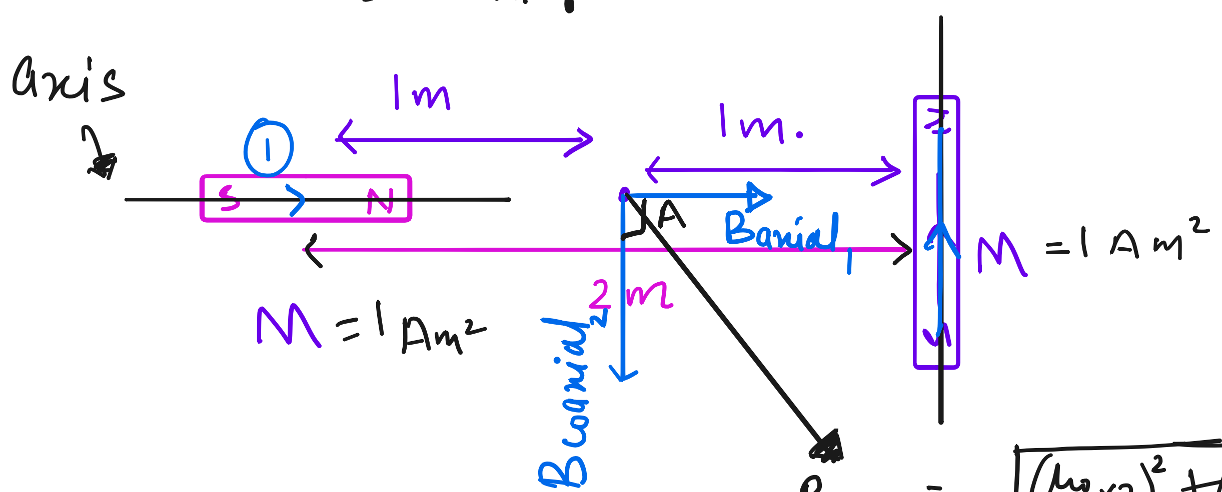
1. Two identical magnetic dipoles of magnetic moments 1.0 $A\text{-}m^2$ each, placed at a separation of $2m$ with their axis perpendicular to each other. The resultant magnetic field at a point midway between the dipoles is

(a) $5 \times 10^{-7}\,T$ (b) $\sqrt{5} \times 10^{-7}\,T$

(c) $10^{-7}\,T$ (d) None of these

$B_{axial_1} = \frac{\mu_0}{4\pi}\frac{2M}{(1)^2} = \frac{\mu_0}{4\pi} \times 2$

$B_{coaxial_2} = \frac{\mu_0}{4\pi}\frac{M}{r^3} = \frac{\mu_0}{4\pi}$



$B_{Net} = \sqrt{\left(\frac{\mu_0}{4\pi}\times 2\right)^2 + \left(\frac{\mu_0}{4\pi}\times 1\right)^2}$

2. Two short magnets placed along the same axis with their like poles facing each other repel each other with a force which varies inversely as

