Magnetic Effects of Electric Current

One Shot ❌
GUN-SHOT ✅

100% Paper
Yahi se
Aayega !!

MAGNET

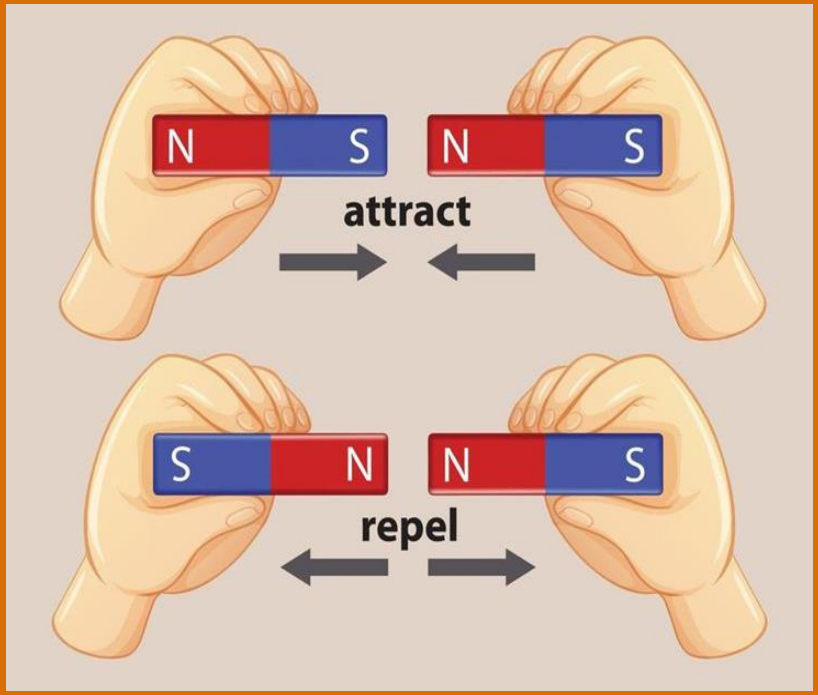
An object which attracts pieces of iron, nickel and cobalt.

TWO POLES OF A MAGNET :

North pole and South pole.

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

MAGNETIC FIELD (B) – Magnet ka Dabdaba

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

It is a quantity that has both directions and magnitude

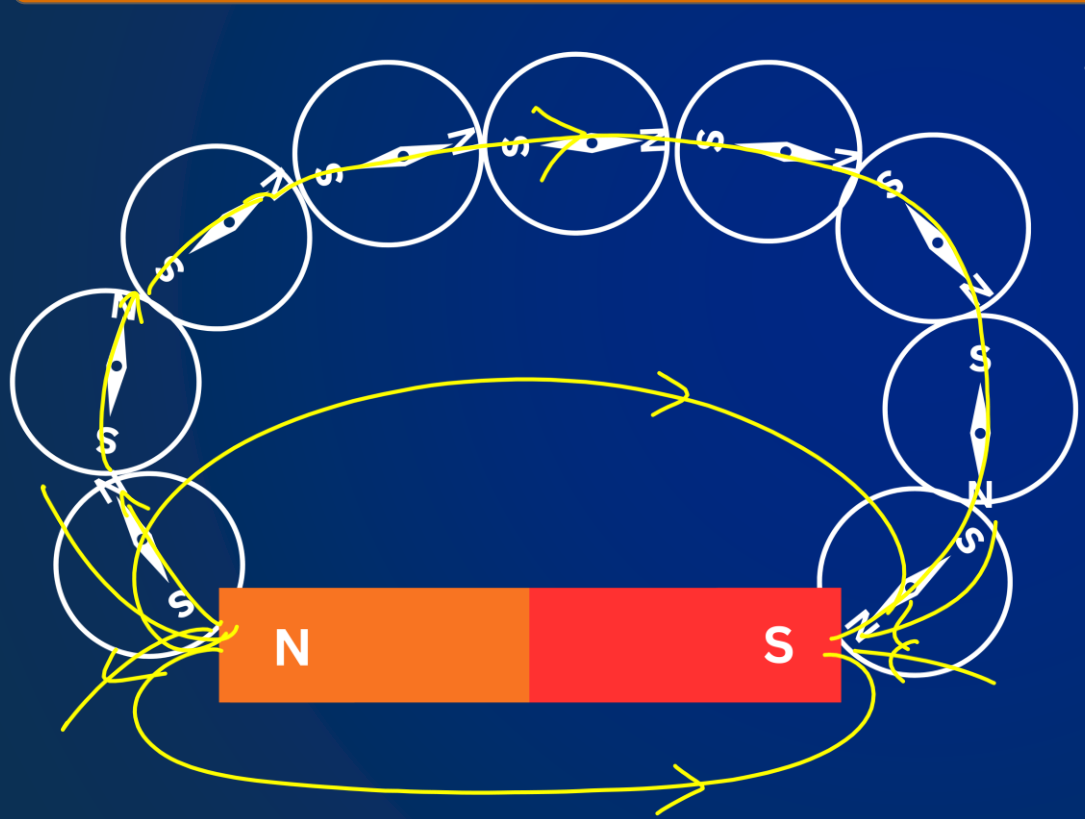
DIRECTION OF MAGNETIC FIELD (B)

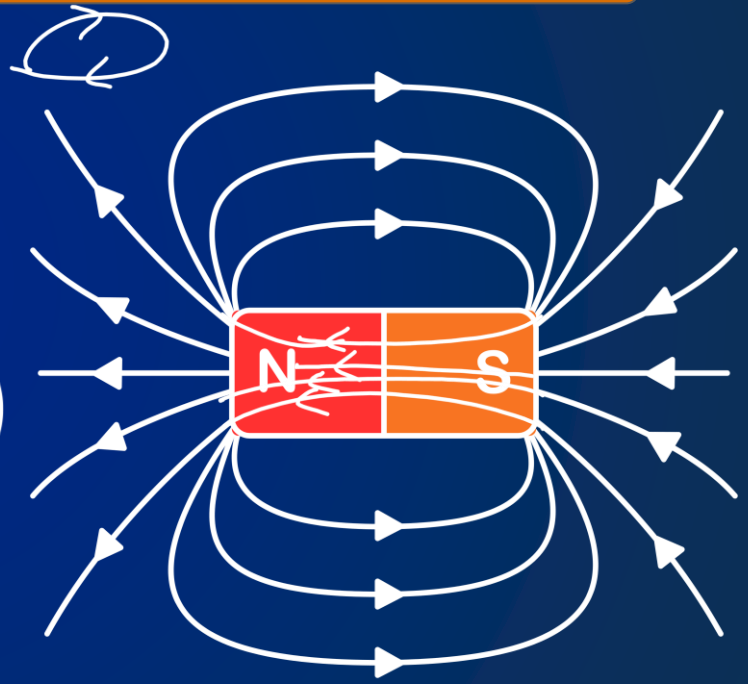
The path along which a free North Pole moves

Compass → North

MAGNETIC FIELD LINES

Imaginary lines along which a free North Pole moves

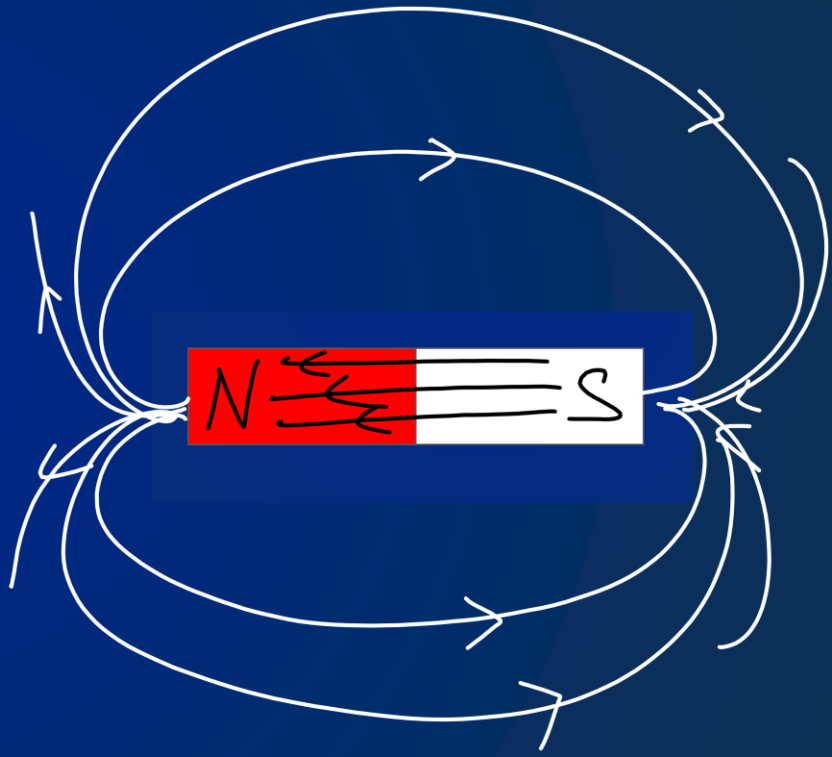




PROPERTIES OF MAGNETIC FIELD LINES

- Outside Magnet N→S
- Inside Magnet S→N
- Closed Curves
- Two field lines cannot Cross/Intersect each other

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



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

If they cross X

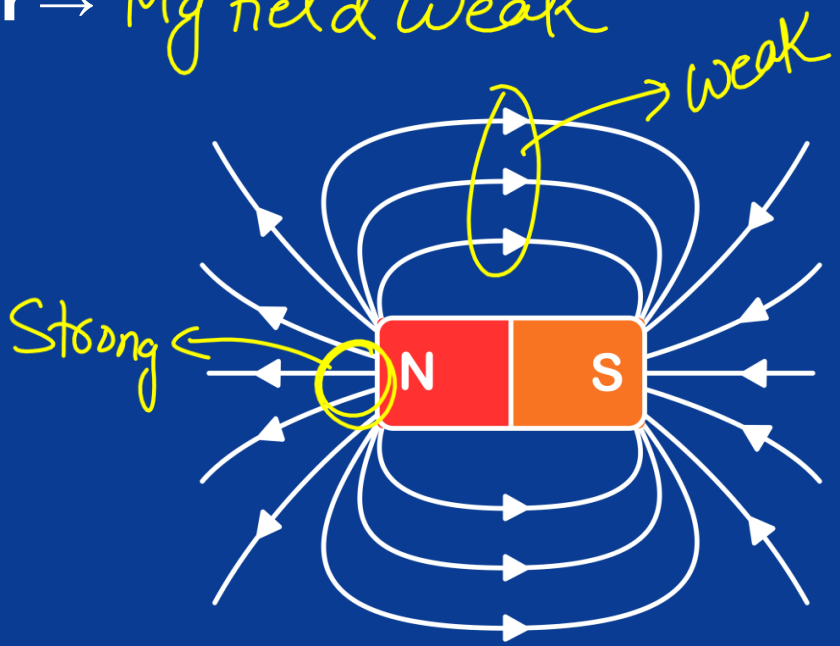
! Yiy !

