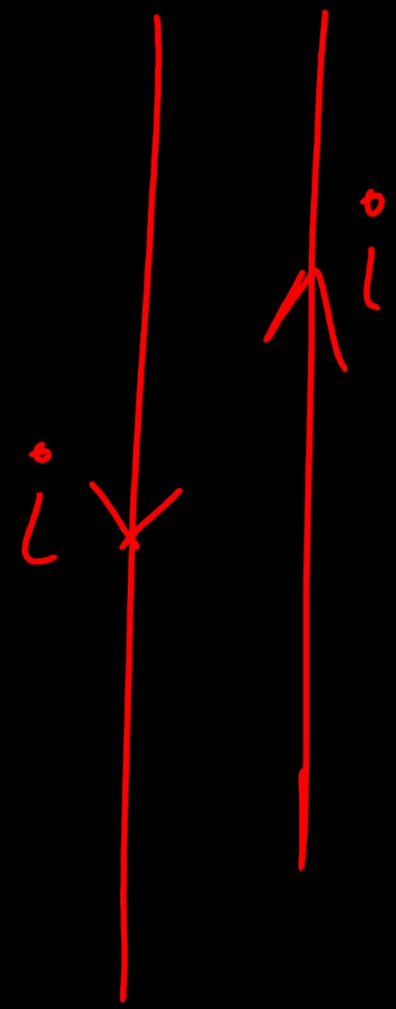
2 . Distance (d) → Distance increases → Weaker Magnetic Field → Deflection decreases

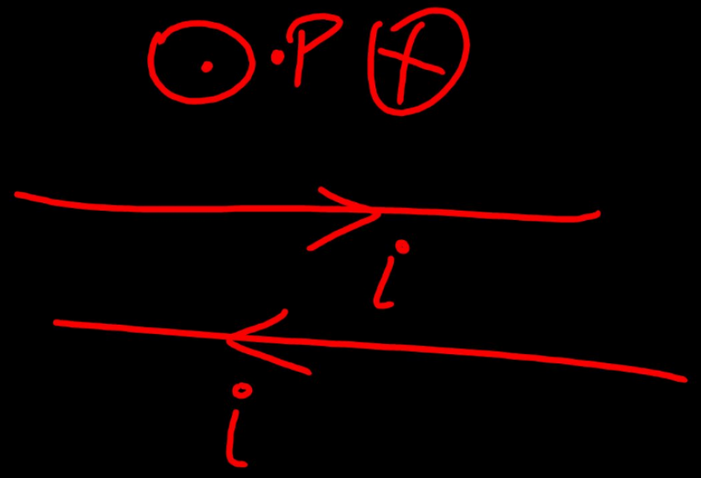
3 . Reverse the direction of current → Direction of Magnetic Field Reverses.



Note - Field is inversely proportional to distance from wire.

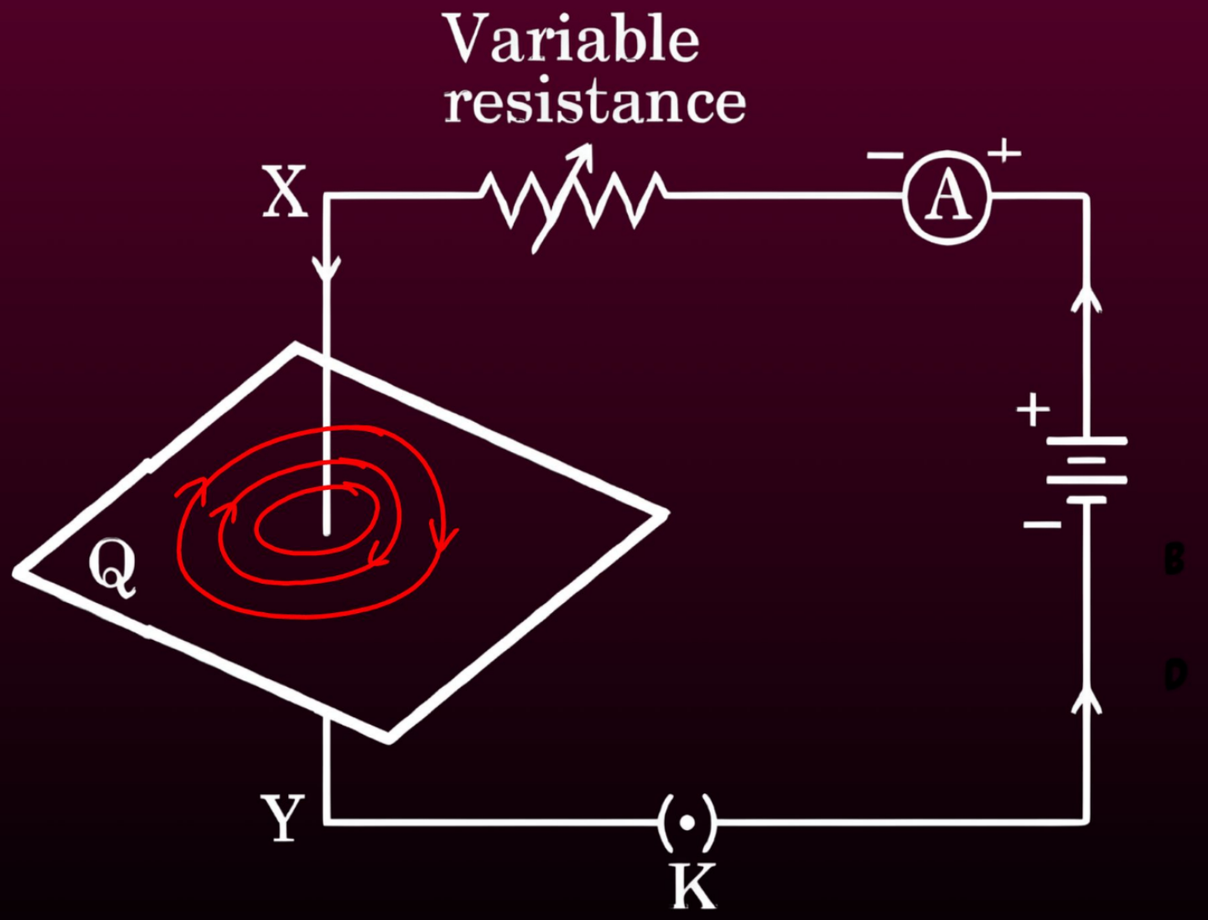
Closeness of lines decreases as we move away from wire


i
i


P
i
i

(i) Draw the magnetic field lines when current flows from conductor X to Y.
(ii) Name and state the rule used in determining the direction of the magnetic field lines in the situation given above.

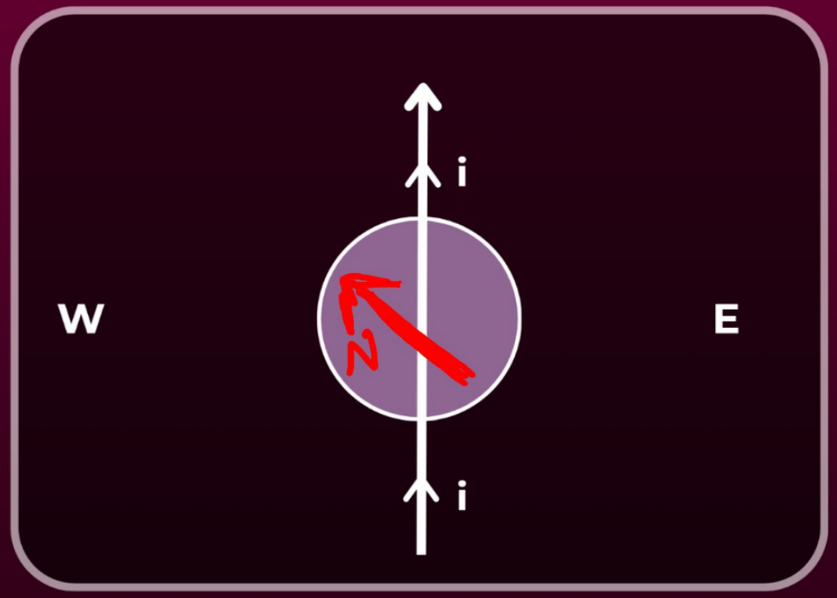
(CBSE 2025, 2018, 2023, 2022)



ii) MAXWELL'S RIGHT HAND THUMB RULE-
Hold a current-carrying wire in your right hand. Keep your thumb pointing in the direction of current.
The direction in which your fingers wraps (curl) around the wire gives the direction of magnetic field lines.