(a) Square of the distance

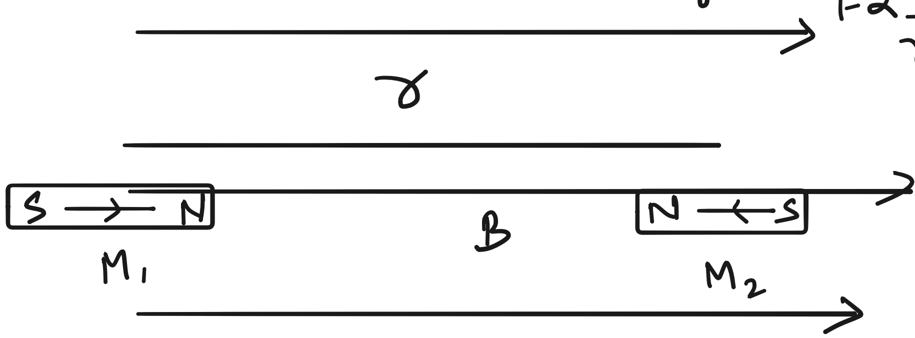
(b) Cube of the distance

(c) Distance

(d) Fourth power of the distance

$B_{Net} = \frac{\mu_0}{4\pi}\sqrt{5} = 10^{-7} \times \sqrt{5}$ tesl

$F \propto \frac{1}{r^2}$ $F \propto \frac{1}{r^3}$ $F \propto \frac{1}{r^4}$



$U = -MB\cos\theta = MB = M_1 \frac{\mu_0}{4\pi}\frac{2M_2}{r^3}$

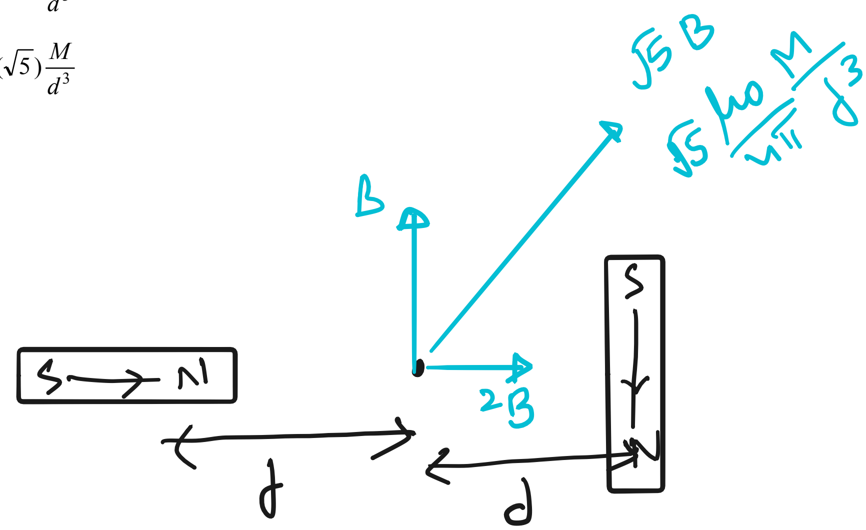
$F = -\frac{\partial U}{\partial r} = -\frac{\partial}{\partial r}\frac{2\mu_0 M_1 M_2}{4\pi r^3} = \frac{\mu_0 6 M_1 M_2}{4\pi r^4}$

$F \propto \frac{1}{r^4}$

3. Two identical short bar magnets, each having magnetic moment M, are placed a distance of $2d$ apart with axes perpendicular to each other in a horizontal plane. The magnetic induction at a point midway between them is

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

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



$\tan 45^\circ = \frac{\tan\delta}{\cos 30^\circ}$

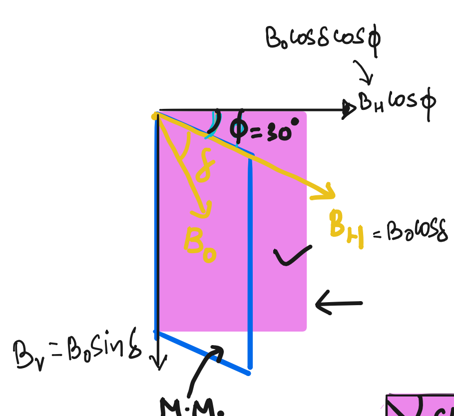
$\tan\delta = \sqrt{3}/2$

4. If a magnet is suspended at an angle 30° to the magnetic meridian, it makes an angle of 45° with the horizontal. The real dip is

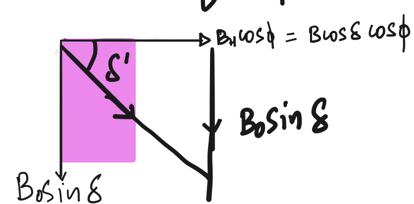
(a) $\tan^{-1}(\sqrt{3}/2)$ (b) $\tan^{-1}(\sqrt{3})$

(c) $\tan^{-1}(\sqrt{3/2})$ (d) $\tan^{-1}(2/\sqrt{3})$

$\tan\delta' = \frac{\tan\delta}{\cos\phi}$ ← real dip, found in magnetic meridian; δ' = App. angle of dip; ϕ = angle of declination.



$\tan\delta' = \frac{B_0 \sin\delta}{B_0 \cos\delta \cos\phi}$



$\tan\delta' = \tan\delta / \cos\phi$

5. The true value of angle of dip at a place is 60°, the apparent dip in a plane inclined at an angle of 30° with magnetic meridian is **[AIEEE 2002]**

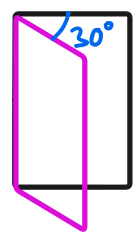
(a) $\tan^{-1}\frac{1}{2}$ (b) $\tan^{-1}(2)$

(c) $\tan^{-1}\left(\frac{2}{3}\right)$ (d) None of these

$\delta = 60^{\circ}$, δ'

$\phi = 30^{\circ}$

$\tan\delta' = \frac{\tan\delta}{\cos\phi}$



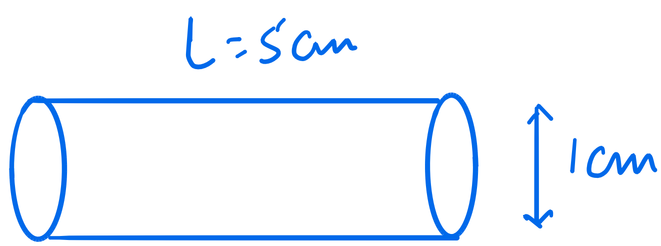
$\tan\delta' = \frac{\tan 60}{\cos 30^{\circ}}$