Magnetic Field (B) → direction → MFL

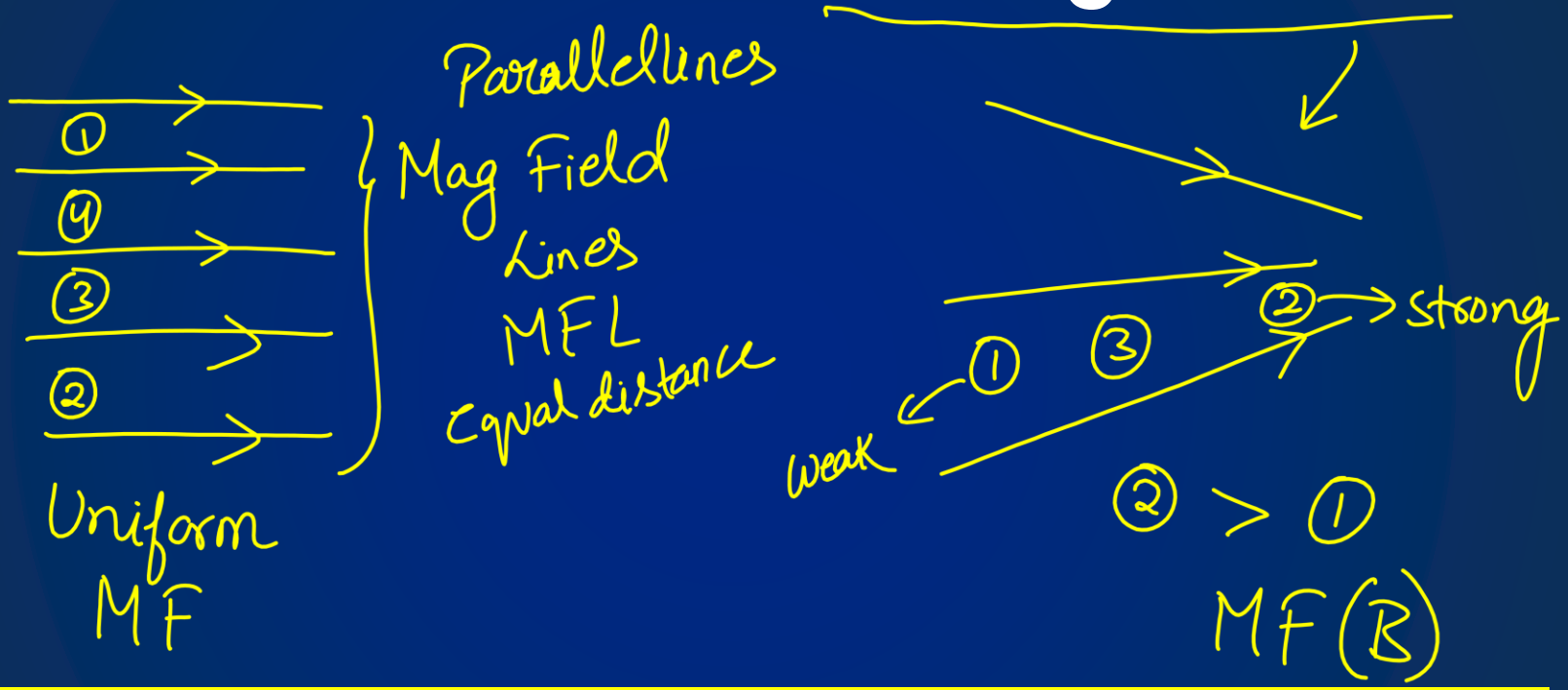
MAGNITUDE OF MAGNETIC FIELD

Field Lines Closer (Crowded) → Mag. Field Strong

Field Lines Far → Mg Field Weak



Uniform & non-uniform magnetic field



Q. How is a uniform magnetic field in a given region represented? Draw a diagram in support of your answer.

(CBSE 2024)

Assertion (A) : Magnetic field lines never intersect each other.

Reason (R) : If they intersect, then at the point of intersection, the compass needle would point towards two directions, which is not possible.

(CBSE2024)

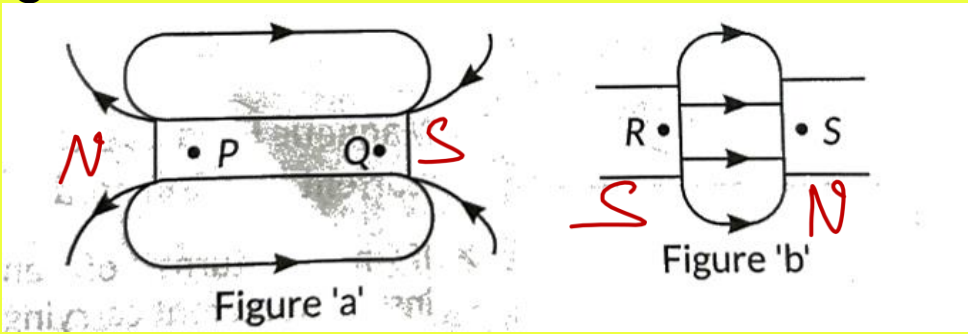
(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

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

(c) Assertion (A) is true, but Reason (R) is false.

(d)Assertion (A) is false, but Reason (R) is true.

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



(Term II, 2021-22)

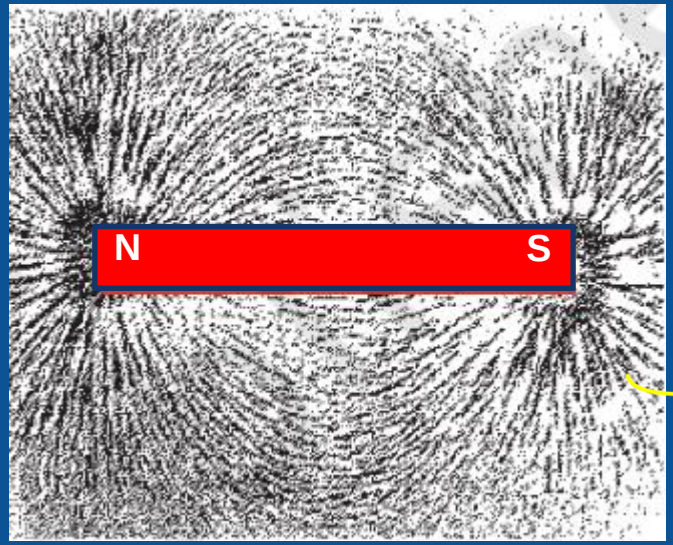
(a) State the inference drawn about the direction of the magnetic field lines on the basis of these diagrams.

Out MFL N→S

Inside MFL S→N

Kyu?

Activity 12.2 – Sach ki field lines



Sprinkle some iron fillings uniformly around the bar magnet

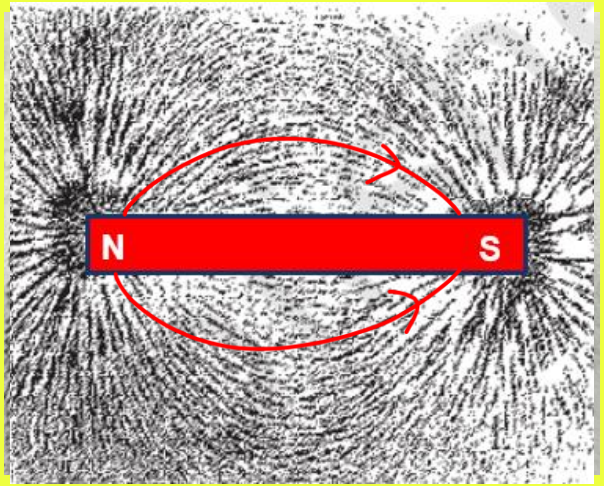
Tap → arrangement

→ Iron Fillings

→ In the direction of MFL
Mag Field Lines

Study the diagram given below and answer the

CBSE 2020



Force → MF → MFL

because they are arranged in MFL direction

(a) Why do the iron filings arrange in such a pattern?

(b) Why do the iron filings near the bar magnet seem to align in the shape of closed curves?