Activity 12.4 Current wire placed over compass

A



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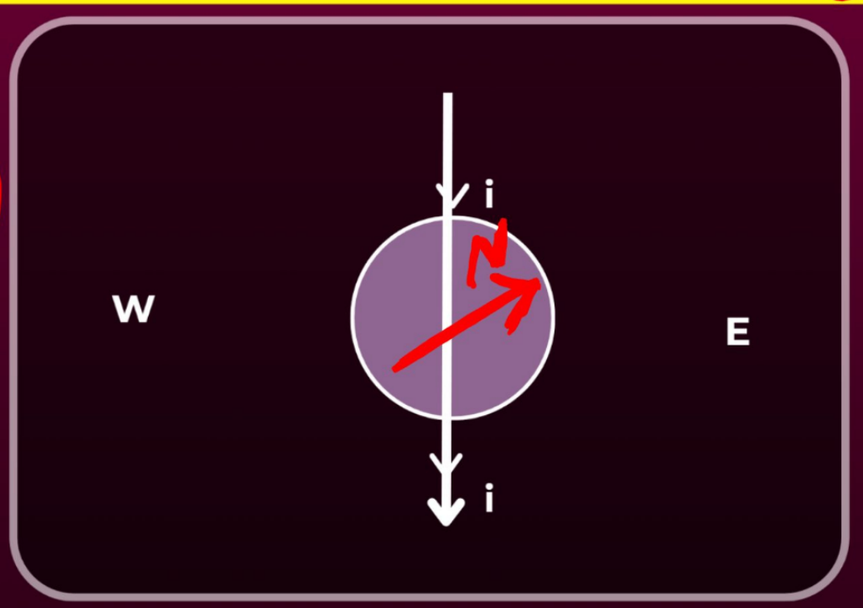
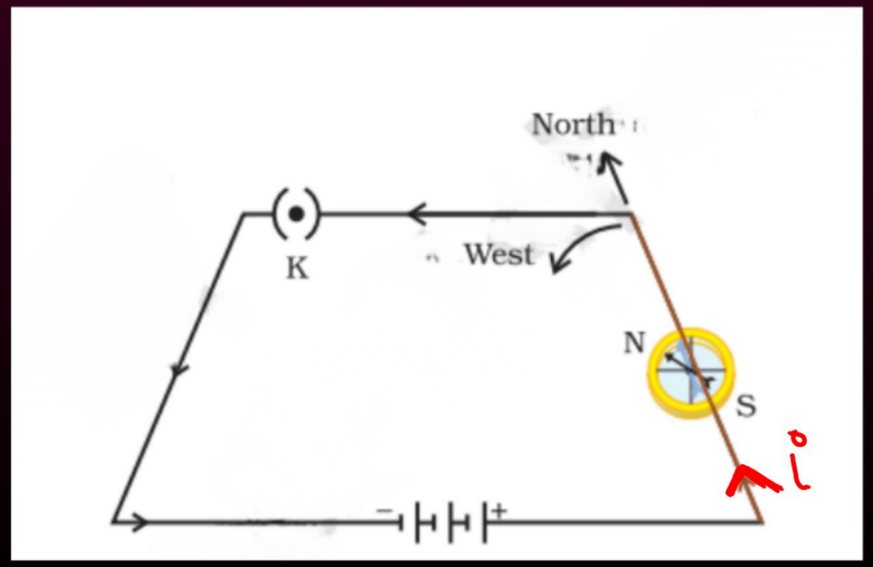
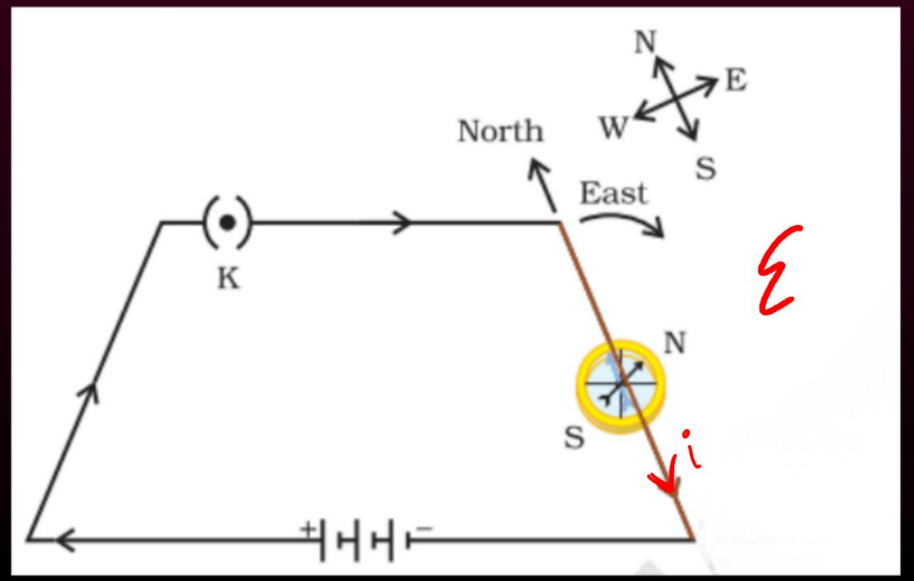


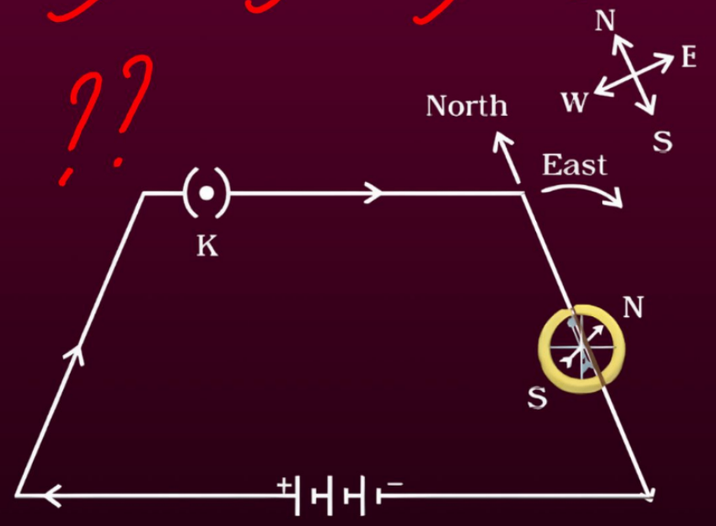




(i) What does the circuit diagram show?
(ii) What will happen if the direction of current is reversed? Justify your answer giving a circuit diagram.

(CBSE 2025, 2013, 2020, 2022)

ANS



(i) The diagram shows a current carrying wire placed over a magnetic Compass. The compass deflects when current flows in the wire. This shows that a current carrying wire produces a magnetic field around it.

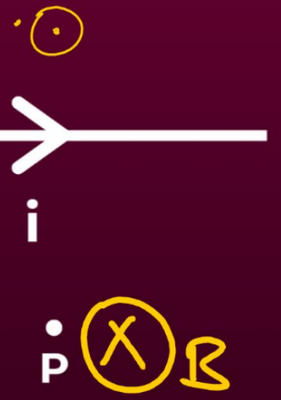
(ii) The direction of deflection of compass needle will also reverse on reversing the direction of current.

Q) Find the direction of magnetic field produced at point P

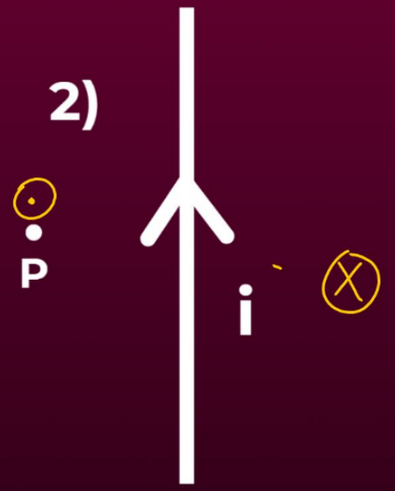
into Paper
Inward → ⊗

out of Paper
Outward → ⊙

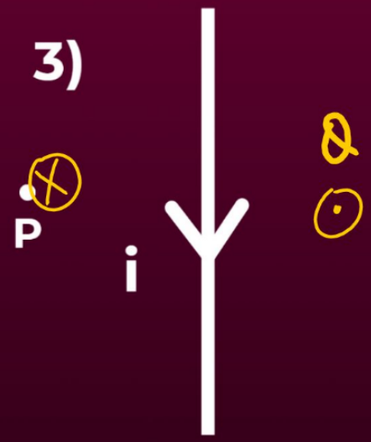
1)



2)

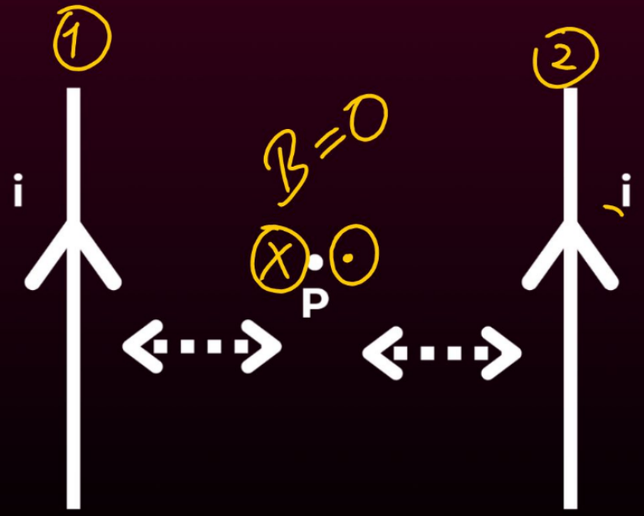


3)



4)

5)



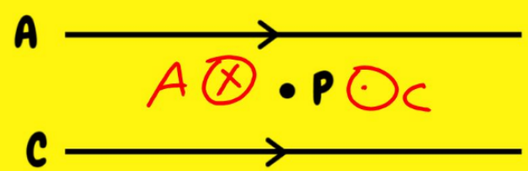
The resultant magnetic field at point ‘P’ situated midway between two parallel wires (paced horizontally) each carrying a steady current I is

