Magnetism and Matter

Question1

The magnetic field (B) inside a long solenoid having ' n ' turns per unit length and carrying current ' i ' when iron core is kept in it, is ($\mu_0 =$ permeability of vacuum, $\chi =$ magnetic susceptibility)

MHT CET 2025 5th May Evening Shift

Options:

A.

$\mu_0 \mathrm{ni}(1+\chi)$

B.

$\mu_0 \mathrm{ni}^2(1+\chi)$

C.

$\mu_0 n i \chi$

D.

$\mu_0 \mathrm{ni}(1-\chi)$

Answer: A

Solution:

Step 1: Recall field in a solenoid without core

For a long solenoid (no core, just vacuum/air inside), the field is:

$B_0 = \mu_0 n i$

where

- μ_0 is permeability of free space,

- n is number of turns per unit length,
- i is the current.

Step 2: Include effect of core material

If a core with magnetic susceptibility χ is introduced, the relative permeability is:

$\mu_r = 1 + \chi$

Thus, the effective permeability is:

$\mu = \mu_0(1 + \chi)$

Step 3: Final expression

Now, the magnetic field becomes:

$B = \mu n i = \mu_0(1 + \chi) n i$

Step 4: Match with options

That matches **Option A**:

$\mu_0 \, n i (1 + \chi)$

✅ **Correct Answer: Option A**

Question2

The work done in turning a magnet of magnetic moment ' M ' by an angle of 90° from the meridian is ' n ' times the corresponding Work done to turn it through an angle of 60° where the value of ' n ' is $(\cos 90^\circ = 0, \cos 60^\circ = 0.5)$

MHT CET 2025 26th April Morning Shift

Options:

A. 0.5

B. 2

C. 0.25

D. 1

Answer: B

Solution:

Work done W in rotating a magnetic field is given by:

$$W = MB(\cos\theta_1 - \cos\theta_2)$$

Work done in turning from 0° to 90°

$$\begin{aligned} W_1 &= MB(\cos 0^\circ - \cos 90^\circ) \\ &= MB(1-0) \\ &= MB \end{aligned}$$

Work done in turning from 0° to 60°

$$\begin{aligned} W_2 &= MB(\cos 0^\circ - \cos 60^\circ) \\ &= MB\left(1-\frac{1}{2}\right) \\ &= \frac{MB}{2} \\ W_1 &= nW_2 \\ \therefore \quad n &= \frac{W_1}{W_2} = \frac{MB}{\frac{MB}{2}} = 2 \end{aligned}$$

Question3

A bar of iron having magnetic moment $2.4 Am^2$ weighs 66 g . If the density of the material of the bar is $7700 \ kg/m^3$, the intensity of magnetisation in Am^{-1} is

MHT CET 2025 26th April Morning Shift

Options:

A. 1.4×10^5

B. 2.8×10^5

C. 1.4×10^4

D. 2.8×10^4

Answer: B

Solution:

Step 1: Find the volume of the iron bar

The volume is found by dividing the mass by the density.

$$V = \frac{\text{mass}}{\text{density}} = \frac{66\times10^{-3}}{77\times10^{2}} = \frac{6}{7} \times 10^{-5} \text{ m}^3$$

Step 2: Use the magnetic moment and volume to find magnetization

Magnetization (M) is found by dividing the magnetic moment by the volume:

$$M = \frac{\text{magnetic moment}}{\text{volume}} = \frac{2.4}{\frac{6}{7}\times10^{-5}}$$

Step 3: Calculate the final value

When you do the calculation, you get:

$$M = 2.8 \times 10^5 \text{ A/m}$$

Question4

To protect the instrument from magnetic field, it is completely surrounded by

MHT CET 2025 25th April Evening Shift

Options:

A. soft ferromagnetic substance.

B. diamagnetic substance only.

C. paramagnetic substance only.

D. both diamagnetic and paramagnetic substances.

Answer: A

Solution:

Reasoning:

- To shield from magnetic fields, materials with **high magnetic permeability** are used, because they provide a low reluctance path to magnetic lines of force and prevent them from entering the protected region.
- Such materials are **soft ferromagnetic substances** (like soft iron, mu-metal).
- Diamagnetic or paramagnetic materials alone are not effective in providing shielding from magnetic fields.

✅ Correct Answer:

Option A: soft ferromagnetic substance.

Question5

Magnetic hysteresis is exhibited by magnetic materials which are

MHT CET 2025 22nd April Evening Shift

Options:

A. only paramagnetic

B. only diamagnetic

C. only ferromagnetic

D. both para and ferromagnetic

Answer: C

Solution:

Step 1: Recall what hysteresis means

- Magnetic hysteresis refers to the lag between magnetization (M) and the applied magnetic field (H).
- When a ferromagnetic material is magnetized and then the field is removed, it retains residual magnetization (remanence). To demagnetize, a reverse field (coercivity) must be applied.
- This hysteresis loop is a characteristic property of **ferromagnetic materials**.

Step 2: Analyze the options

- **Paramagnetic:** Do not show hysteresis. Magnetization disappears instantly when external field is removed.
- **Diamagnetic:** Weak and opposite response, no hysteresis.

- **Ferromagnetic:** Show hysteresis because of domain alignment and tendency to retain magnetization.
- **Both para and ferromagnetic:** Incorrect, since only ferromagnetic materials show hysteresis.

✅ **Correct Answer: Option C – only ferromagnetic**

Question6

Susceptibility of a paramagnetic substance is

MHT CET 2025 22nd April Morning Shift

Options:

A. negative and large.

B. negative and small.

C. positive and large.

D. positive and small.

Answer: D

Solution:

For a **paramagnetic substance**, the magnetic susceptibility (χ):

- Is **positive** (since paramagnetic materials are weakly attracted to a magnetic field).
- But it is relatively **small** in magnitude compared to ferromagnetic substances.

So, the correct answer is:

Option D — positive and small. ✅

Question7

The space within the current carrying toroid is filled with aluminium of susceptibility ' χ '. The percentage increase in the magnetic field ' B ' will be

MHT CET 2025 21st April Evening Shift

Options:

A. $\frac{\chi}{2} \times 100$

B. $2\chi \times 100$

C. $(1 + \chi) \times 100$

D. $\chi \times 100$

Answer: D

Solution:

Step 1. Recall magnetic field in a toroid (without material)

For a toroid with N turns and current I, inside magnetic field (without core) is:

$B_0 = \mu_0 \cdot \frac{NI}{l}$

where $l = 2\pi r$ (mean circumference).

Step 2. With a material (relative permeability)

If the medium inside has magnetic susceptibility χ, then:

$\mu_r = 1 + \chi$

So the permeability is:

$\mu = \mu_0(1 + \chi)$

Thus the new field inside:

$B = \mu \frac{NI}{l} = (1 + \chi)B_0$

Step 3. Percentage increase

The increase:

$\Delta B = B - B_0 = \chi B_0$

$\%$ increase $= \frac{\Delta B}{B_0} \times 100 = \chi \times 100$

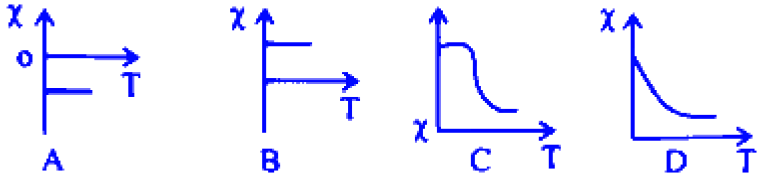
✅ **Final Answer:**

$\boxed{\chi \times 100}$

That corresponds to **Option D**.

