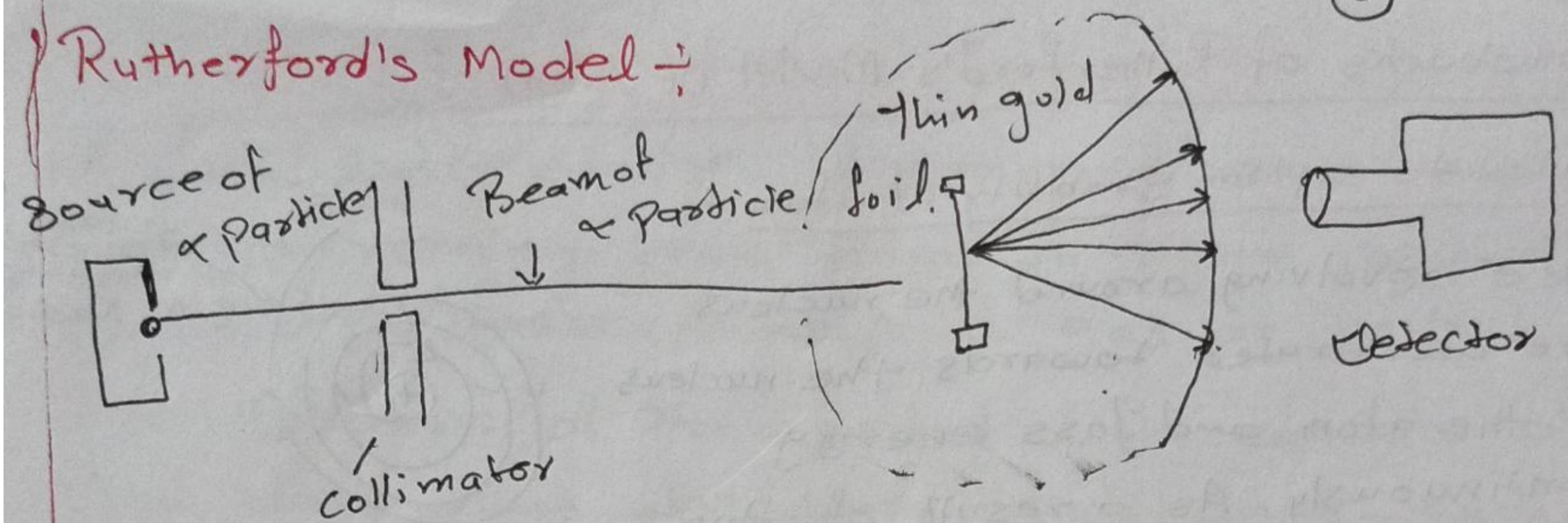
Rutherford's Model :-

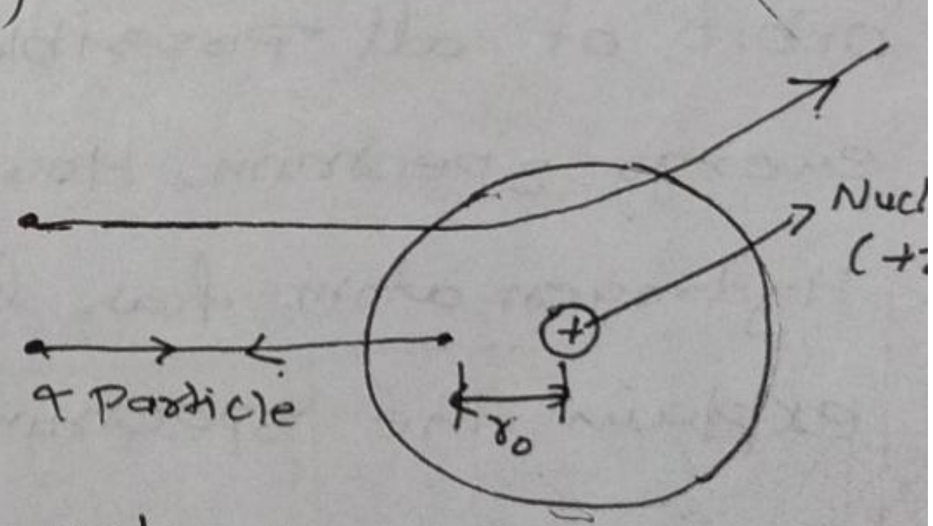


Conclusion :-

(1) Most of α Particles Pass through the gold foil undef
so it indicates that most of the space in an atom is
empty.

