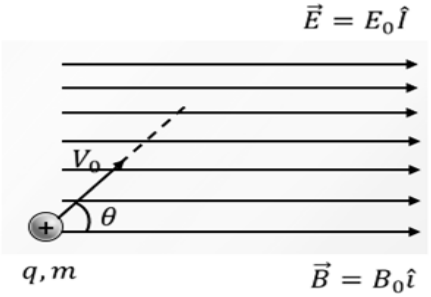
Chapter

Magnetism

Exercise

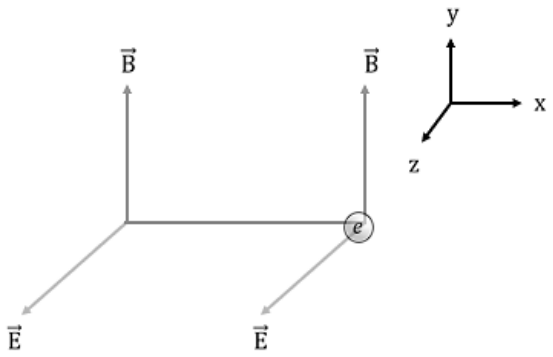
Q.1 A positive charge particle is projected in a region containing uniform electric and magnetic fields with a velocity vo as shown in figure. The acceleration of particle at time t can be expressed as: (The symbols used have usual meaning)



(A) $\frac{2qE}{m}\hat{\imath} - \omega^2 R\cos\omega t\,\hat{k}$ **(B)** $\frac{qE}{m}\hat{\imath} + \omega^2 R\left[-\sin\omega t\hat{j} + \cos wt\hat{k}\right]$

(C) $\frac{qE}{m}\hat{\imath}$ **(D)** $\frac{qE}{2m}\hat{\imath} + \omega^2 R\left[\sin\omega t\hat{j} - \cos\omega t\hat{k}\right]$

Q.2 A beam of electrons is moving with constant velocity in a region having electric and magnetic fields of strength 20 Vm^{-1} and 0.5 T at right angles to the direction of motion of the electrons. What is the velocity of the electrons ?



(A) 8 ms^{-1} **(B)** 5.5 ms^{-1} **(C)** 20 ms^{-1} **(D)** 40 ms^{-1}

Q.3 An electron of mass m = 9.1 × 10^{-31} kg charge q = -1.6 × 10^{-19} C experiences no deflection, if subjected to an electric field of E = 3.2 × 10^5 V/m and a magnetic field of B = 2 .0 × 10^{-3} Wb/(m^2) Both the fields are normal to the path of electrons and to each other. If the electric field is removed, then the electron will revolve in an orbit of radius?

(A) 45 m **(B)** 4.5 m **(C)** 0.45 m **(D)** 0.045 m

Q.4 An electron and a proton enter a region of uniform magnetic field in a direction perpendicular to the field with the same kinetic energy. They revolve in circular paths of radii r_e and r_p respectively. Then

(A) $r_e = r_p$ **(B)** $r_e < r_p$

(C) $r_e > r_p$ **(D)** r_e may be less or greater than r_p

Q.5 A cyclotron can accelerate

(A) neutrons **(B)** a-particles

(C) High velocity y-particles **(D)** High velocity x-rays

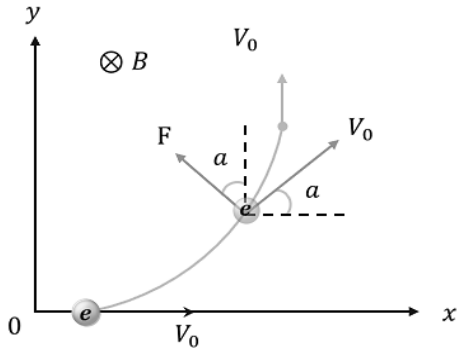
Q.6 A proton of energy 100 eV is moving perpendicular to a magnetic field of 10^{-4} T. The cyclotron frequency of the proton in rad/sec is:

(A) 2.8×10^6 **(B)** 9.6×10^6 **(C)** 5.6×10^6 **(D)** 1.76×10^6

Q.7 The approximate operating magnetic field for accelerating protons in a cyclotron oscillator having frequency of 12 MHz is:

(A) 0.790 T **(B)** 0.690 T **(C)** 0.395 T **(D)** 0.345 T

Q.8 If a charged particle (q, m) enters into the transverse magnetic field at origin with velocity $v_0\,\hat{i}$, then find the maximum possible positive x-coordinate of the particle, if the magnetic field is given as; $B = B_0 x\,(-\hat{k})$, $x \geq 0$,

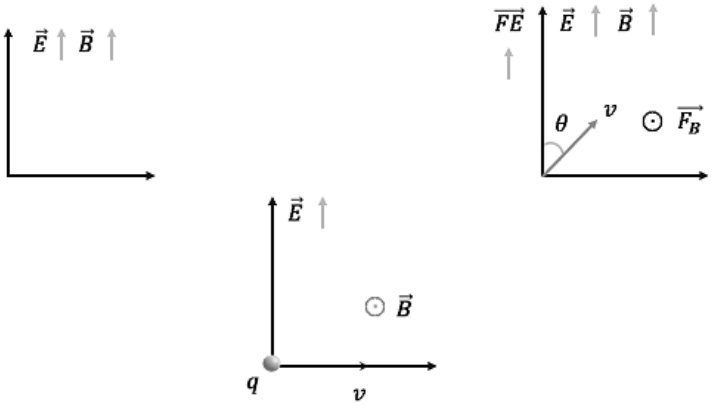


(A) $\frac{2mv_0}{qB_0}$ **(B)** $(\frac{2mv_0}{qB_0})^{1/2}$ **(C)** $(\frac{2mv_0}{qB_0})^{3/2}$ **(D)** $(\frac{mv_0}{2qB_0})^{3/2}$

Q.9 A device uses hall effect to measure magnetic fields. When in a magnetic field of 200 G, it gives a hall voltage of 16 μV. If with the same current and orientation, it gives a hall voltage of 23 μV in an unknown field, then the magnitude of unknown field is

(A) 28.8 G **(B)** 0.288 G **(C)** 288 G **(D)** 2.88 G

Q.10 A charged particle goes undeflected in a region containing electric and magnetic fields. It is possible that



(A) $\vec{E} || \vec{B}, \vec{V} \,|||\, \vec{E}$ **(B)** $\vec{E}$ is not parallel to $\vec{B}$

(C) $\vec{V} \parallel \vec{B}, \vec{E}$ is not parallel to $\vec{B}$ **(D)** $\vec{E} || \vec{B}$, but $\vec{V}$ is not parallel to $\vec{B}$

ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(B)	(D)	(C)	(B)	(B)	(B)	(A)	(C)	(C)	(A), (B)