Question8

The variation of magnetic susceptibility (χ) with temperature for a diamagnetic substance is shown correctly by graph



MHT CET 2025 21st April Morning Shift

Options:

A. D

B. B

C. A

D. C

Answer: C

Solution:

Magnetic susceptibility of a diamagnetic substance is independent of temperature. Its value is low and negative $|x| \approx 1$

$\therefore$ Graph (A) correctly represents variation of magnetic susceptibility (x) with temperature for a diamagnetic substance.

Question9

Two bar magnets A and B are geometrically similar but the magnetic moment of A is twice that of B. T_1 is the time period of oscillation when their like poles are kept together. When unlike poles are kept together, the time period of oscillation is T_2. The ratio $T_1 : T_2$ will be

Options:

A. 1 : 3

B. 1 : 2

C. 1 : $\sqrt{3}$

D. $\sqrt{3}$: 1

Answer: C

Solution:

Finding the Total Magnetic Moment

When Like Poles Are Together:

We add the magnetic moments:

$$\begin{aligned} M_{\text{total}} &= M_A + M_B \\ &= 2M_B + M_B \\ &= 3M_B \end{aligned}$$

When Unlike Poles Are Together:

We subtract the magnetic moments:

$$\begin{aligned} M_{\text{total}} &= M_A - M_B \\ &= 2M_B - M_B \\ &= M_B \end{aligned}$$

Finding the Time Period

The formula for the time period is$T = 2\pi\sqrt{\frac{I}{M_{\text{total}} \quad B_H}}$where I is the moment of inertia, M_{total} is the total magnetic moment, and B_H is the horizontal component of Earth's magnetic field.

Let T_1 be the time period when like poles are together and T_2 be the time period when unlike poles are together.

$$\frac{T_1}{T_2} = \sqrt{\frac{M_2}{M_1}} = \sqrt{\frac{M_B}{3M_B}} = \frac{1}{\sqrt{3}}$$

Question10

The magnetic susceptibility of iron is 5499 . The relative permeability of iron will be

MHT CET 2025 20th April Morning Shift

Options:

A. 5500×10^7

B. 5500×10^{-7}

C. 5500

D. 5501

Answer: C

Solution:

Magnetic susceptibility (χ_m) and relative permeability (μ_r) are related by the formula:

$\mu_r = 1 + \chi_m$

Given:

$\chi_m = 5499$

Substitute the value:

$\mu_r = 1 + 5499 = 5500$

So, the correct answer is:

Option C: 5500

Question11

If M is the magnetisation induced in the material, H is the magnetic field intensity, B is the net magnetic field inside the material then the correct relation between them is ($\mu_0 =$ permeability of free space)

MHT CET 2025 19th April Evening Shift

Options:

A. $\mathrm{B} = \frac{\mu_0}{(\mathrm{H+M})}$

B. $B = \mu_0(H - M)$

C. $\mathrm{B} = \frac{\mu_0}{(\mathrm{H-M})}$

D. $B = \mu_0(H + M)$

Answer: D

Solution:

The correct NCERT relation between B, H, and M is:

$B = \mu_0(H + M)$

Let's break it down:

1. **Magnetic field inside the material (B):**

- B is the net magnetic field inside a magnetised material.

1. **External magnetic field (H):**

- H is the magnetic field intensity produced by external currents (without the material).

1. **Magnetisation (M):**

- M is the magnetic moment per unit volume, representing how much the material is magnetised.

1. **Relation:**

- According to NCERT, the relation is:

  $B = \mu_0(H + M)$

- Here, μ_0 is the permeability of free space.

Correct option:

$\boxed{B = \mu_0(H + M)}$

So, the answer is Option D.

Question12

A solenoid having 400 turns per metre has a core of a material with relative permeability 400. When a current of 0.5 A is passed through

it, the magnetization of the core material in Am^{-1} is nearly

MHT CET 2024 16th May Evening Shift

Options:

A. 6×10^5

B. 6×10^4

C. 8×10^5

D. 8×10^4

Answer: D

Solution:

Magnetic intensity,

$$\begin{aligned} & \mathrm{H}=\mathrm{nI}=400 \times 0.5=200 \mathrm{Am}^{-1} \\ & \mu_{\mathrm{r}}=1+\chi \Rightarrow \chi=\left(\mu_{\mathrm{r}}-1\right) \\ \therefore \quad & \mathrm{M}=\chi \mathrm{H}=\left(\mu_{\mathrm{r}}-1\right) \mathrm{H}=(400-1) \times 200 \\ & =7.98 \times 10^4 \mathrm{Am}^{-1} \\ & \approx 8 \times 10^4 \mathrm{Am}^{-1} \end{aligned}$$

Question13

The materials having negative magnetic susceptibility are

MHT CET 2024 16th May Morning Shift

Options:

A. both paramagnetic and ferromagnetic.

B. paramagnetic.

C. diamagnetic.

D. ferromagnetic.

Answer: C

Solution:

In magnetism:

Diamagnetic materials have a **negative** magnetic susceptibility ($\chi < 0$).

Paramagnetic and **ferromagnetic** materials both have a **positive** magnetic susceptibility ($\chi > 0$), with ferromagnets having a much larger (and nonlinear) susceptibility.

Hence, the materials with **negative** magnetic susceptibility are **diamagnetic**.

Answer: (C) diamagnetic.

Question14

A bar magnet has length 4 cm , cross-sectional area $2\ \mathrm{cm}^2$ and magnetic moment $6\mathrm{Am}^2$. The intensity of magnetisation of bar magnet is

MHT CET 2024 11th May Morning Shift

Options:

A. $9 \times 10^5\ \mathrm{A/m}$

B. $7.5 \times 10^5\ \mathrm{A/m}$

C. $4.5 \times 10^5\ \mathrm{A/m}$

D. $3.0 \times 10^5\ \mathrm{A/m}$

Answer: B

Solution:

Intensity of magnetization

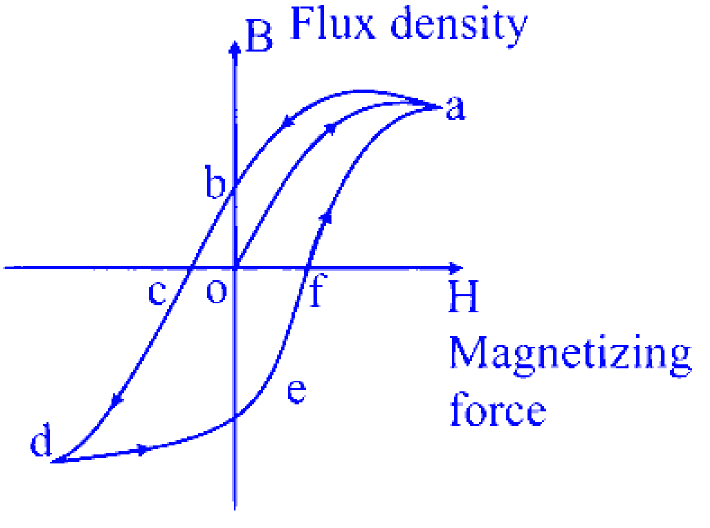
$$= \frac{M_{nat}}{\text{Volume}}$$

$$= \frac{M_{net}}{\text{length} \times \text{area of cross-section}}$$

$$= \frac{6}{(4 \times 10^{-2}) \times (2 \times 10^{-1})} = 7.5 \times 10^5 \text{ A/m}$$