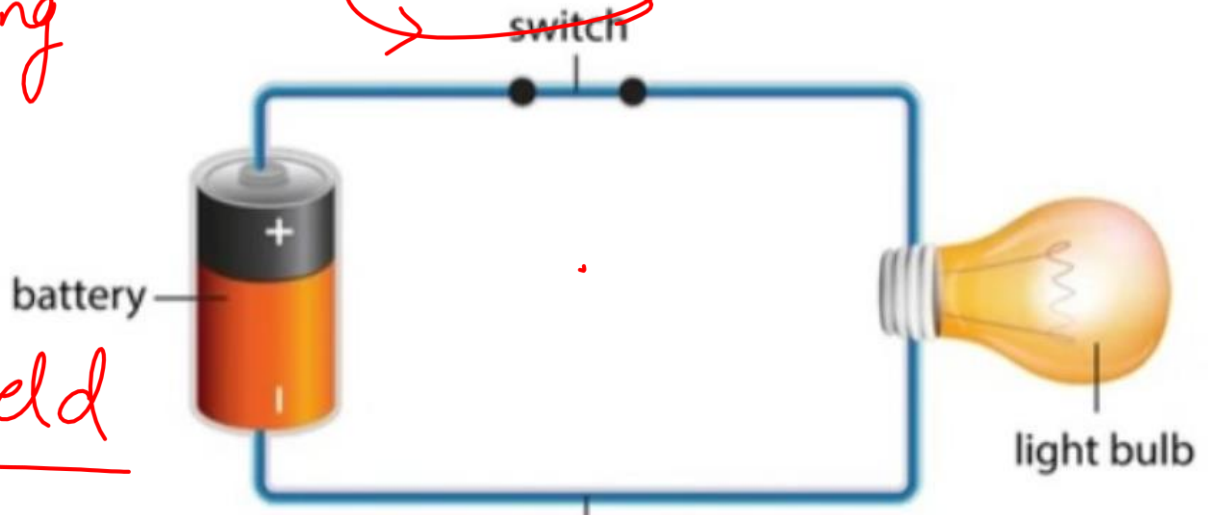
→ Because MFL forms closed curve

Oersted Discovery
Magnetic Effect Of Current

Current carrying Wire

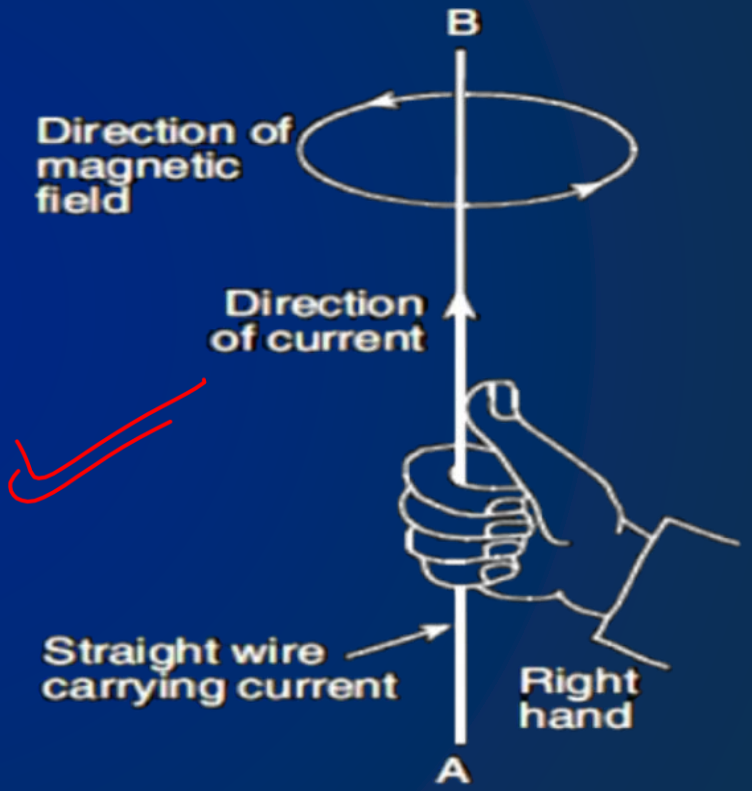
↓

Magnetic Field



Maxwell's Right hand thumb rule

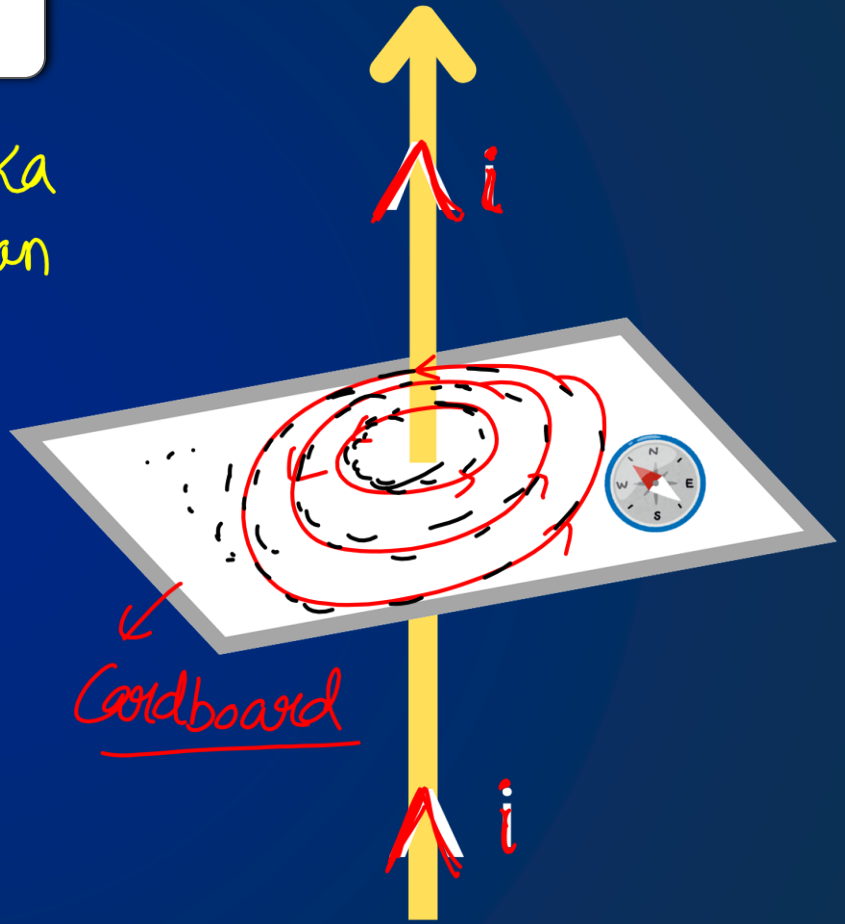
Imagine that you are grasping (or holding) the current-carrying wire in your right hand so that your thumb points in the direction of current, then the direction in which your fingers wrap the wire will give the direction of magnetic field lines around the wire.



Activity 12.1 → Oersted Discovery

Iron Filings — Iron Ka Chooran

1) Concentric Circles

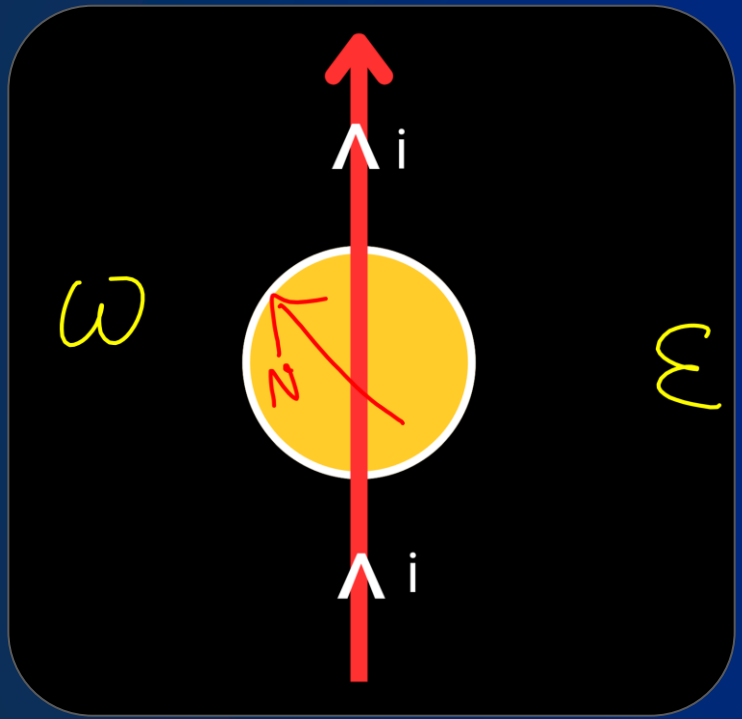


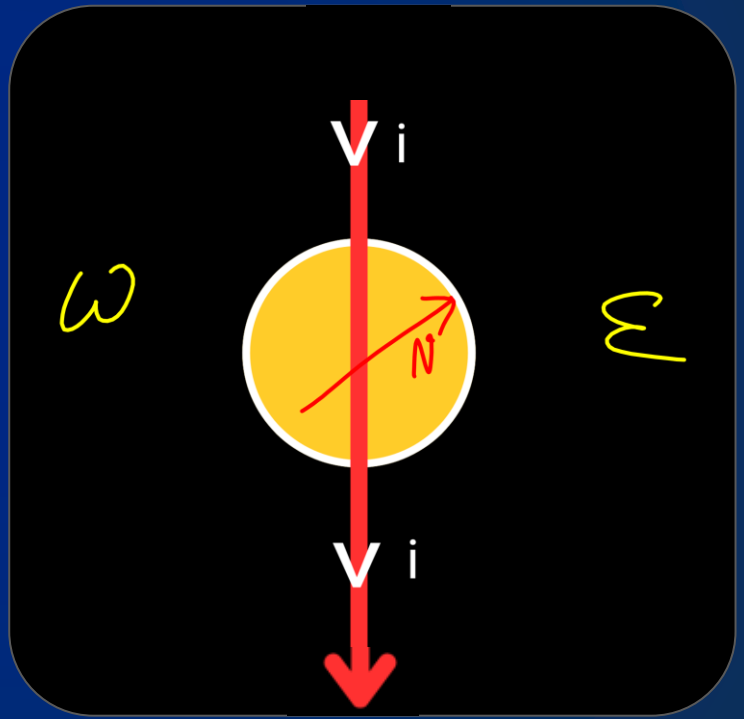
Factors on which Magnetic Field Due To Straight Wire depends

- **Current (i) →** More Current — Stronger Magnetic Field
- **Distance (d) →** More Distance — Weaker Magnetic Field
- **Change direction of current →**

Reverse i direction → Mag Field direction reverses

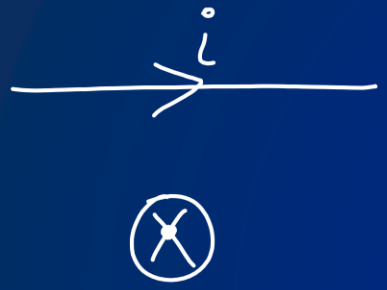
Activity 12. 4 Current wire placed over compass

