Prayas JEE (2025)

Magnetism [KPP]

1. A charged particle of mass 'm' and charge 'q' moving under the influence of uniform electric field $E\hat{i}$ and a uniform magnetic field $B\hat{k}$ follows a trajectory from point P to Q as shown in figure. The velocities at P and Q are respectively, $v\hat{i}$ and $-2v\hat{j}$. Then which of the following statements (A, B, C, D) are the correct? (Trajectory shown is schematic and not to scale):

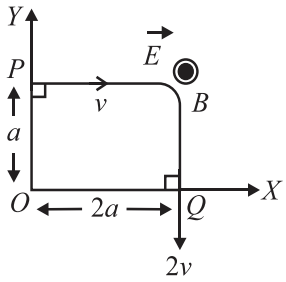
(A) $E = \frac{3}{4}\left(\frac{mv^2}{qa}\right)$

(B) Rate of work done by the electric field at P is $\frac{3}{4}\left(\frac{mv^3}{a}\right)$

(C) rate of work done by both the fields at Q is zero

(D) the difference between the magnitude of angular momentum of the particle at P and Q is 2 mav.

(JEE Main 2020)



(1) (A), (B), (C), (D)
(2) (A), (B), (C)
(3) (B), (C), (D)
(4) (A), (C), (D)

2. A long, straight wire of radius a carries a current distributed uniformly over its cross-section. The ratio of the magnetic fields due to the wire at distance $a/3$ and $2a$, respectively from the axis of the wire is:

(JEE Main 2020)

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

3. A particle of mass m and charge q has an initial velocity $\vec{v} = v_0\,\hat{j}$. If an electric field $\vec{E} = E_0\,\hat{i}$ and magnetic field $\vec{B} = B_0\,\hat{i}$ act on the particle, its speed will double after a time: **(JEE Main 2020)**

(1) $\frac{2mv_0}{qE_0}$ (2) $\frac{3mv_0}{qE_0}$
(3) $\frac{\sqrt{3}mv_0}{qE_0}$ (4) $\frac{\sqrt{2}mv_0}{qE_0}$

4. Photon with kinetic energy of 1MeV moves from south to north. It gets an acceleration of 10^{12} m/s^2 by an applied magnetic field (west to east). The value of magnetic field:
(Rest mass of proton is 1.6×10^{-27} kg):

(JEE Main 2020)

(1) 71 mT (2) 7.1 mT
(3) 0.071 mT (4) 0.71 mT

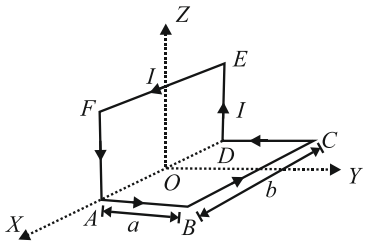
5. A loop $ABCDEFA$ of straight edges has six corner points $A(0, 0, 0)$, $B(5, 0, 0)$, $C(5, 5, 0)$, $D(0, 5, 0)$, $E(0, 5, 5)$ and $F(0, 0, 5)$. The magnetic field in this region is $\vec{B} = (3\,\hat{i} + 4\,\hat{k})T$. The quantity of flux through the loop $ABCDEFA$ (in Wb) is _____.

(JEE Main 2020)

6. Consider a circular coil of wire carrying constant current I, forming a magnetic dipole. The magnetic flux through an infinite plane that contains the circular coil and excluding the circular coil area is given by ϕ_i. The magnetic flux through the area of the circular coil area is given by ϕ_0. Which of the following option is correct? **(JEE Main 2020)**

(1) $\phi_1 = -\phi_0$
(2) $\phi_1 = \phi_0$
(3) $\phi_1 < \phi_0$
(4) $\phi_1 > \phi_0$

7. A wire carrying current I is bent in the shape $ABCDEFA$ as shown, where rectangle $ABCDA$ and $ADEFA$ are perpendicular to each other. If the sides of the rectangles are of lengths a and b, then the magnitude and direction of magnetic moment of the loop $ABCDEFA$ is: **(JEE Main 2020)**



(1) $\sqrt{2}abl$, along $\left(\frac{\hat{j}}{\sqrt{2}}+\frac{\hat{k}}{\sqrt{2}}\right)$

(2) $\sqrt{2}abl$, along $\left(\frac{\hat{j}}{\sqrt{5}}+\frac{2\hat{k}}{\sqrt{5}}\right)$

(3) abl, along $\left(\frac{\hat{j}}{\sqrt{2}}+\frac{\hat{k}}{\sqrt{2}}\right)$

(4) abl, along $\left(\frac{\hat{j}}{\sqrt{5}}+\frac{2\hat{k}}{\sqrt{5}}\right)$

8. A small circular loop of conducting wire has radius a and carries current I. It is placed in a uniform magnetic field B perpendicular to its plane such that when rotated slightly about its diameter and released, it starts performing simple harmonic motion of time period T. If the mass of the loop is m then: **(JEE Main 2020)**

(1) $T=\sqrt{\frac{\pi m}{2IB}}$ (2) $T=\sqrt{\frac{2\pi m}{IB}}$

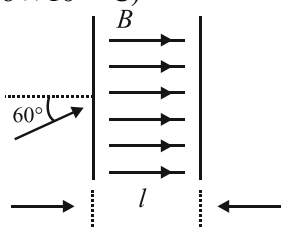
(3) $T=\sqrt{\frac{\pi m}{IB}}$ (4) $T=\sqrt{\frac{2m}{IB}}$

9. Magnitude of magnetic field (in SI units) at the centre of a hexagonal shape coil of side 10 cm, 50 turns and carrying current I (Ampere) in units of $\frac{\mu_0 I}{\pi}$ is: **(JEE Main 2020)**

(1) $250\sqrt{3}$ (2) $5\sqrt{3}$

(3) $500\sqrt{3}$ (4) $50\sqrt{3}$

10. The figure shows a region of length 'l' with a uniform magnetic field of 0.3T in it and a proton entering the region with velocity 4×10^5 ms^{-1} making an angle 60° with the field. If the proton completes 10 revolution by the time it cross the region shown, 'l' is close to (mass of proton = 1.67×10^{-27} kg, charge of the proton = 1.6×10^{-19} C) **(JEE Main 2020)**



(1) 0.11 m (2) 0.22 m

(3) 0.44 m (4) 0.88 m

11. A charged particle carrying charge 1 μC is moving with velocity $(2\hat{i}+3\hat{j}+4\hat{k})$ms^{-1}. If an external magnetic field of $(5\hat{i}+3\hat{j}-6\hat{k})\times10^{-3}T$ exists in the region where the particle is moving then the force on the particle is $\vec{F}\times10^{-9}N$. The vector $\vec{F}$ is. **(JEE Main 2020)**

(1) $-0.3\hat{i}+0.32\hat{j}-0.09\hat{k}$

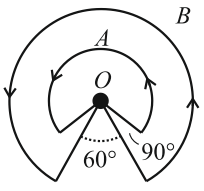
(2) $-300\hat{i}+320\hat{j}-90\hat{k}$

(3) $-30\hat{i}+32\hat{j}-9\hat{k}$

(4) $-3.0\hat{i}+3.2\hat{j}-0.9\hat{k}$

12. A galvanometer coil has 500 turns and each turn has an average area of 3×10^{-4} m^2. If a torque of 1.5 Nm is required to keep this coil parallel to magnetic field when a current of 0.5 A is flowing through it, the strength of the field (in T) is _____. **(JEE Main 2020)**

13. A wire A, bent in the shape of an arc of a circle, carrying a current of 2A and having radius 2 cm and another wire B, also bent in the shape of arc of a circle, carrying a current of 3A and having radius of 4 cm, are placed as shown in the figure. The ratio of the magnetic fields due to the wires A and B at the common centre O is: **(JEE Main 2020)**



(1) 4 : 6 (2) 6 : 4

(3) 6 : 5 (4) 2 : 5

14. A small bar magnet placed with its axis at 30° with an external field of 0.06 T experiences a torque of 0.018 Nm. The minimum work required to rotate it from its stable to unstable equilibrium position is:
(JEE Main 2020)

