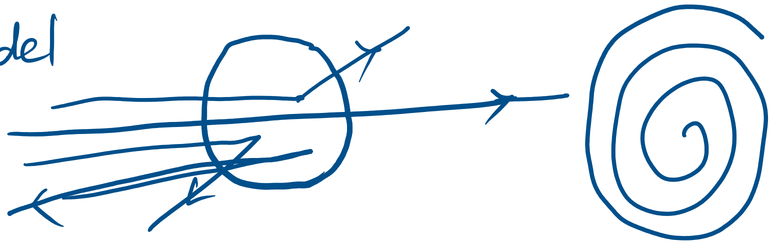
Atomic Structure. 4-8 marks.

1. Dalton's Atomic Theory:
2. Thomson's Model. – Plum Pudding Model.
3. Rutherford's Model



Isotopes : $_1H^1$, $_1H^2$, $_1H^3$

Isobars : $_{15}P^{32}$, $_{16}S^{32}$

Isotones : Same no. of neutrons

$_6C^{14}$, $_8O^{16}$, $_7N^{15}$ ⇒ (8)

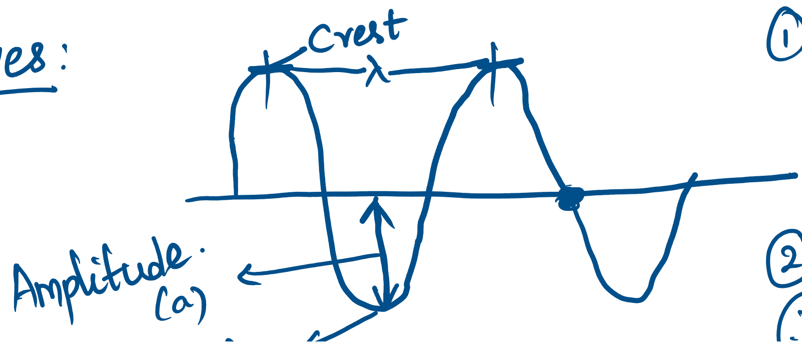
(★) Isoelectronic : no. of e^- ⇒ Same. N_2, CO, CN^- (14) e^-

Isosters : Same no. of atoms & Electrons.

(2) N_2 and CO (2) – $14e^-$ CO_2 and N_2O

HCl and F_2 – $18e^-$

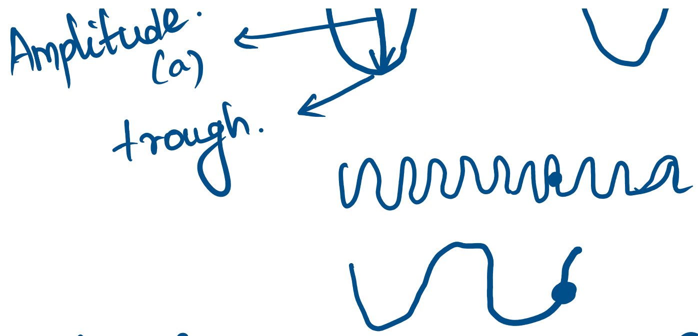
Waves:



(1) Wave length (λ): cm, m

$1\,Å = 10^{-10}\,m$

(2) Frequency (ν)



(2) Frequency (ν)

$\nu \propto 1/\lambda$

$\nu = \frac{c}{\lambda}$

(3) Velocity : (c)

$$C = \nu \times \lambda$$

(4) wavenumber : $\bar{\nu}$

λ per cm

$\bar{\nu} = 1/\lambda$

$$\bar{\nu} = \frac{\nu}{c}$$

EMR :

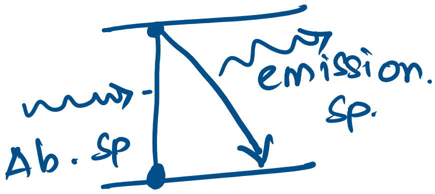
Radio waves   Microwaves   IR   vis   UV   X γ

Wavelength. 3×10^{14} —— decreases. ——→ 0.1

Rahul Mishra Vent to Uncle Xavier's Garden

Atomic Spectrum:

		n_1	n_2
UV	Lyman	1	2,3,4...
Vis	Balmer	2	3,4,5...
IR	Paschen	3	4,5,6...
	Brackett	4	5,6,7,...
	Pfund	5	6,7,8...



$$1/\lambda = \bar{\nu} = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

R → Rydberg const (109678 cm^{-1})

Planck's quantum theory :

$E \propto \nu$

$$E = h\nu$$

h → Planck's Const

 → quantum (Smallest)

↓

Photon (in case of light)

↳ Planck's Const (of light)
6.626×10^{-34} J s

Bohr's Atomic Model:

> $\frac{nh}{2\pi} = mvr$ (angular momentum)

> Energy level ⇒ K, L, M, N... ⇒ Sta. Orbit

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

A Series of lines in the Spectrum of atomic hydrogen lies at wavelength 656.46, 482.7, 434.17, 410.29 nm — Visible.
wavelength of next line?