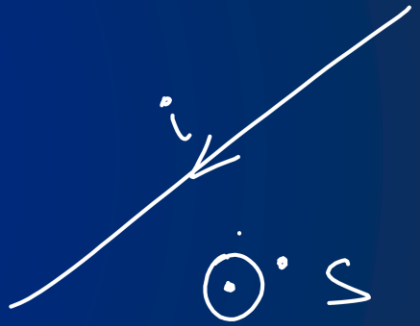


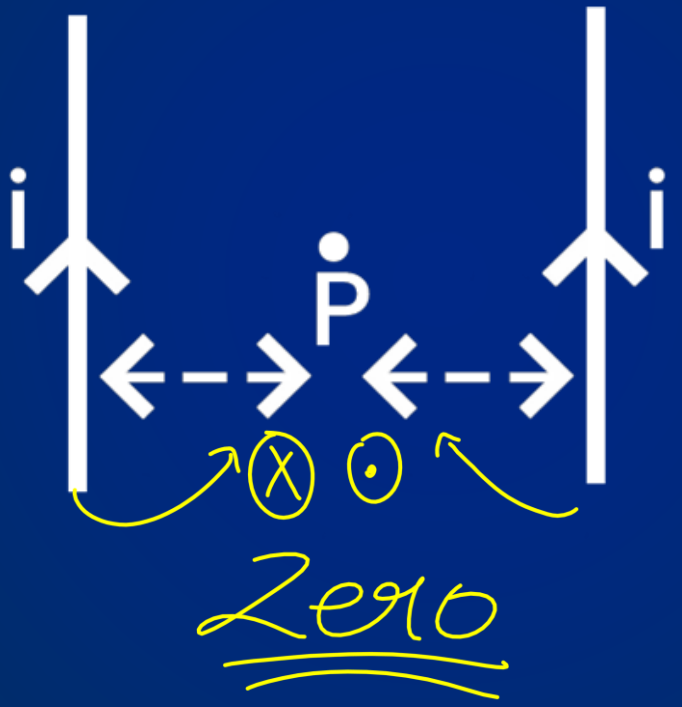


Practice

inwards → ⊗
outwards → ⊙






i
P
i
Zero

Q. Draw the pattern of the magnetic field produced around a vertical current carrying straight conductor passing through a horizontal cardboard. Mark the direction of current and the magnetic field lines. Name and state the rule which is used to determine the direction of magnetic field associated with a current carrying conductor.

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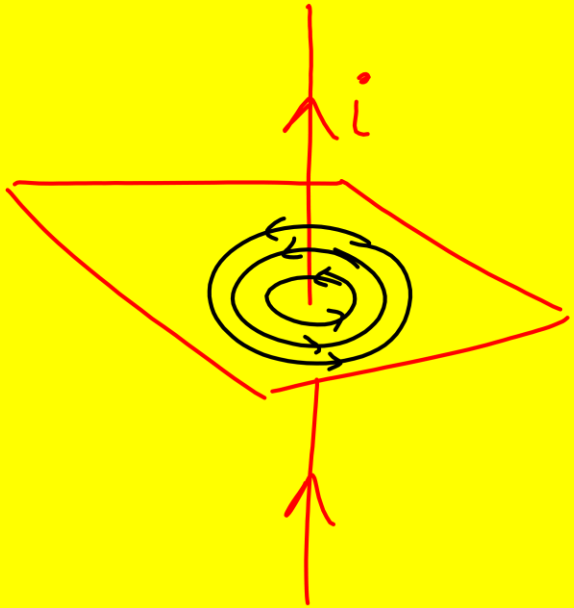


Q. List two factors on which the strength of magnetic field at a point due to a current carrying straight conductor depends. State the rule that determines the direction of magnetic field produced in this case.

i ↑ B ↑
d ↑ B ↓

(CBSE Term II, 2021-22)

2023
Q Total

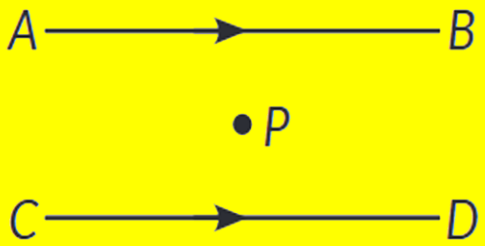
Q. The resultant magnetic field at point 'P' situated midway between two parallel wires (placed horizontally) each carrying a steady current I is

(a)in the same direction as the current in the wires

(b)in the vertically upward direction

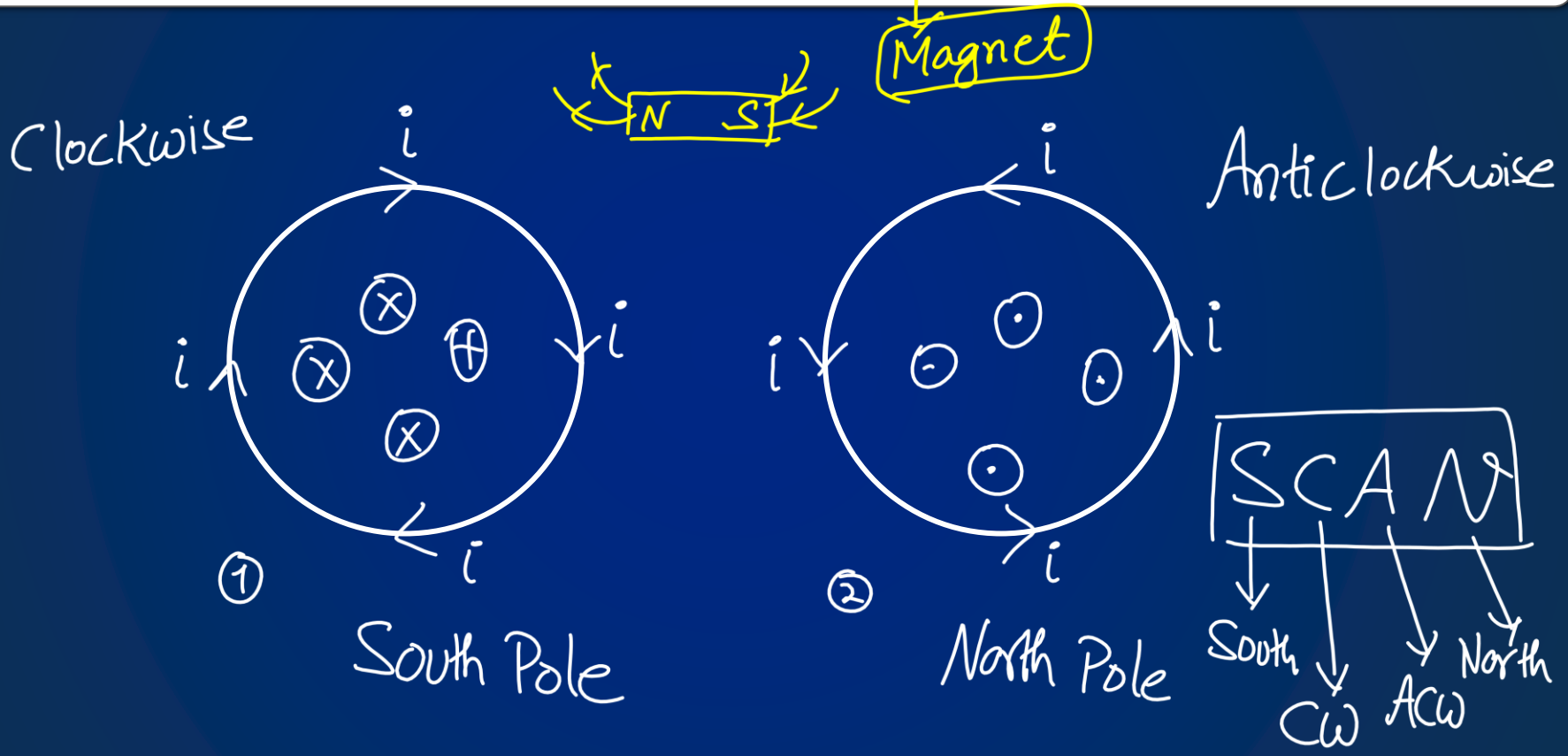
(c)zero

(d)in the vertically downward direction

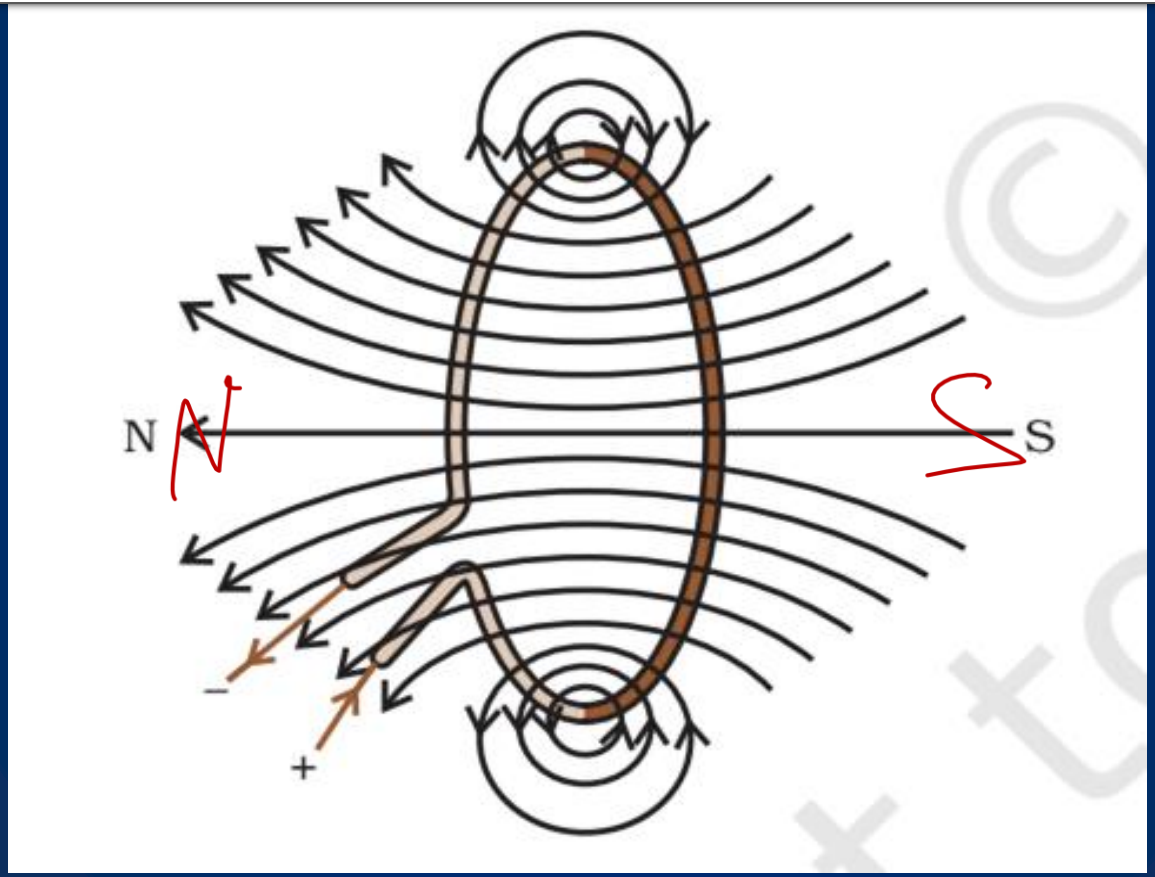


(CBSE 2023)

