1.

Match the following

	List-I		List-II
(a)	Tangent galvanometer → g	(e)	Uniform calibration of scale
(b)	Radial magnetic field → e	(f)	High resistance
(c)	Ammeter → h	(g)	Reduction factor
(d)	Voltmeter → f	(h)	Low resistance

The correct match is

(1) a-h, b-g, c-f, d-e

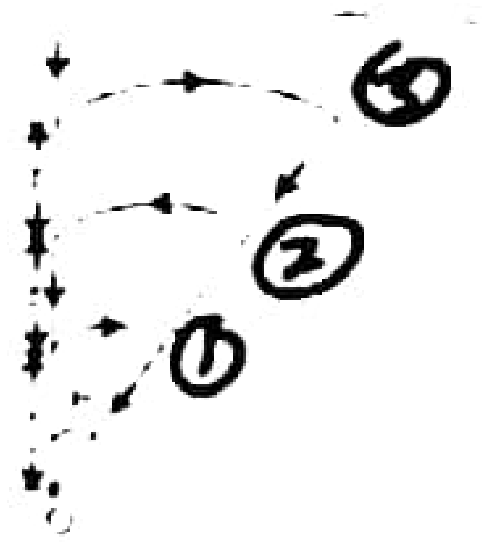
✓(2*) a-g, b-e, c-h, d-f

(3) a-h, b-e, c-f, d-g

(4) a-g, b-h, c-e, d-f

2.

Shown in the figure is a conductor carrying a current I. The magnetic field intensity at the point O(common centre of all the three arcs) is :



(A) $\frac{5\mu_0 I\theta}{24\pi r}$ (B) $\frac{\mu_0 I\theta}{24\pi r}$ (C) $\frac{11\mu_0 I\theta}{24\pi r}$ (D) zero

$$B_N = B_1 - B_2 + B_3$$

$$= \frac{\mu_0}{4\pi} I(\theta)\left(\frac{1}{r} - \frac{1}{2r} + \frac{1}{3r}\right)$$

$$= \frac{5}{24\pi}\frac{\mu_0 I\theta}{r}$$

3.

... The magnitude of magnetic field strength is

(C) ... (D) None

$$B = \frac{\mu_0}{4\pi}\frac{I}{r}\left(-\sin\alpha + \sin\beta\right)$$

$$= \frac{\mu_0}{4\pi}\frac{I}{a}\left(\frac{b}{\sqrt{a^2+b^2}}\right)$$

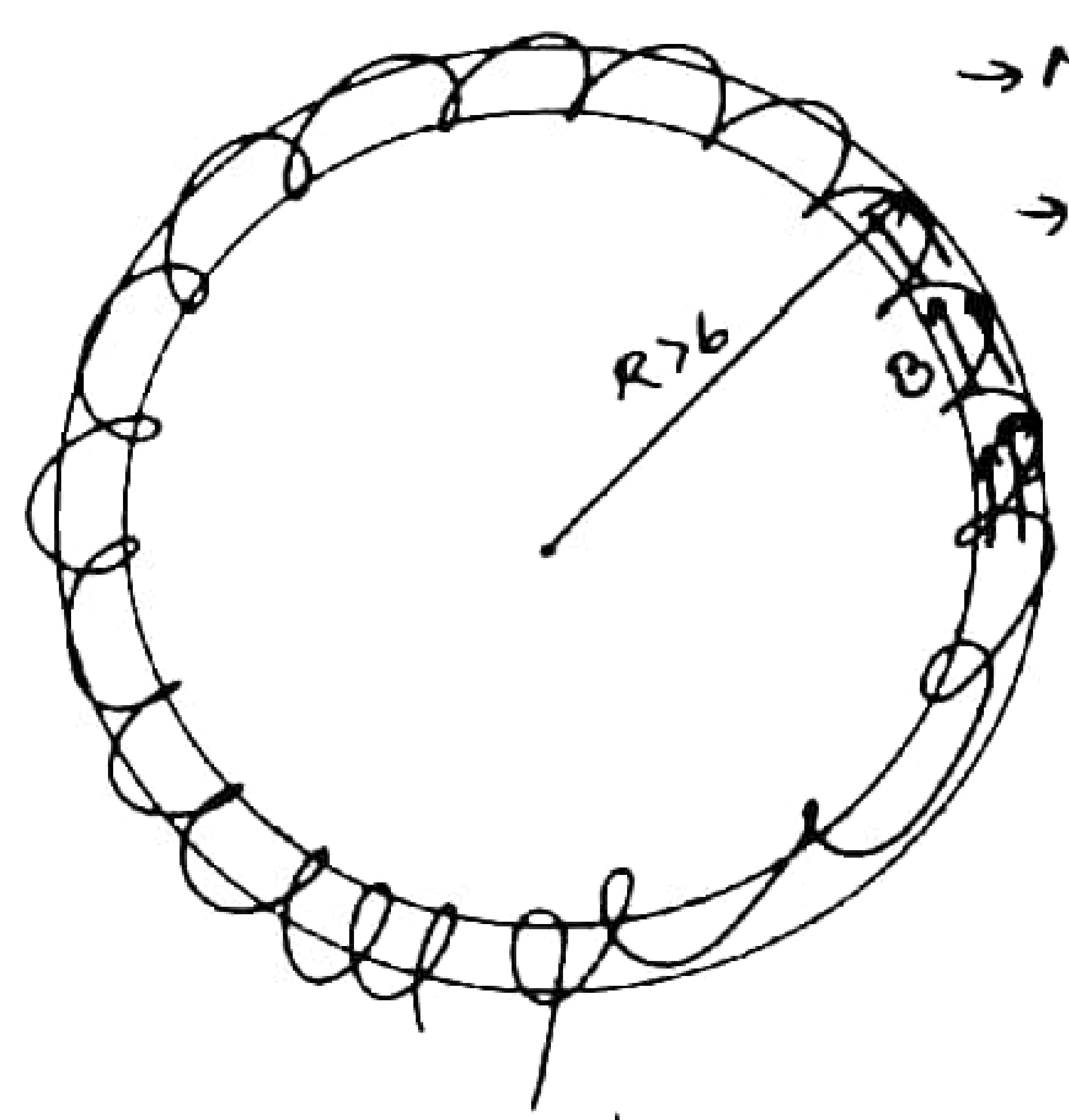
$$= \frac{\mu_0 I}{4\pi a}\left(\frac{b}{\sqrt{a^2+b^2}}\right)$$

$(a, 0)$

4.

Consider a toroid of circular cross-section of radius b, major radius R much greater than minor radius b. Find the total energy stored in toroid. (I is current)

(A) $\frac{\mu_0 N^2 I^2 b^2}{2R}$ (B) $\frac{\mu_0 N^2 I^2 b^2}{3R}$ (C) $\frac{\mu_0 N^2 I^2 b^2}{6R}$ (D) $\frac{\mu_0 N^2 I^2 b^2}{4R}$



→ Mean Circumferential Rad ≈ R

→ $U = \frac{1}{2} L I^2$

$B = \mu_0 \frac{N}{2\pi R} \times I$

$\phi_{Total} = N B A$

$= N \cdot \frac{\mu_0 N I \cdot \pi b^2}{2\pi R}$

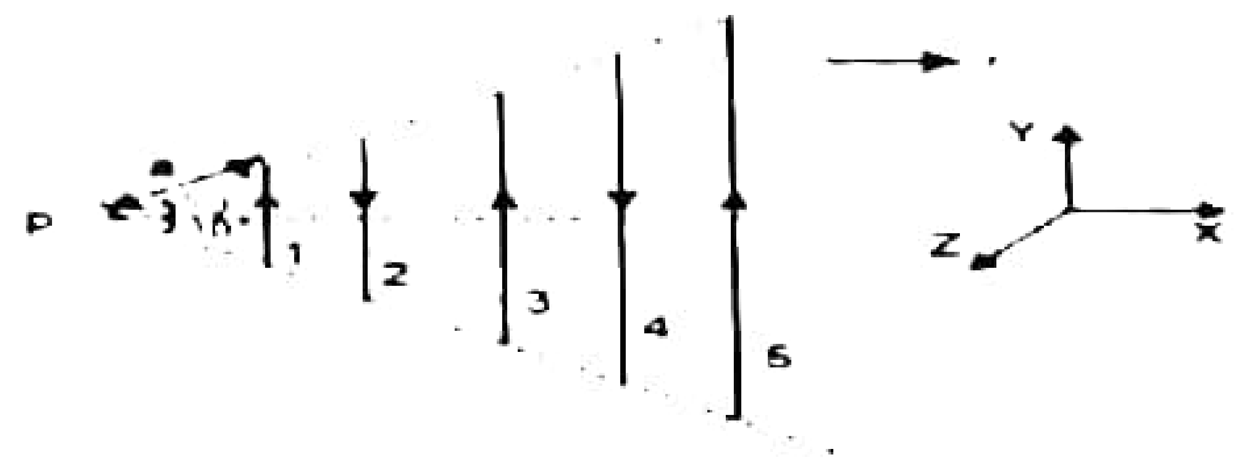
$\phi_T = \frac{\mu_0 N^2 b^2 I}{2R} = L I$

$L = \frac{\mu_0 N^2 b^2}{2R}$

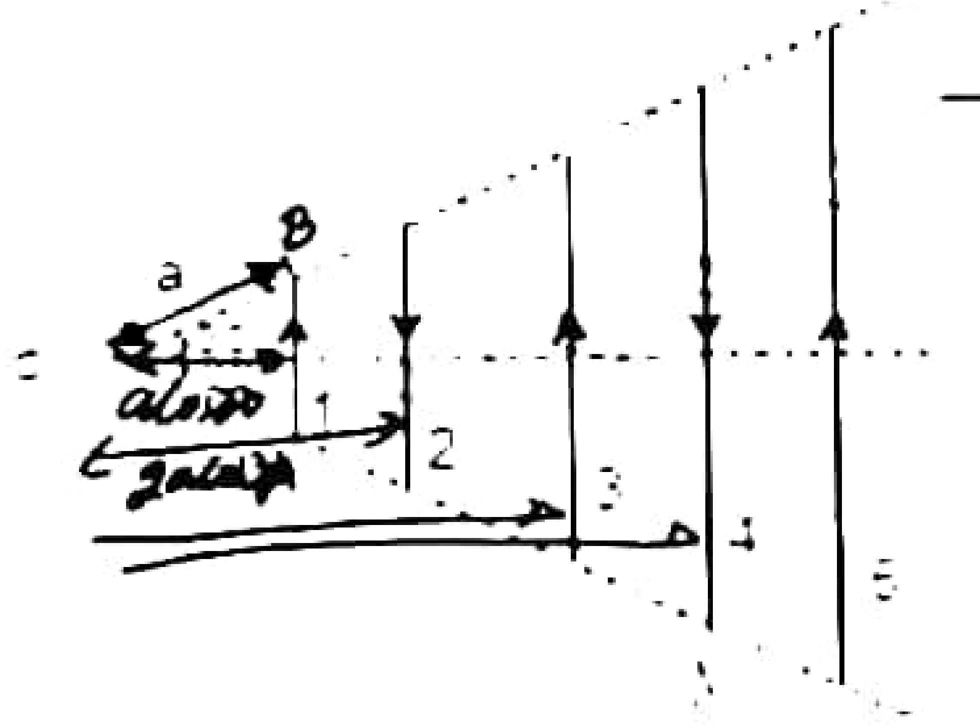
$U = \frac{1}{2} \times \frac{\mu_0 N^2 b^2}{2R} \times I^2$

$U = \frac{\mu_0 N^2 b^2 I^2}{4R}$

5\. Infinite number of straight wires each carrying current I are equally placed as shown in the figure. Adjacent wires have current in opposite direction. Net magnetic field at point P is



(A) $\frac{\mu_0 I}{4\pi}\frac{\ln 2}{\sqrt{3}a}\hat{k}$ (B) $\frac{\mu_0 I}{4\pi}\frac{\ln 4}{\sqrt{3}a}\hat{k}$ (C) $\frac{\mu_0 I}{4\pi}\frac{\ln 4}{\sqrt{3}a}(-\hat{k})$ (D) zero



$B_N = B_1 - B_2 + B_3 - B_4 - - -$

$B_1 = \frac{\mu_0}{4\pi}\frac{I}{a\cos 30}(2\sin 30)$

$B_2 = \frac{\mu_0}{4\pi}\frac{I}{2a\cos 30}(2\sin 30)$

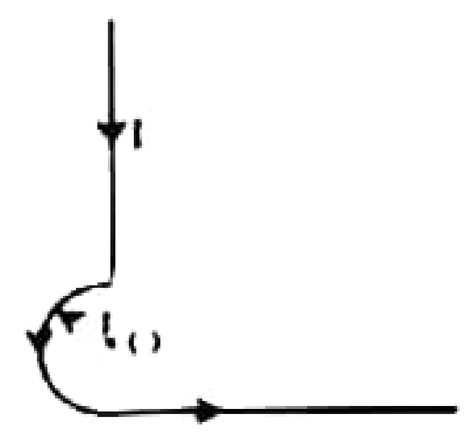
$B_N = \frac{\mu_0}{4\pi}\frac{I \times 2\tan 30}{a}\left(1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} - \right)$

$B_N = \frac{\mu_0 I}{2\sqrt{3}a}\log_e 2\ \hat{k}$

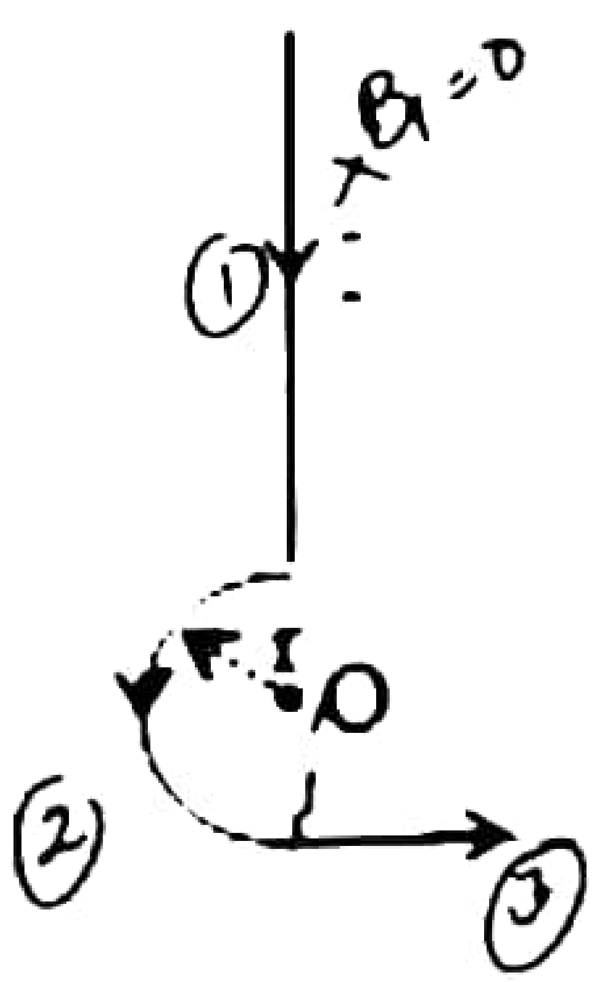
$B_N = \frac{\mu_0}{4\pi}\frac{I}{\sqrt{3}a}2\log_e 2$

$B_N = \frac{\mu_0}{4\pi}\frac{I}{a\sqrt{3}}\log_e 4\ \hat{k}$

6\. In the figure, the magnetic induction at point O is –



(A) $\frac{\mu_0 I}{4\pi r}$ (B) $\frac{\mu_0 I}{4r} + \frac{\mu_0 I}{2\pi r}$ (C) $\frac{\mu_0 I}{4r} + \frac{\mu_0 I}{4\pi r}$ (D) $\frac{\mu_0 I}{4r} - \frac{\mu_0 I}{4\pi r}$



$B_N = B_2 + B_3$

$= \frac{\mu_0}{4\pi}\frac{I}{r}(\pi) + \frac{\mu_0}{4\pi}\frac{I}{r}$

$= \frac{\mu_0 I}{4r} + \frac{\mu_0 I}{4\pi r}$

7.

