Exercise-1

ONLY ONE OPTION CORRECT TYPE

SECTION (A) : MAGNET AND MAGNETIC FIELD DUE TO A MOVING CHARGE

1. The charge on a particle is 100 times that of electron. It is revolving in a circular path of radius 0.8 m at a frequency of 10^{11} revolutions per second. The magnetic field at the centre of path will be -

(1) $10^{-7}\ \mu_0$ (2) $\frac{10^{-7}}{\mu_0}$ (3) $10^{-17}\ \mu_0$ (4) $10^{-6}\ \mu_0$

2. Gauss is the unit of -

(1) Magnetic induction (2) Intensity of magnetization
(3) dipole moment (4) None of these

3. A ring of radius r is uniformly charged with charge q. If the ring is rotated about it's axis with angular frequency ω, then the magnetic induction at its centre will be -

(1) $10^{-7} \times \frac{\omega}{qr}$ (2) $10^{-7} \times \frac{q}{\omega r}$ (3) $10^{-7} \times \frac{r}{q\omega}$ (4) $10^{-7} \times \frac{q\omega}{r}$

4. If an electron revolves in the path of a circle of radius of 0.5×10^{-10} m at a frequency of 5×10^{15} cycles/s, the equivalent electric current in the circle is (charge of an electron 1.6×10^{-19} C) **[EAMCET-2000]**

(1) 0.4 mA (2) 0.8 mA (3) 1.2 mA (4) 1.6 mA

5. A charged particle moves through a magnetic field in a direction perpendicular to it. Then the : **[AIPMT 2003]**

(1) Acceleration remains unchanged (2) Velocity remains unchanged
(3) Speed of the particle remains unchanged (4) Direction of the particle remains unchanged

6. A particle mass m, charge Q and kinetic energy T enters a transverse uniform magnetic field of induction $\vec{B}$. After 3 s the kinetic energy of the particle will be **[AIPMT 2008]**

(1) 3T (2) 2T (3) T (4) 4T

7. If a current is passed through a spring then the spring will : **[AIEEE 4/300 2002]**

(1) expand (2) compress (3) remain same (4) none of these

8. At a specific instant emission of radioactive compound is deflected in a magnetic field. The compound can emit : **[AIEEE 4/300 2002]**

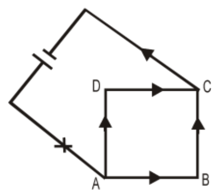
(i) electrons (ii) protons (iii) He^{2+} (iv) neutrons

The emission at the instant can be

(1) i, ii, iii (2) i, ii, iii, iv (3) iv (4) ii, iii

SECTION (B) : MAGNETIC FIELD DUE TO A STRAIGHT WIRE

1. A thin wire is bent to form a square loop ABCD. A battery of e.m.f 2V is connected between the points A and C. The magnetic induction due to the current in the loop at centre O will -



(1) be zero (2) point away from the plane of paper

(3) point along the plane of paper (4) point into the plane of paper

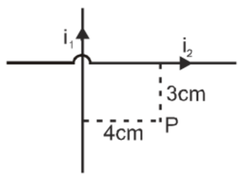
2. A small linear segment of an electric circuit is lying on x-axis extending from $x = -\frac{a}{2}$ to $x = \frac{a}{2}$ and a current i is flowing in it. The magnetic induction due to the segment at a point x = a on x-axis will be -

(1) $\propto a$ (2) zero (3) $\propto a^2$ (4) $\propto \frac{1}{a}$

3. A current i is flowing in a straight conductor of length L. The magnetic induction at a point distant $\frac{L}{4}$ from its centre will be -

(1) $\frac{4\mu_0 i}{\sqrt{5}\pi L}$ (2) $\frac{\mu_0 i}{2\pi L}$ (3) $\frac{\mu_0 i}{\sqrt{2} L}$ (4) zero

4. Two insulated wires of infinite length are lying mutually at right angles to each other as shown in. Currents of 2A and 1.5A respectively are flowing in them. The value of magnetic induction at point P will be-

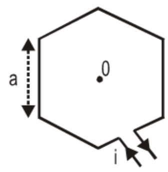


(1) 2×10^{-3} N/A-m (2) 2×10^{-5} N/A-m (3) 1.5×10^{-5} tesla (4) 2×10^{-4} N/A-m

5. A current of i ampere is flowing in an equilateral triangle of side a. The magnetic induction at the centroid will be -

(1) $\frac{\mu_0 i}{3\sqrt{3}\pi a}$ (2) $\frac{3\mu_0 i}{2\pi a}$ (3) $\frac{5\sqrt{2}\mu_0 i}{3\pi a}$ (4) $\frac{9\mu_0 i}{2\pi a}$

6. A current is flowing in a hexagonal coil of side a (Fig.). The magnetic induction at the centre of the coil will be -



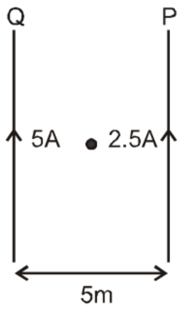
(1) $\frac{3\sqrt{3}\mu_0 i}{\pi a}$ (2) $\frac{\mu_0 i}{3\sqrt{3}\pi a}$ (3) $\frac{\mu_0 i}{\sqrt{3}\pi a}$ (4) $\frac{\sqrt{3}\mu_0 i}{\pi a}$

7. A straight wire of diameter 0.5 mm carrying a current of 1A is replaced by another wire of diameter 1 mm carrying the same current. The strength of magnetic field far away is : **[AIPMT 1999]**

(1) twice the earlier value (2) one-half of the earlier value

(3) one quarter of the earlier value (4) same as earlier value

8. Two long parallel wires P and Q are held at a distance of 5m between them. If P and Q carry current of 2.5 amp and 5 amp respectively in the same direction, then the magnetic field at a point half-away between the wires is **[CBSE PMT-2000]**



(1) $\frac{\mu_0}{\pi}$ (2) $\frac{\sqrt{3}\mu_0}{2\pi}$ (3) $\frac{\mu_0}{2\pi}$ (4) $\frac{3\mu_0}{2\pi}$

9. A long straight wire carries an electric current of 2 A. The magnetic induction at a perpendicular distance of 5m from the wire will be **[EAMCET Med.-2000]**

(1) 4×10^{-8} T (2) 8×10^{-8} T (3) 12×10^{-8} T (4) 16×10^{-8} T

10. The strength of the magnetic field at a point distant r near a long straight current carrying wire is B. The field at a distance r/2 will be **[PCET-2000]**

(1) B/2 (2) B/4 (3) 4B (4) 2B

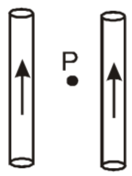
11. A wire in the form of a square of side 'a' carries a current 'i'. Then the magnetic induction at the centre of the square wire is (Mangetic permeability of free space = μ_0) **[EAMCET (BE)-2001]**

(1) $\frac{\mu_0 i}{2\pi a}$ (2) $\frac{\mu_0 i\sqrt{2}}{\pi a}$ (3) $\frac{2\sqrt{2}\mu_0 i}{\pi a}$ (4) $\frac{\mu_0 i}{\sqrt{2}\pi a}$

12. The vector form of Biot-Savart's law for a current carrying element is **[RPMT 2009]**

(1) $d\vec{B} = \frac{\mu_0}{4\pi}\frac{Id\vec{l}\sin\phi}{r^2}$ (2) $d\vec{B} = \frac{\mu_0}{4\pi}\frac{Idl \times \hat{r}}{r^2}$ (3) $d\vec{B} = \frac{\mu_0}{4\pi}\frac{Id\vec{l} \times \hat{r}}{r^3}$ (4) $d\vec{B} = \frac{\mu_0}{4\pi}\frac{Id\vec{l} \times \hat{r}}{r^2}$

13. Two long straight wires are kept parallel. A current of 1 ampere is flowing in each wire in same direction. Distance between them is 2r. Intensity of magnetic field at midpoint between them : **[RPMT 2010]**



(1) $\frac{\mu_0 i}{r}$ (2) $\frac{4\mu_0 i}{r}$ (3) 0 (4) $\frac{\mu_0 i}{4r}$

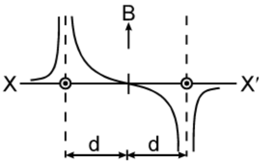
14. Two infinitely long, thin, insulated, straight wires lie in the x-y plane along the x and y-axis respectively. Each wire carries a current I, respectively in the positive x-direction and positive y-direction. The magnetic field will be zero at all points on the straight line: **[JEE - 93]**

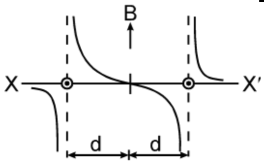
(1) y = x (2) y = – x (3) y = x – 1 (4) y = – x + 1

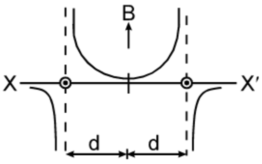
15. Two parallel, long wires carry currents i_1 and i_2 with $i_1 > i_2$. When the current are in the same direction, the magnetic field at a point midway between the wire is 10μT. If the direction of i_2 is reversed, the field becomes 30μT. The ratio i_1/i_2 is

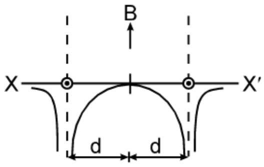
(1) 4 (2) 3 (3) 2 (4) 1

16. Two long parallel wires are at a distance 2d apart. They carry steady equal currents flowing out of the plane of the paper, as shown. The variation of the magnetic field B along the XX' is given by **[JEE 2000(Scr.), 3/105]**

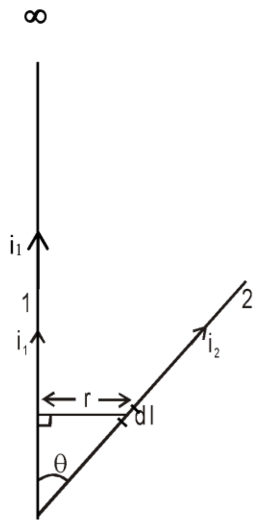
(1) 

(2) 

(3) 

(4) 

17. Wires 1 and 2 carrying currents i_1 and i_2 respectively are inclined at an angle θ to each other. What is the force on a small element dl of wire 2 at distance r from wire 1 (as shown in figure) due to the magnetic field of wire 1? **[AIEEE 4/300 2002]**



(1) $\frac{\mu_0}{2\pi r} i_1 i_2 dl \tan\theta$ (2) $\frac{\mu_0}{2\pi r} i_1 i_2 dl \sin\theta$

(3) $\frac{\mu_0}{4\pi r} i_1 i_2 \, dl (\cos\theta + 1)$ (4) $\frac{\mu_0}{4\pi r} i_1 i_2 dl \sin\theta$

18. A current i ampere flows along an infinitely long straight thin walled tube, then the magnetic induction at any point inside the tube is : **[AIEEE 4/300 2004]**

(1) infinite (2) zero (3) $\frac{\mu_0}{4\pi}, \frac{2i}{r}$ tesla (4) $\frac{2i}{r}$ tesla

19. A long straight wire of radius *a* carries a steady current *i*. The current is uniformly distributed across its crosssection. The ratio of the magnetic field at $\frac{a}{2}$ and 2a from axis is : **[AIEEE 3/120 2007]**

(1) 1/4 (2) 4 (3) 1 (4) 1/2

20. A current I flows along the length of an infinitely long, straight, thin walled pipe. Then : **[AIEEE 3/120 2007]**

(1) the magnetic field is zero only on the axis of the pipe
(2) the magnetic field is different at different points inside the pipe

(3) the magnetic field at any point inside the pipe is zero
(4) the magnetic field at all points inside the pipe is the same, but not zero

21. Two identical conducting wires AOB and COD are placed at right angles to each other. The wire AOB carries an electric current I_1 and COD carries a current I_2. The magnetic field on a point lying at a distance d from O, in a direction perpendicular to the plane of the wires AOB and COD, will be given by : **[AIEEE 3/120 2007]**

(1) $\frac{\mu_0}{2\pi}\left(\frac{I_1+I_2}{d}\right)^{1/2}$ (2) $\frac{\mu_0}{2\pi d}\left(I_1^2+I_2^2\right)^{1/2}$ (3) $\frac{\mu_0}{2\pi d}$ (I1 + I2) (4) $\frac{\mu_0}{2\pi d}\left(I_1^2+I_2^2\right)$

SECTION (C) : MAGNETIC FIELD DUE TO A CIRCULAR LOOP

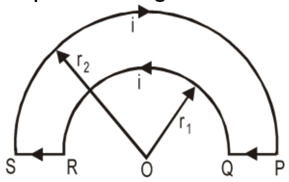
1. An electric current i is flowing in a circular coil of radius a. At what distant from the centre on the axis of the coil will the magnetic field be 1/8th of its value at the centre -

(1) 3 a (2) $\sqrt{3}$ a (3) $\frac{a}{3}$ (4) $\frac{a}{\sqrt{3}}$

2. The ratio of magnetic inductions at the centre of a circular coil of radius a and on its axis at a distance equal to its radius, will be -

(1) $\frac{1}{\sqrt{2}}$ (2) $\frac{\sqrt{2}}{1}$ (3) $\frac{1}{2\sqrt{2}}$ (4) $\frac{2\sqrt{2}}{1}$

3. A wire loop PQRSP is constructed by joining two semi circular coils of radii r_1 and r_2 respectively as shown in the fig. Current i is flowing in the loop. The magnetic induction at point O will be -



(1) $\frac{\mu_0 i}{4}\left[\frac{1}{r_1}-\frac{1}{r_2}\right]$ (2) $\frac{\mu_0 i}{4}\left[\frac{1}{r_1}+\frac{1}{r_2}\right]$ (3) $\frac{\mu_0 i}{2}\left[\frac{1}{r_1}-\frac{1}{r_2}\right]$ (4) $\frac{\mu_0 i}{2}\left[\frac{1}{r_1}+\frac{1}{r_2}\right]$

4. The magnetic field on the axis of a current carrying circular coil of radius a at a distance 2a from its centre will be-

(1) $\frac{\mu_0 i}{2}$ (2) $\frac{\mu_0 i}{10\sqrt{5}a}$ (3) $\frac{\mu_0 i}{4a}$ (4) $\mu_0 i$

5. The use of Helmholtz coils is to produce -

(1) uniform magnetic field (2) non-uniform magnetic field
(3) varying magnetic field (4) zero magnetic field

6. Two similar coils of radius R and number of turns N are lying concentrically with their planes at right angles to each other. The currents flowing in them are I and I$\sqrt{3}$ respectively. The resultant magnetic induction at the centre will be (in Wb/m2).