Question15

In the following graph of flux density versus magnetizing force, coercivity and retentivity are respectively represented by the points



MHT CET 2024 10th May Morning Shift

Options:

A. c, b

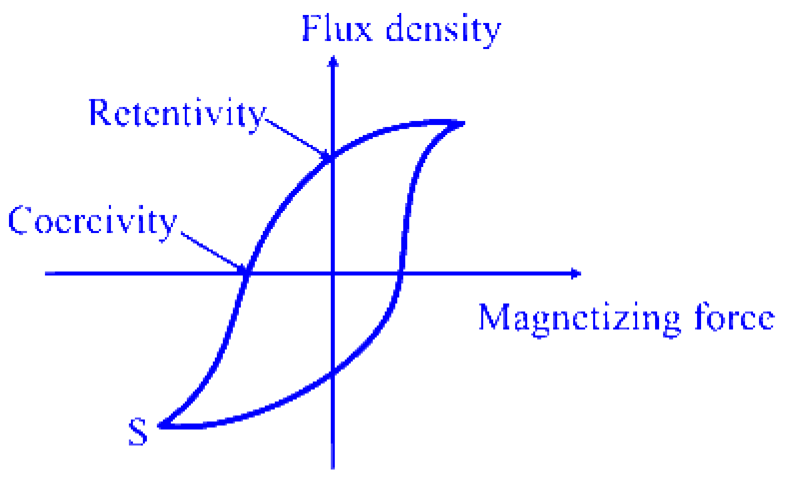
B. a, o

C. d, c

D. f, e

Answer: A

Solution:



Question16

The correct relation between total magnetic field (B), magnetic intensity (H), permeability of free space (μ_0) and susceptibility (χ) is

MHT CET 2024 9th May Evening Shift

Options:

A. $\frac{B}{H}=\mu_0(1-\chi)$

B. $\frac{\mathrm{B}}{\mathrm{H}}=\mu_0(1+\chi)^2$

C. $\frac{\mathrm{B}}{\mathrm{H}}=\mu_0(1+\chi)$

D. $\frac{\mathrm{B}}{\mathrm{H}}=\mu_0(1-\chi)^2$

Answer: C

Solution:

✅ Correct Answer: C — $\frac{B}{H} = \mu_0(1+\chi)$

✔ Explanation

For a magnetic material placed in a magnetic field:

Magnetic susceptibility:

$$M = \chi H$$

Magnetic field inside the material:

$$B = \mu H$$

where

$$\mu = \mu_0(1+\chi)$$

So:

$$\frac{B}{H} = \mu_0(1+\chi)$$

This is the **correct relation** between total magnetic field B, magnetic intensity H, permeability μ_0, and susceptibility χ.

Question17

A magnetic intensity of $500 \mathrm{~A/m}$, produces a magnetic flux of $2.4 \times 10^{-5} \mathrm{~Wb}$ in an iron bar of cross-sectional area $0.4 \mathrm{~cm}^2$. The magnetic permeability of the iron bar is

MHT CET 2024 4th May Evening Shift

Options:

A. $2.4 \times 10^{-3} \mathrm{~N/m}^2$

B. $1.2 \times 10^{-3} \mathrm{~N/m}^2$

C. $2.4 \times 10^{-4} \mathrm{~N/m}^2$

D. $1.2 \times 10^{-4} \mathrm{~N/m}^2$

Answer: B

Solution:

The magnetic permeability (μ) can be calculated using the formula:

$\mu = \frac{B}{H}$

Where:

B is the magnetic flux density,

H is the magnetic field intensity.

Firstly, compute the magnetic flux density B using the formula:

$B = \frac{\Phi}{A}$

Given:

Magnetic flux (Φ) = 2.4×10^{-5} Wb,

Cross-sectional area (A) = $0.4 \text{ cm}^2 = 0.4 \times 10^{-4} \text{ m}^2$ (converted from cm^2 to m^2).

Now, calculate B:

$B = \frac{2.4 \times 10^{-5}}{0.4 \times 10^{-4}} = \frac{2.4 \times 10^{-5}}{4 \times 10^{-5}} = 0.6 \text{ T}$

Now that we have B, use the provided magnetic field intensity $H = 500 \text{ A/m}$ to compute the magnetic permeability μ:

$\mu = \frac{0.6}{500} = 0.0012 \text{ N/A}^2$

Thus, the magnetic permeability of the iron bar is:

Option B: $1.2 \times 10^{-3} \text{ N/m}^2$.

Question18

The magnetic moments associated with two closely wound circular coils A and B of radius $r_A = 10$ cm and $r_B = 20$ cm respectively are equal if (N_A, I_A and N_B, I_B are number of turns and current of A and B respectively)

MHT CET 2024 4th May Morning Shift

Options:

A. $2N_A I_A = N_B I_B$

B. $N_A = 2 N_B$

C. $N_A I_A = 4 N_B I_B$

D. $4N_A I_A = N_B I_B$

Answer: C

Solution:

The magnetic moment M of a coil is given by the formula:

$M = N \cdot I \cdot A$

where:

N is the number of turns,

I is the current,

A is the area of the coil.

For a circular coil, the area A is given by:

$A = \pi r^2$

Given that the magnetic moments of coils A and B are equal, we have:

$N_A \cdot I_A \cdot \pi r_A^2 = N_B \cdot I_B \cdot \pi r_B^2$

Simplifying, we can eliminate π:

$N_A \cdot I_A \cdot r_A^2 = N_B \cdot I_B \cdot r_B^2$

Substituting the given radii $r_A = 10$ cm and $r_B = 20$ cm, we have:

$N_A \cdot I_A \cdot (10)^2 = N_B \cdot I_B \cdot (20)^2$

This simplifies to:

$N_A \cdot I_A \cdot 100 = N_B \cdot I_B \cdot 400$

Further simplification gives:

$N_A \cdot I_A = 4 \cdot N_B \cdot I_B$

Therefore, the correct relationship is expressed in Option C:

Option C: $N_A I_A = 4 N_B I_B$

Question19

The magnetic susceptibility of the material of a rod is 599. The absolute permeability of the material of the rod will be [$\mu_0 = 4\pi \times 10^{-7}$ SI unit]

MHT CET 2024 3rd May Evening Shift

Options:

A. $2\pi \times 10^{-4}$

B. $2.4\pi \times 10^{-4}$

C. $4\pi \times 10^{-4}$

D. $4.8\pi \times 10^{-4}$

Answer: B

Solution:

The magnetic susceptibility, denoted as χ_m, is related to the relative permeability μ_r by the equation:

$\mu_r = 1 + \chi_m$

Given that the magnetic susceptibility χ_m of the material is 599, the relative permeability μ_r can be calculated as:

$\mu_r = 1 + 599 = 600$

The absolute permeability μ is then given by the product of the relative permeability and the permeability of free space (μ_0):

$\mu = \mu_r \cdot \mu_0$

Substituting the given values:

$\mu = 600 \cdot 4\pi \times 10^{-7}$

Calculating this gives:

$\mu = 2400\pi \times 10^{-7}$

Which simplifies to:

$\mu = 2.4\pi \times 10^{-4}$

Thus, the absolute permeability of the material of the rod is $2.4\pi \times 10^{-4}$, which corresponds to Option B.