Two particles X and Y having equal charges, after being accelerated through the same potential difference, enter a region of uniform magnetic field and describe circular paths of radii R_1 and R_2 respectively. The ratio of the masses of X to that of Y is-

(A) $\frac{R}{R}$ (B) $\frac{R_2}{R_1}$ (C) $\left(\frac{R_1}{R_2}\right)^2$ (D) $\frac{R_1}{R_2}$

Sol^n $q_x = q_y$

$V_x = V_y$

$\frac{m_x}{m_y} = ?$

$R = \frac{\sqrt{2mqV}}{qB} \propto \sqrt{m}$

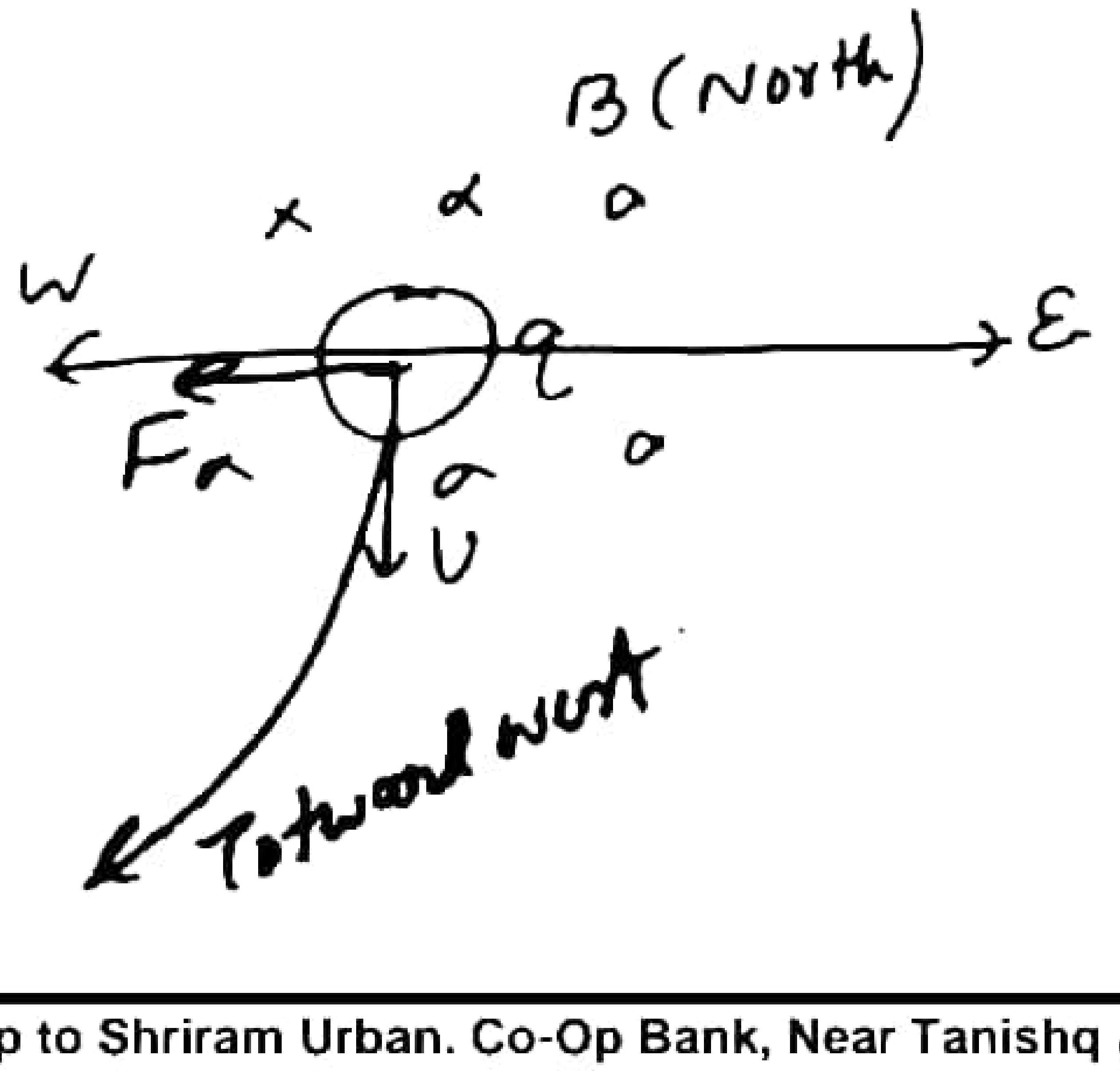
$\frac{R_1}{R_2} = \sqrt{\frac{m_x}{m_y}}$

$\frac{m_x}{m_y} = \left(\frac{R_1}{R_2}\right)^2$

8.

A negative charged particle falling freely under gravity enters a region having horizontal magnetic field pointing towards north. The particle will be deflected towards-

(A) East (B) West (C) North (D) South



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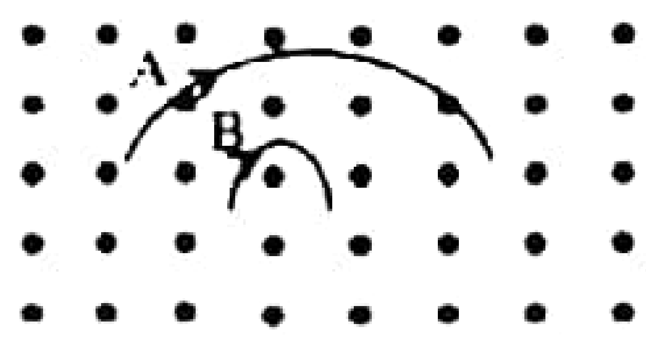
9.

Two particle A and B of masses m_A and m_B respectively and having the same charge are moving in a plane. A uniform magnetic field exists perpendicular to this plane. The speeds of the particles are v_A and v_B respectively and the trajectories are as shown in the figure. Then-



(A) $m_A v_A < m_B v_B$

(B) $m_A v_A > m_B v_B$

(C) $m_A < m_B$ and $v_A < v_B$

(D) $m_A = m_B$ and $v_A = v_B$

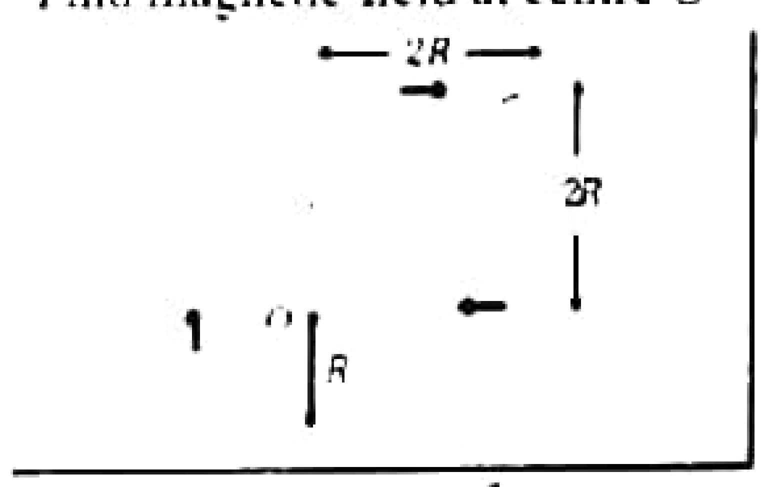
$r_A > r_B$

$\frac{m_A v_A}{qB} > \frac{m_B v_B}{qB}$

$\boxed{m_A v_A > m_B v_B}$

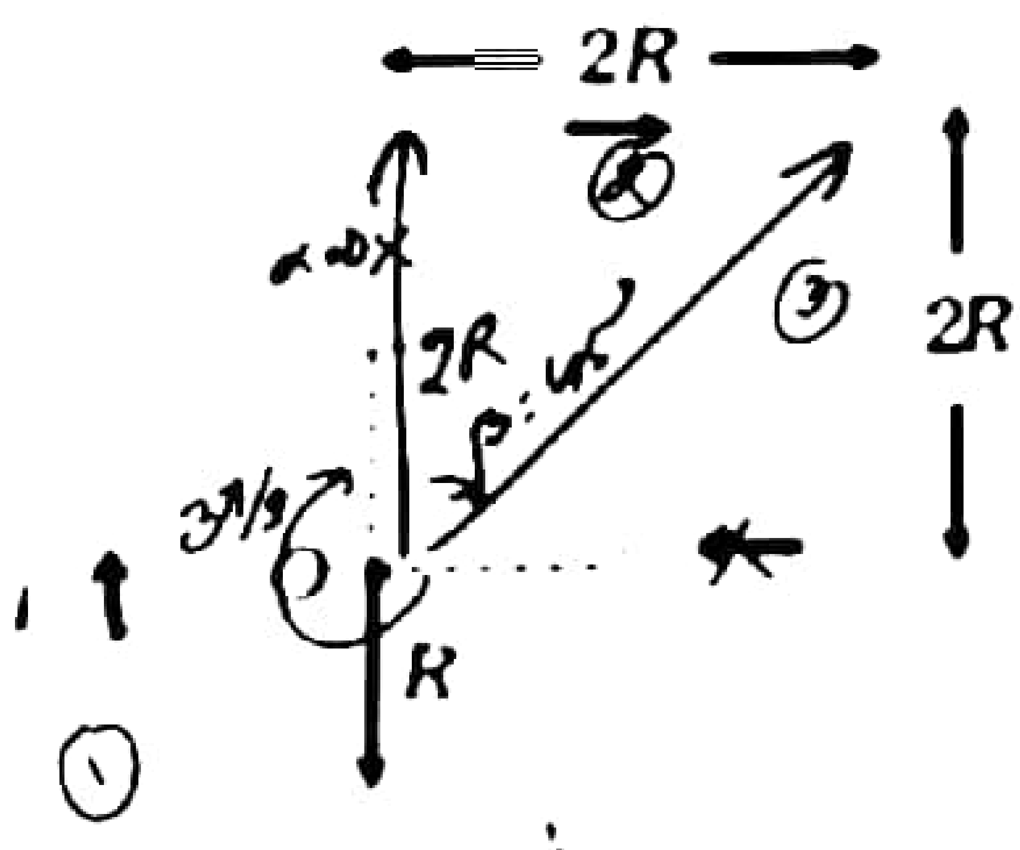
10.

Find magnetic field at centre O



(a) $\frac{\mu}{4\pi}\left(\frac{1}{\sqrt{2}}+\frac{3\pi}{2}\right)$ ⊙ (b) $\frac{\mu}{4\pi}\frac{I}{r}\left(\frac{1}{\sqrt{2}}+\frac{3\pi}{2}\right)$ ⊙

(c) $\frac{\mu}{4\pi}\left(\frac{1}{\sqrt{2}}-\frac{3\pi}{2}\right)$ (d) $\frac{\mu}{4\pi}\frac{I}{r}\left(\frac{1}{\sqrt{2}}-\frac{3\pi}{2}\right)$



$B_T = B_1 + 2B_2$

$= \frac{\mu_0}{4\pi}\frac{I}{R}\left(\frac{3\pi}{2}\right) + 2\times\frac{\mu_0}{4\pi}\frac{I}{2R}\left[\sin 0 + \sin 45\right]$

$= \frac{\mu_0}{4\pi}\frac{I}{R}\left[\frac{3\pi}{2} + \frac{2}{2}\times\frac{1}{\sqrt{2}}\right]$

$= \frac{\mu_0}{4\pi}\frac{I}{R}\left(\frac{3\pi}{2}+\frac{1}{\sqrt{2}}\right)$ ⊗

11.

A particle moves in a circular path of diameter 1.0 m under the action of magnetic field of 0.40 Tesla . An electric field of 200 V/m makes the path of particle straight. Find the charge/mass ratio of the particle.

(A) 2.5×10^3 cb/kg (B) 2×10^5 cb/kg (C) 3.5×10^5 cb/kg (D) 3×10^5 cb/kg

Soln

$r = \frac{1}{2} m$

$B = 0.4 T$

$E = 200 V/m$

$qE = qvB$

$\frac{E}{B} = v$

$\frac{200}{0.4} = v$

$v = 500 m/s$

$r = \frac{mv}{qB}$

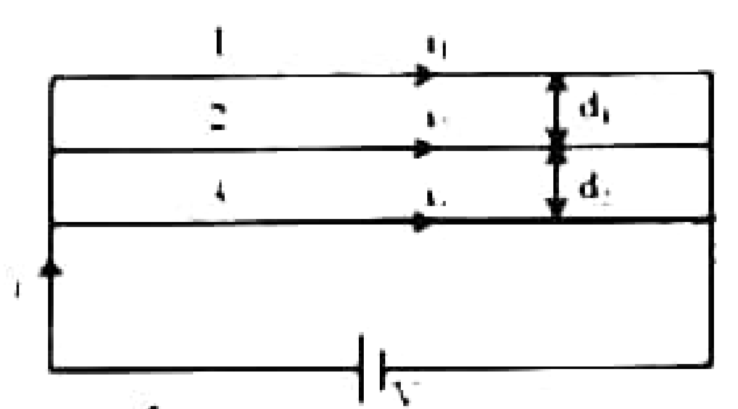
$\frac{q}{m} = \frac{v}{rB}$

$= \frac{500}{\frac{1}{2} \times 0.4}$

$= \frac{10000}{4} = 2500 = 2.5 \times 10^3$ c/kg

12.