(1) $\frac{\mu_0 NI}{2R}$ (2) $\frac{\mu_0 NI}{R}$ (3) $\sqrt{3}\,\mu_0\frac{NI}{2R}$ (4) $\sqrt{5}\frac{\mu_0 NI}{2R}$

7. Two similar coils are kept mutually perpendicular such that their centres coincide. At the centre, find the ratio of the magnetic field due to one coil and the resultant magnetic field through both coils, if the same current is flown : **[RPMT 2006]**

(1) 1 : $\sqrt{2}$ (2) 1 : 2 (3) 1 : 3 (4) $\sqrt{3}$: 1

8. A coil of one turn is made of a wire of certain length and then from the same length a coil of two turns is made. If the same current is passed in both the cases, then the ratio of the magnetic induction at their centres will be : **[AIPMT 1998]**

(1) 2 : 1 (2) 1 : 4 (3) 4 : 1 (4) 1 : 2

9. Magnetic field due to 0.1A current flowing through a circular coil of radius 0.1 m and 1000 turns at the centre of the coil is : **[AIPMT 1999]**

(1) 0.2 T (2) 2×10^{-4} T (3) 6.28×10^{-4} T (4) 9.8×10^{-4} T

10. Magnetic field due to a ring having n turns at a distance x from the centre on its axis is proportional to (if r = radius of ring) **[RPET-2000]**

(1) $\frac{r}{(x^2+r^2)}$ (2) $\frac{r^2}{(x^2+r^2)^{3/2}}$ (3) $\frac{nr^2}{(x^2+r^2)^{3/2}}$ (4) $\frac{n^2r^2}{(x^2+r^2)^{3/2}}$

11. A circular arc of wire subtends an angle $\frac{\pi}{2}$ at the centre. If it carries a current I and its radius of curvature is R, then the magnetic field at the centre of the arc is **[KCET-2000]**

(1) $\frac{\mu_0 I}{8R}$ (2) $\frac{\mu_0 I}{R}$ (3) $\frac{\mu_0 I}{2R}$ (4) $\frac{\mu_0 I}{4R}$

12. The magnetic field of a given length of wire carrying a current for a single turn circular coil at centre is B, then its value for two turns for the same wire when same current passing through it is :- **[AIPMT 2002]**

(1) $\frac{B}{4}$ (2) $\frac{B}{2}$ (3) 2B (4) 4B

13. If in a circular coil A of radius R, current i is flowing and in another coil B of radius 2R a current 2i is flowing, then the ratio of the magnetic fields, B_A and B_B produced at the centre by them will be : **[AIEEE 4/300 2002]**

(1) 1 (2) 2 (3) 1 / 2 (4) 4

14. A long wire carries a steady current. It is bent into a circle of one turn and the magnetic field at the centre of the coil is B. It is then bent into a circular loop of n turns. The magnetic field at the centre of the coil will be: **[AIEEE 4/300 2004]**

(1) nB (2) n^2B (3) 2nB (4) $2n^2$B

15. The magnetic field due to a current carrying circular loop of radius 3 cm at a point on the axis at a distance of 4 cm from the centre is 54 μT. What will be its value at the centre of the loop ? **[AIEEE 4/300 2004]**

(1) 250 μT (2) 150 μT (3) 125 μT (4) 75 μT

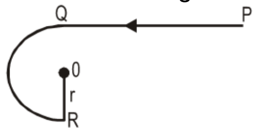
16. A long solenoid has 200 turns per cm and carries a current i. The magnetic field at its centre is 6.28×10^{-2} Weber/m^2. Another long solenoid has 100 turns per cm and it carries a current i/3. The value of the magnetic field at its centre is : **[AIEEE 4.5/180 2006]**

(1) 1.05×10^{-4} Weber/m2 (2) 1.05×10^{-2} Weber/m^2

(3) 1.05×10^{-5} Weber/m^2 (4) 1.05×1010^{-3} Weber/m^2

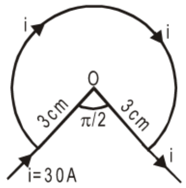
SECTION (D) : MAGNETIC FIELD DUE TO A STRAIGHT WIRE AND CIRCULAR ARC

1. The magnetic induction at centre O due to the arrangement shown in fig.-



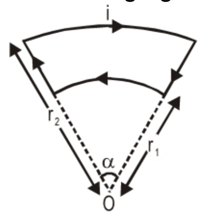
(1) $\frac{\mu_0 i}{4\pi r}(1+\pi)$ (2) $\frac{\mu_0 i}{4\pi r}$ (3) $\frac{\mu_0 i}{4\pi r}(1-\pi)$ (4) $\frac{\mu_0 i}{r}$

2. A current of 30 amp. is flowing in a conductor as shown in the fig. The magnetic induction at point O will be-



(1) 1.5 Tesla (2) $1.5\pi \times 10^{-4}$ Tesla (3) zero (4) 0.15 Tesla

3. The magnetic induction at centre O in the following figure will be -



(1) $\frac{\mu_0 i\alpha}{4\pi}\left(\frac{1}{r_1}-\frac{1}{r_2}\right) \odot$ (2) $\frac{\mu_0 i\alpha}{4\pi}\left(\frac{1}{r_1}+\frac{1}{r_2}\right) \odot$ (3) $\frac{\mu_0 i\alpha}{2\pi}\left[\frac{1}{r_1}-\frac{1}{r_2}\right] \otimes$ (4) $\frac{\mu_0 i\alpha}{2\pi}\left[\frac{1}{r_1}+\frac{1}{r_2}\right] \otimes$

4. Two circular coils 1 and 2 are made from the same wire but the radius of the 1st coil is twice that of the 2nd coil. What is the ratio of potential difference applied across them so that the magnetic field at their centres is the same : **[AIPMT 2006]**

(1) 3 (2) 4 (3) 6 (4) 2

SECTION (E) : MAGNETIC FIELD DUE TO A CYLINDER, LARGE SHEET, SOLENOID, TOROID AND AMPERE'S LAW

1. When the number of turns in a toroidal coil is doubled, then the value of magnetic flux density will becomes-

(1) four times (2) eight times (3) half (4) double

2. The length of a solenoid is 0.1 m and its diameter is very small. A wire is wound over it in two layers. The number of turns in the inner layer is 50 and that on the outer layer is 40. The strength of current flowing in two layers is in the same direction and is 3 ampere. The magnetic induction in the middle of the solenoid will be-

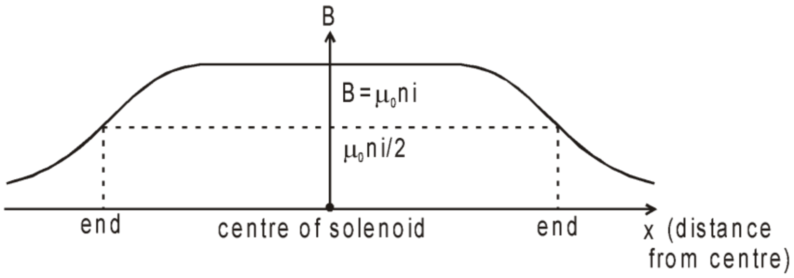
(1) 3.4×10^{-3} Tesla (2) 3.4×10^{-3} Gauss (3) 3.4×10^{3} Tesla (4) 3.4×10^{3} Gauss

3. The magnetic field inside a long solenoid is -

(1) infinite (2) zero (3) uniform (4) non-uniform

4. The correct curve between the magnetic induction (2) along the axis of a along solenoid due to current flow i in it and distance x from one end is -

(1)



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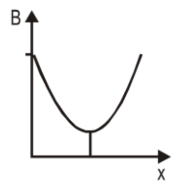

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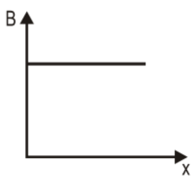

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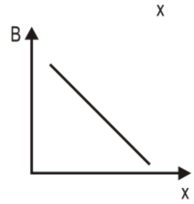
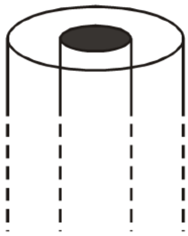


5. An long solenoid has 200 turns per cm and carries a current of 2.5 amp. The magnetic field at its centre is [$\mu_0 = 4\pi \times 10^{-7}$ weber/amp-m] : **[MPPET-2000]**

(1) 3.14×10^{-2} weber/m^2 (2) 6.28×10^{-2} weber/m^2
(3) 9.42×10^{-2} weber/m^2 (4) 12.56×10^{-2} weber/m^2

6. In a coaxial, straight cable, the central conductor and the outer conductor carry equal currents in opposite directions. The magnetic field is zero.



(1) outside the cable (2) inside the inner conductor
(3) inside the outer conductor (4) in between the two conductors.

7. A wire is wound on a long rod of material of relative permeability $\mu_r = 4000$ to make a solenoid. If the current through the wire is 5 A and number of turns per unit length is 1000 per metre, then the magnetic field inside the solenoid is :

(1) 25.12 mT (2) 12.56 m T (3) 12.56 T (4) 25.12 T

8. A cylindrical wire of radius R is carrying current i uniformly distributed over its cross-section. If a circular loop of radius ' r ' is taken as amperian loop, then the variation value of $\oint \vec{B} \cdot d\vec{\ell}$ over this loop with radius ' r ' of loop will be best represented by:

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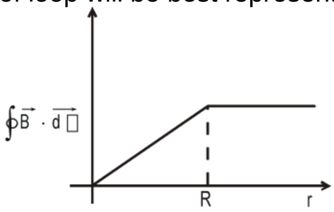

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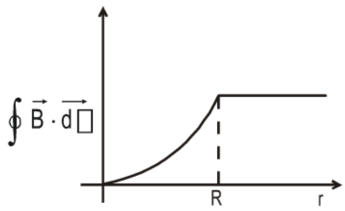

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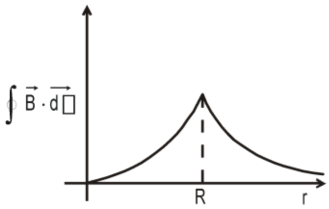
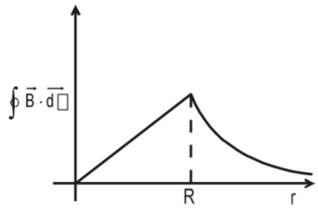


(4)


9. A current I flows along the length of an infinitely long, straight, thin walled pipe. Then **[JEE - 1993]**

(1) the magnetic field at all points inside the pipe is the same, but not zero
(2) the magnetic field at any point inside the pipe is zero
(3) the magnetic field is zero only on the axis of the pipe
(4) the magnetic field is different at different points inside the pipe.

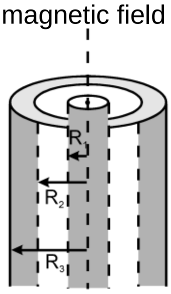
10. A long solenoid carrying a curent prouces a magnetic field B along its axis. If the current is doubled and the number of turns per cm is halved, the new value of the magnetic field is : **[AIPMT 2003]**

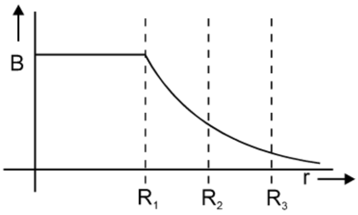
(1) 2B (2) 4B (3) B/2 (4) B

11. A long, thick straight conductor of radius R carries current I uniformly distributed in its cross section area. The ratio of energy density of the magnetic field at distance R/2 from surface inside the conductor and outside the conductor is:

(1) 1: 16 (2) 1: 1 (3) 1: 4 (4) 9/16

12. A coaxial cable is made up of two conductors. The inner conductor is solid and is of radius R_1 & the outer conductor is hollow of inner radius R_2 and outer radius R_3. The space between the conductors is filled with air. The inner and outer conductors are carrying currents of equal magnitudes and in opposite directions. Then the variation of magnetic field with distance from the axis is best plotted as:



(1)


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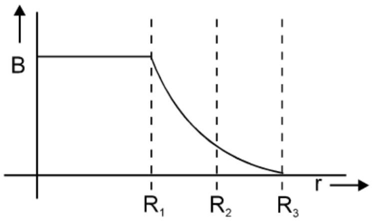

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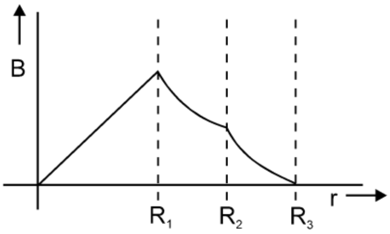

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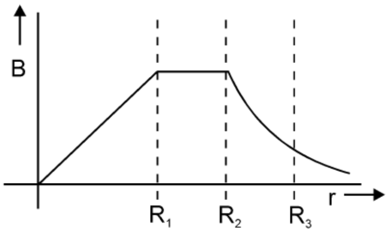


SECTION (F) : MAGNETIC FORCE ON A CHARGE

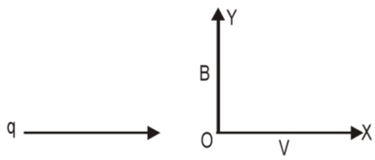
1. When a charged particle moves at right angles to a magnetic field then which of the following quantities changes-
(1) energy (2) momentum (3) speed (4) all of above

2. A proton, a deutron and an α-particle are accelerated through the same potential difference and then they enter a uniform normal magnetic field. If the radius of circular path of proton is 8 cm then the radius of circular path of deutron will be -
(1) 11.31 cm (2) 22 cm (3) 5 cm (4) 2.5 cm

3. A proton and an α-particle enter a uniform magnetic field at right angles to it with same velocity. The time period of α particle as compared to that of proton, will be -
(1) four times (2) two times (3) half (4) one fourth

4. A charged particle with charge q is moving in a uniform magnetic field. If this particle makes some angle ($0 < \theta < 180^o$) with the magnetic field then its path will be -
(1) circular (2) straight line (3) helical (4) parabolic

5. If a positively charged particle is moving as shown in the fig., then it will get deflected due to magnetic field towards -



(1) +x direction (2) +y direction (3) –x direction (4) +z direction

6. Which of the following particles will experience maximum magnetic force (magnitude) when projected with the same velocity perpendicular to a magnetic field?
(1) electron (2) proton (3) He^+ (4) Li^{++}

7. An electric current i enters and leaves a uniform circular wire of radius a through diametrically opposite points. A charged particle q moving along the axis of the circular wire passes through its centre at speed υ. The magnetic force acting on the particle when it passes through the centre has a magnitude
(1) $qv\frac{\mu_0 i}{2a}$ (2) $qv\frac{\mu_0 i}{2\pi a}$ (3) $qv\frac{\mu_0 i}{a}$ (4) zero

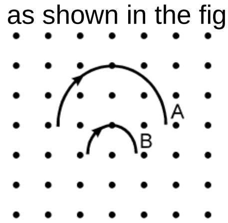
8. A charge particle is moved along a magnetic field line. The magnetic force on the particle is
(1) along its velocity (2) opposite to its velocity
(3) perpendicular to its velocity (4) zero.

9. 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. **[JEE - 88]**
(1) $\left(\frac{R_1}{R_2}\right)^{1/2}$ (2) $\frac{R_2}{R_1}$ (3) $\left(\frac{R_1}{R_2}\right)^2$ (4) $\frac{R_1}{R_2}$

10. A negative charged particle falling freely under gravity enters a region having uniform horizontal magnetic field pointing towards north. The particle will be deflected towards **[REE - 91]**
(1) East (2) West (3) North (4) South

11. A proton of mass m and charge q enters a magnetic field B with a velocity v at an angle θ with the direction of B. The radius of curvature the resulting path is **[REE - 92]**
(1) $\frac{mv}{qB}$ (2) $\frac{mv \sin\theta}{qB}$ (3) $\frac{mv}{qB \sin\theta}$ (4) $\frac{mv \cos\theta}{qB}$

12. Two particles 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 **[JEE 2001(Scr.),3/105]**



(1) $m_Av_A < m_Bv_B$ (2) $m_Av_A > m_Bv_B$ (3) $m_A < m_B$ and $v_A < v_B$ (4) $m_A = m_B$ and $v_A = v_B$

13. A charged particle is released from rest in a region of steady and uniform electric and magnetic fields which are parallel to each other. The particle will move in a **[JEE '99(Scr.),2/100]**
(1) Straight line (2) Circle (3) Helix (4) Cycloid

14. A particle of mass M and charge Q moving with velocity $\vec{v}$ describes a circular path of radius R when subjected to a uniform transverse magnetic field of induction B. The work done by the field when the particle completes one full circle is **[RPMT 2008]**
(1) $\left(\frac{mv^2}{R}\right)2\pi R$ (2) Zero (3) BQ.2πR (4) BQv.2πR

15. An electron moves with a velocity 1×10^3 m/s in a magnetic field of induction 0.3 T at an angle 30°. If $\frac{e}{m}$ of electron is 1.76×10^{11} C/kg, the radius of the path is nearly : **[AIPMT 2000]**

(1) 10^{-9} meter (2) 2×10^{-8} meter (3) 10^{-8} meter (4) 10^{-10} meter

16. A charged particle of charge q and mass m enters perpendicularly in a magnetic field $\vec{B}$. Kinetic energy of the particle is E; then frequency of rotation is : **[AIPMT 2001]**

(1) $\frac{qB}{m\pi}$ (2) $\frac{qB}{2\pi m}$ (3) $\frac{qBE}{2\pi m}$ (4) $\frac{qB}{2\pi E}$

17. A beam of particles with specific charge 10^8 C/kg is entering with velocity 3×10^5 m/s by making an angle of 30° with the uniform magnetic field of 0.3 tesla. Radius of curvature of path of particle is **[CBSE PMT-2000]**

(1) 0.5 cm (2) 0.02 cm (3) 1.25 cm (4) 2 cm

18. If an electron enters a magnetic field with its velocity pointing in the same direction as the magnetic field, then : **[MP PMT-2000]**

(1) the electron will turn to its right (2) the electron will turn to its left
(3) the velocity of the electron will increase (4) the velocity of the electron will remain unchanged