a. in the same direction as the current in the wires

b. in the vertically upward direction

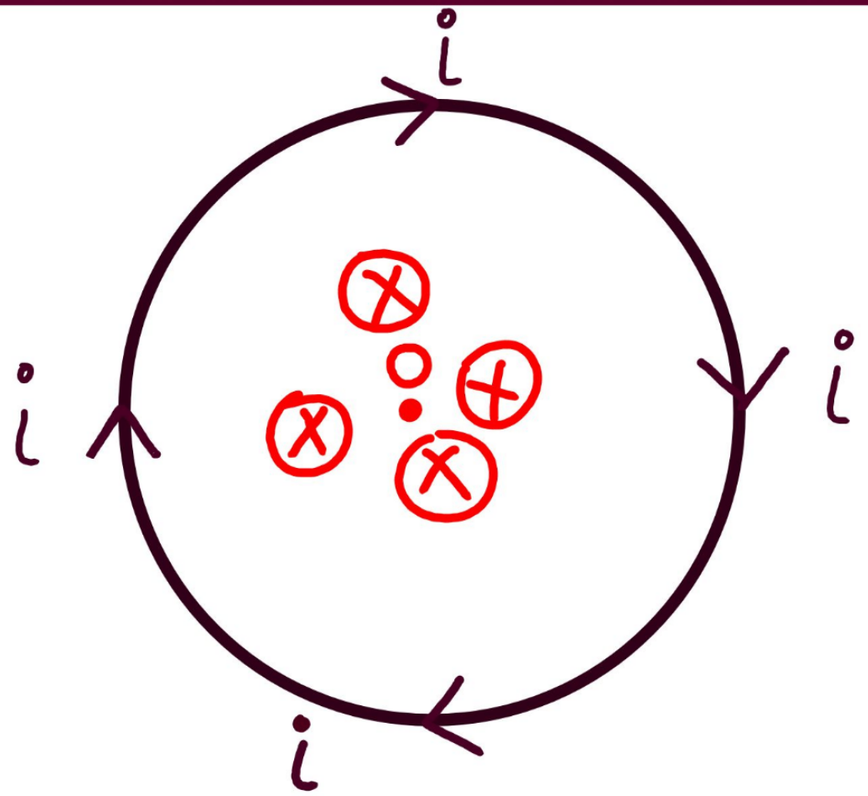
c. zero

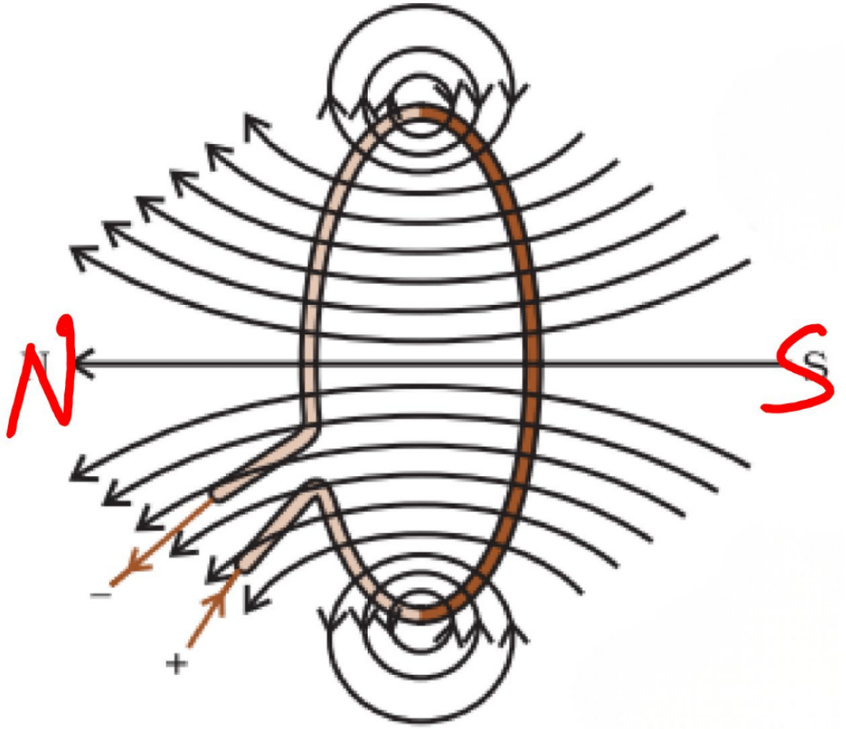
d. in the vertically downward direction

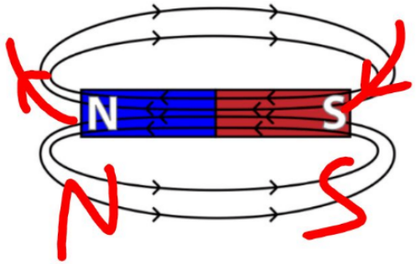


(CBSE 2023)

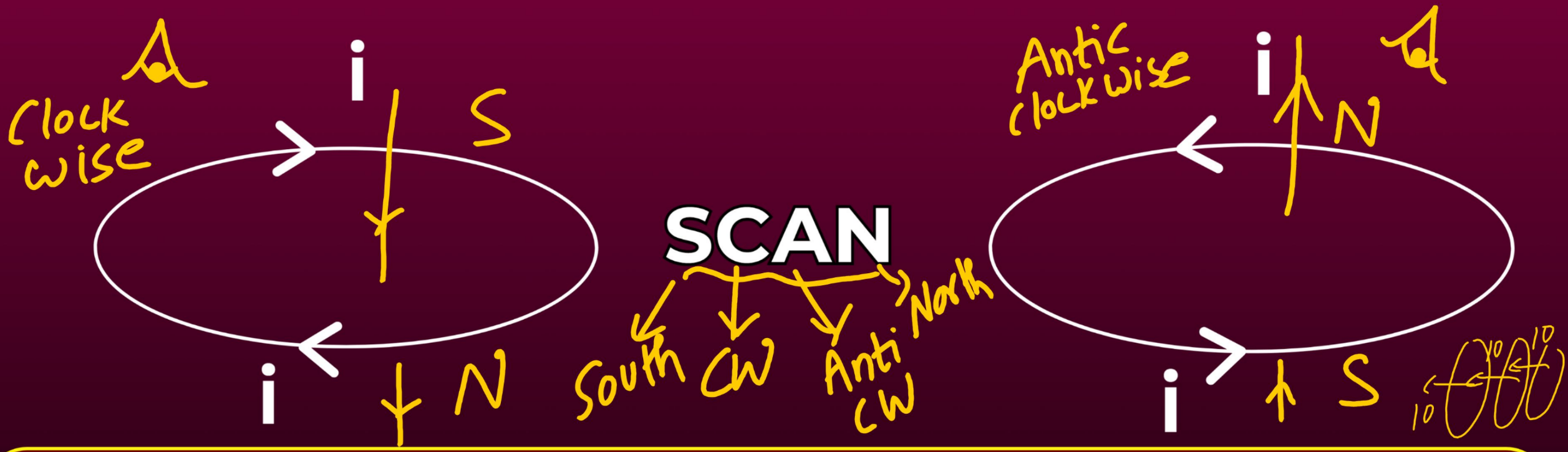
MAGNETIC FIELD DUE TO A CURRENT THROUGH A CIRCULAR LOOP







1. At every point on a current-carrying circular loop, the magnetic field lines form concentric circles around the wire.
2. Each small part of the wire produces a magnetic field at the center in same direction. This makes a strong magnetic field at the center .



If the wire is coiled in many turns (n turns), the total magnetic field also becomes ‘n’ times stronger than that of a single loop.
This happens because the current in each circular turn has the same direction and the magnetic field due to each turn adds up.

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A)

CW

B)

ACW

N

The correct pattern of magnetic field lines of the field produced by a current carrying circular loop is

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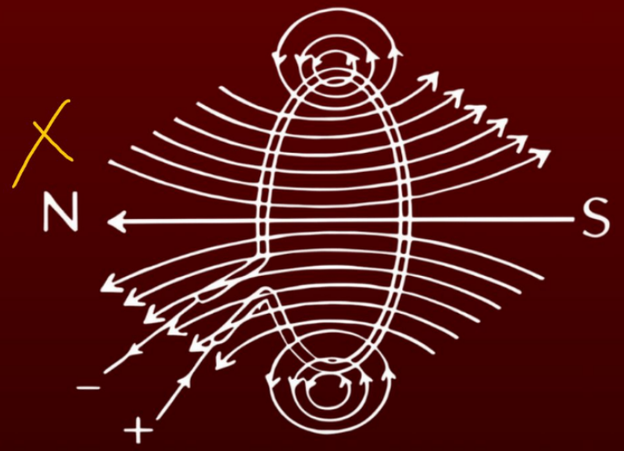
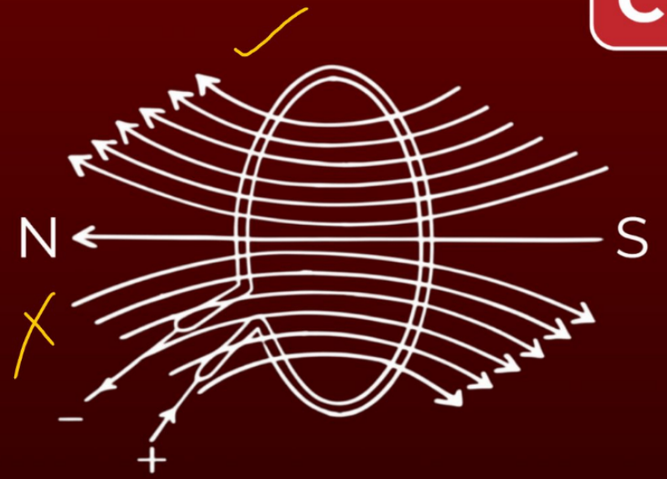
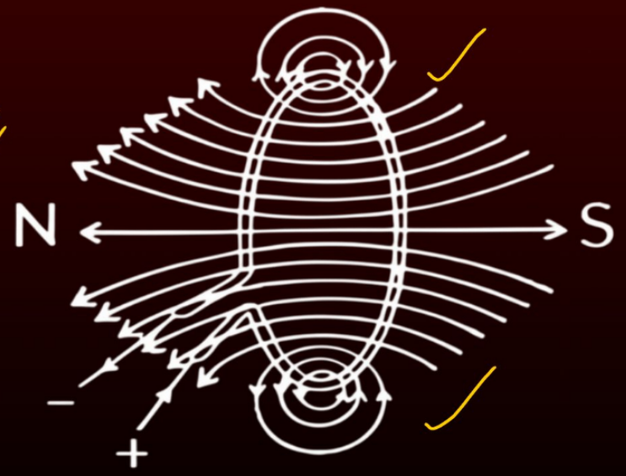
A



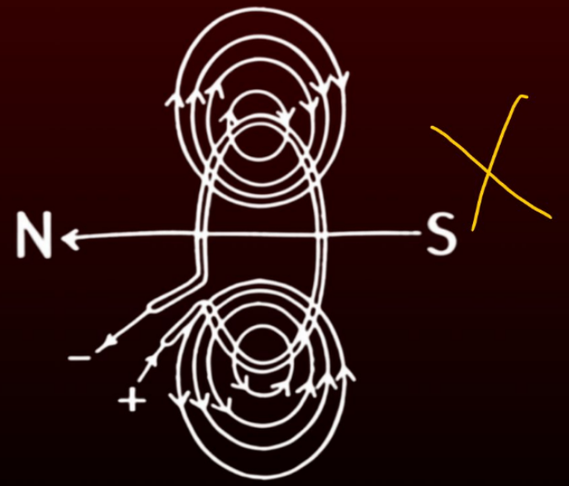
B



C



D



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 is called a Solenoid.