Magnetic Field Pattern due to a Circular Loop Carrying Current

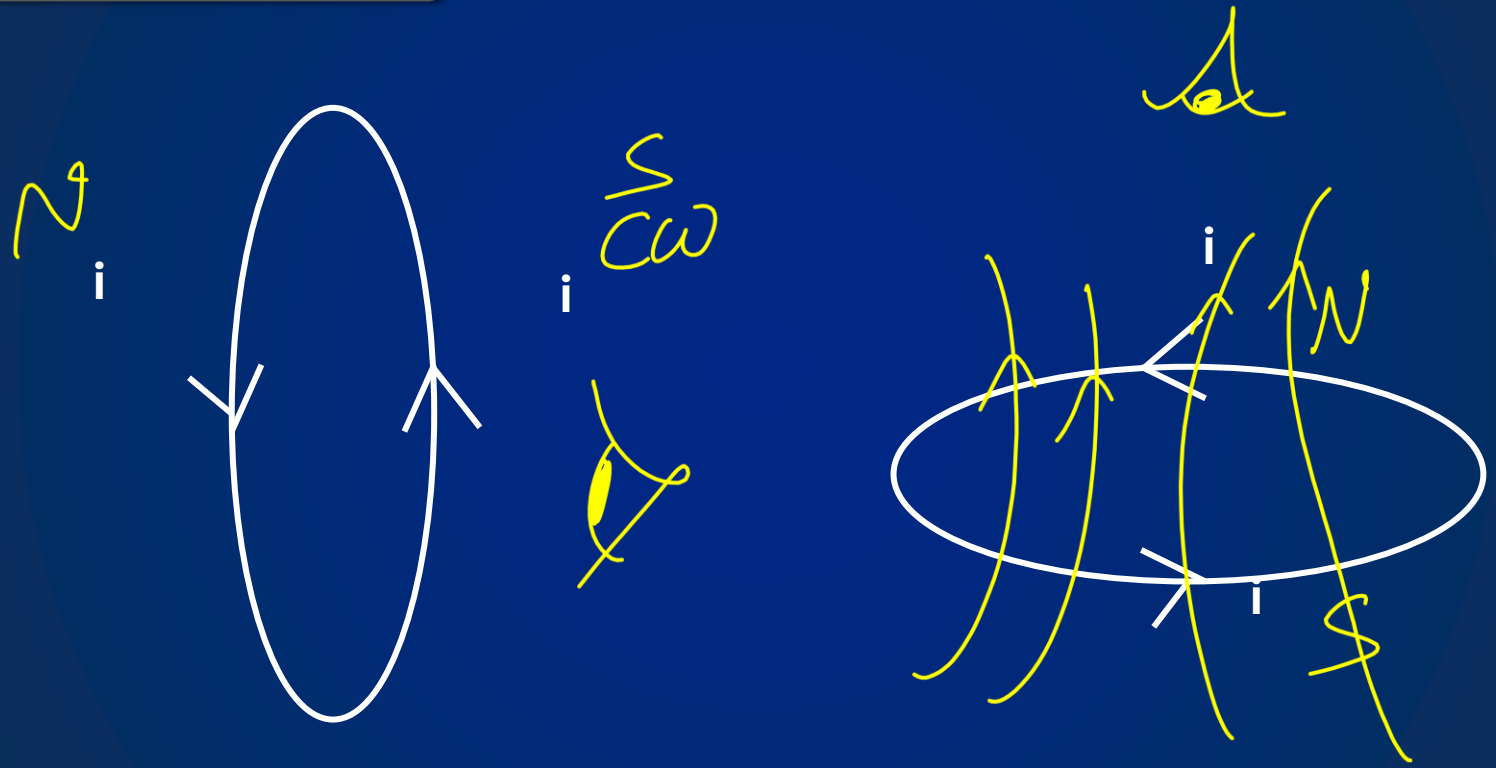


Magnetic Field Pattern due to a Circular Loop Carrying Current



Practice

SCAN

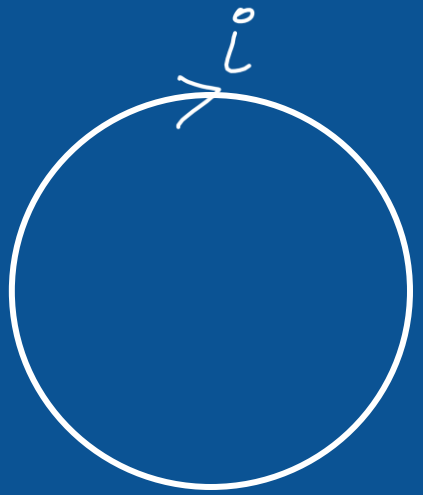


Magnetic Field due to a Circular Loop Carrying Current depends on

(i) → Current $i \uparrow \Rightarrow$ Mag Field $\uparrow$ $B \uparrow$

(ii) → no. of turns → $n \uparrow \Rightarrow$ Mag Field $\uparrow$ $B \uparrow$

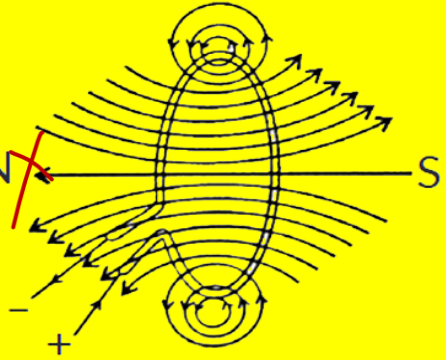
(iii) → Radius → $r \downarrow$ $B \uparrow$ Mag Field $\uparrow$



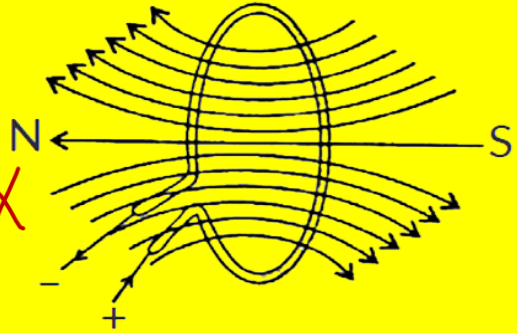
Q. The correct pattern of magnetic field lines of the field produced by a current carrying circular loop is

(CBSE 2023)

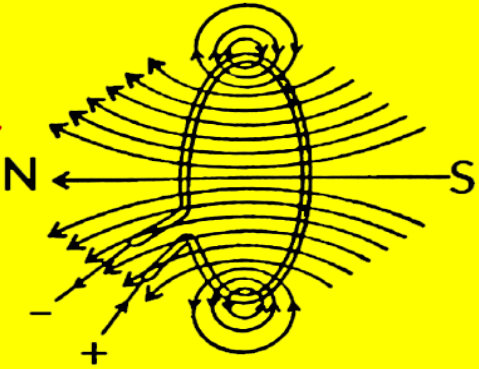
(a)



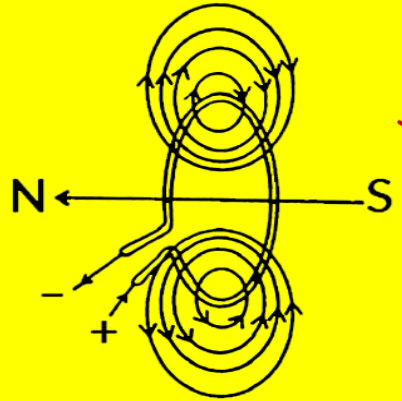
(b)



(c)



(d)



Q. Assertion (A): The strength of the magnetic field produced at the centre of a current carrying circular coil increases on increasing the number of turns in it.
Reason (R): The current in each circular turn has the same direction and the magnetic field due to each turn then just adds up.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A)

(b) Both Assertion (A) and Reason (R) are true, but Reason is not the correct explanation of the Assertion (A)

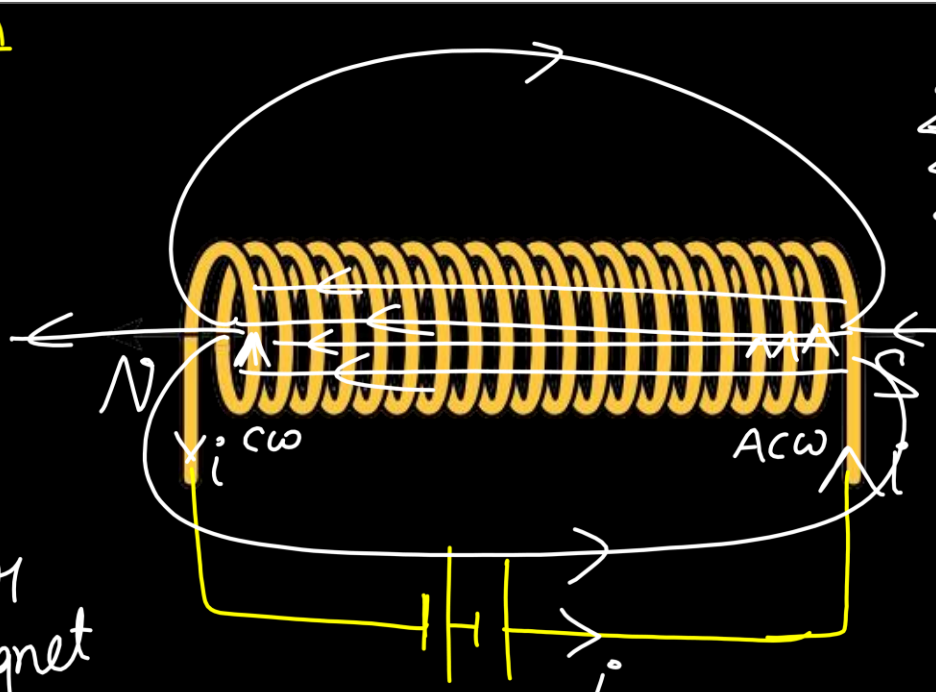
(c) Assertion (A) is true, but Reason (R) is False.

