CHAPTER

3 Classification of Elements and Periodicity in Properties

Trends at a Glance

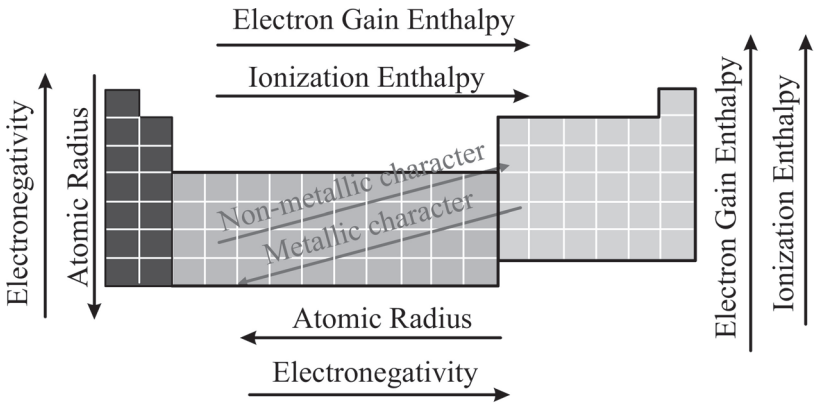

Fig.: The periodic trends of elements in the periodic table

Periodic Variation in Ionisation Energy

- For representative (s- and p- block) elements-Trend across a period:

  General trend-the Z_{eff} **increases** in a period, hence
  IE increases.

Table: Trend in ionisation energy across periods

Period No.	Trend in ionisation energy	Comments
2	**Expected:** Li < Be < B < C < N < O < F < Ne **Actual:** Li < B < Be < C < O < N < F < Ne	Irregular Trend
3	**Expected** Na < Mg < Al < Si < P < S < Cl < Ar **Actual:** Na < Al < Mg < Si < S < P < Cl < Ar	
4	**Expected:** K < Ca < Ga < Ge < As < Se < Br < Kr **Actual:** K < Ga < Ca < Ge < Se < As < Br < Kr	
5	Rb < Sr < ln < Sn < Sb < Te < l < Xe	Regular Trend
6	Cs < Ba < Tl < Pb < Bi < Po < At < Rn	

- For representative (s-and p-block) elements-Trend across a period:

Table: Exceptions in the trend of variation of ionisation energy across periods

Exceptions to the trend across periods		
Expected	**Actual**	**Explanation**
Be < B Mg < Al Ca < Ga	Be > B Mg > Al Ca > Ga	Be, Mg and Ca have fully-filled ns^2 orbitals
N < O P < S As < Se	N > O P > S As > Se	N, P and As have half-filled electronic configuration

- For representative (s-and p-block) elements - Trend down the group:
  General trend-the size increases down a group, hence IE decreases.

Table: Exceptions in the trend of variation of ionisation energy down the group

Exceptions to the trend across groups				
Group No.	**Expected**	**Actual**	**Explanatin**	**Overall order in group**
13	Al > Ga	Al ≈ Ga	Poor shielding of d-electrons in Ga	B > Tl > Ga ≥ Al > ln
	ln > Tl	ln < Tl	Lanthanoid contraction in Tl	
14	Sn > Pb	Sn < Pb	Lanthanoid contraction in Pb	C > Si > Ge > Pb > Sn

Factors Affecting Electronegativity

Table: Effect of Atomic radius, Z_{eff}, oxidation state and Hybridisation on Electro negativity

Factor	Effect on EN
Atomic Radius	Atomic radius ↑, EN↓
Li (r = 133 pm, EN = 1.0) Na (r = 155 pm, EN = 0.9)	
Z_{eff}	Z_{eff} ↑, EN ↑
O(Z_{eff} = 4.55, EN = 3.5 F(Z_{eff} = 5.20, EN = 4.0)	
Oxidation State	For the atoms of same element in different compunds, as ON↑, EN↑
EN of $Fe^{3+} > Fe^{2+}$, EN of $O^{2-} < O^{-}$	
Hybridisation	Greater the %s chracter, greater is the attraction on the electrons, greater is the EN.
$sp > sp^2 > sp^3$	