CBSE 2023

1. Magnetic Field lines due to a solenoid is similar to those of a bar magnet

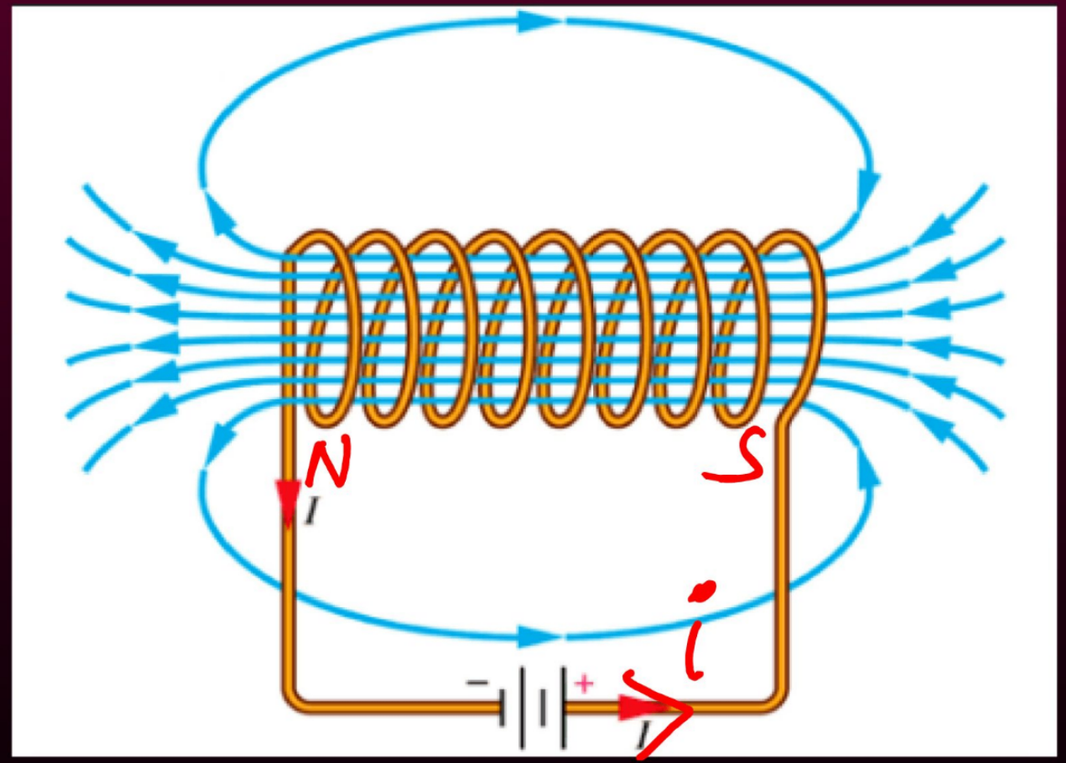
Out → N → S Inside → S → N

2. Field lines inside the solenoid →

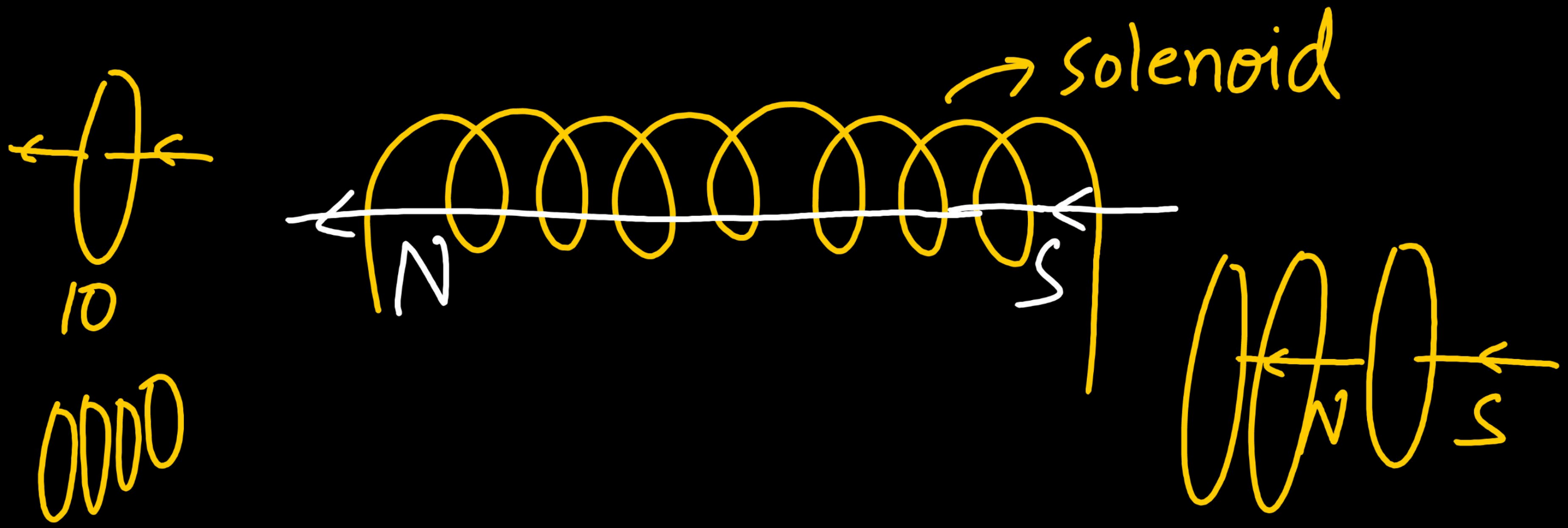
parallel straight lines → imp

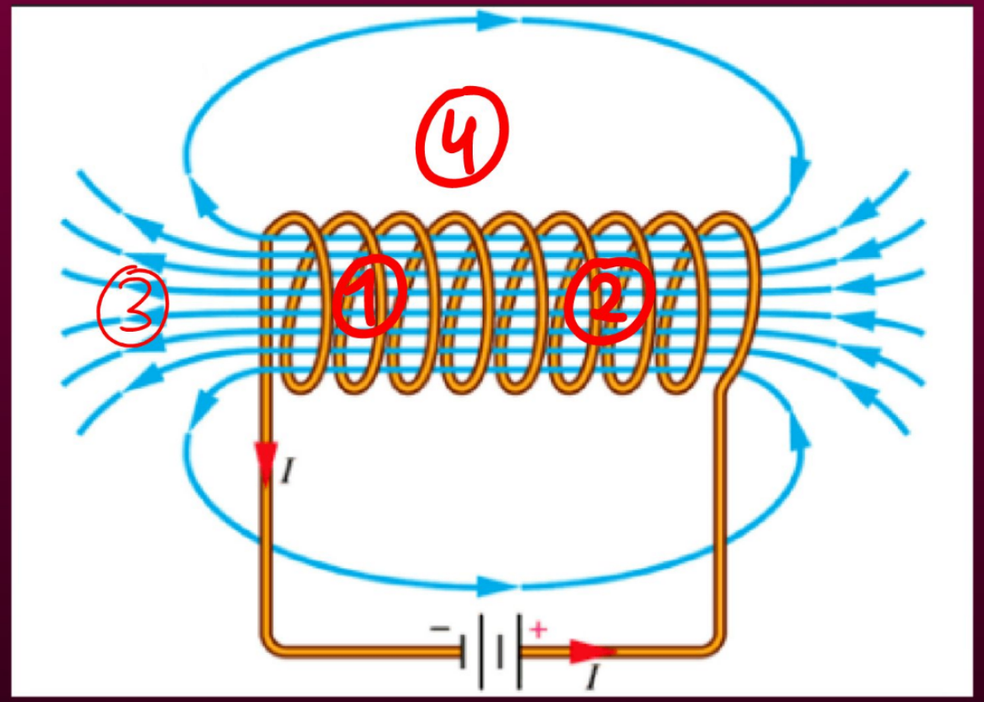
Uniform magnetic field →

magnetic field is the same at all points inside the solenoid.



3. It's Polarity can be reversed by reversing current direction

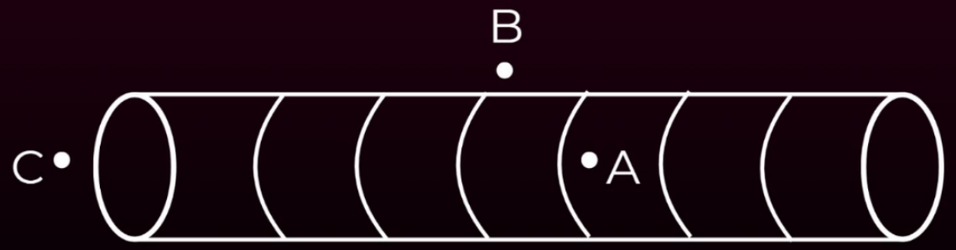

solenoid
N
S
N
S



Strength of Magnetic Field :→

① = ② inside > ③ > ④

For the current carrying solenoid as shown, draw magnetic field lines and give reason to explain that out of the three points A, B and C, at which point the field strength is maximum and at which point it is minimum ?



Comment

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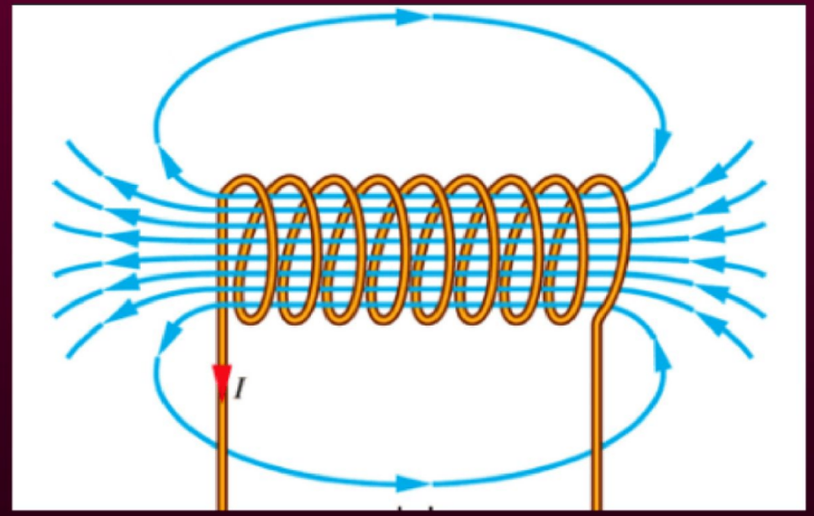
STRENGTH OF MAGNETIC FIELD DUE TO A SOLENOID DEPENDS ON

B=Kni

1. **Number of turns** : Larger the number of turns → stronger the magnetic field.
2. **Current** : Larger the current → stronger the magnetic field
3. **Length of air gap** → lesser gap → more turns → more magnetic field.
4. **Nature of core** : The use of soft iron rod as core in a solenoid produces the stronger magnetic field.

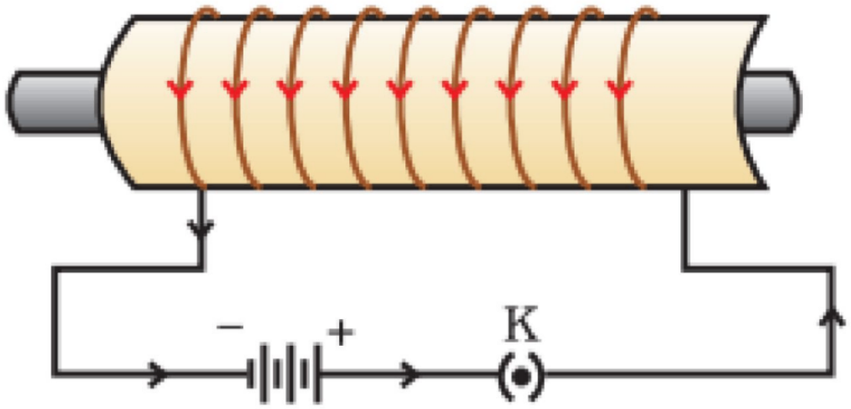


ELECTROMAGNET

$B = K n i$

A long coil of insulated wire wrapped around a soft iron core forms an Electromagnet.