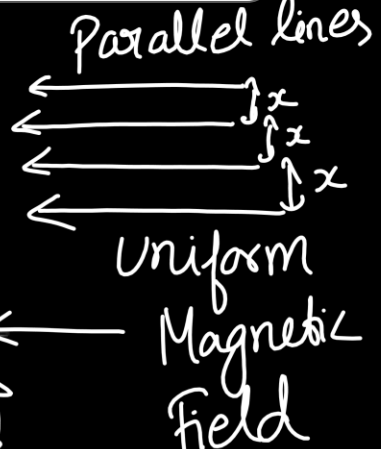
(d) Assertion (A) is false, but Reason (R) is true.

(CBSE 2023)

Magnetic Field ines due to a Solenoid

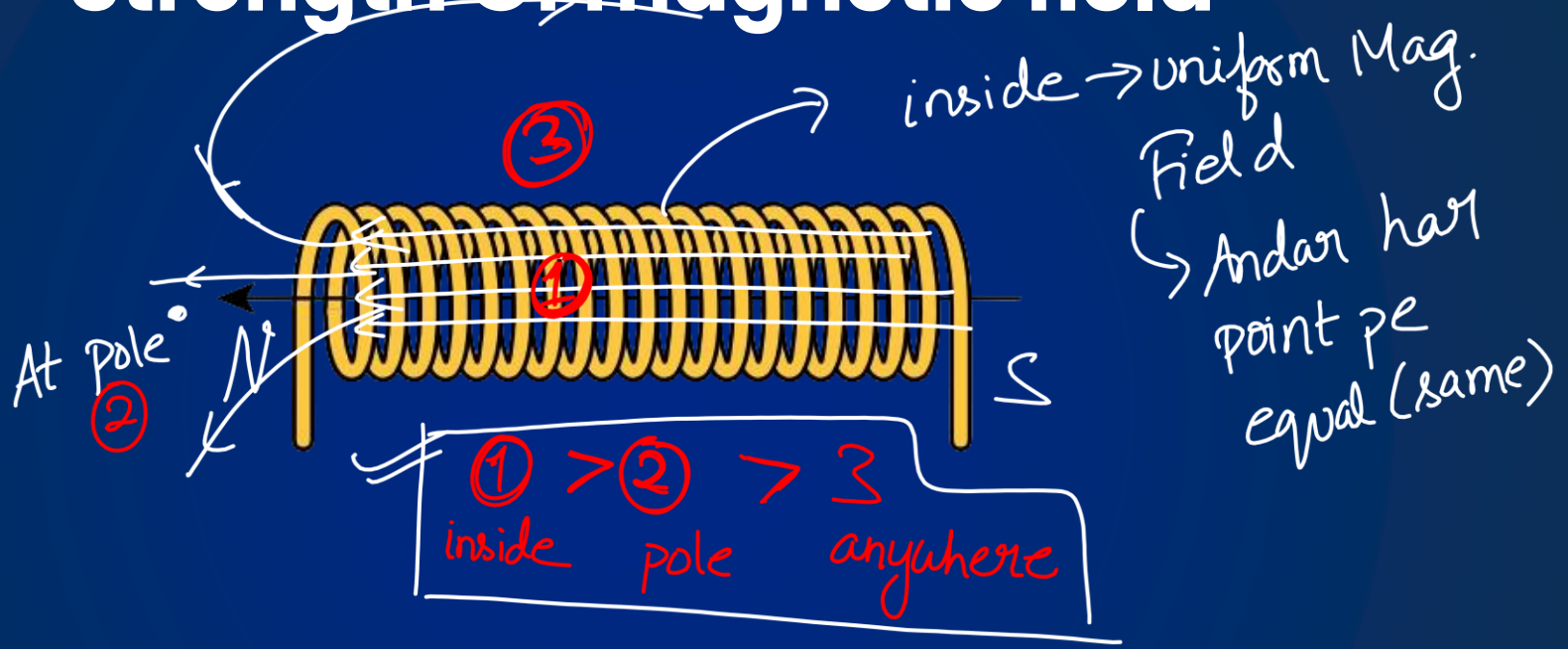
- **A coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder**





Yad karo bar magnet

Strength Of magnetic field



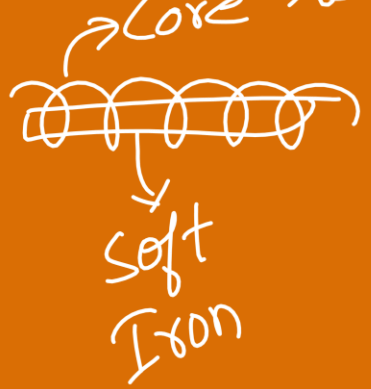
Strength of a Magnetic Field due to a Solenoid depends on

(i) number of turns $(n\uparrow) \Rightarrow$ Mag Field $\uparrow$

Direction of Current Revouse $\Rightarrow$ Polarity reverse

(ii) Current $\Rightarrow$ $i\uparrow \Rightarrow$ Mag Field $\uparrow$

learn



(iii) The gap between the turns Mag Field $\uparrow$

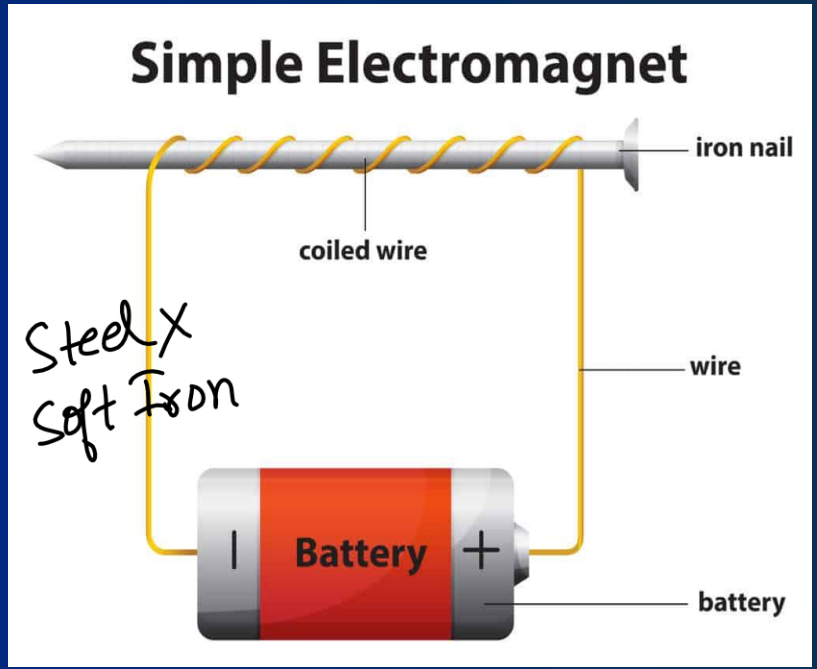
reduce

(iv) The nature of "core material" used in making solenoid.

Electromagnet

Solenoid → Core → Soft Iron

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



Strength of an Electromagnet

(i) number of turns in the coil. ↑ Mag Field ↑

(ii) The current flowing in the coil. i ↑

(iii) The length of air gap between turns. reduced

n ↑ i ↑ gap ↓ Mag 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.

Learn

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

(a) a straight conductor

(b) a circular loop

(c) a solenoid

(d) a circular coil.

Electro Magnet

(CBSE 2024)

Q. The magnetic field inside a long straight current carrying solenoid

(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.

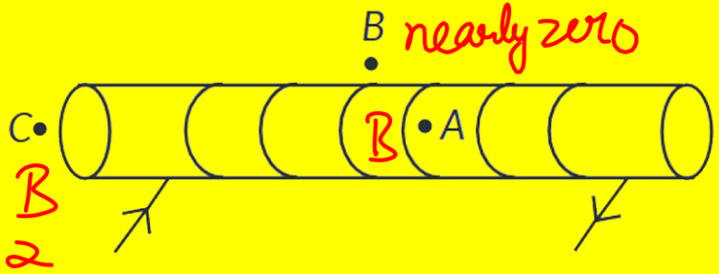
(CBSE 2023)

Q. What is a solenoid? When does a solenoid behave as a magnet? Draw the pattern of the magnetic field produced inside it showing the directions of the magnetic field lines.

(CBSE 2023)

Q. 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?

(CBSE 2023)



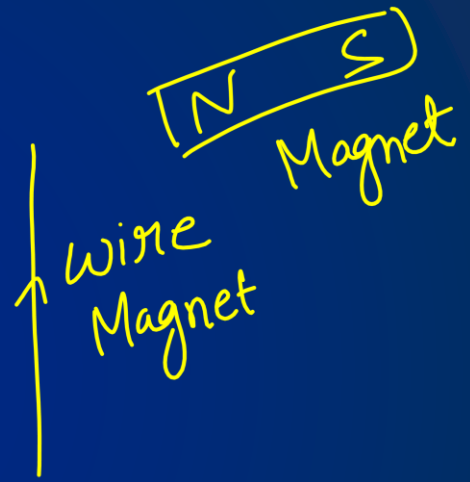
A → Max

B → Min

A > C > B

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

↓

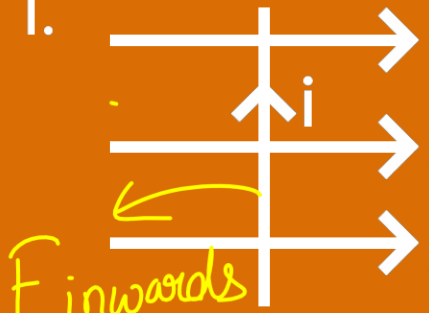
Magnetic Field → experience Force

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 a way that the forefinger points in the direction of magnetic field and the centre finger points in the direction of current, then the direction in which thumb points, gives the direction of force acting on the conductor.