19. A charge of 1C is moving in a perpendicular magnetic field of 0.5 Tesla with a velocity of 10 m/sec. Force experienced is: **[RPMT-2000]**

(1) 5 N (2) 10 N (3) 0.5 N (4) 0 N

20. An electron accelerated by 200 V, enters a magnetic field. If its velocity is 8.4×10^6 m/sec. then (e/m) for it will be : (in C/kg) **[RPMT-2000]**

(1) 1.75×10^{10} (2) 1.75×10^{11} (3) 1.75×10^9 (4) 1.75×10^6

21. A charge q is moving in a uniform magnetic field. The magnetic force acting on it does not depend upon **[RPET-2000]**

(1) charge (2) mass (3) velocity (4) magnetic field

22. An electron is travelling in east direction and a magnetic field is applied in upward direction, then electron will deflect towards **[RPET-2000]**

(1) south (2) north (3) west (4) east

23. A proton enters a magnetic field with velocity parallel to the magnetic field. The path followed by the proton is a **[KCET-2000]**

(1) circle (2) parabola (3) helix (4) straight line

24. An electron (mass = 9.0×10^{-31} kg and charge = 1.6×10^{-19} coulomb) is moving in a circular orbit in a magnetic field of 1.0×10^{-4} weber/m^2. Its period of revolution is : **[MPPET-2000]**

(1) 3.5×10^{-7} second (2) 7.0×10^{-7} second (3) 1.05×10^{-6} second (4) 2.1×10^{-6} second

25. A particle of mass 0.6 g and having charge of 25 nC is moving horizontally with a uniform velocity 1.2×10^4 ms^{-1} in a uniform magnetic field, then the value of the minimum magnetic induction is (g = 10ms^{-2}) **[EAMCET (BE)-2001]**

(1) Zero (2) 10 T (3) 20 T (4) 200 T

26. An electron is moving with velocity $\vec{v}$ in the direction of magnetic field $\vec{B}$, then force acting on electron is :- **[RPMT 1999]**

(1) Zero (2) $e(\vec{v} \times \vec{B})$ (3) $e(\vec{B} \times \vec{v})$ (4) 200 Joule

27. A vertical wire carries a current in upward direction. An electron beam sent horizontally towards the wire will be deflected (gravity free space)

(1) towards right (2) towards left (3) upwards (4) downwards

28. If an electron and a proton having same momentum enter perpendicularly to a magnetic field, then : **[AIEEE 4/300 2002]**

(1) curved path of electron and proton will be same (ignoring the sense of revolution)
(2) they will move undeflected
(3) curved path of electron is more curved than that of proton

(4) path of proton is more curved

29. A magnetic needle is kept in a non-uniform magnetic field. It experiences : **[AIEEE 4/300 2005]**
(1) a torque but not a force (2) neither a force nor a torque
(3) a force and a torque (4) a force but not a torque

30. Two thin, long, parallel wires, separated by a distance 'd' carry a current of 'i' A in the same direction. They will : **[AIEEE 4/300 2005]**
(1) attract each other with a force of $\frac{\mu_0 i^2}{(2\pi d)}$ (2) repel, each other with a force of $\frac{\mu_0 i^2}{(2\pi d)}$
(3) attract each other with a force of $\frac{\mu_0 i^2}{(2\pi d^2)}$ (4) repel each other with a force of $\frac{\mu_0 i^2}{(2\pi d^2)}$

31. A uniform electric field and a uniform magnetic field are acting along the same direction in a certain region. If an electron is projected along the direction of the fields with a certain velocity, then : **[AIEEE 4/300 2005]**
(1) its velocity will decrease (2) its velocity will increase
(3) it will turn towards right of direction of motion (4) it will turn towards left of direction of motion.

32. A charged particle of mass m and charge q travels on a circular path of radius r that is perpendicular to a magnetic field B. The time taken by the particle to complete one revolution is :**[AIEEE 4/300 2005]**
(1) $\frac{2\pi mq}{B}$ (2) $\frac{2\pi q^2 B}{B}$ (3) $\frac{2\pi qB}{m}$ (4) $\frac{2\pi m}{qB}$

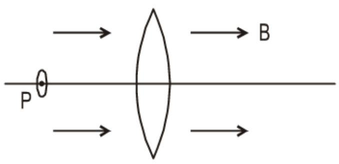
33. In a region, steady and uniform electric and magnetic fields are present. These two fields are parallel to each other. A charged particle is released from rest in this region. The path of the particle will be a : **[AIEEE 1.5/180 2006]**
(1) circle (2) helix (3) straight line (4) ellipse

34. A charged particle with charge q enters a region of constant, uniform and mutually orthogonal fields $\vec{E}$ and $\vec{B}$ with a velocity $\vec{v}$ perpendicular to both $\vec{E}$ and $\vec{B}$, and comes out without any change in magnitude or direction of $\vec{v}$. Then :______________ **[AIEEE 3/120 2007]**
(1) $\vec{v} = \vec{E} \times \vec{B} / B^2$ (2) $\vec{v} = \vec{E} \times \vec{E} / B^2$ (3) $\vec{v} = \vec{E} \times \vec{E} / E^2$ (4) $\vec{v} = \vec{B} \times \vec{E} / E^2$

35. A charged particle moves through a magnetic field perpendicular to its direction. Then : **[AIEEE 3/120 2007]**
(1) the momentum changes but the kinetic energy is constant
(2) both momentum and kinetic energy of the particle are not constant
(3) both, momentum and kinetic energy of the particle are constant
(4) kinetic energy changes but the momentum is constant

36. An α particle is accelerated by a potential difference of 10^4V. Find the change in its direction of motion, if it enters normally in a region of thickness 0.1 m having transverse magnetic induction of 0.1 Tesla. (Given: mass of α-particle is equal to 6.4×10^{-27} kg) **[REE - 94]**
(1) 15° (2) 30° (3) 45° (4) 60°

37. Figure shows a convex lens of focal length 10 cm lying in a uniform magnetic field B of magnitude 1.2 T parallel to its principal axis. A particle having a charge 2.0×10^{-3} C and mass 2.0×10^{-5} kg is projected perpendicular to the plane of the diagram with a speed of 4.8 m/s. The particle moves along a circle with its centre on the principal axis at a distance of 15 cm from the lens. The axis of the lens and of the circle are same. Show that the image of the particle goes along a circle and find the radius of that circle.

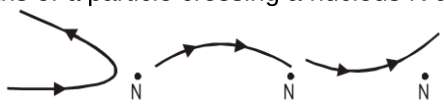


(1) 8 cm (2) 16 cm (3) 32 cm (4) 64 cm

SECTION (G) : ELECTRIC AND MAGNETIC FORCE ON A CHARGE

1. Uniform electric and magnetic fields are produced in the same direction. An electron moves in such a way that its velocity remains in the direction of electric field. The electron will –
(1) turn towards left (2) turn towards right
(3) get decelerated (4) get accelerated

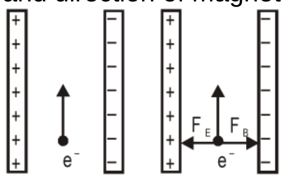
2. In the following fig., three paths of α particle crossing a nucleus N are shown. The correct path is -



(a) (b) (c)

(1) a and c (2) a and b (3) a, b and c (4) only a

3. The distance between the plates of a parallel plate condenser is 4 mm and potential difference between them is 200V. The condenser is placed in a magnetic field B. An electron is projected vertically upwards parallel to the plates with a velocity of 10^6 m/s. The electron passes undeviated through the space between the plates. The magnitude and direction of magnetic field B will be –



(1) 0.05T $\otimes$ (2) 0.02T $\otimes$ (3) 0.05 T Outward (4) 0.02T Outward

4. A beam of protons enters a uniform magnetic field of 0.3T with velocity of 4×10^5 m/s in a direction making an angle of 60º with the direction of magnetic field. The path of motion of the particle will be
(1) circular (2) Straight line (3) Spiral (4) helical

5. In the above question, the radius of path of the particle will be
(1) 12.0m (2) 1.2m (3) 0.12m (4) 0.012m

6. In above question the pitch of the helix will be
(1) 4.37 m (2) 0.437 m (3) 0.0437 m (4) 0.00437 m

7. In a certain region of space electric field $\vec{E}$ and magnetic field $\vec{B}$ are perpendicular to each other and an electron enters in region perpendicular to the direction of $\vec{B}$ and $\vec{E}$ both and moves undeflected, then velocity of electron is : **[AIPMT 2001]**

(1) $\frac{|\vec{E}|}{|\vec{B}|}$ (2) $\vec{E} \times \vec{B}$ (3) $\frac{|\vec{B}|}{|\vec{E}|}$ (4) $\vec{E} \cdot \vec{B}$

8. A charged particle with velocity 2×10^3 m/s passed undeflected through electric and perpendicular magnetic field. Magnetic field is 1.5 Tesla. Find electric field intensity. **[UP, CPMT-2001]**
(1) 2×10^3 N/C (2) 1.5×10^3 N/C (3) 3×10^3 N/C (4) $4/3 \times 10^{-3}$ N/C

9. A charge particle moves in a region having a uniform magnetic field and a parallel, uniform electric field. At some instant, the velocity of the particle is perpendicular to the field direction. The path of the particle will be
(1) a straight line (2) a circle
(3) a helix with uniform pitch (4) a helix with nonuniform pitch.

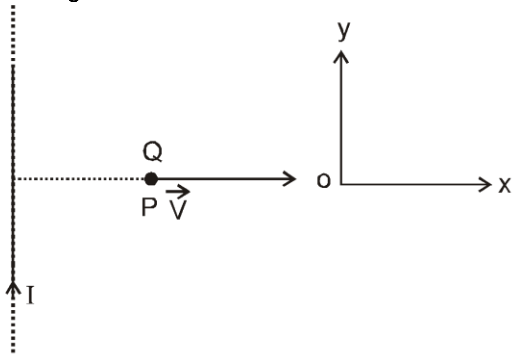
10. In a mass spectrometer used for measuring the masses of ions, the ions are initially accelerated by an electric potential V and then made to describe semicircular paths of radius R using a magnetic field B. If V and B are kept constant, the ratio $\left(\frac{\text{charge on the ion}}{\text{mass of the ion}}\right)$ will be proportional to : **[RPMT 2008]**

(1) $\frac{1}{R}$ (2) $\frac{1}{R^2}$ (3) R_2 (4) R

11. A charge 'q' moves in a region where electric field $\vec{E}$ and magnetic field $\vec{B}$ both exits, then the force on it is: **[AIPMT 2002]**

(1) $q\vec{v}\times\vec{B}$ (2) $q\vec{E}+q\vec{v}\times\vec{B}$ (3) $q\vec{E}+q\vec{B}\times\vec{v}$ (4) $q\vec{B}+q(\vec{E}\times\vec{v})$

12. A very long straight wire carries a current I. At the instant when a charge +Q at point P has velocity $\vec{V}$, as shown, the force on the charge is :- **[AIPMT 2005]**



(1) Opposite to ox (2) along ox (3) opposite to oy (4) along oy

13. An electron moves in a circular orbit with a uniform speed v. It produces a magnetic field B at the centre of the circle. The radius of the circle is proportional to : **[AIPMT 2005]**

(1) $\frac{B}{v}$ (2) $\frac{v}{B}$ (3) $\sqrt{\frac{v}{B}}$ (4) $\sqrt{\frac{B}{v}}$

14. When a charged particle moving with velocity $\vec{v}$ is subjected to a magnetic field of induction $\vec{B}$, the force on it is non-zero. This implies that : **[AIPMT 2006]**

(1) angle between $\vec{v}$ and $\vec{B}$ is necessarily 90°
(2) angle between $\vec{v}$ and $\vec{B}$ can have any value other than 90°
(3) angle between $\vec{v}$ and $\vec{B}$ can have any value other than zero and 180°
(4) angle between $\vec{v}$ and $\vec{B}$ is either zero or 180°

15. Under the influence of a uniform magnetic field a charged particle is moving in a circle of radius R with constant speed v. The time period of the motion : **[AIPMT 2007]**

(1) depends on v and not on R (2) depends on both R and v
(3) is independent of both R and v (4) depends on R and not on v

16. In a mass spectrometer used for measuring the masses of ions, the ions are initially accelerated by an electric potential V and then made to describe semicircular paths of radius R using a describe semicircular paths of radius R using a magnetic field B. If V and B are kept constant, the ratio $\left(\frac{\text{charge on the ion}}{\text{mass of the ion}}\right)$ will be proportional to : **[AIPMT 2007]**

(1) $\frac{1}{R}$ (2) $\frac{1}{R^2}$ (3) R_2 (4) R

17. A beam of electrons passed undeflected through mutually perpendicular electric and magnetic fields. If the electric field is switched off, and the same magnetic field is maintained, the electrons move: **[AIPMT 2007]**
(1) in an elliptical orbit (2) in a circular orbit
(3) along a parabolic path (4) along a straight line

18. A magnetic lines of force inside a bar magnet : **[AIEEE 4/300 2003]**
(1) are from north-pole to south-pole of the magnet
(2) do not exist
(3) depend upon the area of cross-section of the bar magnet
(4) are from south-pole to north-pole of the magnet

19. An experimenter's diary reads as follows; "a charged particle is projected in a magnetic field of $(7.0\hat{i} - 3.0\hat{j}) \times 10^{-3}$ T. The acceleration of the particle is found to be $(x\hat{i} + 7.0\hat{j}) \times 10^{-6}$ m/s^2. Find the value of x.
(1) 2 (2) 4 (3) 3 (4) 1

SECTION (H) : MAGNETIC FORCE ON A CURRENT CARRYING WIRE

1. A 0.5 m long straight wire in which a current of 1.2 A is flowing is kept a right angles to a uniform magnetic field of 2.0 tesla. The force acting on the wire will be -
(1) 2N (2) 2.4 N (3) 1.2 N (4) 3 N

2. Two parallel wires P and Q carry electric currents of 10 A and 2A respectively in mutually opposite directions. The distance between the wires is 10 cm. If the wire P is of infinite length and wire Q is 2m long, then the force acting Q will be -
(1) 4×10^{-5} N (2) 8×10^{-5} N (3) 4×10^{5} N (4) 0 N

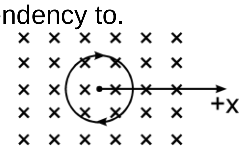
3. A current of 2A is flowing in a wire of length 50 cm. If this wire is lying in a uniform magnetic field of 5×10^{-4} N/A-m making an angle of 60º with the field, then the force acting on the wire will be -
(1) 4.33×10^{-4} N (2) 4N (3) 4 dyne (4) zero

4. A current-carrying, straight wire is kept along the axis of a circular loop carrying a current. The straight wire
(1) will exert an inward force on the circular loop
(2) will exert an outward force on the circular loop
(3) will not exert any force on the circular loop
(4) will exert a force on the circular loop parallel to itself.

5. A proton beam is going from north to south and an electron beam is going from south to north. Neglection the earth's magnetic field, the electron beam will be deflected
(1) towards the proton beam (2) away from the proton beam
(3) away from the electron beam (4) None of these

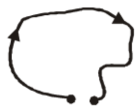
6. Two parallel wires carrying currents in the same direction attract each other because of **[RPMT 2007]**
(1) potential difference between them (2) mutual inductance between them
(3) electric force between them (4) magnetic force between them

7. A conducting loop carrying a current I is placed in a uniform magnetic field pointing into the plane of the paper as shown. The loop will have a tendency to. **[JEE 2003 (Screening) 3/84]**



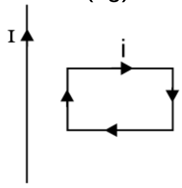
(1) move along the positive x direction (2) move along the negative x direction
(3) contract (4) expand

8. A thin flexible wire of length L is connected to two adjacent fixed points carries a current I in the clockwise direction, as shown in the figure. When system is put in a uniform magnetic field of strength B going into the plane of paper, the wire takes the shape of a circle. The tension in the wire is : **[JEE 2010, 3/163, –1]**



(1) IBL (2) $\frac{IBL}{\pi}$ (3) $\frac{IBL}{2\pi}$ (4) $\frac{IBL}{4\pi}$

9. A rectangular loop carrying a current i is situated near a long straight wire such that the wire is parallel to one of the sides of the loop and the plane of the loop is same of the left wire. If a steady current I is established in the wire as shown in the (fig) the loop will - **[JEE - 85]**



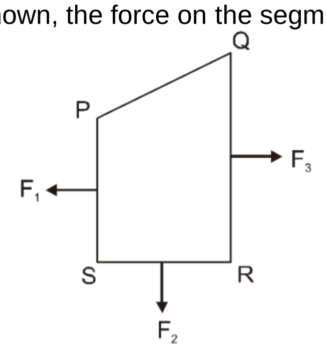
(1) Rotate about an axis parallel to the wire (2) Move away from the wire
(3) Move towards the wire (4) Remain stationary.