(1) 9.2×10^{-3} J
(2) 6.4×10^{-2} J
(3) 11.7×10^{-3} J
(4) 7.2×10^{-3} J

15. A square loop of side $2a$, and carrying current I, is kept in XZ plane with its centre at origin. A long wire carrying the same current I is placed parallel to the z-axis and passing through the point (0, b, 0), (b>>a). The magnitude of the torque on the loop about z-axis is given by:
(JEE Main 2020)

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

16. A particle of charge q and mass m is moving with a velocity $-v\hat{i}(v \neq 0)$ towards a large screen placed in the Y-Z plane at a distance d. If there is a magnetic field $\vec{B} = B_0\hat{k}$, the minimum value of v for which the particle will not hit the screen is:
(JEE Main 2020)

(1) $\frac{qdB_0}{2m}$ (2) $\frac{qdB_0}{m}$
(3) $\frac{2qdB_0}{m}$ (4) $\frac{qdB_0}{3m}$

17. An electron is moving along $+x$ direction with a velocity of 6×10^6 ms^{-1}. It enters a region of uniform electric field of 300 V/cm pointing along $+y$ direction. The magnitude and direction of the magnetic field set up in this region such that the electron keeps moving along the x direction will be:
(JEE Main 2020)

(1) 5×10^{-3} T, along $+z$ direction
(2) 3×10^{-4} T, along $-z$ direction
(3) 3×10^{-4} T, along $+z$ direction
(4) 5×10^{-3} T, along –z direction

18. A charged particle going around in a circle can be considered to be a current loop. A particle of mass m carrying charge q is moving in a plane with speed v under the influence of magnetic field $\vec{B}$ The magnetic moment of this moving particle:
(JEE Main 2020)

(1) $21 - \frac{mv^2\vec{B}}{B^2}$ (2) $-\frac{mv^2\vec{B}}{2\pi B^2}$
(3) $\frac{mv^2\vec{B}}{2B^2}$ (4) $-\frac{mv^2\vec{B}}{2B^2}$

19. A square loop of side $2a$ and carrying current I is kept in xz plane with its centre at origin. A long wire carrying the same current I is placed parallel to z-axis and passing through point (0, b, 0), (b >> a). The magnitude of torque on the loop about z-axis will be:
(JEE Main 2020)

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

20. A proton, a deuteron and an α particle are moving with same momentum in a uniform magnetic field. The ratio of magnetic forces acting on them is ____ and their speed is ____in the ratio.
(JEE Main 2021)

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

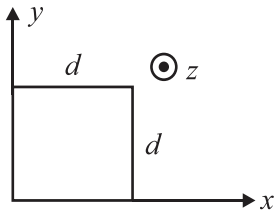
21. Magnetic fields at two points on the axis of a circular coil at a distance of 0.05m and 0.2 m from the centre are in the ratio 8 : 1. The radius of coil is ____.
(JEE Main 2021)

(1) 0.2 m (2) 0.1 m
(3) 0.15 m (4) 1.0 m

22. A charge Q is moving $\overrightarrow{dl}$ distance in the magnetic field $\vec{B}$. Find the value of work done by $\vec{B}$.
(JEE Main 2021)

(1) 1 (2) infinite
(3) zero (4) –1

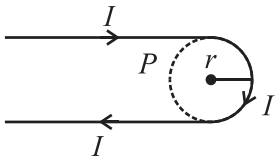
23. The magnetic field in a region is given by $\vec{B} = B_0\left(\frac{x}{a}\right)\hat{k}$. A square loop of side d is placed with its edges along the x and y axes. The loop is moved with a constant velocity $\vec{v} = v_0\hat{i}$. The emf induced in the loop is: **(JEE Main 2021)**



(1) $\frac{B_0 v_0^2 d}{2a}$ (2) $\frac{B_0 v_0 d}{2a}$

(3) $\frac{B_0 v_0 d^2}{a}$ (4) $\frac{B_0 v_0 d^2}{2a}$

24. A hairpin like shape as shown in figure is made by bending a long current carrying wire. What is the magnitude of a magnetic field at point P which lies on the centre of the semicircle? **(JEE Main 2021)**



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

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

25. A loop of flexible wire of irregular shape carrying current is placed in an external magnetic field. Identify the effect of the field on the wire. **(JEE Main 2021)**

(1) Loop assumes circular shape with its plane normal to the field.

(2) Loop assumes circular shape with its plane parallel to the field.

(3) Wire gets stretched to become straight.

(4) Shape of the loop remains unchanged.

26. Which of the following statements are correct?

(A) Electric monopoles do not exist whereas magnetic monopoles exist.

(B) Magnetic field lines due to a solenoid at its ends and outside cannot be completely straight and confined.

(C) Magnetic field lines are completely confined within a toroid.

(D) Magnetic field lines inside a bar magnet are not parallel.

(E) x = –1 is the condition for a perfect diamagnetic material, where x is its magnetic susceptibility.

Choose the correct answer from the options given below: **(JEE Main 2021)**

(1) (C) and (E) only

(2) (B) and (D) only

(3) (A) and (B) only

(4) (B) and (C) only

27. A deuteron and an alpha particle having equal kinetic energy enter perpendicular into a magnetic field. Let r_d and r_α be their respective radii of circular path. The value of r_d/r_α is equal to: **(JEE Main 2021)**

(1) $1/\sqrt{2}$ (2) $\sqrt{2}$

(3) [illegible] (4) 2

28. At an angle of 30° to the magnetic meridian, the apparent dip is 45°. Find the true dip: **(JEE Main 2021)**

(1) $\tan^{-1}\sqrt{3}$ (2) $\tan^{-1}\frac{1}{\sqrt{3}}$

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

29. The magnetic susceptibility of a material of a rod is 499. Permeability in vacuum is $4\pi \times 10^{-7}$ H/m. Absolute permeability of the material of the rod is: **(JEE Main 2021)**

(1) $4\pi \times 10^{-4}$ H/m (2) $2\pi \times 10^{-4}$ H/m

(3) $3\pi \times 10^{-4}$ H/m (4) $4\pi \times 10^{-4}$ H/m

30. Statement I: The ferromagnetic property depends on temperature. At high temperature, ferromagnet becomes paramagnet.

Statement II: At high temperature, the domain wall area of a ferromagnetic substance increases.

In the light of the above statements, choose the most appropriate answer from the options given below: **(JEE Main 2021)**

(1) Statement I is true but Statement II is false

(2) Both Statement I and Statement II are true

(3) Both Statement I and Statement II are false

(4) Statement I is false but Statement II is true

31. Choose the correct option: **(JEE Main 2021)**

(1) True dip is not mathematically related to apparent dip.
(2) True dip is less than apparent dip.
(3) True dip is always greater than the apparent dip.
(4) True dip is always equal to apparent dip.

32. Two ions having same mass have charges in the ratio 1 : 2. They are projected normally in a uniform magnetic field with their speeds in the ratio 2 : 3. The ratio of the radii of their circular trajectories is:
(JEE Main 2021)

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

33. In a uniform magnetic field, the magnetic needle has a magnetic moment 9.85×10^{-2} A/m^2 and moment of inertia 5×10^{-6} kg m^2. If it performs 10 complete oscillations in 5 seconds then the magnitude of the magnetic field is _____ mT. [Take π^2 as 9.85]
(JEE Main 2021)

34. Match List I with List II.

List I		List II	
(a)	Capacitance, C	(i)	$M^1L^1T^{-3}A^{-1}$
(b)	Permittivity of free space, ε_0	(ii)	$M^{-1}L^{-3}T^4A^2$
(c)	Permeability of free space, μ_0	(iii)	$M^{-1}L^{-2}T^4A^2$
(d)	Electric field, E	(iv)	$M^1L^1T^{-2}A^{-2}$

Choose the correct answer from the options given below **(JEE Main 2021)**

(1) (a) → (iii), (b) → (ii), (c) → (iv), (d) → (i)
(2) (a) → (iii), (b) → (iv), (c) → (ii), (d) → (i)
(3) (a) → (iv), (b) → (ii), (c) → (iii), (d) → (i)
(4) (a) → (iv), (b) → (iii), (c) → (ii), (d) → (i)

35. Two ions of masses 4 amu and 16 amu have charges +2e and +3e respectively. These ions pass through the region of constant perpendicular magnetic field. The kinetic energy of both ions is same. Then:
(JEE Main 2021)

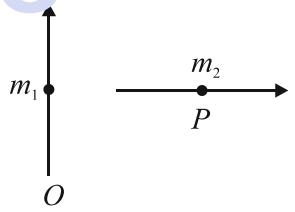
(1) lighter ion will be deflected less than heavier ion
(2) lighter ion will be deflected more than heavier ion
(3) both ions will be deflected equally
(4) no ion will be deflected.

