PARISHRAM

2026

Ch-1 (V. imp)
Ch-2 (Thoda sa)

Magnetism and Matter

'easy'
'Chota'
'Theory'

PHYSICS LECTURE - 1

BY - RAKSHAK SIR

Topics *to be covered*

- **A** Bar Magnet Ki Gaatha.
- **B** Magnetic Field Due To A Bar Magnet
- **C** Dipole In Uniform Magnetic Field
- **D**

Unit-III	**Magnetic Effects of Current and Magnetism**	17
	Chapter–4: Moving Charges and Magnetism	
	Chapter–5: Magnetism and Matter	
Unit-IV	**Electromagnetic Induction and Alternating Currents**	
	Chapter–6: Electromagnetic Induction	
	Chapter–7: Alternating Current	

Chapter–5: Magnetism and Matter

L - I

Bar magnet, bar magnet as an equivalent solenoid (qualitative treatment only), magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis (qualitative treatment only), torque on a magnetic dipole (bar magnet) in a uniform magnetic field (qualitative treatment only), magnetic field lines.

Magnetic properties of materials- Para-, dia- and ferro – magnetic substances with examples, Magnetization of materials, effect of temperature on magnetic properties.

Introduction

Magnet

An island in Greece called Magnesia where magnetic ore deposits were found in 600 B.C.

A magnet freely suspended points towards north - south direction.

A name lodestone (loadstone) or leading stone was given for property of direction.

Used for navigation on ships.

Bar Magnet – Basic Property

N S

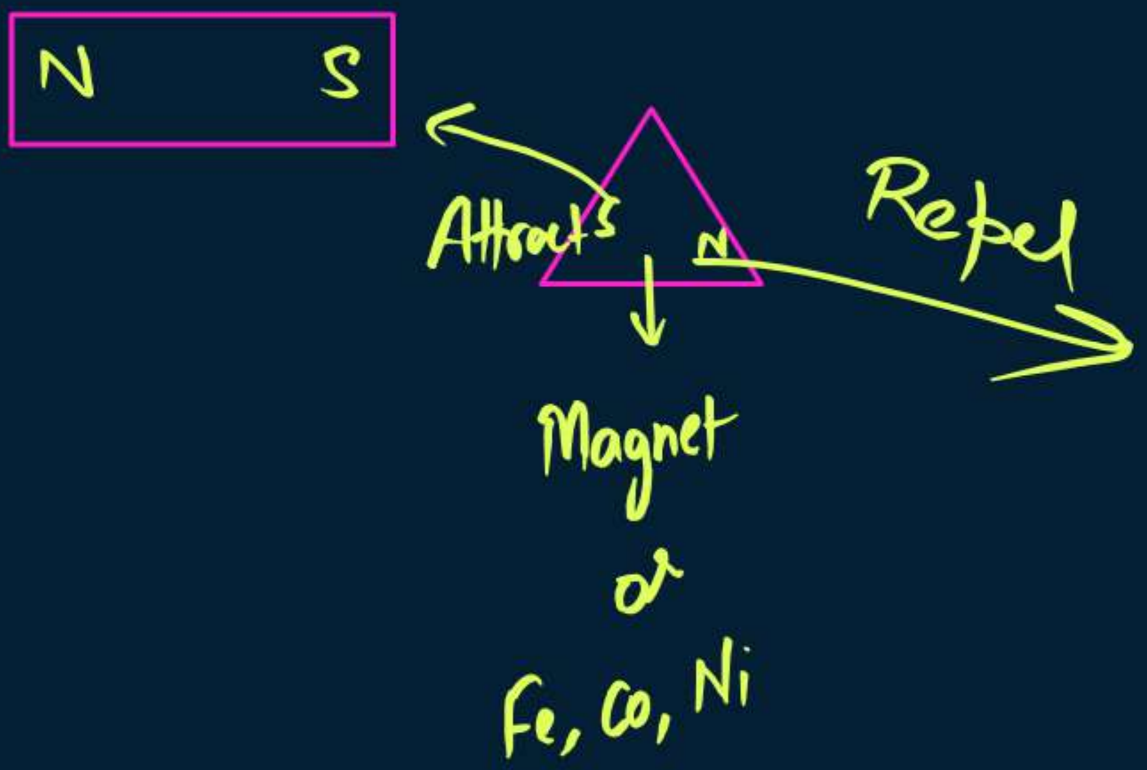
Attractive and Directive Property, Attracts Small pieces of Iron, Cobalt etc.
This Property is called Magnetism

$M \rightarrow$ dipole moment

1. Attractive Property - Ends are called Poles have Magnetic Pole Strength (m)
2. Dipole, not Monopole
3. Like Poles repel and Unlike poles attract
4. Aligned towards N-S of Earth
5. Magnetic Induction, induced in other magnetic Substances

Repulsion is Sure Test of Magnetism

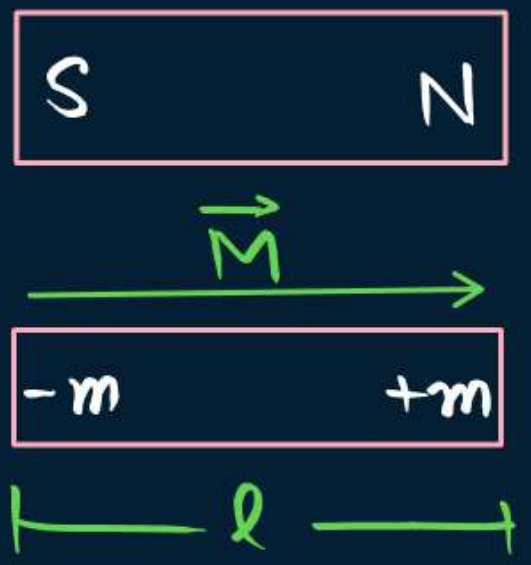
Magnet can Attract other materials and Magnets too
but
Magnet can only repel another magnet



Bar Magnet – Dipole Moment and Pole Strength

Dipole (N, S) — $(\vec{M})$ — (m)

Y.K.B. (cn-1)



$m \rightarrow$ pole strength

$l \rightarrow$ length of the magnet

Dipole moment = pole strength × separation

$$\boxed{\vec{M} = m \times \vec{l}}$$

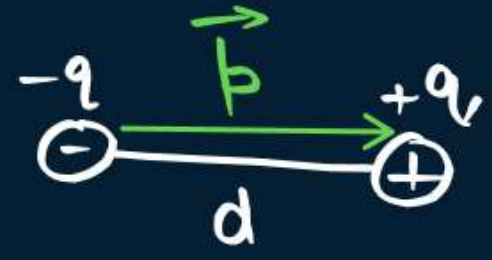
SI unit of m :- $M = ml$

$$m = \frac{M}{l} = \frac{\text{Ampere (metre)}^2}{\text{(metre)}}$$

$m \rightarrow$ Ampere-metre

$\hookrightarrow$ (Am)

m = Ampere-meter



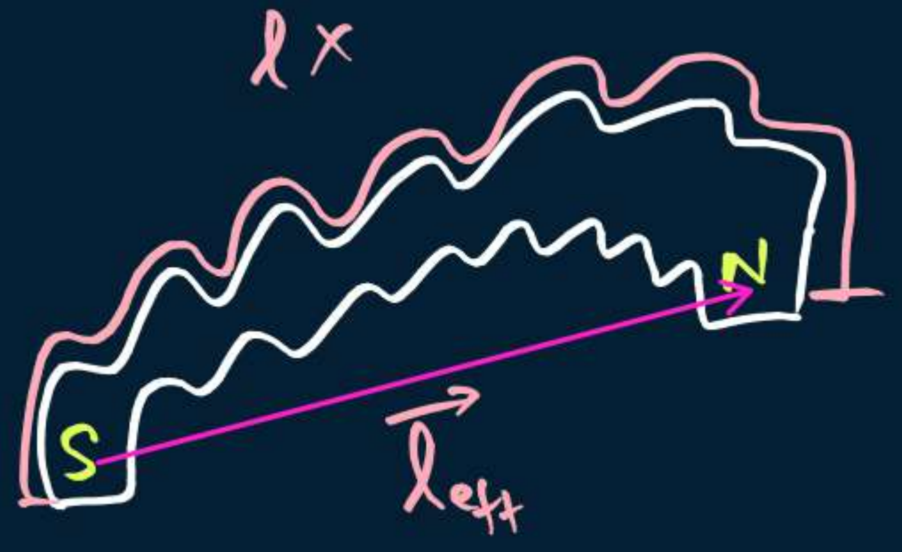
p = Charge × separation

$p = qd$

$M = NiA$

$M \rightarrow$ Ampere (metre)^2

Magnet of Irregular shape



$$\boxed{\vec{M} = m \times \vec{l}}$$

$\vec{M}$ ↓ (S → N)

$\vec{l}$ ↓ Vector length (S → N)

QUESTION

A steel wire of length l has a magnetic moment M. It is then bent into a semi – circular arc. The new magnetic moment is

(A) M

(B) $2M/\pi$

(C) M/π

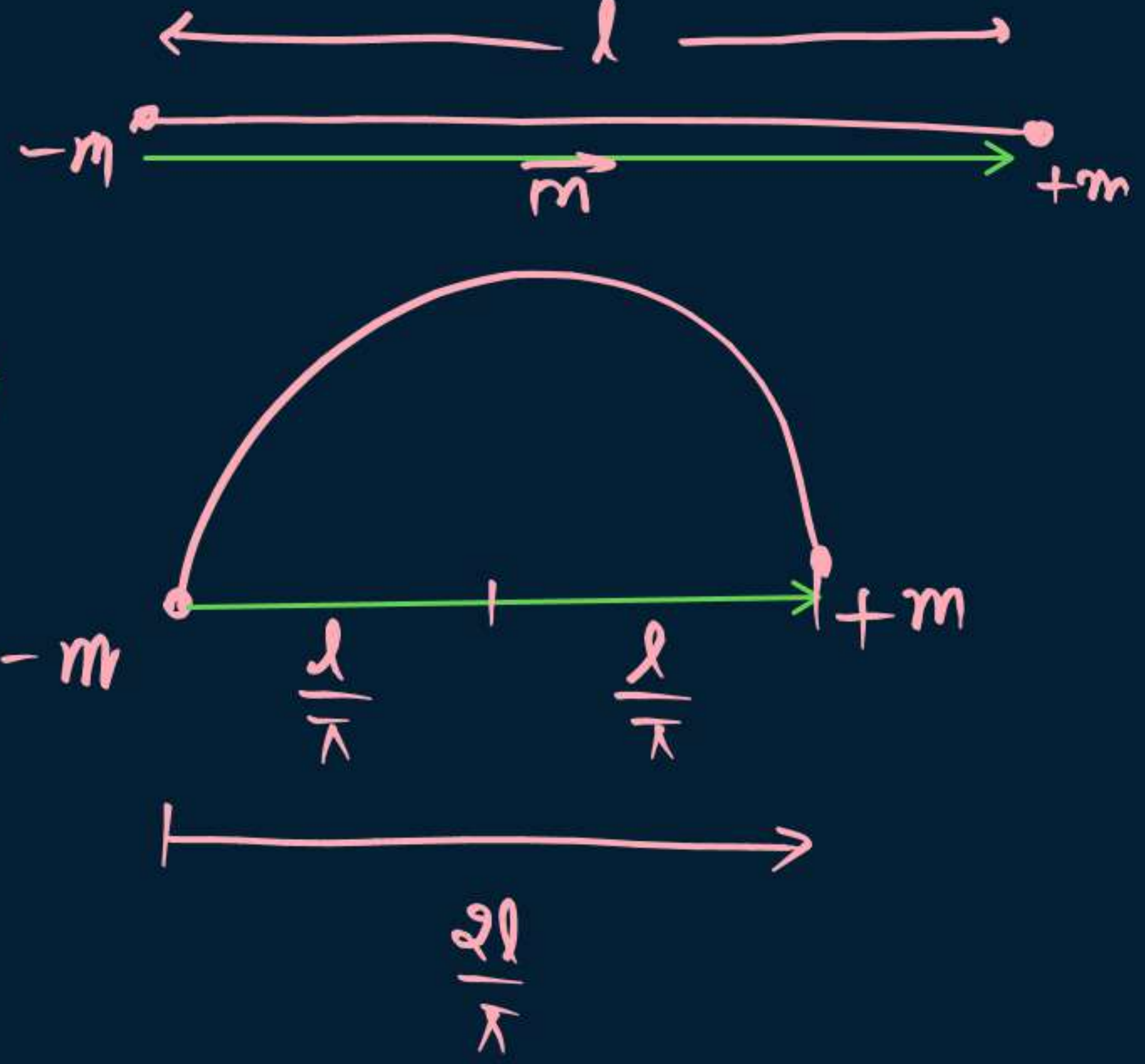
(D) $2M\pi$

$M = m\ell$

$M' = m \times \ell_{eff}$

$= m \times \frac{2\ell}{\pi}$

$M' = \frac{2M}{\pi}$ ✓



$\ell = \pi R$

$R = \frac{\ell}{\pi}$

QUESTION

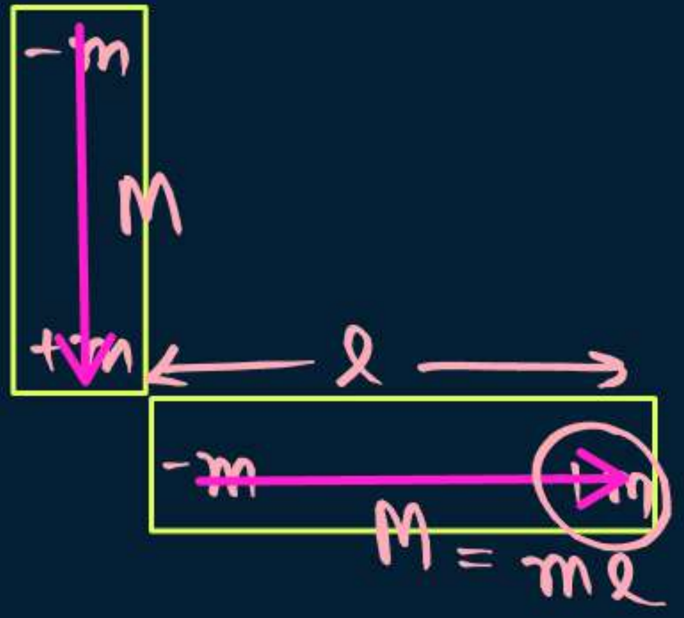
Two identical thin bar magnets each of length (l) and pole strength (m) are placed at right angle to each other with north pole of one touching the south pole of the other. Magnetic moment of the system is

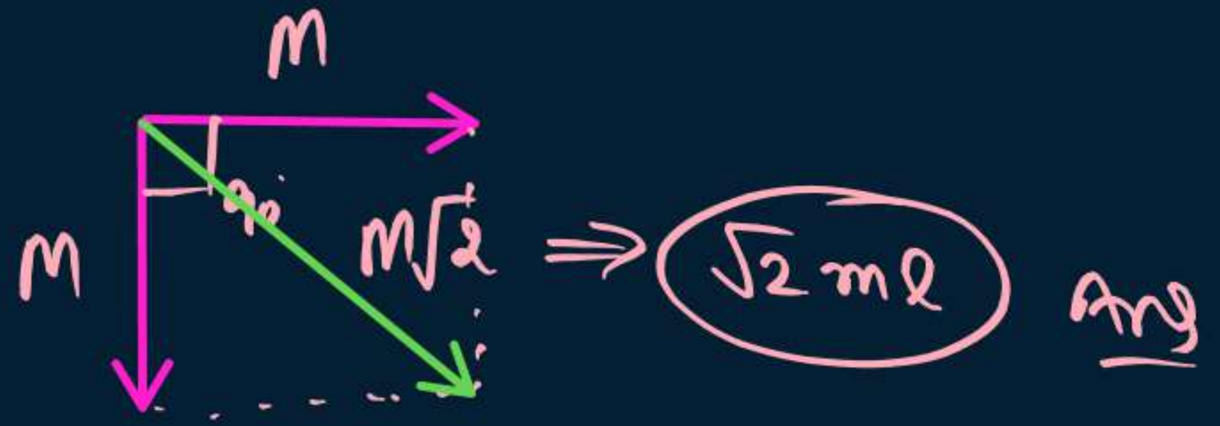
A. 2 ml

B. ml

C. $\sqrt{2}$ ml

D. ml/2





QUESTION

H.W.