Three long wires of resistances in the ratio 3 : 4 : 5 are connected in parallel to each other as shown in figure . If net force on middle wire is zero then $\frac{d_1}{d_2}$ will be –

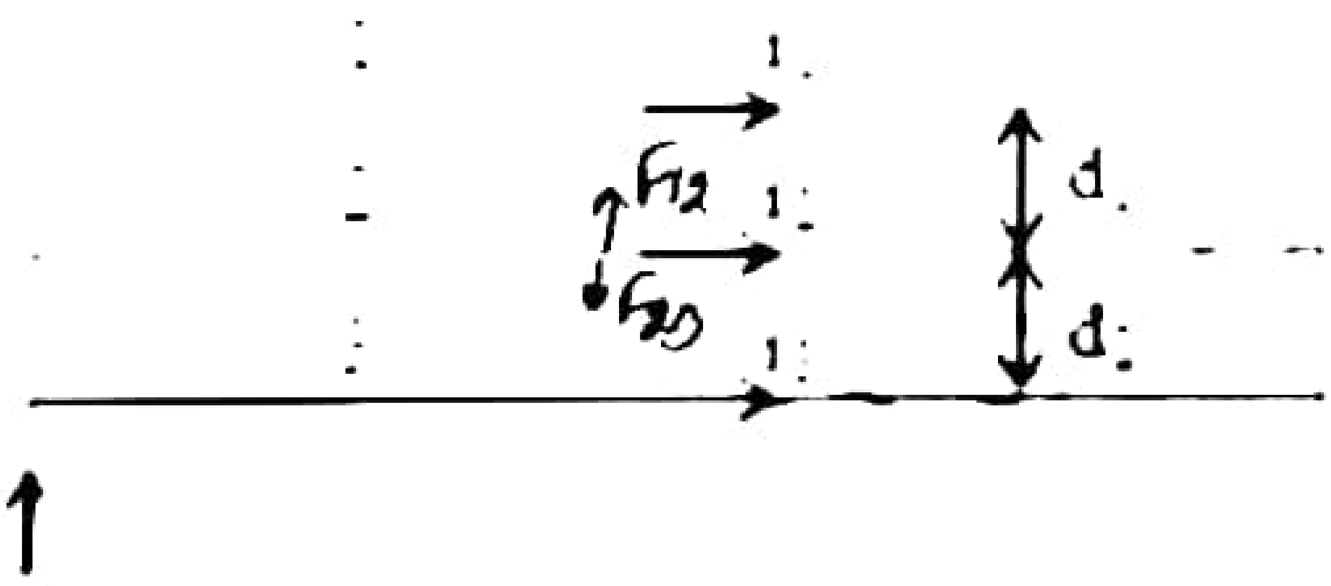


(A) 9 : 25 (B) 5 : 3 (C) $\sqrt{5} : \sqrt{3}$ (D) 1 : 1

$R_1 : R_2 : R_3 = 3 : 4 : 5$

$I_1 : I_2 : I_3 = \frac{1}{3} : \frac{1}{4} : \frac{1}{5}$

$I_1 = \frac{I}{3}$ $I_2 = \frac{I}{4}$ $I_3 = \frac{I}{5}$



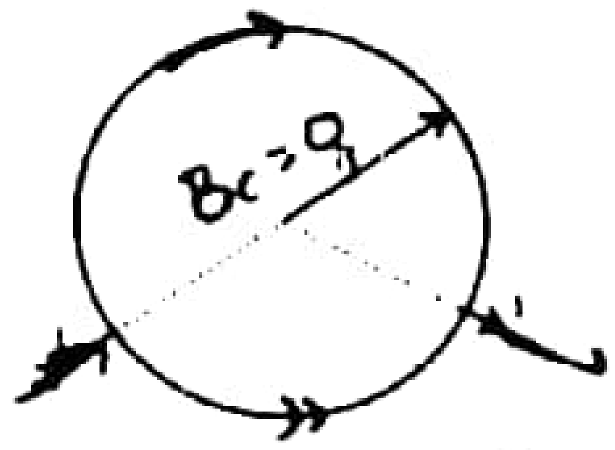
$F_{12} = F_{23}$

$\frac{\mu_0}{4\pi} \frac{2 I_1 I_2 l}{d_1} = \frac{\mu_0}{4\pi} \frac{2 I_2 I_3 l}{d_2}$

$\frac{d_1}{d_2} = \frac{I_1}{I_3} = \frac{5}{3}$

13.

A ring is made of homogeneous uniform wire. Current passes through it as shown in figure. Find magnetic induction at its centre.



(A) 1 (B) 3 (C) 2 (D) 0

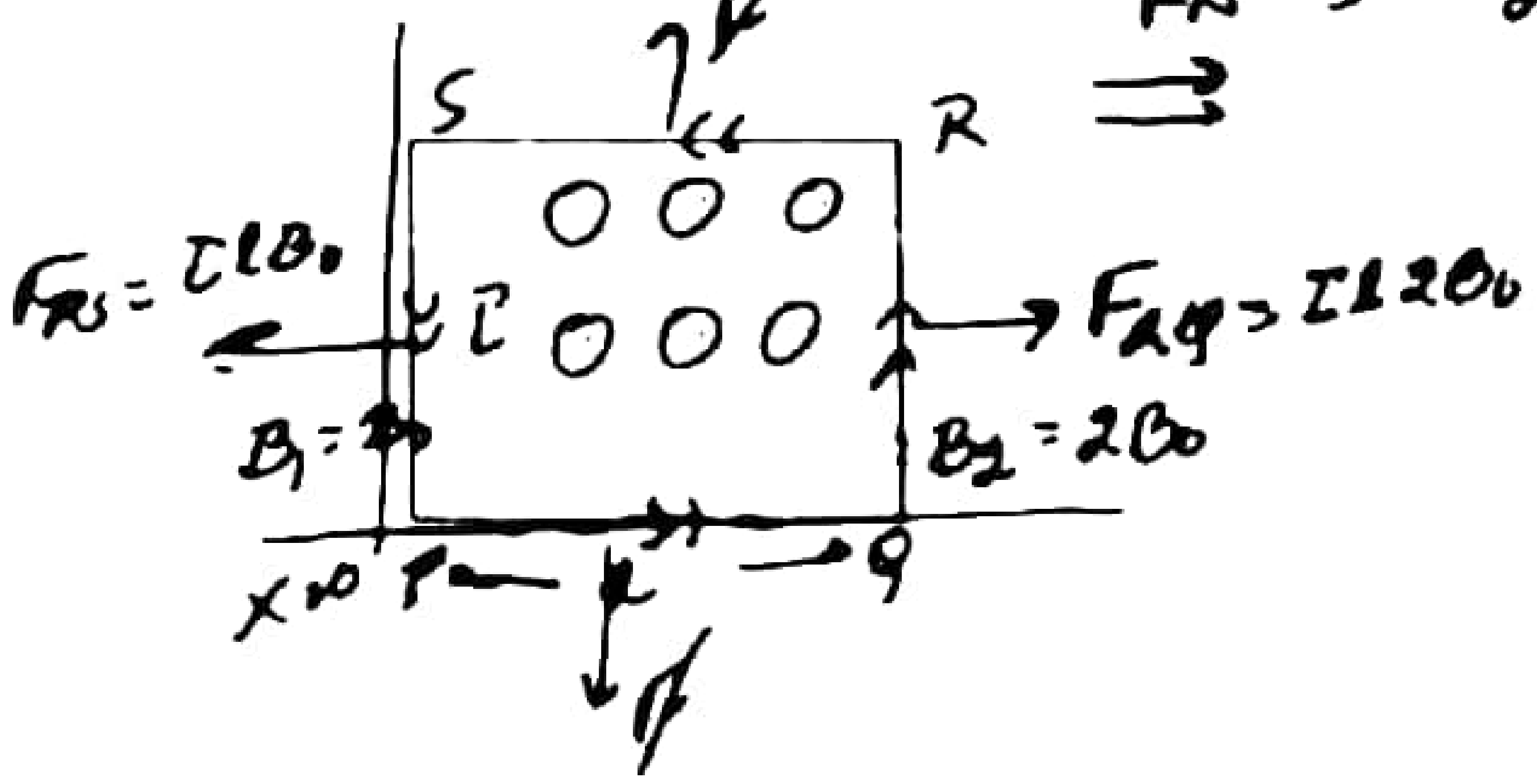
14.

Q.14 The magnetic field existing in a region is given by $\vec{B} = B_0\left[1 + \frac{x}{l}\right]\hat{k}$

A square loop of edge l and carrying current i, is placed with its edges parallel to the x-y axis. Find the magnitude of the net magnetic force experienced by the loop.

(A) $2B_0 i l$ (B) $B_0 i_0 l$ (C) $B_0 i l$ (D) $B i l$

$\vec{B} = B_0\left(1 + \frac{x}{l}\right)\hat{k}$



$F_N = F_2 - F_1 = 2IlB_0 - IlB_0$

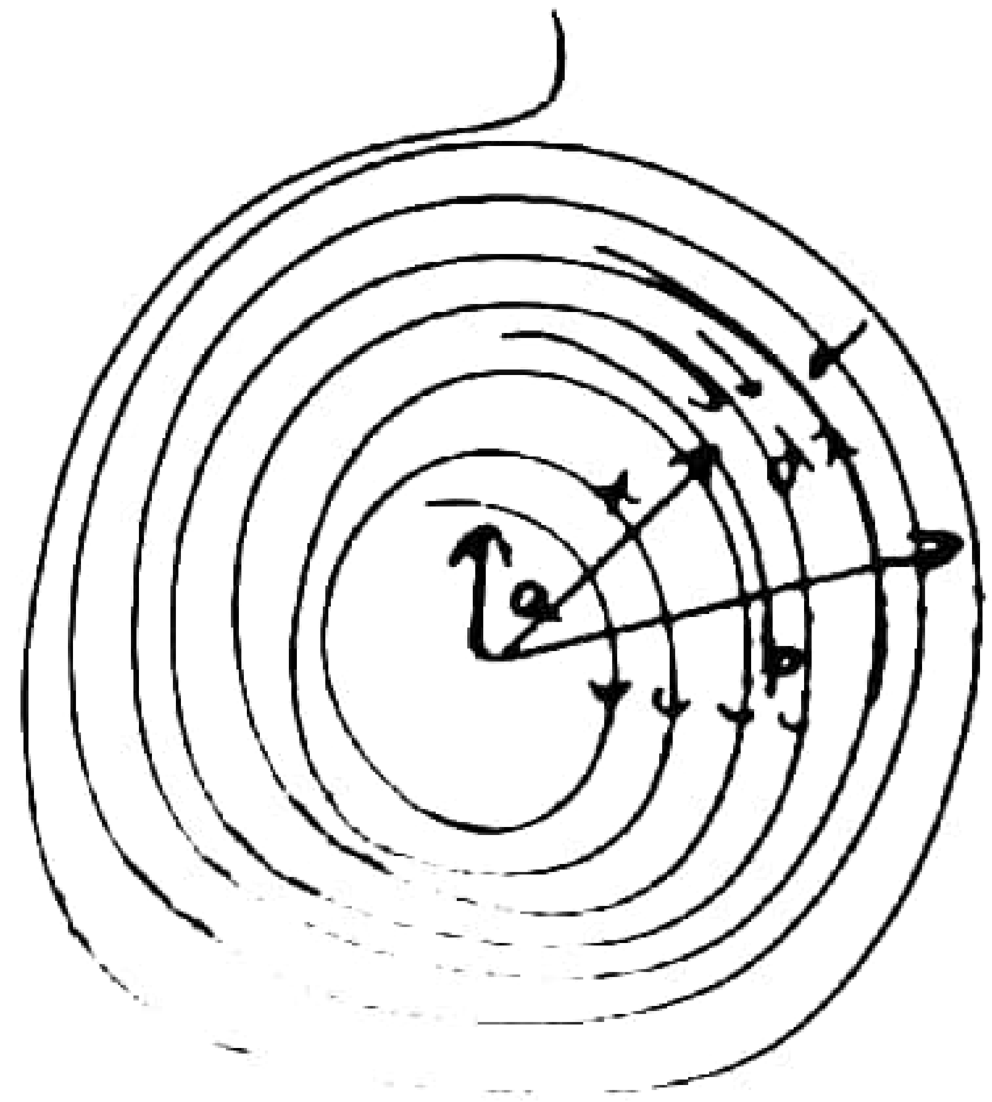
$= IlB_0$

15.

A coil having N turns is wound tightly in the form of a spiral with inner and outer radii a and b respectively. When a current I passes through the coil, the magnetic field at the centre is-

(A) $\frac{\mu_0 NI}{b}$ (B) $\frac{2\mu_0 NI}{a}$ (C) $\frac{\mu_0 NI}{2(b-a)} \ln\frac{b}{a}$ (D) $\frac{\mu_0 IN}{2(b-a)} \ln\frac{b}{a}$

Sol^n



(b−a) width = N turns

1 width = $\frac{N}{(b-a)}$ turns.

dx width = $\frac{N}{(b-a)}dx$ turns

$\int dB = \int_a^b \frac{\mu_0 I}{2x} \times \frac{N}{(b-a)} dx$

$B = \frac{\mu_0 NI}{2(b-a)} \int_a^b \frac{dx}{x}$

$B = \frac{\mu_0 NI}{2(b-a)} \ln\frac{b}{a}$

16.

Statement 1: For a charged particle describing circular path in a uniform transverse magnetic field, the kinetic energy remain constant Correct

Statement 2: The work done by the force due to magnetic field on a moving charge is always zero Correct

(1) Both Statement – 1 and Statement – 2 are true

(2) Statement – 1 is true and Statement – 2 is false

(3) Statement – 1 is False and Statement – 2 is true

(4) Both Statement – 1 and Statement – 2 are False

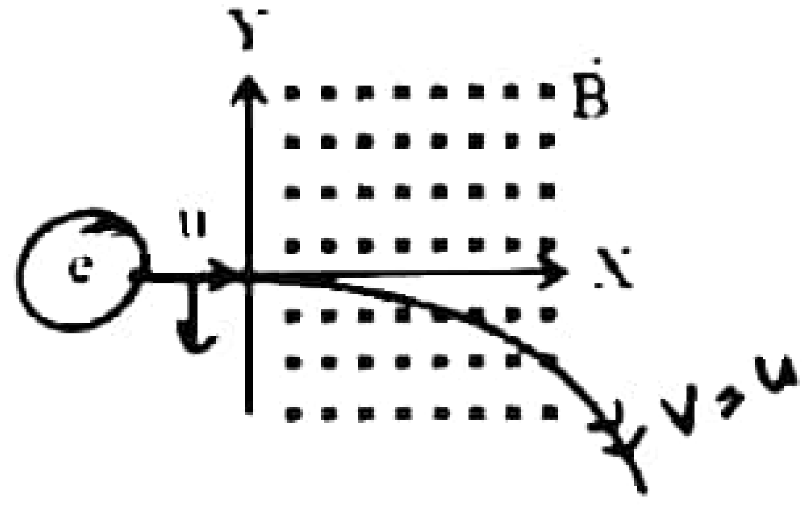
$W_m = 0$

$\Delta K = 0$

K = Const

17.

