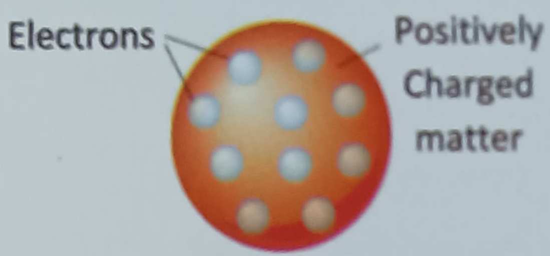
STRUCTURE OF ATOM

e	-1.6×10^{-19} C	9.1×10^{-31} kg
p	$+1.6 \times 10^{-19}$ C	1.672×10^{-27} kg
n	Neutral	1.674×10^{-27} kg

ATOMIC MODELS

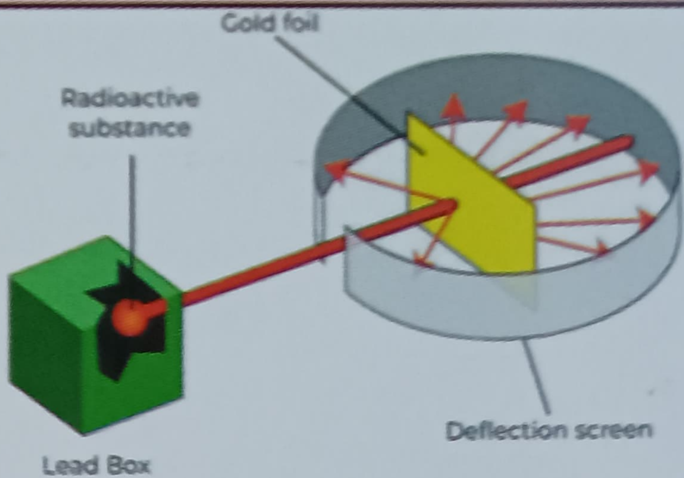
THOMSON ATOMIC MODEL (Plum/Watermelon)



$\simeq$

RUTHERFORD'S ATOMIC MODEL

- Most of the space in the atom is empty.
- The positive charge is concentrated in a very small volume.



- The volume of the nucleus is very small compared to the total volume of the atom.

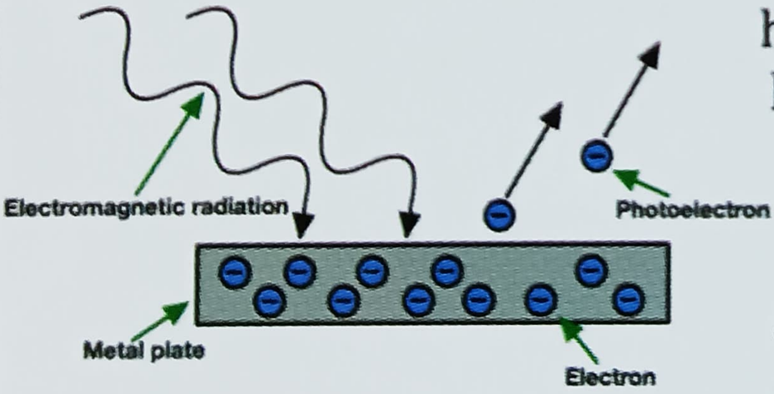
Important terms

Isoelectronic : Same no. of electrons	CH_4, NH_3, H_2O
Isotopes : Same atomic no. different mass no.	$_1H^1$, $_1H^2$, $_1H^3$
Isobars : same mass no. different atomic no.	$_{18}Ar^{40}$, $_{20}Ca^{40}$
Isotones : same number of neutrons	$_6C^{13}$, $_7N^{14}$

Photoelectric Effect

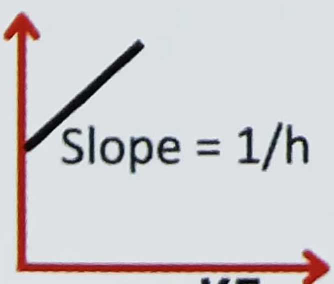
- No. of Photoelectrons $\propto$ Intensity of Light
- Kinetic Energy $\propto$ Frequency of Light

Emission of electron from the surface of metal when a photon of certain v is incident to metal surface.

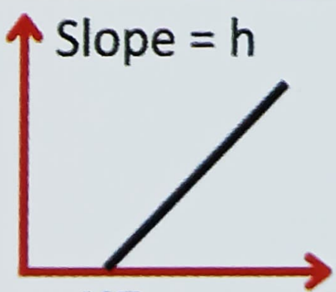


$$h\upsilon = h\upsilon_0 + 1/2\, mv^2$$
$$h\upsilon = w_0 + 1/2\, mv^2$$
w_0 = Work Function
υ_0 = Threshold Freq.