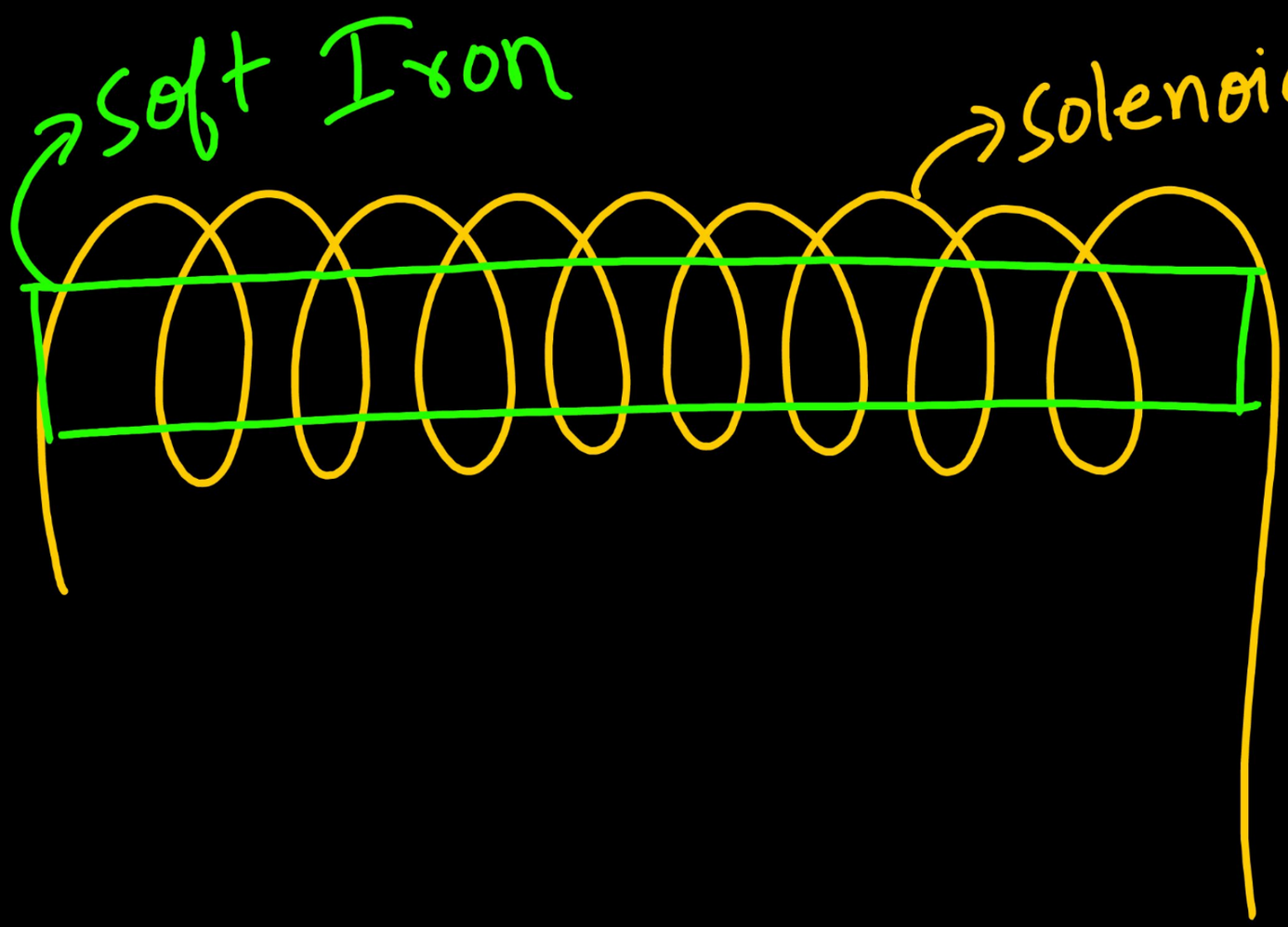
1. Electromagnet is a temporary magnet.
2. Current magnetise soft iron core temporarly.
3. It's Polarity can be reversed.



Simple Electromagnet

STRENGTH OF AN ELECTROMAGNET

1. **Number of turns** : Larger the number of turns → stronger the magnetic field.
2. **Current** : Larger the current → stronger the magnetic field
3. **Length of air gap** → lesser gap → more turns → more magnetic field.



$B = 20$

$B = 50$

$B_{\text{Total}} = 70$

PROPERTIES	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

The current carrying device which produces a magnetic field similar to that of a bar magnet is

