H.W
8/7/21

[Home assignment]

1. Ampere's ~~cir~~ circuital law; the integral of the

2. A proton is accelerated through a potential difference V, subjected to a uniform field acting normal to the velocity of the proton. If the potential difference is doubled, how will the radius of the circular path described by the proton is the magnetic field change?

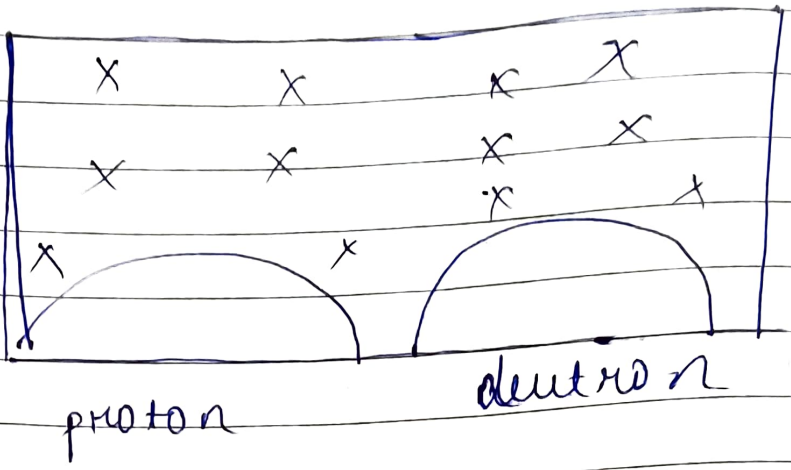
We know the radius of circular path

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

So, if accelerating voltage is doubled i.e if $V_1 = 2V$, then.

$$\frac{r_1}{r} = \sqrt{\frac{V_1}{V}} = \sqrt{\frac{2V}{V}} = \sqrt{2} \text{ or } r_1 = \sqrt{2}r$$

2)



mass of deutron = 2m (1 proton + 1 neutron)

mass of proton = m (1 proton)

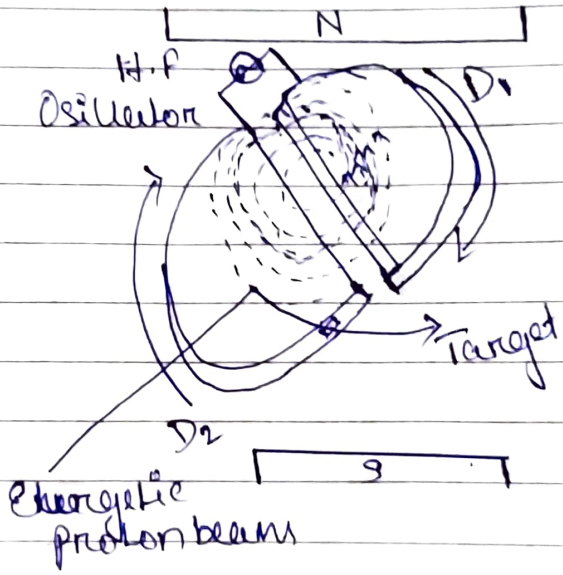
$\because R(\text{proton}) = \frac{mv}{qB}$

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

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

3) Cyclotron: is a device by which the positively charged particles like protons, deutrons, etc, can be accelerated

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



4) Let us Consider: Mass of protons = M

Charge of protons = q Mass of alpha proton Particles

= 4M

Charge of alpha particles = 2q

Cyclotron frequency.

$$\upsilon = \frac{Bq}{2\pi M} \Rightarrow \upsilon \propto \frac{q}{M}$$

for proton: frequency, $\upsilon_p \propto \frac{q}{M}$

for alpha particles: frequency

$$\upsilon_\alpha \propto \frac{2q}{4M} \text{ or } \upsilon_\alpha \propto \frac{q}{2M}$$

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

Velocity, $v = \frac{Bqr}{M} = r \propto \frac{q}{M}$

for proton: ~~pendicular~~ velocity, $\upsilon_p \propto \frac{q}{M}$

for alpha particles: velocity,

$$\upsilon_\alpha \propto \frac{2q}{4M} \text{ or } \upsilon_\alpha \propto \frac{q}{2M}$$

Thus particles will not exit the does with same velocity. The velocity of protons is twice than the velocity of alpha particles

5(a) The paths of an α-particles, neutrons and an electron moving with equal velocity, in a uniform magnetic field $\vec{B}$ going into the plane of the paper have been depicted in the fig.

(i) The positively charged alpha-~~pat~~particle describe a circular path of radius r_α in the plain of paper in an anticlockwise direction under the magnetic force where $r_\alpha = \frac{m_\alpha v}{q_\alpha B}$

(ii) The neutron, being a chargeless particle, experiences no force due to magnetic field and travel with a constant velocity along a straight path

iii) The negatively charged electrons describe a circular path of radius $r_e = \frac{m_e v}{eB}$ in the clockwise directions under the magnetic forces. As

$m_e < < m_\alpha$, hence $r_e < < r_\alpha$.