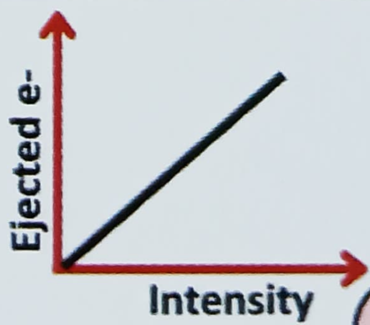
After Threshold, **it's all Kinetic Energy**



v vs KE



KE vs v



Emission Spectrum of Hydrogen Atom

Continuous spectrum

Absorption spectrum

Emission spectrum

$$\bar{\nu} = \frac{1}{\lambda} = R_H \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] \times Z^2$$

n_1 & n_2 = energy levels of transitions
R_H = Rydberg Cosntant
Z = atomic number

Number of Spectral Lines	$\frac{(n_2 - n_1)(n_2 - n_1 + 1)}{2}$

Spectrum Lines of Hydrogen Atom

Series	n_1	n_2	Spectral Reg.
Lymann	1	2,3..	U.V.
Balmer	2	3,4..	Visible
Paschen	3	4,5..	IR
Brackett	4	5,6..	IR
Pfund	5	6,7..	IR

Bohr's Theory

- Electron in circular orbits
- Energy of electron doesn't change in an orbit.
- Energy is absorbed or emitted in the difference of $\Delta E = h\nu = hc/\lambda$

Bohr model Formulas

Angular Momentum is quantised; n = 1,2,3...	$mvr = n\frac{h}{2\pi}$
Bohr's Radius	$r_n = 0.529 \times \frac{n^2}{Z}$ A°
Energy of Electron T.E. = -K.E. = P.E/2	$E_n = -13.6 \times \frac{Z^2}{n^2}$ eV $E_n = -2.18 \times 10^{-18} \times \frac{Z^2}{n^2}$ J

De-Broglie Hypothesis

$$\lambda = \frac{h}{p} = \frac{h}{mv} = \frac{h}{\sqrt{2m(KE)}} = \frac{h}{\sqrt{2mqV}} = \frac{12.24}{\sqrt{V}} \text{ A}^o$$

V = Potential; q= charge; KE = Kinetic Energy

Heisenberg Uncertainity Principle

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

Δx = Change in Position

Δp = Change in Momentum

Wolfgang Pauli & Neil Bohr OBSERVING SPIN 1954

Quantum Numbers

Principal quantum number (n)

- Positive integer with values n = 1,2,3,4..
- n denotes the **shell number, energy of electron, size of the shell.**
- Maximum number of electron in shell = $\mathbf{2n^2}$
- Maximum number of orbitals in shell = $\mathbf{n^2}$

Azimuthal Quantum number (*l*)

- Positive integer with values *l* = 0,1,2,3,..
- *l* denotes the **subshell, suborbit, sub energy level.**
- value of *l* ranges from 0 to n-1

l	0	1	2	3
orbital	s	p	d	f

Magnetic quantum Number (m)

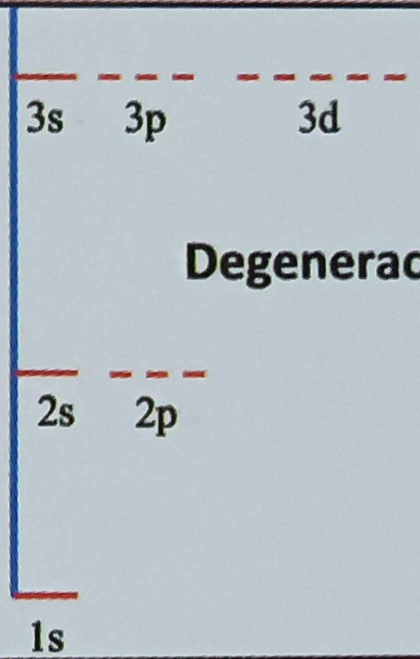
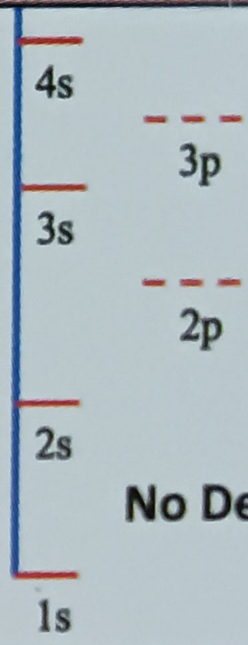
- Positive integer depending upon value of *l* as m ranges from -*l* to +*l* (total = 2*l*+1 values)
- It tells about the orientation of the orbital.

  eg : p orbital has *l* = 1 (m = -1, 0, +1)

Spin Quantum Number (s)

- Electron rotates on its own axis in clockwise or anticlockwise direction. So the spin quantum number can have two values of +1/2 and -1/2.

Energy in different electron systems

Monoelectronic	Polyelectronic
 Degeneracy = n^2	 No Degeneracy

Electronic configuration rules

Aufbau Principle : Ground state electrons filled into atomic orbitals in the increasing order of orbital energy level.

Hunds Rule : Before the double occupation of any orbital, every orbital in the sub level is singly occupied.

Pauli's Principle : In single atom no two electrons will have an identical set of quantum numbers (n, l, m, and m.).

Exceptions

- Chromium : $[Ar]4s^1 3d^5$ (Half Filled configuration)
- Copper : $[Ar]4s^1 3d^{10}$ (Fully Filled configuration)

Nodes (n=Principle Qno. ; l = Azimutal Qno.)

Radial node = n-l-1 ; Angular Node = l