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A A straight conductor

B A circular loop

C A solenoid

D A circular coil

The magnetic field inside a long straight current carrying solenoid

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A is zero

B decreases as we move towards its end

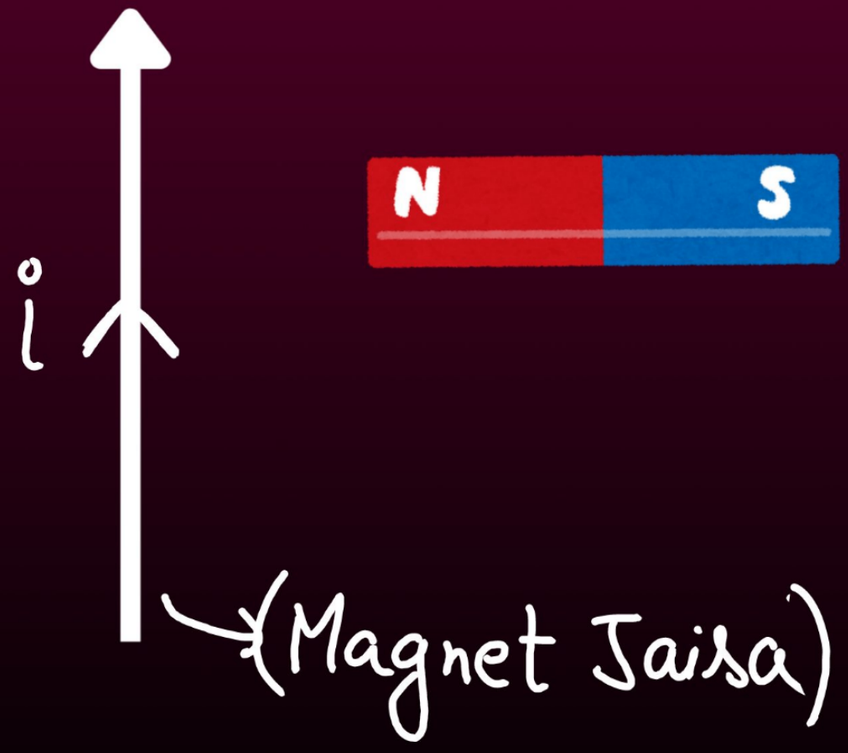
C increases as we move towards its end

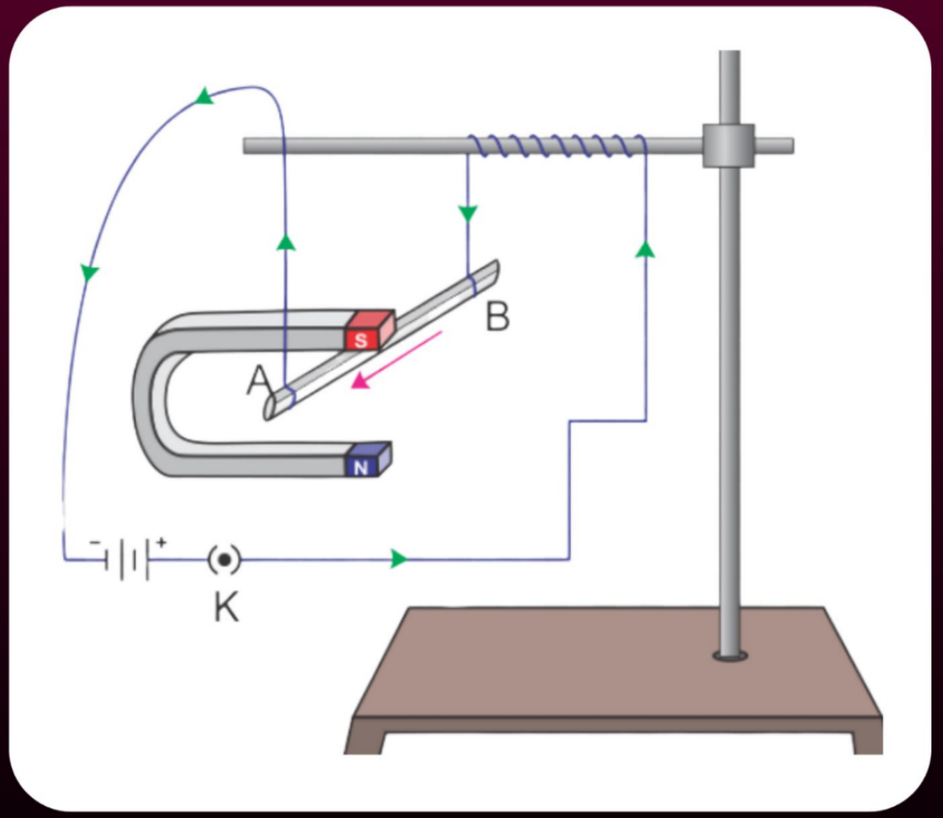
D is same at all points

FORCE (F) ON CURRENT-CARRYING CONDUCTOR PLACED IN A MAGNETIC FIELD

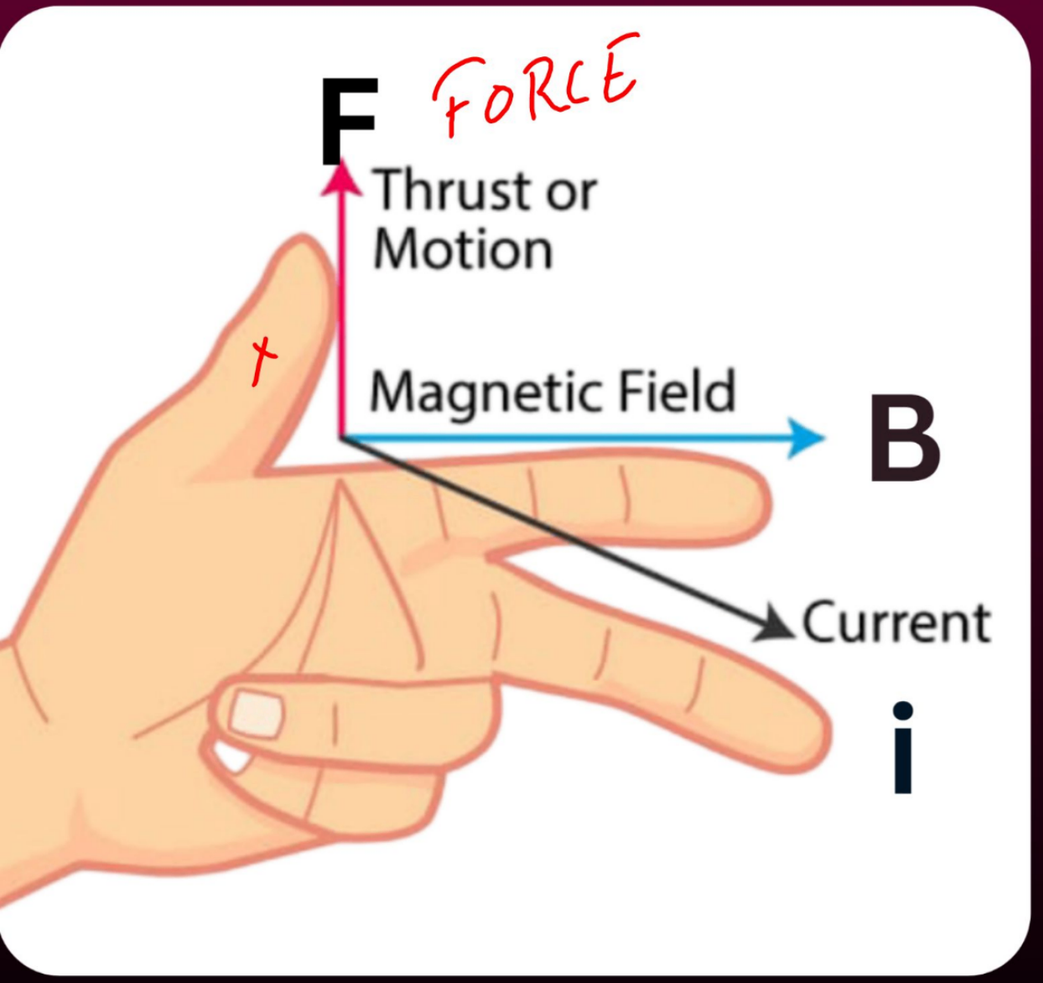
When a current - carrying conductor is placed in a magnetic field, a force is exerted on the conductor which can make the conductor move.

→ wire





FLEMING'S LEFT - HAND RULE FOR THE DIRECTION OF FORCE



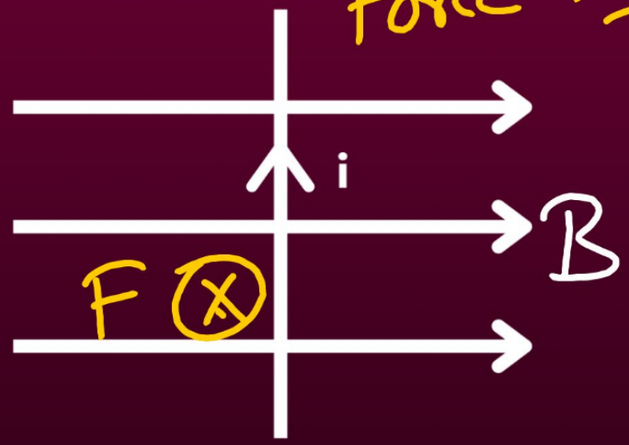
ACCORDING TO FLEMING'S LEFT HAND RULE -

Stretch your left hand so that your thumb, forefinger, and middle finger are at right angles (90°) to each other.

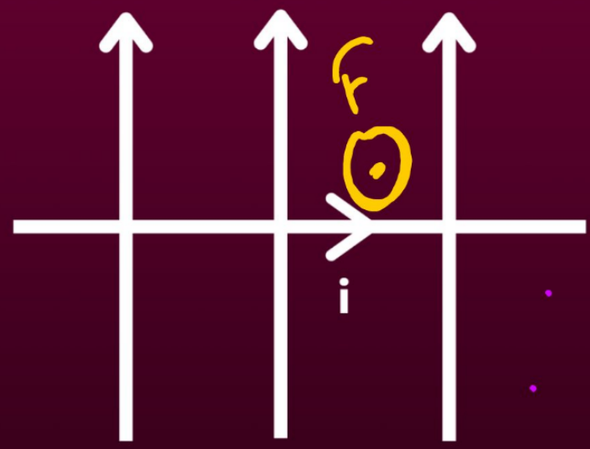
- Point your forefinger in the direction of the magnetic field (B).
- Point your middle finger in the direction of the current (I).
- Then your thumb will show the direction of the force (motion) on the wire.