Following figures show the arrangement of bar magnets in different configurations. Each magnet has magnetic dipole moment $\vec{m}$. Which configuration has highest net magnetic dipole moment? **[2014]**

(A)

(B)

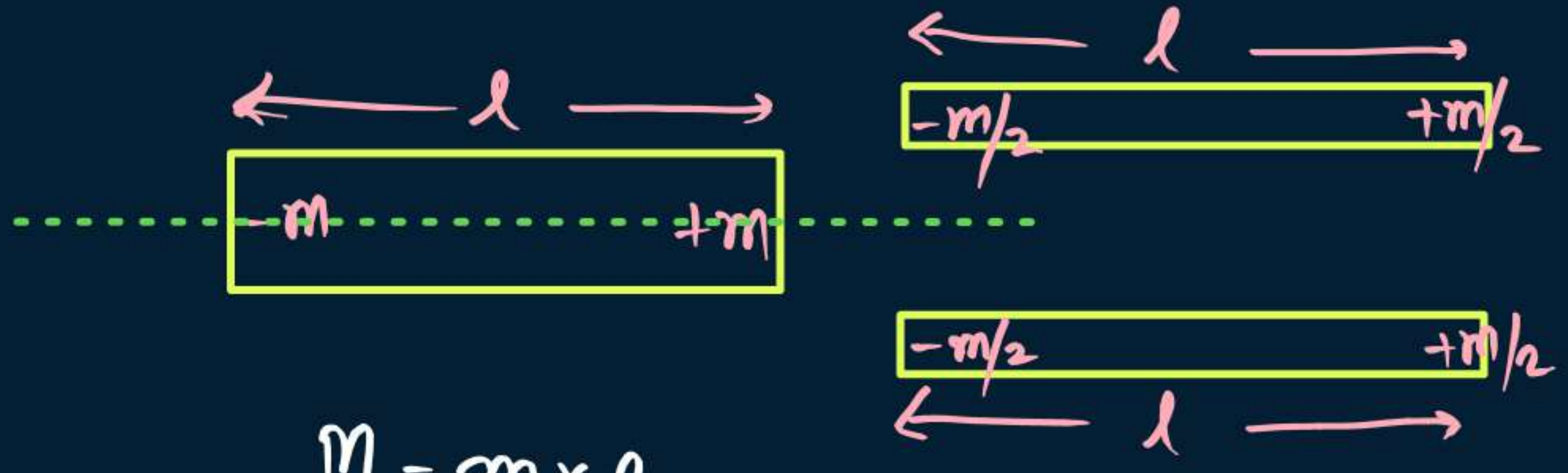
(C)

(D)

Cutting of Magnet

$l \rightarrow$ same, $m \rightarrow$ divide

a) Cutting along the length of magnet (laterally)



$$M = m \times l$$

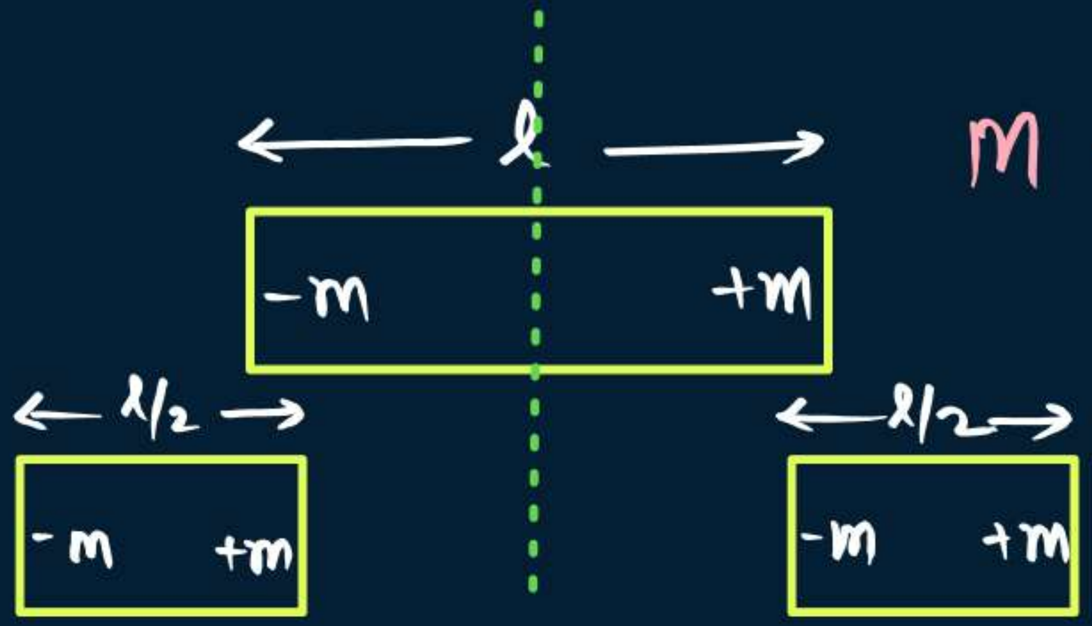
$$M' = \frac{m}{2} \times l = \frac{M}{2}$$

$$M' = \frac{M}{2}$$

dipole moment becomes half.

b) Cutting perpendicular to the length of magnet (transverse)

$m \rightarrow$ same
$l \rightarrow$ divide



$$M = ml$$

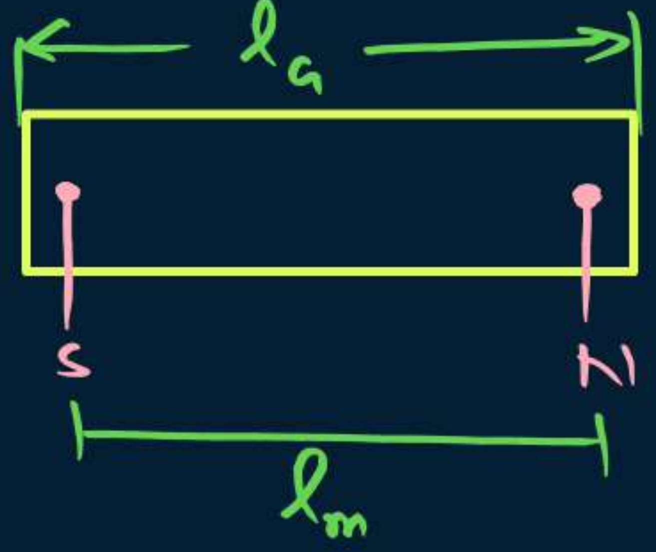
$$M' = m\frac{l}{2}$$

$$M' = \frac{M}{2}$$

Dipole moment becomes half.

Magnetic and Geometric Length

$\uparrow l_m$ $\uparrow l_g$



$$\boxed{\frac{l_m}{l_g} = \frac{5}{6}}$$

Force between two magnetic poles

$+m_1 \xleftarrow{\quad r \quad} \xrightarrow{\quad} +m_2$

याद

$$\boxed{F = \frac{\mu_0}{4\pi}\frac{m_1 m_2}{r^2}}$$

Y.K.B.

Ch-1

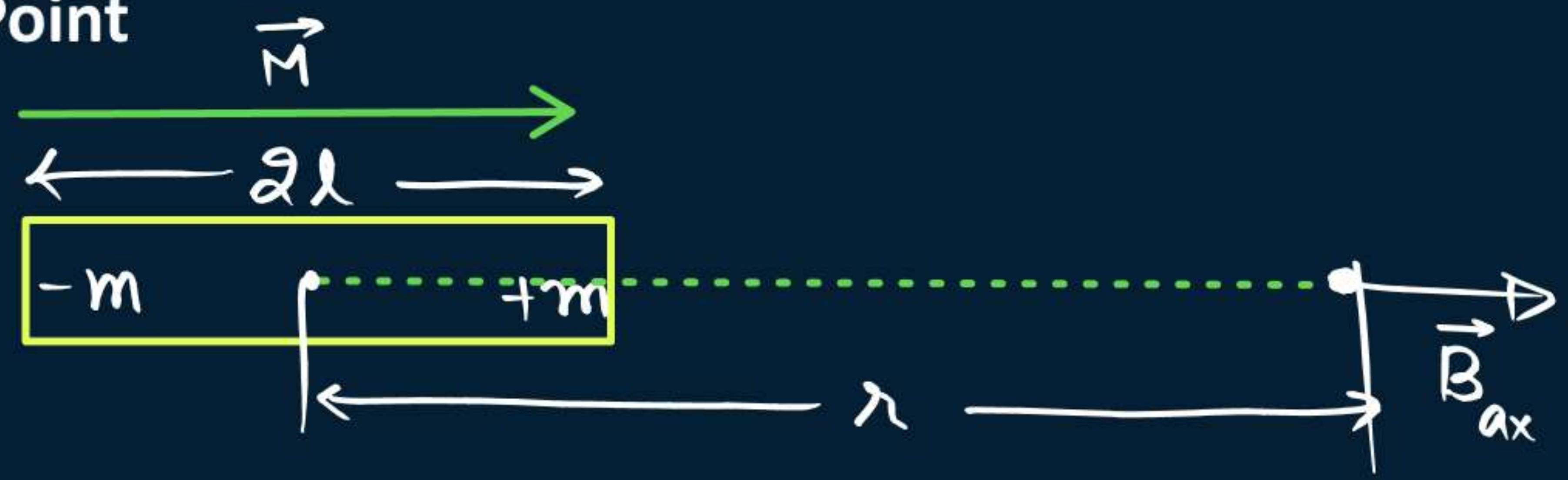
$+q_1 \xleftarrow{\quad r \quad} \xrightarrow{\quad} +q_2$

$$F = \frac{k q_1 q_2}{r^2}$$

$$F = \left(\frac{1}{4\pi\epsilon_0}\right)\frac{q_1 q_2}{r^2}$$

Magnet field due to a dipole

a) Axial Point



$$\boxed{\vec{B}_{ax} = 2\frac{\mu_0}{4\pi}\frac{\vec{M}}{r^3}}$$

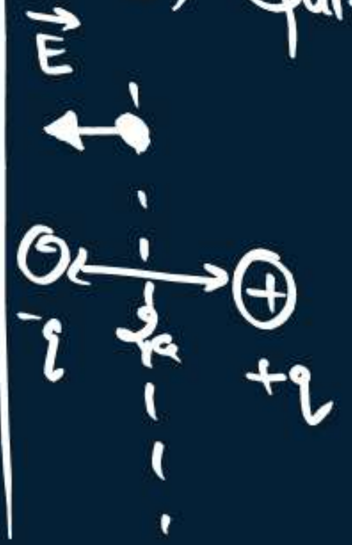
Y.K.B.

Short dipole

1) Axial

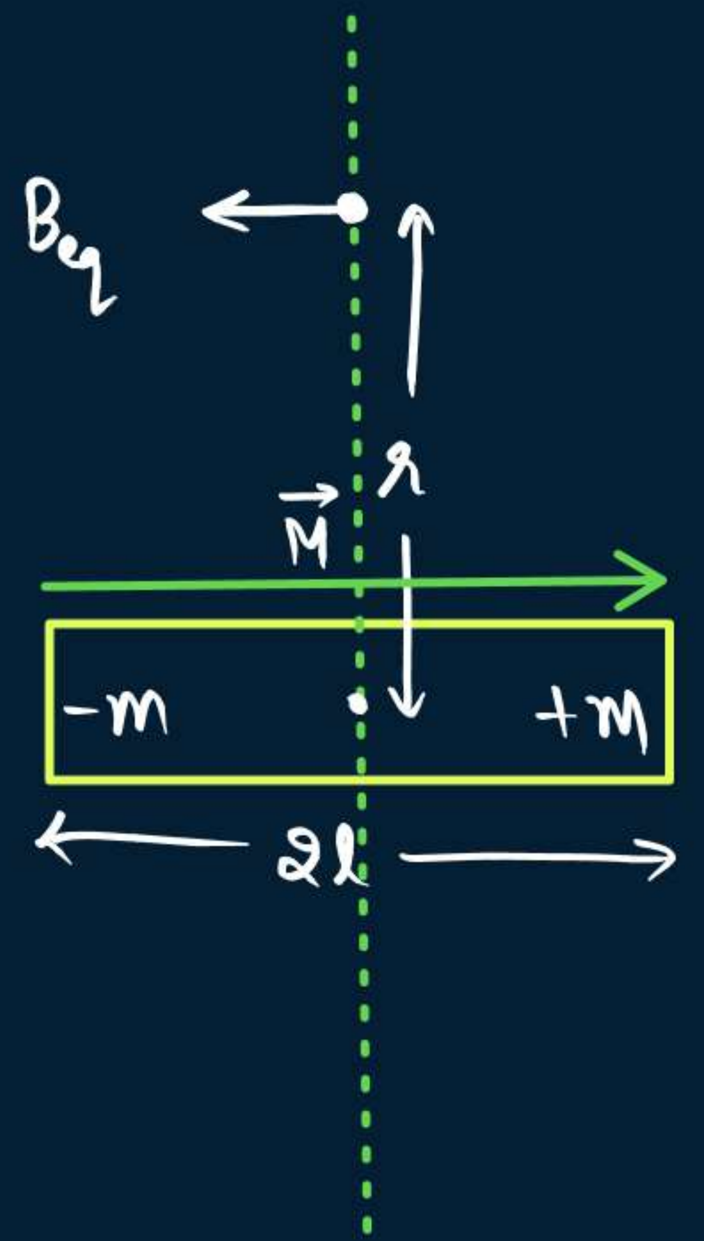
$$\boxed{E_{ax} = \frac{2kp}{r^3}}$$

2) Equitorial



$$\boxed{E_{eq} = \frac{kp}{r^3}}$$

b) Equitorial Point



$$\boxed{B_{eq} = \frac{\mu_0}{4\pi}\frac{M}{r^3}}$$

$$\boxed{\vec{B}_{eq} = -\frac{\mu_0}{4\pi}\frac{\vec{M}}{r^3}}$$

QUESTION

Two identical bar magnets, each of magnetic moment M, are placed as shown in figure, magnetic field at point P is

