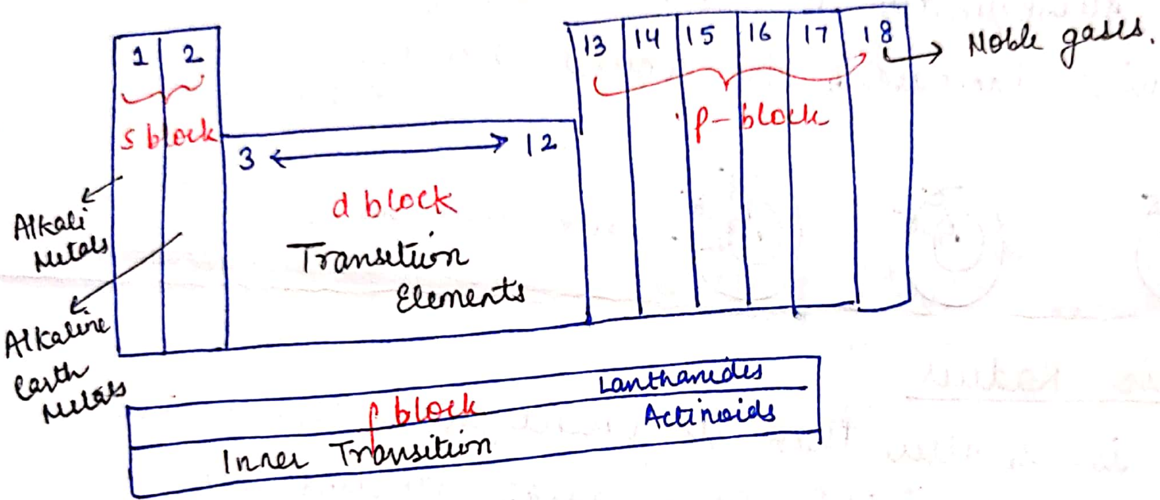
UNIT-I
Fundamental Chemistry

* INORGANIC CHEMISTRY

- Periodic Table & periodic properties of Elements (ionization potential, electron affinity, Electronegativity)
- Mole concept
- Molarity & Normality
- Quantitative volumetric Analysis
- Chemical Bonding – Ionic, covalent, coordinate & Hydrogen Bonds)

* Periodic Table



Groupwise e^- configuration

→ electrons in same group have similar valence shell e^- conf. with same no. of electrons.

Example Group 1 → ns^1
Group 2 → ns^2
Grp 13 → ns^2np^1
14 → ns^2np^2

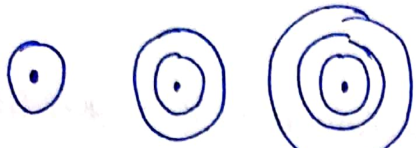
Periodwise e^- configuration

n remain same while there is successive addition of electrons.

* Trends in Physical properties

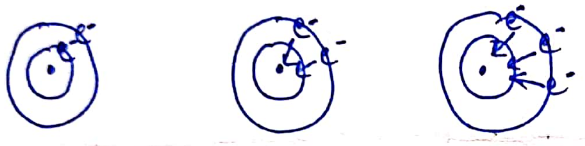
(a) <u>Atomic Radius</u>

Along the group, principal quantum no, n ~~som~~ increases and no. of valence e^-'s remains same. so, size will increase.



$\longrightarrow n \uparrow \Rightarrow$ Atomic Radii $\uparrow$.

Along the period, n remains same but no. of electron subsequently increases. Thus, effective nuclear charge will increase & size would decrease



size decreases.

(b) <u>Ionic Radius</u>

- Cation is smaller than its parent atom coz it has fewer e^-'s while its nuclear charge remains same.
- Anion is larger than its parent atom coz addition of one or more e^-'s will result in increased repulsion among e^-'s & decrease in effective charge.

$F^- > F \quad Na > Na^+$

<u>Isoelectronic species</u> $\Rightarrow$ species with same no. of electrons.

Ex - $O^{2-}, F, Na^+, Mg^{2+} \Rightarrow e^- = 10$

Q:- Ionic Radii Mg, Mg^{2+}, Al, Al^{3+}

$Al^{3+} < Al < Mg^{2+} < Mg$.

N^{3-} O^{2-} F^- Na^+ Mg^{2+} Al^{3+}

$N^{3-} > O^{2-} > F^- > Na^+ > Mg^{2+} > Al^{3+}$ $e^- = 10$

Isoelectronic species.