(2) the +ve charges in an atom concentrated in a ver
small region at the centre of atom named as nucle
(10^{-15} m. as compared dia. of atom 10^{-10} m)

Distance of closest Approach :-



the minimum distance up to which an energetic α Particle travelling directly towards a nucleus can move before coming to rest and retracing its path is known as distance of closest approach

K.E of α Particle $= \frac{1}{2} mv^2$.

P.E. of the system $= qV$

$= 2e\left(\frac{1}{4\pi\epsilon_0}\frac{Ze}{r_0}\right) = \frac{1}{4\pi\epsilon_0}\frac{2Ze^2}{r_0}$

At the closest Approach

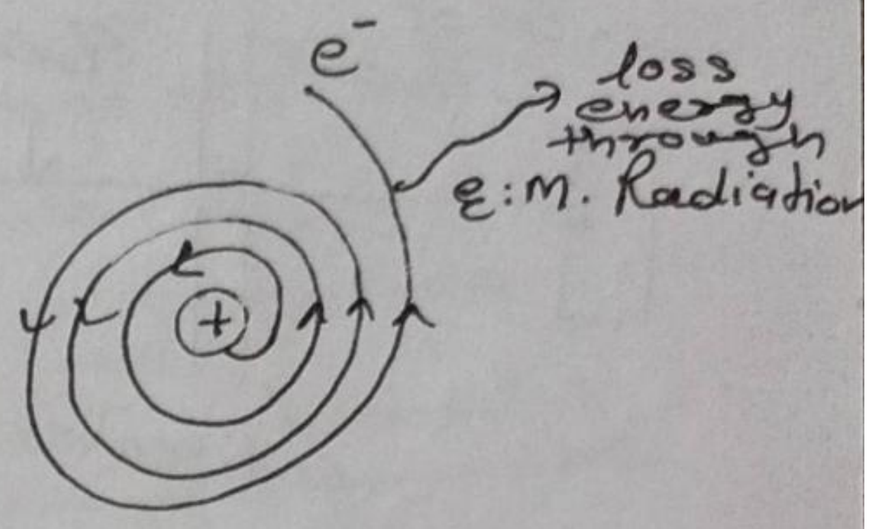
K.E = P.E.

$\frac{1}{2}mv^2 = \frac{1}{4\pi\epsilon_0}\frac{2Ze^2}{r_0}$

$$r_0 = \frac{1}{4\pi\epsilon_0}\frac{2Ze^2}{\frac{1}{2}mv^2}$$

Drawbacks of Rutherford's Model of Atom :-

1) **failed to explain stability of atom :-**



The e^- revolving around the nucleus are accelerated towards the nucleus of the atom. and loss energy continuously. As a result of this, the radius of path of the e^- should go on decreasing and it should fall into the nucleus & no atom exist. But it never happens. So Rutherford could not explain the fact.