$= \frac{\sqrt{3}}{\sqrt{3}/2} = 2$

6. A cylindrical rod magnet has a length of 5 cm and a diameter of 1 cm. It has a uniform magnetisation of 5.30 × $10^3 Amp/m^3$. What its magnetic dipole moment

(a) $1\times10^{-2} J/T$ (b) $2.08\times10^{-2} J/T$

(c) $3.08\times10^{-2} J/T$ (d) $1.52\times10^{-2} J/T$



Formula

$I = \frac{M}{Vol.}$

$M = I \times Vol = 5.30 \times 10^{3} \times \pi (0.5\times10^{-2})^2 \times 5 \times 10^{-2}$

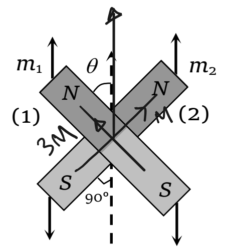
7. Two magnets of equal mass are joined at right angles to each other as shown the magnet 1 has a magnetic moment 3 times that of magnet 2. This arrangement is pivoted so that it is free to rotate in the horizontal plane. In equilibrium what angle will the magnet 1 subtend with the magnetic meridian

(a) $\tan^{-1}\left(\frac{1}{2}\right)$

(b) $\tan^{-1}\left(\frac{1}{3}\right)$

(c) $\tan^{-1}(1)$

(d) $0°$



$\tan\theta = \frac{M}{3M} = \frac{1}{3}$

$\tan\theta = \frac{1}{3}$

$\theta = \tan^{-1}(1/3)$

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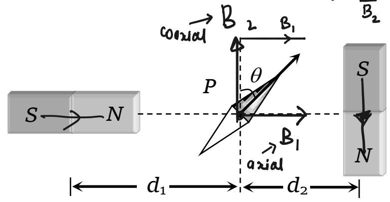
8. Two magnets A and B are identical and these are arranged as shown in the figure. Their length is negligible in comparison to the separation between them. A magnetic needle is placed between the magnets at point P which gets deflected through an angle θ under the influence of magnets. The ratio of distance d_1 and d_2 will be

(a) $(2\tan\theta)^{1/3}$

(b) $(2\tan\theta)^{-1/3}$

(c) $(2\cot\theta)^{1/3}$

(d) $(2\cot\theta)^{-1/3}$



$\tan\theta = \frac{2d_2^3}{d_1^3}$

$\frac{d_2}{d_1} = \left(\frac{\tan\theta}{2}\right)^{1/3}$

$\frac{d_1}{d_2} = \left(\frac{2}{\tan\theta}\right)^{1/3} = (2\cot\theta)^{1/3}$

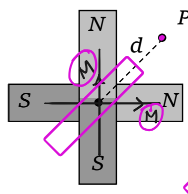
9. Two short magnets of equal dipole moments M are fastened perpendicularly at their centre (figure). The magnitude of the magnetic field at a distance d from the centre on the bisector of the right angle is

(a) $\frac{\mu_0}{4\pi}\frac{M}{d^3}$

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

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

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



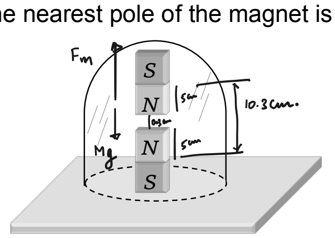
10. Two identical bar magnets with a length 10 cm and weight 50 $gm\text{-}weight$ are arranged freely with their like poles facing in a inverted vertical glass tube. The upper magnet hangs in the air above the lower one so that the distance between the nearest pole of the magnet is 3mm. Pole strength of the poles of each magnet will be

(a) 6.64 $amp \times m$

(b) 2 $amp \times m$

(c) 10.25 $amp \times m$

(d) None of these



$x = 0.1m.$

16. If ϕ_1 and ϕ_2 be the angles of dip observed in two vertical planes at right angles to each other and ϕ be the true angle of dip, then

(a) $\cos^2\phi = \cos^2\phi_1 + \cos^2\phi_2$

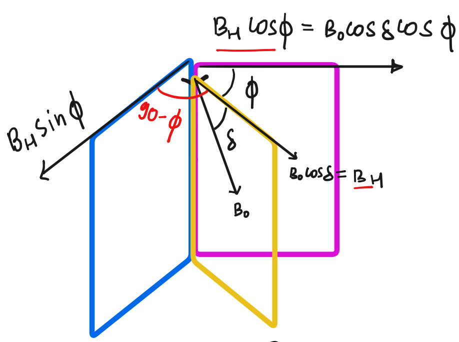
(b) $\sec^2\phi = \sec^2\phi_1 + \sec^2\phi_2$

