DPP – 4 (Magnetic Field & Force)

Video Solution on Website:- https://physicsaholics.com/home/courseDetails/34

Video Solution on YouTube:- https://youtu.be/21k4wMpRxBc

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Q 1. Lorentz force can be calculated by using the formula
(where the symbols have their usual meaning)
(a) $\vec{F} = q\left(\vec{E} + (\vec{V} \cdot \vec{B})\right)$ (b) $\vec{F} = q\left(\vec{E} - (\vec{V} \times \vec{B})\right)$
(c) $\vec{F} = q\left(\vec{E} + (\vec{V} \times \vec{B})\right)$ (d) $\vec{F} = q(\vec{E} \times \vec{B} + \vec{V})$

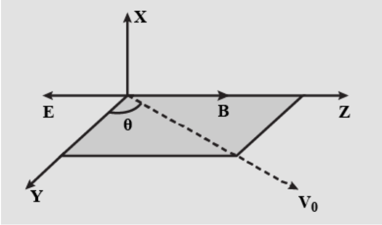
Q 2. A proton moving with a constant velocity passes through a region of space without any change in its velocity. If $\vec{E}$ and $\vec{B}$ represent the electric and magnetic fields respectively, then this region of space may not have:
(a) $\vec{E} = 0,\ \vec{B} = 0$ (b) $\vec{E} = 0,\ \vec{B} \neq 0$
(c) $\vec{E} \neq 0,\ \vec{B} = 0$ (d) $\vec{E} \neq 0,\ \vec{B} \neq 0$

Q 3. A proton beam (mass of proton = m) passes without deviation through a region of space where there are uniform transverse mutually perpendicular electric and magnetic field with magnitude E and B. Then the beam strikes a grounded target. Find the force imparted by the beam on the target if the beam current is equal to I ?
(a) $\frac{mEI}{Be}$ (b) $\frac{meI}{BE}$ (c) $\frac{2mEI}{Be}$ (d) $\frac{2meI}{BE}$

Q 4. A non-relativistic proton beam passes without deviation through a region of space where there are uniform transverse mutually perpendicular electric and magnetic fields with E = 120 kV/m and B = 50 mT. Then the beam strikes a grounded target. Find the force which the beam acts on the target if the beam current is equal to I = 0.8 mA. (mass of proton = 1.67×10^{-27}Kg)
(a) 20 μN (b) 2 μN
(c) 15 μN (d) 32 μN

Q 5. In a region of space, both electric and magnetic field are present simultaneously in opposite direction. A positively charged particle is projected with certain speed an angle $\theta(<90^0)$ with magnetic field. It will move in a
(a) Helical path of uniform pitch
(b) Helical path of increasing pitch
(c) Helical path of decreasing pitch
(d) Helical path, whose pitch first decreases and then increases

Q 6. In a certain region uniform electric field E and magnetic field B are present in the opposite direction. At the instant t = 0, a particle of mass m carrying a charge q is given velocity V_o at an angle θ, with the y axis, in the yz plane. The time after which the speed of the particle would be minimum is equal to:



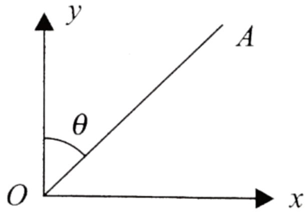
(a) $\frac{mV_0}{qE}$
(b) $\frac{mV_0 \sin\theta}{qE}$
(c) $\frac{mV_0 \cos\theta}{qE}$
(d) $\frac{\pi mV_0 \sin\theta}{qE}$

Q 7. A charged particle is at rest in the region where magnetic field and electric field are parallel. The particle will move in a
(a) Straight line (b) Circle
(c) Ellipse (d) Helical path

Q 8. A particle of mass 1×10^{-26}kg and charge $+1.6 \times 10^{-19}$C travelling with a velocity of 1.28×10^6 m/s along positive direction of x-axis enters a region in which a uniform electric field $\vec{E}$ and a uniform magnetic field $\vec{B}$ are present such that $E_x = E_y = 0, E_z = -102.4\ kV/m$ and $B_x = B_z = 0$, $B_y = 8 \times 10^{-2}\ Wb/m^2$. The particle enters this region at origin at time t=0. Then
(a) Net force acts on particle along the +ve z-direction
(b) Net force acts on the particle along –ve z-direction
(c) Net force acts on the particle is zero
(d) Net force acts in x-z plane

Q 9. A charged particle moves undeflected in a region of crossed electric and magnetic fields. If the electric field is switched off, the particle has an initial acceleration `a`. If the magnetic field is switched off, instead of electric field, the particle will have an initial acceleration (magnitude)
(a) Equal to 0 (b) > a
(c) Equal to a (d) < a

Q 10. A uniform magnetic field B_0 and electric field E_0 exist along y and negative z axis respectively. Under the influence of these field a charge particle moves along OA undeflected. If electric field is switched off, find the pitch of helical trajectory in which the particle will move.



(a) $\frac{2\pi m E_0}{q B_0^2 \tan\theta}$ (b) $\frac{2\pi m E_0}{q B_0^2 \cot\theta}$

(c) $\frac{4\pi m E_0}{q B_0^2 \tan\theta}$ (d) $\frac{4\pi m E_0}{q B_0^2 \cot\theta}$

Q 11. A moving charge will gain energy due to the application of

(a) Electric field (b) Magnetic field

(c) Both of these (d) None of these

Q 12. An electron (mass = 9.1×10^{-31}kg ; charge = 1.6×10^{-19}C experiences no deflection if subjected to an electric field of 3.2×10^5 V/m, and a magnetic fields of $2.0 \times 10^{-3}\ Wb/m^2$. Both the fields are normal to the path of electron 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

Answer Key

Q.1 c	Q.2 c	Q.3 a	Q.4 a	Q.5 d
Q.6 b	Q.7 a	Q.8 c	Q.9 c	Q.10 a
Q.11 a	Q.12 c			