36. The fractional change in the magnetic field intensity at a distance 'r' from centre on the axis of current carrying coil of radius 'a' to the magnetic field intensity at the centre of the same coil is: (Take $r < a$)
(JEE Main 2021)

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

37. If the maximum value of accelerating potential provided by a ratio frequency oscillator is 12 kV. The number of revolution made by a proton in a cyclotron to achieve one sixth of the speed of light is .....
[$m_P = 1.67 \times 10^{-27}$ kg, $e = 1.6 \times 10^{-19}$ C, Speed of light = 3×10^8 m/s] **(JEE Main 2021)**

38. Two short magnetic dipoles m_1 and m_2 each having magnetic moment of 1 Am^2 are placed at point O and P respectively. The distance between OP is 1 meter. The torque experienced by the magnetic dipole m_2 due to the presence of m_1 is _____ $\times 10^{-7}$ Nm.
(JEE Main 2021)



39. A coil in the shape of an equilateral triangle of side 10 cm lies in a vertical plane between the pole pieces of permanent magnet producing a horizontal magnetic field 20 mT. The torque acting on the coil when a current of 0.2 A is passed through it and its plane becomes parallel to the magnetic field will be $\sqrt{5} \times 10^{-5}$ Nm. The value of x is _____.
(JEE Main 2021)

40. A uniform conducting wire of length is 24a, and resistance R is wound up as a current carrying coil in the shape of an equilateral triangle of side 'a' and then in the form of a square of side 'a'. The coil is connected to a voltage source V_0. The ratio of magnetic moment of the coils in case of equilateral triangle to that for square is $1:\sqrt{y}$ where y is_____.
(JEE Main 2021)

41. A coaxial cable consists of an inner wire of radius 'a' surrounded by an outer shell of inner and outer radii 'b' and 'c' respectively. The inner wire carries an electric current i_0, which is distributed uniformly across cross-sectional area. The outer shell carries an equal current in opposite direction and distributed uniformly. What will be the ratio of the magnetic field at a distance x from the axis when (i) $x < a$ and (ii) $a < x < b$? **(JEE Main 2021)**

(1) $\frac{x^2}{a^2}$ (2) $\frac{a^2}{x^2}$

(3) $\frac{x^2}{b^2-a^2}$ (4) $\frac{b^2-a^2}{x^2}$

42. A coil having N turns is wound tightly in the form of a spiral with inner and outer radii 'a' and 'b' respectively. Find the magnetic field at centre, when a current I passes through coil: **(JEE Main 2021)**

(1) $\frac{\mu_0 IN}{2(b-a)}\log_e\left(\frac{b}{a}\right)$

(2) $\frac{\mu_0 I}{8}\log_e\left[\frac{a+b}{a-b}\right]$

(3) $\frac{\mu_0 I}{4(a-b)}\left[\frac{1}{b}-\frac{1}{b}\right]$

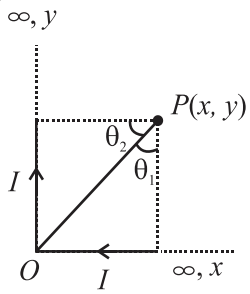
(4) $\frac{\mu_0 I}{8}\left(\frac{a-b}{a+b}\right)$

43. A current of 1.5 A is flowing through a triangle, of side 9 cm each. The magnetic field at the centroid of the triangle is: (Assume that the current is flowing in the clockwise direction.) **(JEE Main 2021)**

(1) 3×10^{-7} T, outside the plane of triangle
(2) 23×10^{-7} T, outside the plane of triangle
(3) 23×10^{-5} T, inside the plane of triangle
(4) 3×10^{-5} T, inside the plane of triangle

44. A long solenoid with 1000 turns/m has a core material with relative permeability 500 and volume 10^3 cm^3. If the core material is replaced by another material having relative permeability of 750 with same volume maintaining same current of 0.75 A in the solenoid, the fractional change in the magnetic moment of the core would be approximately (x/499). Find the value of x. **(JEE Main 2021)**

45. There are two infinitely long straight current carrying conductors and they are held at right angles to each other so that their common ends meet at the origin as shown in the figure given below. The ratio of current in both conductor is 1 : 1. The magnetic field at point P is _____. **(JEE Main 2021)**



(1) $\frac{\mu_0 I}{4\pi xy}\left[\sqrt{x^2+y^2}+(x+y)\right]$

(2) $\frac{\mu_0 I}{4\pi xy}\left[\sqrt{x^2+y^2}-(x+y)\right]$

(3) $\frac{\mu_0 Ixy}{4\pi}\left[\sqrt{x^2+y^2}-(x+y)\right]$

(4) $\frac{\mu_0 Ixy}{\pi}\left[\sqrt{x^2+y^2}+(x+y)\right]$

46. Two charged particles, having same kinetic energy, are allowed to pass through a uniform magnetic field perpendicular to the direction of motion. If the ratio of radii of their circular paths is 6 : 5 and their respective masses ratio is 9 : 4. Then, the ratio of their charges will be: **(JEE Main 2022)**

(1) 8 : 5 (2) 5 : 4
(3) 5 : 3 (4) 8 : 7

47. The electric current in a circular coil of 2 turns produces a magnetic induction B_1 at its centre. The coil is unwound and is rewound into a circular coil of 5 turns and the same current produces a magnetic induction B_2 at its centre. The ratio of B_2/B_1 is: **(JEE Main 2022)**

(1) 5/2 (2) 25/4
(3) 5/4 (4) 25/2

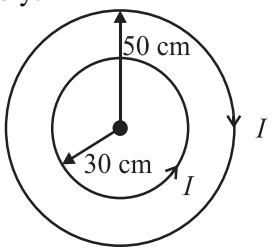
48. A charge particle is moving in a uniform magnetic field $\left(2\hat{i}+3\hat{j}\right)T$. If it has an acceleration of $\left(\alpha\hat{i}-4\hat{j}\right)\text{m/s}^2$, then the value of α will be. **(JEE Main 2022)**

(1) 3 (2) 6
(3) 12 (4) 2

49. B_X and B_Y are the magnetic field at the centre of two coils of two coils X and Y respectively, each carrying equal current. If coil X has 200 turns and 20 cm radius and coil Y has 400 turns and 20 cm radius, the ratio of B_X and B_Y is: **(JEE Main 2022)**

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

50. Two concentric circular loops of radii $r_1 = 30$ cm and $r_2 = 50$ cm are placed in X-Y plane as shown in the figure. A current $I = 7$A is flowing through them in the direction as shown in figure. The net magnetic moment of this system of two circular loops is approximately: **(JEE Main 2022)**



(1) $\frac{7}{2}\hat{k}Am^2$ (2) $-\frac{7}{2}\hat{k}Am^2$
(3) $7\hat{k}Am^2$ (4) $-7\hat{k}Am^2$

51. A cyclotron is used to accelerate protons. If the operating magnetic field is 1.0 T and the radius of the cyclotron 'dees' is 60 cm, the kinetic energy of the accelerated protons in MeV will be:
[use $m_p = 1.6 \times 10^{-27}$ kg, $e = 1.6 \times 10^{-19}$ C]. **(JEE Main 2022)**