A uniform magnetic field $\vec{B} = -B_0\hat{k}$ exists in region $X > 0$. An electron moving with velocity $\vec{U}$ along +X axis if $\vec{V}$ is the final velocity of the electron when it comes out of the magnetic field, then–



(A) $V > U, Y < 0$ (B) $V < U, Y > 0$ (C) $V = U, Y > 0$ (D) $V = U, Y < 0$

18.

A large metal sheet carries an electric current along its surface. Current per unit length is λ. Magnetic field near the metal sheet is –

$B = \frac{1}{2}\mu_0\lambda$

(A) $\frac{1}{2}\mu_0\lambda$ (B) $\frac{\lambda\mu_0}{2\pi}$ (C) $\lambda\,\mu_0$ (D) $\frac{\mu_0}{2\lambda\pi}$

19.

An electric current i is flowing in a circular coil of radius a. At what distant from the centre of the axis of the coil will the magnetic field be $\frac{1}{8}$th of its value at the centre?

(A) 3a (B) $\sqrt{3}$ a (C) $\frac{a}{3}$ (D) $\frac{a}{\sqrt{3}}$

$B_{ax} = \frac{1}{8} B_c$

$\frac{B_c}{\left(1+\frac{x^2}{a^2}\right)^{3/2}} = \frac{1}{8} B_c$

$8 = \left(1+\frac{x^2}{a^2}\right)^{3/2}$

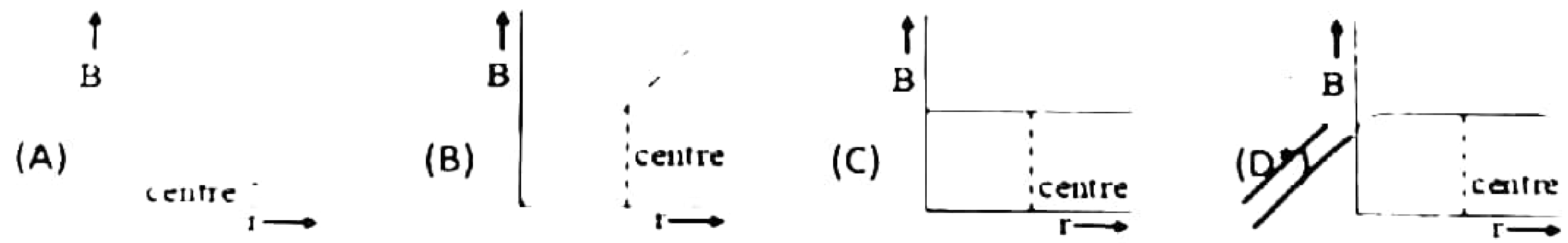
$(8)^{2/3} = 1+\frac{x^2}{a^2}$

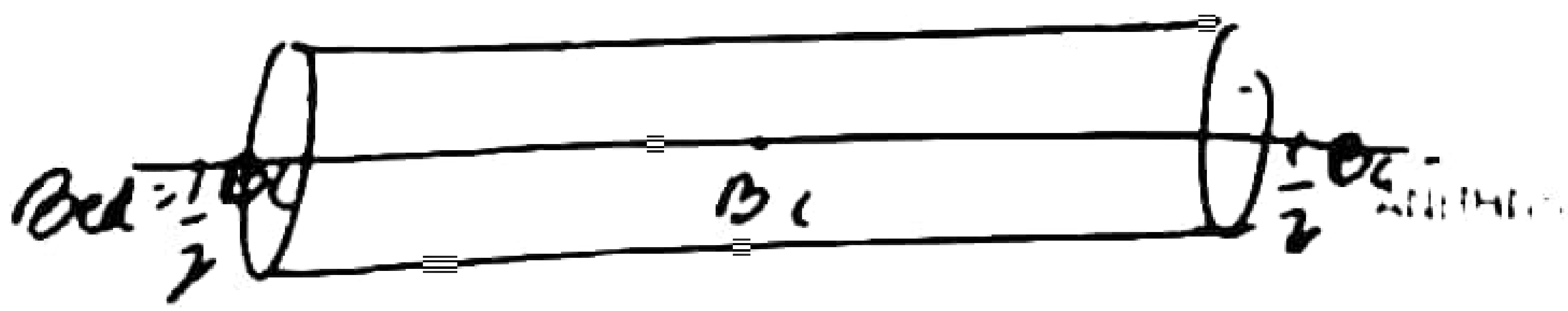
$4 = 1+\frac{x^2}{a^2}$

$x = \sqrt{3}a$

20.

In a solenoid the magnetic induction produced due to current (B) is a function of distance x from one end -





21.

A hollow tube is carrying an electric current along the length distributed uniformly over its surface. The magnetic field -

(A) increases linearly from the axis to the surface

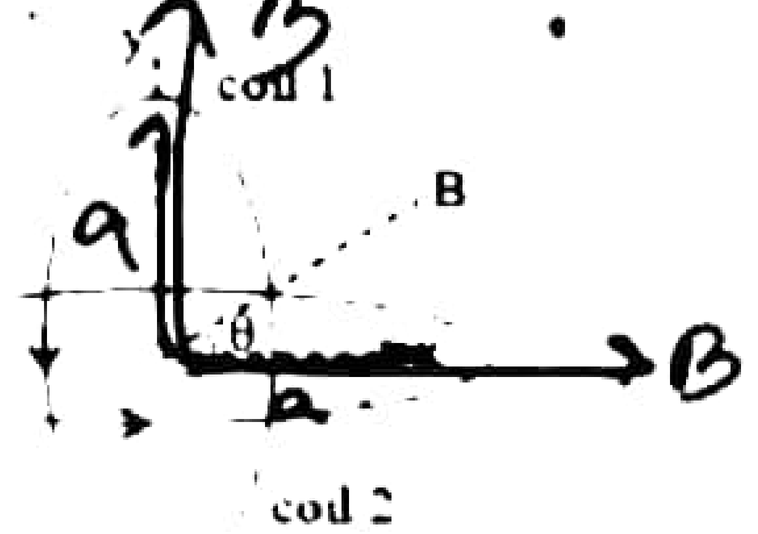
(B) is non-zero inside the tube

(C) inside the tube is zero

(D) is zero just outside the tube

22.

For the arrangement of fig the magnetic field at the centre O will be -



(A) $\frac{\sqrt{2}\mu_0 NI}{2a}$ (B) $\frac{\mu_0 NI}{2\sqrt{2}a}$ (C) $\frac{\mu_0 NI}{2}$ (D) $\frac{\mu_0 NI}{2a}$

$B_{N} = \sqrt{2}\, B$

$= \sqrt{2} \times \frac{\mu_0 NI}{2a}$

23.

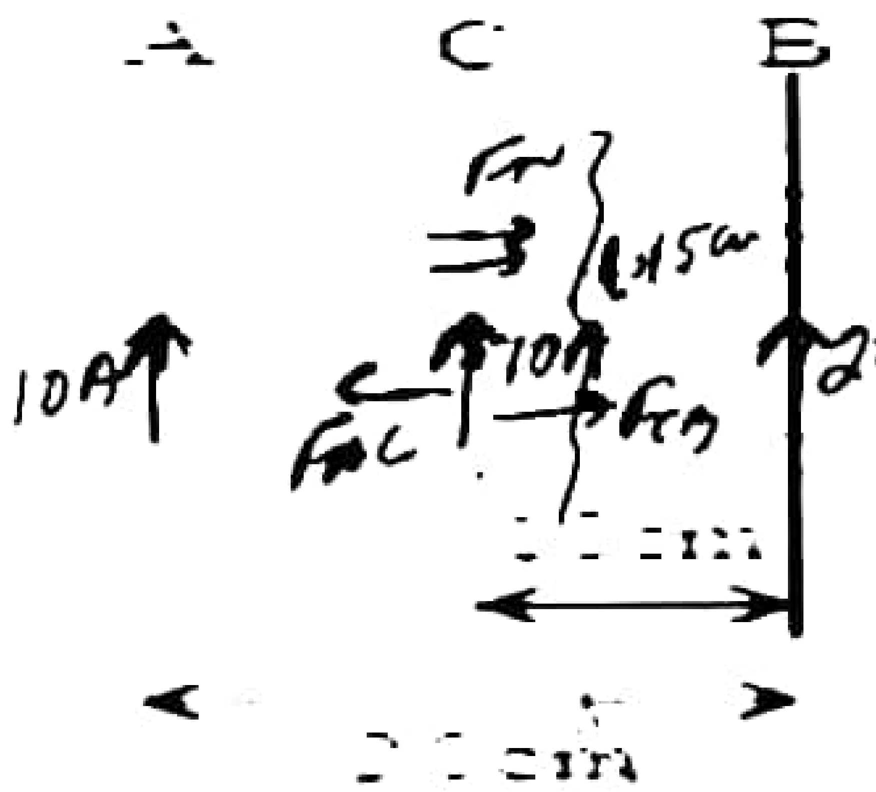
In the adjoining figure two very long, parallel wires A and B carry currents of 10 ampere and 20 ampere respectively and are at a distance 20 cm apart. If a third wire C (length 15 cm) having a current of 10 ampere is placed between them then how much force will act on C? The direction of current in all the three wires is same

(A) 3 × 10 N (left) ✗

(B) 30×10^{-6} N (right) ✓

(C) 6 × 10 N (left) ✗

(D) 6 × 10 N (right)



$F_N = F_{CB} - F_{AC}$

$= \frac{\mu_0}{4\pi} \frac{2 \times 20 \times 10 \times 15}{10} - \frac{\mu_0}{4\pi} \frac{2 \times 10 \times 10 \times 15}{10}$

$= 10^{-7} \times 600 - 10^{-7} \times 300$

$= 300 \times 10^{-7}$

$= 3 \times 10^{-5}$ N

$= 30 \times 10^{-6}$ N (Right).

24.

Of dia, para and ferromagnetism, the universal property of all substances is -

(A) diamagnetism ✓

(B) paramagnetism

(C) ferromagnetism

(D) all of the above

25.

A thin rectangular magnet suspended freely has a period of oscillation equal to T. Now it is broken into two equal halves (each having half of the original length) and one piece is made to oscillate freely in the same field. If its period of oscillation is T', the ratio $\frac{T'}{T}$ is -

(A) $\frac{1}{2\sqrt{2}}$

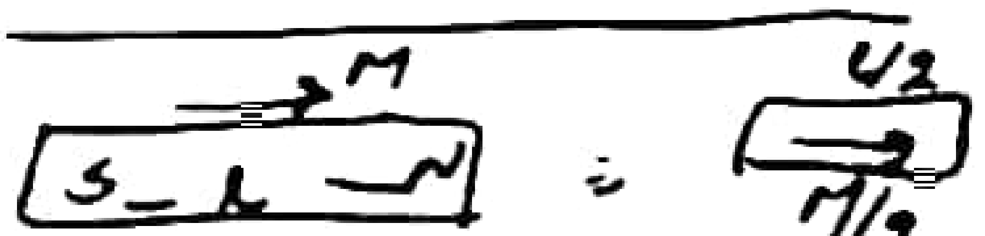
(B) $\frac{1}{2}$ ✓

(C) 2

(D) $\frac{1}{4}$

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

$T' = 2\pi\sqrt{\frac{I}{8 \times \frac{M}{2} B}}$



$I = \frac{1}{12} m l^2$

$I = \frac{1}{12} \times \frac{m}{2} \times \left(\frac{l}{2}\right)^2 = \frac{1}{8} \times \frac{1}{12} m l^2 = \frac{1}{8} I$

$T' = \frac{1}{2} \times 2\pi\sqrt{\frac{I}{MB}}$

$T' = \frac{1}{2} T \Rightarrow \frac{T'}{T} = \frac{1}{2}$

26.
Two magnets are held together in a vibration magnetometer and are allowed to oscillate in the earth's magnetic field with like poles together. 12 oscillations per minute are made but for unlike poles together only 4 oscillations per minute are executed. The ratio of their magnetic moments is -

(A) 3 : 1 (B) 1 : 3 (C) 3 : 5 (D) 5 : 4

$T_S = \frac{1}{12}\,min = 5\,sec$

$T_D = \frac{1}{4}\,min = 15\,s$

$\frac{M_1}{M_2} = \frac{T_D^2 + T_S^2}{T_D^2 - T_S^2} = \frac{225+25}{225-25} = \frac{250}{200} = \frac{5}{4}$

27.
The ratio of magnetic fields due to a smaller bar magnet in the end on position to broad side on position is-

(A) 1/4 (B) 1/2 (C) 1 (D) 2

$B_{ax} = 2B_{eq}$

$\frac{B_{ax}}{B_{eq}} = \frac{2}{1}$

28.
Potential energy of a bar magnet of magnetic moment M placed in a magnetic field of induction B such that it makes an angle θ with the direction of B is -

(A) MB sin θ (B) – MB cos θ (C) MB (1 – cos θ) (D) MB (1+ cosθ)

29.

A current of 3 A is flowing in a plane circular coil of radius 4 cm and number of turns 20. The coil is placed in a uniform magnetic field of magnetic induction 0.5 T. Then the dipole moment of the coil is -

(A) 3000 Am^2 (B) 0.3 Am^2 (C) 300 $A\,m^2$ (D) 75 $A\,m^2$

$M = NIA$

$= 20 \times 3 \times \pi \times 16 \times 10^{-4}$

$= 0.3\, A\cdot m^2$

30.

Magnetic lines of force are -

(A) continuous

(B) discontinuous

(C) sometimes continuous and sometimes discontinuous

(D) nothing can be said

31.