A $2\left(\frac{\mu_0}{4\pi}\right)\frac{M}{d^3}$

B $\left(\frac{\mu_0}{4\pi}\right)\frac{M}{d^3}$

C $\sqrt{5}\left(\frac{\mu_0}{4\pi}\right)\frac{M}{d^3}$

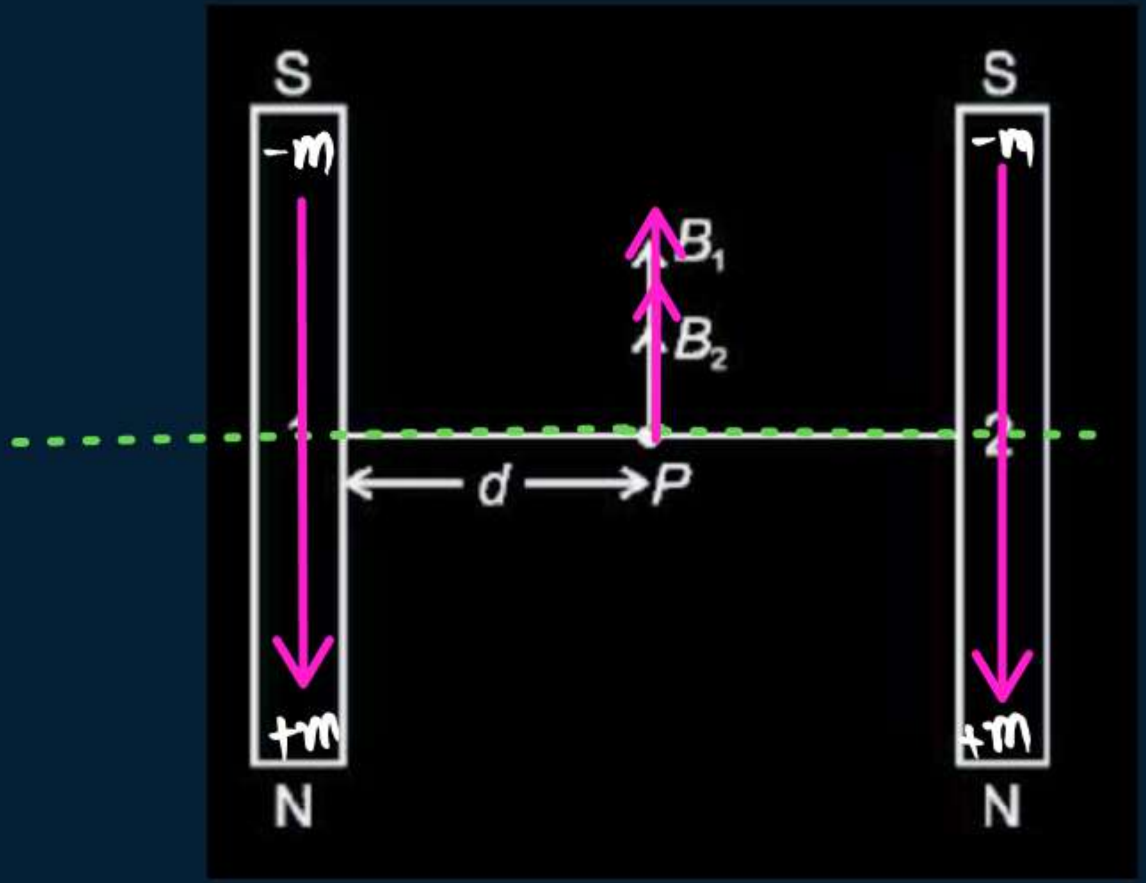
D $2\sqrt{5}\left(\frac{\mu_0}{4\pi}\right)\frac{M}{d^3}$

$$B_{eq} = \frac{\mu_0}{4\pi}\frac{M}{d^3}$$

$$B_{eq} = \frac{\mu_0}{4\pi}\frac{M}{d^3}$$

$$B = B_1 + B_2$$

$$= 2\frac{\mu_0}{4\pi}\frac{M}{d^3}$$

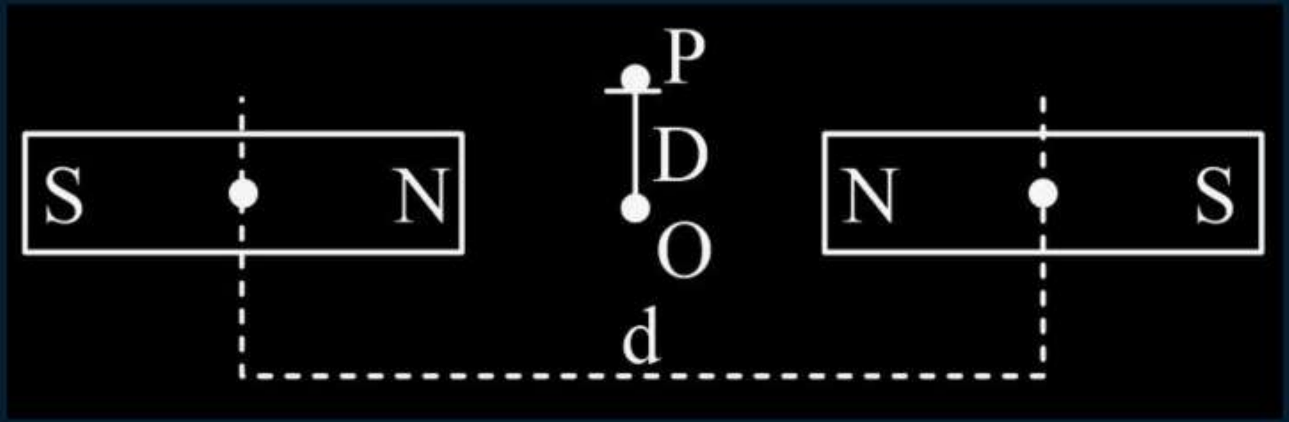


QUESTION

H.W.

Two identical bar magnets are fixed with their centres at a distance d apart. A stationary charge Q is placed at P in between the gap of the two magnets at a distance D from the centre O as shown in the figure .The force on the charge Q is

[2010]



A) Zero

B) directed along OP

C) directed along PO

D) directed perpendicular to the plane of paper

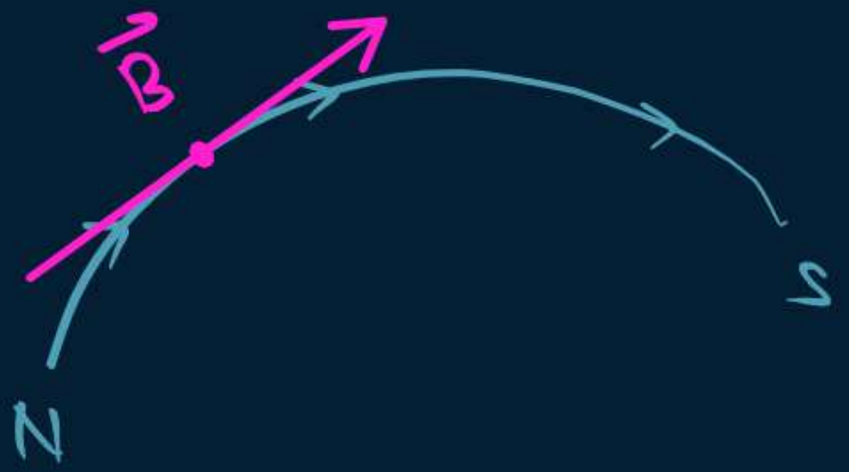
Properties of Magnetic Field Lines

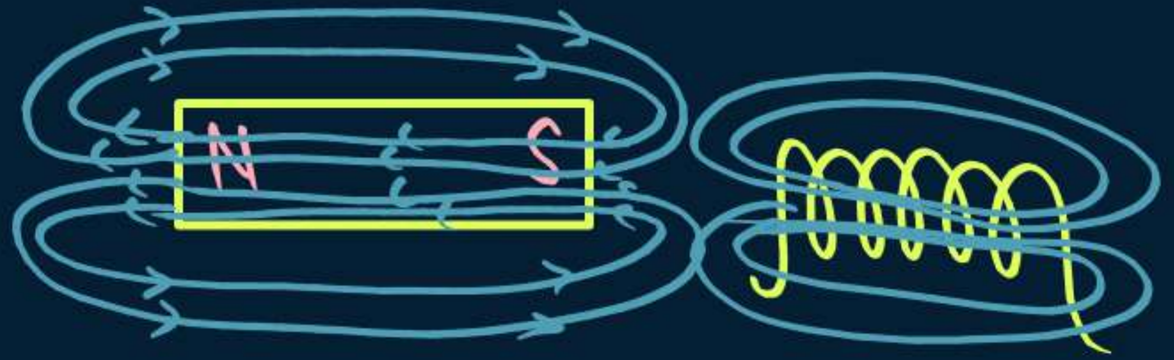
(MFL or MLF)

Mag Lines of Force

1. These are imaginary lines, the tangent to which gives the direction of magnetic field at that point.

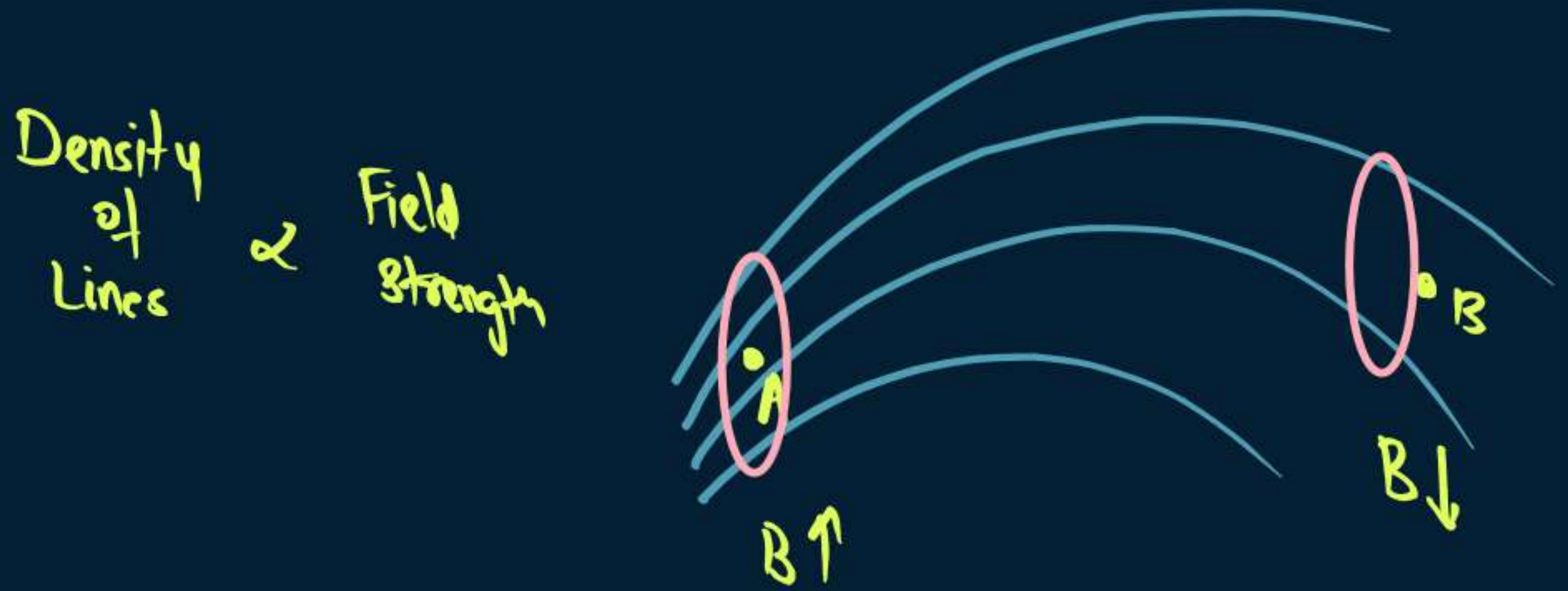
2. Magnetic field lines always form closed loops. They do not have any starting or end point.





3. No two magnetic field lines can intersect each other. Because at the point of intersection, there will be two directions of magnetic field, which is not possible.

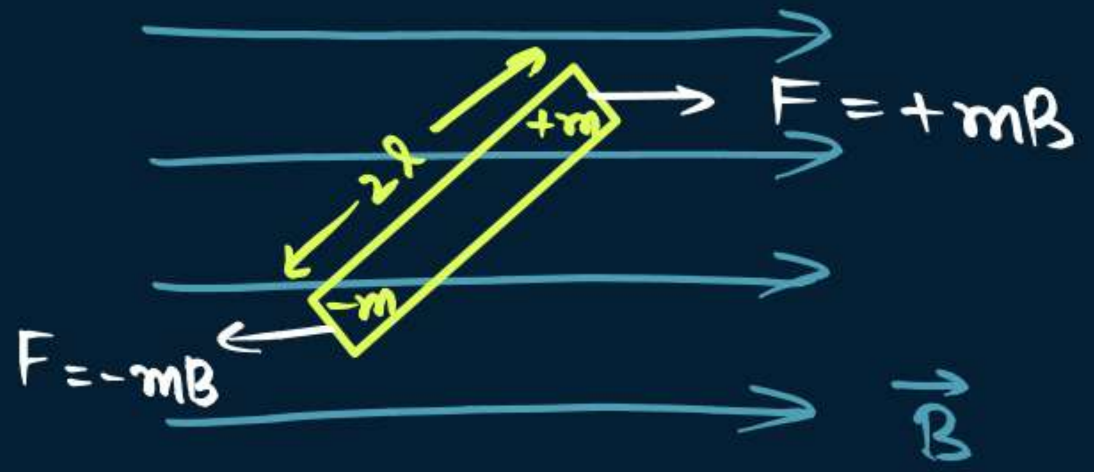
4. Larger the number of field lines crossing per unit area, the stronger is the magnitude of magnetic field B.



5. Inside the bar magnet, the field lines are from south to north, and outside the bar magnet, the field lines are shown north to south.

