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DPP – 4 (Magnetic Field & Force)

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Q 1. An electron is moving along positive x-axis. A uniform electric field exists towards negative y-axis What should be the direction of magnetic field of suitable magnitude so that net force on electron is zero?

(a) positive z-axis (b) negative z-axis

(c) positive y-axis (d) negative y-axis

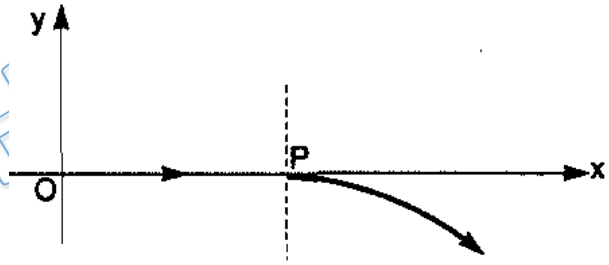
Q 2. A particle of charge q and mass m starts moving from the $\vec{E}$ = E$\hat{\imath}$ and magnetic field $\vec{B}$ = B$\hat{\imath}$ wth a velocity $\vec{v}$ = $v_0\hat{\jmath}$. The speed of the particle will become $2v_0$ after a time :

(a) $t = \frac{2mv_0}{qE}$ (b) $t = \frac{2Bq}{mv_0}$ (c) $t = \frac{\sqrt{3}Bq}{mv_0}$ (d) $t = \frac{\sqrt{3}mv_0}{qE}$

Q 3. A particle of specific charge (charge/mass) a starts moving from the origin under the action of an electric field $\vec{E} = E_0\hat{\imath}$ and magnetic field $\vec{B} = B_0\hat{k}$. Its velocity at (x_0, 0, 0) is $(4\hat{\imath} + 3\hat{\jmath})$. The value of x_o is :

(a) $\frac{13}{2}\frac{\alpha E_0}{B_0}$ (b) $\frac{16\alpha B_0}{E_0}$ (c) $\frac{25}{2\alpha E_0}$ (d) $\frac{5\alpha}{2B_0}$

Q 4. For a positively charged particle moving in a x –y plane initially along the x-axis, there is a sudden change in its path due to the presence of electric and/or magnetic fields beyond P. The curved path is shown in the x - y plane and is found to be non-circular. Which one of the following combinations is possible?



(a) $\vec{E} = 0; \vec{B} = b\hat{\jmath} + c\hat{k}$ (b) $\vec{E} = a\hat{\imath}; \vec{B} = c\hat{k} + a\hat{\imath}$

(c) $\vec{E} = 0; \vec{B} = c\hat{\jmath} - b\hat{k}$ (d) $\vec{E} = a\hat{\imath}; \vec{B} = c\hat{k} + b\hat{\jmath}$

Q 5. A proton enters in a uniform electric and magnetic fields $\vec{E}$ and $\vec{B}$ respectively. Velocity of proton is $\vec{v}$. All three vectors are mutually perpendicular. The proton is deflected along positive x-axis when either of the fields or both are switched on simultaneously. Which of the following statement(s) is/are correct?

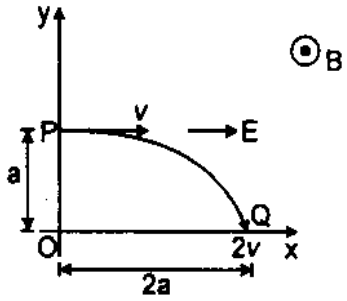
(a) $\vec{v}$ may be along positive y-axis

(b) $\vec{E}$ is along positive x-axis

(c) $\vec{B}$ may be along positive z-axis

(d) $\vec{B}$ may be along negative y-axis

Q 6. A particle of charge +q and mass m moving under the influence of a uniform electric field E$\hat{\imath}$ and uniform magnetic field B $\hat{k}$ follows a trajectory from P to Q as shown in figure. The velocities at P and Q are v$\hat{\imath}$ and – 2v$\hat{\jmath}$. Which of the following statements is/are correct?



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

(b) Rate of work done by the electric field at P is $\frac{3}{4}\left(\frac{mv^2}{a}\right)$

(c) Rate of work done by electric field at P is zero

(d) Rate of work done by both the fields at Q is zero

Q 7. In a certain region of space, electric and magnetic fields are crossed

(a)A charged particle moves undeflected in the region only if $\vec{V}$ is perpendicular $\vec{E}$ to $\vec{B}$ both

(b)A charged particle must move undeflected in the region, if $\vec{V}$ is perpendicular $\vec{E}$ to $\vec{B}$ both

(c)A positron moves undeflected if its velocity is $\vec{V}$, for an electron to move undeflected its velocity must be - $\vec{V}$.