Statement 1: If an electron while coming vertically from outer space enter the earth's magnetic field, it is deflected towards west. Correct

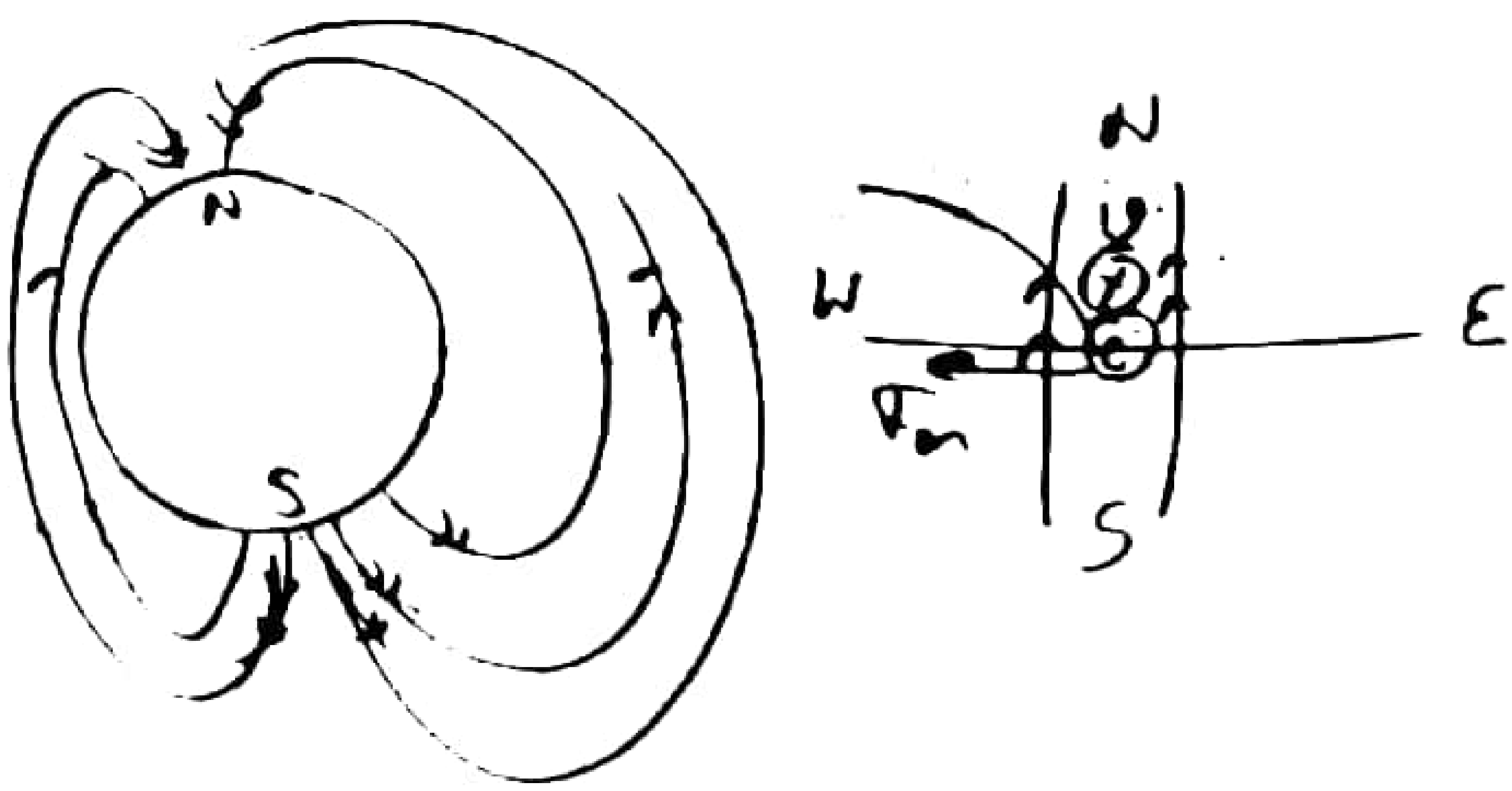
Statement 2: Direction of force experienced by a charged particle in a magnetic field is determined by Fleming's left hand rule. Correct

(1) Both Statement – 1 and Statement – 2 are true

(2) Statement – 1 is true and Statement – 2 is false

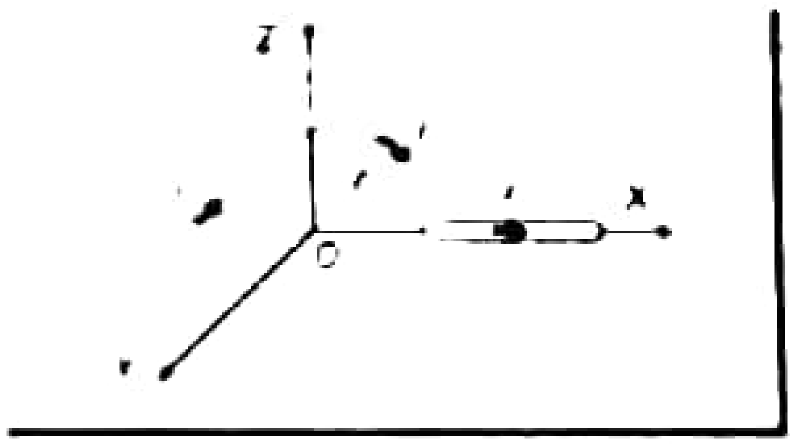
(3) Statement – 1 is False and Statement – 2 is true

(4) Both Statement – 1 and Statement – 2 are False



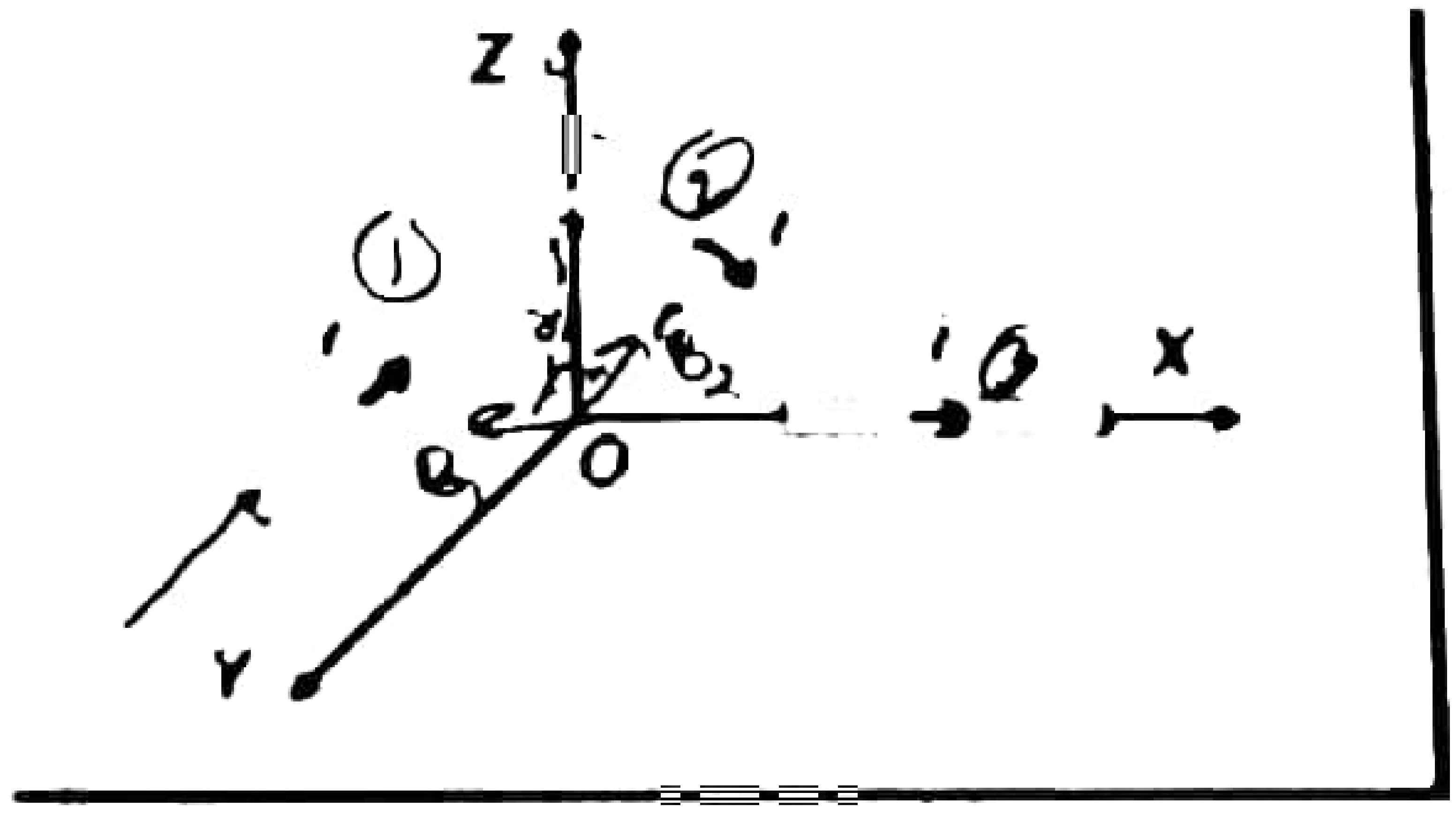
32.

Find magnetic field at O



(a) [illegible] (b) [illegible]

(c) $\frac{\mu}{4\pi}\frac{\pi i}{2r}$ (d) None of these



$\vec{B}_N = -B_1\hat{i} - B_2\hat{j}$

$B_N = \sqrt{B_1^2 + B_2^2}$

$B_1 = \frac{\mu_0}{4\pi}\frac{I}{r}$

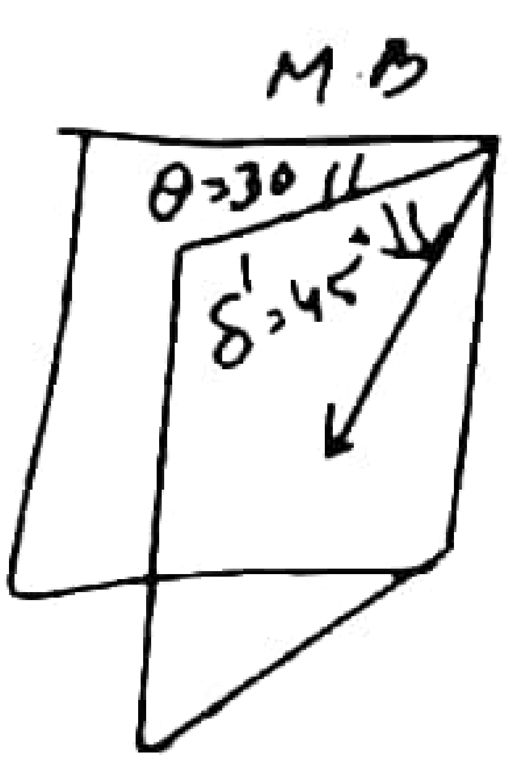
$B_2 = \frac{\mu_0}{4\pi}\frac{I}{r}\left(\frac{\pi}{2}\right)$

$B_N = \frac{\mu_0}{4\pi}\frac{I}{r}\sqrt{1 + \frac{\pi^2}{4}}$

33.

If a magnet is suspended at angle 30° to the magnetic meridian, the dip needle 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) $\tan^{-1}(2/\sqrt{3})$

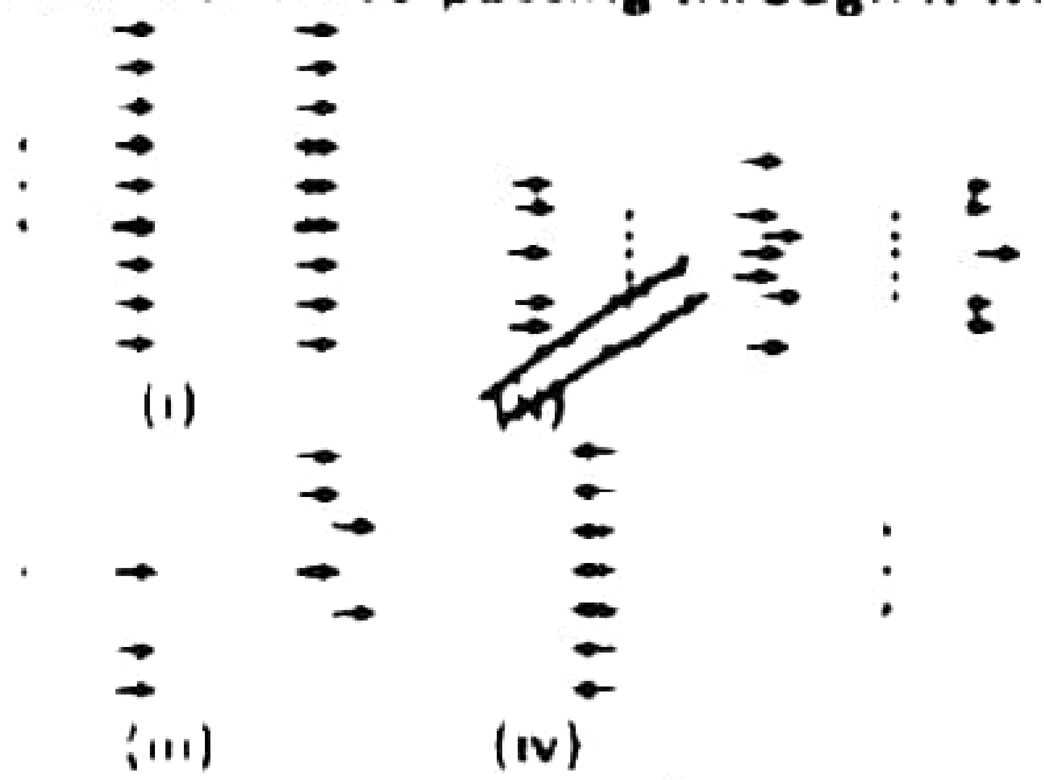


$\tan\delta' = \frac{\tan\delta}{\cos\theta}$

$\tan\delta = \tan 45° \times \cos 30°$

$\delta = \tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$

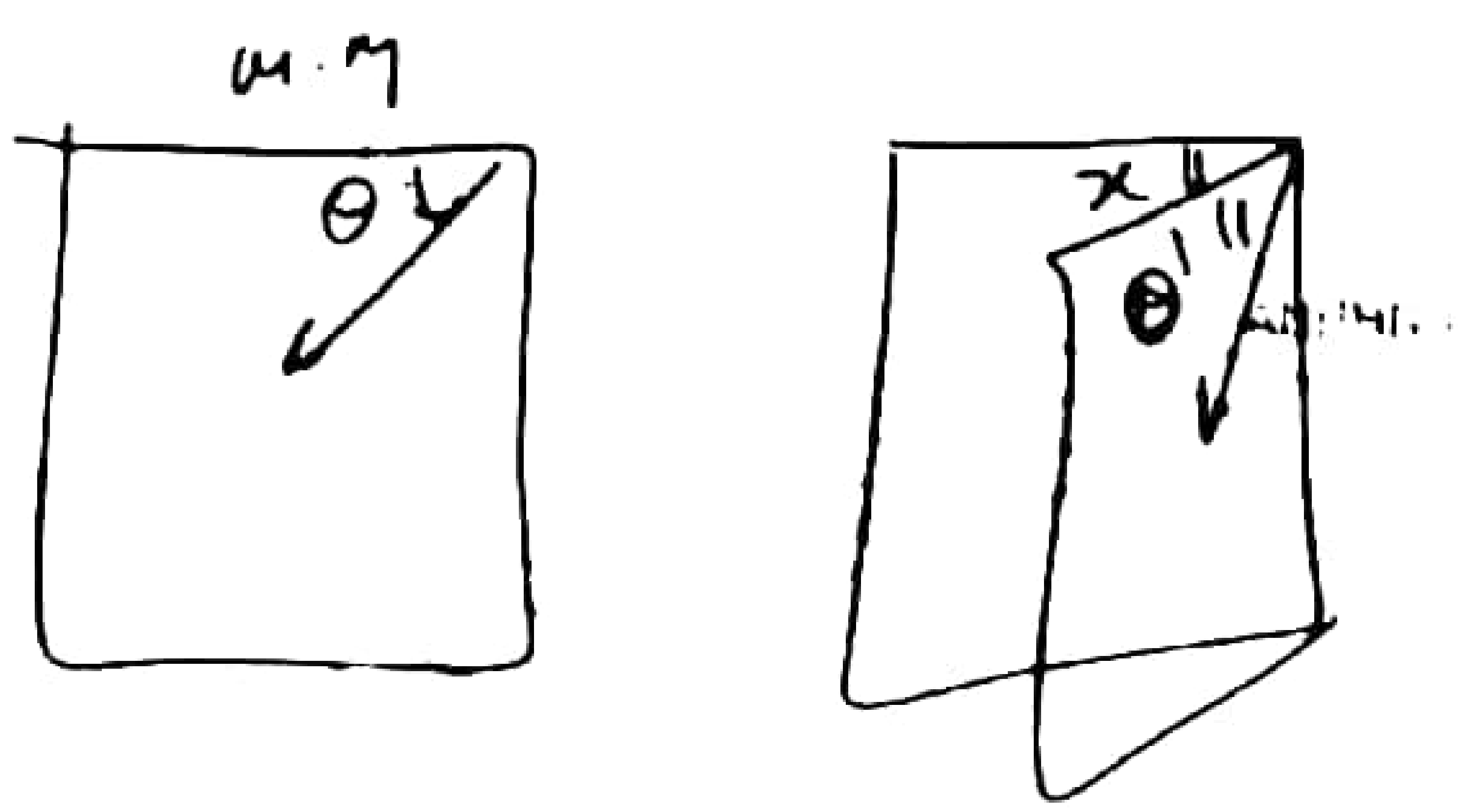
34.
A uniform magnetic field parallel to the plane of paper, existed in space initially directed from left to right. When a bar of soft iron is placed in the field parallel to it, the lines of force passing through it will be represented by Fig.



