9-7-21

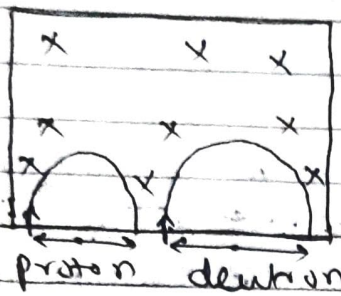
1) $r = \frac{1}{B}\sqrt{\frac{2mV}{q}}$

$\therefore r \propto \sqrt{V}$

$\frac{r'}{r} = \sqrt{\frac{2V}{V}} = \sqrt{2} \Rightarrow r' = \sqrt{2}r$

The radius becomes $\sqrt{2}$ of original radius.

2)



Mass of deutron = 2m

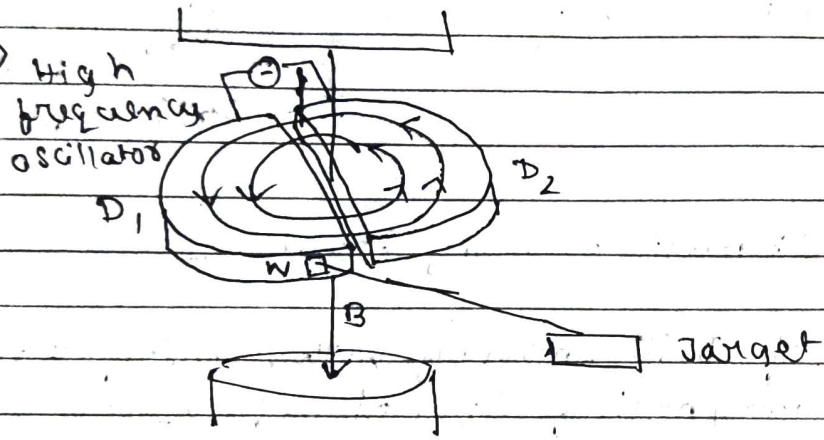
" " proton = m

$R(\text{proton}) = \frac{mV}{qB}$

$R(\text{deutron}) = \frac{2m \times V}{qB}$

$\text{Ratio}\left(\frac{\text{proton}}{\text{deutron}}\right) = \frac{1}{2}$

3)



A charged particle can be accelerated to high speeds by passing it through electric field many number of times and at the same time magnetic field makes the charged particle to move in a circular path.

$qVS\!\!\!/ = qVB\sin 90^\circ = \frac{mv^2}{r} \Rightarrow r = \frac{mV}{qB}$

$T = \frac{2\pi r}{V} = \frac{2\pi}{V} \cdot \frac{mV}{qB} = \frac{2\pi m}{qB}$

$f = \frac{1}{T} = \frac{qB}{2\pi m}$ [Thus frequency is independent of radius and velocity of particle]

4. i) m_p → mass of proton mass of alpha particle = m
q → charge " " charge " " " = q

$$\nu = \frac{Bq}{2\pi m} \Rightarrow \nu \propto \frac{q}{m}$$

For proton: Frequency, $\nu_p \propto \frac{q}{m_p}$

For alpha particle: $\nu_\alpha \propto \frac{2q}{2m}$

Thus, particles will not accelerate with same cyclotron frequency. The frequency of proton is twice the frequency of alpha particle.

ii) $$v = \frac{Bqr}{m} \Rightarrow v \propto \frac{q}{m}$$

$$v_p \propto \frac{q}{m} \qquad v_\alpha \propto \frac{q}{2m}$$

Thus particle will not exit the dees with same velocity. $v_p = 2 v_\alpha$

5)