10. Select the correct alternative(s):
Two thin long parallel wires separated by a distance 'b' are carrying a current 'i' ampere each. The magnitude of the force per unit length exerted by one wire on the other is **[JEE-'86]**

(1) $\frac{\mu_0 i^2}{b^2}$ (2) $\frac{\mu_0 i^2}{2\pi b}$ (3) $\frac{\mu_0 i}{2\pi b}$ (4) $\frac{\mu_0 i}{2\pi b^2}$

11. Two parallel wires carry currents of 20 A and 40 A in opposite directions. Another wire carrying a current antiparallel to 20 A is placed midway between the two wires. The magnetic force on it will be
(1) towards 20 A (2) towards 40 A
(3) zero (4) perpendicular to the plane of the currents

12. A closed loop PQRS carrying a current is placed in a uniform magnetic field. if the magnetic forces on segments PS, SR and RQ are F_1, F_2 and F_3 respectively and are in the plane of the paper and along the directions shown the directions shown, the force on the segment QP is **[AIPMT 2008]**



(1) $F_3 - F_1 - F_2$ (2) $\sqrt{(F_3 - F_1)^2 + F_2^2}$ (3) $\sqrt{(F_3 - F_1)^2 - F_2^2}$ (4) $F_3 - F_1 + F_2$

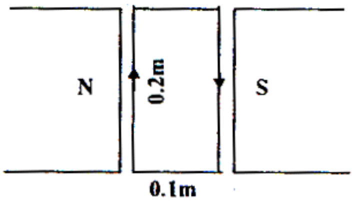
13. Two long conductors, separated by a distance d carry currents I_1 and I_2 in the same direction. They exert a force F on each other. Now the current in one of them is increased to two times and its direction is reversed. The distance is also increased to 3d. The new value of the force between them is :
[AIEEE 4/300 2004]
(1) –2 F (2) F/3 (3) –2F/3 (4) – F/3

SECTION (I) : MAGNETIC FORCE AND TORQUE ON A CURRENT CARRYING LOOP AND MAGNETIC DIPOLE MOMENT

1. If the angular momentum of electron is $\vec{J}$ then its magnetic moment will be -

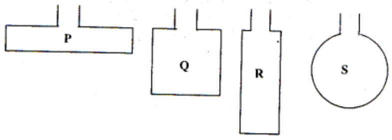
(1) $\frac{eJ}{m}$ (2) $\frac{eJ}{2m}$ (3) eJ2m (4) $\frac{2m}{eJ}$

2. A coil of 100 turns is lying in a magnetic field of 1T as shown in the figure. A current of 1A is flowing in this coil. The torque acting on the coil will be



(1) 1N–m (2) 2N–m (3) 3N–m (4) 4N–m

3. Four wires of equal length are bent in the form of four loops P, Q, R and S. These are suspended in a uniform magnetic field and same current is passed in them. The maximum torque will act on.



(1) P (2) Q (3) R (4) S

4. A bar magnet has a magnetic moment 2.5 JT^{-1} and is placed in a magnetic field of 0.2 T. Work done in turning the magnet from parallel to antiparallel position relative to the field direction. **[REE - 95]**
(1) 0.5 J (2) 1 J (3) 2.0 J (4) Zero

5. A circular loop of area 1 cm^2, carrying a current of 10 A, is placed in a magnetic field of 0.1 T perpendicular to the plane of the loop. The torque on the loop due to the magnetic field is
(1) zero (2) 10^{-4} N-m (3) 10^{-2} N-m (4) 1 N-m

6. A toroid of mean radius ' a ' , cross section radius ' r ' and total number of turns N. It carries a current ' i '. The torque experienced by the toroid if a uniform magnetic field of strength B is applied :
(1) is zero
(2) is $B\, i\, N\, \pi\, r^2$
(3) is $B\, i\, N\, \pi\, a^2$
(4) depends on the direction of magnetic field.

7. A bar magnet of magnetic moment $\vec{M}$ is placed in a magnetic field of induction $\vec{B}$.The torque exerted on it is : **[AIPMT 1999]**
(1) $\vec{M}\vec{B}$ (2) $-\vec{M}\vec{B}$ (3) $\vec{M}\times\vec{B}$ (4) $-\vec{M}\times\vec{B}$

8. Current is flowing in a coil of area A and number of turns N, then magnetic moment of the coil M is equal to: **[AIPMT 2001]**
(1) NiA (2) $\frac{Ni}{A}$ (3) $\frac{Ni}{\sqrt{A}}$ (4) N^2Ai

9. A circular loop has a radius of 5 cm and it is carrying a current of 0.1 amp. Its magnetic moment is: **[MP PMT-2000]**
(1) 1.32×10^{-4} amp. – m^2
(2) 2.62×10^{-4} amp. – m^2
(3) 5.25×10^{-4} amp. – m^2
(4) 7.85×10^{-4} amp. – m^2

10. The dipole moment of a current loop is independent of **[BHU Med.-2000]**
(1) current in the loop
(2) number of turns
(3) area of the loop
(4) magnetic field in which it is situated

11. Current I is carried in a wire of length L. If the wire is formed into a circular coil, the maximum magnitude of torque in a given magnetic field B, will be: **[UPSEAT-2000]**
(1) $\frac{LIB}{4\pi}$ (2) $\frac{L^2IB}{4\pi}$ (3) $\frac{L^2IB}{2}$ (4) $\frac{LIB^2}{2}$

12. Due to the flow of current in a circular loop of radius R, the magnetic induction produced at the centre of the loop is B. The magnetic moment of the loop is [μ_0 = Permeability constant] : **[MPPET-2000]**
(1) $BR^3/ 2\pi\mu_0$ (2) $2\pi BR^3/ \mu_0$ (3) $BR^2/ 2\pi\mu_0$ (4) $2\pi BR^2/ \mu_0$

13. The magnetic moment of a circular coil carrying current is : **[MPPET-2000]**
(1) directly proportional to the length of the wire in the coil
(2) inversely proportional to the length of the wire in the coil
(3) directly proportional to the square of the length of the wire in the coil
(4) inversely proportional to the square of the length of the wire in the coil

14. To double the torque acting on a rectangular coil of n turns, when placed in a magnetic field.
(1) area of the coil and the magnetic induction should be doubled **[EAMCET-2001]**
(2) area or current through the coil should be doubled
(3) only area of coil should be doubled
(4) number of turns are to be halved

15. Magnetic dipole moment of rectangular loop is **[RPET-2000]**
(1) inversely proportional to current in loop
(2) inversely proportional to area of loop
(3) parallel to plane of loop and proportional to area of loop
(4) perpendicular to plane of loop and proportional to area of loop

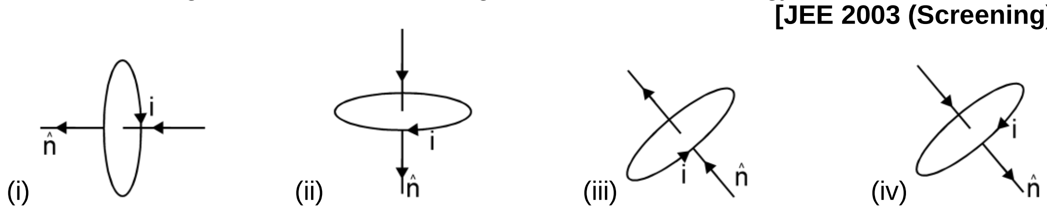
16. Two bar magnets having same geometry with magnetic moments M and 2M, are firstly placed in such a way what their similar poles are same side then its time period of osculation is T_1. Now the polarity of one of the magnet is reversed then time period of oscillation is T_1. Then time period of oscillations will be :- **[AIPMT 2002]**
(1) $T_1 < T_2$ (2) $T_1 > T_2$ (3) $T_1 = T_2$ (4) $T_2 = \infty$

17. A charged particle (charge q) is moving in a circle of radius R with uniform speed v. The associated magnetic moment μ is given by : **[AIPMT 2007]**
(1) $\frac{qvR}{2}$ (2) qvR_2 (3) $\frac{qvR^2}{2}$ (4) qvR

18. A magnetic needle lying parallel to a magnetic field requires W units of work to turn it through 60º. The torque needed to maintain the needle in this position will be : **[AIEEE 4/300 2003]**
(1) $\sqrt{3}$ W (2) W (3) $(\sqrt{3}/2)$W (4) 2 W

19. Two particles, each of mass m and charge q, are attached to the two ends of a light rigid rod of length 2 R. The rod is rotated at constant angular speed about a perpendicular axis passing through its centre. The ratio of the magnitudes of the magnetic moment of the system and its angular momentum about the centre of the rod is: **[JEE '98, 2/200]**
(1) $\frac{q}{2m}$ (2) $\frac{q}{m}$ (3) $\frac{2q}{m}$ (4) $\frac{q}{\pi m}$

20. A current carrying loop is placed in a uniform magnetic field towards right in four different orientations, I, II, III & IV, arrange them in the decreasing order of Potential Energy.
[JEE 2003 (Screening) 3/84]



(1) I, III, II, IV (2) I, II, III, IV (3) I, IV, II, III (4) III, IV, I, II

21. A circular coil of diameter 2.0 cm has 500 turns in it and carries a current of 1.0 A. Its axis makes an angle of 30º with the uniform magnetic field of magnitude 0.40 T that exists in the space. Find the torque acting on the coil.
(1) $\pi \times 10_{-8}$ N - m (2) $\pi \times 10_{-4}$ N - m (3) $\pi \times 10_{-6}$ N - m (4) $\pi \times 10_{-2}$ N - m

SECTION (J) : MAGNETIC FIELD DUE TO A MAGNET AND EARTH

1. When a current of 1 ampere is passed in a coil lying in the magnetic meridian then a magnetic needle at its centre gives some deflection. If the current in the coil is increased to $\sqrt{8}$ ampere then at what distance from the centre of the coil will the deflection of needle remains unchanged ?
(1) 2R (2) 4R (3) 8R (4) R

2. Tangent galvanometer measures : **[AIPMT 2001]**
(1) capacitance (2) current (3) resistance (4) potential difference

SECTION (K) : PROPERTIES OF MAGNETIC MATERIAL

1. When a small magnetising field H is applied to a magnetic material, the intensity of magnetisation is proportional to :
(1) H^{-2} (2) $H^{1/2}$ (3) H (4) H^2

2. How does the magnetic susceptibility χ of a paramagnetic material change with absolute temperatue T ?
(1) $\chi \propto T$ (2) $\chi \propto T^{-1}$ (3) χ = constant (4) $\chi \propto e^T$

3. Consider the following statements for a paramagnetic substance kept in a magnetic field :
(a) If the magnetic field increases, the magnetisation increases.
(b) If temperature rises, the magnetisation increases.
(1) Both (a) and (b) are true (2) (a) is true but (b) is false
(3) (b) is true but (a) is false (4) Both (a) and (b) are false

4. Which of the following relations is not correct ?
(1) $B = \mu_0 (H + I)$ (2) $B = \mu_0 H (1 + \chi_m)$ (3) $\mu_0 = \mu (1 + \chi_m)$ (4) $\mu_r = 1 + \chi_m$

5. The hysteresis loop for the material of a permanent magnet is :
(1) short and wide (2) tall and narrow (3) tall and wide (4) short and narrow

6. Select the incorrect alternative (s) :
When a ferromagnetic material goes through a complete cycle of magnetisation, the magnetic susceptibility :
(1) has a fixed value (2) may be zero (3) may be infinite (4) may be nagative

7. The material for making permanent magnets should have :
(1) high retentivity, high coercivity (2) high retentivity, low coercivity
(3) low retentivity, high coercivity (4) low retentivity, low coercivity

8. (a) Soft iron is a conductor of electricity. (b) It is a magnetic material. (c) It is an alloy of iron.
(d) It is used for making permanent magents. State whether :
(1) a and c are true (2) a and b are true (3) c and d are true (4) b and d are true

9. Soft iron is used in many electrical machines for :
(1) low hysteresis loss and low permeability (2) low hysteresis loss and high permeability
(3) high hysteresis loss and low permeability (4) high hysteresis loss and high permeability

10. For protecting a sensitive equipment from the extrnal magnetic field, it should be : **[AIPMT 1998]**
(1) placed inside an aluminium can
(2) placed inside an iron can
(3) wrapped with insulation around it when passing current thought it
(4) surrounded with fine copper sheet

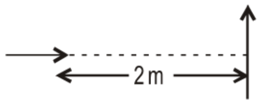
11. If a long hollow copper pipe carries a current, then magnetic filed is produced : **[AIPMT 1999]**
(1) inside the pipe only (2) outside the pipe only
(3) both inside and outside the pipe (4) no where

12. The materials suitable for making electromagnets should have : **[AIEEE 4/300 2004]**
(1) high retentivity and high coercivity (2) low retentivity and low coercivity
(3) high retentivity and low coercivity (4) low retentivity and high coercivity

13. Needles N_1, N_2 and N_3 are made of a ferromagnetic, a paramagnetic and a diamagnetic substance respectively. A magnet when brought close to them will : **[AIEEE 1.5/180 2006]**
(1) attract all three of them
(2) attract N_1 and N_2 strongly but repel N_3
(3) attract N_1 strongly, N_2 weakly and repel N_3 weakly
(4) attract N_1 strongly, but repel N_2 and N_3 weakly

Exercise-2

1. Two identical magnetic dipoles of magnetic moments 1.0 A-m^2 each, placed at a separation of 2 m with their axes perpendicular to each other. The resultant magnetic field at a point midway between the dipole is: **[REE - 95]**

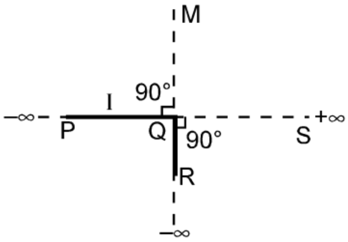


(1) 5×10^{-7} T (2) $\sqrt{5} \times 10^{-7}$ T (3) 10^{-7} T (4) 2×10^{-7} T

2. A moving charge produces
(1) electric field only (2) magnetic filed only (3) both of them (4) none of these

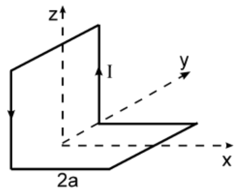
3. Consider a long, straight wire of cross-section area A carrying a current i. Let there be n free electrons per unit volume. An observer places himself on a trolley moving in the direction opposite to the current with a speed υ = (i/nAe) and separated from the wire by a distance r. The magnetic field seen by the observer is
(1) $\frac{\mu_0 i}{2\pi r}$ (2) zero (3) $\frac{\mu_0 i}{\pi r}$ (4) $\frac{2\mu_0 i}{\pi r}$

4. An infinitely long conductor PQR is bent to form a right angle as shown. A current I flows through PQR. The magnetic field due to this current at the point M is H_1. Now, another infinitely long straight conductor QS is connected at Q so that the current in PQ remaining unchanged. The magnetic field at M is now H_2. The ratio H_1/H_2 is given by **[JEE 2000(Scr.), 3/105]**



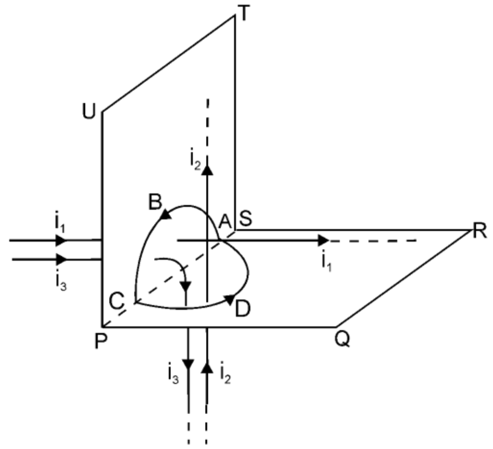
(1) 1/2 (2) 1 (3) 2/3 (4) 2

5. A non-planer loop of conducting wire carrying a current I is placed as shown in the figure. Each of the straight sections of the loop is of length 2a. The magnetic field due to this loop at the point P(a, 0, a) points in the direction. **[JEE 2001(Scr.), 3/105]**