PRACTICE

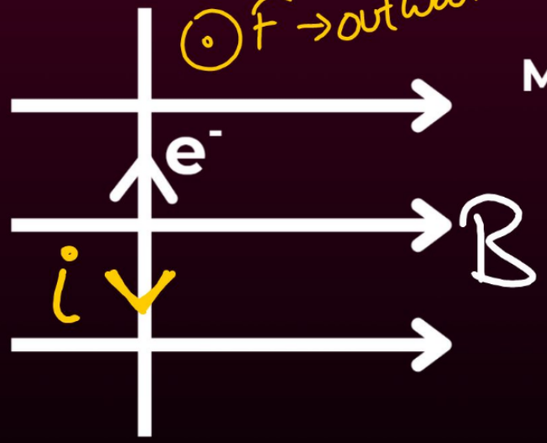
① Force → Into the paper



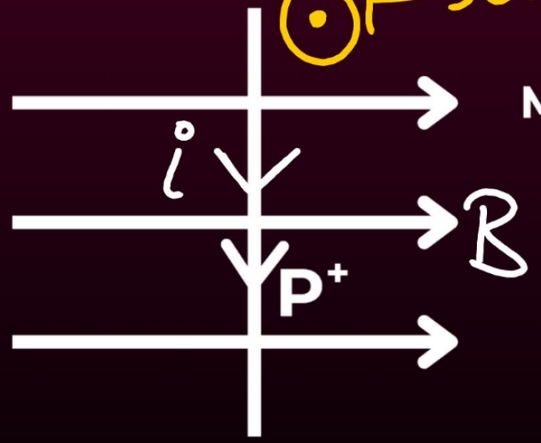
② Force → out of Plane of paper

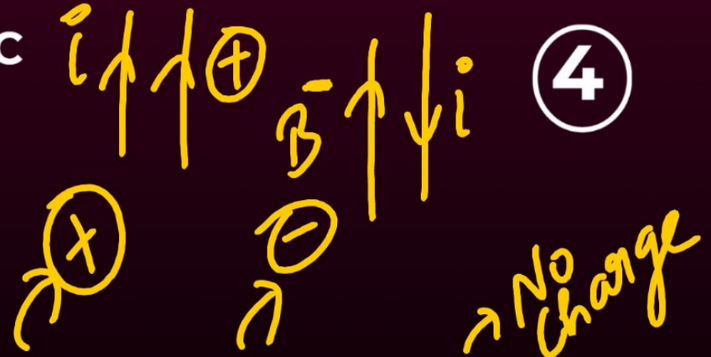


③ ⊙F → outward



④

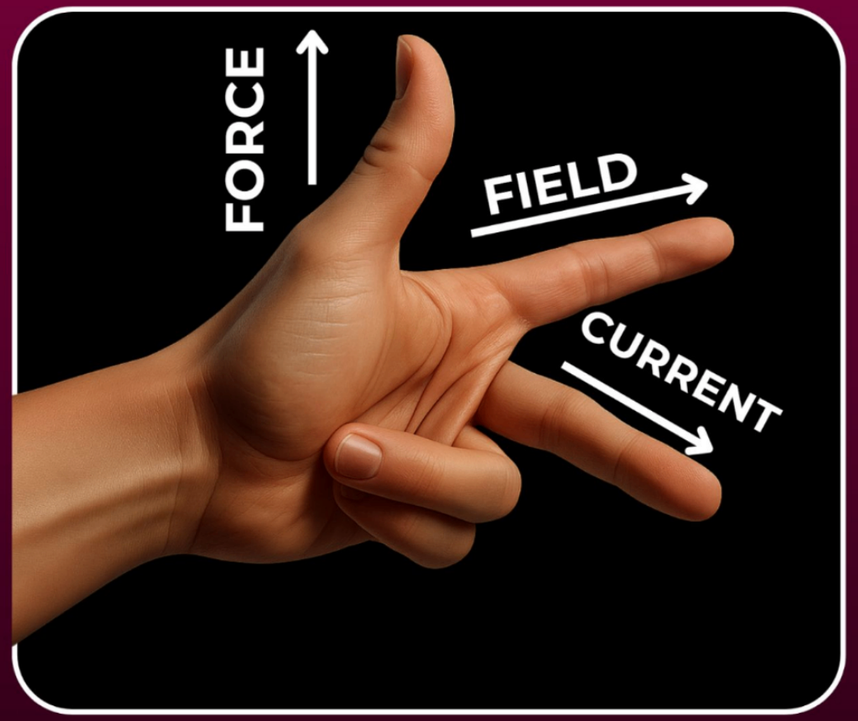




Alpha, Beta, Gamma

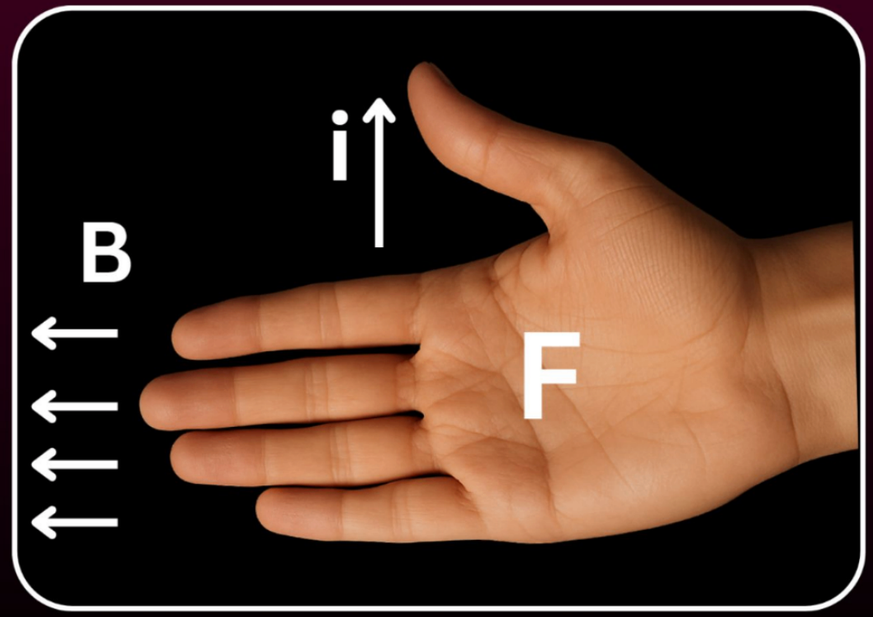
NOOB

FLEMING'S LEFT HAND RULE



SIGMA

MASTER MAGICAL RIGHT HAND PALM RULE



FACTORS ON WHICH FORCE ON CURRENT WIRE DEPENDS

$F = iBl$

$= Bil$

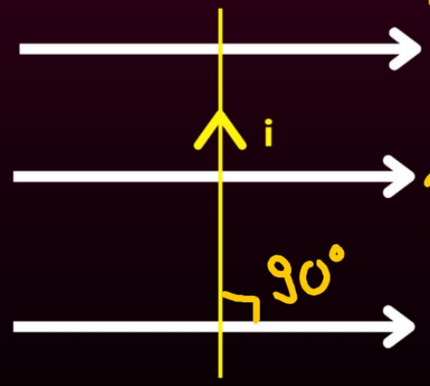
Current (i) ↑ Force ↑

Magnetic Field (B) ↑ Force ↑

Length (l) ↑ Force ↑

Angle

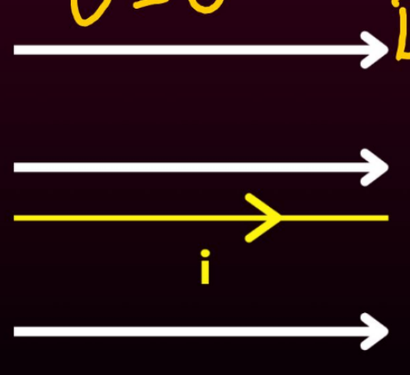
imp



F → Max

MAGNETIC FIELD

Perpendicular



θ = 0°

F = 0

Min

MAGNETIC FIELD

Parallel

An alpha particle enters a uniform magnetic field as shown. The direction of force experienced by the alpha particle is

+ve

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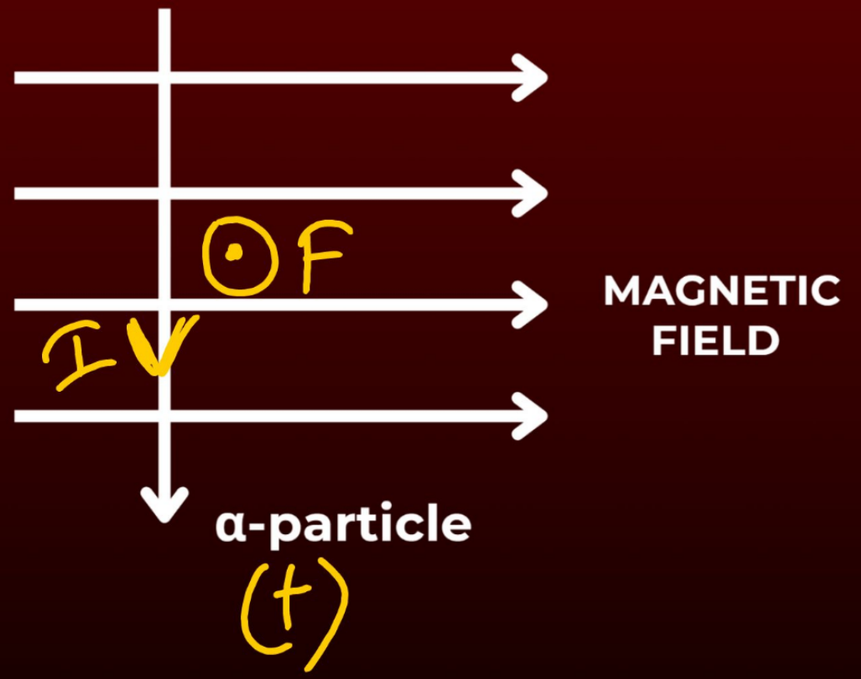
A towards right

B towards left

C into the page

D out of the page



A uniform magnetic field exists in the plane of paper as shown in the diagram. In this field, an electron (e^-) and a position (p^+) enter as shown. The electron and positron experience forces

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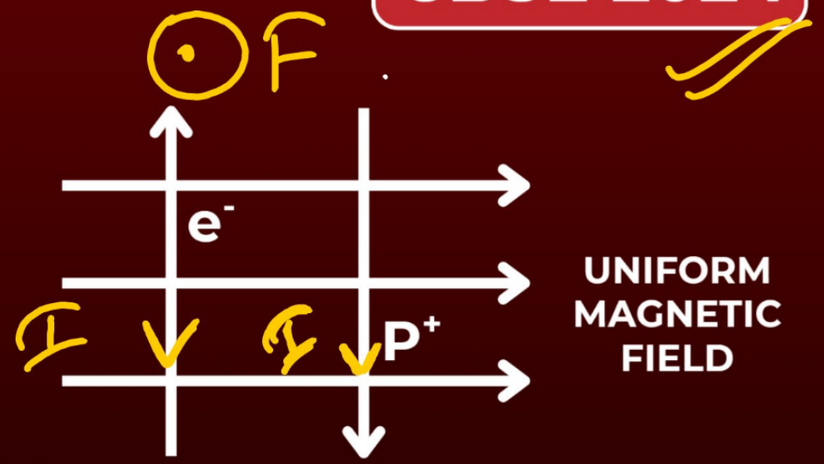


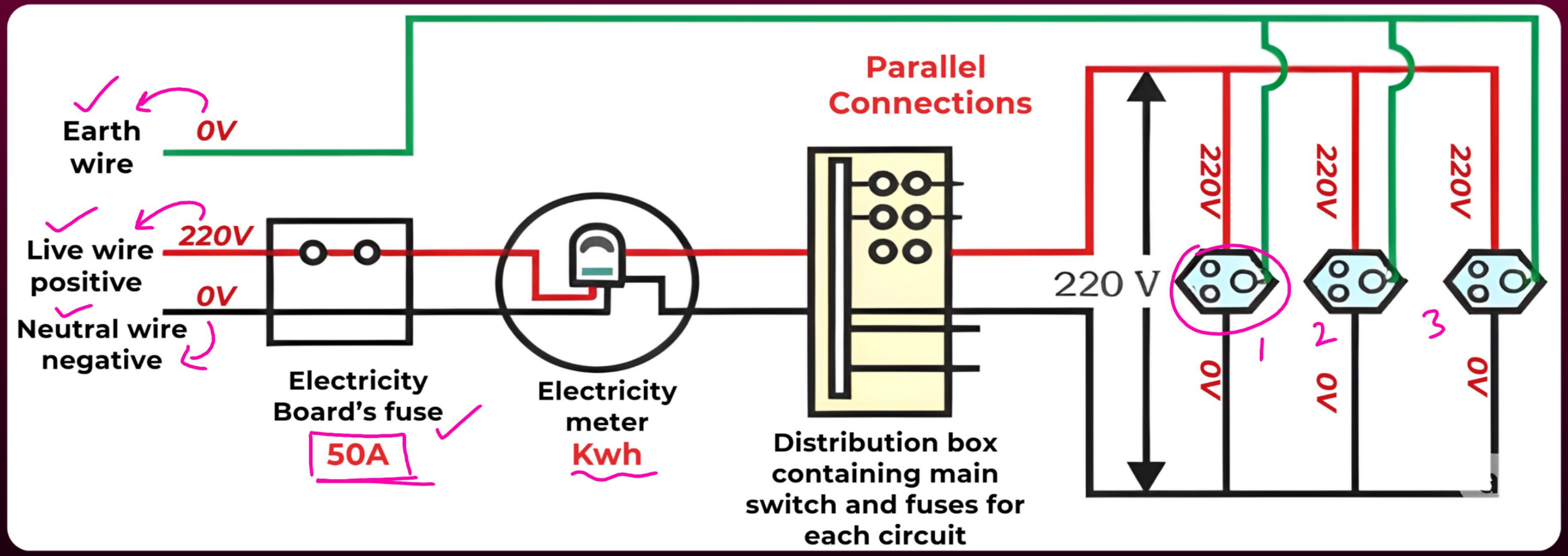
A. both pointing into the plane of the paper

B. both pointing out of the plane of the paper

C. pointing into the lane of the paper and out of the plane of the paper respectively

D. pointing out of the plane of the paper and into the plane of the paper respectively

DOMESTIC ELECTRIC CIRCUITS (OR DOMESTIC WIRING)



Parallel Connections Advantages -

1. Devices of different types need different current
2. Independence Of Different Devices
3. All devices get 220V Potential Difference