(d)A charged particle may move undeflected even if it is not moving with $\vec{V}$ perpendicular to $\vec{B}$

Q 8. A charged particle goes undeflected in a region containing electric and magnetic field. It is possible that -

(a) $\vec{E}||\vec{B}$, $\vec{v}||\vec{E}$

(b) $\vec{E}$ is not parallel to $\vec{B}$

(c) $\vec{v}||\vec{B}$ but $\vec{E}$ is not parallel to $\vec{B}$

(d) $\vec{E}||\vec{B}$ but $\vec{v}$ is not parallel to $\vec{E}$

Comprehension(Q.9 to Q.11)

A particle having charge q = 1C and mass m = 1 kg is released from rest at origin. There are electric and magnetic fields given by :

$\vec{E} = (10\hat{\imath})$ N/C for x £ 1.8 m and $\vec{B} = (-5\hat{k})T$ for 1.8 m £ x £ 2.4 m

A screen is placed parallel to y – z plane at x = 3.0 m. Neglect gravity forces.

Q 9. The speed with which the particle with collide the screen (in m/s) is :

(a) 3 (b) 6 (c) 9 (d) 12

Q 10. y-coordinate of particle where it collides with the screen is ..... m.:

(a) $\frac{0.6(\sqrt{3}-1)}{\sqrt{3}}$ (b) $\frac{0.6(\sqrt{3}+1)}{\sqrt{3}}$

(c) 1.2 $(\sqrt{3}+1)$ (d) $\frac{1.2(\sqrt{3}-1)}{\sqrt{3}}$

Q 11. Time after which the particle will collide the screen is ..... second –

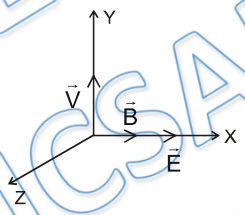
(a) $\frac{1}{5}\left(3+\frac{\pi}{6}+\frac{1}{\sqrt{3}}\right)$ (b) $\frac{1}{5}\left(6+\frac{\pi}{3}+\sqrt{3}\right)$

(c) $\frac{1}{3}\left(5+\frac{\pi}{6}+\frac{1}{\sqrt{3}}\right)$ (d) $\frac{1}{3}\left(6+\frac{\pi}{18}+\sqrt{3}\right)$

Q 12. Column I lists the field in a region and Column II lists the path of a charge q and mass m on which the particle can move. Match the appropriate entries of Column II with entries of Column I. [Consider all fields to be uniform]

Column I	**Column II**
(A) Only uniform electric field $\vec{E}$ is present	(p)The particle can move on straight line
(B) Only uniform magnetic field $\vec{B}$ is present	(q)The particle can move on circle
(C) Only uniform gravitational field $\vec{g}$ is present	(r)The particle can move on parabolic path
(D) Both uniform $\vec{E}$ and uniform $\vec{B}$ are present	(s)The particle can remain in rest
	(t)The particle can move in a helical path of constant pitch

Q 13. A particle of charge = 1μC and mass m = 1 gm starts moving from origin at t = 0 under an electric field of 10^3 N/C along x-axis and magnetic field of 10 tesla along the same axis with the velocity of $\vec{v} = 20\hat{j}$ m/sec as shown, the speed of the particle at the time of $20\sqrt{3}$ sec will be :



(a) 20 m/sec (b) 40 m/sec (c) 10 m/sec (d) None

Q 14. A positively charge particle is projected from origin with speed 8m/sec at an angle π/3 with + x axis and π/6 with +y axis. There are unifom electric and magnetic field along -x axis and + x axis respectvely. If B= 1T and E = 1N/c and π = 22/7

(a) Charge will return to origin after some time.

(b) Its kinetic energy will first decrease then increase.

(c) charge will cross yz plane with positive y coordinate.

(d)Nothing can be said as charge and mass are not given

Answer Key

Q.1 a	Q.2 d	Q.3 c	Q.4 b	Q.5 a, b, c
Q.6 a, b, d	Q.7 d	Q.8 a, b	Q.9 b	Q.10 d
Q.11 a	Q.13 b	Q.14 b,c		

Q.12 A(p, r), B(p, q, s, t), C(p, r), D(p)