(c) $\tan^2\phi = \tan^2\phi_1 + \tan^2\phi_2$

✓(d) $\cot^2\phi = \cot^2\phi_1 + \cot^2\phi_2$

$$\tan\delta_1 = \frac{\tan\delta}{\cos\phi}$$

$$\tan\delta_2 = \frac{\tan\delta}{\sin\phi}$$



$$\cot^2\delta = \cot^2\delta_1 + \cot^2\delta_2$$

$$H = \frac{B_0}{\mu_0}$$

$$4\times10^3 = \frac{\mu_0 n i}{\mu_0} = \frac{60}{0.12}\times i$$

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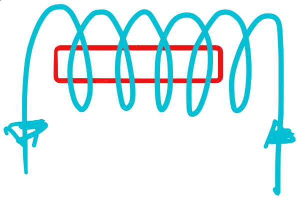
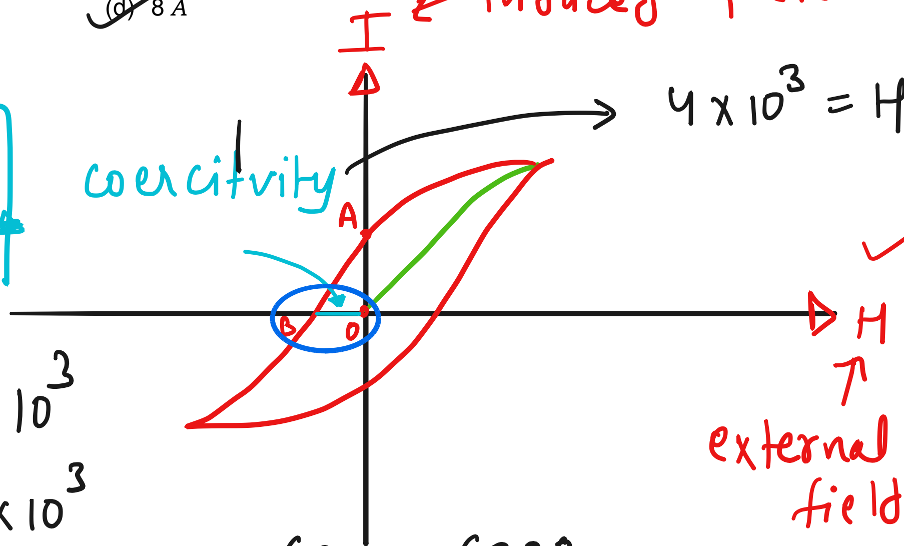
17. A bar magnet has coercivity $4\times10^{3}\ Am^{-1}$. It is desired to demagnetise it by inserting it inside a solenoid 12 cm long and having 60 turns. The current that should be sent through the solenoid is

(a) 2 A (b) 4 A

(c) 6 A (d) 8 A

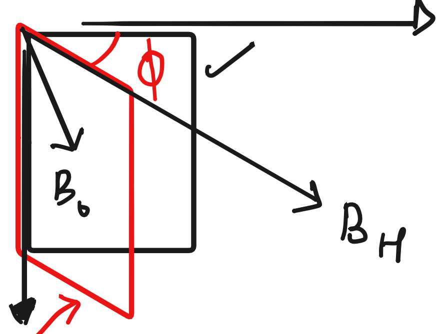




18. A dip needle vibrates in the vertical plane perpendicular to the magnetic meridian. The time period of vibration is found to be 2 $seconds$. The same needle is then allowed to vibrate in the horizontal plane and the time period is again found to be 2 $seconds$. Then the angle of dip is

(a) 0° (b) 30°

(c) 45° (d) 90°



19. A dip needle lies initially in the magnetic meridian when it shows an angle of dip θ at a place. The dip circle is rotated through an angle x in the horizontal plane and then it shows an angle of dip θ'. Then $\frac{\tan\theta'}{\tan\theta}$ is

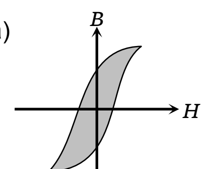
(a) $\frac{1}{\cos x}$ (b) $\frac{1}{\sin x}$

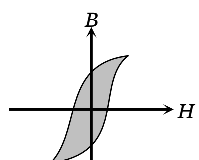
(c) $\frac{1}{\tan x}$ (d) $\cos x$

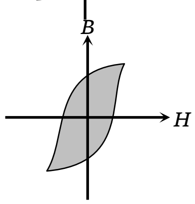
$\tan\delta' = \frac{\tan\delta}{\cos x}$

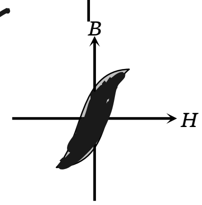
$\frac{\tan\delta'}{\tan\delta} = \frac{1}{\cos x}$

20. For substances hysteresis $(B - H)$ curves are given as shown in figure. For making temporary magnet which of the following is best.

