7/21

Home Assignment :

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

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

$= qvB\hat{j}$

∴ Force is acting along Y axis.

ii) For a beam of particle to be undeflected, the electric and magnetic forces on the beam is equal and opposite.

$$eE = evB$$

$$\Rightarrow v = \frac{E}{B}$$

$E = 100\ KV/m = 100 \times 10^3\ V/m \qquad B = 50\ mT = 50 \times 10^{-3}\ T$

$$v = \frac{1 \times 10^5}{50 \times 10^{-3}} = 0.02 \times 10^8$$

$$= 2 \times 10^6\ ms^{-1}$$

The beam strikes the target with constant v so force is zero. If it comes to rest, the force on the target is equal to rate of change of linear momentum of the beam.

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

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

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

∴ Magnetic field is along -ve z axis.

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

$$B = \frac{f}{qv\sin\theta}$$

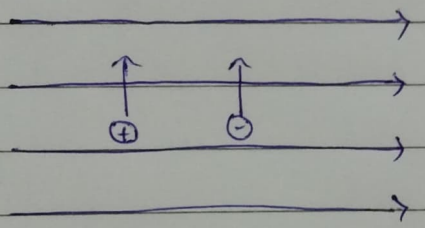
If $f = 1N$, $q = 1C$, $v = 1 ms^{-1}$, $\theta = 90°$

$$B = \frac{1N}{1C \cdot 1 ms^{-1} \cdot \sin 90°}$$

$$= 1 N A^{-1} m^{-1}$$

$$= 1 T$$

4)



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

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

∴ As electron is lighter in mass, it moves with a greater frequency.

5) When it enters normal to the field, it follows a circular path whereas when it enters at 30° to the field direction, it follows a helical path.