(A) (i) (B) (ii) (C) (iii) (D) (iv)

35.
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) $\cos x$

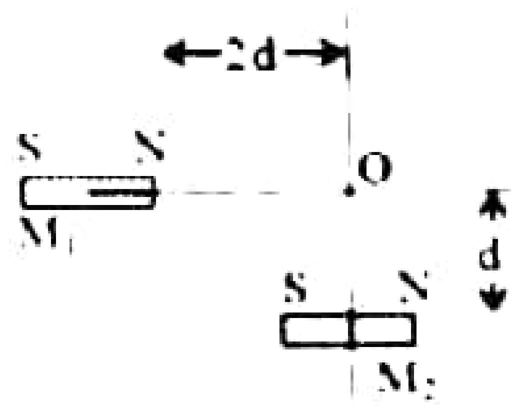


$\tan\theta' = \frac{\tan\theta}{\cos x}$

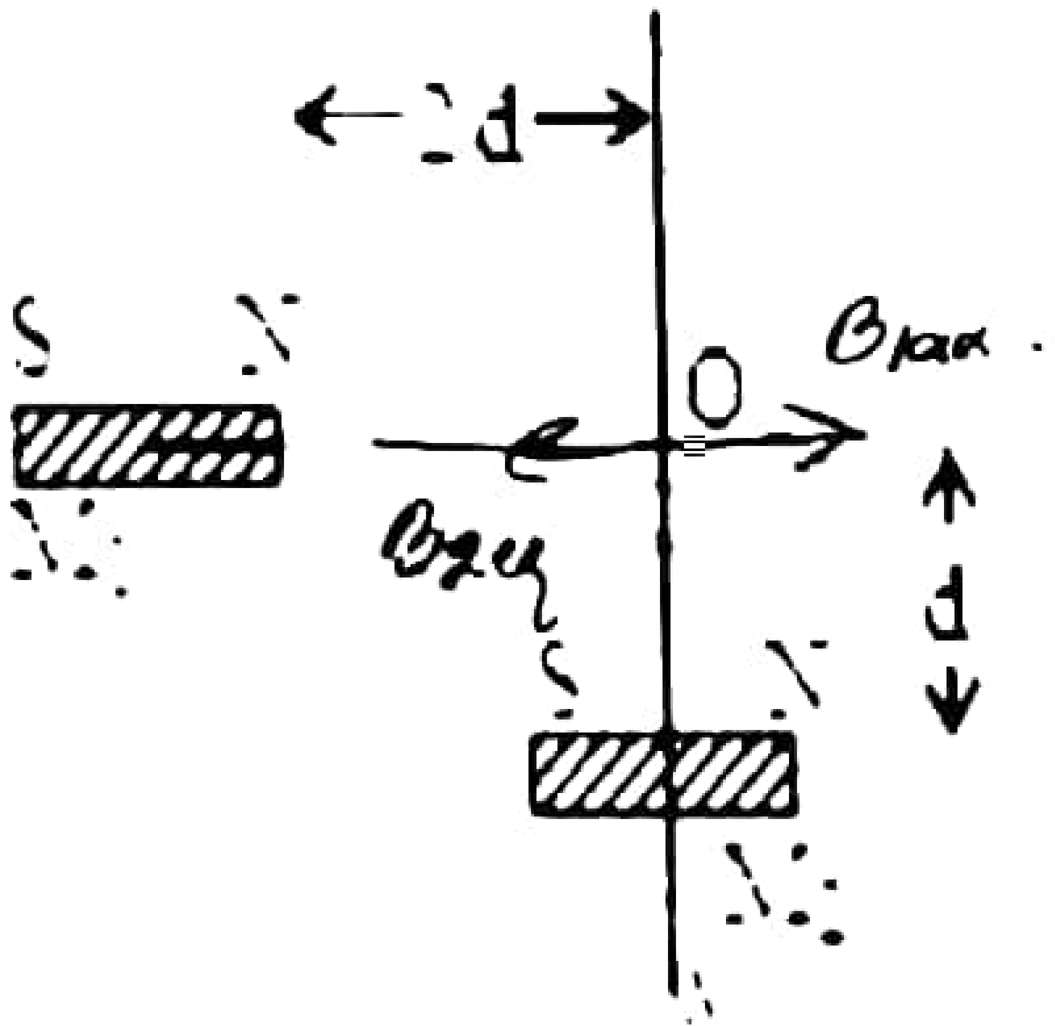
$\frac{\tan\theta'}{\tan\theta} = \frac{1}{\cos x}$

36.

Two short bar magnet of magnetic moments M_1 and M_2 are kept on X and Y axis as shown is figure. If resultant magnetic field at origin is zero, Then $\frac{M_1}{M_2}$ will be



(A) 1 : 4 (B) 4 : 1 (C) 2 : 1 (D) 8 : 1



if $B_N = 0$

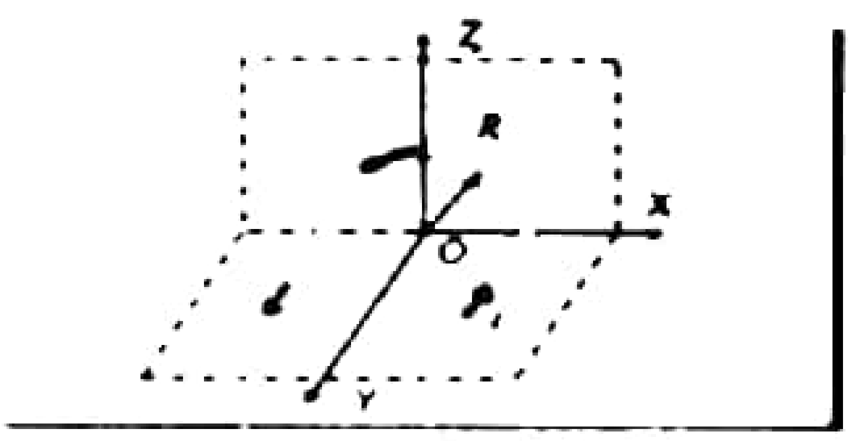
$B_{1ax} = B_{2eq}$

$\frac{\mu_0}{4\pi}\frac{2M_1}{8d^3} = \frac{\mu_0}{4\pi}\frac{M_2}{d^3}$

$\frac{M_1}{M_2} = \frac{4}{1}$

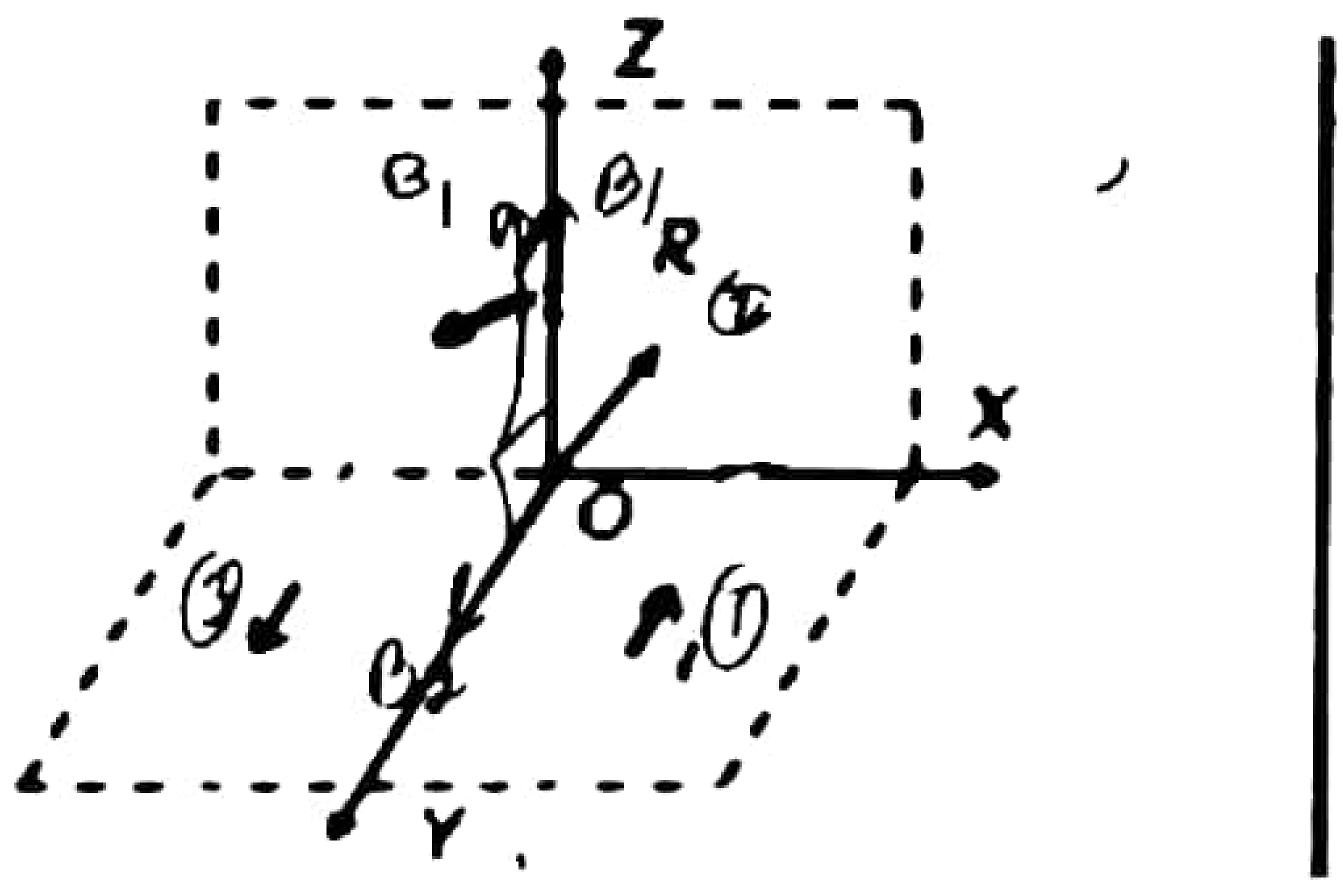
37.

Find magnetic field at O



(a) $\frac{\mu_0}{4\pi}\frac{I}{R}(\pi+2)$ (b) $\frac{\mu_0}{4\pi}\frac{I}{R}(\pi-2)$

(c) $\frac{\mu_0}{4\pi}\frac{I}{R}\sqrt{4+\pi^2}$ (d) Zero



$B_N = \sqrt{(2B_1)^2 + B_2^2}$

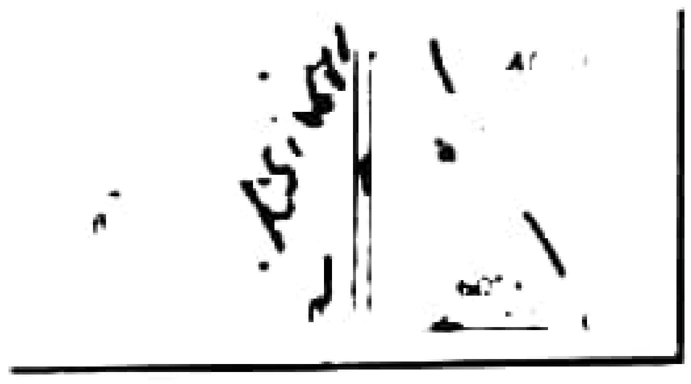
$B_1 = \frac{\mu_0}{4\pi}\frac{I}{R}$

$B_2 = \frac{\mu_0}{4\pi}\frac{I}{R}(\pi)$

$B_N = \frac{\mu_0}{4\pi}\frac{I}{R}\sqrt{4+\pi^2}$

38.

The magnitude and direction of magnetic force on the side AC in the given figure will be



(a) B at right angles to plane of paper upwards

(b) Zero

(c) Bil perpendicular to plane of paper downwards

(d) perpendicular to plane of paper upwards

$$\vec{F}_{OA} + \vec{F}_{AC} + \vec{F}_{CB} = 0$$

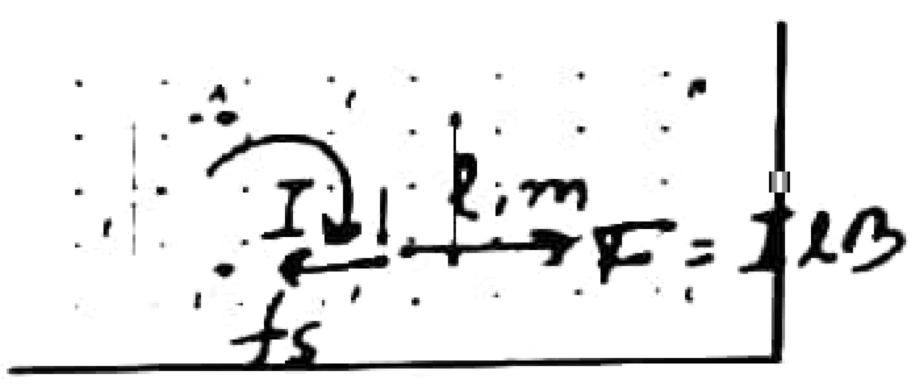
$$[l \parallel B]$$

$$I \frac{l\sqrt{3}}{2} B(-\hat{k}) + \vec{F}_{AC} = 0$$

$$\vec{F}_{AC} = \frac{I\sqrt{3}lB}{2}(\hat{k})$$

39.