Question20

A magnetic needle of magnetic moment $6 \times 10^{-2} \mathrm{Am}^2$ and moment of inertia 9.6×10^{-5} kg m^2 performs simple harmonic motion in a magnetic field of 0.01 T . Time taken to complete 10 oscillations is [Take $\pi = 3 \cdot 14$]

MHT CET 2024 3rd May Morning Shift

Options:

A. 0.2512 s

B. 2.512 s

C. 25.12 s

D. 251.2 s

Answer: C

Solution:

The time period for the oscillation of a magnetic needle performing simple harmonic motion in a magnetic field is given by the formula:

$T = 2\pi\sqrt{\frac{I}{mB}}$

where:

T is the time period of one oscillation.

$I = 9.6 \times 10^{-5}\,\mathrm{kg\,m}^2$ is the moment of inertia.

$m = 6 \times 10^{-2}\,\mathrm{Am}^2$ is the magnetic moment.

$B = 0.01\,\mathrm{T}$ is the magnetic field.

First, calculate the time period T:

$T = 2\pi\sqrt{\frac{9.6\times10^{-5}}{6\times10^{-2}\times0.01}}$

$= 2\pi\sqrt{\frac{9.6\times10^{-5}}{6\times10^{-4}}}$

$= 2\pi\sqrt{0.16}$

$= 2\pi(0.4)$

Substituting the value of $\pi = 3.14$,

$T = 2 \times 3.14 \times 0.4 = 2.512\,\mathrm{s}$

Since this T represents the time for one oscillation, the time taken for 10 oscillations is:

$10T = 10 \times 2.512\,\mathrm{s} = 25.12\,\mathrm{s}$

The correct answer is thus:

Option C: 25.12 s

Question21

The relation between total magnetic field (B), magnetic intensity (H), permeability of free space (μ_0) and susceptibility (χ) is

MHT CET 2024 3rd May Morning Shift

Options:

A. $\frac{\mathrm{H}}{\mathrm{B}} = \mu_0(1+\chi)$

B. $\frac{B}{H} = \mu_0(1+\chi)$

C. $\frac{\mathrm{H}}{\mathrm{B}} = \mu_0(\chi-1)$

D. $\frac{B}{H} = \mu_0(1-x)$

Answer: B

Solution:

The relationship between the total magnetic field (B), magnetic intensity (H), the permeability of free space (μ_0), and magnetic susceptibility (χ) is given by the equation:

$B = \mu_0(1+\chi)H$

Rearranging this equation, we can express $\frac{B}{H}$ as:

$\frac{B}{H} = \mu_0(1+\chi)$

This corresponds to **Option B**, which is:

$\frac{B}{H} = \mu_0(1 + \chi)$

Question22

A ferromagnetic material is heated above its curie temperature. The correct statement from the following is that

MHT CET 2024 2nd May Evening Shift

Options:

A. ferromagnetic domains are perfectly arranged.

B. ferromagnetic domains become random.

C. ferromagnetic domains are not influenced.

D. ferromagnetic material changes itself into diamagnetic material.

Answer: B

Solution:

Answer: **(B) ferromagnetic domains become random.**

When a ferromagnetic material is heated above its Curie temperature (T_c), the thermal energy overcomes the exchange interactions that align the magnetic dipoles. As a result, the magnetic domains lose their ordered alignment and become randomized, causing the material to lose its ferromagnetism and become paramagnetic.

Question23

At certain place a magnet makes 30 oscillations per minute. At another place if the magnetic induction is increased by two times the magnetic induction at first place, then the time period of same magnet will be

MHT CET 2024 2nd May Morning Shift

Options:

A. $\frac{2}{\sqrt{3}}$ s

B. $2\sqrt{3}$ s

C. $\frac{\sqrt{3}}{2}$ s

D. $\sqrt{3}$ s

Answer: A

Solution:

$$T = 2\pi\sqrt{\frac{I}{MB}} \Rightarrow T \propto \frac{1}{\sqrt{B}}$$

$$\text{Given }_{n_1} = 30 \text{ osc. /min} \Rightarrow T_1 = 2 \text{ s}$$

$$\therefore \quad \frac{T_2}{T_1} = \frac{\sqrt{B_1}}{\sqrt{B_2}}$$

$$\text{Now, } B_2 = B_1 + 2B_1 = 3B_1$$

$$\therefore \quad \frac{T_2}{T_1} = \sqrt{\frac{B_1}{3B_1}} = \frac{1}{\sqrt{3}} \Rightarrow T_2 = \frac{1}{\sqrt{3}} \times 2 = \frac{2}{\sqrt{3}} \text{ s}$$

Question24

In the hysteresis curve the value of magnetization (B) which will be present in a substance when value of magnetizing force (H) is made zero $(H = 0)$ is called as

MHT CET 2023 14th May Evening Shift

Options:

A. coercivity

B. retentivity

C. domain

D. saturation

Answer: B

Solution:

Retentivity or remanence is the ability of a magnetic substance to retain magnetism even in the absence of a magnetising field.

$\therefore$ Retentivity corresponds to the value of B when value of H is zero.

Question25

Magnetic shielding is done by surrounding the instrument to be protected from magnetic field by

MHT CET 2023 13th May Evening Shift

Options:

A. soft ferromagnetic substance soft iron.

B. diamagnetic substance fine copper gauge.

C. paramagnetic substance aluminium.

D. paramagnetic material tantalum.

Answer: A

Solution:

For shielding, the magnetic field lines / flux should transfer via the shielding material not the object inside it.

Therefore, ferromagnetic, soft iron which attracts all field line (or the magnetic field lines prefer to more towards) towards itself, it used for magnetic shielding.

Question26

For which of the following substances, the magnetic susceptibility is independent of temperature?

MHT CET 2023 13th May Morning Shift

Options:

A. Diamagnetic only.

B. Paramagnetic only.

C. Ferromagnetic only.

D. Diamagnetic and paramagnetic both.

Answer: A

Solution:

Diamagnetic substances have a small negative value for magnetic susceptibility and is independent of temperature.