(a)


(b)


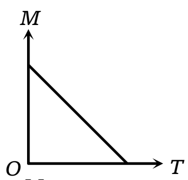
(c)


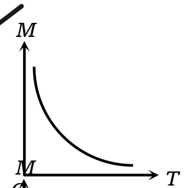
(d)


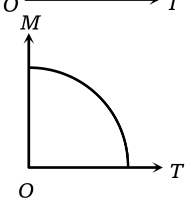
Area of Hysteresis loop gives loss in energy, in form of Heat

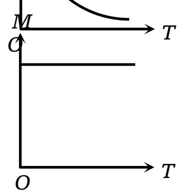
Information mug up.

21. A curve between magnetic moment and temperature of magnet is

(a)


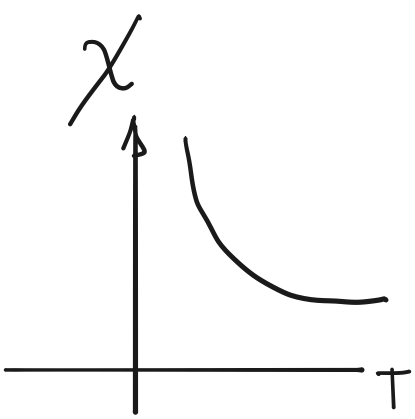
(b) ✓


(c)


(d)


assume material is para-magnet.

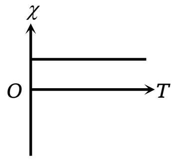
$$I = \frac{M}{V}$$

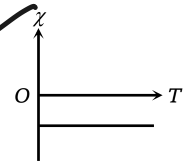


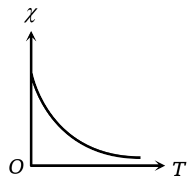
$$\frac{I}{H} = \chi$$

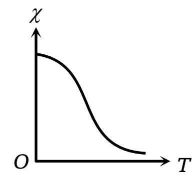
$$\frac{M}{VH} = \chi$$

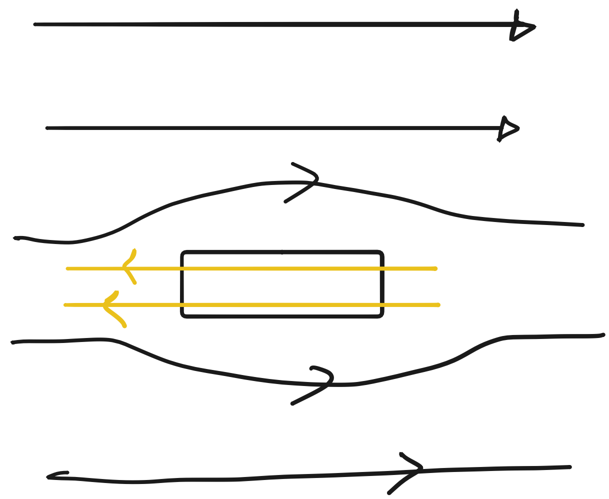
22. The variation of magnetic susceptibility (χ) with temperature for a diamagnetic substance is best represented by

(a)


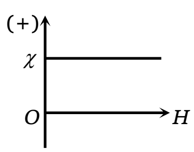
(b)


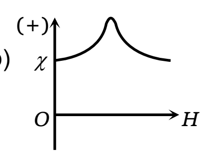
(c)


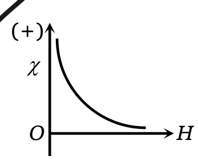
(d)


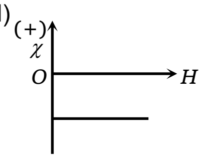


23. The variation of magnetic susceptibility (χ) with magnetising field for a paramagnetic substance is

(a)


(b)


(c)


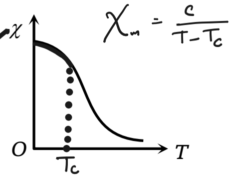
(d)


Curie law

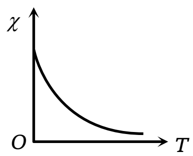
$\downarrow \chi_m = \frac{C}{T \uparrow}$ ← curie constant

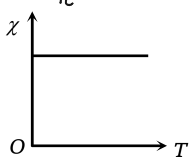
$\downarrow \chi_m = \frac{\downarrow I}{H}$ ← induced Magnetization Intensity

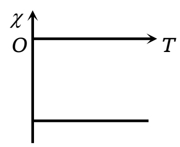
24. The variation of magnetic susceptibility (χ) with absolute temperature T for a ferromagnetic material is

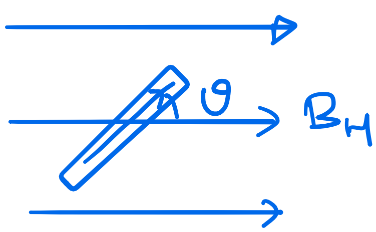
(a) 

$\chi_m = \frac{c}{T - T_c}$

(b) 

(c) 

(d) 



