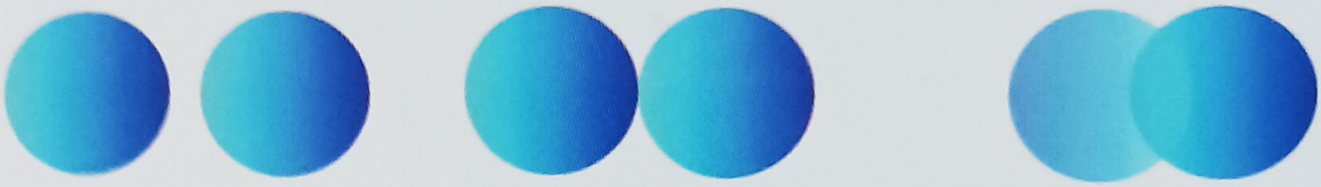
PERIODIC PROPERTIES

Properties	↓ Group	→ period
Atomic radii	increases	decreases
Ionisation enthalpy	decreases	increases
Electron affinity	decreases	increases
Electronegativity	decreases	increases
Metallic character	increases	decreases
Non metallic character	decreases	increases
Oxidising nature	decreases	increases
Reducing nature	increases	decreases
Oxide - acidic nature	decreases	increases
Oxides - basic nature	increases	decreases
Metal reactivity	increases	---
Non metal reactivity	decreases	---

General electronic Configuration

S BLOCK	F BLOCK
ns^{1-2} ; n = 2-7	$(n-2)f^{1-14}(n-1)d^{0-10}ns^2$; n = 6-7
D BLOCK	**P BLOCK**
$(n-1)\ d^{1-10}ns^{0-2}$; n = 2-7	ns^2np^{1-6} ; n = 2-6



Van Der Waals Metallic Covalent

Atomic Radius

ATOMIC RADIUS - TRENDS AND EXCEPTIONS

Atomic Radius $\propto$ no. of shells $\propto {}^{1}/_{Z_{eff}} \propto \sigma$ (Screening)

- Sc > Ti > V > Cr < Mn > Fe $\approx$ Co $\approx$ Ni < Cu < Zn
- **Lanthanoid Contraction :** Poor shielding of f e^-. **Size Trend** : 3d < 4d =5d. **Exception** : Sc < Y < La
- Size of Anionic **A^- > A** Parent Atom **B > B^+** Size of Cationic. **Case of Radius of Anions** : I^- > H^- > Br^- > Cl^- > F^-
- **Isoelectronic species** ; Size $\propto$ Anionic Charge.
- $C^{4-} > N^{3-} > O^{2-} > F^- > Na^+ > Mg^{2+} > Al^{3+} > Si^{4+} > P^{5+}$
- Smaller the value of Z/e^-, Larger the size of species.

For s,p : Screening increases along the period and group
Screening power trend : ns > np > nd > nf
Penetration effect trend : ns > np > nd > nf

ffective collision results in Products.

IONISATION ENTHALPY

$IE \propto {}^{1}/_{size} \propto Z_{eff} \propto$ Penetration $\propto$ oxidation state

${}^{1}/_{IE} \propto$ Met. Char. $\propto$ Red. Char. $\propto$ Reactivity $\propto$ Basicity

Variations of IE_1 due to stable configurations

- Li < Be > B < C < N > O < F < Ne (2nd Period)
- Na < Mg > Al < Si < P > S < Cl < Ar (3rd Period)

Variations of IE_2 due to stable configurations

- Li > Be <B > C < N < O ≅ F < Ne (2nd Period)

Exceptional Cases in Ionisation enthalpy

- B > Tl > Ga ≥ Al > In (Transition contraction)
- Hf > Zr (Lanthanide Contraction)
- C > Si > Ge > Pb > Sn (Lanthanide Contraction)

ELECTRON AFFINITY

$EA \propto Z_{eff} \propto$ oxid. nature $\propto {}^{1}/_{size} \propto {}^{1}/_{Screening\ effect}$

- **Successive Electron affinity Decreases**
  - $O + e^- \rightarrow O^-$ (ΔH = -ve) ;
  - $O^- + e^- \rightarrow O^{2-}$ (ΔH = +ve)
- For Noble gases, E.A. = 0
- EA increases along period, dec. along the group

Exceptional Cases in Ionisation enthalpy

- Cl > F > Br > I (Due to Interatomic repulsion in F)
- S > Se > Te > Po > O (Due to Small size of Oxygen)
- B < Al & N < P (Due to small size of 2nd pd. atom)

ELECTRONEGATIVITY

$$EN \propto Z_{eff} \propto {}^{1}/_{size} \propto \%\ s\ charac. \propto Oxidation\ state \propto {}^{1}/_{Met.\ char.} \propto {}^{1}/_{Bond\ Length} \propto Bond\ Energy \propto Acidity\ of\ oxides \propto {}^{1}/_{Acidity\ of\ Hydrides}$$

Some Important Trends

- F > Cl > Br > I Due to increase in size
- $Fe^{3+} > Fe^{2+} > Fe$ Due to increase in positive charge
- C in Ethane < Ethene < Ethyne (%s-char)