Question27

A solenoid of 500 turns/m is carrying a current of 3 A. Its core is made of iron which has relative permeability 5001. The magnitude of magnetization is

MHT CET 2023 10th May Evening Shift

Options:

A. $4.5 \times 10^6 \mathrm{~Am}^{-1}$

B. $6.0 \times 10^{-6} \mathrm{~Am}^{-1}$

C. $7.5 \times 10^6 \mathrm{~Am}^{-1}$

D. $9.0 \times 10^6 \mathrm{~Am}^{-1}$

Answer: C

Solution:

Given: $\mathrm{n}=500 \text{ turns} / \mathrm{m}, \mathrm{I}=3 \mathrm{~A}$

$$
\begin{aligned}
& \mu_{\mathrm{r}}=5001 \\
& \therefore \quad \mu=n I=500 \times 3 \mathrm{~A} \\
& =1500 \mathrm{~A} / \mathrm{m} \\
& \text{But, } \chi_{\mathrm{m}}=\mu_{\mathrm{r}}-1 \\
& =5001-1 \\
& =5000 \\
& \therefore \quad \text{Magnetization } \mathrm{M}=\chi_{\mathrm{m}} \mathrm{H} \\
& =5000 \times 1500 \\
& =7.5 \times 10^6 \mathrm{Am}^{-1}
\end{aligned}
$$

Question28

According to Curie's law in magnetism, the correct relation is ($\mathrm{M}=$ magnetization in paramagnetic sample, $\mathrm{B}=$ applied magnetic field, $\mathrm{T}=$ absolute temperature of the material, $\mathrm{C}=$ curie's constant)

MHT CET 2023 10th May Morning Shift

Options:

A. $\mathrm{M}=\frac{\mathrm{T}}{\mathrm{CB}}$

B. $\mathrm{M}=\frac{\mathrm{CB}}{\mathrm{T}}$

C. $\mathrm{C}=\frac{\mathrm{MB}}{\mathrm{T}}$

D. $\mathrm{C}=\frac{\mathrm{T}^2}{\mathrm{MB}}$

Answer: B

Solution:

The correct relation according to Curie's Law in magnetism is:

Option B$\mathrm{M}=\frac{\mathrm{CB}}{\mathrm{T}}$

Curie's Law states that the magnetization M of a paramagnetic material is directly proportional to the applied magnetic field B, and inversely proportional to the absolute temperature T of the material. The proportionality constant C is known as the Curie constant and is specific to the paramagnetic material.

To better understand this law, let's dissect Option B, which correctly reflects the Curie's Law formula. The Magnetization M, which is the extent to which the material becomes magnetized when exposed to an external magnetic field, is given by:

$\mathrm{M}=\frac{\mathrm{CB}}{\mathrm{T}}$

- C is the Curie constant,

- B is the applied magnetic field, and

- T is the absolute temperature.

So, the higher the field B, the larger the induced magnetization M, and the higher the temperature T, the smaller the magnetization due to the increased thermal motion of the magnetic moments which tend to randomize the orientation and reduce magnetization. The correct formula (Option B) reflects this inverse temperature dependence and direct magnetic field dependence of the magnetization.

Question29

A thin rod of length L has magnetic moment M when magnetised. If rod is bent in a semicircular arc what is magnetic moment in new shape?

MHT CET 2023 9th May Evening Shift

Options:

A. $\frac{M}{L}$

B. $\frac{M}{\pi}$

C. $\frac{\mathrm{M}}{2\pi}$

D. $\frac{2\mathrm{M}}{\pi}$

Answer: D

Solution:

Magnetic moment of rod = M

Let r be the radius after bending it into a semicircular arc.

$\therefore$ The separation between the two ends is 2r. Here length = circumference of the semicircle i.e., $L = \pi r$

$\therefore \quad r = \frac{L}{\pi}$

Also $M = m \times L$ and $m = \frac{M}{L}$

$$\therefore \quad M_{\text{new}} = m(2r) = \frac{M}{L} \times \frac{2L}{\pi} = \frac{2M}{\pi}$$

Question30

The materials suitable for making electromagnets should have

MHT CET 2023 9th May Morning Shift

Options:

A. high retentivity and high coercivity

B. low retentivity and low coercivity

C. high retentivity and low coercivity

D. low retentivity and high coercivity

Answer: B

Solution:

The correct option for materials suitable for making electromagnets is **Option B: low retentivity and low coercivity**.

To understand why, let's dive into the terms retentivity and coercivity in the context of magnetic materials:

- **Retentivity** (or remanence) is the ability of a magnetic material to retain a certain amount of residual magnetism after an external magnetizing field is removed. High retentivity means the material retains a significant amount of magnetization, while low retentivity means it loses most of the magnetization when the external field is removed.

- **Coercivity** is the measure of the coercive force required to reduce the magnetization of a magnetic material to zero after the magnetization of the sample has been driven to saturation. Essentially, it indicates how difficult it is to demagnetize the material. High coercivity means it is difficult to demagnetize, while low coercivity indicates it is easy to demagnetize.

Electromagnets are designed to be turned on and off (magnetized and demagnetized) easily with the application and removal of an electric current. Therefore, materials used for electromagnets should have **low retentivity** so they can easily lose their magnetism when the current is turned off and **low coercivity** so they can be magnetized and demagnetized easily with small changes in current. This ensures the electromagnet is effective in applications that require rapid switching between the magnetized and demagnetized states.

Materials with high retentivity and high coercivity are more suitable for permanent magnets, which are intended to maintain their magnetic field without a continuous external power source.

Question31

The magnetic susceptibility of the material of a rod is 349 and permeability of vacuum μ_0 is $4\pi \times 10^{-7}$ SI units. Absolute permeability of the material of the rod in SI units is

MHT CET 2022 11th August Evening Shift

Options:

A. 4400×10^{-7}

B. 4200×10^{-7}

C. 4800×10^{-7}

D. 4600×10^{-7}

Answer: A

Solution:

The relative permeability $\mu_{\mathrm{R}} = 1 + \chi$

$\therefore$ Absolute permeability

$$\begin{aligned} \mu = \mu_{\mathrm{R}} \mu_0 &= \mu_0(1+\chi) \\ &= 4\pi \times 10^{-7}[1+349] \\ &= 350 \times 4 \times 3.142 \times 10^{-7} \\ &\doteqdot 4400 \times 10^{-7} \text{ SI units} \end{aligned}$$

Question32

Two bar magnets 'P' and 'Q' are kept in uniform magnetic field 'B' with magnetic moments 'M_P' and 'M_Q' respectively. Magnet 'P' is oscillating with frequency twice that of magnet 'Q'. If the moment of inertia of the magnet 'P' is twice that of magnet 'Q' then

MHT CET 2021 24th September Evening Shift

Options:

A. $M_Q = 2M_P$

B. $M_P = 2M_Q$

C. $M_P = 8M_Q$

D. $M_Q = 8MP_P$

Answer: C

Solution:

To solve this problem, we need to analyze the relation between the frequency of oscillations of the magnets, their moments of inertia, and their magnetic moments.

The frequency of oscillation of a magnet in a uniform magnetic field is given by:

$$\nu = \frac{1}{2\pi}\sqrt{\frac{MB}{I}}$$

Where:

- ν is the frequency of oscillation
- M is the magnetic moment of the magnet
- B is the magnetic field strength
- I is the moment of inertia of the magnet

For magnet 'P' and magnet 'Q', we can write:

$$\nu_P = \frac{1}{2\pi}\sqrt{\frac{M_P B}{I_P}}$$

$$\nu_Q = \frac{1}{2\pi}\sqrt{\frac{M_Q B}{I_Q}}$$

We are given that:

- $\nu_P = 2\nu_Q$
- $\mathrm{I_P} = 2\mathrm{I_Q}$

Substituting the given conditions into the frequency equations:

$$\nu_P = 2\nu_Q = 2\left(\frac{1}{2\pi}\sqrt{\frac{\mathrm{M_Q B}}{\mathrm{I_Q}}}\right) = \frac{1}{2\pi}\sqrt{4\frac{\mathrm{M_Q B}}{\mathrm{I_Q}}}$$