(1) 12 (2) 18
(3) 16 (4) 32

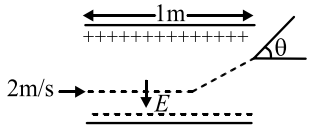
52. The current sensitivity of a galvanometer can be increased by:

(1) decreasing the number of turns
(2) increasing the magnetic field
(3) decreasing the area of the coil
(4) decreasing the torsional constant of the spring

Choose the most appropriate answer from the options given below: **(JEE Main 2022)**

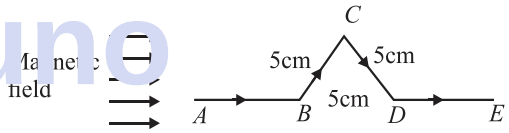
(1) (2) and (3) only
(2) (3) and (4) only
(3) (1) and (3) only
(4) (2) and (4) only

53. A uniform electric field $E = (8m/e)$ V/m is created between two parallel plates of length 1m as shown in figure, (where m = mass of electron and e = charge of electron). An electron enters the field symmetrically between the plates with a speed of 2 m/s. The angle of the deviation (θ) of the path of the electron as it comes out of the field will be _____. **(JEE Main 2022)**



(1) $\tan^{-1}(4)$ (2) $\tan^{-1}(2)$
(3) $\tan^{-1}(1/3)$ (4) $\tan^{-1}(3)$

54. A triangular shaped wire carrying 10A current is placed in a uniform magnetic field of 0.5T, as shown in figure. The magnetic force on segment CD is (Given $BC = CD = BD = 5$ cm). **(JEE Main 2022)**



(1) 0.126 N (2) 0.312 N
(3) 0.216 N (4) 0.245 N

55. A closely wounded circular coil of radius 5 cm produces a magnetic field of 37.68×10^{-4} T at its center. The current through the coil is _____ A.
[Given, number of turns in the coil is 100 and $\pi = 3.14$]. **(JEE Main 2022)**

56. An electron with energy 0.1 keV moves at right angle to the earth's magnetic field of 1×10^{-4} Wbm^{-2}. The frequency of revolution of the electron will be: (Take mass of electron = 9.0×10^{-31} kg). **(JEE Main 2022)**

(1) 1.6×40^5 Hz (2) 5.6×10^5 Hz
(3) 2.8×10^6 Hz (4) 1.8×10^6 Hz

57. In a coil of resistance 8Ω, the magnetic flux due to an external magnetic field varies with time a $\phi = \frac{2}{3}\left(9 - t^2\right)$. The value of total heat produced in the coil, till the flux becomes zero, will be _____ J. **(JEE Main 2022)**

58. A magnetic needle makes an angle of 45° with magnetic meridian makes an angle of 60° with the horizontal. The actual value of the angle of dip is **(JEE Main 2022)**

(1) $\tan^{-1}\left(\sqrt{\frac{3}{2}}\right)$ (2) $\tan^{-1}(\sqrt{6})$

(3) $\tan^{-1}\left(\sqrt{\frac{2}{3}}\right)$ (4) $\tan^{-1}\left(\sqrt{\frac{1}{2}}\right)$

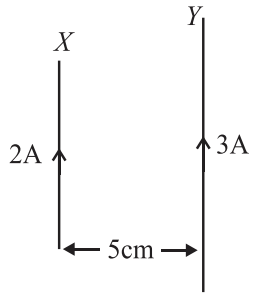
59. The magnetic field at the center of current carrying circular loop is B_1. The magnetic field at a distance of $\sqrt{3}$ times radius of the given circular loop from the center on its axis is B_2. The value of B_1/B_2 will be: **(JEE Main 2022)**

(1) 9 : 4 (2) $12:\sqrt{5}$

(3) 8 : 1 (4) $5:\sqrt{3}$

60. A wire of length 314 cm carrying current of 4 A is bent to form a circle. The magnetic moment of the coil is _____ A-m^2. [Given $\pi = 3.14$] **(JEE Main 2022)**

61. A wire X of length 50 cm carrying a current of 2A is placed parallel to a long wire Y of length 5m. The wire Y carries a current of 3A. The distance between wires is 5cm and currents flow in the same direction. The force acting on the wire Y is: **(JEE Main 2022)**



(1) 1.2×10^{-5} N directed towards wire X.

(2) 1.2×10^{-4} N directed away from wire X.

(3) 1.2×10^{-4} N directed towards wire X.

(4) 2.4×10^{-5} N directed towards wire X.

62. Given below are two statements: One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): In an uniform magnetic field, speed and energy remains the same for a moving charged particle.

Reason (R): Moving charged particle experiences magnetic force perpendicular to its direction of motion. **(JEE Main 2022)**

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

(2) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)

(3) (A) is true but (R) is false

(4) (A) is false but (R) is true.

63. The magnetic field at the centre of a circular coil of radius r, due to current I flowing through it, is B. The magnetic field at a point along the axis at a distance $r/2$ from the centre is: **(JEE Main 2022)**

(1) $B/2$ (2) $2B$

(3) $\left(\frac{2}{\sqrt{5}}\right)^3 B$ (4) $\left(\frac{2}{\sqrt{3}}\right)^3 B$

64. A proton, a deuteron and α-particle with same kinetic energy enter into a uniform magnetic field at right angle to magnetic field. The ratio of the radii of their respective circular paths is: **(JEE Main 2022)**

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

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

65. A long straight wire with a circular cross-section having radius R, is carrying a steady current I. The current I is uniformly distributed across this cross-section. Then the variation of magnetic field due to current I with distance r ($r < R$) from its centre will be: **(JEE Main 2022)**

(1) $B \propto r^2$ (2) $B \propto r$

(3) $B \propto 1/r^2$ (4) $B \propto 1/r$

66. A long solenoid carrying a current produces 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 magnetic field will be equal to **(JEE Main 2022)**

(1) B (2) $2B$

(3) $4B$ (4) $B/2$

67. A proton and an alpha particle of the same velocity enter in a uniform magnetic field which is acting perpendicular to their direction of motion, The ratio of the circular paths described by the alpha particle and proton is: **(JEE Main 2022)**

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

68. A bar magnet having a magnetic moment of 2.0×10^5 JT^{-1}, is placed along the direction of uniform magnetic field of magnitude $B = 14 \times 10^{-5}$ T. The work done in rotating the magnet slowly through 60° form the direction of field is: **(JEE Main 2022)**

(1) 14 J (2) 8.4 J
(3) 4 J (4) 1.4 J

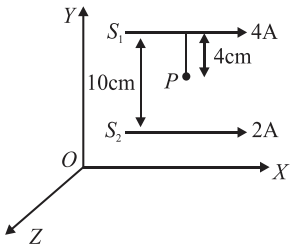
69. A metal surface is illuminated by a radiation of wavelength 4500Å. The ejected photo-electron enters a constant magnetic field of 2 mT making an angle of 90° with the magnetic field. If it starts resolving in a circular path of radius 2 mm, the work function of the metal is approximately: **(JEE Main 2022)**

(1) 1.36 eV (2) 1.69 eV
(3) 2.78 eV (4) 2.23 V

70. Two 10 cm long, straight wires, each carrying a current of 5A are kept parallel to each other. If each wire experienced a force of 10^{-5} N, then separation between the wires is _____ cm. **(JEE Main 2022)**

71. Two long parallel conductors S_1 and S_2 are separated by a distance 10 cm and carrying currents of 4A and 2A respectively. The conductors are placed along x-axis in X-Y plane. There is a point P located between the conductors (as shown in figure). A charge particle of 3π coulomb is passing through the point P with velocity $\vec{v} = \left(2\hat{i} + 3\hat{j}\right)$ m/s; where $\hat{i}$ & $\hat{j}$ represents unit vector x & y axis respectively. The force acting on the charge particle is $4\pi \times 10^{-5}\left(-x\hat{i} + 2\hat{j}\right)$ N. The value of x is:

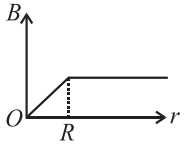
(JEE Main 2022)

