DPP - Daily Practice Problems

Chapter-wise Sheets

Date : | **Start Time :** | **End Time :**

PHYSICS

CP18

SYLLABUS : Moving Charges and Magnetism

Max. Marks : 120 **Marking Scheme :** (+4) for correct & (–1) for incorrect answer **Time : 60 min.**

INSTRUCTIONS : This Daily Practice Problem Sheet contains 30 MCQs. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

1. A 10 eV electron is circulating in a plane at right angles to a uniform field at magnetic induction 10^{-4} Wb/m^2 (= 1.0 gauss). The orbital radius of the electron is

(a) 12 cm (b) 16 cm

(c) 11 cm (d) 18 cm

2. An insulating rod of length ℓ carries a charge q distributed uniformly on it. The rod is pivoted at its mid point and is rotated at a frequency f about a fixed axis perpendicular to rod and passing through the pivot. The magnetic moment of the rod system is $\frac{1}{2a}\pi q f \ell^2$. Find the value of a.

(a) 6 (b) 4

(c) 5 (d) 8

3. Two long parallel wires carry currents i_1 andn i_2 such that $i_1 > i_2$. When the currents are in the same direction, the magnetic field at a point midway between the wires is 6×10^{-6} T. If the direction of i_2 is reversed, the field becomes 3×10^{-5} T. The ratio of $\frac{i_1}{i_2}$ is

(a) $\frac{1}{2}$ (b) 2 (c) $\frac{2}{3}$ (d) $\frac{3}{2}$

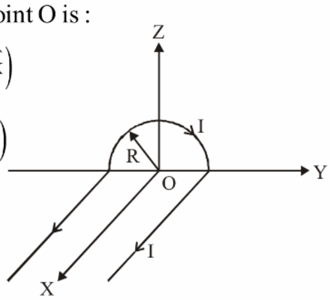
4. A moving coil galvanometer has 150 equal divisions. Its current sensitivity is 10-divisions per milliampere and voltage sensitivity is 2 divisions per millivolt. In order that each division reads 1 volt, the resistance in ohms needed to be connected in series with the coil will be

(a) 10^5 (b) 10^3 (c) 9995 (d) 99995

RESPONSE GRID 1. ⓐⓑⓒⓓ 2. ⓐⓑⓒⓓ 3. ⓐⓑⓒⓓ 4. ⓐⓑⓒⓓ

Space for Rough Work

5. 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 :



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

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

(c) $\vec{B} = \frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} - 2\hat{k}\right)$

(d) $\vec{B} = \frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} + 2\hat{k}\right)$

6. 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 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:

(a) 3×10^{-2} N-m (b) 3×10^{-3} N-m
(c) 1.5×10^{-3} N-m (d) 1.5×10^{-2} N-m

7. An alternating electric field, of frequency v, 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 :

(a) $B = \frac{mv}{e}$ and $K = 2m\pi^2v^2R^2$

(b) $B = \frac{2\pi mv}{e}$ and $K = m^2\pi vR^2$

(c) $B = \frac{2\pi mv}{e}$ and $K = 2m\pi^2v^2R^2$

(d) $B = \frac{mv}{e}$ and $K = m^2\pi vR^2$

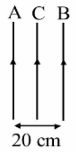
8. A galvanometer of 50 ohm resistance has 25 divisions. A current of 4×10^{-4} ampere gives a deflection of one per division. To convert this galvanometer into a voltmeter having a range of 25 volts, it should be connected with a resistance of

(a) 2450 Ω in series (b) 2500 Ω in series.
(c) 245 Ω in series. (d) 2550 Ω in series.

9. 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 $2a$ is

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

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



(a) 3×10^{-5} N (left)
(b) 3×10^{-5} N (right)
(c) 6×10^{-5} N (left)
(d) 6×10^{-5} N (right)

11. Two tangent galvanometers A and B have coils of radii 8 cm and 16 cm respectively and having resistance of 8Ω each. They are connected in parallel with a cell of emf 4V and negligible internal resistance. The deflections produced in the tangent galvanometers A and B are 30° and 60° respectively. If A has 2 turns, then B must have

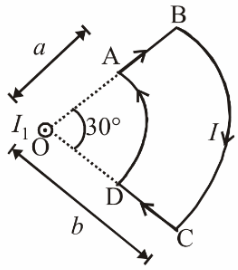
(a) 18 turns (b) 12 turns
(c) 6 turns (d) 2 turns

12. A 2 μC charge moving around a circle with a frequency of 6.25×10^{12} Hz produces a magnetic field 6.28 tesla at the centre of the circle. The radius of the circle is

(a) 2.25 m (b) 0.25 m (c) 13.0 m (d) 1.25 m

13. A current loop $ABCD$ is held fixed on the plane of the paper as shown in the figure. The arcs BC (radius = b) and DA (radius = a) of the loop are joined by two straight wires AB and CD. A steady current I is flowing in the loop. Angle made by AB and CD at the origin O is 30°. Another straight thin wire with steady current I_1 flowing out of the plane of the paper is kept at the origin.