Equating this to the expression for ν_P, we get:

$$\frac{1}{2\pi}\sqrt{\frac{\mathrm{M_P B}}{\mathrm{I_P}}} = \frac{1}{2\pi}\sqrt{4\frac{\mathrm{M_Q B}}{\mathrm{I_Q}}}$$

Squaring both sides:

$$\frac{\mathrm{M_P B}}{\mathrm{I_P}} = 4\frac{\mathrm{M_Q B}}{\mathrm{I_Q}}$$

Given that $\mathrm{I_P} = 2\mathrm{I_Q}$, substitute this into the equation:

$$\frac{\mathrm{M_P B}}{2\mathrm{I_Q}} = 4\frac{\mathrm{M_Q B}}{\mathrm{I_Q}}$$

Simplify:

$$\frac{\mathrm{M_P}}{2} = 4\mathrm{M_Q}$$

So:

$$\mathrm{M_P} = 8\mathrm{M_Q}$$

Therefore, the correct option is:

Option C: $\mathrm{M_P} = 8\mathrm{M_Q}$

Question33

A magnetic dipole of magnetic moment M, is freely suspended in a magnetic field of induction B. The minimum and maximum values of potential energy of the dipole, respectively are

MHT CET 2021 24th September Evening Shift

Options:

A. $-\mathrm{MB}, +\mathrm{MB}$

B. $0, \mathrm{MB}$

C. 0, 2MB

D. MB, 0

Answer: A

Solution:

Let’s analyze the potential energy of a magnetic dipole in a magnetic field. The potential energy U of a magnetic dipole with a magnetic moment M in a magnetic field of induction B is given by:

$U = -\mathrm{M} \cdot \mathrm{B} \cdot \cos\theta$

where θ is the angle between the magnetic moment vector M and the magnetic field vector B. The potential energy varies with the angle θ.

To find the minimum and maximum values of the potential energy, let's examine the extreme values of $\cos\theta$, which are -1 and 1 respectively.

1. When $\theta = 0$ degrees (or 0 radians),

$\cos(0) = 1$

$U_{\text{min}} = -\mathrm{M} \cdot \mathrm{B} \cdot 1 = -\mathrm{MB}$

So, the minimum potential energy is $-\mathrm{MB}$.

2. When $\theta = 180$ degrees (or π radians),

$\cos(180^\circ) = -1$

$U_{\text{max}} = -\mathrm{M} \cdot \mathrm{B} \cdot (-1) = \mathrm{MB}$

So, the maximum potential energy is MB.

Hence, the correct option is:

Option A

$-\mathrm{MB}, +\mathrm{MB}$

Question34

A current 'I' is flowing in a conductor of length 'L' when it is bent in the form of a circular loop, its magnetic moment will be

MHT CET 2021 24th September Morning Shift

Options:

A. $\frac{\mathrm{IL}}{4\pi^2}$

B. $4\pi\mathrm{L}^2$

C. $\frac{4\pi}{\mathrm{IL}^2}$

D. $\frac{\mathrm{IL}^2}{4\pi}$

Answer: D

Solution:

Let's determine the magnetic moment of a conductor of length L carrying a current I when it is bent to form a circular loop.

First, recall the formula for the magnetic moment m of a current loop:

$m = I \cdot A$

where I is the current and A is the area of the loop.

Since the conductor is bent into a circular loop, let's find the radius r of the loop. The length of the conductor equals the circumference of the loop:

$L = 2\pi r$

Solving for the radius r, we get:

$r = \frac{L}{2\pi}$

Next, the area A of a circle is given by:

$A = \pi r^2$

Substitute the expression for r into the area formula:

$A = \pi\left(\frac{L}{2\pi}\right)^2 = \pi \cdot \frac{L^2}{4\pi^2} = \frac{L^2}{4\pi}$

Now, substitute the area back into the magnetic moment formula:

$m = I \cdot \frac{L^2}{4\pi}$

Therefore, the magnetic moment of the circular loop is:

$m = \frac{IL^2}{4\pi}$

So, the correct answer is option D:

$\frac{\mathrm{IL}^2}{4\pi}$

Question35

A bar magnet has length $3 \mathrm{~cm}$, cross-sectional area $2 \mathrm{~cm}^2$ and magnetic moment $3 \mathrm{~Am}^2$. The intensity of magnetisation of bar magnet is

MHT CET 2021 23th September Morning Shift

Options:

A. $2 \times 10^5 \mathrm{~A} / \mathrm{m}$

B. $3 \times 10^5 \mathrm{~A} / \mathrm{m}$

C. $4 \times 10^5 \mathrm{~A} / \mathrm{m}$

D. $5 \times 10^5 \mathrm{~A} / \mathrm{m}$

Answer: D

Solution:

To determine the intensity of magnetization (I) of the bar magnet, we can use the formula:

$I=\frac{M}{V}$

where M is the magnetic moment and V is the volume of the bar magnet. The volume can be obtained using the length (l) and the cross-sectional area (A) of the bar magnet:

$V=A \cdot l$

Given that the length of the bar magnet l is $3 \mathrm{~cm}=3 \times 10^{-2} \mathrm{~m}$ and the cross-sectional area A is $2 \mathrm{~cm}^2=2 \times 10^{-4} \mathrm{~m}^2$, we can calculate the volume as:

$V=2 \times 10^{-4} \mathrm{~m}^2 \times 3 \times 10^{-2} \mathrm{~m}=6 \times 10^{-6} \mathrm{~m}^3$

Now, substituting the given magnetic moment $M=3 \mathrm{~Am}^2$ and the calculated volume into the intensity of magnetization formula, we get:

$I=\frac{M}{V}=\frac{3 \mathrm{~Am}^2}{6 \times 10^{-6} \mathrm{~m}^3}=\frac{3}{6 \times 10^{-6}} \mathrm{~A} / \mathrm{m}=\frac{1}{2 \times 10^{-6}} \mathrm{~A} / \mathrm{m}=0.5 \times 10^6 \mathrm{~A} / \mathrm{m}=5 \times 10^5 \mathrm{~A} / \mathrm{m}$

Therefore, the correct answer is:

Option D

$5 \times 10^5 \mathrm{~A} / \mathrm{m}$

Question36

The relative permeability of iron is 2000. Its absolute permeability in SI unit will be $\left(\frac{\mu_0}{4\pi} = 10^{-7}\text{SI unit}\right)$

MHT CET 2021 22th September Evening Shift

Options:

A. $8\pi \times 10^{-7}$

B. $4\pi \times 10^{-5}$

C. $8\pi \times 10^{-4}$

D. $\frac{500}{\pi} \times 10^{-7}$

Answer: C

Solution:

First, let's understand the terms involved. Relative permeability (μ_r) is a dimensionless quantity that describes how much the material can be magnetized relative to vacuum. Absolute permeability (μ), on the other hand, measures the material's ability to support the formation of a magnetic field within itself and is given in units of henries per meter (H/m) in the SI unit system. The relationship between absolute permeability, relative permeability, and the permeability of free space (vacuum permeability, μ_0) is given by:

$\mu = \mu_r \times \mu_0$

Given that the relative permeability of iron is $\mu_r = 2000$, and the vacuum permeability $\mu_0 = 4\pi \times 10^{-7} H/m$ (note that the value provided $\frac{\mu_0}{4\pi} = 10^{-7}$ indicates $\mu_0 = 4\pi \times 10^{-7} H/m$ when rearranged), we can now calculate the absolute permeability of iron as follows:

$\mu = \mu_r \times \mu_0 = 2000 \times (4\pi \times 10^{-7})$

$\mu = 8000\pi \times 10^{-7} H/m$

$\mu = 8\pi \times 10^{-4} H/m$

Therefore, the absolute permeability of iron in SI units is $8\pi \times 10^{-4} H/m$, which corresponds to **Option C**.