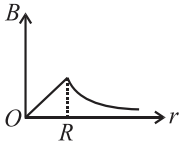


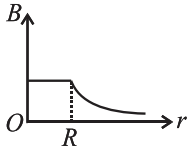
(1) 2 (2) 1
(3) 3 (4) –3

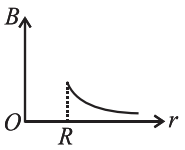
72. A deutron and a proton moving with equal kinetic energy enter into to a uniform magnetic field at right angle to the field. If r_d and r_p are the radii of their circular paths respectively, then the ratio r_d / r_p will be $\sqrt{x}:1$ where x is _____. **(JEE Main 2022)**

73. An infinitely long hollow conducting cylinder with radius R carries a uniform current along its surface. Choose the correct representation of magnetic field (2) as a function of radial distance (r) from the axis of cylinder. **(JEE Main 2022)**

(1) 

(2) 

(3) 

(4) 

74. A singly ionized magnesium atom (A = 24) ion is accelerated to kinetic energy 5 keV and is projected perpendicularly into a magnetic field B of the magnitude 0.5 T. The radius of path formed will be _____ cm. **(JEE Main 2022)**

75. Two parallel, long wires are kept 0.20 m apart in vacuum, each carrying current of x A in the same direction. If the force of attraction per meter of each wire is 2×10^{-6} N, then the value of x is approximately: **(JEE Main 2022)**

(1) 1 (2) 2.4
(3) 1.4 (4) 2

76. A coil is placed in a time varying magnetic field. If the number of turns in the coil were to be halved and the radius of wire doubled, the electrical power dissipated due to the current induced in the coil would be: (Assume the coil to be short circuited). **(JEE Main 2022)**

(1) Halved (2) Quadrupled
(3) The same (4) Doubled

77. A charged particle moves along circular path in a uniform magnetic field in a cyclotron. The kinetic energy of the charged particle increases to 4 times of its initial value. What will be the ratio of new radius to the original radius of circular path of the charged particle: **(JEE Main 2022)**

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

78. Two long current carrying conductors are placed parallel to each other at a distance of 8 cm between them. The magnitude of magnetic field produced at mid-point between the two conductors due to current flowing in them is 300 μT. The equal current flowing in the two conductors is: **(JEE Main 2022)**

(1) 30A in the same direction
(2) 30A in the opposite direction
(3) 60A in the opposite direction.
(4) 300A in the opposite direction

79. **Assertion (A):** Non-polar materials do not have any permanent dipole moment

Reason (R): when an non-polar materials is placed in a electric filed. The centre of the positive charge distribution of it's individual atom or molecule coinside with the centre of the negative charge distribution.

In the light of above statements, choose the most appropriate answer from the options given below.

(JEE Main 2022)

(1) Both (A) and (R) are correct and (R) is the correct explanation of (A)
(2) Both (A) and (R) are correct and (R) is not the correct explanation of (A)
(3) (A) is correct but (R) is not correct
(4) (A) is not correct but (R) is correct

80. At a certain place the angle of dip is 30° and the horizontal component of earth's magnetic field is 0.5 G. The earth's total magnetic field (in G), at that certain place, is: **(JEE Main 2022)**

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

81. Two long straight wires P and Q carrying equal current 10 A each were kept parallel to each other at 5 cm distance. Magnitude of magnetic force experienced by 10 cm length of wire P is F_1. If distance between wires is halved and currents on them are double, force F_2 on 10 cm length of wire P will be: **(24 January 2023 - Shift 1)**

(1) $8\,F_1$ (2) $10\,F_1$
(3) $F_1/8$ (4) $F_1/10$

82. A circular loop of radius r is carrying current I A. The ratio of magnetic field at the centre of circular loop and at a distance r from the center of the loop on its axis is: **(24 January 2023 - Shift 1)**

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

83. A long solenoid is formed by winding 70 turns cm^{-1}. If 2.0 A current flows, then the magnetic field produced inside the solenoid is _____.
($\mu_0 = 4\pi \times 10^{-7}$ TmA^{-1}) **(24 January 2023 - Shift 2)**

(1) 1232×10^{-4} T (2) 176×10^{-4} T
(3) 352×10^{-4} T (4) 88×10^{-4} T

84. A single turn current loop in the shape of a right angle triangle with sides 5 cm, 12 cm, 13 cm is carrying a current of 2A. The loop is in a uniform magnetic field of magnitude 0.75 T whose direction is parallel to the current in the 13 cm side of the loop. The magnitude of the magnetic force on the 5 cm side will be $x/130$ N. The value of x is. **(24 January 2023 - Shift 2)**

85. A solenoid of 1200 turns is wound uniformly in a single layer on a glass tube 2 m long and 0.2 m in diameter. The magnetic intensity at the center of the solenoid when a current of 2 A flows through it is: **(25 January 2023 - Shift 1)**

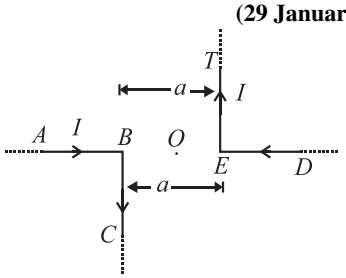
(1) 2.4×10^3 A m^{-1}
(2) 1.2×10^3 A m^{-1}
(3) 1 A m^{-1}
(4) 2.4×10^{-3} A m^{-1}

86. For a moving coil galvanometer, the deflection in the coil is 0.05 rad when a current of 10 mA is passed through it. If the torsional constant of suspension wire is 4.0×10^{-5} Nm rad^{-1}, the magnetic field is 0.01 T and the number of turns in the coil is 200, the area of each turn (in cm^2) is: **(25 January 2023 - Shift 2)**

(1) 2.0 (2) 1.0
(3) 1.5 (4) 0.5

87. Two long parallel wires carrying currents 8 A and 15 A in opposite directions are placed at a distance of 7 cm from each other. A point P is at equidistant from both the wires such that the lines joining the point P to the wires are perpendicular to each other. The magnitude of magnetic field at P is _____$\times 10^{-6}$ T.
(Given: $\sqrt{2} = 1.4$) **(25 January 2023 - Shift 2)**

88. The magnitude of magnetic induction at mid-point O due to current arrangement as shown in Fig will be: **(29 January 2023 - Shift 1)**



(1) $\frac{\mu_0 I}{2\pi a}$ (2) 0

(3) $\frac{\mu_0 I}{4\pi a}$ (4) $\frac{\mu_0 I}{\pi a}$

89. A square loop of area 25 cm^2 has a resistance of 10 Ω. The loop is placed in uniform magnetic field of magnitude 40.0 T. The plane of loop is perpendicular to the magnetic field. The work done in pulling the loop out of the magnetic field slowly and uniformly in 1.0 sec, will be: **(29 January 2023 - Shift 2)**

(1) 2.5×10^{-3} J (2) 1.0×10^{-3} J

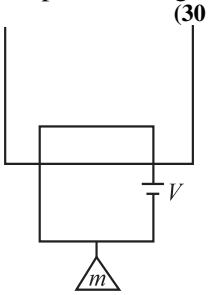
(3) 1.0×10^{-4} J (4) 5×1 J

90. The electric current in a circular coil of four turns produces a magnetic induction 32 T at its centre. The coil is unwound and is rewound into a circular coil of single turn, the magnetic induction at the centre of the coil by the same current will be: **(29 January 2023 - Shift 2)**

(1) 8 T (2) 4 T

(3) 2 T (4) 16 T

91. A massless square loop, of wire of resistance 10 Ω. Supporting a mass of I g. hangs vertically with one of its sides in a uniform magnetic field of 10^3 G, directed outwards in the shaded region. A dc voltage V is applied to the loop. For what value of V. The magnetic force will exactly balance the weight of the supporting mass of 1g?
(If sides of the loop = 10 cm, g = 10 ms^{-2}) **(30 January 2023 - Shift 1)**