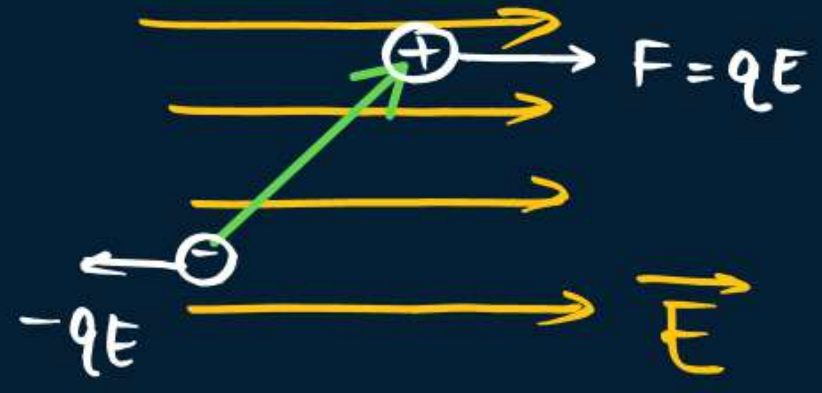
Bar magnet in external field

Ch-1
Y.K.B.



$$\vec{\tau} = \vec{M} \times \vec{B}$$
$$\tau = MB\sin\alpha$$

$$U = -\vec{M} \cdot \vec{B}$$
$$U = -MB\cos\alpha$$



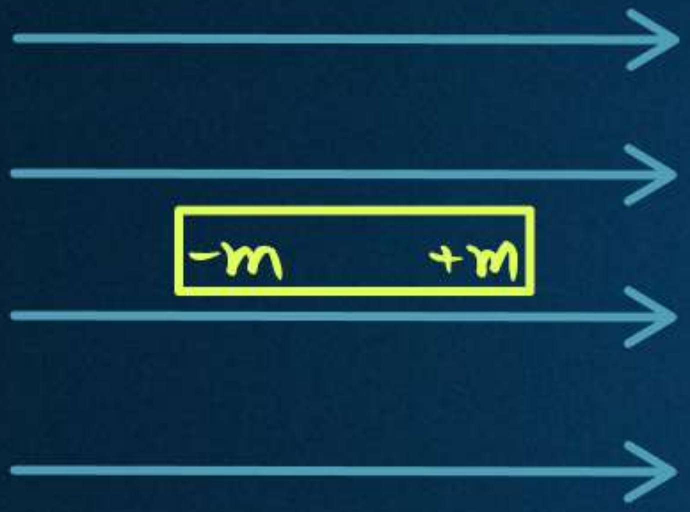
$$\vec{\tau} = \vec{p} \times \vec{E}$$
$$|\tau| = pE\sin\theta$$

$$U = -\vec{p} \cdot \vec{E}$$
$$U = -pE\cos\theta$$

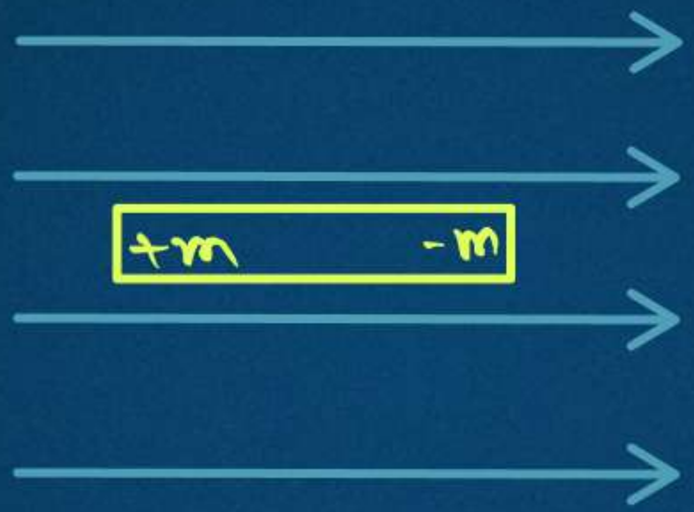
Equilibrium

Stable	Unstable	Neutral
$\alpha = 0^\circ$	$\alpha = 180^\circ$	$\alpha = 90^\circ$
$\vec{\tau} = \vec{m} \times \vec{B}$ $\tau = mB\sin\alpha$ $= mB\sin 0^\circ$ $\tau = 0$	$\vec{\tau} = \vec{m} \times \vec{B}$ $\tau = mB\sin\alpha$ $= mB\sin 180$ $\tau = 0$	$\vec{\tau} = \vec{m} \times \vec{B}$ $\tau = mB\sin\alpha$ $= mB\sin 90$ $\tau_{max} = mB$
$U = -\vec{m} \cdot \vec{B}$ $U = -mB\cos\alpha$ $U = -mB\cos 0^\circ$ $U = -mB$	$U = -\vec{m} \cdot \vec{B}$ $U = -mB\cos\alpha$ $= -mB\cos 180$ $U = -mB(-1)$ $U = +mB$	$U = -\vec{m} \cdot \vec{B}$ $U = -mB\cos\alpha$ $= -mB\cos 90$ $U = 0$

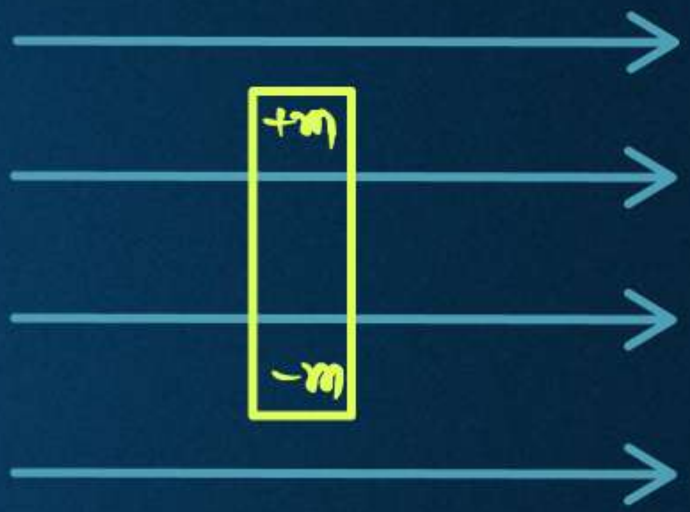
Stable eq



Unstable eq

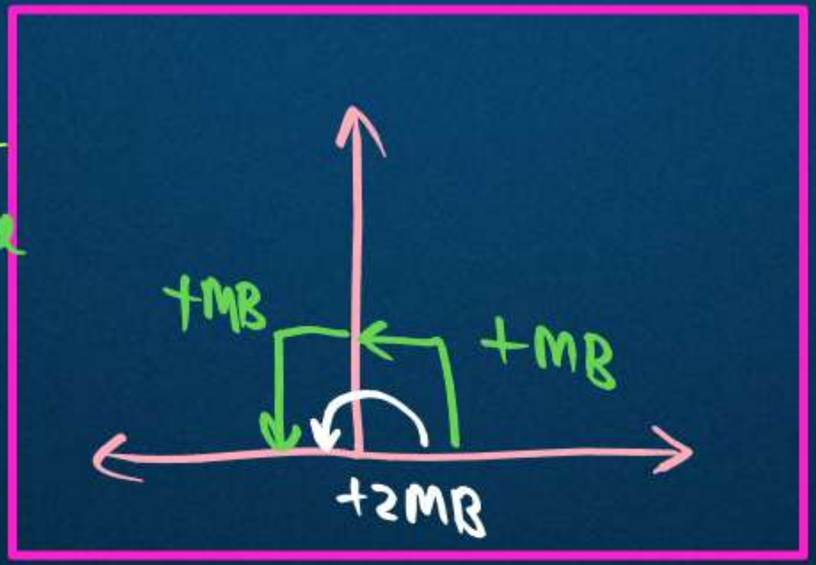


Neutral eq



RDx

Workdone



QUESTION

A short bar magnet of magnetic moment 0.4 J T^{-1} is placed in a uniform magnetic field of 0.16 T. The magnet is in unstable equilibrium when the potential energy is

(A) 0.064 J

(B) – 0.064 J

(C) Zero

(D) – 0.082 J

$U = +mB$

$= 0.4 \times 0.16$

$=$

QUESTION

Work done is taking a magnet from stable equilibrium position to unstable equilibrium position in external magnetic field is

(A) 2 MB

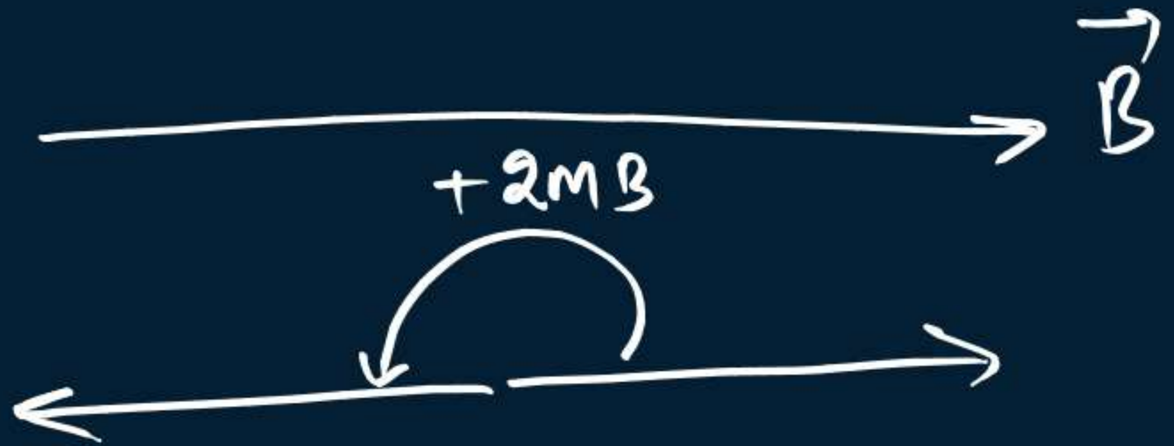
(B) −2 MB

(C) MB

(D) − MB

$W = +2MB$

$W =$



Gauss Law in Magnetism

No Fayda

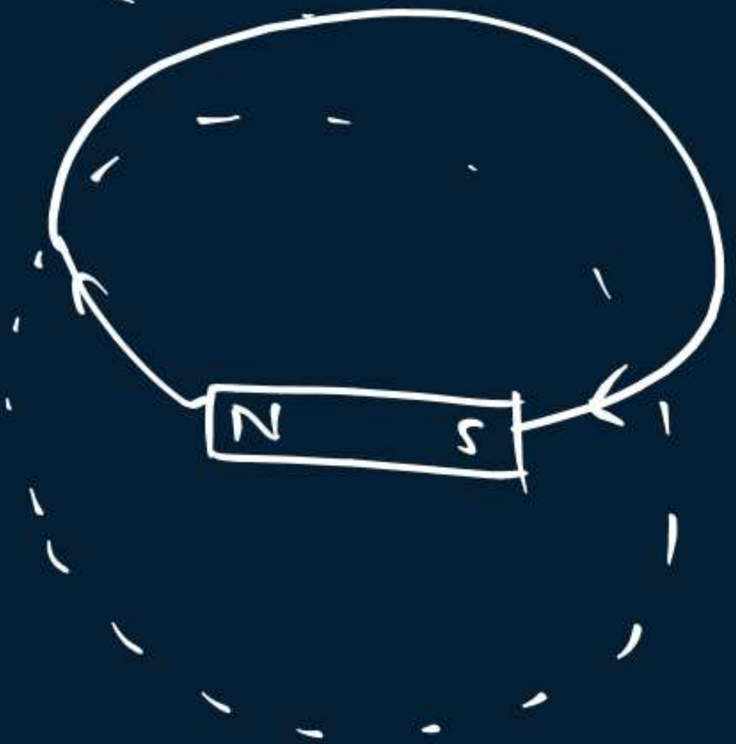
↓

Monopoles do not exist

Gaussian surface

$$\phi = \frac{q_{enc}}{\epsilon_0}$$

$$= \frac{+q-q}{\epsilon} = 0$$



$$\boxed{\oint \vec{B} \cdot d\vec{A} = 0}$$

Monopoles do not exist

Y.K.B.

Ch-1

$$\oint \vec{E} \cdot d\vec{A} = \phi = \frac{q_{enc}}{\epsilon_0}$$

Homework

Notes

Revision of ch-1

Revise !!!

DPP (Try)

PARISHRAM

2026

Lecture - 02

Magnetism and Matter

PHYSICS LECTURE - 2

BY - RAKSHAK SIR

Topics *to be covered*

- **A** Magnetic Materials ki charcha.
- **B** Temperature Dependence
- **C**
- **D**

Magnetic Materials $\neq$ Magnets

are affected by Magnetism.

Paramagnetic | Diamagnetic | Ferromagnetic

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* Terminology

i) Magnetizing Intensity (H)

ii) Intensity of Magnetization (I)

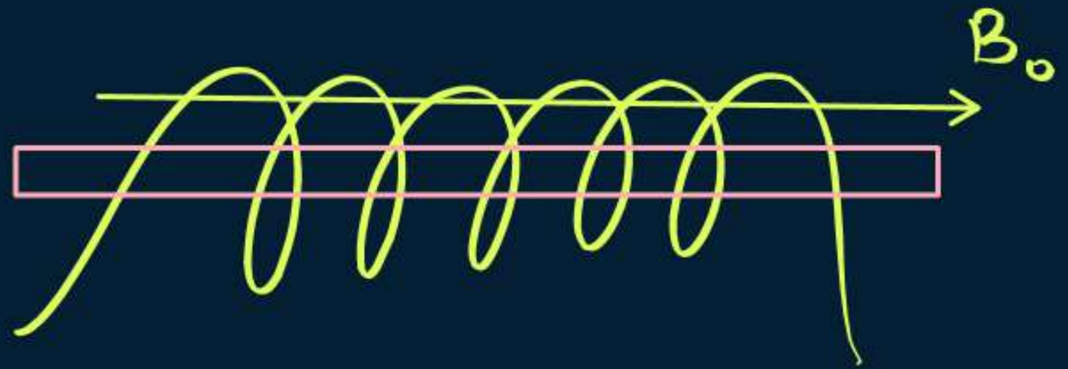
iii) Permeability (μ)

iv) Susceptibity (χ_B)

$\hookrightarrow$ Chi (Kai)

Important Terminologies –
1. Magnetizing Intensity (H)

Ability of a solenoid to magnetize others.



$$B_0 = \mu_0 \boxed{ni}$$

$$B_0 = \mu_0 H$$

$$\boxed{H = ni}$$

$$\frac{N}{\ell} \times i \longrightarrow \frac{\text{Ampere}}{\text{Metre}}$$

SI unit of H :- Ampere $(\text{metre})^{-1}$

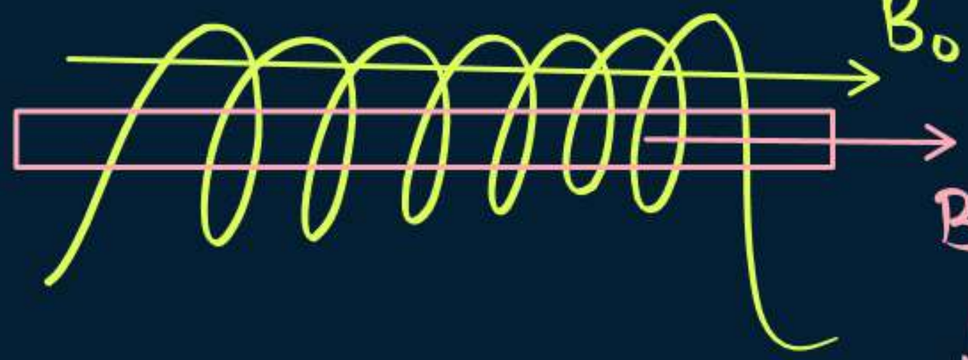
$= Am^{-1}$

2. Magnetization Intensity / Intensity of Magnetization (I)

Ability of a material to get magnetized.