Question37

The permeability of a metal is $0.1256\ \text{TmA}^{-1}$. Its relative permeability will be $\left(\frac{\mu_0}{4\pi} = 10^{-7}\ \text{SI unit}\right)$ $(\pi = 3.14)$

MHT CET 2021 22th September Morning Shift

Options:

A. 10^5

B. 3×10^5

C. 2×10^6

D. 10^4

Answer: A

Solution:

To find the relative permeability (μ_r) of the metal, we use the formula:

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

Given:

$\mu = 0.1256 \text{ TmA}^{-1}$

$\mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1}$

First, calculate the value of μ_0:

$\mu_0 = 4 \times 3.14 \times 10^{-7} = 12.56 \times 10^{-7} = 1.256 \times 10^{-6} \text{ TmA}^{-1}$

Now, substitute the values into the relative permeability formula:

$\mu_r = \frac{0.1256}{1.256 \times 10^{-6}} = \frac{0.1256 \times 10^6}{1.256}$

$\mu_r = 10^5$

Hence, the relative permeability of the metal is:

Option A: 10^5

Question38

The north pole of a long horizontal bar magnet is being brought towards closed circuit consisting of a coil. The direction of induced current produced in it is

MHT CET 2021 21th September Evening Shift

Options:

A. anticlockwise

B. horizontal

C. vertical

D. clockwise

Answer: A

Solution:

According to the Lenz's law, the induced current is such that it opposes the change in flux which causes it. Hence the induced current produces a field which opposes the field due to the magnet. For this it should flow in anticlockwise direction.

Question39

What is susceptibility of a medium, if its relative permeability is 0.85?

MHT CET 2021 21th September Morning Shift

Options:

A. 1.85

B. 0.15

C. -0.15

D. -0.85

Answer: C

Solution:

Relative permeability $\mu_r = 1 + \chi$

$\therefore \chi = \mu_r - 1 = 0.85 - 1 = -0.15$

Question40

A steel wire of length / has a magnetic moment M. It is then bent into a semicircular arc. The new magnetic moment is

MHT CET 2020 19th October Evening Shift

Options:

A. $M \times \ell$

B. $\frac{M}{\ell}$

C. $\frac{2M}{\pi}$

D. M

Answer: C

Solution:

The length of wire, which is bent in form of semicircular arc of radius r is

$I = \pi r$

$r = \frac{I}{\pi}$

The diameter of semicircular wire,

$d = 2r = \frac{2}{\pi}$

$\therefore$ Magnetic moment of semicircular wire,

$M' = m \times d = m \times \frac{2}{\pi}$ ... (i)

The magnetic moment of straight wire,

$M = ml$

Substituting in Eq. (i), we get

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

Question41

A domain in a ferromagnetic substance is in the form of a cube of side 1μ m. If it contains 8×10^{10} atoms and each atomic dipole has a dipole moment of $9 \times 10^{-24} \mathrm{Am}^2$, then the magnetisation of the domain is

MHT CET 2020 19th October Evening Shift

Options:

A. $7.2 \times 10^5 \mathrm{Am}^{-1}$

B. $7.2 \times 10^3 \mathrm{Am}^{-1}$

C. $7.2 \times 10^9 \mathrm{Am}^{-1}$

D. $7.2 \times 10^{12} \mathrm{Am}^{-1}$

Answer: A

Solution:

Given, number of atoms, $N=8 \times 10^{10}$ atoms and dipole moment, $M=9 \times 10^{-24} \mathrm{Am}^2$

The maximum dipole moment is given by

$$\begin{aligned} M_{\max } & =N M \\ & =8 \times 10^{10} \times 9 \times 10^{-24} \\ & =7.2 \times 10^{-13} \mathrm{Am}^2 \end{aligned}$$

The volume of cubic domain,

$$\begin{aligned} V=I^3 & =\left(10^{-6}\right)^3 \quad\left[\because l=1 \mu \mathrm{~m}=10^{-6} \mathrm{~m}\right] \\ & =10^{-18} \mathrm{~m}^3 \end{aligned}$$

The magnetisation of domain

$$=\frac{M_{\max }}{V}=\frac{7.2 \times 10^{-13}}{10^{-18}}=7.2 \times 10^5 \mathrm{Am}^{-1}$$

Question42

For a paramagnetic substance, the magnetic susceptibility is

MHT CET 2020 19th October Evening Shift

Options:

A. large and negative

B. small and positive

C. large and positive

D. small and negative

Answer: B

Solution:

The magnetic susceptibility for paramagnetic substance is positive and very small.

Question43

The magnetic susceptibility of a paramagnetic material at $-73^{\circ}\mathrm{C}$ is 0.0075. Its value at $-173^{\circ}\mathrm{C}$ will be

MHT CET 2020 16th October Evening Shift

Options:

A. 0.0150

B. 0.0075

C. 0.0030

D. 0.0045

Answer: A

Solution:

For paramagnetic substance, magnetic susceptibility is given by

$$\begin{aligned} \chi_m T &= \text{ constant} \\ \Rightarrow \quad (\chi_m)_1 T_1 &= (\chi_m)_2 T_2 \quad \text{... (i)} \end{aligned}$$

$$\begin{aligned} \text{Here, } (\chi_m)_1 &= 0.0075, \\ T_1 &= -73^\circ\text{C} = 273 - 73 = 200 \text{ K} \\ \text{and} \quad T_2 &= -173^\circ\text{C} = 273 - 173 = 100 \text{ K} \end{aligned}$$

Substituting the given values in Eq. (i), we get

$$\begin{aligned} 0.0075 \times 200 &= (\chi_m)_2 \times 100 \\ (\chi_m)_2 &= 0.0150 \end{aligned}$$

Question44

If the angle of dip at places A and B are 30° and 45° respectively, then the ratio of horizontal component of earth's magnetic field at A to that at B will be

$$\left[\sin 45^\circ = \cos 45^\circ = \frac{1}{\sqrt{2}}, \sin \frac{\pi}{6} = \frac{1}{2}, \cos \frac{\pi}{6} = \frac{\sqrt{3}}{2}\right]$$

MHT CET 2020 16th October Evening Shift

Options:

A. $\sqrt{2} : 1$

B. $1 : \sqrt{2}$

C. $\sqrt{3} : \sqrt{2}$

D. $\sqrt{2} : \sqrt{3}$

Answer: C

Solution:

The horizontal component of earth's magnetic field,

$H = B\cos\delta$

At place A,

$$H_A = B\cos\delta_A$$
$$= B\cos 30^\circ = \frac{\sqrt{3}B}{2}$$

At place B,

$$H_B = B\cos\delta_B$$
$$= B\cos 45^\circ$$
$$= \frac{B}{\sqrt{2}}$$

The ratio of $H_A : H_B$ becomes,

$\frac{H_A}{H_B} = \frac{\sqrt{3}B}{2} \times \frac{\sqrt{2}}{B} = \frac{\sqrt{3}}{\sqrt{2}}$

Question45

A thin light weight rod of diamagnetic substance such as silver is suspended in uniform external magnetic field. It will align itself with its length

MHT CET 2020 16th October Evening Shift

Options:

A. parallel to magnetic field

B. perpendicular to magnetic field

C. inclined at an angle 45° to magnetic field

D. inclined at an angle 120° to magnetic field

Answer: B

Solution:

When a thin, lightweight rod made of a diamagnetic material such as silver is suspended in a uniform external magnetic field, it will align itself with its length perpendicular to the magnetic field.