Practice

1.



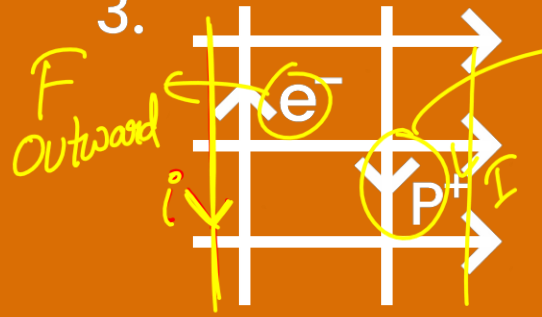
MAGNETIC FIELD (B)

2.

(B) MAGNETIC FIELD

Force outwards

3.

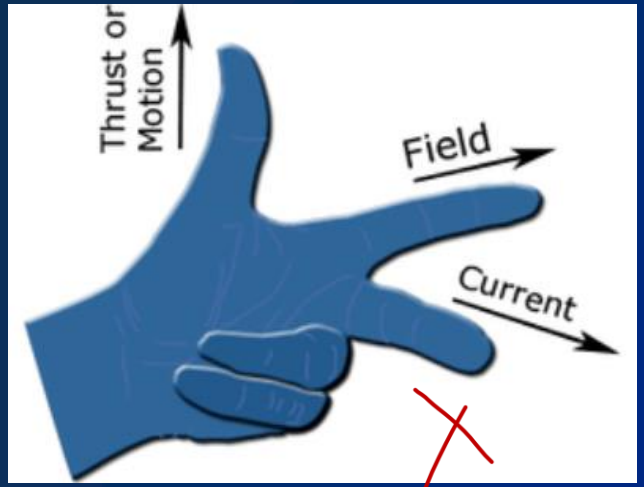


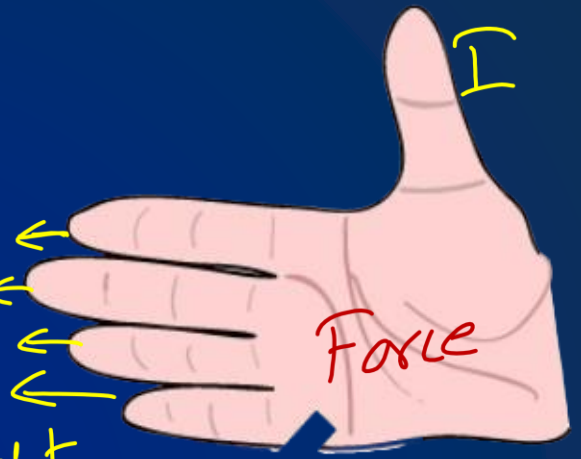
MAGNETIC FIELD (B)

+ve −ve no change

Alpha ,beta,gamma

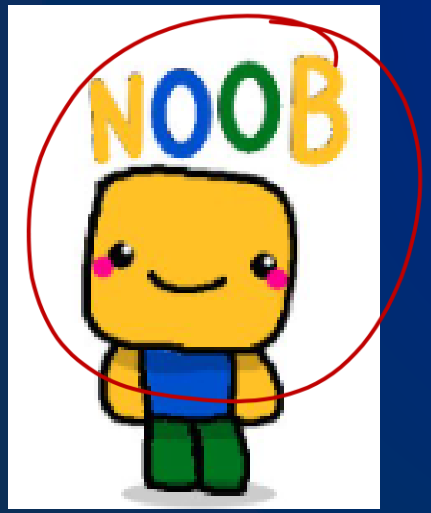
Direction of Force

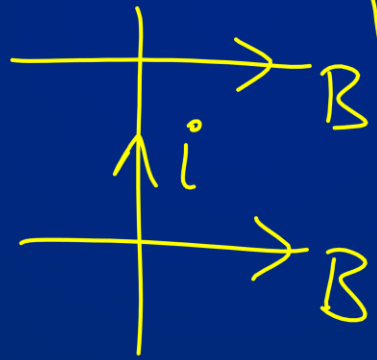




Comment H.W.

Right Hand





AP Rule Magical

SIGMA

Factors on which Force on current wire depends

Current (i) ↑ F ↑

Magnetic Field (B) ↑ F ↑

Length (l) ↑ F ↑

Angle } imp

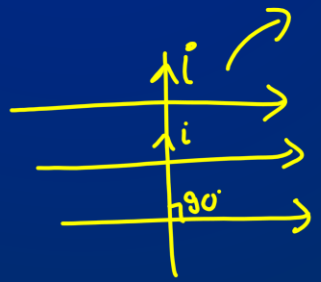
$F \to B\,i\,l$

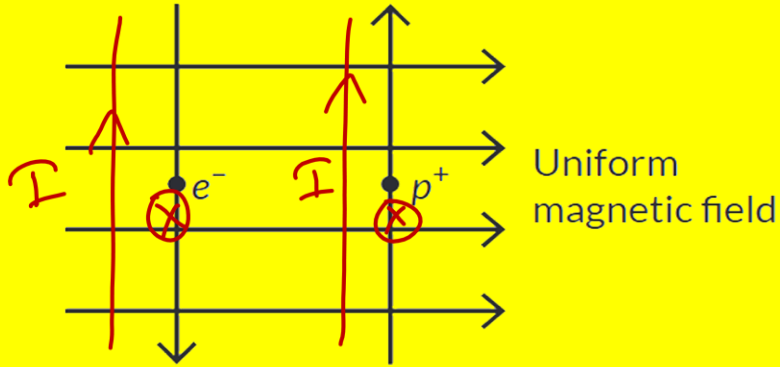
↑ ↑

imp

F = 0

F → Max



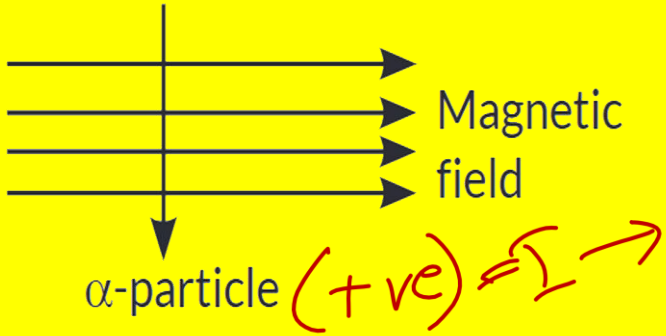


Q. A uniform magnetic field exists in the plane of paper as shown in the diagram. In this field, an electron (e^-) and a positron (p^+) enter as shown. The electron and positron experience forces

(a) both pointing into the plane of the paper
(b) both pointing out of the plane of the paper
(c) pointing into the plane 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.

(CBSE 2024)

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



α → comment

(a) towards right
(b) towards left
(c) into the page
(d) out of the page

(CBSE 2023)

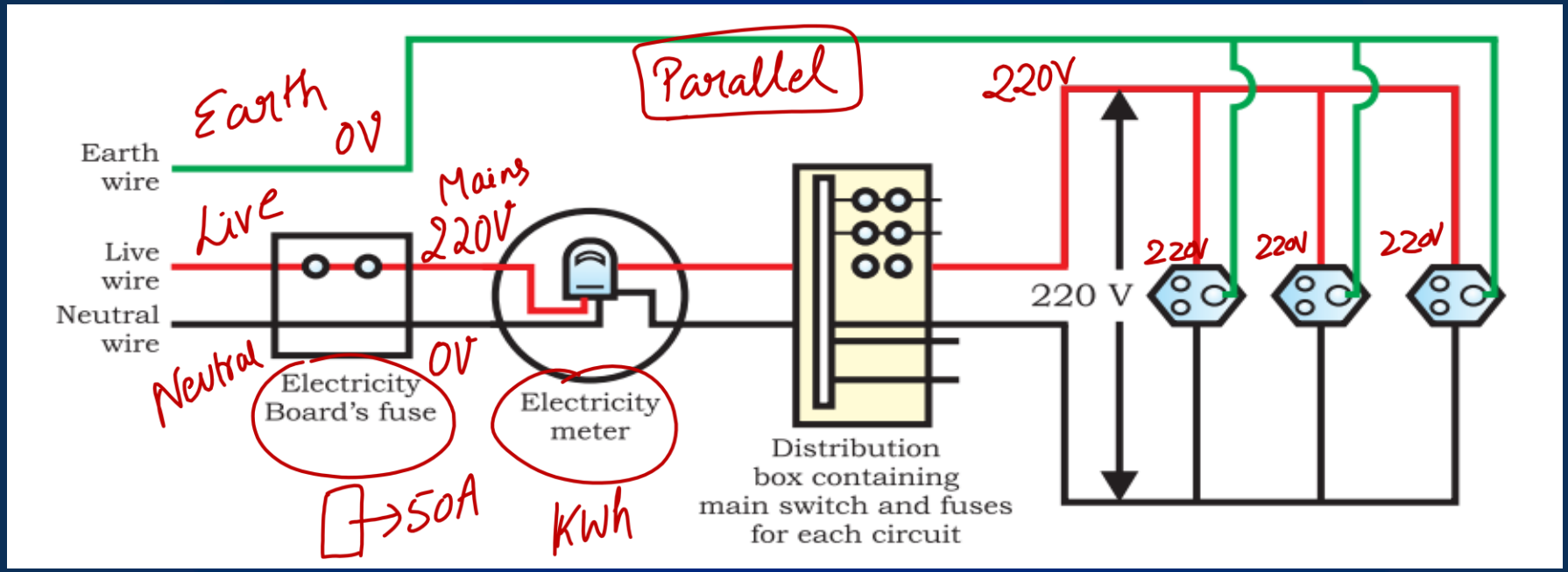
D.C
Direct Current

1. Do not change it's 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. Changes 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