Exceptions to Electronegativities

- Zn < Cd < Hg (Due to Lanthanoid Contraction)
- Ga>Al & Ge>Si (Due to transition contraction)

BOND CHARACTERISTICS

Factors Affecting Bond Length

- BL ∝ Size of atoms : H-I > H-Br > H-Cl > H-F
- BL ∝ 1/Multiplicity of bond : C≡C < C=C < C-C
- BL ∝ 1/s-character : C-H of $sp^3 > sp^2 > sp$

Factors Affecting Bond Strength or Energy

- BS ∝ 1/Size of atoms H-I < H-Br < H-Cl < H-F
- BS ∝ Multiplicity of bond N≡N > O=O > H-H
- **B.E.** ∝ 1/lone pairs (due to repulsion b/w atoms)

CALCULATING BOND ANGLE (BA)

Check for Hybridisation state $sp^3 < sp^2 < sp$

↓ If H is same

If Lone pair available, LP ↑ ⟹ BA ↓

↓ If LP is same

Check for Central Atom (CA)

If CA is same

Size of CA ↑ ⟹ BA ↓

E.N. of CA ↑ ⟹ BA ↑

Check for Side Atoms (SA)

Size of SA ↑ ⟹ BA ↑

E.N. of SA ↑ ⟹ BA ↓

1. $CO_2 > BCl_3 > CH_4$ (Hybridisation)
2. $CH_4 > NH_3 > H_2O$ (Lone Pair presence)
3. $NF_3 > PF_3 > AsF_3$ (Central atom Difference)
4. $Cl_2O > H_2O > OF_2$ (Side atom Difference)

LATTICE ENTHALPY

$$M^{n+}(g) + X^{n-}(g) \leftrightharpoons MX(g) + \text{Lattice Energy}$$

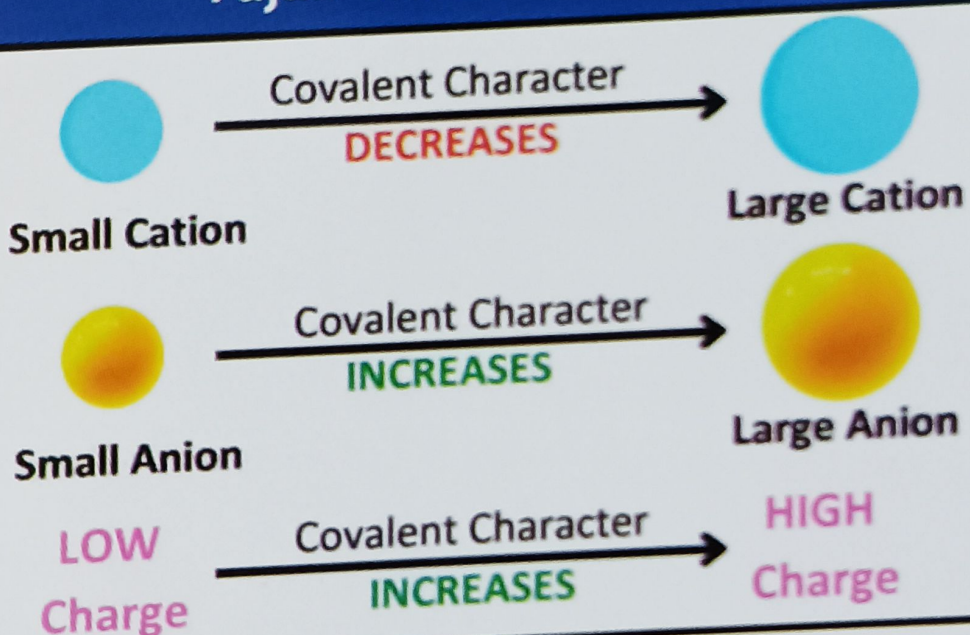
- Lattice energy $\propto$ charge $\propto$ 1/ionic distance.
- Larger the value of LE, more will be the stability.
- High value of LE gives high MP,BP but low solubility.
- LiF > LiCl > LiBr > LiI (Ionic distance increases)
- MgO > $MgCl_2$ > NaCl (Charge increases)

HYDRATION ENTHALPY

$Na^+(g) + Water \rightarrow Na^+(aq) + Hyd.\ Energy$

- Hydration energy $\propto$ charge density $\propto$ 1/size
- $Fe^{2+}(aq) < Fe^{3+}(aq)$ (Increase in Charge)
- $Li^+ > Na^+ > K^+ > Rb^+ > Cs^+$ (Increase in Size)
- NOTE : ionic mobility $\propto$ 1/hydration radius of ions

Fajan's Rule Summary



Covalent Character order of some compounds

- NaI > NaBr > NaCl > NaF (Size of Anion)
- $BaCl_2 < SrCl_2 < CaCl_2 < MgCl_2$ (Cation Size dec.)
- $NaCl < MgCl_2 < AlCl_3$ (Charge on Cation inc.)
- CuCl is more covalent than NaCl, Since cation with 18 electrons in outermost shell have greater polarisation towards anion (pseudo inert gas configuration)