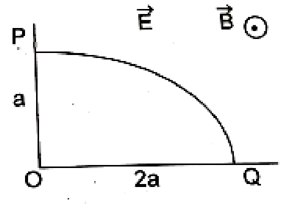
CPP
REVISION-2

MAGNETICS

Single Correct Answer Type:

1. A particle of charge +q and mass m moving under the influence of a uniform electric field $E\hat{i}$ and a uniform magnetic field $B\hat{k}$ follows a trajectory from P to Q as shown in figure.

The velocity at P and Q are $V\hat{i}$ and $-2V\hat{j}$. Which of the following statements/s is/are correct ?

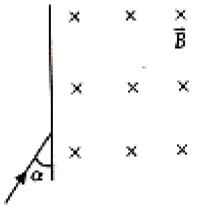


(A) E = 3/4 (mv^2/aq)
(B) Rate of work done by the electric field at P is 3/4 (mv^3/a)
(C) Rate of work done by the electric field at P is zero.
(D) Rate of work done by both of the fields at Q is zero.

2. 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 mass of X to that of Y is :

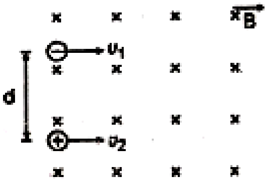
(A) $\left(\frac{R_1}{R_2}\right)^{1/2}$ (B) $\frac{R_2}{R_1}$ (C) $\left(\frac{R_1}{R_2}\right)^2$ (D) $\frac{R_1}{R_2}$

3. Find the time spent by the particle in the magnetic field. Mass and charges of the particle are given by m and q respectively.



(A) $\frac{2\pi m}{qB}$ (B) $\frac{2m\alpha}{qB}$
(C) $\frac{2\alpha m}{Bq\pi}$ (D) $\frac{\alpha m}{\pi qm}$

4. Two identical particles having the same mass m and charges + q and –q separated by a distance d enter in uniform magnetic field B directed perpendicular to paper inwards with speeds v_1 and v_2 as show in figure. The particles will not collide if : (Ignore electrostatic force)



(A) $d > \frac{m}{Bq}(v_1 + v_2)$ (B) $d < \frac{m}{Bq}(v_1 + v_2)$ (C) $d < \frac{2m}{Bq}(v_1 + v_2)$ (D) $v_1 = v_2$

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

(A) $-\frac{2v_0}{B_0\alpha}$ (B) $\frac{v_0}{B_0\alpha}$ (C) $\frac{2v_0}{B_0\alpha}$ (D) $-\frac{v_0}{B_0\alpha}$

6. A proton moving with a constant velocity passes through a region of space without change in its velocity. If E and B represent electric and magnetic field respectively, the region of space may not have

(A) E = 0, B = 0 (B) $E = 0, B \neq 0$ (C) $E \neq 0, B = 0$ (D) $E \neq 0, B \neq 0$

7. A uniform magnetic field $\vec{B} = B_0\hat{j}$ exists in space. A particle of mass m and charge q is projected towards negative x^{axis} with speed v from a point (d 0, 0). The maximum value of v for which the particle does not hit the y-z plane is :

(A) $\frac{2Bq}{dm}$ (B) $\frac{Bqd}{m}$ (C) $\frac{Bq}{2dm}$ (D) $\frac{Bqd}{2m}$

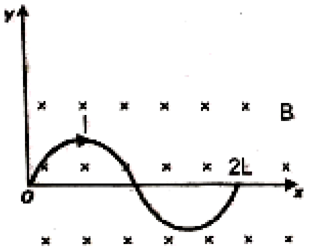
8. A particle of mass m and charge q moves with a constant velocity v along the positive x-direction. It enters a region containing a uniform magnetic field B directed along the negative z-direction, extending from x = a to x = b. The minimum value of v required so that the particle can just enter the region x > b is :

(A) $\frac{qbB}{m}$ (B) $\frac{q(b-a)B}{m}$ (C) $\frac{qaB}{m}$ (D) $\frac{q(b+a)B}{2m}$

9. The magnetic field existing in a region is given by $\vec{B} = B_0\left(1+\frac{x}{\ell}\right)\hat{k}$. A square loop of edge ℓ and carrying a current i, is placed with its edges parallel to the X-Y axes. Find the magnitude of the net magnetic force experienced by the loop.

(A) $3\,iB_0\ell$ (B) $2\,iB_0\ell$ (C) $iB_0\ell$ (D) None

10. A wire carrying a current I is placed in a uniform magnetic field in the form of the curve $I = a\sin\left(\frac{\pi X}{L}\right) O \le x \le 2L$. The force acting on the wire is found to be ….. times IBL.



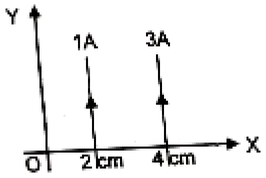
(A) 1 (B) 2

(C) 3 (D) 4

11. A rectangular coil of 100 turns has length 5 cm and width 4 cm. It is placed with its plane parallel to a uniform magnetic field and a current of 2 A is through the coil. Find the magnitude of the magnetic field B, if the torque acting on the coil is 0.2 N m.