Magnetic field Applied (Solenoid)

$B_0 = \mu_0 H$



$B_m = \mu_0 I$

Magnetic field produce (material)

$$\boxed{I = \frac{M}{Vol} = \frac{m \times \cancel{l}}{A \times \cancel{l}} = \frac{m}{A}} \rightarrow \frac{A\,\cancel{m}}{m^{\cancel{2}}}$$

SI unit of I $\longrightarrow \frac{\text{Ampere}}{\text{Metre}}$

$\longrightarrow Am^{-1}$

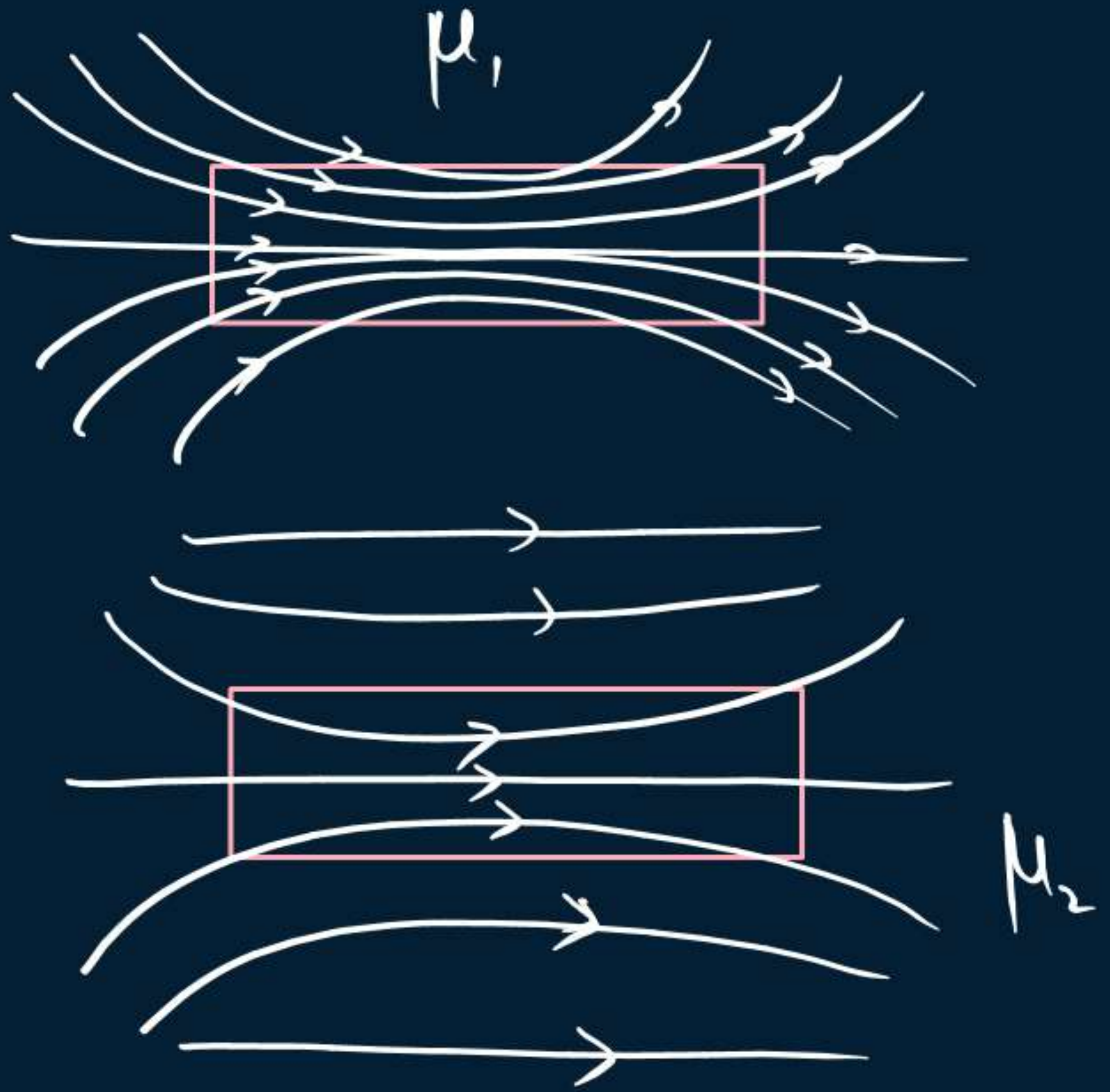
3. Magnetic Permeability(μ)

$\mu \uparrow$ No. of M.F.L. $\uparrow$ Acha Magnet $\uparrow$

$\mu_0 \rightarrow$ permeablity of free space

$\mu \rightarrow$ permeability of medium

It measures that how many magnetic field lines can penetrate inside the material.



$$\boxed{\mu_r = \frac{\mu}{\mu_0}}$$

$\mu \rightarrow$ med

$\mu_0 \rightarrow$ free space

$\mu_r \rightarrow$ relative permeability (No Unit)

$(\mu_1 > \mu_2)$

Y.K.B (ch-1)

$\epsilon = K\epsilon_0$

$\epsilon = \epsilon_r \epsilon_0$

$$\boxed{\epsilon_r = \frac{\epsilon}{\epsilon_0}}$$

ϵ_0 - permittivity of free space

$\epsilon \rightarrow$ permittivity of med

$\epsilon_r \rightarrow$ Relative permit" OR

Or

$K \rightarrow$ Di-electric constant

4. Magnetic Susceptibility (χ) → Sensitivity ↑

The ratio of magnetization intensity (I) to the magnetizing intensity (H).

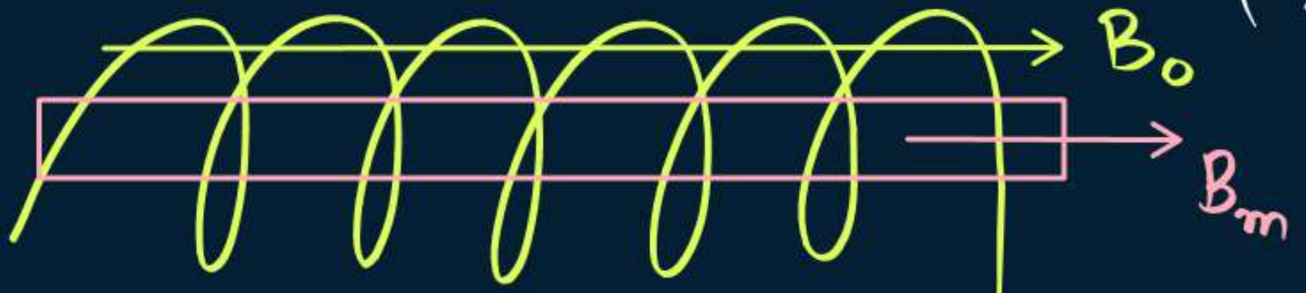
$$\boxed{\chi = \frac{I}{H}} \quad \frac{I \to \cancel{Am^{-1}}}{H \to \cancel{Am^{-1}}}$$

↓

No Unit

Relation between susceptibility and permeability

(χ) (μ_r)



Teacher ← $B_0 = \mu_0 H$

Student ← $B_m = \mu_0 I$

Total ← $B_{net} = \mu H$

$$\vec{B}_{net} = \vec{B}_0 + \vec{B}_m$$

$$\mu H = \mu_0 H + \mu_0 I$$

$$\mu H = \mu_0 (H + I)$$

$$\frac{\mu}{\mu_0} H = H + I$$

$$\frac{\mu}{\mu_0} = \frac{\cancel{H}^1}{\cancel{H}_1} + \frac{I}{H}$$

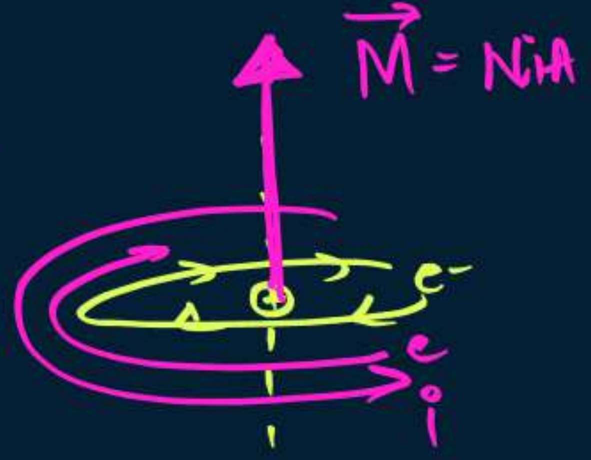
यानि $\boxed{\mu_r = 1 + \chi}$

Magnetic Materials –
a) Paramagnetic Materials

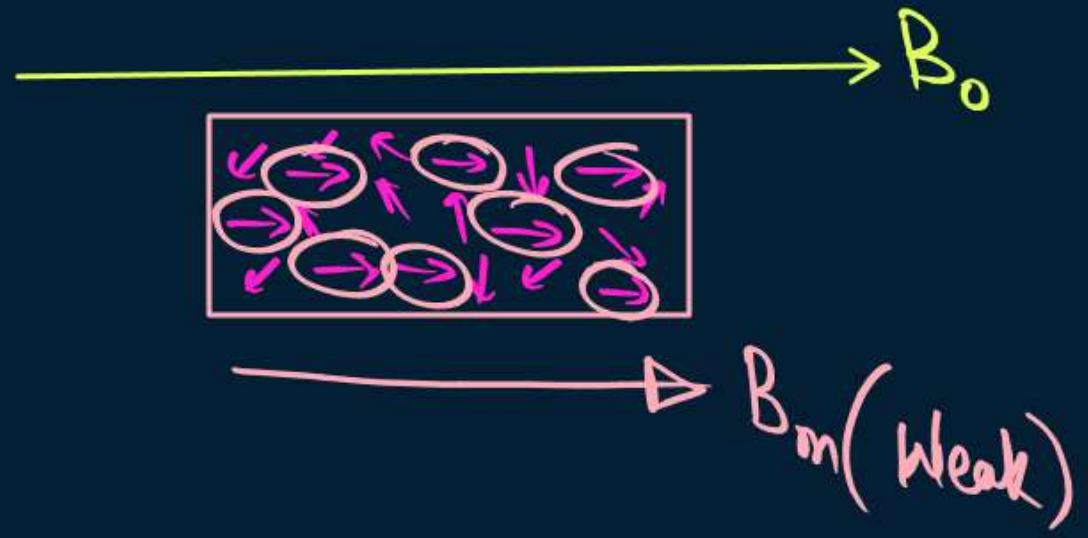
Attract (Weak)

- Have unpaired electrons. ↑↓ | ↑↓ | ↑ → $M_{indi} \neq 0$

  $M_{net} = 0$



- This is due to the spin of electrons.
- The individual atoms (or ions or molecules) of a paramagnetic material possess a permanent magnetic dipole moment of their own. But due to random thermal motion, net dipole moment is seen to be zero.



b) Diamagnetic Materials

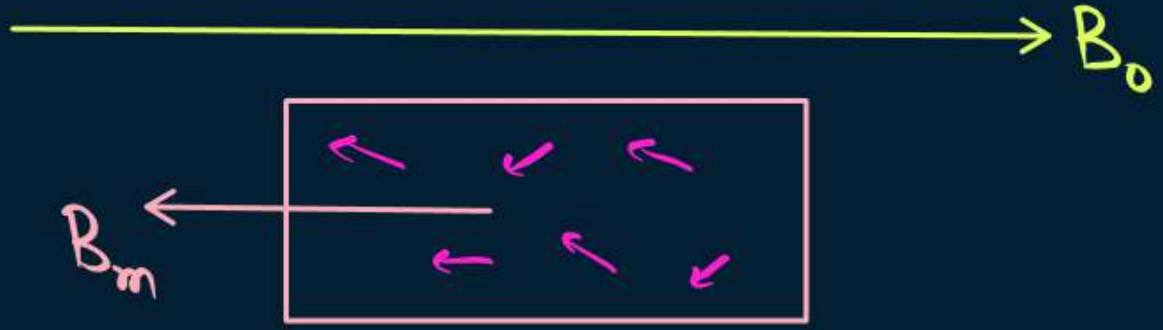
Repel (Weak)

- No unpaired electrons.

- This is due to the orbital motion of electrons.
- There is no individual or overall magnetic moment.

$M_{indi} = 0$

$M_{net} = 0$



c) Ferromagnetic Materials

Attract (strong)

- Higher amount of paramagnetism.

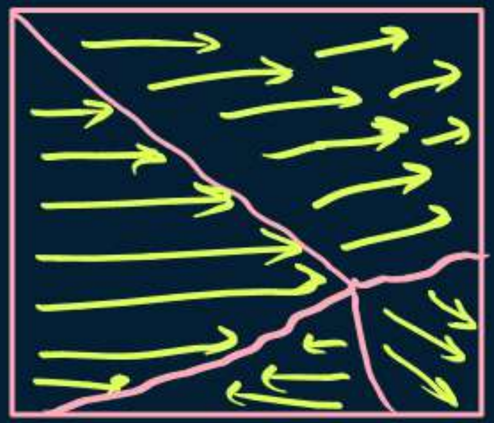
$M_{indi} \neq 0$

$M_{net} = 0$

- The individual atoms (or ions or molecules) in a ferromagnetic material possess a dipole moment as in a paramagnetic material. However, they interact with one another in such a way that they spontaneously align themselves in a common direction over a macroscopic volume called domain. The explanation of this cooperative effect requires quantum mechanics and is beyond the scope

Groupism

B_0



$M_{indi} \neq 0$

$M_{net} \neq 0$

QUESTION

$\mu_d = 0$ $\mu_p \neq 0$

If the magnetic dipole moment of an atom of diamagnetic material, paramagnetic material and ferromagnetic material are denoted by μd, μp and μf respectively, then **[2005]**

(A) $\mu_d = 0$ and $\mu_p \neq 0$

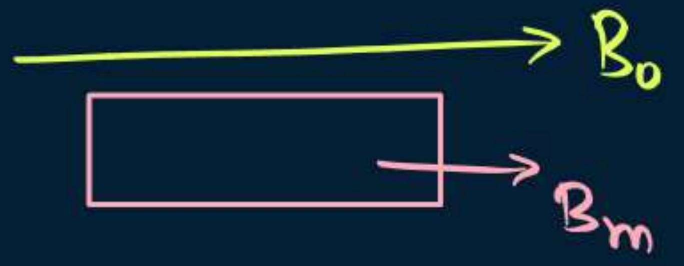
(B) $\mu_d \neq 0$ and $\mu_p = 0$

(C) $\mu_p = 0$ and $\mu_f \neq 0$

(D) $\mu_d \neq 0$ and $\mu_f \neq 0$.

(a) Paramagnetic

1. The get feebly (weakly) magnetized in the direction of magnetic field.



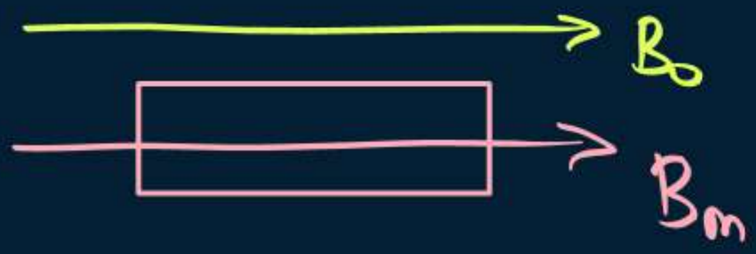
$B_0 >> B_m$

(b) Diamagnetic

1. The get feebly (weakly) magnetized in the direction opposite to magnetic field.

(c) Ferromagnetic

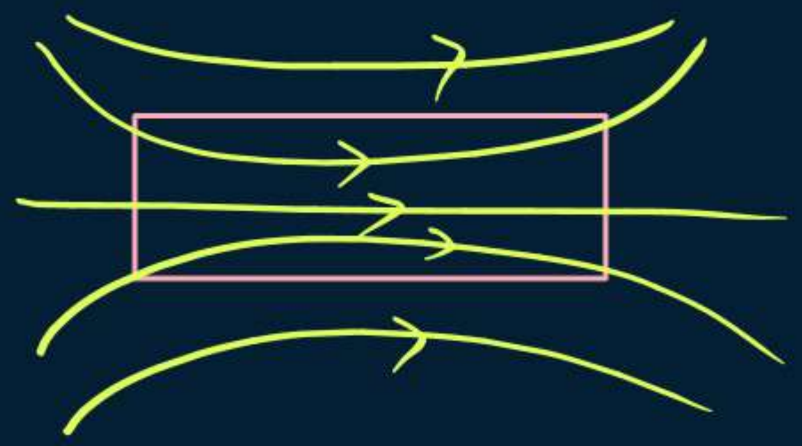
1. The get strongly magnetized in the direction of magnetic field.



