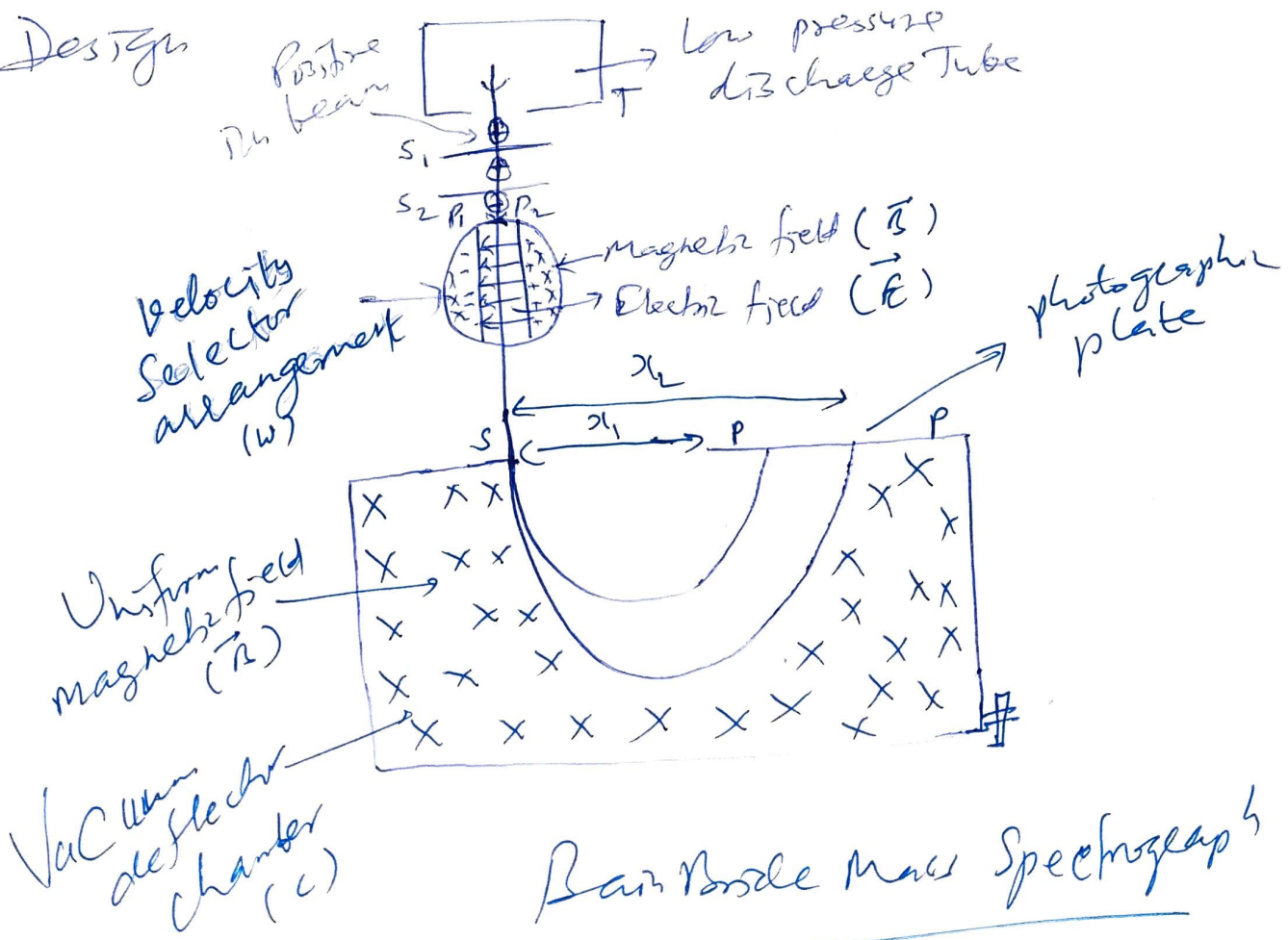


Bainbridge Mass Spectrograph:- If perpendicular uniform magnetic and electric fields are applied on a charged particle and its velocity v is given by $v = \frac{E}{B}$, the particle will move undeflected from its path. This velocity selector arrangement is used in Bainbridge mass spectrograph.

The charged particles with specific velocity can be separated from other particles. The $\left(\frac{q}{m}\right)$ can be determined for a positively charged ion and its mass can be determined.