(A) 0.5 T (B) 0.25 T (C) 0.1 T (D) 0.2 T

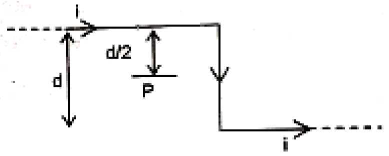
12. Two long parallel conductors are placed at right angles to a metre scale at the 2 cm and 6 cm marks, as shown in the figure, they carry currents of 1A and 3A respectively. They will produce zero magnetic field at the (ignore the earth's magnetic field)



(A) 5 cm mark (B) 3 cm mark

(C) 1 cm mark (D) 8 cm mark

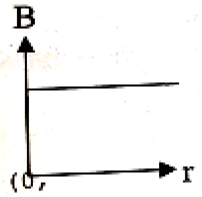
13. A wire in the shape shown in figure carries a current i. The magnetic filed B at point P is

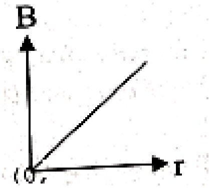


(A) $\frac{\mu_0 i}{\pi d}\left[2+\sqrt{2}\right]$ (B) $\frac{\mu_0 i}{2\pi d}\left[2+\sqrt{2}\right]$

(C) $\frac{2\mu_0 i}{\pi d}\left[2-\sqrt{2}\right]$ (D) None

14. A long straight thin conductor has a current of 'I' ampere. The magnetic induction B away from the conductor at a distance 'r' from its axis varies as shown in

(A)


(B)


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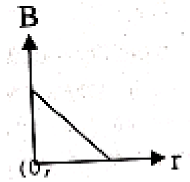
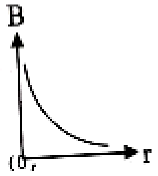


(D)


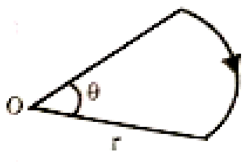
15. Two very long straight parallel wires carry steady currents I in the same direction. The distance between the wires is d. At a certain instant of time, a point charge q is at a point equidistant from the two wires, the plane of the wires. Its instantaneous velocity v is perpendicular to this plane. The magnitude of the force due to the magnetic field acting on the charge at this instant is

(A) $\frac{\mu_0 I \upsilon}{2\pi d}$ (B) $\frac{\mu_0 I q \upsilon}{\pi d}$ (C) $\frac{2\mu_0 I q \upsilon}{\pi d}$ (D) zero

16. Each of the two long, parallel wires, separated by a distance R, carries a current i. The magnetic field of one exerts a force F on the other. When R is increased to 2R and i is reduced to i/2, the force F becomes

(A) 4 F (B) F/2 (C) F/4 (D) F/8

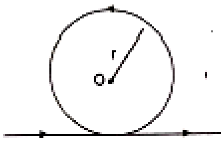
17. A wire bent in the form of a sector of radius r subtending an angle θ^0 at centre, as shown in figure is carrying a current i. The magnetic field at O is :



(A) $\frac{\mu_0 i}{2r}\theta$ (B) $\frac{\mu_0 i}{2r}(\theta/180)$

(C) $\frac{\mu_0 i}{2r}(\theta/360)$ (D) zero

18. An infinitely long straight conductor is bent into shape as shown in figure. It carries a current i amp, and the radius of circular loop is r metre. Then the magnetic induction at the centre of the circular loop is



(A) 0 (B) ∞

(C) $\frac{\mu_0 i}{2\pi r}(\pi+1)$ (D) $\frac{\mu_0 i}{2\pi r}(\pi-1)$

19. A long straight wire along the z-axis carries a current I in the negative z direction. The magnetic vector field $\vec{B}$ at a point having coordinates (x, y) in the z = 0 plane is ..

(A) $\frac{\mu_0 I(y\hat{i}-x\hat{j})}{2\pi(x^2+y^2)}$ (B) $\frac{\mu_0 I(x\hat{i}+y\hat{j})}{2\pi(x^2+y^2)}$ (C) $\frac{\mu_0 I(x\hat{j}-y\hat{i})}{2\pi(x^2+y^2)}$ (D) $\frac{\mu_0 I(x\hat{i}-y\hat{j})}{2\pi(x^2+y^2)}$

20. A magnet is suspended by a vertical string attached to its middle point. Find the position in which the magnet can stay in equilibrium. The horizontal component of earth's field is $25\pi T$ and its vertical component is $40\mu T$.

(A) $\tan^{-1}\left(\frac{5}{8}\right)$ (B) $\tan^{-1}\left(\frac{8}{5}\right)$ (C) $\sin^{-1}\left(\frac{5}{8}\right)$ (D) $\cos^{-1}\left(\frac{5}{8}\right)$

Numerical Based:

21. Two parallel, long wires carry currents $i_1 \& i_2 (i_1 > i_2)$ when the currents are in the same direction, the magnetic induction at a point midway between the two wires is X. If the direction of i_2 is reversed, the magnetic induction becomes 2x, then i_1 / i_2 is

22. If B_1 is the magnetic field induction at a point on the axis of a circular coil of radius R situated at a distance $R\sqrt{3}$ and B_2 is the magnetic field at the centre of the coil then $B_2 / B_1 =$

23. 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 3 turns. The magnetic field at the centre of coil will be ____ times of B.

24. The work done in turning a magnetic of magnetic moment M by an angle of 90° from the magnetic meridian is n times the corresponding work done in turning it through an angle of 60°. The value of n is

25. A magnet of pole strength 20 A-m and length 12cm is initially held normal to uniform field of magnetic induction 0.8 T, on releasing it reaches to the position parallel to the field with kinetic energy

KEY

1.	**D**	**2.**	**C**	**3.**	**B**	**4.**	**C**	**5.**	**C**
6.	**B**	**7.**	**B**	**8.**	**B**	**9.**	**C**	**10.**	**B**
11.	**A**	**12.**	**B**	**13.**	**D**	**14.**	**D**	**15.**	**D**
16.	**D**	**17.**	**C**	**18.**	**C**	**19.**	**A**	**20.**	**B**
21.	**3**	**22.**	**8**	**23.**	**9**	**24.**	**2**	**25.**	**1.92 J**

✤ *Wish You all the Best* ✤