The magnitude of the magnetic field (B) due to the loop $ABCD$ at the origin (O) is :



(a) $\frac{\mu_o I(b-a)}{24ab}$

(b) $\frac{\mu_o I}{4\pi}\left[\frac{b-a}{ab}\right]$

(c) $\frac{\mu_o I}{4\pi}[2(b-a)+\pi/3(a+b)]$

(d) zero

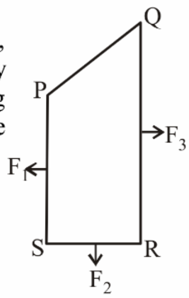
14. A galvanometer of resistance, G is shunted by a resistance S ohm. To keep the main current in the circuit unchanged, the resistance to be put in series with the galvanometer is

(a) $\frac{S^2}{(S+G)}$ (b) $\frac{SG}{(S+G)}$ (c) $\frac{G^2}{(S+G)}$ (d) $\frac{G}{(S+G)}$

RESPONSE GRID					
	5. ⓐⓑⓒⓓ	6. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ
	10. ⓐⓑⓒⓓ	11. ⓐⓑⓒⓓ	12. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ	14. ⓐⓑⓒⓓ

Space for Rough Work

15. 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 force on the segment QP is



(a) $F_3 - F_1 - F_2$
(b) $\sqrt{(F_3 - F_1)^2 + F_2^2}$
(c) $\sqrt{(F_3 - F_1)^2 - F_2^2}$
(d) $F_3 - F_1 + F_2$

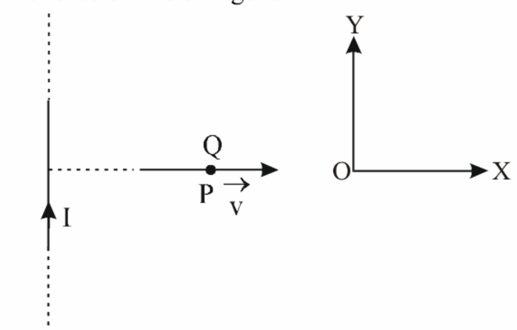
16. A beam of electrons is moving with constant velocity in a region having simultaneous perpendicular electric and magnetic fields of strength 20 Vm^{-1} and 0.5 T respectively at right angles to the direction of motion of the electrons. Then the velocity of electrons must be

(a) 8 m/s (b) 20 m/s (c) 40 m/s (d) $\frac{1}{40}$ m/s

17. A current I flows in an infinitely long wire with cross section in the form of a semi-circular ring of radius R. The magnitude of the magnetic induction along its axis is:

(a) $\frac{\mu_0 I}{2\pi^2 R}$ (b) $\frac{\mu_0 I}{2\pi R}$ (c) $\frac{\mu_0 I}{4\pi R}$ (d) $\frac{\mu_0 I}{\pi^2 R}$

18. 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



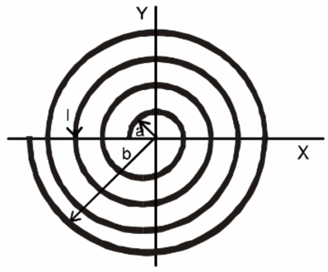
(a) along OY (b) opposite to OY
(c) along OX (d) opposite to OX

19. A particle of mass m and charge q, accelerated by potential difference V enters a region of uniform transverse magnetic field B. If d is the thickness of region of magnetic field, then the deviation of the particle from initial direction when it leaves the field is

(a) $\sin^{-1}\left[Bd\left(\frac{q}{2mV}\right)^{1/2}\right]$ (b) $\cos^{-1}\left[Bd\left(\frac{q}{2mV}\right)^{1/2}\right]$