$\tau = MB\sin\theta$

25. A compass needle whose magnetic moment is 60 $amp \times m^2$ pointing geographical north at a certain place, where the horizontal component of earth's magnetic field is 40 $\mu\ Wb/m^2$, experiences a torque $1.2 \times 10^{-3}\ N \times m$. What is the declination at this place **[EAMCET (Engg.) 1996]**

(a) 30° (b) 45°
(c) 60° (d) 25°

$\tau = MB\sin\theta$

$1.2 \times 10^{-3} = 60 \times 40 \times 10^{-6} \times \sin\theta$

$1.2 = 2.4\sin\theta, \quad \sin\theta = 1/2$

26. Due to a small magnet intensity at a distance x in the end on position is 9 Gauss. What will be the intensity at a distance $\frac{x}{2}$ on broad side on position

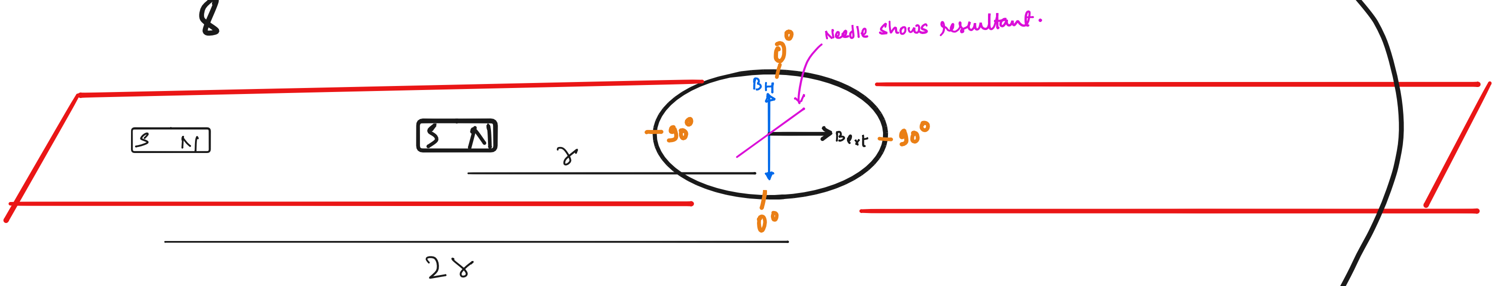
(a) 9 *Gauss* (b) 4 *Gauss*

(c) 36 *Gauss* (d) 4.5 *Gauss*

27. The needle of a deflection galvanometer shows a deflection of 60° due to a short bar magnet at a certain distance in $\tan A$ position. If the distance is doubled, the deflection is

(a) $\sin^{-1}\left(\frac{\sqrt{3}}{8}\right)$ (b) $\cos^{-1}\left(\frac{\sqrt{3}}{8}\right)$

(c) $\tan^{-1}\left(\frac{\sqrt{3}}{8}\right)$ (d) $\cot^{-1}\left(\frac{\sqrt{3}}{8}\right)$



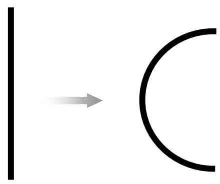
28. A magnetised wire of moment M is bent into an arc of a circle subtending an angle of 60° at the centre; then the new magnetic moment is

(a) $(2M/\pi)$

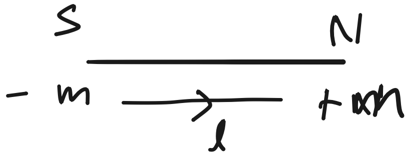
(b) (M/π)

(c) $(3\sqrt{3}M/\pi)$

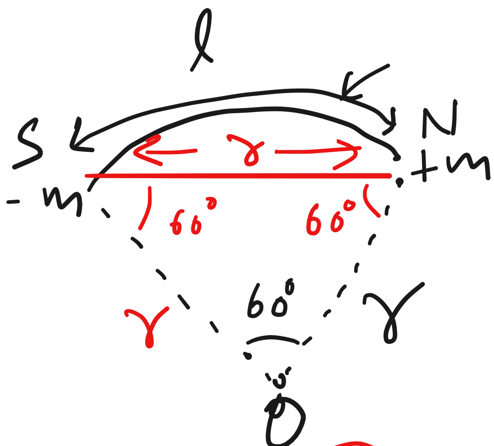
(d) $(3M/\pi)$ ✓



angle = $\frac{arc}{r}$



$M = ml$



$arc = r \times \frac{\pi}{3}$

$arc = \frac{\pi r}{3}$

$\frac{\pi r}{3} = l$

$r = \frac{3l}{\pi}$

$M' = mr = \frac{m 3l}{\pi} = \frac{M3}{\pi}$

29. A tangent galvanometer shows a deflection 45° when 10 mA current pass through it. If the horizontal component of the earth's field is 3.6×10^{-5} T and radius of the coil is 10 cm. The number of turns in the coil is