(1) $\frac{1}{10}$ V (2) 100 V

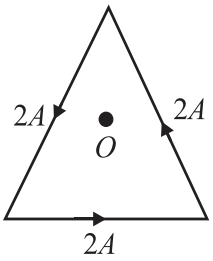
(3) 1 V (4) 10 V

92. The magnetic moments associated with two closely wound circular coils A and B of radius r_A = 10 cm and r_B = 20 cm respectively are equal if: (Where N_A, I_A and N_B, I_B are number of turn and current of A and B respectively) **(30 January 2023 - Shift 1)**

(1) $2\,N_A I_A = N_B I_B$ (2) $N_A = 2\,N_B$

(3) $N_A I_A = 4\,N_B I_B$ (4) $4\,N_A I_A = N_B I_B$

93. As shown in the figure, a current of 2A flowing in an equilateral triangle of side $4\sqrt{3}$ cm. The magnetic field at the centroid O of the triangle is:
(Neglect the effect of earth's magnetic field.) en below: **(30 January 2023 - Shift 2)**

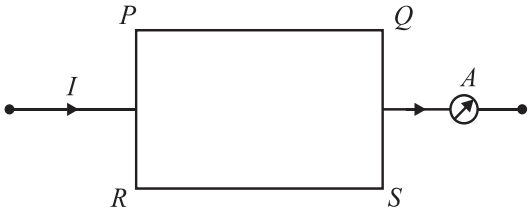


(1) $4\sqrt{3}\times10^{-4}$ T (2) $4\sqrt{3}\times10^{-5}$ T

(3) $\sqrt{3}\times10^{-4}$ T (4) $3\sqrt{3}\times10^{-5}$ T

94. A current carrying rectangular loop $PQRS$ is made of uniform wire. The length $PR = QS$ = 5 cm and $PQ = RS$ = 100 cm. If ammeter current reading changes from I to 2I, the ratio of magnetic forces per unit length on the wire PQ due to wire RS in the two cases respectively $f_{PQ}^{I} : f_{PQ}^{2I}$ is:

(30 January 2023 - Shift 2)



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

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

95. A bar magnet with a magnetic moment 5.0 Am^2 is placed in parallel position relative to a magnetic field of 0.4 T. The amount of required work done in turning the magnet form parallel to antiparallel position relative to the field direction is:

(31 January 2023 - Shift 1)

(1) 4 J (2) 1 J

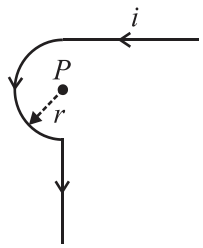
(3) 2 J (4) Zero

96. A long conducting wire having a current I flowing through it, is bent into a circular coil of N turns. Then it is bent into a circular coil of n turns. The magnetic field is calculated at the centre of coils in both the cases. The ratio of the magnetic field in first case to that of second case is: **(31 January 2023 - Shift 2)**

(1) $N : n$ (2) $n^2 : N^2$

(3) $N^2 : n^2$ (4) $n : N$

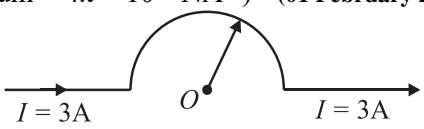
97. Find the magnetic field at the point P in figure. The curved portion is a semicircle connected to two long straight wires. **(01 February 2023 - Shift 1)**



(1) $\frac{\mu_0 i}{2r}\left(1+\frac{2}{\pi}\right)$ (2) $\frac{\mu_0 i}{2r}\left(1+\frac{1}{\pi}\right)$

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

98. As shown in the figure, a long straight conductor with semicircular arc of radius $\frac{\pi}{10}$ m is carrying current $I = 3$ A. The magnitude of the magnetic field. at the center O of the arc is: (The permeability of the vacuum = $4\pi \times 10^{-7}$ NA^{-2}) **(01 February 2023 - Shift 2)**



(1) 6 μT (2) 1 μT

(3) 4 μT (4) 3 μT

99. A square shaped coil of area 70 cm^2 having 600 turns rotates in a magnetic field of 0.4 wbm^{-2}, about an axis which is parallel to one of the side of the coil and perpendicular to the direction of field. If the coil completes 500 revolution in a minute, the instantaneous emf when the plane of the coil is inclined at 60° with the field, will be V.

(Take $\pi = \frac{22}{7}$) **(01 February 2023 - Shift 2)**

100. A long straight wire of circular cross-section (radius a) is carrying steady current I. The current I is uniformly distributed across this cross-section. The magnetic field is: **(06 April 2023 - Shift 1)**

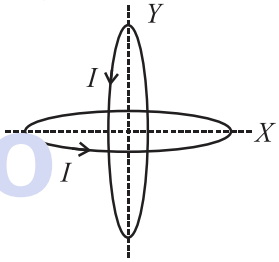
(1) inversely proportional to r in the region $r < a$ and uniform throughout in the region $r > a$.

(2) directly proportional to r in the region $r < a$ and inversely proportional to r in the region $r > a$.

(3) Zero in the region $r < a$ and inversely proportional to r in the region $r > a$.

(4) uniform in the region $r < a$ and inversely proportional to distance r from the axis, in the region $r > a$.

101. Two identical circular wires of radius 20 cm and carrying current $\sqrt{2}$ A are placed in perpendicular planes as shown in figure. The net magnetic field at the centre of the circular wires is _____ $\times 10^{-8}$ T. (Take $\pi = 3.14$) **(06 April 2023 - Shift 1)**



102. A proton with a kinetic energy of 2.0 eV moves into a region of uniform magnetic field of magnitude $\frac{\pi}{2} \times 10^{-3}$ T. The angle between the direction of magnetic field and velocity of proton is 60°. The pitch of the helical path taken by the proton is _____cm. (Take, mass of proton = 1.6×10^{-27} kg and charge on proton = 1.6×10^{-19} C). **(06 April 2023 - Shift 2)**

103. A charge particle moving in magnetic field B, has the components of velocity along B as well as perpendicular to B. The path of the charge particle will be: **(08 April 2023 - Shift 1)**

(1) helical path with the axis perpendicular to the direction of magnetic field B

(2) helical path with the axis along magnetic field B

(3) circular path

(4) straight along the direction of magnetic field B

104. The magnetic intensity at the centre of a long current carrying solenoid is found to be 1.6×10^3 A m^{-1}. If the number of turns is 8 per cm, then the current flowing through the solenoid is _____A.

(08 April 2023 - Shift 1)

105. The ratio of magnetic field at the centre of a current carrying coil of radius r to the magnetic field at distance r from the centre of coil on its axis is $\sqrt{x}$: 1. The value of x is _____. **(08 April 2023 - Shift 2)**

106. Given below are two statements:

Statement I: If the number of turns in the coil of a moving coil galvanometer is doubled then the current sensitivity becomes double.

Statement II: Increasing current sensitivity of a moving coil galvanometer by only increasing the number of turns in the coil will also increase its voltage sensitivity in the same ratio

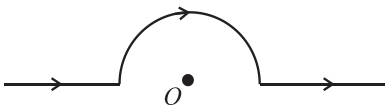
In the light of the above statements, choose the correct answer from the options given below:

(10 April 2023 - Shift 1)

(1) Statement I is true but Statement II is false
(2) Statement I is false but Statement II is true
(3) Both Statement I and Statement II are false
(4) Both Statement I and Statement II are true

107. A straight wire carrying a current of 14 A is bent into a semicircular arc of radius 2.2 cm as shown in the figure. The magnetic field produced by the current at the centre O of the arc is _____ $\times 10^{-4}$ T.

(10 April 2023 - Shift 2)



108. An electron is allowed to move with constant velocity along the axis of current carrying straight solenoid.

(A) The electron will experience magnetic force along the axis of the solenoid.
(B) The electron will not experience magnetic force.
(C) The electron will continue to move along the axis of the solenoid.
(D) The electron will be accelerated along the axis of the solenoid.
(E) The electron will follow parabolic path-inside the solenoid.

Choose the correct answer from the option given below: **(11 April 2023 - Shift 2)**

(1) B, C and D only
(2) A and D only
(3) B and C only
(4) B and E only

109. A straight wire AB of mass 40 g and length 50 cm is suspended by a pair of flexible leads in uniform magnetic field of magnitude 0.40 T as shown in the figure. The magnitude of the current required in the wire to remove the tension in the supporting leads is _____A. (Take g = 10 m s^{-2}).