Design



Bainbridge Mass Spectrograph

Neon gas is filled in tube T, due to high voltage the gas decomposes in positiveth and negative ~~the~~ electrons. Positive ion beam is accelerated and moves towards slits S_1 and S_2 .

It passes through velocity selector arrangement.

The particles with velocity $v = \frac{E}{B}$ passes and enters in perpendicular magnetic field in vacuum chamber C. The particles are deflected in circular path and strike on plate PP.

$$r = \frac{mv}{qB_0} \quad \text{--- (1)}$$

$$\therefore v = \frac{E}{B}$$

$$r = \frac{m \frac{E}{B}}{qB_0} = \frac{mE}{qBB_0} \quad \text{--- (ii)}$$

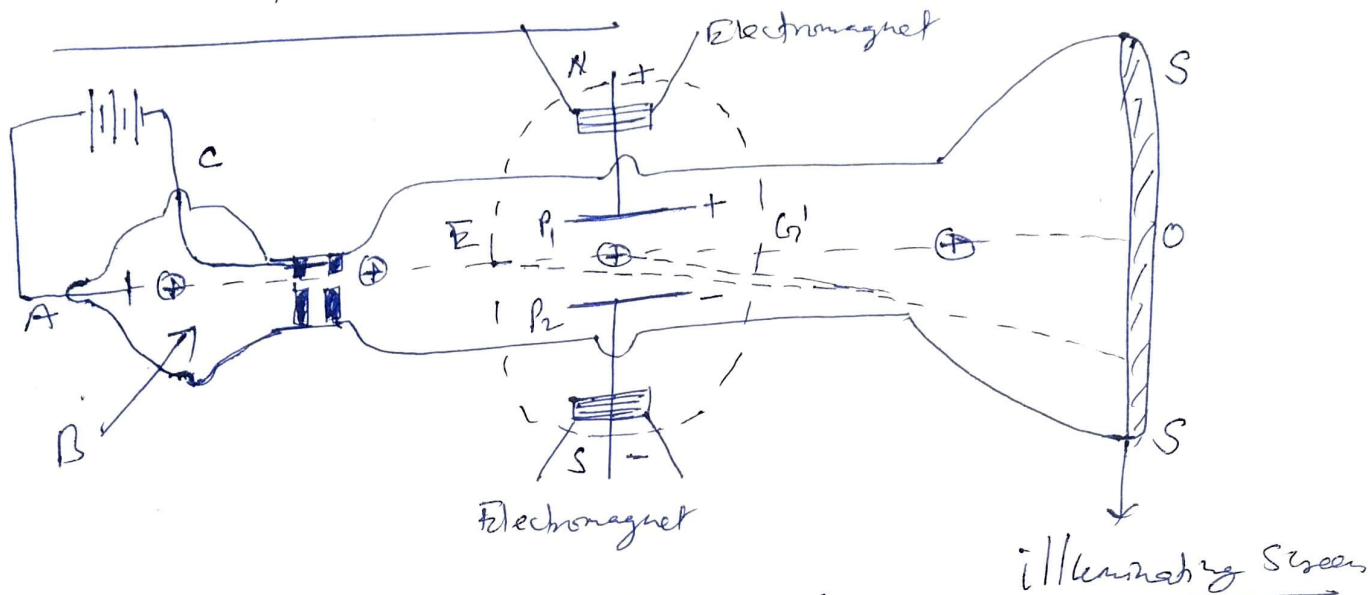
A spot is made on photographic plate when particle strikes on it. If the distance of spot from slit S is x , then $x = 2r$

$$\Rightarrow m = \left(\frac{qBB_0}{2E} \right) x \quad \text{--- (iii)}$$

$$\Rightarrow \underline{\underline{m \propto x}}$$

The ions of neon gas are focussed on two spots. \Rightarrow two ions have different mass m_1 and m_2 . This spectrograph was used for study of isotopes in elements.

Thomson Parabola Method

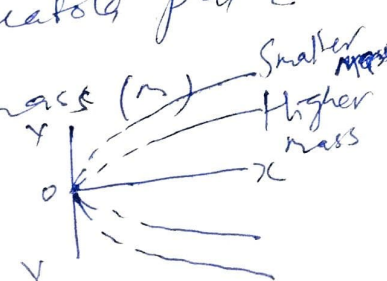


High potential applied to anode A and cathode C.
 Due to discharge in tube the gas (Hydrogen, Neon) is decomposed and positive ions and electrons are obtained.