Diamagnetic substances are materials that become weakly magnetized in the direction opposite to the applied external magnetic field. As a result, in a uniform magnetic field, a freely suspended diamagnetic rod will position itself perpendicular to the magnetic field.

Question46

Two identical bar magnets each of magnetic moment M, separated by some distance are kept perpendicular to each other. The magnetic induction at a point at the same distance d from the centre of magnets, is (μ_0 = permeability of free space)

MHT CET 2020 16th October Morning Shift

Options:

A. $\frac{\mu_0}{4\pi}(\sqrt{3})\frac{M}{d^3}$

B. $\frac{\mu_0}{4\pi}(\sqrt{2})\frac{M}{d^3}$

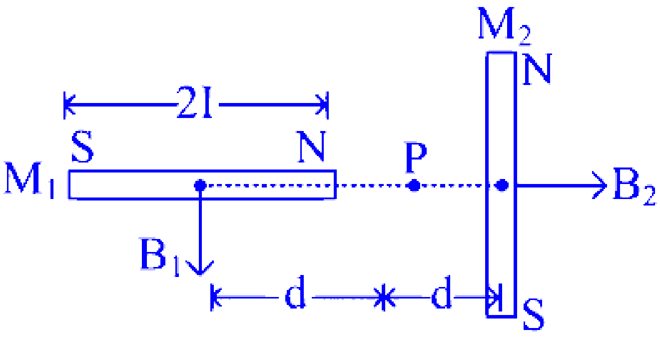
C. $\frac{\mu_0}{4\pi}(\sqrt{5})\frac{M}{d^3}$

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

Answer: C

Solution:

The situation is as shown below



The magnetic field at P due to first magnet is

$B_1 = \frac{\mu_0}{4\pi} \times \frac{2M_1}{d^3}$ (along M_1)

and magnetic field at P due to second magnet is

$B_2 = \frac{\mu_0}{4\pi} \times \frac{M_2}{d^3}$ (opposite to M_2)

The resultant field at P,

$$B = \sqrt{B_1^2 + B_2^2} = \frac{\mu_0}{4\pi d^3}\sqrt{4M_1^2 + M_2^2}$$
$$= \frac{\mu_0}{4\pi}\sqrt{5}\frac{M}{d^3} \quad (\because M_1 = M_2 = M)$$

Question47

An iron rod is placed parallel to magnetic field of intensity $2000\ \mathrm{A/m}$. The magnetic flux through the rod is $6 \times 10^{-4}\ \mathrm{Wb}$ and its cross-sectional area is $3\ \mathrm{cm}^2$. The magnetic permeability of the rod in $\frac{\mathrm{Wb}}{\mathrm{A-m}}$ is

MHT CET 2020 16th October Morning Shift

Options:

A. 10^{-1}

B. 10^{-2}

C. 10^{-4}

D. 10^{-3}

Answer: D

Solution:

Given, magnetic field intensity,

$H = 2000\mathrm{Am}^{-1}$,

Magnetic flux, $\phi = 6 \times 10^{-4}$ Wb,

Cross-sectional area, $A = 3\ \mathrm{cm}^2 = 3 \times 10^{-4}\ \mathrm{m}^2$

As, we know, $\phi = BA$ and $B = \mu H$

$$\Rightarrow \quad \mu \frac{B}{H} = \frac{\phi}{AH} = \frac{6 \times 10^{-4}}{3 \times 10^{-4} \times 2000}$$
$$= 10^{-3} \text{ Wb A}^{-1} \text{ m}^{-1}$$

Question48

A magnetizing field of 5000 A/m produces a magnetic flux of $4 \times 10^{-5} \text{ Wb}$ in an iron rod of cross-sectional area 0.4 cm^2. The permeabilit of the rod in Wb/A-m, is

MHT CET 2019 3rd May Morning Shift

Options:

A. 4×10^{-6}

B. 1×10^{-3}

C. 2×10^{-4}

D. 3×10^{-5}

Answer: C

Solution:

Given, magnetising field, $H = 5000 \text{ A/m}$

Magnetic flux, $\phi = 4 \times 10^{-5} \text{ Wb}$

Cross-sectional area, $A = 0.4 \text{ cm}^2 = 4 \times 10^{-5} \text{ m}^2$

$\therefore$ Permeability of rod,

$$\mu = \frac{B}{H} = \frac{\phi}{AH} \qquad \left[\because \phi = BA \Rightarrow B = \frac{\phi}{A}\right]$$
$$= \frac{4 \times 10^{-5}}{4 \times 10^{-5} \times 5000} = 2 \times 10^{-4} \text{ Wb/A} - \text{m}$$

Question49

The magnetization of bar magnet of length 5 cm , cross sectional area $2 \mathrm{~cm}^2$ and net magnetic moment $1 \mathrm{Am}^2$ is

MHT CET 2019 2nd May Evening Shift

Options:

A. $3 \times 10^5 \mathrm{~A/m}$

B. $4 \times 10^5 \mathrm{~A/m}$

C. $2 \times 10^5 \mathrm{~A/m}$

D. $1 \times 10^5 \mathrm{~A/m}$

Answer: D

Solution:

Given,

$$\begin{aligned} l &= 5 \mathrm{~cm} = 5 \times 10^{-2} \mathrm{~m} \\ a &= 2 \mathrm{~cm}^2 = 2 \times 10^{-4} \mathrm{~m}^2 \end{aligned}$$

and $\quad M = 1 \mathrm{Am}^{-2}$

The magnetisation of the bar magnet is given by

$I = \frac{M}{V}$

where, $\quad V = \text{volume of bar magnet} = a \times l$

$\Rightarrow \quad I = \frac{M}{a \times l}$

Substituting given values, we get

$$\begin{aligned} I &= \frac{1}{2 \times 10^{-4} \times 5 \times 10^{-2}} = \frac{1}{10^{-5}} \\ &= 1 \times 10^5 \mathrm{~A/m} \end{aligned}$$

Question50

Magnetic susceptibility of a paramagnetic substance is

MHT CET 2019 2nd May Evening Shift

Options:

A. large and positive

B. small and positive

C. small and negative

D. large and negative

Answer: B

Solution:

Answer: **(B) small and positive**

Paramagnetic substances have a magnetic susceptibility (χ_m) that is small and positive. This indicates that when placed in an external magnetic field, the material is weakly attracted to the field. The individual magnetic moments within the material align with the external field, but this alignment is not strong and is generally dependent on temperature. The small, positive value differentiates paramagnetism from ferromagnetism (large and positive susceptibility) and diamagnetism (small and negative susceptibility).
