Assignment

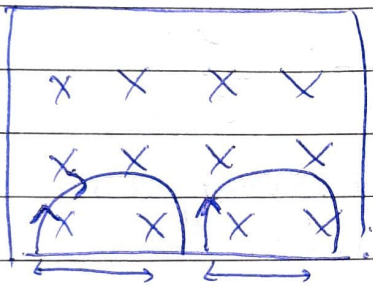
(1) We know that radius of circular path

$$r = \frac{mv}{qB} = \sqrt{\frac{2mV}{qB^2}}$$

So, if accelerating voltage is double; $V_0 = 2V$, then obviously

$$\frac{r_0}{r} = \sqrt{\frac{V_0}{V}} = \sqrt{\frac{2V}{V}} \quad \Big| \quad r_0 = \sqrt{2}\,r$$

(2)



mass of deutron → 2m
mass of proton → m

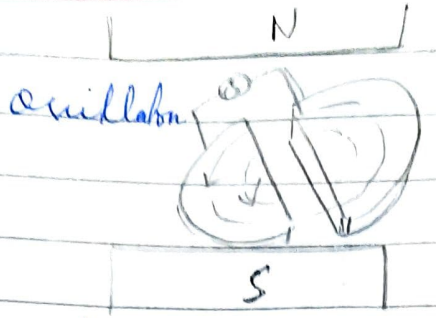
$\therefore R(\text{proton}) = \frac{mv}{qB}$

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

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

(3) Cyclotron: Is a device by which the positive charged particles like protons, deutrons, can be accelerated.

Principle: Cyclotron works on the principle that a positively charged particles can be accelerated by making it to cross the same elec. field repeatedly with help of magnetic field.



The radius is given by, $qvB = \frac{mv^2}{r}$

$$r = \frac{mv}{qB} \quad \cdots (1)$$

$$T = \frac{2\pi r}{v} = \frac{2\pi}{v} \cdot \frac{mv}{qB} \quad (\text{from } (1))$$

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

$$\text{frequency}(f) = \frac{1}{T} = \frac{qB}{2\pi B}$$

So, frequency is independent of both v and r.

(4)

α-particle	proton
charge = $2q$	charge = q
mass = $4m$	mass = m

$$\text{cyclotron } (f) = \frac{B\,2q}{2\pi\,4m} \quad , \quad f' = \frac{Bq}{2\pi m}$$

$$f \propto \frac{q}{2m} \quad , \quad f' \propto \frac{q}{m}$$

Thus particle will not accelerate with same cyclotron freq. The frequency of proton is twice than freq. of α-particle.

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

$$\frac{v_\alpha}{v_p} = \frac{4q \times m}{4m \times q} = 1/2$$

$$v_\alpha = \frac{v_p}{2}$$

(5) We know that charged particle will experience a force when it enters a field. The magnetic field will move the charged particle in circular path, as force is ⊥

$$\frac{mv^2}{r} = Bqv$$

$$r = \frac{mv}{Bq}$$

As, B and v are constant, we can write

$r \propto m/q$

The neutron, will move along the straight line as it has no charge.