HOME ASSIGNMENT

(1) Radius of the circular path = $r' = \sqrt{2}R$

According to question the Potential energy of the proton is converted into Kinetic energy.

$\frac{1}{2} m_p v^2 = eV$

$v = \sqrt{\frac{2eV}{m_p}}$ Now, If V is doubled

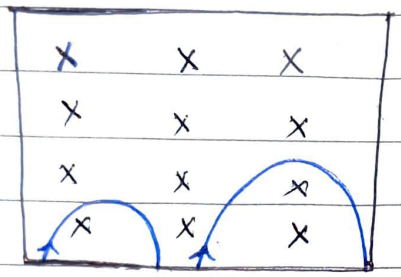
$v = \sqrt{\frac{2e\,2V}{m_p}} = \sqrt{2}v$

Radius of given path will be:

$qvB = m_p v / r$

$r = \frac{m_p v}{qvB}$ $\quad r' = \frac{m_p \times 2V}{qvB} = \sqrt{2}r$ $\quad \boxed{r' = \sqrt{2}r}$

(2)



proton deutron

Mass of deutron = $2m$

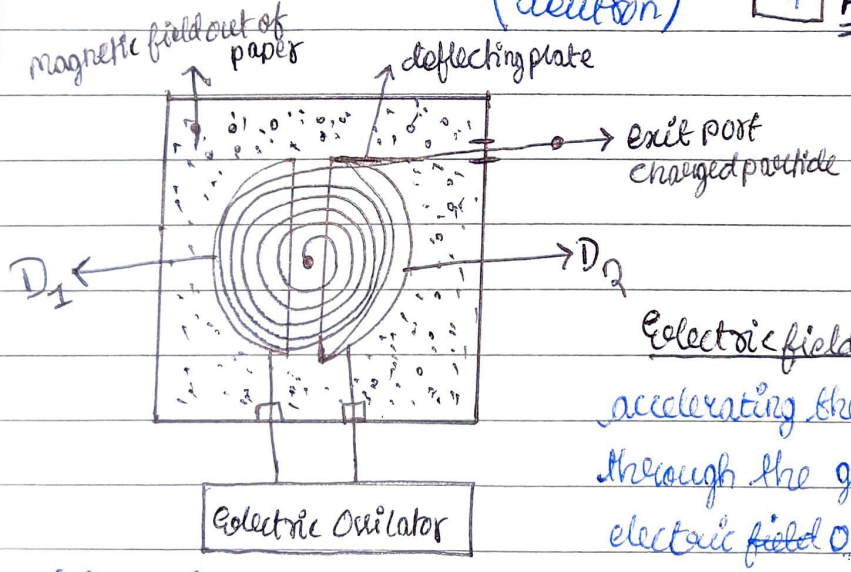
" " proton = m

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

$R(\text{deuteron}) = \frac{2m \times v}{qB}$

$\text{Ratio}\left(\frac{\text{Proton}}{\text{deuteron}}\right) = \boxed{\frac{1}{2}}$ Ans

(3)



Electric field: It helps in accelerating the charged particle through the gap with the help of electric field oscillator. Electric oscillator imparts the energy to charged particle till it comes out from the exit port.

Magnetic field: The magnetic field force exerts a centripetal force when the accelerated charge particle enters normally to the uniform magnetic field. Centripetal force makes the particle move in a semicircular path of increasing radii in each Dee. $qvB = \frac{mv^2}{r}$ $\quad v = \frac{qBr}{m}$ — (1) $\quad KE = \frac{1}{2}\frac{q^2B^2r^2}{m}$ — (2)

(4) i) Using eqn (1)

$$v = \frac{qBr}{m} \qquad v = r\omega = \frac{qBr}{m}$$

$$2\pi\nu = \frac{qB}{m}$$

$$\nu = \frac{qB}{2\pi m}$$

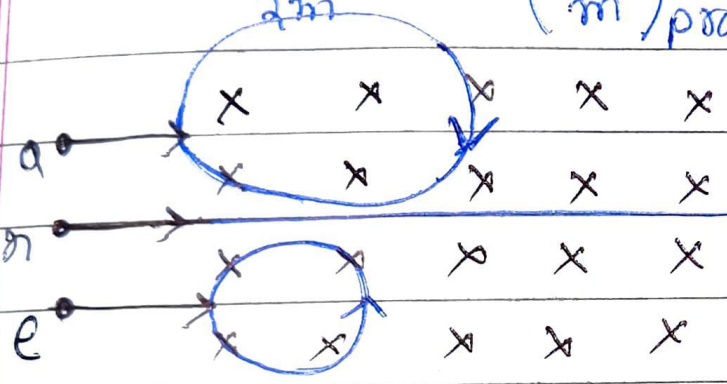
Cyclotron frequency depend upon $\frac{q}{m}$ ratio

$$\left(\frac{q}{m}\right)_d < \left(\frac{q}{m}\right)_p$$

$$\boxed{\nu_d < \nu_p}$$

ii) $K = \frac{q^2B^2r^2}{2m}$ $\qquad \left(\frac{q^2}{m}\right)_{proton} > \left(\frac{q^2}{m}\right)_d$ proton requires higher velocity.

(5)



$d \rightarrow$ circular path (clockwise) deviation $(\vec{v} \times \vec{B})$

$n \rightarrow$ undeviated ($\vec{B}$ has no effect)

$e \rightarrow$ circular path (anticlockwise) small radius due to large $\left(\frac{q}{m}\right)$ ratio $\left[r = \frac{mv}{qB}\right]$ deviation opposite to $(\vec{v} \times \vec{B})$