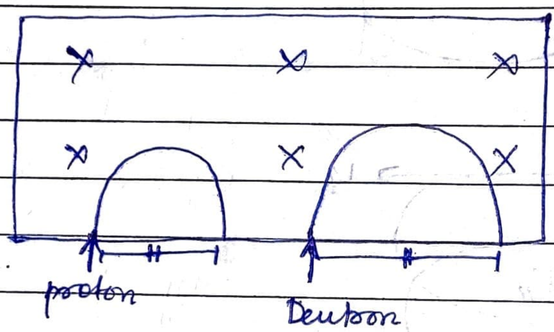
Date
Page

09.02.21 Home Assignment

① Given, a proton is accelarated 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.

② A deutron and a proton moving with the same speed enter the same magnetic field region at right angles to the direction of the field.



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

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

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

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

③ Cyclotron uses the fact that the frequency of revolution of the charged particles in a magnetic field is independent of its energy. Inside the Dees, the particles is acted upon only by magnetic field which makes it go round in a circular path. Every time the particle moves from one D to another it comes electric field

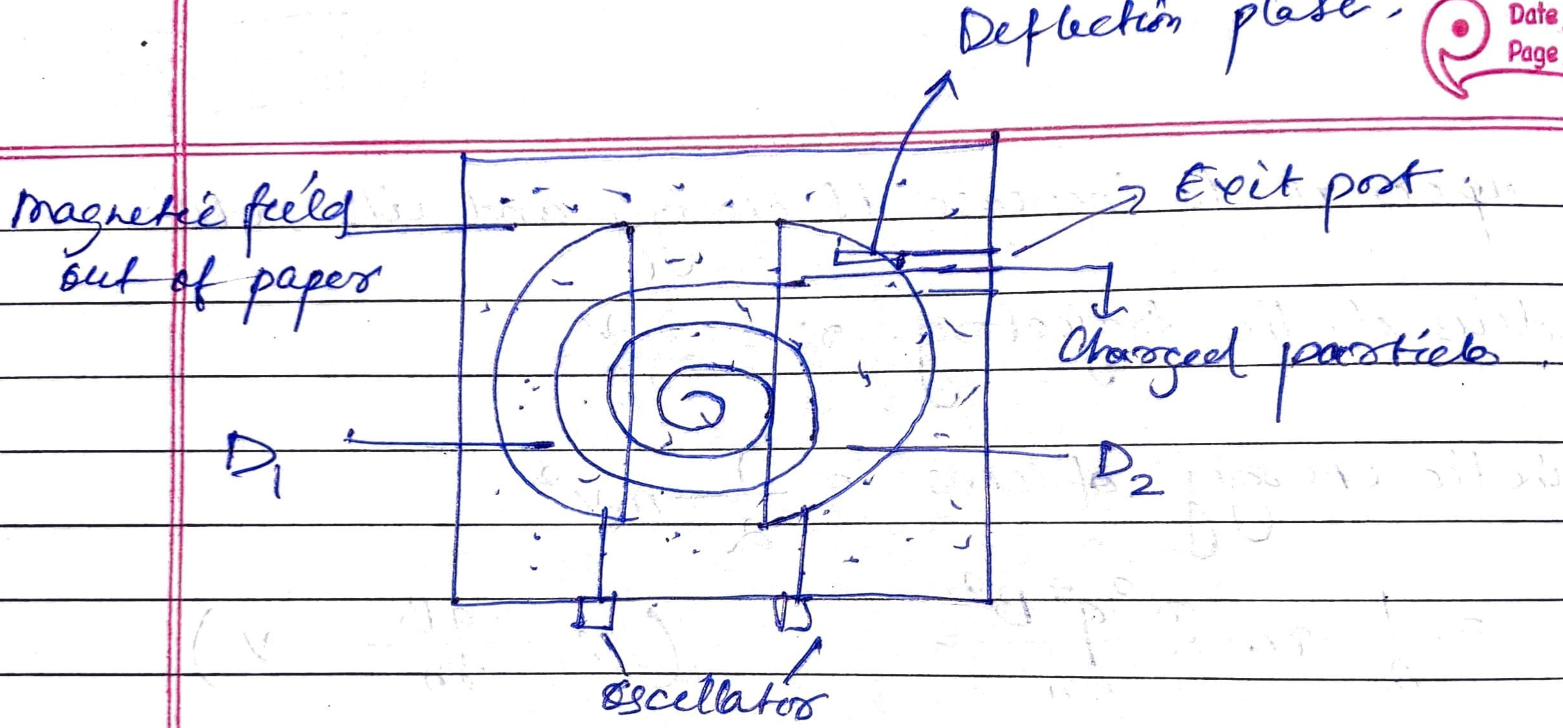
Date ______
Page ______

acts upon it to increase it energy and its radius.

Radius of the trajectory $r = \frac{mv}{qB}$

Kinetic energy of ions $= \frac{1}{2} mv^2$

$= \frac{1}{2} m \frac{r^2 q^2 B^2}{m}$ $\quad \left(\because \frac{rqB}{m} = v \right)$.


Deflection plase.
Exit post.
magnetic field out of paper
Charged particle.
D1
D2
oscellator

(4) Cyclotron frequency $v = \frac{Bq}{2\pi m}$

$v \propto \frac{q}{m}$.

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

For alpha particle, $v_\alpha \propto \frac{2q}{4m} \propto \frac{q}{2m}$

$v_p = 2v_\alpha$

Particle will not accelarate with same cyclotron frequency.

Velocity, $v = \frac{Bqr}{m}$.

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

For $v_\alpha \propto \frac{2q}{4m} \propto \frac{q}{2m}$

$v_p = 2v_a$.

Thus the particle will not leave the Dees with same velocity.

(5) When a charged particle enters a magnetic field, The magnetic field will move the charged particle in a circular path, as the force is perpendicular to the velocity of particle.

radius of circle

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

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

B & v are constant

Date
Page

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

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

The electron will inscribe a circle of radius smaller than that of the alpha particle.

The alpha particle will move in the clockwise direction and the electron will move in anticlockwise direction.