(13 April 2023 - Shift 2)

110. An electron is moving along the positive x-axis. If uniform magnetic field is applied parallel to the negative z-axis, then

A. The electron will experience magnetic force along positive y-axis
B. The electron will experience magnetic force along negative y-axis
C. The electron will not experience any force in magnetic field
D. The electron will continue to move along the positive x-axis
E. The electron will move along circular path in magnetic field

Choose the correct answer from the option given below: **(13 April 2023 - Shift 2)**

(1) A and E only (2) C and D only
(3) B and E only (4) B and D only

111. An electron in a hydrogen atom revolves around its nucleus with a speed of 6.76×10^6 m s^{-1} in an orbit of radius 0.52 Å. The magnetic field produced at the nucleus of the hydrogen atom is _____T.

(15 April 2023 - Shift 1)

112. A regular polygon of 6 sides is formed by bending a wire of length 4π meter. If an electric current of $4\pi\sqrt{3}$ A is flowing through the sides of the polygon, the magnetic field at the centre of the polygon would be $x \times 10^{-7}$ T. The value of x is _____ .

(01 Feb. 2024 - Shift 1)

113. A moving coil galvanometer has 100 turns and each turn has an area of 2.0 cm^2. The magnetic field produced by the magnet is 0.01 T and the deflection in the coil is 0.05 radian when a current of 10 mA is passed through it. The torsional constant of the suspension wire is $x \times 10^{-5}$ N-m/rad. The value of x is _____.

(01 Feb. 2024 - Shift 2)

114. Position of an ant (S in metres) moving in $Y-Z$ plane is given by $S = 2t^2\hat{j} + 5\hat{k}$ (where t is in second). The magnitude and direction of velocity of the ant at $t = 1$ s will be: **(27 January 2024 - Shift 1)**

(1) 16 m/s in y-direction
(2) 4 m/s in x-direction
(3) 9 m/s in z-direction
(4) 4 m/s in y-direction

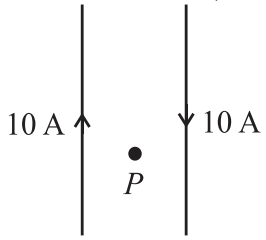
115. A proton moving with a constant velocity passes through a region of space without any change in its velocity. If $\vec{E}$ and $\vec{B}$ represent the electric and magnetic fields respectively, then the region of space may have:

(A) E = 0, B = 0 (B) E = 0, B ≠ 0
(C) E ≠ 0, B = 0 (D) E ≠ 0, B ≠ 0

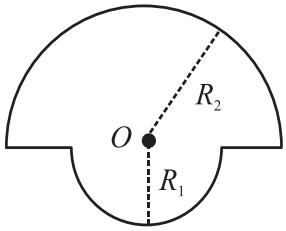
Choose the most appropriate answer from the options given below: **(27 January 2024 - Shift 1)**

(1) (A), (B) and (C) Only
(2) (A), (C) and (D) Only
(3) (A), (B) and (D) Only
(4) (B), (C) and (D) Only

116. Two long, straight wires carry equal currents in opposite directions as shown in figure. The separation between the wires is 5.0 cm. The magnitude of the magnetic field at a point P midway between the wires is _____ μT.
(Given: $\mu_0 = 4\pi \times 10^{-7}$ TmA^{-1}). **(27 January 2024 - Shift 1)**



117. The magnetic field at the centre of a wire loop formed by two semicircular wires of radii $R_1 = 2\pi$ m and $R_2 = 4\pi$ m carrying current $I = 4$A as per figure given below is $\alpha \times 10^{-7}$ T. The value of α is _____.
(Centre O is common for all segments). **(27 January 2024 - Shift 2)**



118. The magnetic potential due to a magnetic dipole at a point on its axis situated at a distance of 20 cm from its centre is 1.5×10^{-5} Tm. The magnetic moment of the dipole is _____ Am^2.
(Given: $\mu_0/4\pi = 10^{-7}$ TmA^{-1}). **(29 January 2024 - Shift 1)**

119. Two particles X and Y having equal charges are being accelerated through the same potential difference. Thereafter they enter normally in a region of uniform magnetic field and describes circular paths of radii R_1 and R_2 respectively. The mass ratio of X and Y is: **(29 January 2024 - Shift 2)**

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

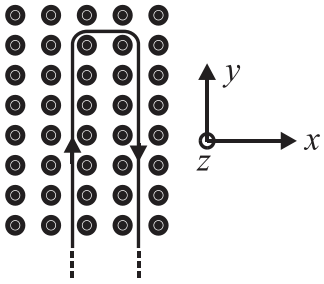
120. A charge of 4.0 μC is moving with a velocity of 4.0×10^6 ms^{-1} along the positive y-axis under a magnetic field $\vec{B}$ of straight $(2\hat{k})$ T. The force acting on the charge is $x\,\hat{i}$ N. The value of x is _____. **(29 January 2024 - Shift 2)**

121. The current of 5A flows in a square loop of sides 1 m is placed in air. The magnetic field at the centre of the loop is $X\sqrt{2} \times 10^{-7}$ T. The value of X is _____ . **(30 January 2024 - Shift 2)**

122. A coil is placed perpendicular to a magnetic field of 5000 T. When the field is changed to 3000 T in 2 s, an induced emf of 22 V is produced in the coil. If the diameter of the coil is 0.02 m, then the number of turns in the coil is: **(31 January 2024 - Shift 1)**

(1) 7 (2) 70
(3) 35 (4) 140

123. A rigid wire consists of a semicircular portion of radius R and two straight sections. The wire is partially immerged in a perpendicular magnetic field $B = B_0\hat{j}$ as shown in figure. The magnetic force on the wire if it has a current i is: **(31 January 2024 - Shift 1)**



(1) $-iBR\hat{j}$ (2) $2iBR\hat{j}$
(3) $iBR\hat{j}$ (4) $-2iBR\hat{j}$

124. An electron moves through a uniform magnetic field $\vec{B} = B_0\hat{i} + 2B_0\hat{j}$ T. At a particular instant of time, the velocity of electron is $\vec{u} = 3\hat{i} + 5\hat{j}$ m/s. If the magnetic force acting on electron is $\vec{F}$ = 5 ekN, where e is the charge of electron, then the value of B_0 is _____ T.
(31 January 2024 - Shift 1)

125. A uniform magnetic field of 2×10^{-3} T acts along positive Y-direction. A rectangular loop of sides 20 cm and 10 cm with current of 5 A is $Y - Z$ plane. The current is in anticlockwise sense with reference to negative X-axis. Magnitude and direction of the torque is:
(31 January 2024 - Shift 2)

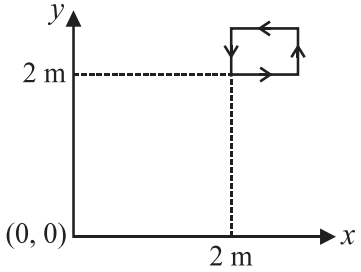
(1) 2×10^{-4} N - m along positive Z-direction
(2) 2×10^{-4} N - m along negative Z-direction
(3) 2×10^{-4} N - m along positive X-direction
(4) 2×10^{-4} N - m along positive Y-direction

126. Two circular coils P and Q of 100 turns each have same radius of π cm. The currents in and are 1 A and 2 A respectively. P and Q are placed with their planes mutually perpendicular with their centers coincide. The resultant magnetic field induction at the center of the coils is $\sqrt{x}$ mT, where x = _____ .
(Use $\mu_0 = 4\pi \times 10^{-7}$ Tm A^{-1}) **(31 January 2024 - Shift 2)**

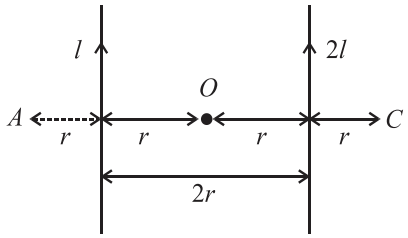
127. An electron is projected with uniform velocity along the axis inside a current carrying long solenoid. Then:
(04 Apr. 2024 - Shift 1)

(1) the electron will continue to move with uniform velocity along the axis of the solenoid.
(2) the electron will be accelerated along the axis.
(3) the electron path will be circular about the axis.
(4) the electron will experience a force at 45° to the axis and execute a helical path.

