CHAPTER

03

Classification of Elements and Periodicity in Properties

A Quick Recapitulation of the Chapter

1. **Periodic table** is the arrangement of elements on the basis of similarity and dissimilarity in properties to systematise their study.
2. Dobereiner, Newlands, Lothar Meyer and Mendeleev arranged the elements on the basis of their atomic weight.
3. **Modern periodic table** arranges the elements in the order of their atomic numbers in 7 periods and 18 groups.
4. Four types of elements can be recognised in the periodic table on the basis of their electronic configuration, i.e. *s*-block, *p*-block, *d*-block and *f*-block elements.
5. Position of elements in the periodic table:
   (a) Period = Principal quantum number of valence shell.
   (b) Group = Number of valence electrons for *s* and *p*-block
   $= (n-1)\ d + ns$ electrons [for *d*-block]
   $= 3$ [for *f*-block]
   (c) Block = orbital receiving the last electron.
6. General electronic configuration of
   s-block element = ns^1
   p-block element = ns^2np^{1-6}
   d-block element = $(n-1)d^{1-10}ns^{0-2}$
   f-block element = $(n-2)f^{1-14}\ (n-1)d^{0-1}ns^2$
7. **Hydrogen** with one electron in the 1*s*-orbital occupies a unique position in the periodic table.
8. The physical and chemical properties of elements vary periodically with their atomic number.
9. The magnitude of screening effect depends upon the number of **inner electrons**.
10. The screening effect and effective nuclear charge are very closely related, i.e.
    $Z' = Z - \sigma$ (Greek letter sigma)
    where, Z' = effective nuclear charge
    Z = atomic number
    σ = screening constant
11. The screening effect of electrons belonging to different subshells decreases in the order
    $s > p > d > f$
12. The order of different atomic radii is van der Waals' radius > metallic radius >> covalent radius.
13. Ionic radius $\propto$ charge on anion $\propto \dfrac{1}{\text{charge on cation}}$
14. **The ionisation energy** of element depends upon its size as IE $\propto \dfrac{1}{\text{size of atom / ion}}$
15. Order of ionisation energy of various orbital is
    $s > p > d > f$
16. **Electron gain enthalpy** affected by various factors :
    (a) Magnitude of $\Delta_{eg}H \propto Z_{eff}$
    (b) Magnitude of $\Delta_{eg}H \propto \dfrac{1}{\text{atomic size}}$
    (c) Magnitude of $\Delta_{eg}H \propto$ penetrating power

17. Electronegativity $\propto \frac{1}{\text{atomic radius}}$
18. **Electronegativity** increases as the oxidation state of the atom increases.
19. Electronegativity measured by the Pauling scale

$$X_A - X_B = 0.208\sqrt{\Delta}$$

where, $\Delta = E_{A-B} - \sqrt{E_{A-A} \times E_{B-B}}$

$X_A - X_B$ = electronegativity difference between two atoms A and B.

20. **Valency** Along a period from left to right increases from 1to 7 with respect to hydrogen and from 1 to 4 and then decrease to 1 with respect to oxygen.
21. In general, the stability of the higher oxidation states in order: $3d << 4d < 5d$.
22. Chemical reactivity is highest at the two extremes of a period and is lowest at its center. (i.e. between group 1 to 17).