AB and CD are two rails on which a metallic conductor EF of mass m and length l can slide. The rails are connected to a source of e.m.f. E which drives a current i in the circuit. The coefficient of friction between the rails and the conductor is μ. The minimum value of μ which can prevent the wire from sliding will be



(a) $\frac{Bl}{img}$ (b) $\frac{img}{Bl}$ (c) $\frac{mg}{Bil}$ (d) $\frac{Bil}{mg}$

$$F \le f_{s\,max}$$

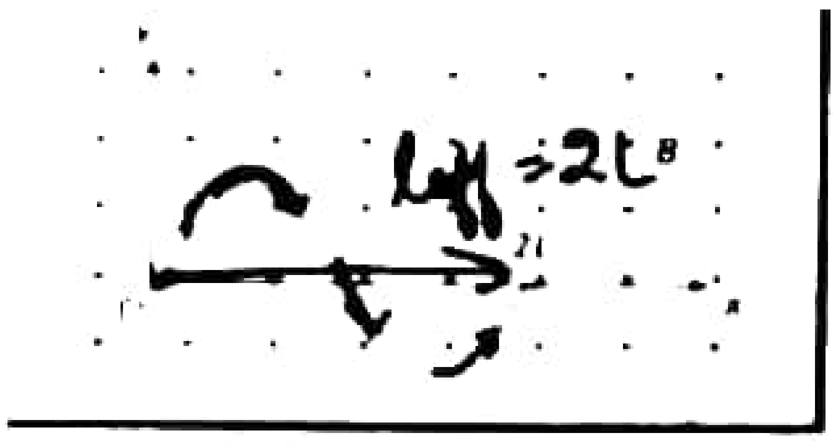
$$IlB \le \mu mg$$

$$\mu \geq \frac{IlB}{mg}$$

$$\mu_{min} = \frac{BIl}{mg}$$

40.

A wire carrying a current I is placed in a uniform magnetic field in the form of the curve $y = a\sin\left(\frac{\pi x}{L}\right)$, $0 \le x \le 2L$. The force acting on the wire is

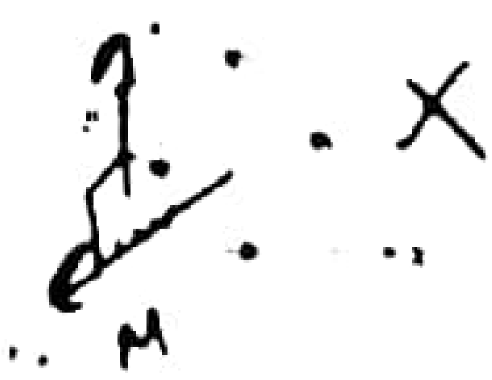


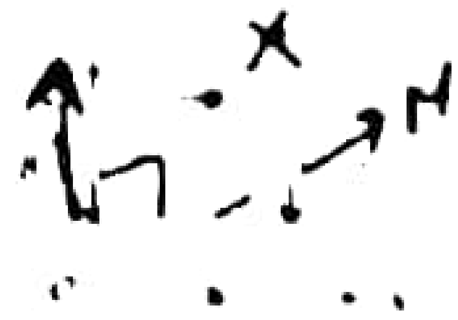
(a) $\frac{BIL}{\pi}$ (b) $BIL\pi$ (c) $2BIL$ (d) Zero

$F = BIL_{eff}$
$= 2BIL$

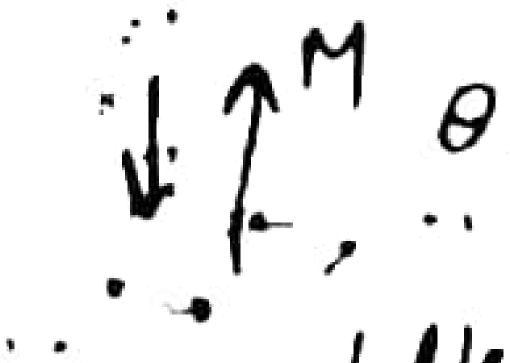
41.

In the following figures which one corresponds to the unstable equilibrium position

(a) 

(b) 

(c) 
Stable

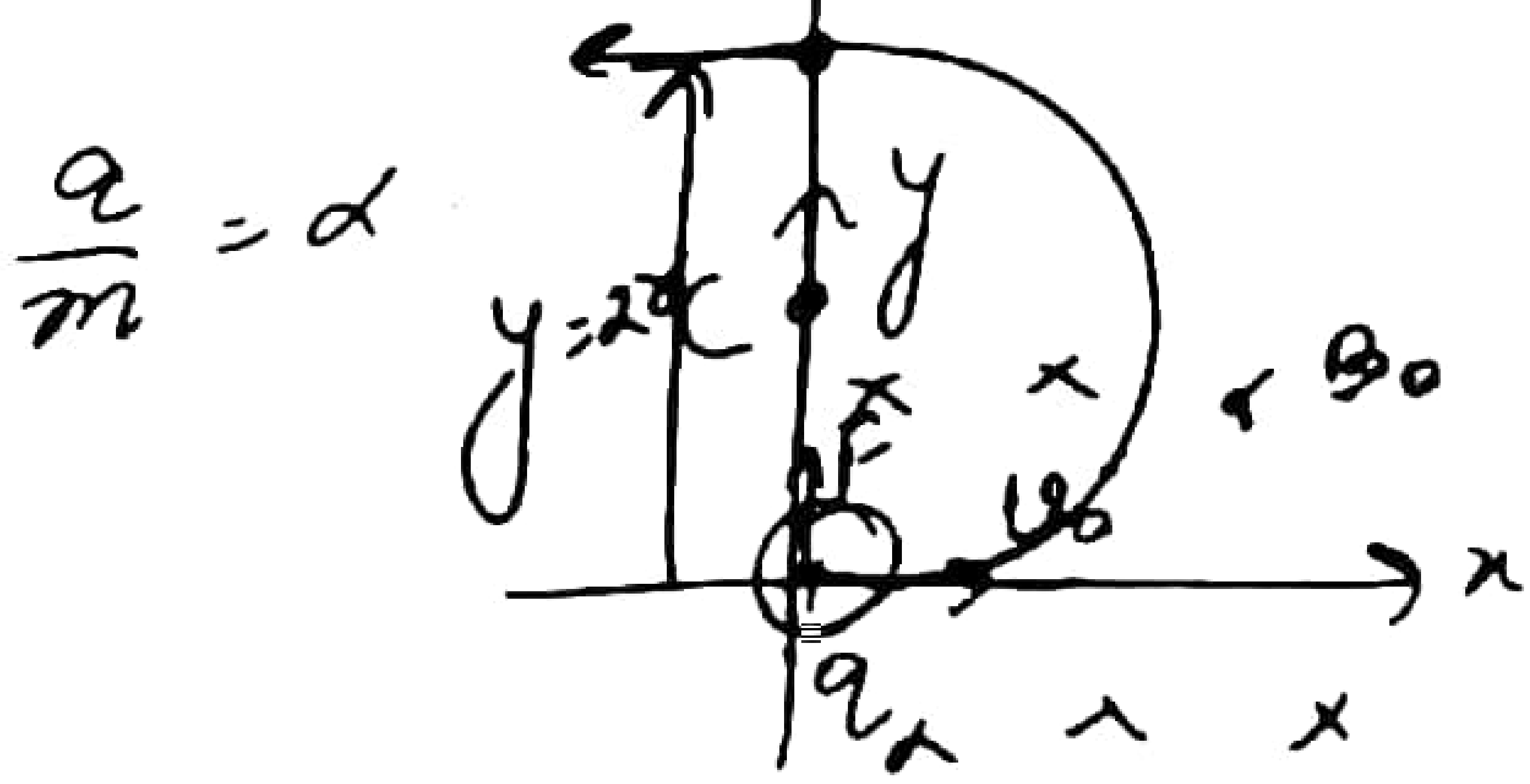
(d) 
$\theta = 180°$
unstable eq^n

42.

A particle of charge per unit mass α is released from origin with a velocity $\vec{v} = v_0\hat{i}$ in a uniform magnetic field $\vec{B} = -B_0\hat{k}$. If the particle passes through (0, y, 0), then y is equal to

(a) $\frac{2v_0}{B_0\alpha}$ (b) $\frac{v_0}{B_0\alpha}$

(c) $\frac{2v_0}{B_0\alpha}$ (d) $\frac{v_0}{B_0\alpha}$

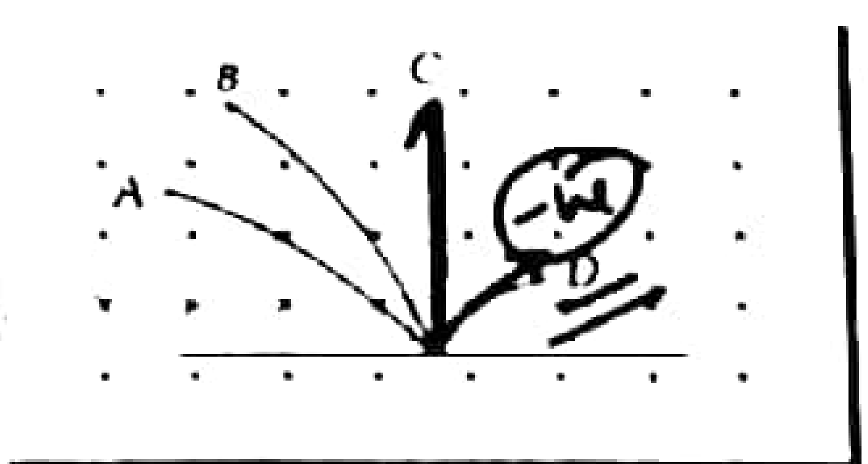


$y = 2r = 2\frac{mv}{qB_0} = \frac{2v}{\alpha B_0}$

43.

A neutron, a proton, an electron and an α-particle enter a region of uniform magnetic field with equal velocities. The magnetic field is perpendicular directed into the paper. The tracks of particles are labelled in fig. The electron follows track

(a) A
(b) B
(c) C
(d) D



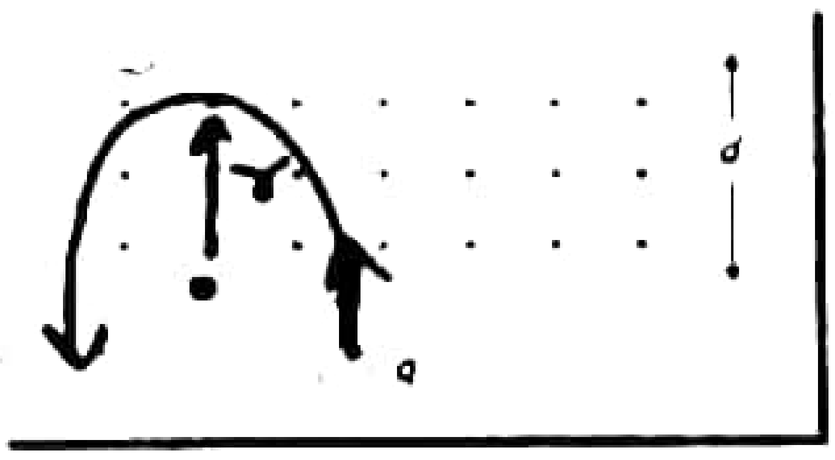
44.
As shown in the figure, a uniform magnetic field B is applied between two identical plates. There is a hole in one plate. If a particle of charge q, mass m and energy E enters this magnetic field through this hole, then the particle will not collide with the upper plate provide

(a) $B\ \frac{2mE}{qd}$

(b) $B\ \frac{\sqrt{2mE}}{qd}$

(c) $B\ \frac{2mE}{qd}$

(d) $B\ \frac{\sqrt{2mE}}{qd}$



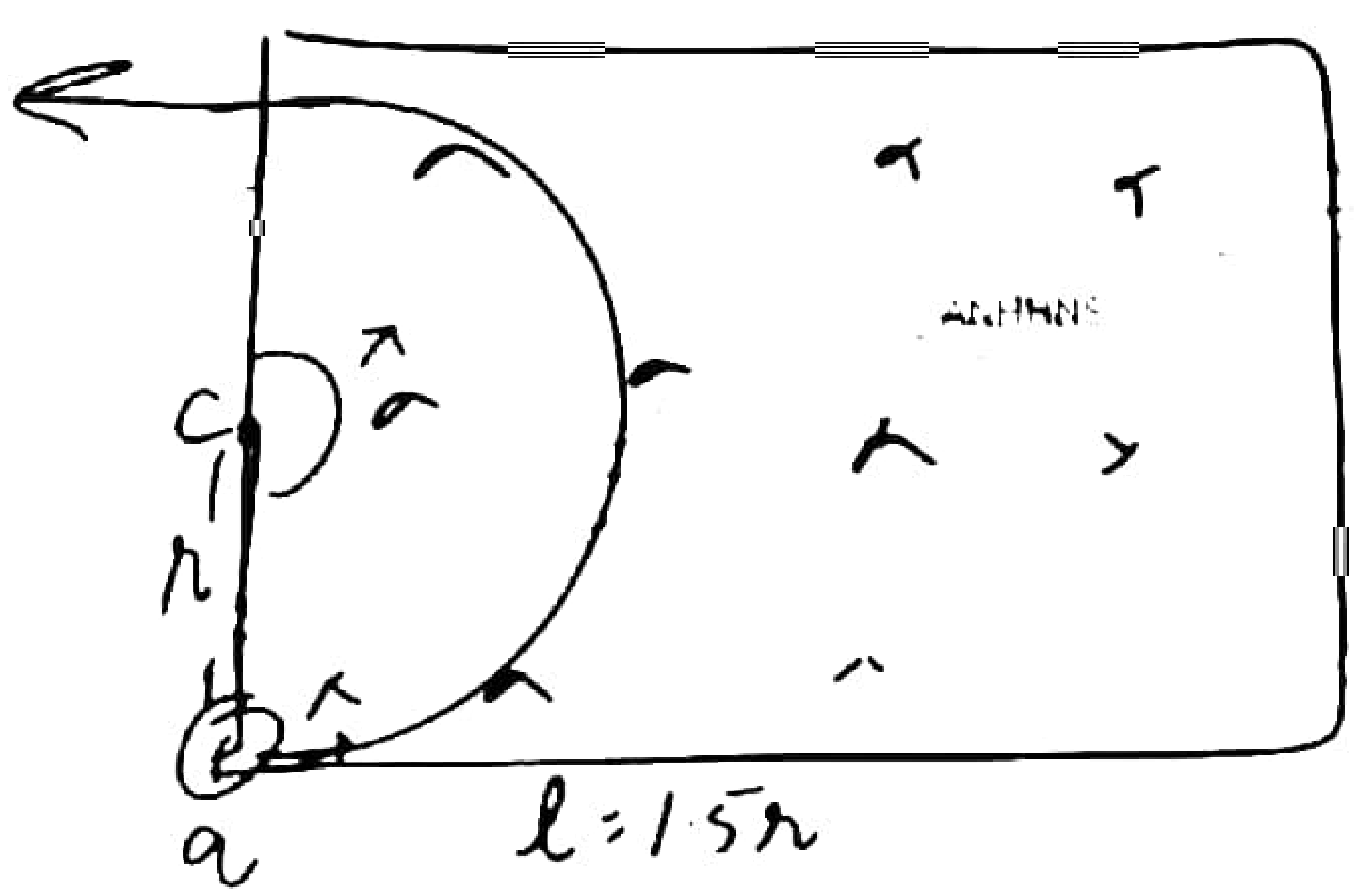
$r < d$

$\frac{\sqrt{2mE}}{qB} < d.$

$B > \frac{\sqrt{2mE}}{qd}$

45.
A charged particle enters a magnetic field at right angles to the magnetic field. The field exists for a length equal to 1.5 times the radius of the circular path of the particle. The particle will be deviated from its path by

(a) 90° (b) $\sin^{-1}(2/3)$ (c) 30° (d) 180°



46.

