1. The radius of the circular path will be:

$r' = \sqrt{2}\, r$

Given, a proton is accelerated through a potential difference V, the direction of magnetic field is normal to the velocity of proton.

This means that the potential energy of proton is converted into kinetic energy.

$1/2\, m_p v^2 = eV$

$v = \sqrt{2eV/m_p}$

If the potential difference is doubled:

$V' = 2V$

Therefore,

$v = \sqrt{2e \times 2V/m_p}$

$v' = \sqrt{2}v$

Radius of the circular path will be:

$qvB = mpv/r$

$r = mpv/qvB$

$r' = mp \times 2v/qvB$

$r' = \sqrt{2}r$

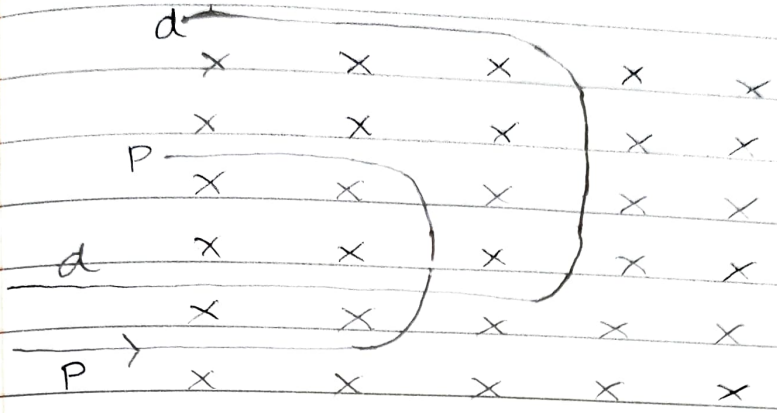
2. mass of deutron $= 2m$

mass of proton $= m$

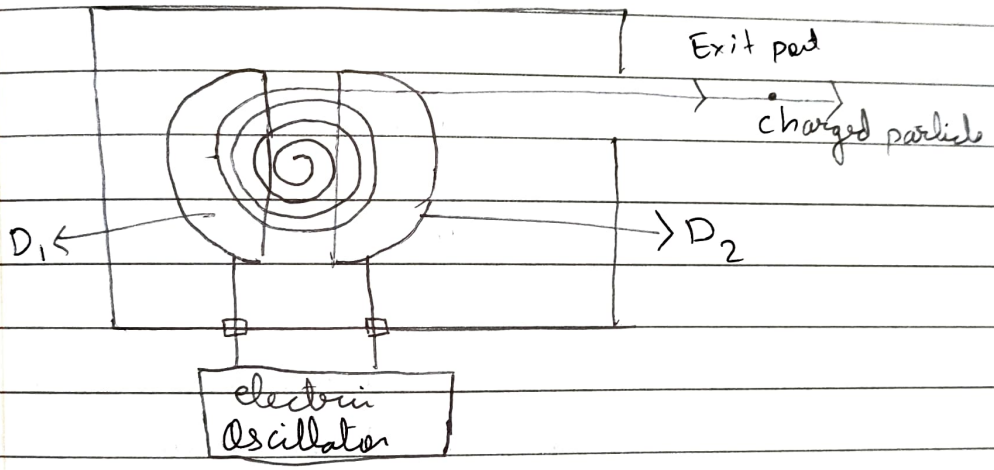
$\therefore R(\text{proton}) = \frac{mv}{qB}$

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

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



3.



Principle : Cyclotron works on the principal that a positively charged particle can be accelerated by making it to cross the same electric field repeatedly with the help of a magnetic field

$$T = \frac{2\pi r}{v} = \frac{2\pi}{v} \cdot \frac{mv}{qB} = \frac{2\pi m}{qB}$$

Hence, the frequency of revolution of the particle will be constant.

4.

i) Let,

mass of proton = m

Charge of proton = q

mass of alpha particle = $4m$

Charge of alpha particle = $2q$

Cyclotron frequency,

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

For proton : Frequency, $v_p \propto \frac{q}{m}$

For alpha particle : Frequency,

$$v_a \propto \frac{2q}{4m} \text{ or } v_a \propto \frac{q}{2m}$$

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

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

$$v_p \propto \frac{q}{m}$$

$$v_a \propto \frac{2q}{4m} \text{ or } v_a \propto \frac{q}{2m}$$

Thus particle will not exit the dees with same velocity. The velocity of proton is twice than the velocity of alpha particle.

5. a particle will trace circular path in clockwise direction as its deviation will be in the direction $(\vec{v} \times \vec{B})$.

Neutron will pass without any deviation as magnetic field does not exert neutral particle.

Electron will trace circular path in anticlockwise direction as its deviation will be in the direction opposite to $(\vec{v} \times \vec{B})$ with a smaller radius due to large charge/mass ratio as $r = mv/qB$