128. The magnetic field existing in a region is given by $\vec{B} = 0.2(1+2x)\hat{k}T$. A square loop of edge 50 cm carrying 0.5 A current is placed in x-y plane with its edges parallel to the x-y axes, as shown in figure. The magnitude of the net magnetic force experienced by the loop is _____ mN.
(04 Apr. 2024 - Shift 1)



129. Two parallel long current carrying wire separated by a distance $2r$ are shown in the figure. The ratio of magnetic field at A to the magnetic field produced at C is $x/7$. The value of x is _____.
(04 Apr. 2024 - Shift 2)



130. In a co-axial straight cable, the central conductor and the outer conductor carry equal currents in opposite directions. The magnetic field is zero:
(05 Apr. 2024 - Shift 1)

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

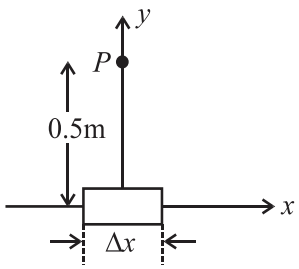
131. A 2 A current carrying straight metal wire of resistance 1Ω, resistivity 2×10^{-6}Ωm, area of cross-section 10 mm^2 and mass 500 g is suspended horizontally in mid air by applying a uniform magnetic field $\vec{B}$. The magnitude of B is _____ $\times 10^{-1}$ T. (given, g = 10 m/s^2).
(05 Apr. 2024 - Shift 1)

132. The electrostatic force $(\vec{F_1})$ and magnetic force $(\vec{F_1})$ acting on a charge q moving with velocity v can be written:
(05 Apr. 2024 - Shift 2)

(1) $\vec{F}_1 = q\vec{E},\ \vec{F}_2 = q(\vec{V} \times \vec{B})$
(2) $\vec{F}_1 = q\vec{B},\ \vec{F}_2 = q(\vec{B} \times \vec{V})$
(3) $\vec{F}_1 = q\vec{E},\ \vec{F}_2 = q(\vec{B} \times \vec{V})$
(4) $\vec{F}_1 = q\vec{V} \cdot \vec{E},\ \vec{F}_2 = q(\vec{B} \cdot \vec{V})$

133. A solenoid of length 0.5 m has a radius of 1 cm and is made up of 'm' number of turns. It carries a current of 5 A. If the magnitude of the magnetic field inside the solenoid is 6.28×10^{-3} then the value of m is _____.
(05 Apr. 2024 - Shift 2)

134. An element $\Delta l = \Delta x \hat{i}$ is placed at the origin and carries a large current $I = 10$ A. The magnetic field on the y-axis at a distance of 0.5 m from the elements Δx of 1 cm length is: **(06 Apr. 2024 - Shift 1)**



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

135. A circular coil having 200 turns, 2.5×10^{-4} m^2 area and carrying 100 μA current is placed in a uniform magnetic field of 1 T. Initially the magnetic dipole moment ($\vec{M}$) was directed along $\vec{B}$. Amount of work, required to rotate the coil through 90° from its initial orientation such that $\vec{M}$ becomes perpendicular to $\vec{B}$, is _____ μJ.
(06 Apr. 2024 Shift 1)

136. A coil having 100 turns, area of 5×10^{-3} m^2, carrying current of 1 mA is placed in uniform magnetic field of 0.20 T such a way that plane of coil is perpendicular to the magnetic field. The work done in turning the coil through 90° is _____ μJ.
(06 Apr. 2024 - Shift 2)

137. An electron with kinetic energy 5 eV enters a region of uniform magnetic field of 3 μT perpendicular to its direction. An electric field E is applied perpendicular to the direction of velocity and magnetic field. The value of E, so that electron moves along the same path, is _____ NC^{-1}.
(Given, mass of electron = 9×10^{-31} kg, electric charge = 1.6×10^{-19} C). **(08 Apr. 2024 - Shift 1)**

138. A long straight wire of radius a carries a steady current I. The current is uniformly distributed across its cross section. The ratio of the magnetic field at $a/2$ and $2a$ from axis of the wire is:
(08 Apr. 2024 - Shift 2)

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

139. Given below are two statements:
Statement (I): When currents vary with time, Newton's third law is valid only if momentum carried by the electromagnetic field is taken into account.
Statement (II): Ampere's circuital law does not depend on Biot-Savart's law.
In the light of the above statements, choose the correct answer from the options given below:
(09 Apr. 2024 - Shift 1)

(1) Both Statement I and Statement II are true
(2) Statement I is true but Statement II is false
(3) Both Statement I and Statement II are false
(4) Statement I is false but Statement II is true

140. A square loop of edge length 2 m carrying current of 2 A is placed with its edges parallel to the x-y axis. A magnetic field is passing through the x-y plane and expressed as $\vec{B} = B_0(1+4x)\hat{k}$, where B_0 = 5 T. The net magnetic force experienced by the loop is _____.
(09 Apr. 2024 - Shift 1)

141. A proton and a deutron ($q = +e$, $m = 2.0$ u) having same kinetic energies enter a region of uniform magnetic field $\vec{B}$, moving perpendicular to $\vec{B}$. The ratio of the radius r_d of deutron path to the radius r_p of the proton path is: **(09 Apr. 2024 - Shift 2)**

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

142. A straight magnetic strip has a magnetic moment of 44 Am^2. If the strip is bent in a semicircular shape, its magnetic moment will be _____ Am^2.
(given π = 22/7). **(09 Apr. 2024 - Shift 2)**

Answer Key

1. (2)	22. (3)	43. (4)	64. (4)	85. (2)	106. (1)	127. (1)
2. (1)	23. (3)	44. (250)	65. (2)	86. (2)	107. (2)	128. (50)
3. (3)	24. (2)	45. (1)	66. (1)	87. (68)	108. (3)	129. (5)
4. (4)	25. (1)	46. (2)	67. (4)	88. (4)	109. (2)	130. (1)
5. (175)	26. (1)	47. (2)	68. (1)	89. (2)	110. (3)	131. (5)
6. (1)	27. (2)	48. (2)	69. (1)	90. (3)	111. (40)	132. (1)
7. (2)	28. (4)	49. (2)	70. (5)	91. (4)	112. (72)	133. (500)
8. (1)	29. (2)	50. (2)	71. (3)	92. (3)	113. (4)	134. (1)
9. (3)	30. (1)	51. (2)	72. (2)	93. (4)	114. (4)	135. (5)
10. (3)	31. (2)	52. (4)	73. (4)	94. (2)	115. (3)	136. (100)
11. (3)	32. (2)	53. (2)	74. (10)	95. (1)	116. (160)	137. (4)
12. (20)	33. (8)	54. (3)	75. (3)	96. (3)	117. (3)	138. (2)
13. (3)	34. (1)	55. (3)	76. (4)	97. (3)	118. (6)	139. (2)
14. (4)	35. (2)	56. (3)	77. (3)	98. (4)	119. (2)	140. (160)
15. (1)	36. (4)	57. (2)	78. (2)	99. (44)	120. (32)	141. (1)
16. (2)	37. (543)	58. (1)	79. (3)	100. (2)	121. (40)	142. (28)
17. (1)	38. (1)	59. (3)	80. (1)	101. (628)	122. (2)	
18. (4)	39. (3)	60. (11)	81. (1)	102. (40)	123. (4)	
19. (1)	40. (3)	61. (1)	82. (3)	103. (3)	124. (5)	
20. (2)	41. (1)	62. (1)	83. (2)	104. (2)	125. (2)	
21. (2)	42. (1)	63. (3)	84. (9)	105. (8)	126. (20)	

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