(1) $\frac{1}{\sqrt{2}}(-\hat{j}+\hat{k})$ (2) $\frac{1}{\sqrt{3}}(-\hat{j}+\hat{k}+\hat{i})$ (3) $\frac{1}{\sqrt{3}}(\hat{i}+\hat{j}+\hat{k})$ (4) $\frac{1}{\sqrt{2}}(\hat{i}+\hat{k})$

6. Figure shows an amperian path ABCDA. Part ABC is in vertical plane PSTU while part CDA is in horizontal plane PQRS. Direction of circumlation along the path is shown by an arrow near point B and at D. $\oint \vec{B}.d\vec{\ell}$ for this path according to Ampere's law will be :



(1) $(i_1 - i_2 + i_3)\,\mu_0$ (2) $(-i_1 + i_2)\,\mu_0$ (3) $i_3\,\mu_0$ (4) $(i_1 + i_2)\,\mu_0$

7. A proton, a deuteron and an α-particle having the same kinetic energy are moving in circular trajectories in a constant magnetic field. If r_p, r_d and r_α denote respectively the radii of the trajectories of these particles then **[JEE '97, 1/100]**

(1) $r_\alpha = r_p < r_d$ (2) $r_\alpha > r_d > r_p$ (3) $r_\alpha = r_d > r_p$ (4) $r_p = r_d = r_\alpha$

8. Two very long, straight, parallel wires carry steady currents I and – I respectively. The distance between the wires is d. At a certain instant of time, a point charge q is at a point equidistant from the two wires, in the plane of the wires. Its instantaneous velocity $\vec{v}$ is perpendicular to this plane. The magnitude of the force due to the magnetic field acting on the charge at this instant is:

[JEE '98; 2/200]

(1) $\frac{\mu_0 Iqv}{2\pi d}$ (2) $\frac{\mu_0 Iqv}{\pi d}$ (3) $\frac{2\mu_0 Iqv}{\pi d}$ (4) 0

9. An ionized gas contains both positive and negative ions. If it is subjected simultaneously to an electric field along the + x direction and a magnetic field along the +z direction, then **[IIT Scr.-2000]**

(1) positive ions deflect towards +y direction

(2) all ions deflect towards +y direction

(3) all ions deflect towards –y direction

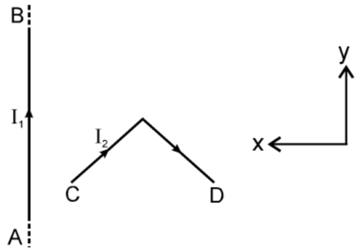
(4) positive ions deflect towards –y direction and negative ions towards +y direction

10. A conducting circular loop of radius r carries a constant current i. It is placed in a uniform magnetic field **B** such that **B** is perpendicular to the plane of the loop. The magnetic force acting on the loop is

[JEE - 83]

(1) i r B (2) $2\pi r i B$ (3) zero (4) $\pi r i B$

11. In the figure shown a current I_1 is established in the long straight wire AB. Another wire CD carrying current I_2 is placed in the plane of the paper. The line joining the ends of this wire is perpendicular to the wire AB. The resultant force on the wire CD is:



(1) towards negative x-axis
(2) towards positive y-axis
(3) somewhere between –x axis and + y axis
(4) somewhere between +x axis and + y axis

12. A steady current 'I' flows in a small square loop of wire of side L in a horizontal plane. The loop is now folded about its middle such that half of it lies in a vertical plane. Let $\vec{\mu}_1$ and $\vec{\mu}_2$ respectively denote the magnetic moments of the current loop before and after folding. Then : **[JEE - 93]**

(1) $\vec{\mu}_2 = 0$
(2) $\vec{\mu}_1$ and $\vec{\mu}_2$ are in the same direction
(3) $\dfrac{|\vec{\mu}_1|}{|\vec{\mu}_2|} = \sqrt{2}$
(4) $\dfrac{|\vec{\mu}_1|}{|\vec{\mu}_2|} = \dfrac{1}{\sqrt{2}}$

13. A particle of charge q and mass m moves in a circular orbit of radius r with angular speed ω.The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on **[JEE 2000(Scr.), 3/105]**

(1) ω and q (2) ω, q and m (3) q and m (4) ω and m

14. A power line lies along the east-west direction and carries a current of 10 ampere. The force per metre due to the earth's magnetic field of 10^{-4} T is

(1) 10^{-5} N (2) 10^{-4} N (3) 10^{-3} N (4) 10^{-2} N

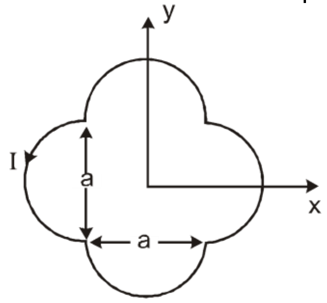
15. A circular coil of radius 20 cm and 20 turns of wire is mounted vertically with its plane in magnetic meridian. A small magnetic needle (free to rotate about vertical axis) is placed at the center of the coil. It is deflected through 45° when a current is passed through the coil in equilibrium Horizontal component of earth's field is 0.34×10^{-4} T. The current in coil is: **[JEE - 93]**

(1) $\dfrac{17}{10\pi}$A (2) 6A (3) 6×10^{-3} A (4) $\dfrac{3}{50}$A

16. The magnetic materials having negative magnetic susceptibility are:

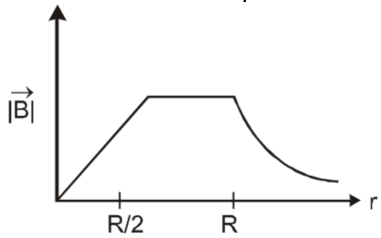
(1) Non magnetic (2) Para magnetic (3) Diamagnetic (4) Ferromagnetic

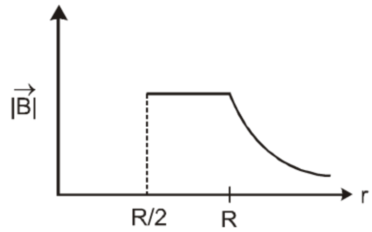
17. A loop carrying current I lies in the x-y plane as shown in the figure. the unit vector $\hat{k}$ is coming out of the plane of the paper. the magnetic moment of the current loop is : **[IIT-JEE-2012, Paper-2; 3/66, –1]**



(1) $a^2 I\hat{k}$ (2) $\left(\frac{\pi}{2}+1\right)a^2 I\hat{k}$ (3) $-\left(\frac{\pi}{2}+1\right)a^2 I\hat{k}$ (4) $(2\pi+1)a^2 I\hat{k}$

18. An infinitely long hollow conducting cylinder with inner radius R/2 and outer radius R carries a uniform current density along is length. The magnitude of the magnetic field, $|\vec{B}|$ as a function of the radial distance r from the axis is best represented by : **[IIT-JEE-2012, Paper-2; 3/66, –1]**

(1)


(2)


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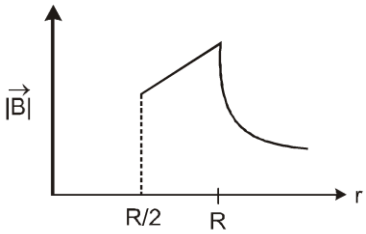

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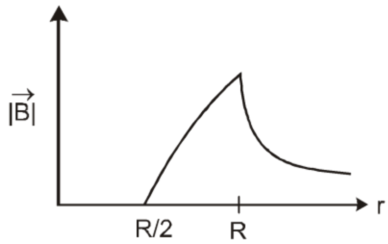
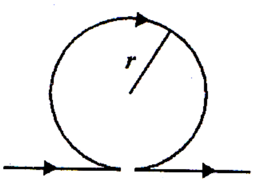


19. If a long horizontal wire is bent as shown in the figure and current i is passed through it, then the magnitude and direction of magnetic field produced at the centre of the circular part will be. **[RPMT-2002]**



(1) $\frac{\mu_0 i}{r}, \otimes$ (2) $\frac{\mu_0 i}{2r}\left(1-\frac{1}{\pi}\right), \otimes$ (3) $\frac{\mu_0 i}{2r}\left[1+\frac{1}{\pi}\right]\otimes$ (4) $\frac{\mu_0 i}{r}\left(1-\frac{1}{\pi}\right), \otimes$

20. The cosmic rays falling down are deflected towards **[RPMT-2002]**
(1) east (2) west (3) directly come down (4) none of the above

21. If $A_1 = 24$ and $q_1 = e$ and $A_0 = 22$ and $q_2 = 2e$ ions enter a uniform perpendicular magnetic field with same speed, the ratio of radius their circular paths will be **[RPMT-2002]**
(1) 12/11 (2) 24/11 (3) 11/12 (4) 11/24

22. Which one of the following is ferro magnetic ? **[RPMT 2002]**
(1) Co (2) Zn (3) Hg (4) Pt

23. Sometimes positive charged particle comes from space towards earth with high velocity. Its deviation due to the magnetic field of earth will be : **[RPMT 2002]**
(1) towards north (2) towards south (3) towards west (4) towards east

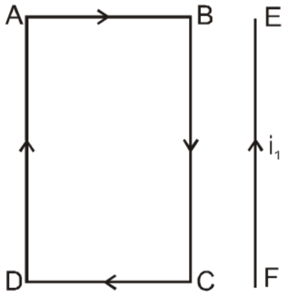
24. For paramagnetic materials magnetic susceptibility is related with temperature as :**[RPMT 2002]**
(1) $\chi \propto T_2$ (2) $\chi \propto T_1$ (3) $\chi \propto T_{-1}$ (4) $\chi \propto T_2$

25. Current I is flowing in a conducting circular loop of radius R. It is kept in a uniform magnetic field B. Find the magnetic force acting on the loop. **[RPMT 2002]**
(1) IRB (2) 2πIRB (3) Zero (4) πIRB

26. The magnetic field at the centre of semi-circular wire carrying current i is **[RPMT 2003]**

(1) $\frac{\mu_0 i}{2r}$ (2) $\frac{\mu_0 i}{4r}$ (3) $\frac{\mu_0 i}{r}$ (4) $\frac{\mu_0 i}{2\pi r}$

27. A wire EF carrying current i_1 is placed near a current carrying rectangular loop ABCD as shown. Then the wire EF **[RPMT 2003]**



(1) remains unaffected (2) is attractted towards loop
(3) is repelled away from loop (4) first attracted and then repelled

28. If a current of i amp is flowing in the winding of solenoid and n is the number of turns per unit length, then the magnetic field at the centre of solenoid is **[RPMT 2003]**

(1) $\mu_0 ni$ (2) $\frac{\mu_0 ni}{2}$ (3) $\frac{\mu_0 i}{2n}$ (4) $\frac{\mu_0 i}{n}$

29. On a magnetic needle placed in a uniform magnetic field : **[RPMT 2004]**
(1) $F \neq 0, \tau \neq 0$ (2) $F \neq 0, \tau = 0$ (3) $F = 0, \tau \neq 0$ (4) $F = 0, \tau = 0$

30. An electron moves at right angle to a magnetic field of 1.5×10^{-2} T with a speed of 6×10^7 m/s. If the specific charge of the electron is 1.7×10^{11} C/kg. The radius of the circular path will be :**[RPMT 2006]**
(1) 2.9 cm (2) 3.9 cm (3) 2.35 cm (4) 2 cm

31. A bar magnet of magnetic moment $\vec{M}$ is placed in the magnetic field $\vec{B}$. The torque acting on the magnet is: **[RPMT 2006]**

(1) $\vec{M} \times \vec{B}$ (2) $\vec{M} - \vec{B}$ (3) $\frac{1}{2}\vec{M} \times \vec{B}$ (4) $\vec{M} + \vec{B}$

32. An electron and proton enter a magnetic field perpendicularly. Both have same kinetic energy. Which of the following is true ? **[RPMT 2007]**
(1) Trajectory of electron is less curved (2) Trajectory of proton is less curved
(3) Both trajectories are equally curved (4) Both move on straight line path

33. A small circular flexible loop of wire of radius r carries a current I. It is placed in a uniform magnetic field B. The the tension in the loop will be doubled if : **[RPMT 2007]**
(1) I is halved (2) B is halved
(3) r is doubled (4) both B and I are doubled

34. Two concentric circular coils of ten turns each are situated in the same plane. Their radii are 20 cm and 40 cm and they carry respectively 0.2A and 0.3A currents in opposite direction. The magnetic field in tesla at the centre is **[RPMT 2007]**

(1) $\frac{35\mu_0}{4}$ (2) $\frac{\mu_0}{80}$ (3) $\frac{7\mu_0}{80}$ (4) $\frac{5\mu_0}{4}$

35. A hydrogen atom is paramagnetic. A hydrogen molecule is- **RPMT 2008]**
(1) diamagnetic (2) paramagnetic (3) ferromagnetic (4) none of these

36. Under the influence of a uniform magnetic field a charged particle is moving in a circle of radius R with constant speed v. The time period of the motion
(1) depends on v and not on R (2) depends on both R and v **[RPMT 2008]**

(3) is independent of both R and v (4) depends on R and not on v

37. A charged particle (charge q) is moving in a circle of radius R with uniform speed v. The associated magnetic moment μ is given by : **[RPMT 2008]**

(1) $\frac{qvR}{2}$ (2) qvR^2 (3) $\frac{qvR^2}{2}$ (4) qvR

38. The charge on a particle Y is double the charge on particle X. These two particles X and Y 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 mass of X to that of Y is :**[RPMT 2009]**

(1) $(2R_1 / R_2)^2$ (2) $(R_1 / 2R_2)^2$ (3) $R_1^2 / 2R_2^2$ (4) $2R_1 / R_2$

39. The magnetic needle of a tangent galvanometer is deflected by an angle 30°due to a magnet. The horizontal component of earth's magnetic field is 0.34×10^{-4} T along the plane of the coil. The intensity of magnetic field of magnet is : **[RPMT 2009]**

(1) 1.96×10^{-4} T (2) 1.96×10^{-5} T (3) 1.96×10^{4} T (4) 1.96×10^{5} T

40. There are 50 turns of a wire in every cm length of a long solenoid. If 4A currents is flowing in the solenoid, the approximate value of magnetic field along its axis at an internal point and at one end will be respectively : **[RPMT 2009]**

(1) 12.6×10^{-3} Wb/m^2 , 6.3×10^{-3} Wb/m^2 (2) 12.6×10^{-3} Wb/m^2, 25.1×10^{-3} Wb/m^2

(3) 25.1×10^{-3} Wb/m^2, 12.6×10^{-3} Wb/m^2 (4) 25.1×10^{-5} Wb/m^2, 12.6×10^{-5} Wb/m^2

41. A particle of charge -16×10^{-18} C moving with velocity 10ms^{-1} along the x-axis enters a region where a magnetic field of induction B is along the y-axis and an electric field of magnitude 10^4V/m is along the negative z-axis. If the charged particle continues moving along the x-axis, the magnitude of B is **[RPMT 2009]**

(1) 10^{16} Wb/m^2 (2) 10^5 Wb/m^2 (3) 10^3 Wb/m^2 (4) 10^{-3} Wb/m^2

42. Before using the tangent galvanometer, its coil is set up in : **[RPMT 2009]**

(1) magnetic meridian (2) perpendicular to magnetic meridian

(3) at angle of 45° to magnetic meridian (4) It does not require any setting

43. Two magnets are kept in a vibration magnetmeter and vibrate in earth's magnetic field. There are 12 vibrations per minute when like poles kept together, but only 4 vibrations per minute when opposite poles kept together then ratio of magnetic moments wil be : **[RPMT 2010]**

(1) 3 : 1 (2) 1 : 3 (3) 3 : 5 (4) 5 : 4

44. In a hydrogen atom an eletron is revolving around nucleus 6.6×10^{15} revolution per second in a radius of 0.53 Å. Value of magnetic field at the centre of the orbit will be : **[RPMT 2010]**

(1) 0.125 V/m^2 (2) 1.25 V/m^2 (3) 12.5 V/m^2 (4) 125 V/m^2 a

45. Properties related to diamagnetism are given below, select wrong statement. **[RPMT 2010]**

(1) Diamagnetic material does not have permanent magnetic moment.

