AS PER LATEST NTA NOTIFICATION

CHAPTER WISE TEST

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PHYSICS JEE MAIN (2025)

Topic – Moving Charges and Magnetism

Time Allowed: 60 mins **Maximum Marks: 100**

Instructions for the Candidate:

The Paper consist of 25(Twenty-Five) Question, which are divided in to two Sections
(a) Section A (MCQ's) Shall consist of 20 (Twenty) Questions. In which all are compulsory.
(b) Section B (NTA) Shall Consist of 5 (Five) Questions. In which all are compulsory.

Section – A (MCQ's)

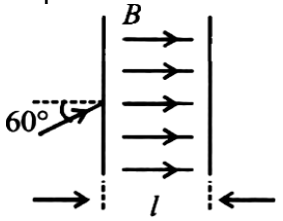
1. An electron having charge 1.6×10^{-19} C and a mass 9×10^{-31} kg is moving with 4×10^{6} ms^{-1} speed in a magnetic field 2×10^{-1} T in a circular orbit. The force acting on electron and the radius of the circular orbit will be respectively:
(A) 1.28×10^{-13} N, 1.1×10^{-3} m
(B) 1.28×10^{-13} N, 1.1×10^{-4} m
(C) 1.28×10^{-14} N, 1.1×10^{-4} m
(D) 1.28×10^{-14} N, 1.1×10^{-3} m

2. A north pole of strength 50 Am and south pole of strength 100 Am are separated by a distance of 10 cm in air. Find the force between them.
(A) 30×10^{-18} N (B) 20×10^{-6} N
(C) 25×10^{-3} N (D) 50×10^{-3} N

3. A proton (mass m and charge +e) and an alpha – particle (mass 4m and charge +2e) are projected with the same kinetic energy at right angles to a uniform magnetic field. Which one of the following statements will be true?
(A) The alpha – particle and the proton will go through the field in a straight line
(B) The alpha – particle will be bent in a circular path with a smaller radius than that of the proton.
(C) The radius of the path of the alpha – particle will be greater than that of the proton.
(D) The alpha – particle and the proton will be bent in a circular path with the same radius.

4. A current of 3 amp is flowing in a plane circular coil of radius 4 cm and number of turns 20. The coil is placed in a uniform magnetic field of magnetic induction 0.5 tesla. Then, the potential energy of the magnetic dipole in the position of stable equilibrium is:
(A) – 0.15 J (B) +1500 J
(C) – 1500 J (D) +0.15 J

5. The figure shows a region of length l with a uniform magnetic field of 0.3 T in it and a proton entering the region with velocity 4×10^{5} ms^{-1} making an angle 60º with the field. If the proton completes 10 revolution by the time it crosses the region shown, l is close to (mass of proton = 1.67×10^{-27} kg, charge of the proton = 1.6×10^{-19} C)

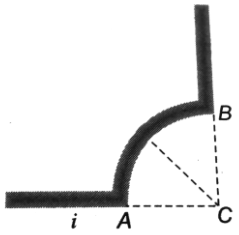


(A) 0.88 m (B) 0.44m
(C) 0.11 m (D) 0.22m

6. Which of the following is likely to have the largest resistance?
   (A) Voltmeter of range 10 V
   (B) A copper wire of length 1 m and diameter 3 mm
   (C) Ammeter of range 1 A
   (D) Moving coil galvanometer

7. The armature current in a DC motor is maximum when the motor has:
   i. picked up maximum speed
   ii. just started
   iii. intermediate speed
   iv. just been switched – of
   (A) i and ii (B) iii and iv
   (C) iv and i (D) only ii

8. A wife – carrying current I is shaped as shown in the figure, The section AB is a quarter circle of radius r. The magnetic field is directed:



   i. at an angle μ /4 to the plane of the paper
   ii. along the bisector of the angle ACB towards AB
   iii. along the bisector of the angle ACB away from AB
   iv. perpendicular to the plane of the paper and directed into the paper
   (A) only iii (B) ii and iii
   (C) iv and i (D) i and ii

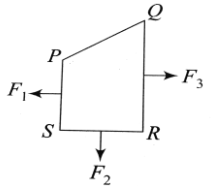
9. A certain region has an electric field $\vec{E} = \left(2\hat{i} - 3\hat{j}\right)$ N/C and a uniform magnetic field $\vec{B} = \left(5\hat{i} + 3\hat{j} + 4\hat{k}\right)$ T. The force experienced by a charge 1 C moving with velocity $\left(\hat{i} + 2\hat{j}\right)$ is:
   (A) $\left(10\hat{i} + 7\hat{j} + 7\hat{k}\right)$ (B) $\left(10\hat{i} + 7\hat{j} - 7\hat{k}\right)$
   (C) $\left(10\hat{i} - 7\hat{j} - 7\hat{k}\right)$ (D) $\left(-10\hat{i} + 7\hat{j} + 7\hat{k}\right)$

10. A circular coil of radius R carries an electric current. The magnetic field due to the coil at a point on the axis of the coil located at a distance r from the centre of the coil such that r >> R, varies as:
   (A) $\frac{1}{r^2}$ (B) $\frac{1}{r^3}$
   (C) $\frac{1}{r^{1/2}}$ (D) $\frac{1}{r}$