Q:- Be, Na, Al, Ca, K Atomic Radii

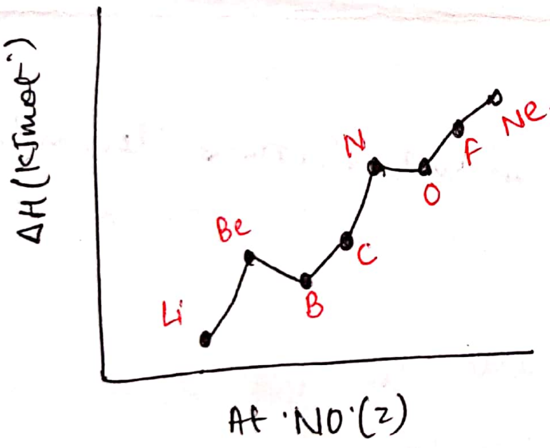
Q:- B, Mg, Na, Be, Rb. "

(B) <u>Ionization Enthalpy</u>

Energy required to remove an e^- from an isolated gaseous atom.

$X(g) \rightarrow X^+ + e^-$ I.E1 $KJmol^{-1}$

$X^+(g) \rightarrow X^{2+} + e^-$ I.E2



* Along the group I.E ↓ses as size ↑ses, so it is easier to remove electrons
* Along the period, I.E ↓ses as size ↓ses.

* $\boxed{Be > B}$

Be $1s^2 2s^2$.
B $1s^2 2s^2 2p^1$

In Be, e^- is removed from s orbital which has e^- near to nuclear. Thus, s orbital has more penetration effect than p orbital.

* $\boxed{N > O}$

$N \rightarrow 1s^2 2s^2 2p^3$ $\boxed{\uparrow | \uparrow | \uparrow}$

Half filled conf. ⇒ High stable
so, difficult to remove e^-.

(d) Electron Gain Enthalpy

Energy released when an e^- is added to neutral gaseous atom.

$$X(g) + e^- \longrightarrow X^-(g)$$

* As we move along the group ⇒ e^- gain enthalpy less −ve.
* As we move along the period ⇒ e^- gain enthalpy more −ve.

Noble gases +ve $\Delta_{eg}H$ coz filled e^- configuration. So, its will be difficult to gain e^-.

$\boxed{O < S}$ $\boxed{F < Cl}$

O & F has smaller size. Thus, due to increased e^- - e^- interelectronic repulsions. e^-'s are not easily accepted. Thus, less −ve e^- gain enthalpy.

Q:- P S Cl F

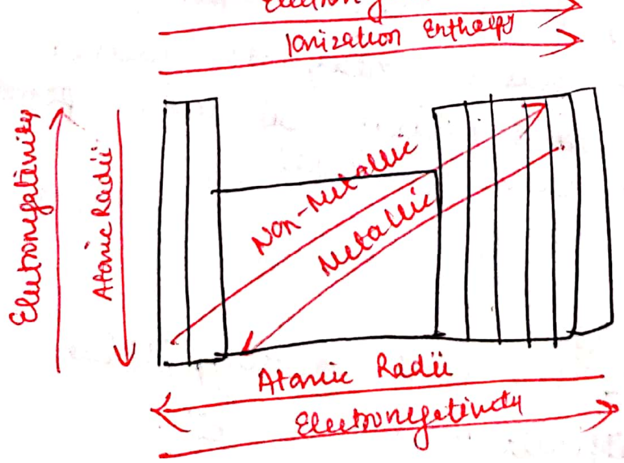
$P < S < \cancel{F} < Cl$

(e) Electronegativity

Ability of an atom to attract shared electrons towards itself.

E.N ↑ses along the period

E.N ↓ses along the group.



stions :

Which one of the following pairs would have a large size ? Explain .

(i) K or K^+ (iv) Li^+ or Na^+

(ii) Br or Br^- (V) P or As

(iii) O^{2-} or F^- (vi) Na^+ or Mg^{2+}

2. Arrange the following in order of increasing radii ?

(i) I, I^+, I^- (iii) O^{2-}, N^{3-}, S^{2-}, F^-

(ii) C, N, Si, P

3. For each of the following pairs, predict which one has lower first ionization enthalpy ?

(i) N or O (iii) Na or Na^+

(ii) Be^+ or Mg^{2+} (iv) I or I^-

4. Arrange the following elements in order of decreasing electron gain enthalpy : B, C, N, O .

5. Which one in the following pair has higher electron gain enthalpy ?

(i) O^-, S

(ii) O, S^-

(iii) O^-, S^-

(iv) N^-, P

Answers

1. (i) K (ii) Br^- (iii) O^{2-} (iv) Na^+ (v) As (vi) Na^+

2. (i) $I^+ < I < I^-$

(ii) $F^- < O^{2-} < N^{3-} < S^{2-}$

(iii) $N < C < P < Si$

3. (i) O (ii) Be^+ (iii) Na (iv) I

4. $N > B > C > O$

5. (i) $O^- > S$ (iii) $S^- > O$

(ii) $S^- > O$ (iv) $N^- > P$