(2) Diamagnetism is explained in terms of eletromagnetic induction.

(3) Diamagnetic substances have small positive magnetic susceptibility.

(4) Magnetic moments of different eletrons cancel each other.

46. In a moving coil galvenometer number of turns are 48 and area of coil is 4×10^{-2} m^2. If intensity of magnetic field is 0.2 then how many number of turns in it are required to increases it's sensitivity by 25% while area (A) and magnetic field (B) are constant ? **[RPMT 2010]**

(1) 24 (2) 36 (3) 60 (4) 54

47. A magnet is parallel to a uniform magnetic field work done to rotate it by 60° is 0.8 joule. Then to rotate it by 30° again will be : **[RPMT 2010]**

(1) 0.8×10^7 Ag (2) 4.0 Ag (3) 8 Ag (4) 0.8 Ag

48. The charge on particle Y is double the charge on particle X. These two particles X and Y after being accelerated through the same potential difference enter region of uniform magnetic field and describe circular parts of radii R_1 and R_2 respectively. The ratio of the mass of X to that of Y is **[2009 RPMT]**

(1) $(2R_1/R_2)^2$ (2) $(R_1/2R_2)^2$ (3) $\frac{R_1^2}{2R_2^2}$ (4) $2R_1/R_2$

49. A proton and a deuteron are accelerated with the same potential difference enter perpendicularly in a region of magnetic field B. If r_p and r_d are the radii of circular paths taken by proton and deuteron respectively, the ratio $\frac{r_d}{r_p}$ would be **[RPMT-2014]**

(1) $2\sqrt{2}$ (2) $\frac{1}{\sqrt{2}}$ (3) $\frac{1}{2\sqrt{2}}$ (4) 2

50. A particle of charge 'q' and mass 'm' move in a circular orbit of radius 'r' with frequency 'v'. The ratio of the magnetic moment to angular momentum is **[RPMT-2014]**

(1) $\frac{2qv}{m}$ (2) $\frac{qv}{2m}$ (3) $\frac{q}{2mr}$ (4) $\frac{q}{2m}$

51. A rectangular loop of length 20 cm, along y -axis and breadth 10 cm along z-axis carries a current of 12 A. If a unifrom magnetic field $(0.3\hat{i} + 0.4\hat{j})$ acts on the loop, the torque acting on it is **[RPMT-2014]**

(1) 9.6×10^{-4} Nm along x - axis (2) 9.6×10^{-3} Nm along y - axis
(3) 9.6×10^{-2} Nm along z - axis (4) 9.6×10^{-3} Nm along z - axis

52. The length of a magnet is large compared to its width and breadth. The time period of its oscillation in a vibration magnetometer is 2s. The magnet is cut perpendicular to its length into three equal parts and three parts are then placed on each other with their like poles together. The time period of this combination will be : **[AIEEE 4/300 2004]**

(1) 2s (2) 2/3 s (3) $2\sqrt{3}$ s (4) $2/\sqrt{3}$ s

53. Two concentric coils each of radius equal to 2π cm are placed at right angles to each other. 3 ampere and 4 ampere are the currents flowing in each coil respectively. **[AIEEE 4/300 2005]**
The magnetic induction in weber/m^2 at the centre of the coils will be ($\mu_0 = 4\pi \times 10^{-7}$ Wb/A.m):

(1) 12×10^{-5} (2) 10^{-5} (3) 5×10^{-5} (4) 7×10^{-5}

54. Relative permittivity and permeability of a material are ε_r and μ_r, respectively. Which of the following values of these quantities are allowed for a diamagnetic material ? **[AIEEE 3/105 2008]**

(1) $\varepsilon_r = 1.5$, $\mu_r = 0.5$ (2) $\varepsilon_r = 0.5$, $\mu_r = 0.5$ (3) $\varepsilon_r = 1.5$, $\mu_r = 1.5$ (4) $\varepsilon_r = 0.5$, $\mu_r = 1.5$

55. A horizontal overhead powerline is at a height of 4 m from the ground and carries a current of 100 A from east to west. The magnetic field directly below it on the ground is ($\mu_0 = 4\pi \times 10^{-7}$ T mA^{-1}):
[AIEEE 3/ 105 2008]

(1) 5×10^{-6} T northward (2) 5×10^{-6} T southward
(3) 2.5×10^{-7} T northward (4) 2.5×10^{-7} T southward

Exercise-3

PART - I : NEET / AIPMT QUESTION (PREVIOUS YEARS)

1. The magnetic froce on a charged particle of charge $-2\mu C$ in a magnetic field of 2T acting in y direction, when the particle velocity is $\left(2\hat{i}+3\hat{j}\right)\times10^{6}$ ms^{-1} is **[AIPMT 2009]**
(1) 8 N in – z direction (2) 4 N in z direction (3) 8 N in y direction (4) 8 N in z direction

2. A bar magnet having a magnetic moment of 2×10^4 JT^{-1} is free to rotate in a horizontal plane. A horizontal magnetic field B= 6×10^{-4} T exists in the space. The work done in taking the magnet slowly from a direction parallel to the field to a direction 60° from the field is **[AIPMT 2009]**
(1) 0.6 J (2) 12 J (3) 6 J (4) 2 J

3. A thin ring of radius R meter has charge q coulomb uniformly spread on it. The ring rotates about its axis with a constant frequency of f revolutions/s. The value of magnetic induction in Wb/m^2 at the centre of the ring is **[AIPMT 2010]**
(1) $\frac{\mu_0 qf}{2\pi R}$ (2) $\frac{\mu_0 q}{2\pi fR}$ (3) $\frac{\mu_0 q}{2fR}$ (4) $\frac{\mu_0 qf}{2R}$

4. Electromagnets are made of soft iron because soft iron has **[AIPMT 2010]**
(1) low retentivity and high coercive force (2) high retentivity and high coercive force
(3) low retentivity and low coercive force (4) high retentivity and low coercive force

5. A square current carrying loop is suspended in a uniform magnetic field acting in the plane of the loop. If the force on one arm of the loop is $\vec{F}$, the net force on the remaining three arms of the loop is **[AIPMT 2010]**
(1) $3\vec{F}$ (2) $-\vec{F}$ (3) $-3\vec{F}$ (4) $\vec{F}$

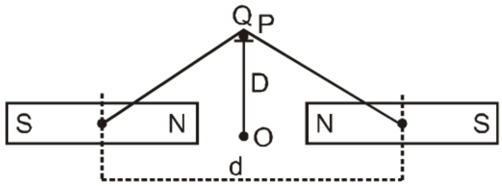
6. A current loop consists of two identical semicircular parts each of radius R, one lying in the x-y plane and the other in x-z plane. If the current in the loop is i. The resultant magnetic field due to the two semicircular parts at their common centre is **[AIPMT (MAINS) 2010]**
(1) $\frac{\mu_0 i}{2\sqrt{2}R}$ (2) $\frac{\mu_0 i}{2R}$ (3) $\frac{\mu_0 i}{4R}$ (4) $\frac{\mu_0 i}{\sqrt{2}R}$

7. A closely wound solenoid of 2000 turns and area of cross-section 1.5×10^{-4} m^2 carries a current of 2.0 A. It is suspended through its centre and perpendicular to its length, allowing it to turn in a horizontal plane in a uniform magnetic field 5×10^{-2} tesla making an angle of 30° with the axis of the solenoid. The torque on the solenoid will be **[AIPMT (MAINS) 2010]**
(1) 3×10^{-3} N m (2) 1.5×10^{-3} N m (3) 1.5×10^{-2} N m (4) 3×10^{-2} N m

8. A particle having a mass of 10^{-2} kg carries a charge of 5×10^{-8} C. The particle is given an initial horizontal velocity of 10^5 ms^{-1} in the presence of electric field $\vec{E}$ and magnetic field $\vec{B}$. To keep the particle moving in a horizontal direction, it is necessary that
(i) should be perpendicular to the direction of velocity and $\vec{E}$ should be along the direction of velocity
(ii) Both $\vec{B}$ and $\vec{E}$ should be along the direction of velocity
(iii) Both $\vec{B}$ and $\vec{E}$ are mutually perpendicular and perpendicular to the direction of velocity.
(iv) $\vec{B}$ should be along the direction of velocity and $\vec{E}$ should be perpendicular to the direction of velocity
Which one of the following pairs of statements is possible **[AIPMT MAINS_ 2010]**
(1) (i) and (iii) (2) (iii) and (iv) (3) (ii) and (iii) (4) (ii) and (iv)

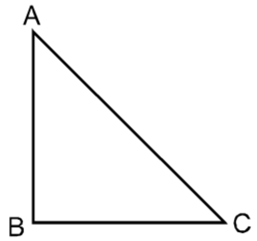
9. The magnetic moment of a diamagnetic atom is **[AIPMT MAINS_ 2010]**
(1) much greater than one (2) one
(3) between zero and one (4) equal to zero

10. Two identical bar magnets are fixed with their centres at a distance d apart. a stationary charge Q is placed at P in between the gap of the two magnets at a distance D from the centre O as shown in the figure **[AIPMT MAINS_ 2010]**



The force on the charge Q is
(1) Zero (2) directed along OP
(3) directed along PO (4) directed perpendicular to the plane of paper

11. A current carrying loop in the form of a right angle isosceles triangle ABC is placed in a uniform magnetic field acting along AB. If the magnetic force on the arm BC is $\vec{F}$, the force on the arm AC is : **[AIPMT 2011]**

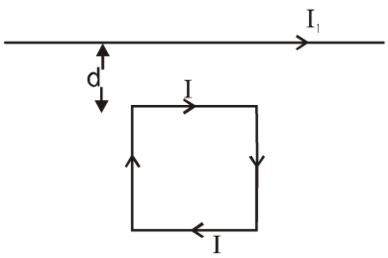


(1) $-\sqrt{2}\,\vec{F}$ (2) $-\vec{F}$ (3) $\vec{F}$ (4) $\sqrt{2}\,\vec{F}$

12. There are four light–weight–rod samples A,B,C,D separtely suspended by threads. A bar magnet is slowly brought near each sample and the following observations are noted : **[AIPMT 2011]**
(i) A is feebly repelled (ii) B is feebly attacted
(iii) C is strongly attracted (iv) D remains unaffected
Which one of the following is true ?
(1) B is of a paramagnetic material (2) C is of a diamagnetic material
(3) D is of a ferromagnetic material (4) A is of a non–magnetic material

13. A uniform electric field and uniform magnetic field are acting along the same direction in a certain region. If an electron is projected in the region such that its velocity is pointed along the direction of fields, then the electron : **[AIPMT 2011]**
(1) will turn towards right of direction of motion (2) speed will decrease
(3) speed will increase (4) will turn towards left direction of motion

14. A square loop, carrying a steady current I, is placed in a horizontal plane near a long straight conductor carrying a steady current I_1 at a distance d from the conductor as shown in figure. The loop will experience : **[AIPMT MAINS_2011]**



(1) a net repulsive force away from the conductor
(2) a net torque acting upward perpendicular to the horizontal plane

(3) a net torque acting downward normal to the horizontal plane
(4) a net attractive force towards the conductor

15. Charge q is uniformly spread on a thin ring of radius R. The ring rotates about its axis with a uniform frequency f Hz. The magnitude of magnetic induction at the centre of the ring is **[AIPMT MAINS_2011]**

(1) $\frac{\mu_0 qf}{2R}$ (2) $\frac{\mu_0 q}{2fR}$ (3) $\frac{\mu_0 q}{2\pi fR}$ (4) $\frac{\mu_0 qf}{2\pi R}$

16. A short bar magnet of magnetic moment 0.4J T_{-1} is place in a uniform magnetic field of 0.16 T. The magnet is in stable equilibrium when the potential energy is: **[AIPMT MAINS_2011]**
(1) –0.064 J (2) zero (3) – 0.082 J (4) 0.064

17. A compass needle which is allowed to move in a horizontal plane is taken to a geomagnetic pole. It :
(1) will become rigid showing no movement **[AIPMT_Pre_2012]**
(2) will stay in any position
(3) will stay in north-south direction only
(4) will stay in east-west direction only

18. An alternating electric field, of frequency ν, is applied across the dees (radius = R) of a cyclotron that is being used to accelerate protons (mass = m). The operating magnetic field (B) used in the cyclotron and the kinetic energy (K) of the proton beam, produced by it, are given by : **[AIPMT_Pre_2012]**

(1) B = $\frac{m\nu}{e}$ and K = $2m\pi_2\nu_2R_2$ (2) B = $\frac{2\pi m\nu}{e}$ and K = $m_2\pi\nu R_2$

(3) B = $\frac{2\pi m\nu}{e}$ and K = $2m\pi_2\nu_2R_2$ (4) B = $\frac{m\nu}{e}$ and K = $m_2\pi\nu R_2$

19. Two similar coils of radius R are lying concentrically with their planes at right angles to each other. The currents flowing in them are I an 2 I, respectively. The resultant magnetic field induction at the centre will be: **[AIPMT_Pre_2012]**

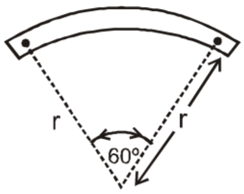
(1) $\frac{\sqrt{5}\mu_0 I}{2R}$ (2) $\frac{3\mu_0 I}{2R}$ (3) $\frac{\mu_0 I}{2R}$ (4) $\frac{\mu_0 I}{R}$

20. A proton carrying 1 MeV kinetic energy is moving in a circular path of radius R in uniform magnetic field. What should be the energy of an α - particle to describe a circle of same radius in the same field ?
[AIPMT 2012 (Mains)]
(1) 2 MeV (2) 1 MeV (3) 0.5 MeV (4) 4 MeV

21. A magnetic needle suspended parallel to a magnetic field requires $\sqrt{3}$ J of work to turn it through 60° . The torque needed to maintain the needle in this position will be : **[AIPMT 2012 (Mains)]**

(1) $2\sqrt{3}$J (2) 3J (3) $\sqrt{3}$J (4) $\frac{3}{2}$J

22. A bar magnet of length '*l*' and magnetic dipole moment 'M' is bent in the form of an arc as shown in figure. The new magnetic dipole moment will be : **[NEET_2013]**



(1) $\frac{3}{\pi}$M (2) $\frac{2}{\pi}$M (3) $\frac{M}{2}$ (4) M

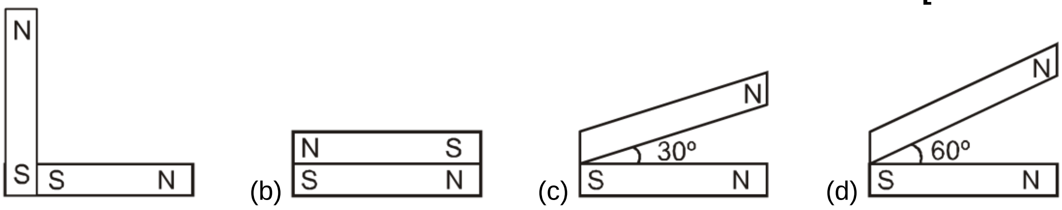
23. A current loop in a magnetic field : **[NEET_2013]**
(1) can be in equilibrium in one orientation
(2) can be in equilibrium in two orientations, both the equilibrium states are unstable

(3) can be in equilibrium in two orientations, one stable while the other is unstable
(4) experiences a torque whether the field is uniform or non uniform in all orientations

24. When a proton is released from rest in a room, it starts with an initial acceleration a_0 towards west. When it is projected towards north with a speed v_0 it moves with an initial acceleration $3a_0$ toward west. The electric and magnetic fields in the room are : **[NEET-2013]**

(1) $\frac{ma_0}{e}$ west, $\frac{2ma_0}{ev_0}$ down
(2) $\frac{ma_0}{e}$ east, $\frac{3ma_0}{ev_0}$ up
(3) $\frac{ma_0}{e}$ east, $\frac{3ma_0}{ev_0}$ down
(4) $\frac{ma_0}{e}$ west, $\frac{2ma_0}{ev_0}$ up

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



(a) (b) (c) (d)