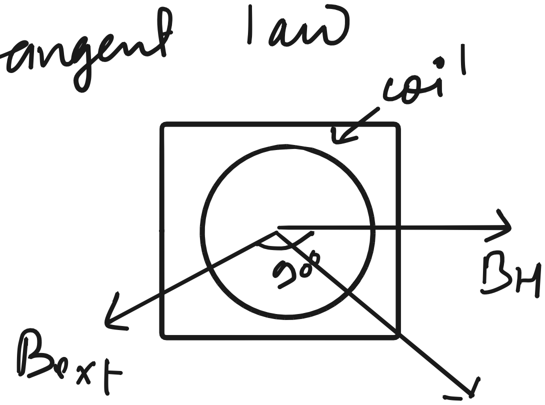
(a) 5700 turns (b) 57 turns

(c) 570 turns (d) 5.7 turns

$i = k\tan\theta$ tangent law

$B_{ext} = B_H \tan\theta$

$N\frac{\mu_0 i}{2r} = B_H \tan\theta$



$$\frac{N \times 4\pi \times 10^{-7} \times 10 \times 10^{-3}}{2 \times 0.1} = 3.6 \times 10^{-6} \times 1$$

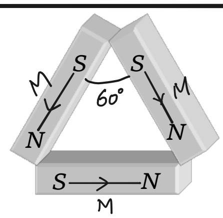
30. Three identical bar magnets each of magnetic moment M are placed in the form of an equilateral triangle as shown. The net magnetic moment of the system is

(a) Zero

(b) $2M$

(c) $M\sqrt{3}$

(d) $\frac{3M}{2}$



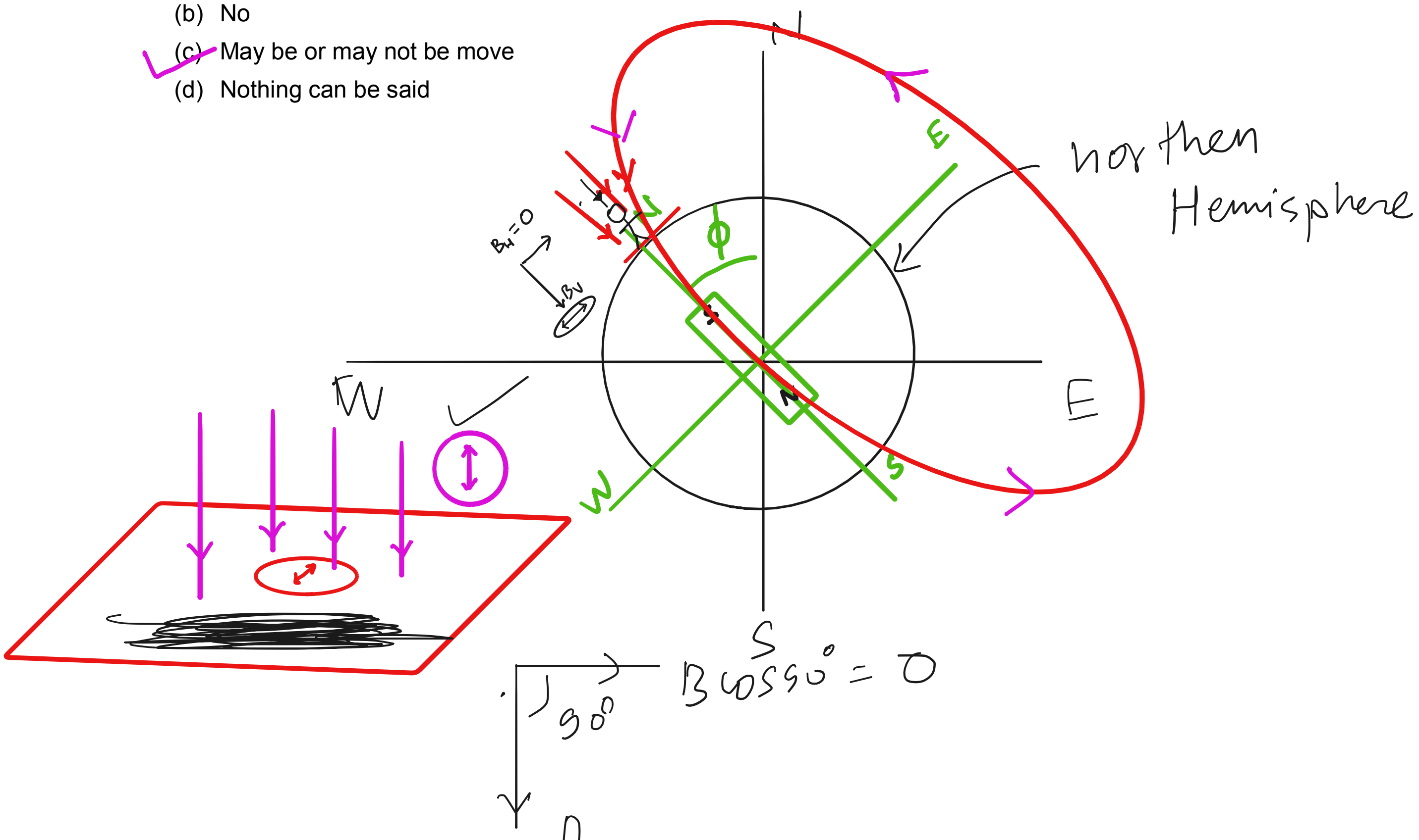
31. A magnetic needle is placed on a cork floating in a still lake in the northern hemisphere. Does the needle together with the cork move towards the north of the lake