(a) Paramagnetic

2. The net magnetic field due to these materials increases slightly.

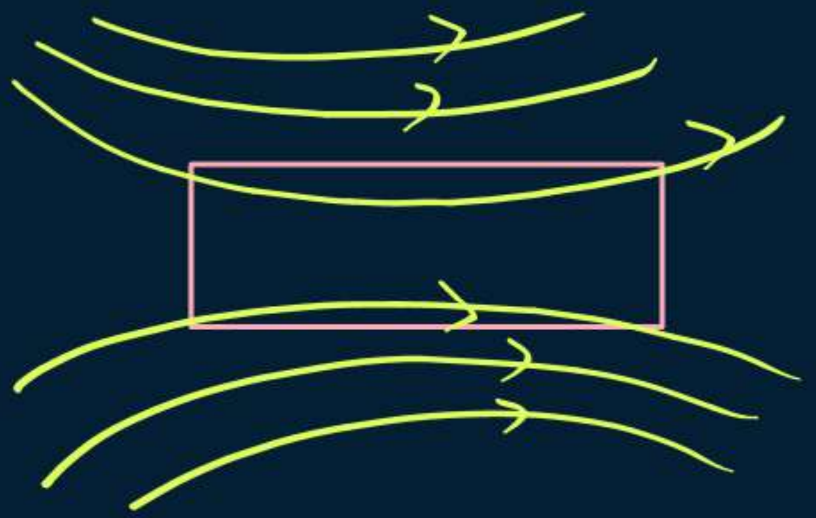
3. $\mu_r > 1$



(b) Diamagnetic

2. The net magnetic field due to these materials decreases slightly.

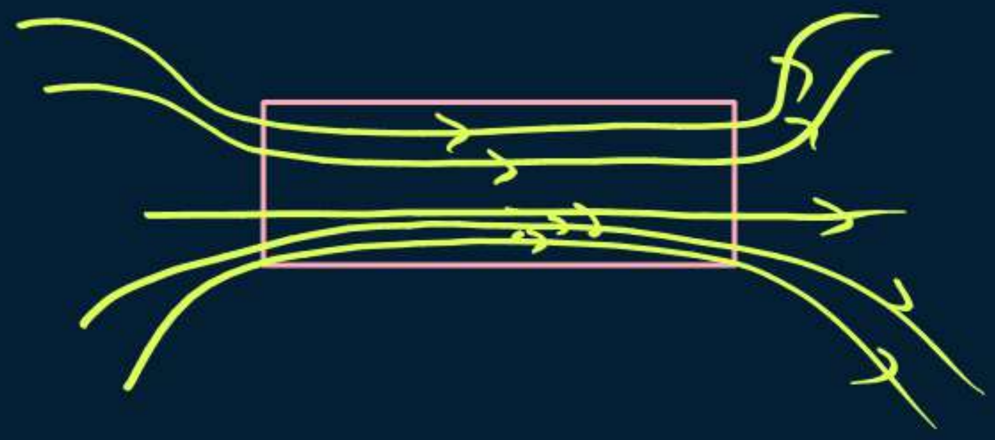
3. $\mu_r < 1$



(c) Ferromagnetic

2. The net magnetic field due to these materials increases by a large amount.

3. $\mu_r >> 1$



(a) Paramagnetic

4. Magnetic field lines are weakly attracted or they are weakly attracted by magnetic field.

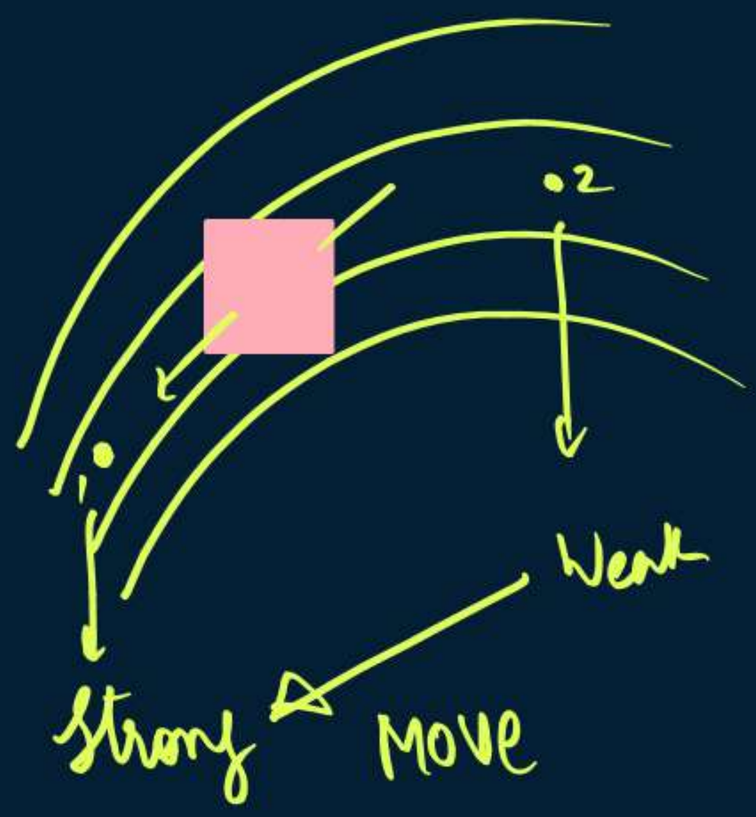
(b) Diamagnetic

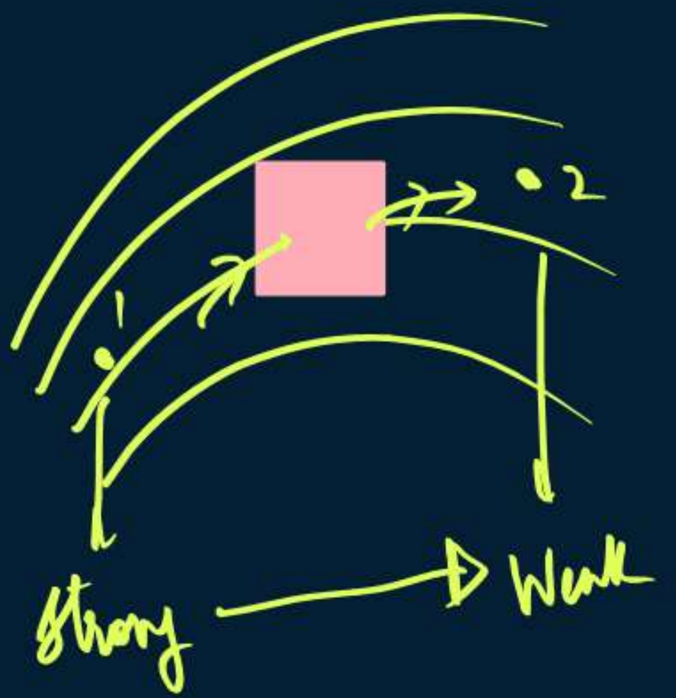
4. Magnetic field lines are weakly repelled or they are weakly repelled by magnetic field.

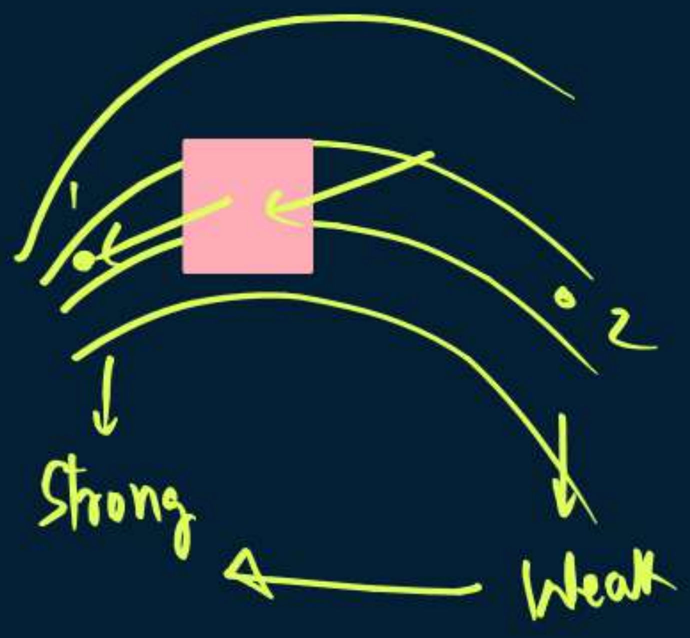
(c) Ferromagnetic

4. Magnetic field lines are strongly attracted or they are strongly attracted by magnetic field.

(a) Paramagnetic	(b) Diamagnetic	(c) Ferromagnetic
5. They have a tendency to move from region of weak magnetic field to strong magnetic field.	5. They have a tendency to move from region of strong magnetic field to weak magnetic field.	5. They have a strong tendency to move from region of weak magnetic field to strong magnetic.







(a) Paramagnetic

6. Susceptibility slightly positive.

$\mu_r > 1$

$1 + \chi > 1$

$\chi > 0 \rightarrow \chi = +0.002$

+ve

7. eg – Al, Cr

(b) Diamagnetic

6. Susceptibility slightly negative.

$\mu_r < 1$

$1 + \chi < 1$

$\chi < 0$ $\quad \chi = -0.004$

−ve

7. eg – Cu, Pb, Bi, Water

'frog'

(c) Ferromagnetic

6. Susceptibility highly positive

$\mu_r >> 1$

$1 + \chi >> 1$

$\chi >> 0 \rightarrow \chi = 50$

+ve

7. eg – Fe, Ni, Co etc.

QUESTION

If a diamagnetic substance is brought near the north or the south pole of a bar magnet, it [2009, 1999]

A) Repelled by the north pole and attracted by the south pole

B) Attracted by the north pole and repelled by the south pole

C) Attracted by both the poles

D) Repelled by both the poles

QUESTION

A diamagnetic material in a magnetic field moves [2003]

A. From stronger to the weaker parts of field

B. From weaker to the stronger parts of the field

C. Perpendicular to the field

D. In none of the above directions

QUESTION

Domain formation is the necessary feature of

A. Diamagnetism

B. Paramagnetism

C. Ferromagnetism

D. All of these

QUESTION

The magnetic susceptibility is negative for [2016]

A. Ferromagnetic material only

B. Paramagnetic and ferromagnetic materials

C. Diamagnetic material only

D. Paramagnetic material only

QUESTION

There are four light-weight-rod samples A, B, C, D separately suspended by threads. A bar magnet is slowly brought near each sample and the following observations are noted

(i) A is feebly repelled (ii) B is feebly attracted

(iii) C is strongly attracted (iv) D remains unaffected [2011]

A. B is of a paramagnetic material

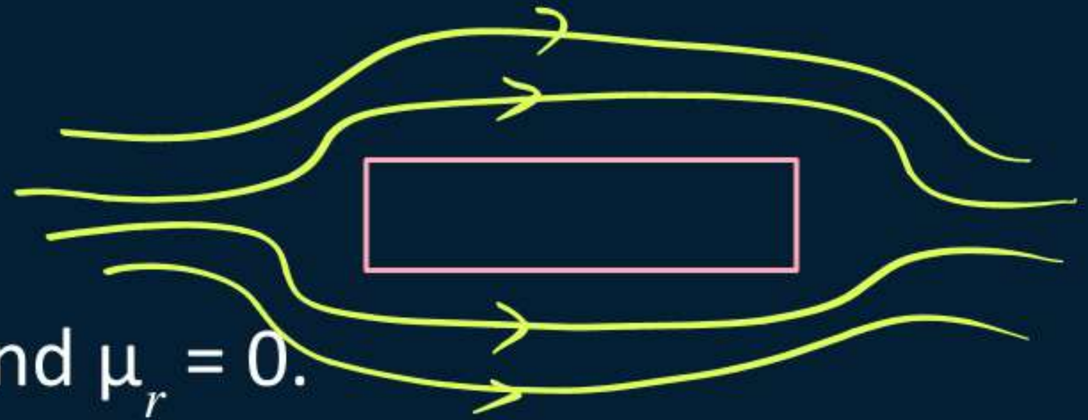
B. C is of a diamagnetic material

C. D is of a ferromagnetic material

D. A is of a non – magnetic material

Superconductors

$T\downarrow$ $R\downarrow$ $i\uparrow$



- Very low temperatures
- Perfect conductivity and perfect diamagnetism.
- Here the field lines are completely expelled! $\chi = -1$ and $\mu_r = 0$.

- A superconductor repels a magnet and (by Newton's third law) is repelled by the magnet.
- Meissner effect
- Magnetically levitated superfast trains.

Homework

Notes

Revision

Practice session

Thank You

PARISHRAM

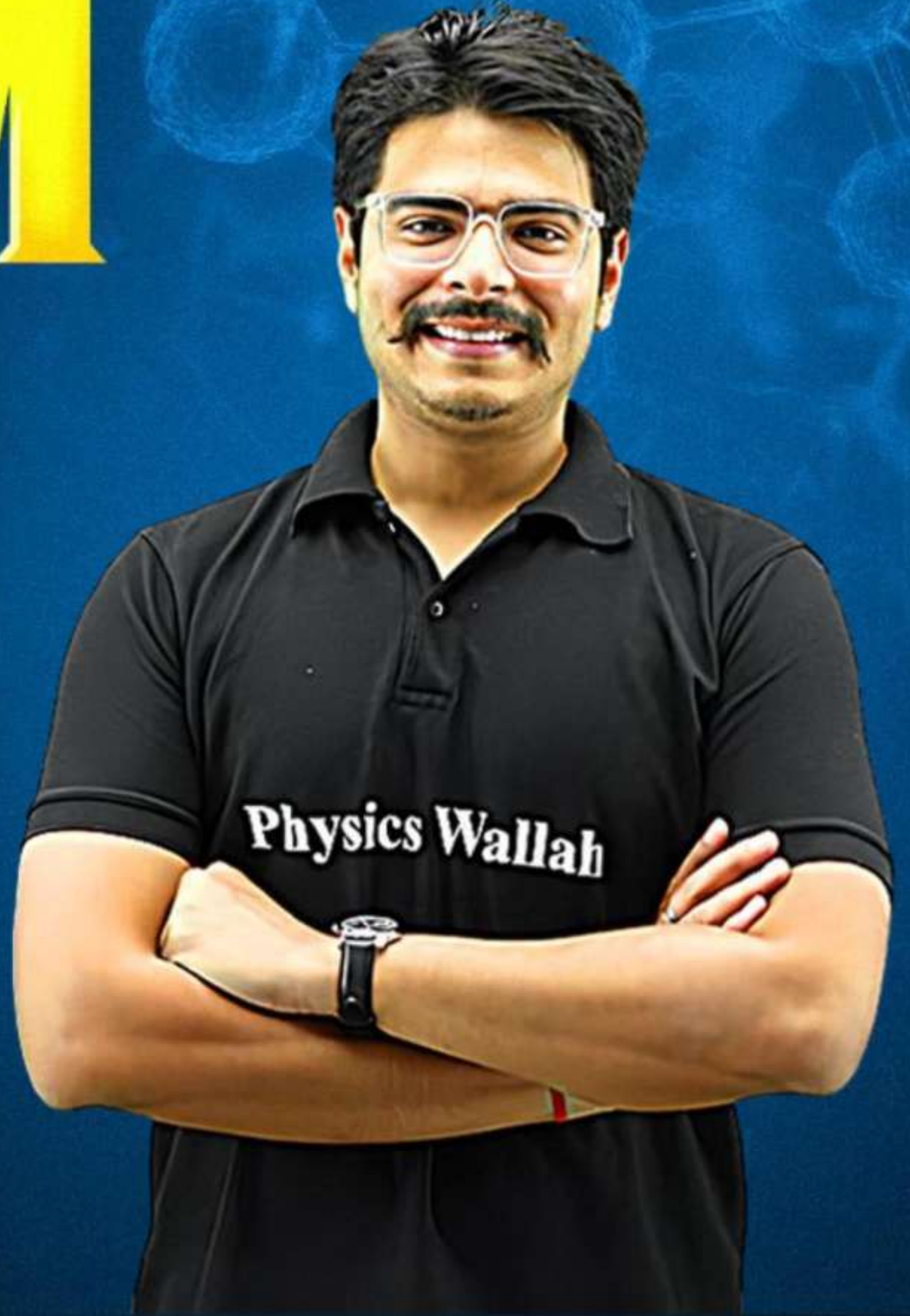
2026

Lecture - 03

Magnetism and Matter

PHYSICS LECTURE - 3

BY - RAKSHAK SIR



Topics *to be covered*

A # Effect of Temperature

B # Practice Session

C # Temperature Dependence

D #

QUESTION

Which one of the following has relative magnetic permeability between 0 and 1?

