$$\frac{mv^2}{r} = \frac{Ze^2}{r^2}$$ Centrifugal force = $\frac{mv^2}{r}$ Pg (2)

Nuclear attractive force $= \frac{Ze^2}{r^2}$

$$\Rightarrow \frac{1}{2} mv^2 = \frac{Ze^2}{2r}$$

$$\Rightarrow K.E = \frac{Ze^2}{2r}$$

v) To explain atomic spectrum, Rutherford proposed that all electrons emit energy during their rotation and revolution in an orbit.

⊛ Drawbacks of Rutherford's atom Model

i) Rutherford's atom model cannot explain atomic stability.

ii) It can not explain the line spectrum.

⊛ Bohr's atom Model :-

i) The angular momentum of each electron is the integral multiple of $\frac{nh}{2\pi}$.

n = No of orbit,
h = Planck's Constant.

ii) Each orbit has a definite energy and are called known energy levels. i.e. stationary states.

iii) No energy will be emitted from an electron during their motion.

iv) Energy emission or absorption takes place only when an electron jumps from one orbit to another.

$$E_2 - E_1 = \Delta E = h\nu$$

Bohr's theory, $E_n = -R_H \times \frac{1}{n^2}$

n = 1, 2, 3, ... = No of orbit

R_H = Rydberg Constant
$= 2.18 \times 10^{18}$ J.

E_n = Energy at n^{th} orbit

⊛ Thomson Atom Model :

1. The electrons are embedded in a sphere of positive charges.
2. The negative and positive charges balance each other.
3. Atom is electrically neutral.

⊛ Drawbacks of Thomson Model :

1. There are no idea about nucleus.
2. There are no idea about orbit.

⊛ Rutherford's atom Model :-

Rutherford's scattering Experiment :-

Observations :

i) Most of the α-particles (99%) passed through gold foil.

ii) Some of these particles deflected by small angles.

iii) A very few α-particles (one out of 20,000 particles) suffered major deflections by more than 90° or even 180° come back in same direction.

Conclusions :-

i) Maximum portion of an atom is empty.

ii) All electrons are scattered in an atom.

iii) All protons are centroid in nucleus.

iv) All electrons are revolving around the nucleus in circular orbit in such a way, the centrifugal force of an electron always equals to nuclear attractive force.

(*) Drawbacks of Bohr's theory :

i) Bohr's theory is only applicable in 'H' Spectrum.
ii) Multi electron spectrum cannot be explained by Bohr's theory.
iii) It can not explain "Zeemann Effect" and "Stark Effect".
iv) Bohr's theory cannot explain Wave Particle duality.

(*) Heisenberg's Uncertainty Principle :-

~~The~~ None can calculate actual position and velocity of an electron symultaneously.

$$\Delta x . \Delta v \geq \frac{h}{4\pi}$$

Δx = Position Uncertainty
ΔV = Velocity Uncertainty.

(*) Wave Particle duality :-

de-Broglie Wave Equation :-

Just as light behave wave and particle both, Electrons behave same as light. Electron also behave wave and particle both.

From Planck's Equⁿ $E = h\nu$ — (i)
from Einstein " $E = mc^2$ — (ii)

Comparing Equⁿ (i) and (ii) $h\nu = mc^2$

$$\Rightarrow h \times \frac{c}{\lambda} = mc^2$$

$$\Rightarrow \lambda = \frac{h}{mc} = \frac{h}{p}$$

λ = Wavelength of $\bar{e}$
h = Planck's Constant
m = mass of $\bar{e}$
c = Velocity of light.

(*)

Orbit	Orbital
The path in which electrons revolve around the nucleus is called orbit. K, L, M, N, ...	The space in which maximum probability of electrons can be found is called orbital. s, p, d, f