H.W

Home - Assignment

Date 8.7.24
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1.) Given :-

Charge of particle = q

velocity of particle = v

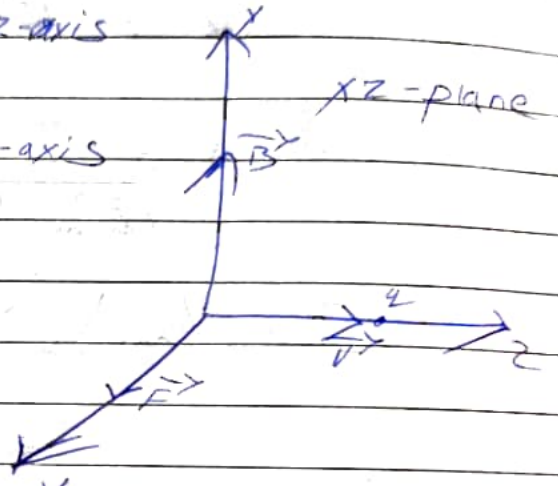
Here,

motion of charge is along z-axis

So, $\vec{v} = v\hat{k}$

magnitude along field is along x-axis

So, $\vec{B} = B\hat{i}$



Now,

$\vec{F} = q(\vec{v} \times \vec{B})$

$= q(v\hat{k} \times B\hat{i})$

$= qvB(\hat{k} \times \hat{i})$

$= qvB(\hat{j})$

∴ Direction of the magnetic force is along Y-axis

a) Now,

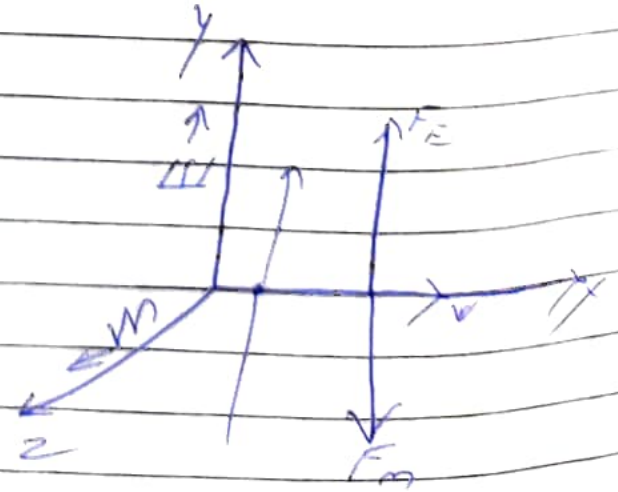
A beam of proton passes an electric horizontally with a velocity v through a region of the electric field and magnetic field mutually perpendicular to each other and normal to the direction of the beam.

So,

As the beam of proton passed undeflected without having any effect of electric and magnetic field.

Then

the force due to the magnetic field and the electric field have the same magnitude



Hence,

$F_E = F_m$

$\Rightarrow qE = qvB\sin 90^\circ$

$\Rightarrow E = vB$

$\Rightarrow v = \frac{E}{B} = \frac{100 \times 10^3}{50 \times 10^{-3}}$

$= 2 \times 10^6 \text{ m/s}$

b) Given,

Current in proton beam = $0.8 \text{ mA} = 8 \times 10^{-4} \text{ A}$

Here,

The beam strikes the screen with a constant velocity because, the magnetic field and electric field will have no effect on it.

So, the force exerted on the screen due to the beam of protons is zero.

2) Given;

A beam of α-particles projected along +x axis experiences force.

So, the direction of motion of particle is along +x-axis

∴ The velocity of α-particles.

$\vec{v} = v\hat{i}$

Magnetic force experienced by the α-particle is along +y axis.

∴ The magnetic force of α-particle

$\vec{F_m} = F_m(\hat{j})$

3.) One tesla is that magnetic field in which a charge of 1C moving with a velocity of 1 ms^{-1} at right angles to the field experiences a force of 1N

4.) The electron will move in a circular path with higher frequency on the opposite direction of the current.

5.) The trajectory for the first proton with motion normal to field is circular & the trajectory for the second proton, making 30° with the field is helical.