[2023]

A Aluminium

B Alnico

C Water

D Sodium

$0 < \mu_r < 1$

$\downarrow$

Diamagnetic

QUESTION

μ μ_0

Which of the following has its permeability less than that of free space? [2023]

A Copper

B Aluminium

C Copper chloride

D Nickel

$\mu < \mu_0$

$\frac{\mu}{\mu_0} < 1$

$\mu_r < 1 \rightarrow$ Diamagnetic

QUESTION

$H\uparrow$ μ ?

If the magnetizing field on a ferromagnetic material is increased. Its permeability

[2022-23]

A decreases

B increases

C remains unchanged

D first decreases and then increases

$\mu\downarrow = \frac{B\nearrow}{H\uparrow}$

$B = \mu(ni)$

$B = \mu H$

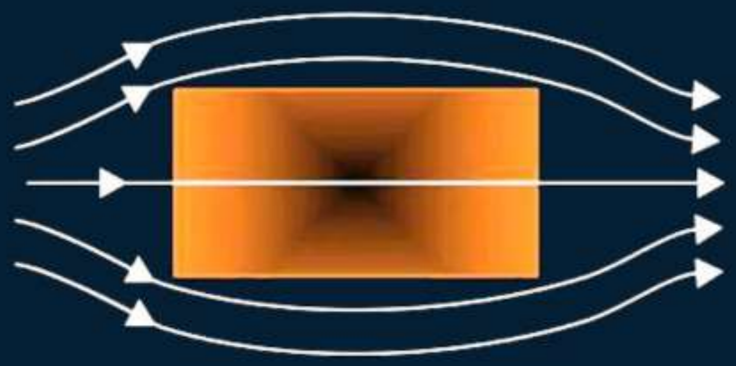
QUESTION

A uniform magnetic field gets modified as shown in figure when two specimens A and B are placed in it.

(i) Identify the specimen A and B.

(ii) How is the magnetic susceptibility of specimen A different from that of specimen B?

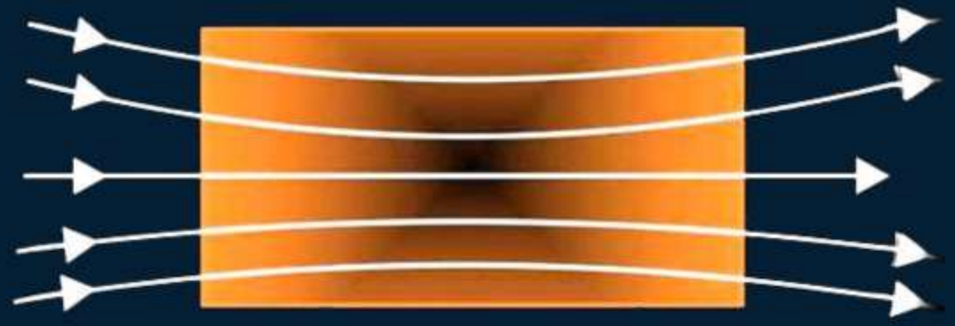
[2020-23]



(a)

Dia

$(\chi < 0)$



(b)

Ferro

$(\chi >> 0)$

QUESTION

Y.K.B. $\boxed{W = \Delta U = pE(\cos\theta_i - \cos\theta_f)}$

$W = \Delta U = MB(\cos\theta_i - \cos\theta_f)$

A current carrying circular loop of magnetic moment $\vec{M}$ is suspended in a vertical plane in an external magnetic field $\vec{B}$ such that its plane is normal to $\vec{B}$. The work done in rotating this loop by 45° about an axis perpendicular to $\vec{B}$ is closest to [2024]

(A) –0.3 MB

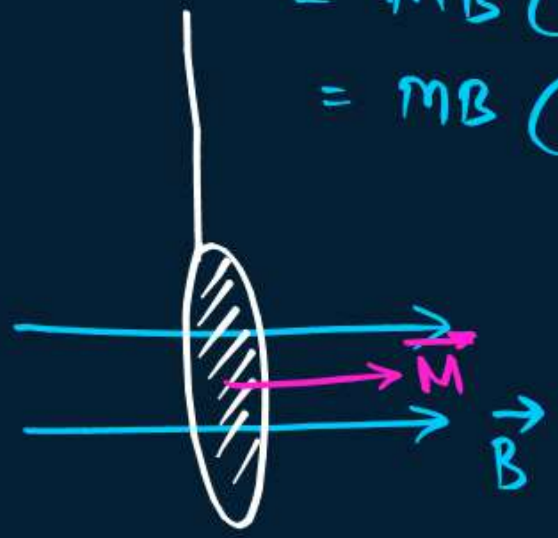
(B) 0.3 MB

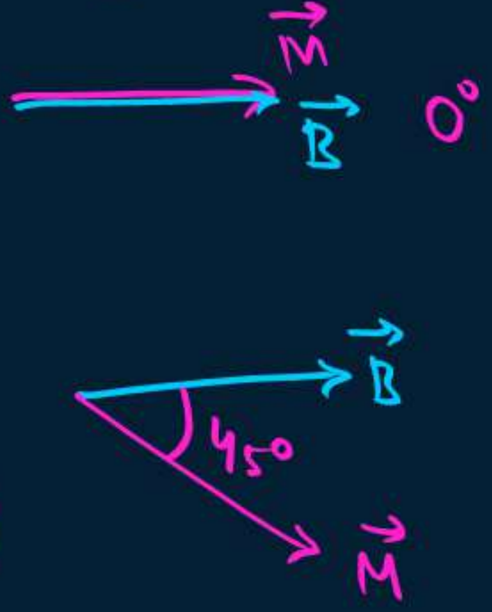
(C) –1.7 MB

(D) 1.7 MB

$= MB(\cos 0° - \cos 45°)$

$= MB\left(1 - \frac{1}{\sqrt{2}}\right)$





$\vec{\tau} = \vec{M} \times \vec{B} = MB\sin 0°$

$\tau = 0$

$MB\frac{(0.4)}{(1.4)}$

$MB \times \left(\frac{4}{14}\right)$

$MB \times 0.3$

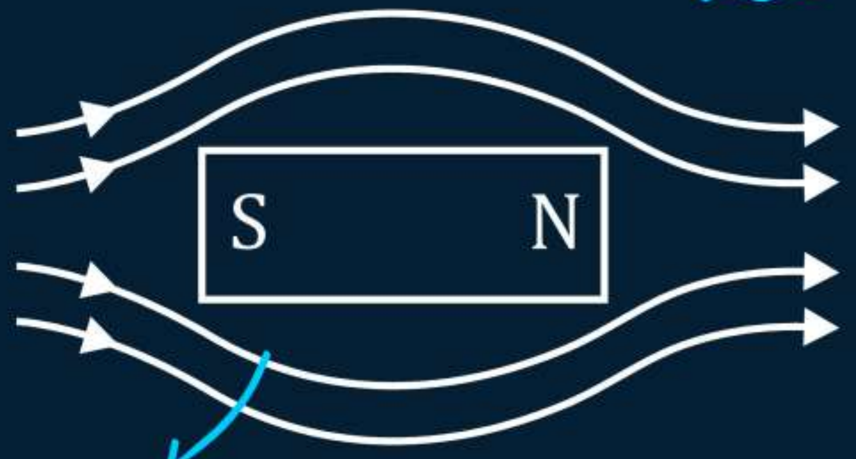
$= MB\left(\frac{\sqrt{2}-1}{\sqrt{2}}\right)$

$= MB\left(\frac{1.414-1}{1.414}\right)$

$\tau = MB\sin 45 = \frac{MB}{\sqrt{2}}$

QUESTION

Which of the following cannot modify any external magnetic field as shown in the figure? **[2023]**



Diamagnetic

(A) Nickel

(B) Silicon

(C) Sodium Chloride

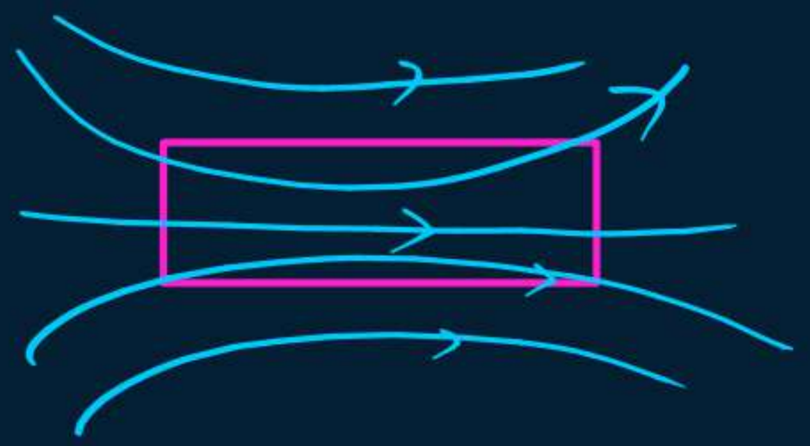
(D) Copper

QUESTION

$0 < \chi < 1$: Paramagnetic

The susceptibility of a magnetic material is 0.9853.

Identify the type of magnetic material. Draw the modification of the field pattern on keeping a piece of this material in a uniform magnetic field. **[2018]**



QUESTION

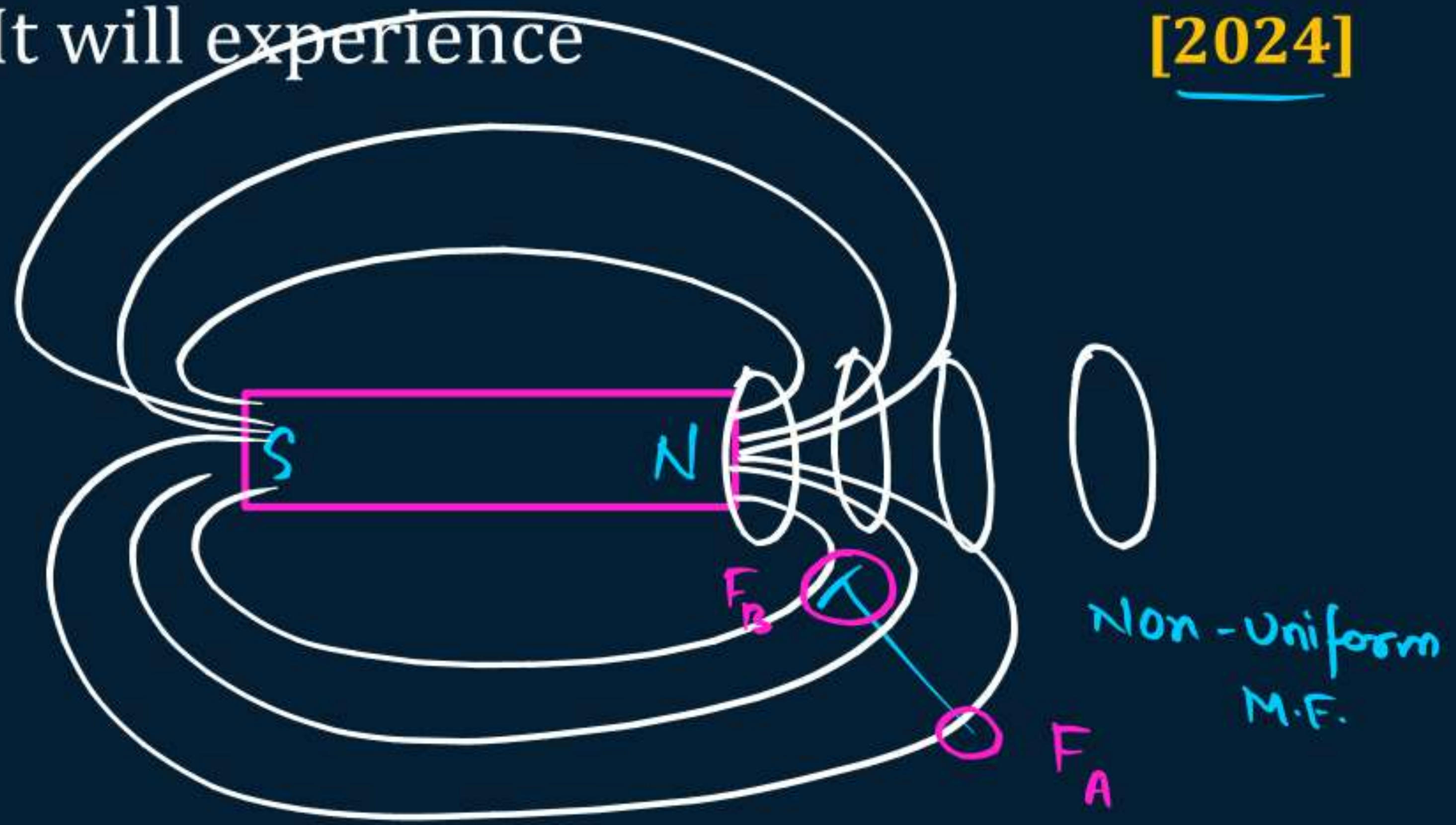
An iron needle is kept near a strong bar magnet. It will experience **[2024]**

A a force of attraction and no torque.

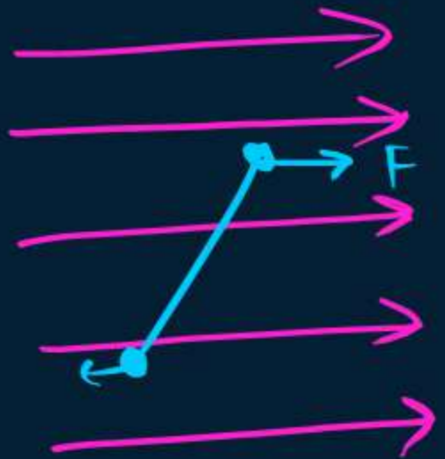
B a force of attraction and a torque.

C a torque and no force.

D neither a force nor a torque.



