Fundamental Equation was deveoped by Schrodinger as $\hat{H}\psi = \psi\hat{E}$ where H= Hamiltonian

(i) Principal quantum number (n) :n = 1,2,3,4…….. Shell = K, L, M, N.....
(ii) Azimuthal Quantum number : For given value of n ,l = 0 to n-1
(iii) Magnetic Quantum number (m) : for subshell with 'l' value m_l=2l+1
(iv) Spin Quantum Number (m_s): $+1/2$ (↑), $-1/2$ (↓)

Schrodinger Equation

Quantum Numbers

•Aufbau Principle: In the ground state of atoms, the orbital's are filled according to increasing energies.
•P auli Exclusion Principle: No2 electrons in an atom can have sae set of four quantum numbers.
•Hund's rule: Pairing of electronsinthe orbitals belonging to same subshell does not take place until eachelectron belonging to the subshell is singly occupied.

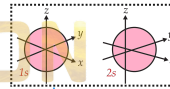
- Dual behaviour of atom i.e., particle and wavelike. De Broglie equation: $\lambda = \frac{h}{mv} = \frac{h}{p}$
- Heisenberg's Uncertainty Principle: It is impossible to determine simultaneously, the exact position and momentum of an electron

Quantum Technical Modal of Atom

Filing of orbitals in atom KE of rejected electron hv = hv0 + 1/2 m e v2

Structure of Atom

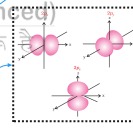
Shapes of orbitals



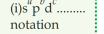
Electric Configuration of atoms

Photoelectric Effect it was found By H.Hertz

s Orbitals:
Spherically symmetric
Size increases with increase in size in n, ie, 4s>3s>2s>1s



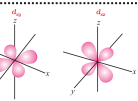
(i)s ^{a}p ^{b}d ^{c}..... notation
(ii)Orbital diagram



- It is the phenomenon of ejection of
- electrons from the surface of a
- metal when light of suitable
- frequency strikes on it.

Energy of orbit

p Orbitals:
Each p Orbitals consists of two sections called lobes on either side of plane passing through the nucleus.



d Orbitals
- "Clover leaf" distribution.
-Two angular nodes.

Developments leading to Bohar's Modal of Atom

Lower the value of (n+l) for an orbital, lower is its energy.

Dual nature ie wave like and particle like of the electromagnetic radiation.
• Experimental results regarding atomic spectra.
• Wave nature of electromagnetic radiation: It was given by James Maxwell.
Frequency (v) : Number of waves that pass a given point in one second. Unit – Hertz (Hz), Velocity of light = Frequency × Wave length
Wave number (v) : Number of wavelengths per unit length. Unit – m^{-1}
• Particle nature of electromagnetic radiation: Planck's quantum theory: E = h
Planck's constant (h) = 6.626 × $^{-10}$ Js

Structure of Atom

Isobars:

Atoms of different elements with different atomic number but same mass number. (Ca and Ar)

Discovery of Election

By J.J.Thomson Charge to mass ratio of electron
$= 1.758820 \times 10^{11}$ C kg^{-1}
Charge an electron $= 1.6022 \times 10^{-19}$C
Mass of electron $= 9.1094 \times 10^{-31}$Kg

Discovery of Proton

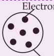
By Ernest Rutherford
Charge on proton $= +1.6022 \times 10^{-19}$C
Mass of Proton$= 1.672 \times 10^{-27}$ Kg

Discovery of Neutron

By James Rutherford
Charge on neutron $= 0$
Mass of neutron$= 1.675 \times 10^{-27}$ Kg

Thomson Model of Atom: (Watermelon Model)

Atom possesses a spherical shape in which the positive charge is uniformly distributed.



Atomic Spectra

Types:

• Emission Spectra: Spectrum of radiation emitted by a substance that has absorbed energy.
• Absorption Spectra: It is like photographic negative of an emission spectra.
• Line / Atomic Spectra: Emission Spectra which do not show a continuous spread of wavelength from red to violet, rather they emit light only at specific wavelength with dark space between them.

$\bar{\nu} = 109677 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right) cm^{-1}$ where

$n_1 = 1,2............n_2 = n_1+1, n_1+2.........$

Series	n_1	n_2	Spectral Region
Lyman	1	2,3.........	Ultraviolet
Balmer	2	3,4.........	Visible
Paschen	3	4,5.........	Infrared
Brackett	4	5,6.........	Infrared
Pfund	5	6,7.........	Infrared

Isotopes

Atoms of same element having same atomic number but different mass number. (Isotopes of hydrogen) Protium $^1H_1$, Deuterium $^2D_1$ and Tritium $^3T_1$.

Mass Number (A)

Number of protons (Z) + number of neutrons (n)

Atomic Number (Z)

Number of protons in nucleus of an atom
or
Number of electrons in a neutral atom

Bohr's Model for Hydrogen Atom

Postulates:

• Electron in H atom can move around the nucleus in a circular path of fixed radius and energy called as orbits. These orbits are arranged concentrically around the nucleus.
• Each of these orbits has a definite energy known as energy levels or stationary states.
• When an electron jumps from a lower energy level to higher one, some energy is absorbed.
• $v = \frac{E}{n} = \frac{E_2 - E_1}{n}$ Bohr's frequency rule.

Angular momentum of electron: $m_e vr = n \frac{h}{2\pi}$ $n=1,2,3.....$

Limitations:

• Unable to account for finer details of H atom. Spectrum observed by sophisticated spectroscopic techniques.
• Could not explain the ability of atoms to form molecules by chemical bonds.

Rutherford's Nuclear Model of Atom

Postulates:

• Positive charge and most of the mass of atoms was densely concentrated in extremely small region (ie) nucleus.
• Nucleus is surrounded by electrons that move around the nucleus with high speed in circular path called orbits.
• Electrons and nucleus are held together by electrostatic forces of attraction.

Drawbacks:

• It cannot explain the stability of an atom.
• It does not say anything about the electronic structure of atoms.