Balmer Series: $n_1 = 2$. $n_2 = ?$

$\lambda = 410.29 \times 10^{-7}$ cm $\quad n_1 = 2$

$$\frac{1}{\lambda} = R\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$$

$$\frac{1}{410.29 \times 10^{-7}} = 109673\left[\frac{1}{2^2} - \frac{1}{n_2^2}\right]$$

$n_2 = 6$

$$\frac{1}{\lambda} = 109673\left[\frac{1}{2^2} - \frac{1}{7^2}\right]$$

$$\frac{1}{\lambda} = 109673 \left[\frac{1}{2^2} - \frac{1}{7^2}\right]$$

$$= 109673 \left[\frac{1}{4} - \frac{1}{49}\right]$$

$$\lambda = 397.2 \times 10^{-7} cm = 397.2 \; nm.$$

Quantum Numbers:

1. Principal : K, L, M, N $\Rightarrow 2n^2$
2. Azimuthal (l) : $\sqrt{l(l+1)} \; h/2\pi$
3. Magnetic quantum Number (m) : $-l$ to $+l$.

   $l = 2. \Rightarrow -2, -1, 0, +1, +2$
4. Spin quantum number : $+\frac{1}{2}$ and $-\frac{1}{2}$

Orbitals:

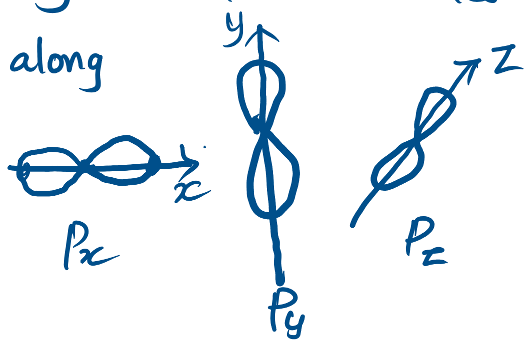
S-Orbital - Spherical, Symmetrical.

Vacant Space bet 2 - S-obt $\Rightarrow$ Radial Node.

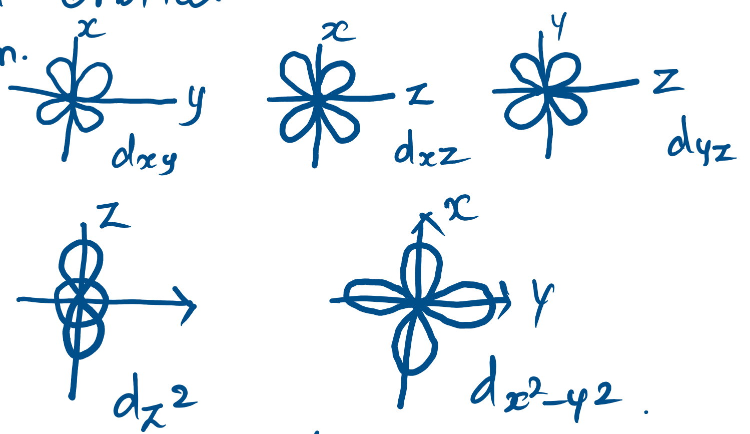
Probability of finding $e^- \Rightarrow 0 \Rightarrow$ Nodes

P-orbital - dumbell Shape. - along

d- Orbital. - double dumbell.



between.



along.

along.

Aufbau Principle: Order of increasing energy

(n+l)

Pauli's Exclusion Principle: Orbital can contain max upto 2 e^-

Hund's Rule: each Orbital must singly occupied first

de-broglie.

$E = h\nu$ (wave) —— (1)

$E = mc^2$ (particle) —— (2)

$h\nu = mc^2$

$\nu = \frac{mc^2}{h}$ $\left[\because \nu = c/\lambda \Rightarrow \nu\lambda = c\right]$

$\frac{c}{\lambda} = \frac{mc^2}{h} \Rightarrow \frac{1}{\lambda} = \frac{mc}{h} \Rightarrow \boxed{\lambda = \frac{h}{mv} = \frac{h}{p}}$

Two Particles A and B are in motion. If wavelength with A 5×10^{-8} m. Cal. wavelength of particle B If its momentum is half of A

$\lambda_A = \frac{h}{P_A}$ and $\lambda_B = \frac{h}{P_B}$

$\frac{\lambda_A}{\lambda_B} = \frac{P_B}{P_A} = \frac{\frac{1}{2}P_A}{P_A} = \frac{1}{2}$

$$\lambda_B \quad P_A \quad P_A$$

$$\frac{\lambda_A}{\lambda_B} = \frac{1}{2}$$

$$\lambda_B = 2\lambda_A = 2 \times 5 \times 10^{-8} = 10 \times 10^{-8} m$$

$$= 10^{-7} m.$$

Heisenberg Uncer. Princ.

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

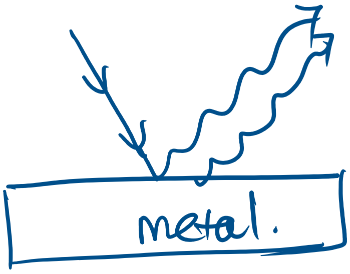
Δx → Position

Δp → momentum.

$p = mv$.

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

Photoelectric Effect:



$$h\nu = h\nu_0 + K.E$$

$$h\nu = h\nu_0 + \frac{1}{2}mv^2$$

$$\frac{1}{2}mv^2 = h\nu - h\nu_0$$

$$\boxed{K.E = h(\nu - \nu_0)}$$

Thereshold. – minimum.

photoelectric Current ↑ , intensity of light ↑