2) **failed to explain the spectrum of an atom :-**

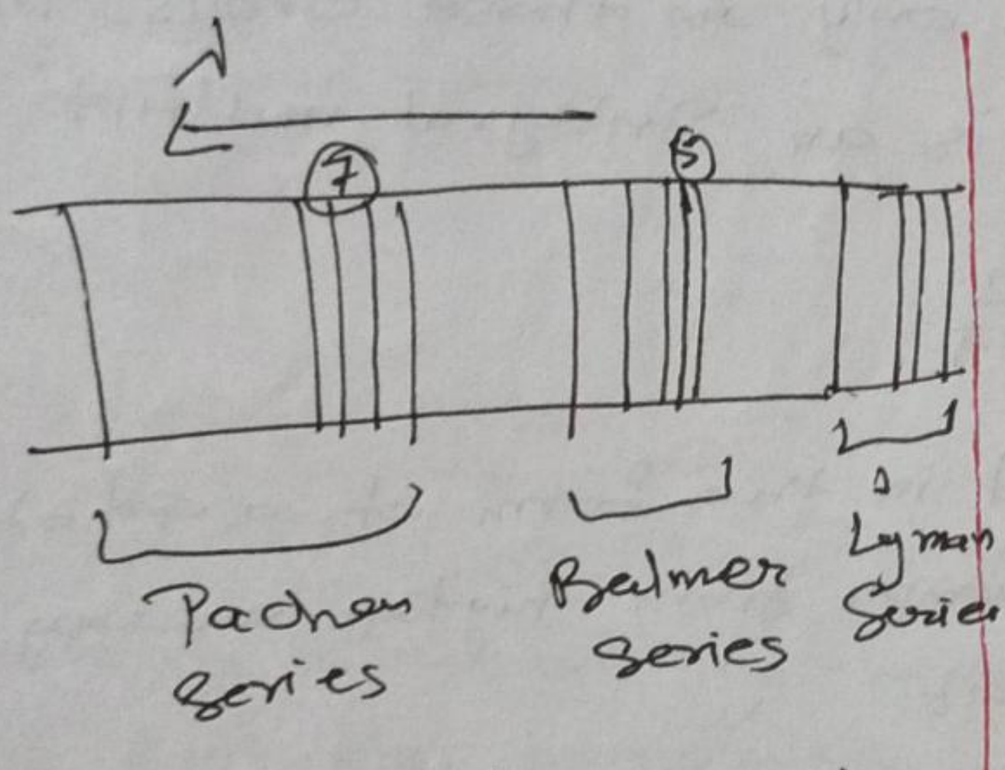
Acc. to him, e^- can revolve around nucleus in circular orbit of all possible radii. So atom can continuous energy spectrum, However even the simplest atom i.e. Hydrogen atom has line spectrum. So he could not explain the spectrum of atom.

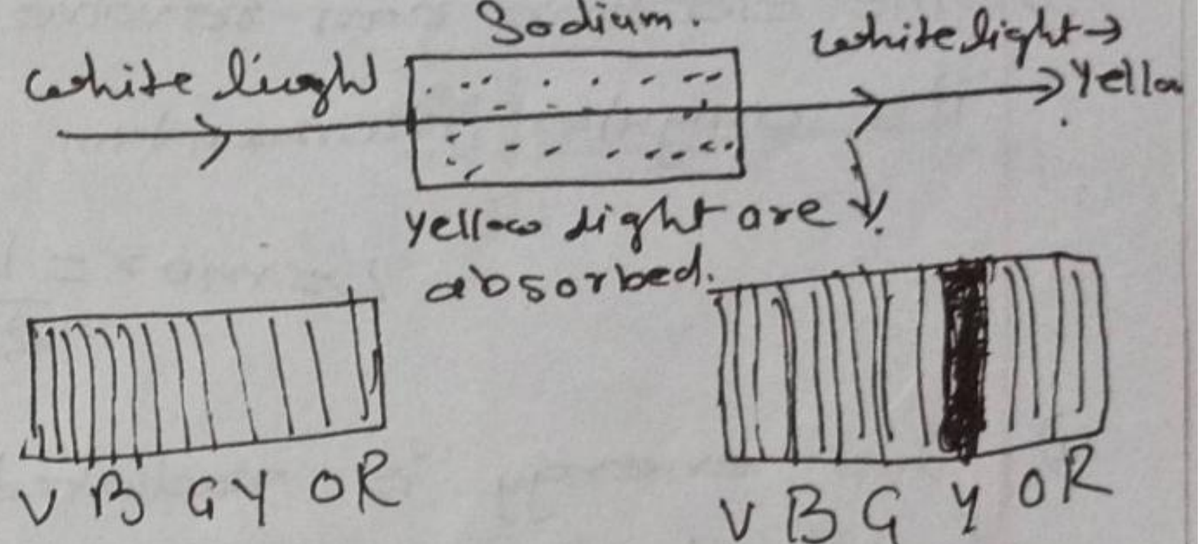
Atomic Spectra

Emission line spectrum :- Each element emit radiation when it jumps from excited state to ground state when electric current passed through discharge tube containing small amount of gas like Hg. light is emitted. when light is allowed to pass through a Prism, a spectrum consisting of spectral line of definite wavelength is obtained. This is known as line emission spectrum.