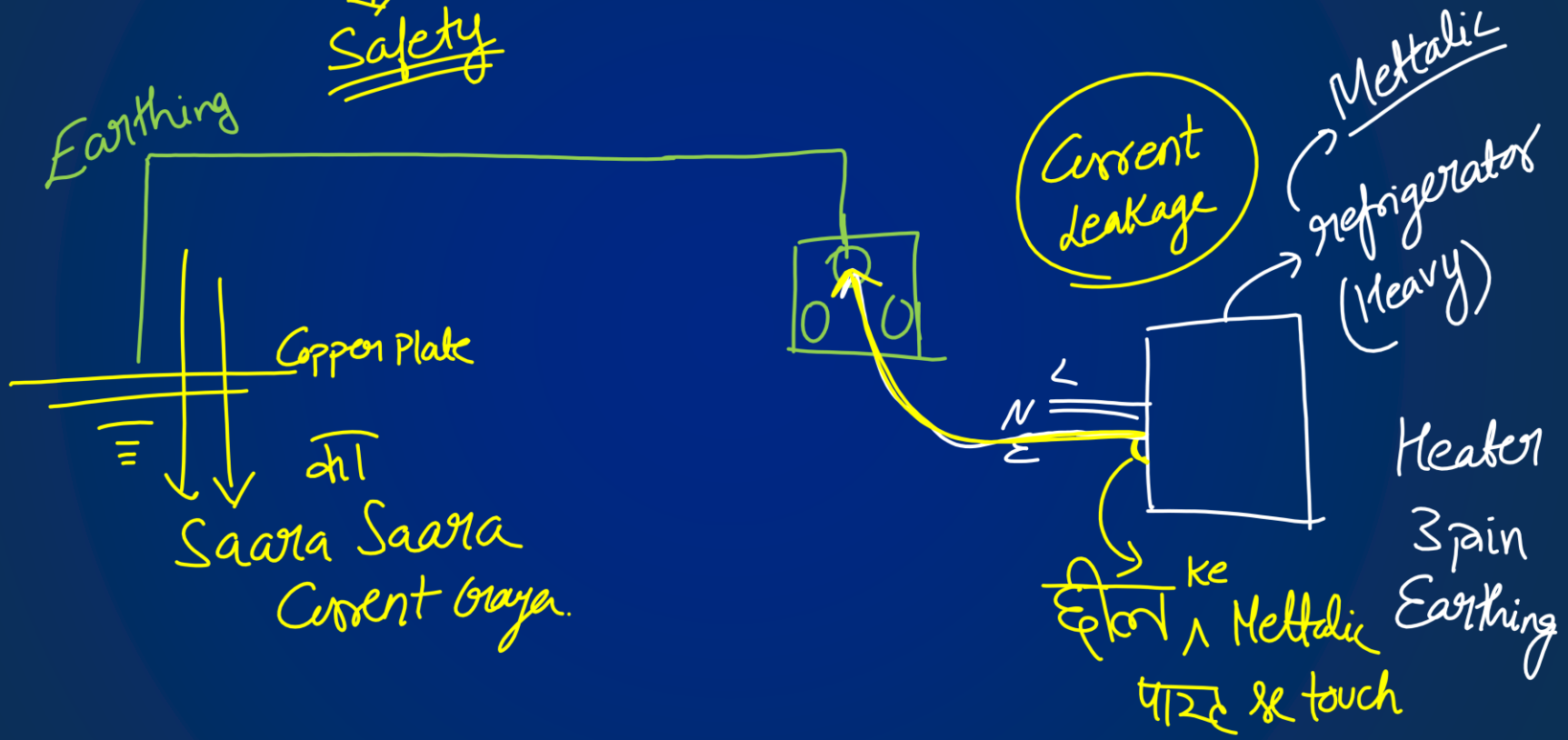
DOMESTIC ELECTRIC CIRCUITS (OR DOMESTIC WIRING)



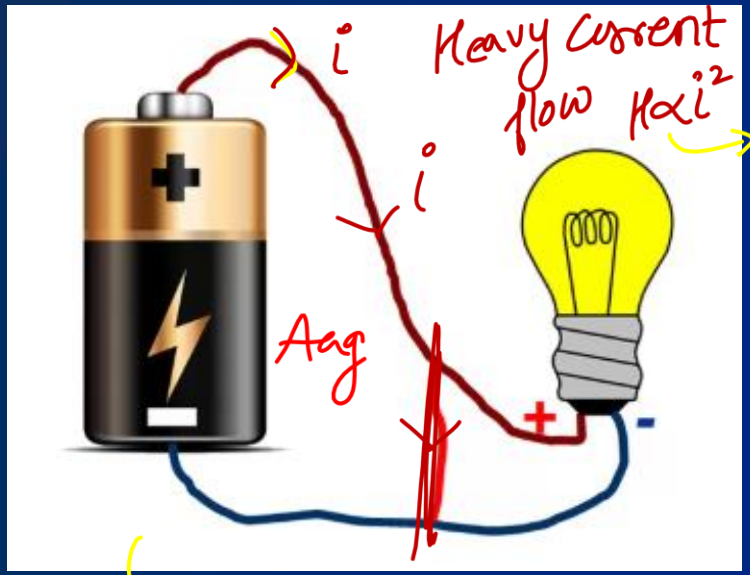
Parallel → Adv → diff devices diff current + diff devices same voltage 220V
1 device fail ✗

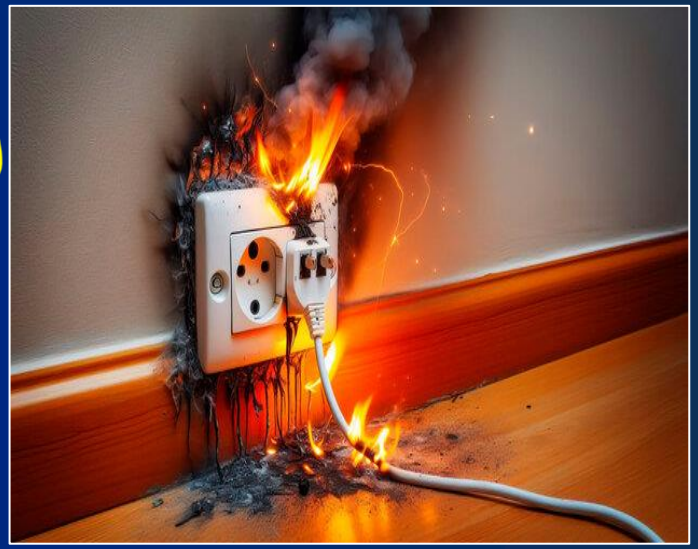
Earthing of Electrical Appliances

Safety



Overloading - Short Circuit

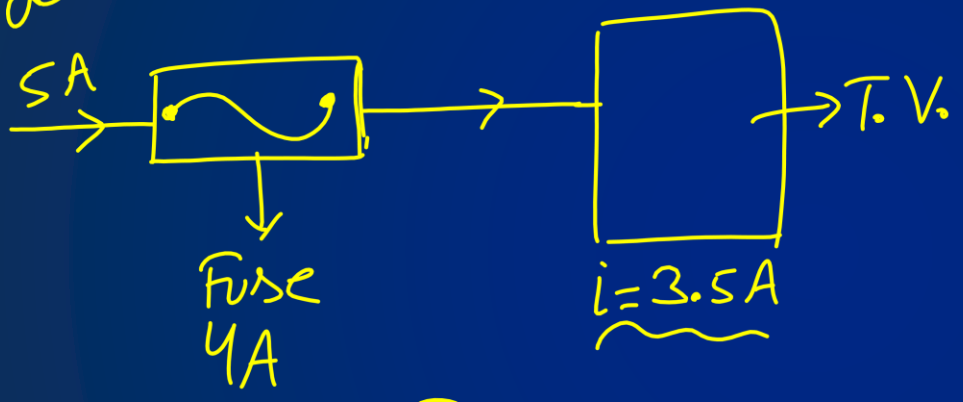




↳ Short circuit ↳ current ↳ Lowest Resistance

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

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 during 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 T.V

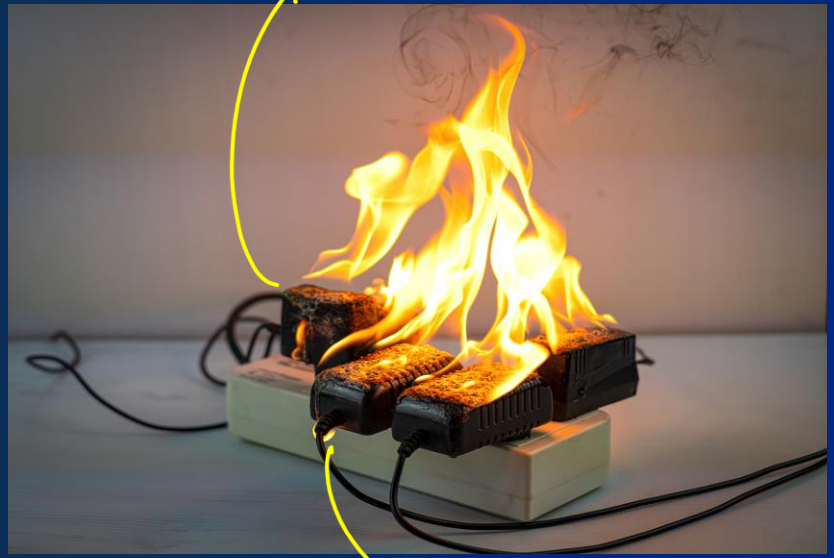
IRON

TOASTER

GEYSERS

OVERLOADING

Multiple devices



Lot of current $i\uparrow$

$H \propto i^2 \rightarrow$ Joule's Law

Sudden spike in voltage.

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

(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.

Q1 H.W.

(CBSE 2023)

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

(a) vary continuously
(b) does not change
(c) reduces substantially
(d) increases heavily.

Q 2 - H.W.

(CBSE 2020)

Q. Differentiate between direct and alternating current. Name the type of current produced by the power plants in our country. Also state its frequency.

(CBSE 2023)

f = 50Hz → Is direction 100 times change