(c) $\tan^{-1}\left[Bd\left(\frac{q}{2mV}\right)^{1/2}\right]$ (d) zero

20. A long insulated copper wire is closely wound as a spiral of 'N' turns. The spiral has inner radius 'a' and outer radius 'b'. The spiral lies in the XY plane and a steady current 'I' flows through the wire. The Z-component of the magnetic field at the centre of the spiral is



(a) $\frac{\mu_0 NI}{2(b-a)} \ell n\left(\frac{b}{a}\right)$

(b) $\frac{\mu_0 NI}{2(b-a)} \ell n\left(\frac{b+a}{b-a}\right)$

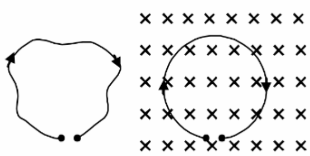
(c) $\frac{\mu_0 NI}{2b} \ell n\left(\frac{b}{a}\right)$

(d) $\frac{\mu_0 NI}{2b} \ell n\left(\frac{b+a}{b-a}\right)$

21. 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

(a) ω and q (b) ω, q and m
(c) q and m (d) ω and m

22. A thin flexible wire of length L is connected to two adjacent fixed points and carries a current I in the clockwise direction, as shown in the figure. When the system is put in a uniform magnetic field of strength B going into the plane of the paper, the wire takes the shape of a circle. The tension in the wire is



(a) IBL (b) $\frac{IBL}{\pi}$ (c) $\frac{IBL}{2\pi}$ (d) $\frac{IBL}{4\pi}$

RESPONSE GRID					
	15. ⓐⓑⓒⓓ	16. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ	18. ⓐⓑⓒⓓ	19. ⓐⓑⓒⓓ
	20. ⓐⓑⓒⓓ	21. ⓐⓑⓒⓓ	22. ⓐⓑⓒⓓ		

Space for Rough Work

23. A battery is connected between two points *A* and *B* on the circumference of a uniform conducting ring of radius r and resistance *R*. One of the arcs *AB* of the ring subtends an angle θ at the centre. The value of the magnetic induction at the centre due to the current in the ring is

(a) proportional to 2 (180° – θ)

(b) inversely proportional to r

(c) zero, only if θ = 180°

(d) zero for all values of θ

24. 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 path 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

(a) $1/R^2$ (b) R^2 (c) R (d) 1/R

25. A uniformly charged ring of radius 10 cm rotates at a frequency of 10^4 rps about its axis. The ratio of energy density of electric field to the energy density of the magnetic field at a point on the axis at distance 20 cm from the centre is 9.1×10^a. Find the value of a.

(a) 7 (b) 9 (c) 8 (d) 6

26. A cyclotron's oscillator frequency is 10 MHz. If the radius of its 'dees' is 60 cm, what is the kinetic energy of the proton beam produced by the accelerator ?

Given $e = 1.60 \times 10^{-19}$ C, $m = 1.67 \times 10^{-27}$ kg. 1 MeV = 1.6×10^{-13} J)

(a) 3.421 MeV (b) 4.421 MeV

(c) 5.421 MeV (d) 7.421 MeV

27. The deflection in a galvanometer falls from 50 division to 20 when a 12 ohm shunt is applied. The galvanometer resistance is

(a) 18 ohm (b) 36 ohm (c) 24 ohm (d) 30 ohm

28. When a long wire carrying a steady current is bent into a circular coil of one turn, the magnetic induction at its centre is B. When the same wire carrying the same current is bent to form a circular coil of n turns of a smaller radius, the magnetic induction at the centre will be

(a) B/n (b) nB (c) B/n^2 (d) n^2B

29. A charged particle moves through a magnetic field perpendicular to its direction. Then

(a) kinetic energy changes but the momentum is constant

(b) the momentum changes but the kinetic energy is constant

(c) both momentum and kinetic energy of the particle are not constant

(d) both momentum and kinetic energy of the particle are constant

30. 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

(a) straight line (b) circle

(c) helix (d) cycloid

RESPONSE GRID					
	23. ⓐⓑⓒⓓ	24. ⓐⓑⓒⓓ	25. ⓐⓑⓒⓓ	26. ⓐⓑⓒⓓ	27. ⓐⓑⓒⓓ
	28. ⓐⓑⓒⓓ	29. ⓐⓑⓒⓓ	30. ⓐⓑⓒⓓ		

DAILY PRACTICE PROBLEM DPP CHAPTERWISE CP18 - PHYSICS			
Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	40	Qualifying Score	50
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work