$F_B > F_A$



QUESTION

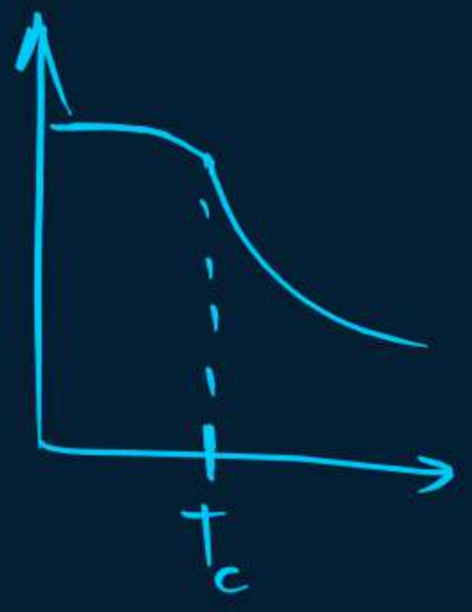
Above Curies temperature, *a* [2020]

(A) ferromagnetic material become diamagnetic

(B) ferromagnetic material become paramagnetic

(C) paramagnetic material become ferromagnetic

(D) paramagnetic material becomes diamagnetic



QUESTION

Which of the following statements is correct? [2021-22]

A Magnetic field lines do not form closed loops. F

B Magnetic field lines start from north pole and end at south pole of a magnet.

F

C The tangent at a point on a magnetic field line represents the direction of the magnetic field at that point.

D Two magnetic field lines may intersect each other.

F

QUESTION

Assertion (A): The poles of a bar magnet cannot be separated. T

Reason (R): Magnetic monopoles do not exist. T

[2021-22]

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

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

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

D. (A) Is false and (R) is also false.

QUESTION

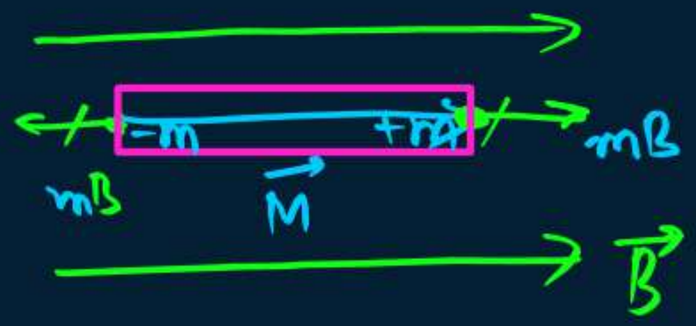
A bar magnet has magnetic dipole moment $\vec{M}$. Its initial position is parallel to the direction of uniform magnetic $\vec{B}$. In this position, the magnitudes of torque and force acting on it respectively are [2021-22]

(A) 0 and MB

(B) MB and MB

(C) 0 and 0

(D) $|\vec{M} \times \vec{B}|$ and 0

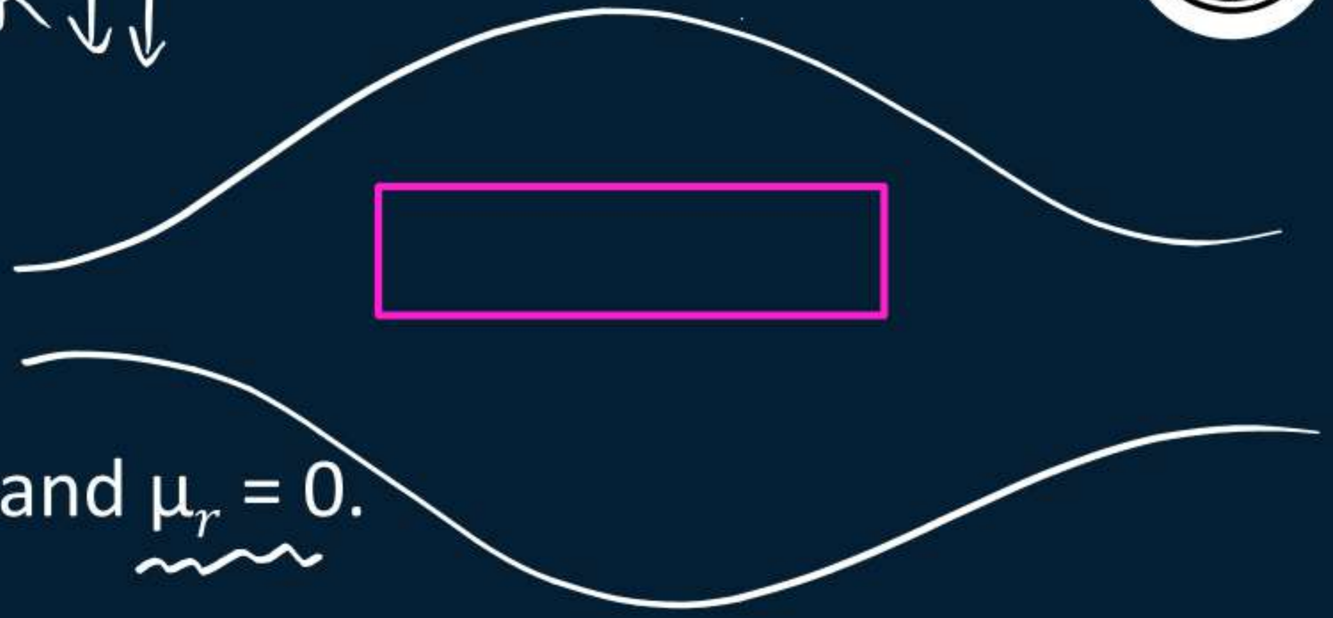


$\tau = M \times B$

$= MB\sin\theta$

$\tau = 0$

Superconductors → i↑↑ R↓↓

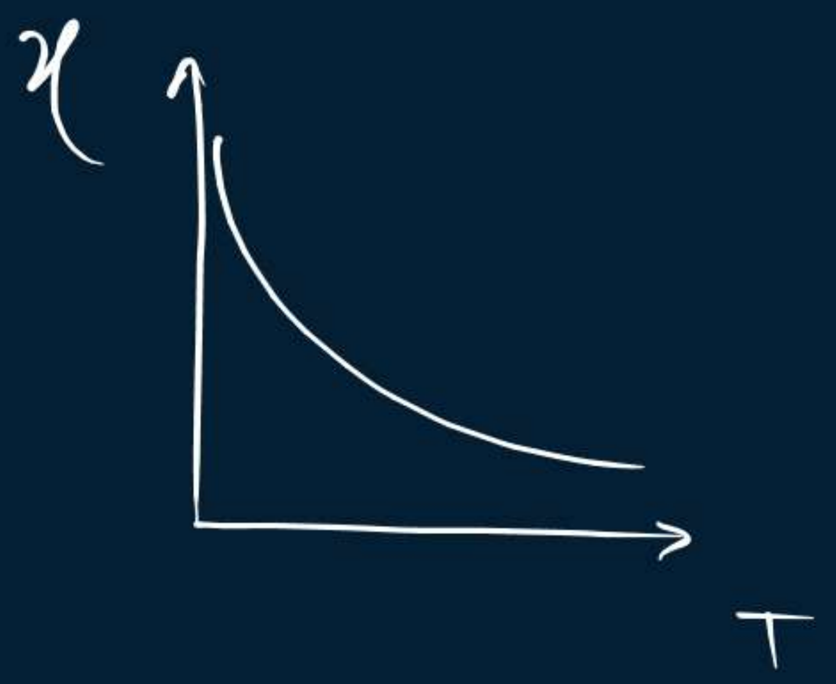


- Very low temperatures T↓↓ R↓↓ i↑↑
- Perfect conductivity and perfect diamagnetism.
- Here the field lines are completely expelled! $\chi = -1$ and $\mu_r = 0$.

- A superconductor repels a magnet and (by Newton's third law) is repelled by the magnet.
- Meissner effect ✓
- Magnetically levitated superfast trains. = Parishram Bharat ✓

Effect of temperature on Magnetic Materials

1. Paramagnetic Materials



$$\chi \downarrow \propto \frac{1}{T} \uparrow$$

$$\boxed{\chi = \frac{C\mu_0}{T}}$$

Curie's Law

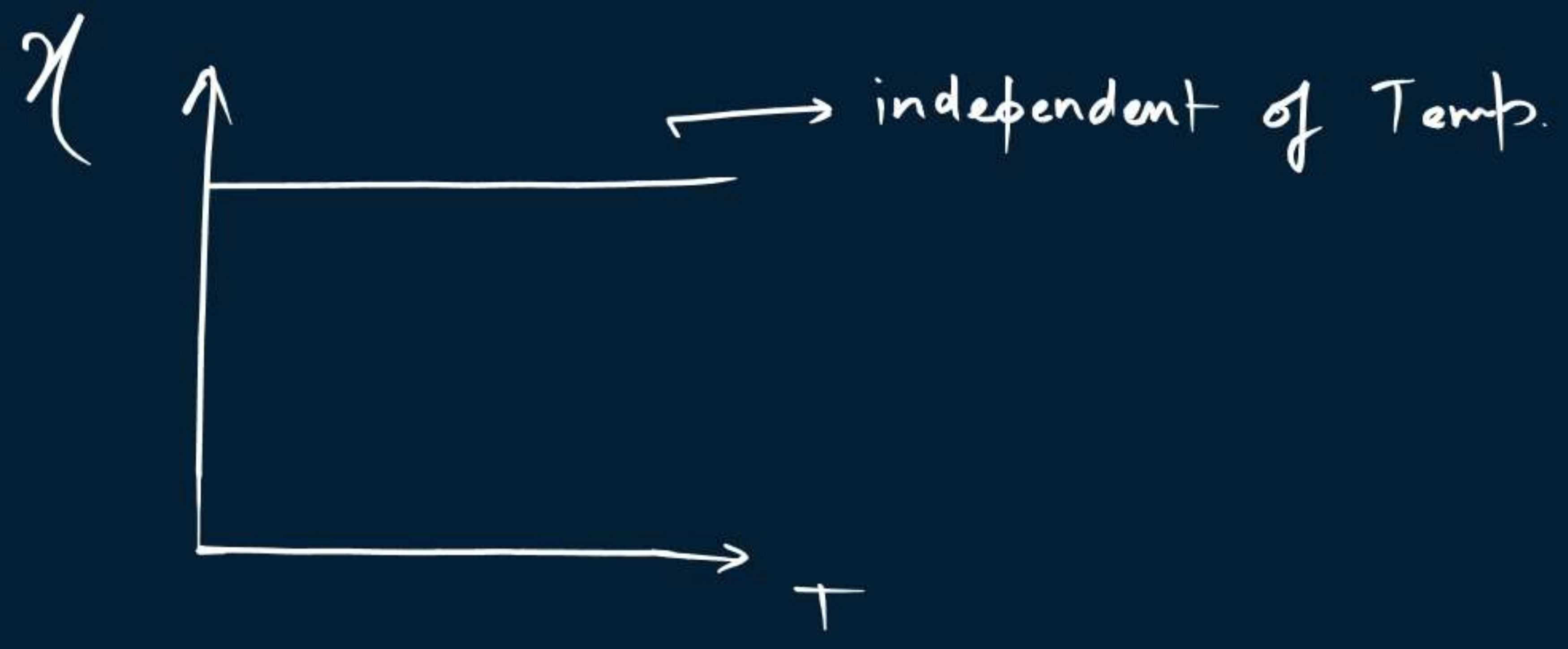
Curie's constant (C)

Kelvin

$$\frac{I}{H} = \frac{C\mu_0}{T}$$

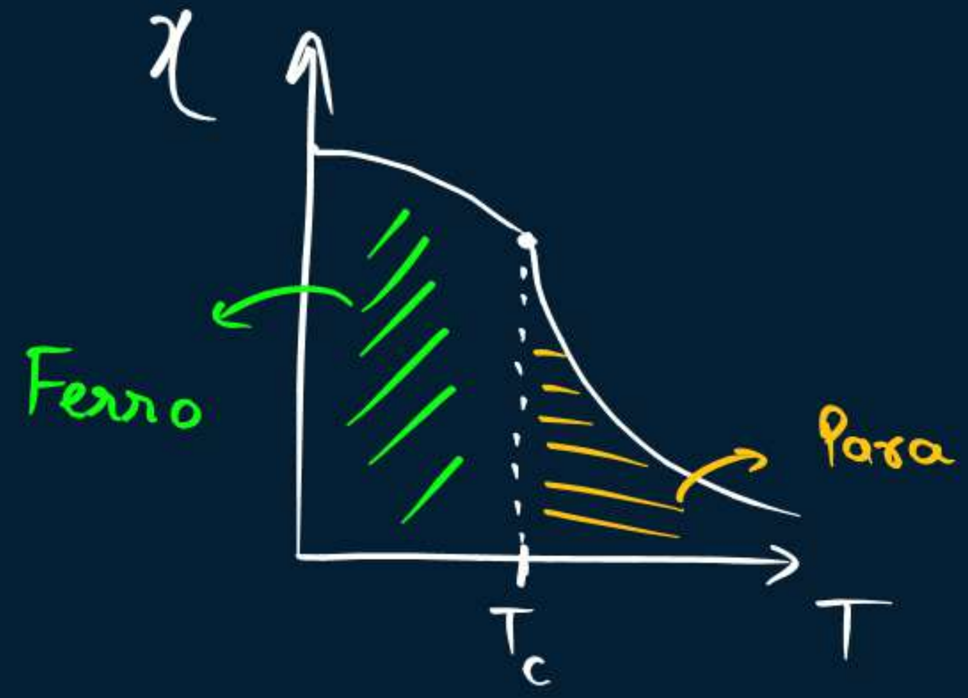
$$I = \frac{C(\mu_0 H)}{T} \longrightarrow \boxed{I = \frac{C B_0}{T}}$$

2. Diamagnetic Materials



3. Ferromagnetic Materials

$\chi \downarrow \quad T \uparrow$



$$\boxed{\chi = \frac{C}{T - T_c}}$$

Curie - Weiss Law

(T_c)

Curie's temperature: The temperature at which ferromagnetic material changes in to paramagnetic material.

QUESTION

Among which the magnetic susceptibility does not depend on the temperature?

χ T

[2001]

A. Diamagnetism

B. Paramagnetism

C. Ferromagnetism

D. Ferrite

QUESTION

Curie temperature above which [2008, 2006]

A. Paramagnetic material becomes ferromagnetic material

B. Ferromagnetic material becomes diamagnetic material

C. Ferromagnetic material becomes paramagnetic material

D. Paramagnetic material becomes diamagnetic material

QUESTION

Susceptibility of a substance at 300 K is –0.00002. Its susceptibility at 600 K is

CUET

Diamagnetic

A –0.00001

B –0.00002

C –0.00004

D –0.00006

QUESTION

A paramagnetic substance of susceptibility 3×10^{-4} is placed in a magnetizing field of 4×10^{-4} Am^{-1}. Then the intensity of magnetization in the units of Am^{-1} is

(A) 1.33×10^{8}

(B) 0.75×10^{-8}

(C) 12×10^{-8}

(D) 14×10^{-8}

$\chi = 3 \times 10^{-4}$

$H = 4 \times 10^{-4}$

$I = ?$

$\chi = \frac{I}{H}$

$\chi H = I$

$3 \times 10^{-4} \times 4 \times 10^{-4}$

12×10^{-8}

QUESTION

Lenz' law

Which of the following property of magnetic material is observed in all the materials?

A Ferromagnetism

B Paramagnetism

C Diamagnetism

D Electromagnetism

Homework

- Revision
- Retry Ques
- NCERT Punch → Solutions –
- Assignment Milega (5^{th} + 6^{th} ch end)