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

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

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

That is, force is acting along y-axis.

a) For a ~~b~~ α of charged particles to pass undeflected crossed electric and magnetic field, the condition is that electric and magnetic forces on the α must be equal and opposite i.e,

$$eE = evB$$

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

Given, $E = 50k\ V/m = 50 \times 10^3\ V/m$, $B = 50\ mT$
$= 50 \times 10^{-3}\ T$

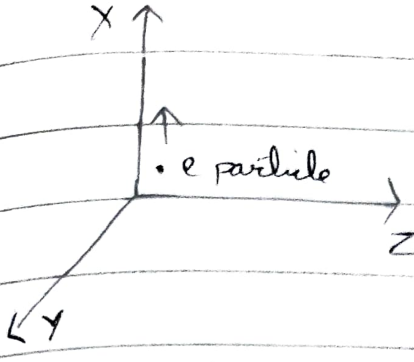
$$v = \frac{50 \times 10^3}{50 \times 10^{-3}} = 1 \times 10^6\ ms^{-1}$$

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

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

where n is the number of protons striking the target per ~~sec~~ second.

2.



By Fleming's left hand rule magnetic field must be along negative Z-axis.

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

4. Mass of electron is low as compared to proton. Hence, when both entre into the uniform magnetic region, the electron will move in a circular path with higher frequency on the opposite direction to the current.

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.