Positive ions move towards cathode. fine beam coming out of cathode strikes on screen S.

Beam passes through parallel electric and magnetic field. The resultant path of positive ion beam is parabolic.

Three and two parabolas were obtained for hydrogen and neon gas. It means more than one kind of ions are present in hydrogen and neon. and their q/m are different. The charge of all ions are same so their mass must be different. so q/m is different and they are focussed in different parabolic path. Same charge (q) but different mass (m)
 → Isotopes

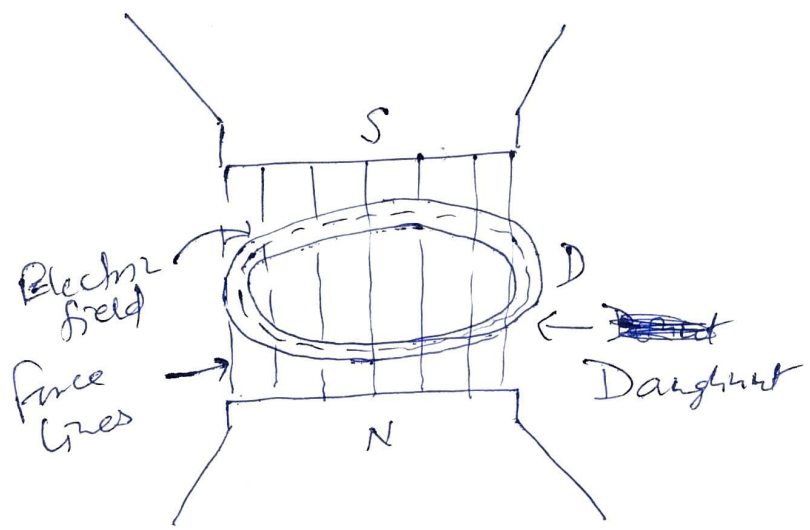
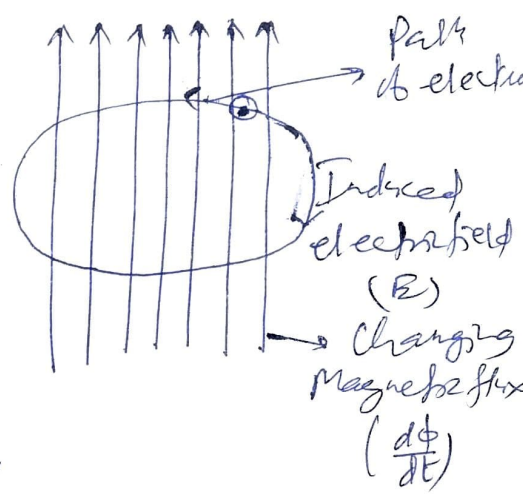
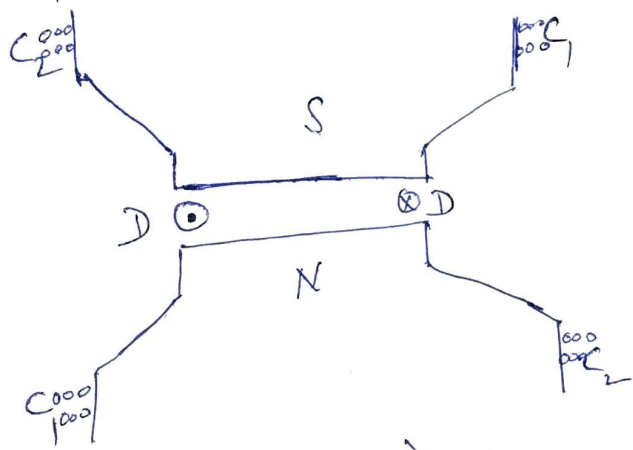


Betatron :- Device to accelerate electrons. (20)

Cyclotron \rightarrow proton, deuteron

Mass of electron very less \rightarrow Very high velocity required to accelerate the electron to high energy.
 The mass of electron also changes due to relativity.

Principle \rightarrow Electron is accelerated by induced e.m.f produced by changing magnetic field



Radius of electron $r = \frac{mv}{eB}$

This device works on the similar principle of a transformer