(1) a (2) b (3) c (4) d

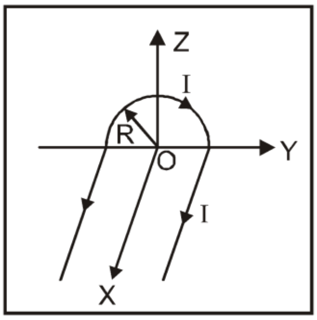
26. Two identical long conducting wires AOB and COD are placed at right angle to each other, with one above other such that 'O' is their common point for the two. The wires carry I_1 and I_2 currents, respectively. Point 'I' is lying at distance 'd' from 'O' along a direction perpendicular to the plane containing the wires. The magnetic field at the point 'P' will be : **[AIPMT- 2014]**

(1) $\frac{\mu_0}{2\pi d}\left(\frac{I_1}{I_2}\right)$ (2) $\frac{\mu_0}{2\pi d}(I_1 + I_2)$ (3) $\frac{\mu_0}{2\pi d}(I_1^2 - I_2^2)$ (4) $\frac{\mu_0}{2\pi d}(I_1^2 + I_2^2)^{1/2}$

27. An electron moving in a circular orbit of radius r makes n rotantions per second. The magnetic fileld produced at the centre has magnitude : **[AIPMT-2015]**

(1) Zero (2) $\frac{\mu_0 n^2 e}{r}$ (3) $\frac{\mu_0 ne}{2r}$ (4) $\frac{\mu_0 ne}{2\pi r}$

28. A wire carrying current I has the shape as shown in adjoining figure. Linear parts of the wire are very long and parallel to X-axis while semicircular portion of radius R is lying in Y-Z plane. Magnetic field at point O is **[AIPMT-2015]**



(1) $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}\left(\mu\hat{i} \times 2\hat{k}\right)$
(2) $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} + 2\hat{k}\right)$
(3) $\vec{B} = \frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} - 2\hat{k}\right)$
(4) $\vec{B} = \frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} + 2\hat{k}\right)$

29. A long straight wire of radius a carries a steady current I. The current is uniformly distributed over its cross-section. The ratio of the magnetic fields B and B , at a radial distances a/2 and 2a respectively, from the axis of the wire is: **[AIPMT-2016]**

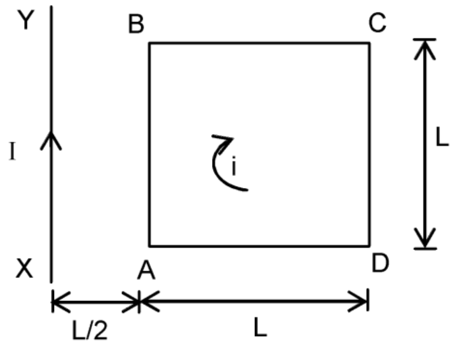
(1) 4 (2) $\frac{1}{4}$ (3) $\frac{1}{2}$ (4) 1

30. The magnetic susceptibility negative for **[AIPMT-2016]**

(1) paramagnetic and ferromagnetic materials (2) diamagnetic material only

(3) paramagnetic material only (4) ferromagnetic material only

31. A square loop ABCD carrying a current i, is placed near and coplanar with a long straight conductor XY carrying a current I, the net force on the loop will be : **[AIPMT-2016]**



(1) $\frac{\mu_0 IiL}{2\pi}$ (2) $\frac{2\mu_0 Ii}{3\pi}$ (3) $\frac{\mu_0 Ii}{2\pi}$ (4) $\frac{2\mu_0 IiL}{3\pi}$

32. A long solenoid has 1000 turns. When a current of 4A flows through it, the magnetic flux linked with each turn of the solenoid is 4×10^{-3} Wb. The self-inductance of the solenoid is **[AIPMT-2016]**

(1) 1H (2) 4H (3) 3 H (4) 2H

33. A long wire carrying a steady current is bent into a circular loop of one turn. The magnetic field at the centre of the loop is B. It is then bent into a circular coil of n turns. The magnetic field at the centre of this coil of n turns will be : **[NEET 2016-17]**

(1) $2n^2$ B (2) nB (3) n^2B (4) 2nB

34. An electron is moving in a circular path under the influence of a transverse magnetic field of 3.57×10^{-2} T. If the value of e/m is 1.76×10^{11} C/kg, the frequency of revolution of the electron is :

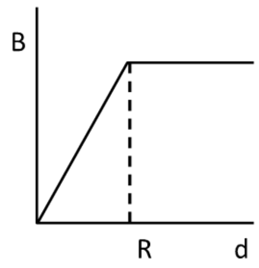
[NEET 2016-17]

(1) 6.82 MHz (2) 1 GHz (3) 100 MHz (4) 62.8 MHz

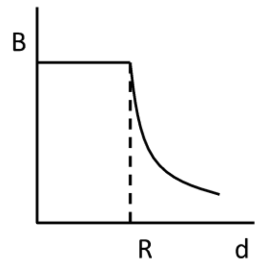
35. A metallic rod of mass per unit length 0.5 kg m^{-1} is lying horizontally on a smooth inclined plane which makes an angle of 30º with the horizontal. The rod is not allowed to slide down by flowing a current through it when a magnetic field of induction 0.25 T is acting on it in the vertical direction. The current flowing in the rod to keep it stationary is : **[NEET 2018]**

(1) 7.14 A (2) 11.32 A (3) 14.76 A (4) 5.98 A

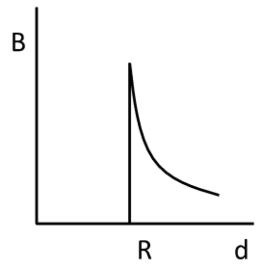
36. A cylindrical conductor of radius R is carrying constant current. The plot of the magnitude of the magnetic field, B with the distance, d from the centre of the conductor, is correctly represented by the figure : **[NEET 2019 - I]**



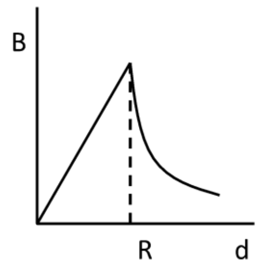
(1)



(2)



(3)



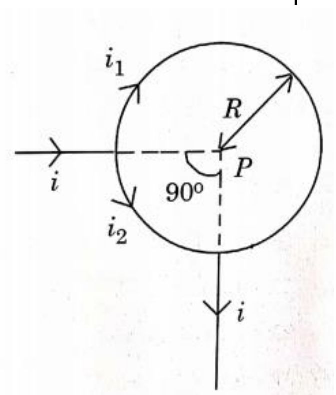
(4)

37. At a point A on the earth's surface of angle of dip, $\delta = +25^o$. At a point B on the earth's surface the angle of dip, $\delta = -25^o$. We can interpret that: **[NEET 2019 - I]**
(1) A and B are both located in the southern hemisphere.
(2) A and B are both located in the northern hemisphere.
(3) A is located in the southern hemisphere and B is located in the northern hemisphere.
(4) A is located in the northern hemisphere and B is located in the southern hemisphere.

38. Ionized hydrogen atoms and α-particle with momenta enters perpendicular to a constant magnetic field, B. The ratio of their radii of their paths $r_H : r_\alpha$ will be : **[NEET 2019-I]**
(1) 1 ; 4 (2) 2 : 1 (3) 1 : 2 (4) 4 : 1

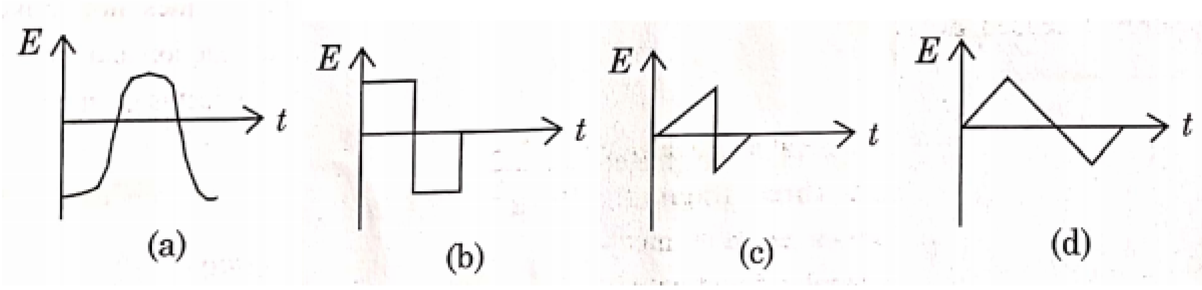
39. Two toroids 1 and 2 have total no. of turns 200 and 100 respectively with average radii 40 cm and 20 cm respectively. If they carry same current i, the ratio of the magnetic fields along the two loops is **[NEET_2019 -II]**
(1) 1 : 1 (2) 4 : 1 (3) 2 : 1 (4) 1 : 2

40. A straight conductor carrying current I splits into two parts as shown in the figure. The radius of the circular loop is R. The total magnetic field at the centre P of the loop is, **[NEET_2019-II]**



(1) zero (2) $3\mu_0 i / 32R$, outward (3) $3\mu_0 i / 32R$, inward (4) $\frac{\mu_0 i}{2R}$, inward

41. The variation of EMF with time for four types of generators are shown in the figures. Which amongst them can be called AC? **[NEET_2019-II]**

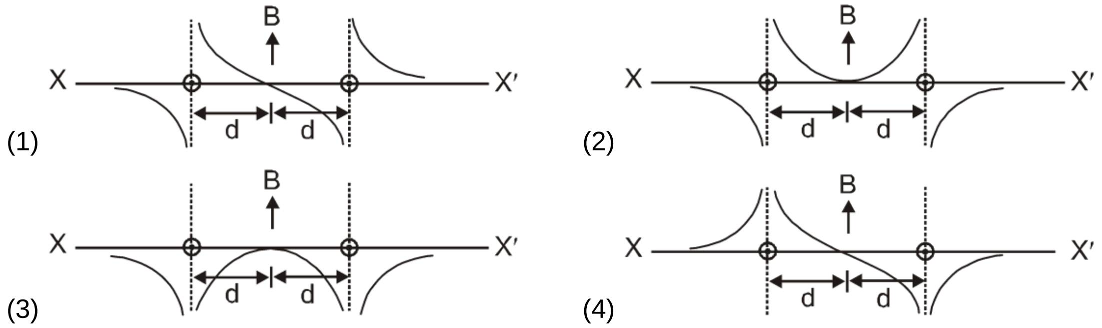


(1) (a) and (d) (2) (a), (b), (c), (d) (3) (a) and (b) (4) only (a)

PART - II : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

1. Two long parallel wires are at a distance 2d apart. They carry steady equal currents flowing out of the plane of the paper as shown. The variation of magnetic field B along the line XX´ is given by

[AIEEE 4/144 2010]



2. A current I flows in an infinitely long wire with cross–section in the form of a semicircular ring of radius R. The magnitude of the magnetic induction along its axis is : **[AIEEE - 2011, 4/120, –1]**

(1) $\frac{\mu_0 I}{\pi^2 R}$ (2) $\frac{\mu_0 I}{2\pi^2 R}$ (3) $\frac{\mu_0 I}{2\pi R}$ (4) $\frac{\mu_0 I}{4\pi R}$

3. An electric charge +q moves with velocity $\vec{v} = 3\hat{i} + 4\hat{j} - 3\hat{k}$, in an electromagnetic field given by : $\vec{E} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{B} = \hat{i} + \hat{j} + 3\hat{k}$. The y - component of the force experienced by + q is :

[AIEEE 2011, 11 May; 4, –1]

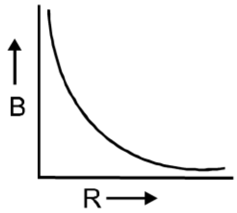
(1) 11 q (2) 5 q (3) 3 q (4) 2 q

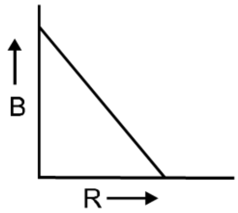
4. A thin circular disk of radius R is uniformly charged with density $\sigma > 0$ per unit area. The disk rotates about its axis with a uniform angular speed ω. The magnetic moment of the disk is :

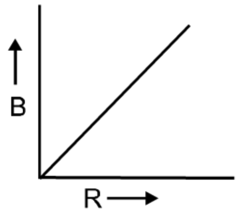
[AIEEE 2011, 11 May; 4, –1]

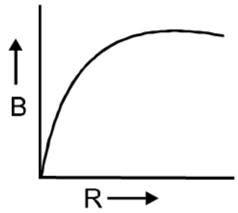
(1) $\pi R^4 \sigma\omega$ (2) $\frac{\pi R^4}{2}\sigma\omega$ (3) $\frac{\pi R^4}{4}\sigma\omega$ (4) $2\pi R^4 \sigma\omega$

5. A charge Q is uniformly distributed over the surface of non-condcting disc of radius R. The disc rotates about an axis perpendicular to its plane and passing through its centre with an angular velocity ω. As a result of this rotation a magnetic field of induction B is obtained at the centre of the disc. if we keep both the amount of charge placed on the disc and its angular velocity to be constant and vary the radius of the disc then the variation of the magnetic induction at the centre of the disc will be represented by the figure : **[AIEEE 2012 ; 4, –1]**

(1) 

(2) 

(3) 

(4) 

6. Proton, Deuteron and alpha particle of same kinetic energy are moving in circular trajectories in a constant magnetic field. The radii of proton, deuteron and alpha particle are respectively r_p, r_d and r_α. Which one of the following relation is **correct**? **[AIEEE 2012 ; 4, –1]**

(1) $r_\alpha = r_p = r_d$ (2) $r_\alpha = r_p < r_d$ (3) $r_\alpha > r_d > r_p$ (4) $r_\alpha = r_d > r_p$

7. Two short bar magnets of length 1 cm each have magnetic moments 1.20 Am^2 and 1.00 Am^2 respectively. They are placed on a horizontal table parallel to each other with their N poles poining towards the South. They have a common magnetic equator and are separated by a distance of 20.0 cm. The value of the resultand horizontal magnetic induction at the mid - point O of the line joining their centres is close to (Horizontal component of earth's magnetic induction is 3.6×10^{-5} Wb/m^2) **[JEE-Mains 2013, 4/120]**

(1) 3.6×10^{-5} Wb/m^2 (2) 2.56×10^{-4} Wb/m^2 (3) 3.50×10^{-4} Wb/m^2 (4) 5.80×10^{-4} Wb/m^2

8. The coercivity of a small magnet where the ferromagnet gets demagnetized is 3×10^3 Am^{-1}. The current required to be passed in a solenoid of length 20 cm and number of turns 100, so that the magnetic gets demagnetized when inside the solenoid, is : **[JEE- Main - 2014]**

(1) 30 mA (2) 60 mA (3) 3 A (4) 6 A

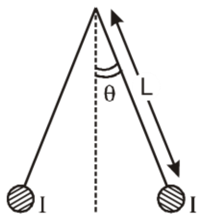
9. Two coaxial ideal and long solenoids of different radii carry current I in the same direction. Let $\vec{F}_1$ be the magnetic force on the inner solenoid due to the outer one and $\vec{F}_2$ be the magnetic force on the outer solenoid due to the inner one. Then : **[JEE(Main)-2015; 4/120, –1]**

(1) $\vec{F}_1 = \vec{F}_2 = 0$ (2) $\vec{F}_1$ is radially inwards and $\vec{F}_2$ is radially outwards

(3) $\vec{F}_1$ is radially inwards and $\vec{F}_2 = 0$ (4) $\vec{F}_1$ is radially outwards and $\vec{F}_2 = 0$

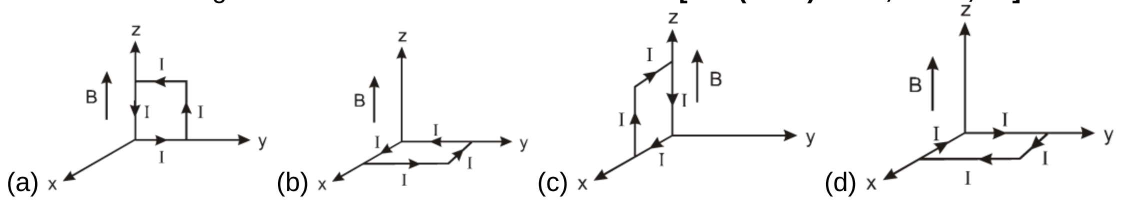
10. Two long current carrying thin wires, both with current I, are held by insulating threads of length L and are in equilibrium as shown in the figure, with threads making an angle 'θ' with the vertical. If wires have mass λ per unit length then the value of I is : (g = gravitational acceleration)

[JEE(Main)-2015; 4/120, –1]



(1) $\sin\theta\sqrt{\frac{\pi\lambda gL}{\mu_0 \cos\theta}}$ (2) $2\sin\theta\sqrt{\frac{\pi\lambda gL}{\mu_0 \cos\theta}}$ (3) $2\sqrt{\frac{\pi gL}{\mu_0}\tan\theta}$ (4) $\sqrt{\frac{\pi\lambda gL}{\mu_0}\tan\theta}$

11. A rectangular loop of sides 10 cm and 5 cm carrying a current I of 12 A is placed in different orientations as shown in the figures below : **[JEE(Main)-2015; 4/120, –1]**



If there is a uniform magnetic field of 0.3 T in the positive z direction, in which orientations the loop would be in (i) stable equilibrium and (ii) unstable equilibrium ?

