3. Classification of Elements & Periodicity in Properties

1 OMQ + 1 VSAQ + 1 SAQ + 1 LAQ [1 M + 2M + 4M+ 8M = 15 M]

CONCEPTS & DEFINITIONS

1.0 The four prominent periodic laws :

i)**'Lawof triads'** by **Dobereiner** (1829)

ii) **'Law of octaves'** by Newlands (1865)

iii) **Mendeleev's** Periodic law

iv) **Modern Periodic law** by **Moseley**.

1.1 Mendeleev's Periodic law : The physical and chemical properties of elements are the periodic functions of their '**Atomic weights**'.

1.2 Modern Periodic law: The physical and chemical properties of the elements are the periodic functions of their '**Atomic numbers**'.

2.1 The Modern periodic table contains :

i) **7** horizontal rows from 1 to 7 are called **periods**.

ii) **18** vertical columns from 1 to 18 are called **groups/ families**

iii) **4** blocks, namely **s-block, p-block, d-block and f-block**.

2.2 Elements of the **same group** have **similar valence shell** electronic **configuration**. Hence they exhibit **similar chemical properties**.But elements of the same period have different valencies.

3.1 Classification of elements basing on the **entry** of **differentiating electron** into sub- shell :

i) s-block elements

ii) p-block elements

iii) d-block elements

iv) f-block elements.

3.2 Types of elements basing on the electronic configuration and chemical properties:

i) Noble gas elements

ii) Representative elements

iii) Transition elements

iv) Inner transition elements.

3.3 Classification of elements basing on the metallic character:

(i) Metals (ii) Semi metals (Metalloids) (iii) Non-metals

3.4 Special names to some groups, periods:

1. The elements of the first group are called **Alkali metals**.
2. The elements of the last group/ Zero group (18^{th}) are called **Noble gases** / Inert / Rare gas elements
3. The elements of 17^{th} group are called **Halogens** (Salt generators).
4. The elements of 16^{th} group are called **Chalcogens** (Ore formers).
5. The **first period** is called **shortest period.** It contains **only 2** elements H and He.
6. The **second & third periods are** called **short periods.** They contain 8 elements.
7. The **fourth & fifth periods** are called **long periods.**They contain 18 elements.
8. The **sixth period** is called the **longest period**.It contains 32 elements from Cs to Rn.
9. The **seventh period** is an **incomplete period**. It starts from Fr.
10. The elements of 4f series of f-block are called **Lanthanides (Rare-earth elements)**.
11. The elements of 5f series of f-block are called **Actinides (Radio- active elements)**.
12. The elements after Uranium are called **Transuranic** elements.

4.1 Certain periodic properties of elements : (i) Atomic radius (ii) Ionization potential (iii) Electron affinity (iv) Electro negativity (v) Electro positivity (vi) Valency

4.2 Atomic radius: The distance between the centre of nucleus and outermost electron of an atom is called atomic radius.

Covalent radius: One-half of the inter-nuclear distance between two adjacent atoms of a covalent molecule is called covalent radius.

Metallic radius : One-half of the inter nuclear distance between two adjacent atoms in a metallic crystal is called metallic radius.

Vander Waals radius : One-half of the inter-nuclear distance between atoms of adjacent molecules facing each other in the solid state is called Vander Waals radius.

5.1 Ionisation Potential (I.P): The minimum energy required to remove the most loosely bounded electron from an isolated, neutral, gaseous atom is called ionisation energy.

The element with highest ionisation potential is 'He' and with least ionisation potential is 'Cs'.

First ionisation potential: "The minimum energy required, to remove a valence electron from an isolated gaseous **atom** ,to convert it into a gaseous uni positive ion" is called first ionization potential (or) Ionisation potential.

Second ionisation potential: The energy required to remove an electron from unipositive gaseous **ion** is called second ionization potential.

Factors influencing I.P. : (i) Atomic radius (ii) Nuclear charge (iii) Screening effect

(iv) Penetration effect of orbitals of valence electrons

(v) Half filled or completely filled sub shells

5.2 Electron affinity: The amount of energy released when an electron is added to neutral isolated gaseous atom is called electron affinity.

The element with **highest** electron affinity is **Chlorine**.

The **Metal** with **highest E.A** is **Gold**

5.3 Electro negativity of elements : The tendency of an atom **to attract** the shared pair of electrons towards itself in a diatomic molecule is called electro negativity.

Mulliken scale, Pauling scale measures are used to calculate electro negativity of elements.

The element with **highest E.N** is **Fluorine.**

5.4 Electro positivity of elements: The tendency of an atom **to lose** electrons is called electro positivity.

5.5 Valency: The combining capacity of an atom with other atoms is called valency.

It is the number of H atoms (or) the number of C*l* atoms (or) double the number of 'O' atoms with which one atom of the element combines.

6.0 Variation of periodic properties in periods and groups :

	Property	Group	Period
i.	Atomic radius	Increases	Decreases
ii.	Electron Affinity	Decreases	Increases
iii.	Electro negativity	Decreases	Increases
iv.	Ionisation potential	Decreases	Increases
v.	Acidic Nature of oxides	Decreases	Increases
vi.	Non Metallic nature	Decreases	Increases
viii.	Electro positivity	Increases	Decreases
ix.	Metallic Nature	Increases	Decreases
x.	Basicnature of oxides	Increases	Decreases

7.1 Inert pair effect: The reluctance of the outermost 'ns' electron pair to take part in a chemical bonding is called inert pair effect.

7.2 Diagonal relationship: The elements of 2^{nd} period have certain similarities with the elements situated diagonally below in the third period.

7.3 Lanthanide contraction: The gradual decrease of atomic size from left to right in lanthanides is called lanthanide contraction.

7.4 Screening effect : The reduction of attractive forces of the nucleus on the valence electrons by the electrons of inner shells is called screening effect or shielding effect.

☛ For **Chem Beats** of this chapter Refer Page **Nos. 202 to 204**