8.7.21

Home Assignment

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

Given $\vec{v} = v\vec{k}$, $\vec{B} = B\vec{i}$

$\vec{F} = q(v\vec{k}) \times (B\vec{i}) = qvB\vec{j}$

That is a force acting along y-axis.

a) For a beam of charged particle to pass under ~~flected~~ cross electric & magnetic field, the condition is that electric & magnetic forces on the beam must be equal & opposite i.e

$eE = eVB$

$V = \frac{E}{B}$

Given $E = 100\ KV/m = 100 \times 10^3$

$B = 50 \times 10^{-3} T$

$V = \frac{100 \times 10^3}{50 \times 10^{-3}} = 2 \times 10^6\ ms^{-1}$

b) The beam strikes the target with a constant velocity, So, force exerted on the target is 0. However, if proton beam comes to rest, it exerts a force on the target equal to rate of change of linear momentum of the beam i.e

$F = \frac{\Delta p}{\Delta t} = \frac{mv}{\Delta t} = \frac{mv}{q/i} = \frac{mvi}{q} = \frac{mvi}{ne}$

2) By Flemings left hand rule, magnetic field must be along negative Z-axis.

3) When a charge of 1C, moving with velocity 1m/s, normal to magnetic field, experiences a force 1N, the magnetic field is said to be 1 Tesla.

4) Electron moves in a circular path with a higher frequency

$\frac{mv^2}{r} = qvB$, $r = \frac{mv}{qB}$

$$\omega = \frac{V}{r} = \frac{qB}{m}$$

$$\omega = 2\pi f \Rightarrow \frac{qB}{m} = 2\pi f = f \propto \frac{1}{m}$$

Since $m_e < m_p$ therefore $f_e > f_p$

Thus electron move in circular path with higher frequency.

5) When an electron enters normal to the field direction, the trajectory is circular.

When an electron enters 30° to the field direction, the trajectory is helical.