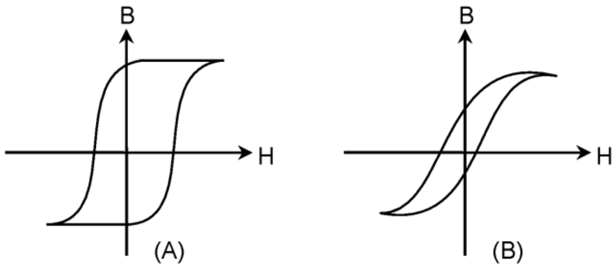
(1) (a) and (b), respectively (2) (a) and (c), respectively

(3) (b) and (d), respectively (4) (b) and (c), respectively

12. Two identical wires A and B, each of length l, carry the same current I. Wire A is bent into a circle of radius R and wire B is bent to form a square of side 'a'. If B_A and B_B are the values of magnetic field at the centres of the circle and square respectively, then the ratio $\frac{B_A}{B_B}$ is :

(1) $\frac{\pi^2}{16\sqrt{2}}$ (2) $\frac{\pi^2}{16}$ (3) $\frac{\pi^2}{8\sqrt{2}}$ (4) $\frac{\pi^2}{8}$

13. Hysteresis loops for two magnetic materials A and B are given below : **[JEE Main 2016]**



These materials are used to make magnets for electric generators, transformer core and electromagnet core. Then it is proper to use :

(1) A for electromgnets and B for electric generators.

(2) A for transformers and B for electric generators.

(3) B for electromgnets and transformers.

(4) A for electric generators and transformers.

14. A magnetic needle of magnetic moment 6.7×10^{-2} Am^2 and moment of inertia 7.5×10^{-6} kg m^2 is performing simple harmonic oscillations in a magnetic field of 0.01 T. Time taken for 10 complete oscillations is : **[JEE Main 2017]**

(1) 8.76 s (2) 6.65 s (3) 8.89 s (4) 6.98 s

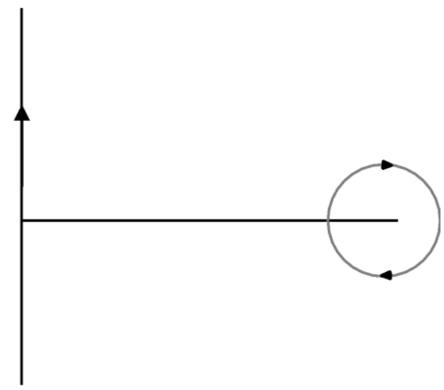
15. The dipole moment of a circular loop carrying a current I, is m and the magnetic field at the centre of the loop is B_1. When the dipole moment is doubled by keeping the current constant, the magnetic field at the centre of loop is B_2. The ratio $\frac{B_1}{B_2}$ is : **[JEE-Main-2018]**

(1) $\sqrt{2}$ (2) $\frac{1}{\sqrt{2}}$ (3) 2 (4) $\sqrt{3}$

16. An electron, a proton and an alpha particle having the same kinetic energy are moving in circular orbits of radii r_e, r_p, r_α respectively in uniform magnetic field B. The relation between r_e, r_p, r_α is : **[JEE-Main-2018]**

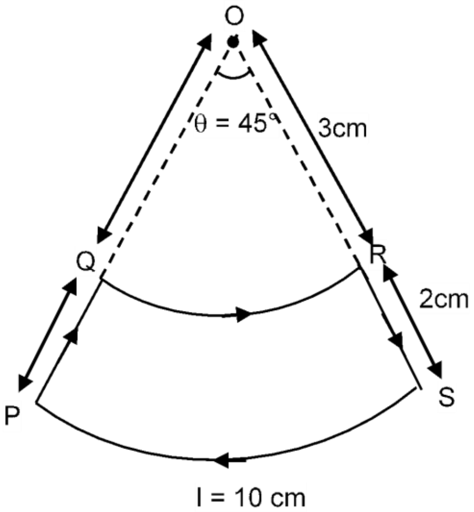
(1) $r_e < r_p < r_\alpha$ (2) $r_e < r_\alpha < r_p$ (3) $r_e > r_p = r_\alpha$ (4) $r_e < r_p = r_\alpha$

17. An infinitely long, current carrying wire and a small current carrying loop are in the plane of the paper as shown. The radius of the loop is a and distance of its centre from the wire is d($d \gg a$). If the loop applies a force F on the wire then : **[JEE-Main-2019]**



(1) $F = 0$ (2) $F \propto \left(\frac{a}{d}\right)^2$ (3) $F \propto \left(\frac{a^2}{d^3}\right)$ (4) $F \propto \left(\frac{a}{d}\right)$

18. A current loop, having two circular arcs joined by two radial lines is shown in the figure. It carries a current of 10 A. The magnetic field at point O will be close to : **[JEE-Main-2019]**



(1) 1.5×10^{-5} T (2) 1.0×10^{-7} T (3) 1.0×10^{-5} T (4) 1.5×10^{-7} T

19. A bar magnet is demagnetized by inserting it inside a solenoid of length 0.2 m, 100 turns, and carrying a current of 5.2 A. The coercivity of the bar magnet is : **[JEE-Main-2019]**

(1) 285 A/m (2) 520 A/m (3) 1200 A/m (4) 2600 A/m

20. One of the two identical conducting wires of length L is bent in the form of a circular loop and the other one into a circular coil of N identical turns. If the same current is passed in both, the ratio of the magnetic field at the central of the loop (B_L) to that at the centre of the coil (B_C), i.e., $\frac{B_L}{B_C}$ will be : **[JEE-Main-2019]**

(1) $\frac{1}{N}$ (2) $\frac{1}{N^2}$ (3) N^2 (4) N

21. A particle having the same charge as of electron moves in a circular path of radius 0.5 cm under the influence of magnetic filed of 0.5 T. If an electric field of 100 V/m makes it to move in a straight path, then the mass of the particle is (Given charge of electron = 1.6×10^{-19} C) **[JEE-Main-2019]**

(1) 2.0×10^{-24} kg (2) 1.6×10^{-27} kg (3) 9.1×10^{-31} kg (4) 1.6×10^{-19} kg

22. A magnet of total magnetic moment $10^{-2}\hat{i}$ A–m² is placed in a time varying magnetic field $B\hat{i}(\cos\omega t)$ where B = 1 Tesla and ω = 0.125 rad/s. The work done for reversing the direction of the magnetic moment at t = 1 second is : **[JEE-Main-2019]**

(1) 0.014 J (2) 0.01 J (3) 0.028 J (4) 0.007 J

23. An insulating thin rod of length ℓ has a linear charge density $\rho(x) = \rho_0 \frac{x}{\ell}$ on it. The rod is rotated about an axis passing through the origin (x = 0) and perpendicular to the rod. If the rod makes n rotations per second, then the time averaged magnetic moment of the rod is : **[JEE-Main-2019]**

(1) $\frac{\pi}{4} n\rho\ell^3$ (2) $\pi n\rho\ell^3$ (3) $\frac{\pi}{3} n\rho\ell^3$ (4) $n\rho\ell^3$

24. At some location on earth the horizontal component of earth's magnetic field is 18×10^{-16}T. At this location, magnetic needle of length 0.12 m and pole strength 1.8 Am is suspended from its mid-point using a thread, it makes 45° angle with horizontal in equilibrium. To keep this needle horizontal, the vertical force that should be applied at one of its ends is : **[JEE-Main-2019]**

(1) 6.5×10^{-5} N (2) 3.6×10^{-5} N (3) 1.3×10^{-5} N (4) 1.8×10^{-5} N

25. A paramagnetic substance in the form of a cube with sides 1 cm has a magnetic dipole moment of 20×10^{-6} J/T when a magnetic intensity of 60×10^{3} A/m is applied. Its magnetic susceptibility is **[JEE-Main-2019]**

(1) 4.3×10^{-2} (2) 2.3×10^{-2} (3) 3.3×10^{-4} (4) 3.3×10^{-2}

26. A paramagnetic material has 10^{28} atoms/m^3. Its magnetic susceptibility at temperature 350 K is 2.8×10^{-4}. Its susceptibility at 300 K is : **[JEE-Main-2019]**

(1) 3.726×10^{-4} (2) 3.672×10^{-4} (3) 3.267×10^{-4} (4) 2.672×10^{-4}

27. The mean intensity of radiation on the surface of the Sun is about 10^8 W/m^2. The rms value of the corresponding magnetic filed is closest to : **[JEE-Main-2019]**

(1) 10^2 T (2) 1 T (3) 10^{-2} T (4) 10^{-4} T

28. A proton and an α-particle (with their masses in the ration of 1 : 4 and charges in the ration of 1 : 2) are accelerated from rest through a potential difference V. If a uniform magnetic field (B) is set up perpendicular to their velocities, the ratio of the radii $r_p : r_\alpha$ of the circular paths described by them will be: **[JEE-Main-2019]**

(1) 1 : 3 (2) $1:\sqrt{3}$ (3) $1:\sqrt{2}$ (4) 1 : 2

Answers

EXERCISE # 1

SECTION (A)

1.	(4)	**2.**	(1)	**3.**	(4)	**4.**	(2)	**5.**	(3)	**6.**	(3)	**7.**	(2)
8.	(1)												

SECTION (B)

1.	(1)	**2.**	(2)	**3.**	(1)	**4.**	(3)	**5.**	(4)	**6.**	(4)	**7.**	(4)
8.	(3)	**9.**	(2)	**10.**	(4)	**11.**	(3)	**12.**	(4)	**13.**	(3)	**14.**	(1)
15.	(3)	**16.**	(2)	**17.**	(3)	**18.**	(2)	**19.**	(3)	**20.**	(3)	**21.**	(2)

SECTION (C)

1.	(2)	**2.**	(4)	**3.**	(1)	**4.**	(2)	**5.**	(1)	**6.**	(2)	**7.**	(1)
8.	(2)	**9.**	(3)	**10.**	(3)	**11.**	(1)	**12.**	(4)	**13.**	(1)	**14.**	(2)
15.	(1)	**16.**	(2)										

SECTION (D)

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

SECTION (E)

1.	(4)	**2.**	(1)	**3.**	(3)	**4.**	(1)	**5.**	(2)	**6.**	(1)	**7.**	(4)
8.	(2)	**9.**	(2)	**10.**	(4)	**11.**	(4)	**12.**	**(3)**				

SECTION (F)

1.	(2)	**2.**	(1)	**3.**	(2)	**4.**	(3)	**5.**	(4)	**6.**	(4)	**7.**	(4)
8.	(4)	**9.**	(3)	**10.**	(2)	**11.**	(3)	**12.**	(2)	**13.**	(1)	**14.**	(2)
15.	(3)	**16.**	(2)	**17.**	(4)	**18.**	(4)	**19.**	(1)	**20.**	(2)	**21.**	(2)
22.	(2)	**23.**	(4)	**24.**	(1)	**25.**	(3)	**26.**	(1)	**27.**	(3)	**28.**	(1)
29.	(3)	**30.**	(1)	**31.**	(1)	**32.**	(4)	**33.**	(3)	**34.**	(1)	**35.**	(1)
36.	(2)	**37.**	(1)										

SECTION (G)

1.	(3)	**2.**	(1)	**3.**	(1)	**4.**	(4)	**5.**	(4)	**6.**	(3)	**7.**	(1)
8.	(3)	**9.**	(4)	**10.**	(2)	**11.**	(2)	**12.**	(4)	**13.**	(3)	**14.**	(3)
15.	(3)	**16.**	(2)	**17.**	(2)	**18.**	(4)	**19.**	(3)				

SECTION (H)

1.	(3)	**2.**	(2)	**3.**	(1)	**4.**	(3)	**5.**	(1)	**6.**	(4)	**7.**	(4)
8.	(3)	**9.**	(3)	**10.**	(2)	**11.**	(2)	**12.**	(2)	**13.**	(3)		

SECTION (I)

1.	(2)	**2.**	(2)	**3.**	(4)	**4.**	(2)	**5.**	(1)	**6.**	(1)	**7.**	(3)
8.	(1)	**9.**	(4)	**10.**	(4)	**11.**	(2)	**12.**	(2)	**13.**	(3)	**14.**	(2)
15.	(4)	**16.**	(1)	**17.**	(1)	**18.**	(1)	**19.**	(1)	**20.**	(1)	**21.**	(4)

SECTION (J)

1.	(4)	**2.**	(2)

SECTION (K)

1.	(3)	**2.**	(2)	**3.**	(2)	**4.**	(3)	**5.**	(1)	**6.**	(1)	**7.**	(1)
8.	(2)	**9.**	(2)	**10.**	(2)	**11.**	(2)	**12.**	(3)	**13.**	(3)		

EXERCISE # 2

1.	(2)	**2.**	(3)	**3.**	(1)	**4.**	(3)	**5.**	(4)	**6.**	(4)	**7.**	(1)
8.	(4)	**9.**	(3)	**10.**	(3)	**11.**	(4)	**12.**	(3)	**13.**	(3)	**14.**	(3)
15.	(1)	**16.**	(3)	**17.**	(2)	**18.**	(4)	**19.**	(2)	**20.**	(1)	**21.**	(2)
22.	(1)	**23.**	(4)	**24.**	(3)	**25.**	(3)	**26.**	(2)	**27.**	(3)	**28.**	(1)
29.	(3)	**30.**	(3)	**31.**	(1)	**32.**	(2)	**33.**	(3)	**34.**	(4)	**35.**	(1)
36.	(3)	**37.**	(1)	**38.**	(3)	**39.**	(2)	**40.**	(3)	**41.**	(3)	**42.**	(1)
43.	(4)	**44.**	(3)	**45.**	(3)	**46.**	(3)	**47.**	(1)	**48.**	(3)	**49.**	(Bonus/2)
50.	(4)	**51.**	(3)	**52.**	(2)	**53.**	(3)	**54.**	(1)	**55.**	(2)		

EXERCISE # 3

PART – I

1.	(1)	**2.**	(3)	**3.**	(4)	**4.**	(4)	**5.**	(2)	**6.**	(1)	**7.**	(3)
8.	(3)	**9.**	(4)	**10.**	(1)	**11.**	(2)	**12.**	(1)	**13.**	(2)	**14.**	(4)
15.	(1)	**16.**	(1)	**17.**	(2)	**18.**	(3)	**19.**	(1)	**20.**	(2)	**21.**	(2)
22.	(1)	**23.**	(3)	**24.**	(1)	**25.**	(3)	**26.**	(4)	**27.**	(3)	**28.**	(2)
29.	(4)	**30.**	(2)	**31.**	(2)	**32.**	(1)	**33.**	(3)	**34.**	(2)	**35.**	(2)
36.	(4)	**37.**	(3)	**38.**	(2)	**39.**	(1)	**40.**	(1)	**41.**	(2)		

PART – II

1.	(1)	**2.**	(1)	**3.**	(1)	**4.**	(3)	**5.**	(1)	**6.**	(2)	**7.**	(2)
8.	(4)	**9.**	(1 or 4)	**10.**	(2)	**11.**	(3)	**12.**	(3)	**13.**	(3)	**14.**	(2)
15.	(1)	**16.**	(4)	**17.**	(2)	**18.**	(3)	**19.**	(4)	**20.**	(2)	**21.**	(1)
22.	(Bonus) correct answer is 0.02 J					**23.**	(1)	**24.**	(1)	**25.**	(3)	**26.**	(3)
27.	(4)	**28.**	(3)										