Absorption line spectrum :-

A white light consists of seven colours or wave lengths ranging from 400nm to 760 nm. When the white light passes through a gas or vapours, then the spectrum of transmitted light consists of few dark lines along with bright lines. Such spectrum is known as absorption line spectrum.

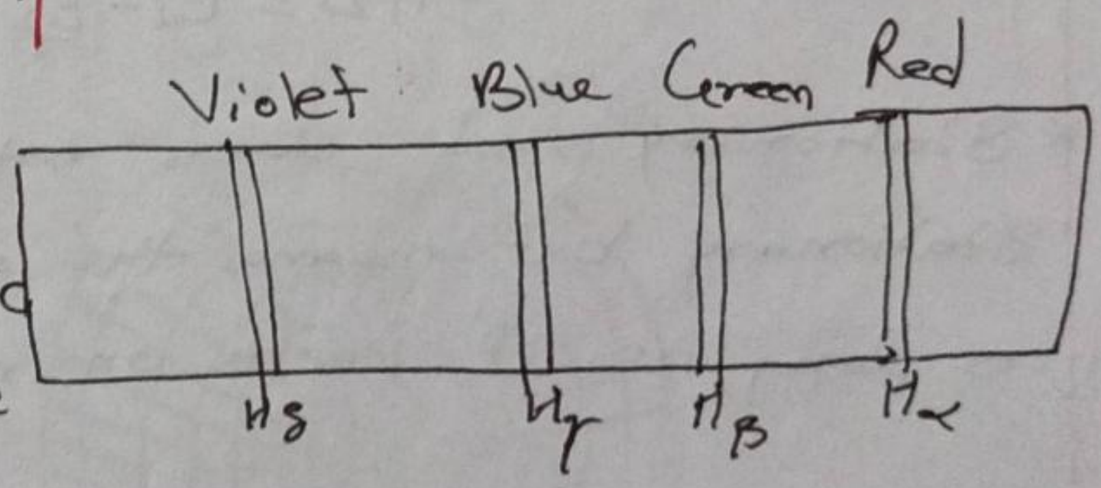




Emission line spectrum

Spectral Series :-

Atomic hydrogen in electric discharge tube emits the spectral series of lines



Spectral series lies in visible regions of em. spectrum is Balmer series

$\frac{1}{\lambda} = R\left[\frac{1}{1^2} - \frac{1}{n^2}\right]$, $n = 2,3,4\ldots$ Lyman series

$\frac{1}{\lambda} = R\left[\frac{1}{2^2} - \frac{1}{n^2}\right]$, $n = 3,4\ldots$ Balmer series

$\frac{1}{\lambda} = R\left[\frac{1}{3^2} - \frac{1}{n^2}\right]$, $n = 4,5\ldots$ Pachan series

$\frac{1}{\lambda} = R\left[\frac{1}{4^2} - \frac{1}{n^2}\right]$, $n = 5,6,7\ldots$ Brackett series

$\frac{1}{\lambda} = R\left[\frac{1}{5^2} - \frac{1}{n^2}\right]$ $n = 6,7,8\ldots$ Pfund series.

Bohr's Atom

1) An atom has a small +ve charged core where supposed whole of the mass of an atom is do be concentrated this core is called nucleus of atom.

2) The electrons revolve around the nucleus is fixed orbits of definite radii; It does not radiate any energy.

3) The electron can revolve only in those orbits, in which its angular momentum is an integral multiple of $\frac{h}{2\pi}$

$$L = mvr = \frac{h}{2\pi}$$

4) The energy is radiated in the form of a photon, only when an electron jumps from higher energy orbit to lower energy orbit

$$h\nu = E_i - E_f \qquad n_i > n_f$$

* Stationary state does not means that the electron is stationary but means the energy of the e^- remain onth as long as it keeps on moving in the same orbit.

K ——— L ——— M ———