(a) Yes

(b) No

(c) May be or may not be move

(d) Nothing can be said



32. The magnet of vibration magnetometer is heated so as to reduce its magnetic moment by 36%. By doing this the periodic time of the magnetometer will

(a) Increases by 36% (b) Increases by 25%
(c) Decreases by 25% (d) Decreases by 64%

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

$$T' = 2\pi\sqrt{\frac{I}{0.64MB}}$$

$$T' = \frac{2\pi}{0.8}\sqrt{\frac{I}{MB}}$$

$$T' = \frac{T}{0.8}\,\frac{10}{8}$$

$$T' = 1.25T$$

$$\frac{T'-T}{T}\times 100$$

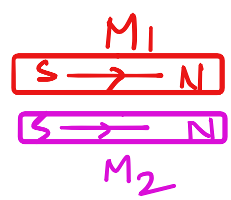
$$\frac{1.25T-T}{T}\times 100$$

25%

33. The ratio of magnetic moments of two bar magnet is 13 : 5. These magnets are held together in a vibration magnetometer are allowed to oscillate in earth's magnetic field with like poles together 15 oscillation per minute are made. What will be the frequency of oscillation of system if unlike poles are together

(a) 10 *oscillations/min* (b) 15 *oscillations/min*
(c) 12 *oscillations/min* (d) $\frac{75}{13}$ *oscillations/min*

$$\frac{M_1}{M_2} = \frac{13}{5}$$



$$T_1 = 2\pi\sqrt{\frac{I_1+I_2}{M_1+M_2}}$$

$$T_2 = 2\pi\sqrt{\frac{I_1+I_2}{M_1-M_2}}$$

$$f_1 = \frac{1}{2\pi}\sqrt{\frac{M_1+M_2}{I_1+I_2}}$$

$$f_2 = \frac{1}{2\pi}\sqrt{\frac{M_1-M_2}{I_1+I_2}}$$

$$\frac{f_2}{f_1} = \sqrt{\frac{M_1+M_2}{M_1-M_2}}$$

$$f_2 = \sqrt{\frac{M_1+M_2}{M_1-M_2}}\times 15.$$

$f_2 = \sqrt{\frac{4}{9}} \times 15 = 10$

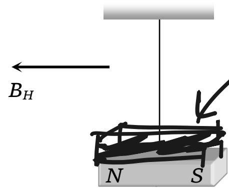
34. A magnet is suspended horizontally in the earth's magnetic field. When it is displaced and then released it oscillates in a horizontal plane with a period T. If a place of wood of the same moment of inertia (about the axis of rotation) as the magnet is attached to the magnet what would the new period of oscillation of the system become

(a) $\frac{T}{3}$

(b) $\frac{T}{2}$

(c) $\frac{T}{\sqrt{2}}$

(d) $T\sqrt{2}$



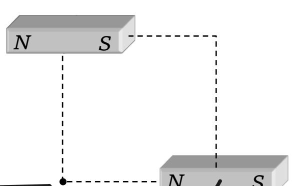
Magnet. 2M

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

$T' = 2\pi\sqrt{\frac{I}{2MB}}$

$T' = \frac{T}{\sqrt{2}}$

35. Two short magnets of magnetic moment 1000 Am^2 are placed as shown at the corn ers of a square of side 10 cm. The net magnetic induction at P is



(a) 0.1 T

(b) 0.2 T

(c) 0.3 T

(d) 0.4 T

$2B = \frac{\mu_0}{4\pi}\frac{2M}{(0.1)^3}$

$\frac{\mu_0}{4\pi}\frac{M}{(0.1)^3} = B$

$\sqrt{5}B = \sqrt{5} \times \frac{\mu_0}{4\pi}\frac{M}{(0.1)^3} = \frac{\sqrt{5} \times 10^{-7} \times 1000}{10^{-3}}$

$= \sqrt{5} \times 10^{-1}$

$\simeq 0.2$

ask doubts please.

~~(29) Prashant~~

~~(28) Komal~~

~~(33) yash~~

~~(31) Shivangi~~

~~(25) Shivani Verma~~

~~Ekt~~

Ekta (17)

~~(7), (21) Prakhar~~