The magnetic needle of a vibration magnetometer makes 12 oscillations per minute in the horizontal component of earth's magnetic field. When an external short bar magnet is placed at some distance along the axis of the needle in the same line, it makes 15 oscillations per minute. If the poles of the bar magnet are interchanged, the number of oscillations it makes per minute is-

(1) $\sqrt{61}$ (2) $\sqrt{63}$ ✓ (3) $\sqrt{65}$ (4) $\sqrt{67}$

$f_1 = 12\ osc^n/min = \frac{1}{2\pi}\sqrt{\frac{B_H}{I}}$

$f_2 = 15 = \frac{1}{2\pi}\sqrt{\frac{B_H + B_M}{I}}$

$B_H \propto f_1^2$

$B_H + B_M \propto f_2^2$

$\Rightarrow B_M \propto f_2^2 - f_1^2$

$f_3 = \frac{1}{2\pi}\sqrt{\frac{B_H - B_M}{I}}$

$B_H - B_M \propto f_3^2$

$f_1^2 - (f_2^2 - f_1^2) = f_3^2$

$f_3 = \sqrt{2f_1^2 - f_2^2}$

$f_3 = \sqrt{2 \times 144 - 225} = \sqrt{288 - 225} = \sqrt{63}$

47.

Statement 1: The plane of the coil of tangent galvanometer should be parallel to the magnetic meridian *correct*

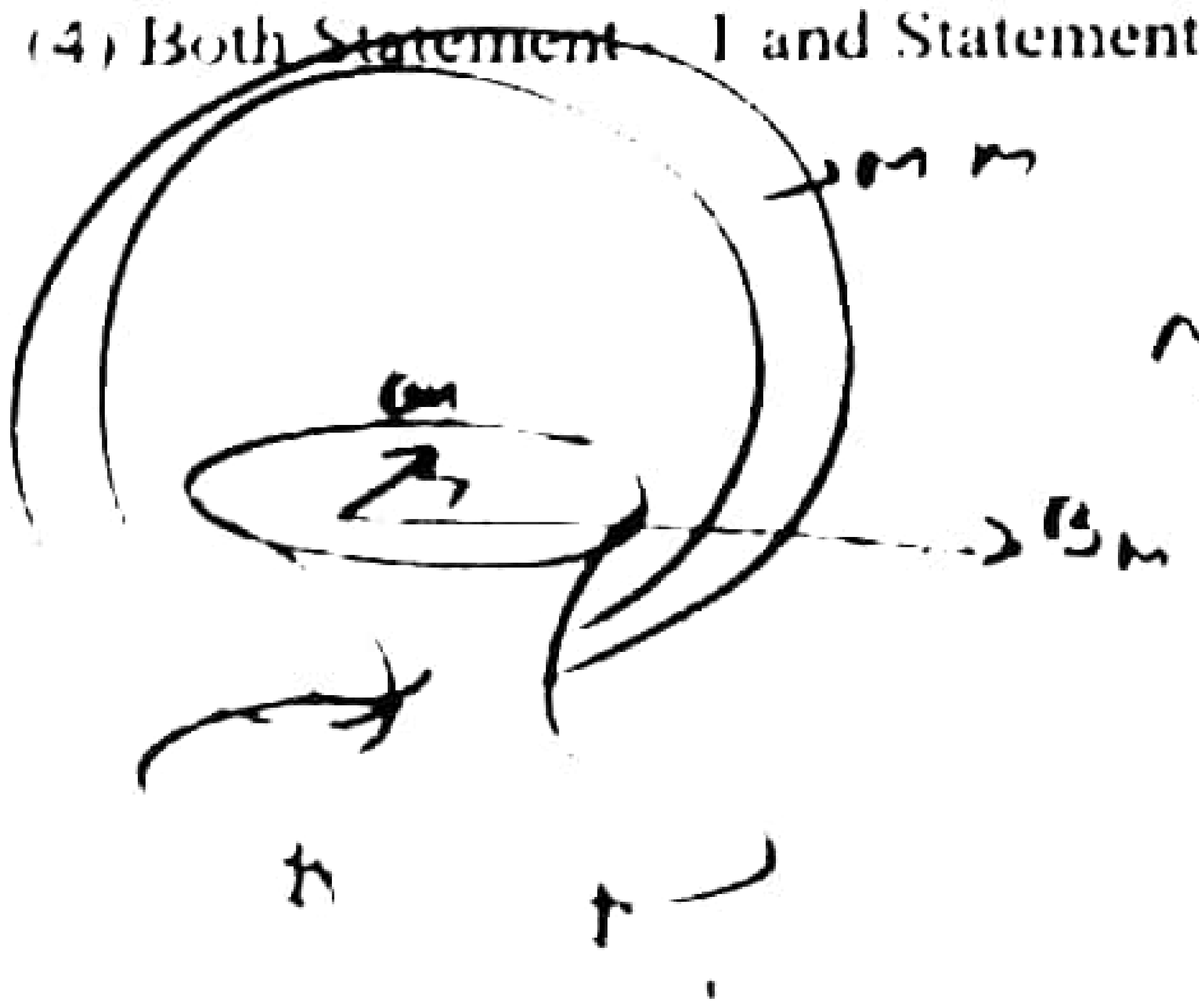
Statement 2: It makes the magnetic field of the coil perpendicular to the horizontal component of earth's magnetic field so that tangent law can be applicable *correct*

(1) Both Statement – 1 and Statement – 2 are true ✓

(2) Statement – 1 is true and Statement – 2 is false

(3) Statement – 1 is False and Statement – 2 is true

(4) Both Statement – 1 and Statement – 2 are False



$B_M = B_H \tan\theta$

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

48.

The coils made of same material in two moving coil galvanometers have their areas in the ratio of 2:3 and number of turns in the ratio 4:5. These two coils carry the same current and are situated in the same field. The deflections produced by these two coils will be in the ratio of

(1*) 8:15 (2) 15:8 (3) 8:1 (4) 1:4

$BINA = C\phi$

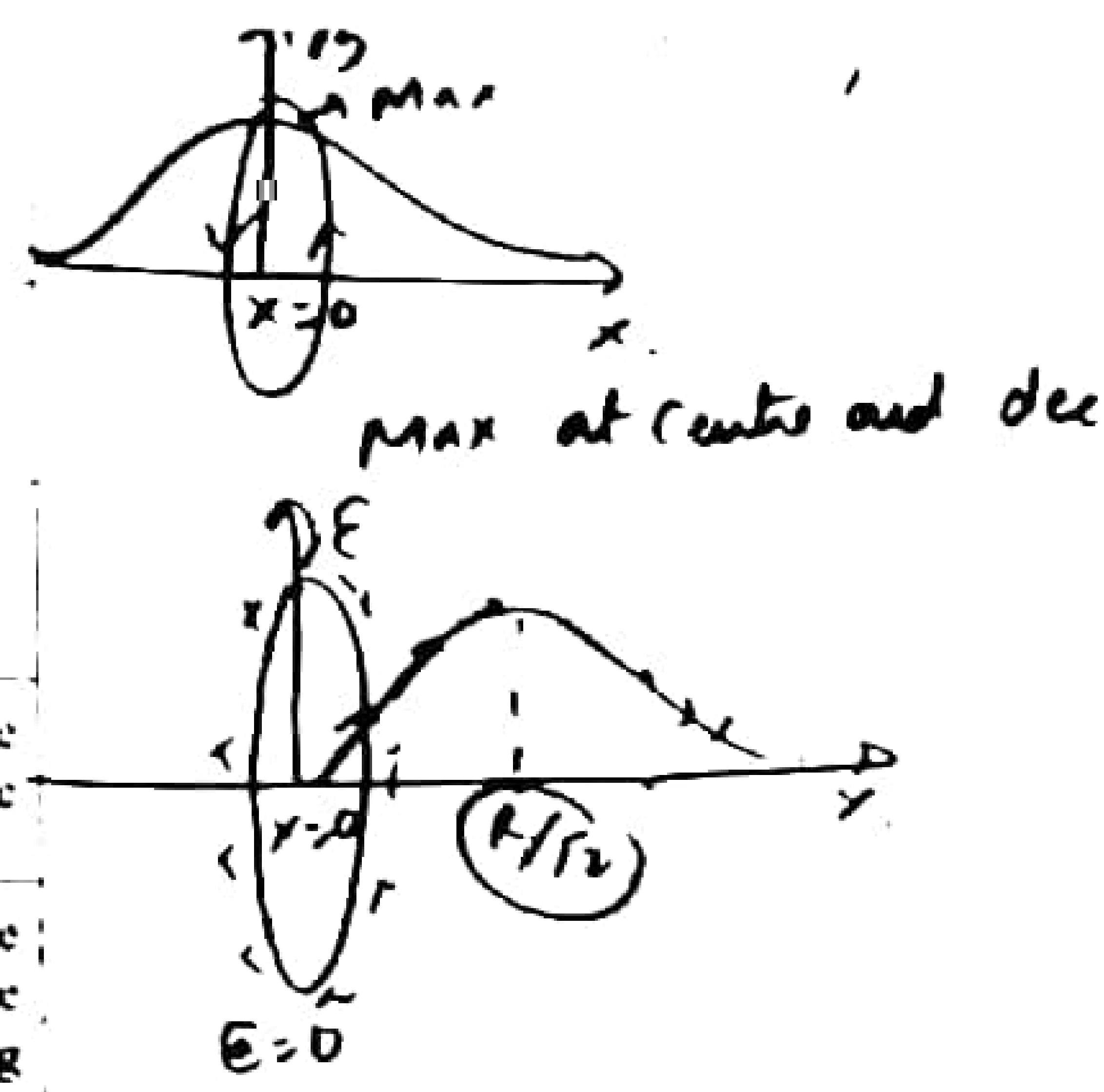
$\frac{A_1}{A_2} = \frac{2}{3}$ $\frac{N_1}{N_2} = \frac{4}{5}$ $I_1 = I_2$ $\frac{\phi_1}{\phi_2} = ?$

$\frac{\phi_1}{\phi_2} = \frac{N_1}{N_2} \times \frac{A_1}{A_2} = \frac{4}{5} \times \frac{2}{3} = \frac{8}{15}$

49.

Match the column I with column II

	Column -I		Column -II
(A)	Magnetic flux density due to a current carrying circular coil is 2, 3	1	Zero
(B)	Magnetic flux density at a point on a current carrying thin wire is 1	2	Maximum at the centre
(C)	Electric field strength due to an uniformly charged ring is 1, 4	3	Continuously decreases as we move away from the centre along the axis.
(D)	Electric potential due to an uniformly charged ring is 2, 3	4	Continuously increases as we move away from the centre upto a definite distance along the axis.



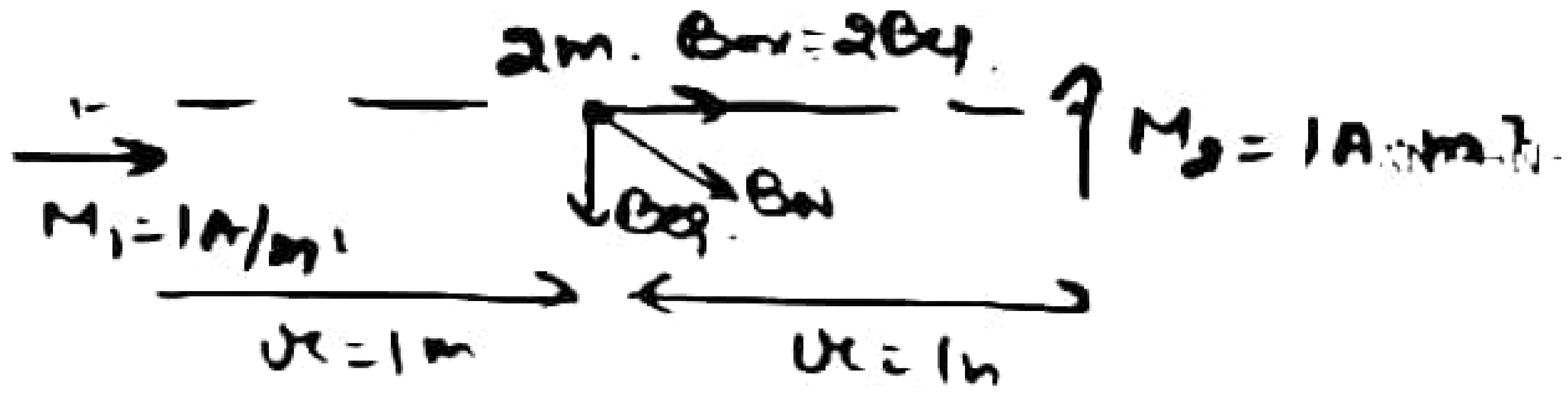
(1*) (1) 2, 3, (2) 1; (3) 1, 4, (4) 2, 3.
(2) (1) 1, 3, (2) 2; (3) 1, 3, (4) 3, 4
(3) (1) 3, 4, (2) 3, (3) 1, 2, (4) 1, 3
(4) (1) 2, 3, (2) 2, (3) 1, 3, (4) 1, 3

Sol.

50.

Two identical magnetic dipoles of magnetic moments 1.0 A-m^2 each, placed at a separation of 2m with their axes perpendicular to each other. The resultant magnetic field at a point midway between the dipole is -

(1) 5×10^{-7} T (2) $\sqrt{5} \times 10^{-7}$ T (3) 10^{-7} T (4) 2×10^{-7} T



$B_N = \sqrt{5} B_{eq}$

$= \sqrt{5} \times \frac{\mu_0}{4\pi} \frac{M}{r^3} = \sqrt{5} \times 10^{-7} \times \frac{1}{1} = \sqrt{5} \times 10^{-7}$