11. 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:
   (A) nB (B) $2n^2$ B
   (C) n^2 B (D) 2nB

12. The current sensitivity of a galvanometer can be increased by:
   A. decreasing the number of turns
   B. increasing the magnetic field
   C. decreasing the area of the coil
   D. decreasing the torsional constant of the spring
   Choose the most appropriate answer from the options given below:
   (A) (B) and (D) only (B) (A) and (C) only
   (C) (B) and (C) only (D) (C) and (D) only

13. 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:



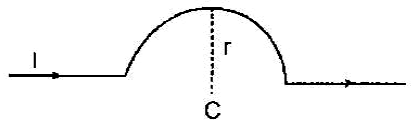
   (A) $F_3 - F_1 + F_2$ (B) $\sqrt{(F_3 - F_1)^2 - F_2^2}$
   (C) $\sqrt{(F_3 - F_1)^2 + F_2^2}$ (D) $F_3 - F_1 - F_2$

14. Which of the following particles will describe the smallest circle when projected with the same velocity perpendicular to the magnetic field?
(A) α – particle (B) Electron
(C) Proton (D) Deuteron

15. A charged particle is moving in a circular orbit of radius 6 cm with a uniform speed of 3×10^6 under the action of a uniform magnetic field 2×10^{-4} Wb/m^2 at right angles to the plane of the orbit. The charge to mass ratio is:
(A) 5×10^{12} C/kg (B) 5×10^{9} C/kg
(C) 5×10^{11} C/kg (D) 2.5×10^{11} C/kg

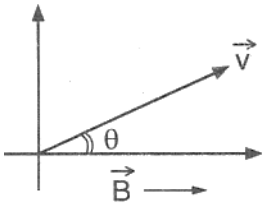
16. A moving coil galvanometer of resistance $100\,\Omega$ is converted to an ammeter by the resistance of 0.1 Ω in the circuit. Galvanometer gives full – scale deflection at 100 μ A. The minimum current in the circuit for maximum deflection is:
(A) 1000.1 mA (B) 1.001 mA
(C) 100.1 mA (D) 10.01 Ma

17. A straight thin conductor is bent as shown in the figure. It carries a current I ampere. The radius of the circular arc is r metre. Then, the magnetic induction at the centre of the semicircular arc is:



(A) $\frac{\mu_0}{4\pi}\left(\frac{\pi I}{r}\right) tesla$ (B) $\frac{\mu_0}{4\pi}\left(\frac{I}{r}\right) tesla$
(C) ∞ (D) Zero

18. A charged particle enters a region of uniform magnetic field B with velocity $\vec{v}$ at an angle θ as shown in the figure. Then the ratio of radius to pitch of the helix is:



(A) $\tan\theta$ (B) $\frac{\tan\theta}{2\pi}$
(C) $\cot\theta$ (D) $\frac{2\pi}{\tan\theta}$

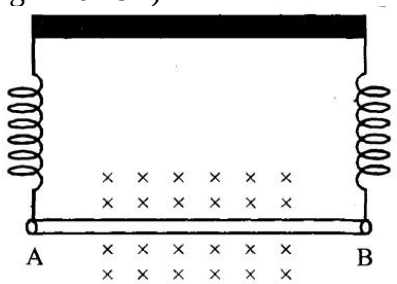
19. The magnetic dipole moment of a current loop is independent of:
(A) number of turns
(B) magnetic field in which it is lying
(C) area of the loop
(D) current in the loop

20. The magnetic field $\overrightarrow{dB}$ due to a small current element $\overrightarrow{dl}$ at a distance r and an element carrying current I is:
(A) $d\vec{B} = \frac{\mu_0 I^2}{4\pi}\left(\frac{\overrightarrow{dl}\times\vec{r}}{r}\right)$
(B) $d\vec{B} = \frac{\mu_0 I^2}{4\pi}\left(\frac{\vec{d}\times\vec{r}}{r^2}\right)$
(C) $d\vec{B} = \frac{\mu_0 I}{4\pi}\left(\frac{\overrightarrow{dl}\times\vec{r}}{r}\right)$
(D) $d\vec{B} = \frac{\mu_0 I}{4\pi}\left(\frac{\overrightarrow{dl}\times\vec{r}}{r^3}\right)$

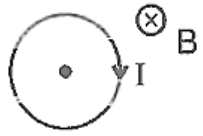
Section – B (NTA)

21. A charge particle of $2\,\mu$ C accelerated by a potential difference of 100 V enters a region of uniform magnetic field of magnitude 4 mT at right angle to the direction of field. The charge particle completes semicircle of radius 3 cm inside magnetic field. The mass of the charge particle is_____ $\times 10^{-18}$ kg.

22. 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 = 10ms^{-2})



23. A current I = 10 A flows in a ring of radius r = 15 cm made of a very thin wire. The tensile strength of the wire is equal to T_0 = 1.5 N. The ring is placed in a uniform magnetic field of strength B as shown in figure. Determine the value of B in tesla so that the ring is just going to rupture.



24. 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. 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 2 A. 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 $\frac{x}{130}$ N. The value of x is _____.

SPACE FOR ROUGH WORK