EARTHING OF ELECTRICAL APPLIANCES

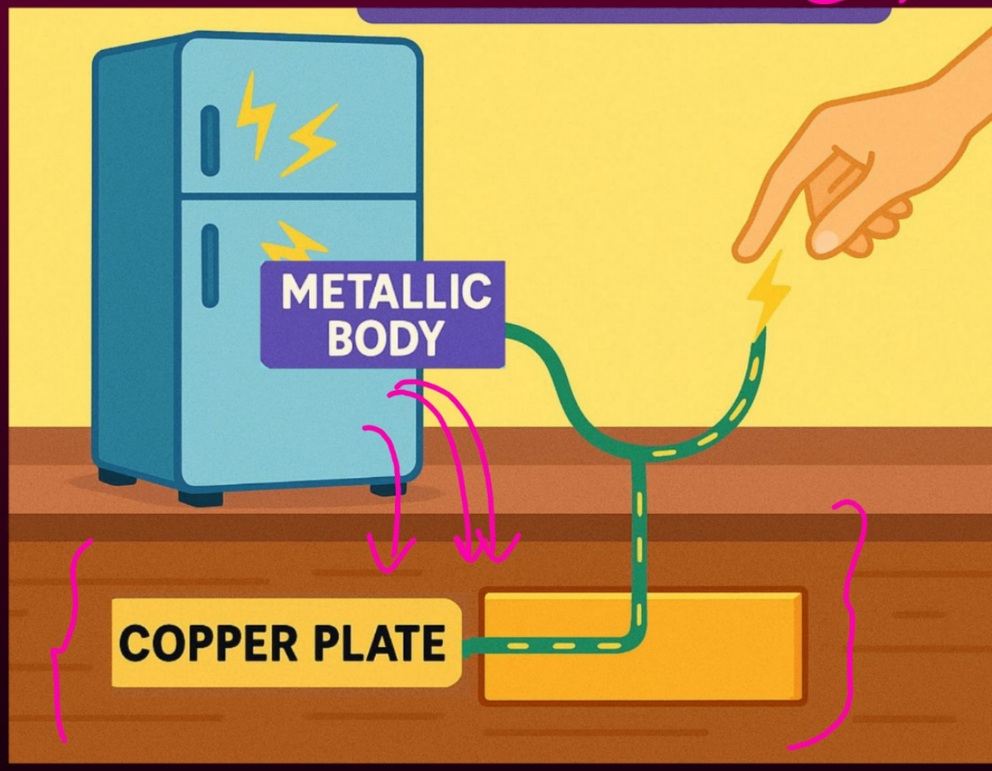
Eathing is used as a safety device, for appliances that have a metallic body,like electric press, toaster, table fan, refrigerator, etc.

The metallic body is connected to the earth wire.

If there is any Leakage of Current to metallic body of appliance due to poor insulation of wire , Earth wire gives a low resistance path to current and a huge current flows from metal body to ground.

Due to this huge current flow , Fuse blows off and supply is cut off.

This prevents anyone who is touching the appliance from an electric shock and Protects damage to appliances

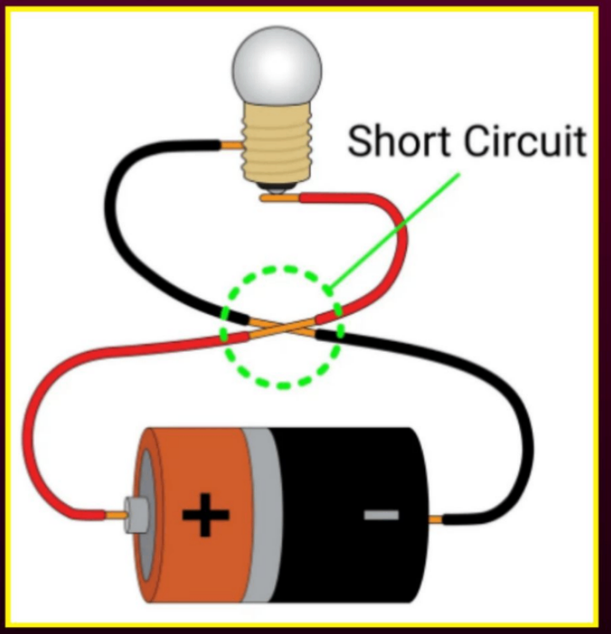


EARTHING - A SAFETY DEVICE

Overloading - Excess Current

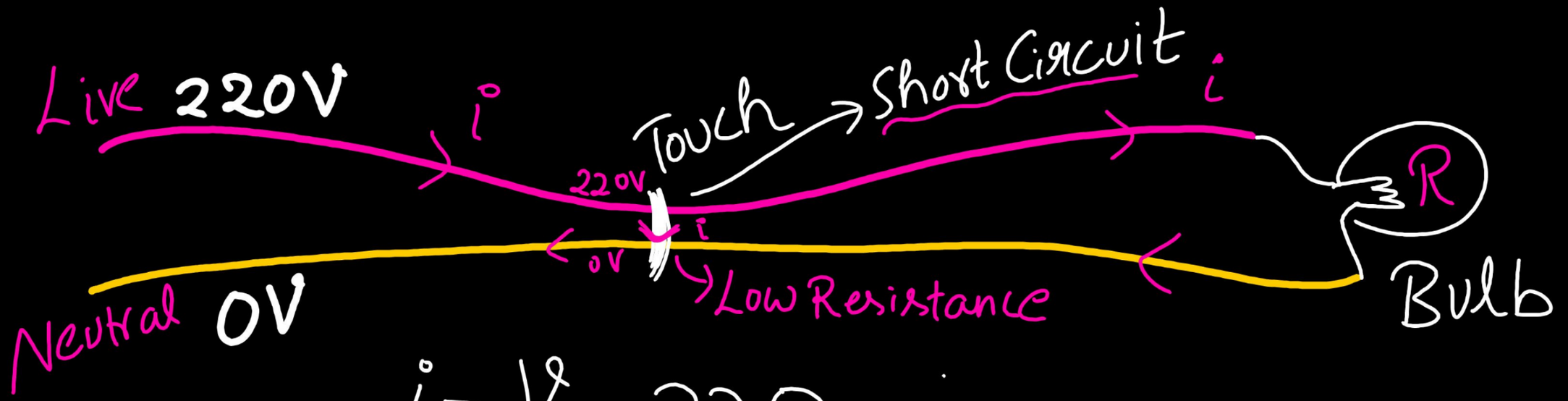
When an electrical circuit has more current than it can safely handle, it is called Overloading. Overloading can occur due to -

1. **Short Circuit** → when the Live wire and the Neutral wire comes in direct contact (if insulation of wires is damaged), a high current flows and this is called Short Circuit.



2.Too many appliances connected to a single socket

3.Sudden hike in supply Voltage



ex

$$i = \frac{V}{R} = \frac{220}{0.001\Omega} = 220\,000A$$

Heat $H = i^2 R t$ — Joule's Law

Heat ↑ ⇒ Fire

FUSE - SAFETY DEVICE

$H = i^2 R t$ i → 5A → Heat

$H = i^2 R t$

Electrical fuse is used to prevent Overloading (Short circuits mostly).
Fuse has low melting point so when high current passes through,it melts due to Heat Produced given by Joule's Law (H =) and stop the flow of current.
Fuse wire is connected in series with the appliance

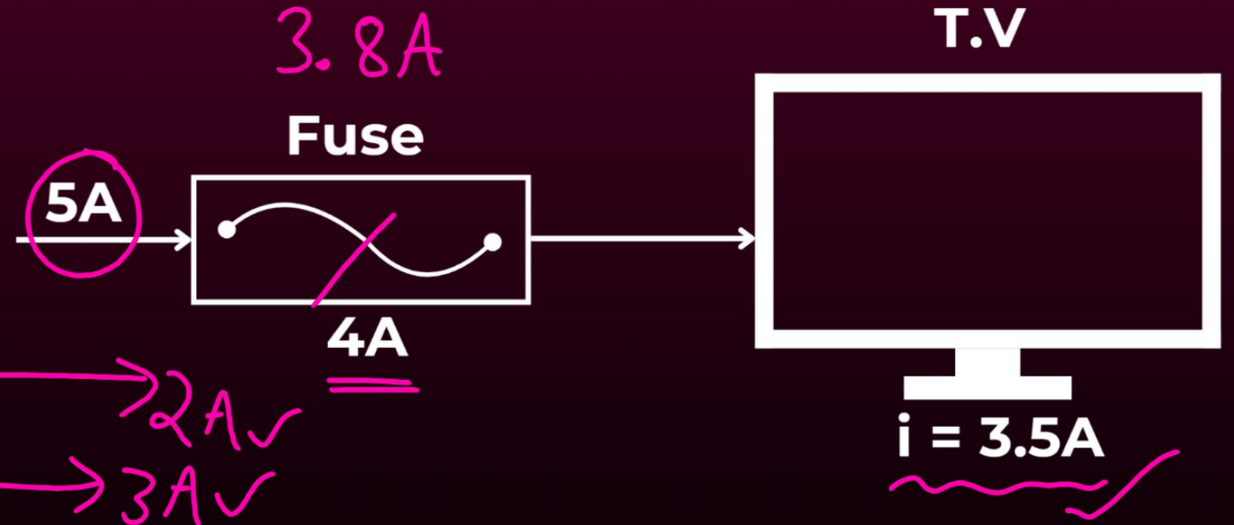
Fuse wire is made from alloy of:

- Copper (Cu) and Tin (Sn) or
- Lead (Pb) and Tin (Sn)

Fuse wire has -

- Low Melting Points
- High Resistance

$H = i^2 R t$



2A ✓
3A ✓
4.5A ✗

Fuse Rating

A 15A fuse – heavy appliances like irons, geysers, and toasters.

A 5A fuse – bulbs, fans, television, etc

5A

IRON

TOASTER

GEYSERS

In domestic electric circuits the wiring with 15 A current rating is for the electric devices which have

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A higher power ratings such as geyser

B lower power ratings such as fan

C metallic bodies and low power ratings

D non - metallic bodies and low power ratings

At the time of short circuit, the electric current in the circuit

CBSE 2020

A vary continuously

B does not change

C increases heavily

D reduces substantially

Heavy Current

@majestic._taranjeet 1 day ago
2:15:57 Option (c) => Ovary

2:15:52
Sir option c)
Ovaryyy
My name's YASHASVI ❤️

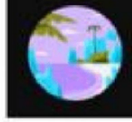
N

@neelk0 6 days ago (edited) 1 subscribers
2:15:54 _ OVARY (Name__ Bhanu Kumawat)

@mayankbhai6714 7 days ago (edited)
2:16:01 option (c) ovary
Sir Please tell my name mayank ,
I am from udaan batch 🤪

@Garv_The_Allrounder 6 days ago
2:15:52
Answer is ovary 😊

@Kunalsingh6622-b9s 4 days ago
Right answer is ovary at 2:15:54



@AnkushKumar-l7d 6 days ago
Sir ji C ovary 2:16:08

@heckerraja4 4 days ago (edited) 356 subscribers
Fruits are made from ovary 2:15:52
My name is Raja Nayak
Thank you sir ❤️❤️

PW

@Danishmushtaqsohil 4 days ago
fruits are formed from ovary

@Adil_sayyed 6 days ago 8 subscribers
2:15:52 sir " ovary "aayaga please naam le Lena aditya khichar 😢😢😢😢😢😢

@sakshitomar1302 6 days ago
2:15:52 answer is ovary