PERIODIC TABLE SHORT NOTES

Dobernier traids

- Arranged elements in group of three.
- Atomic mass of middle element is average of atomic mass of other two elements.

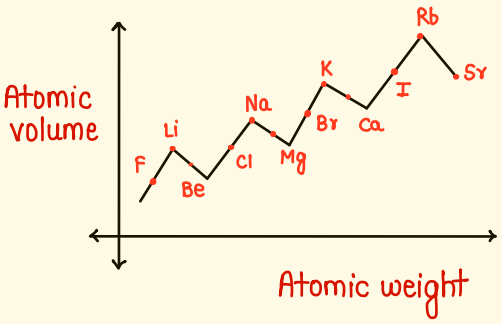
  e.g. Li, Na, K

  7, 23, 29

- **Drawbacks:**

  All known elements were not grouped in traids.

Lother meyer's curve:



- Alkali metals occupy top positions in graph.
- Alkaline earth metals occupy descending positions
- Halogens occupy ascending positions.

Modern periodic table: (Long Form of periodic table)

- Based on Moseley's Law.

  $\sqrt{f} = Z$ $\sqrt{f} = a(Z-b)$

- Periodic properties of element are periodic functions of their atomic number.
- **Periodicity** - Repetition of similar properties of elements after certain regular interval of time.
- **Cause of periodicity** - Repitition of similar electronic configuration of elements after regular interval of time.

Transition elements:

Elements which have incompletely filled d-orbitals in their ground state or most common oxidation state.

- Zn, Cd, Hg are not transition elements.

Pseudo transition elements.

Representative elements:

Combined elements of s and p block are known as Representative elements

Newland Law of octaves:

When elements are arranged in increasing order of atomic mass, then every 8th element starting from first will have similar properties.

e.g. Li, Na, Be, B, C, N, O, F

- **Drawback:**

1) Valid upto calcium only.
2) No position of inert gas.
3) Does not worked for heavier elements.

Mendeleev's periodic table:

Periodic properties of elements are periodic function of their atomic masses.

Merits:

1) Simplied study.
2) Some vacant spaces was left for discovering new elements.

   Eka-aluminium – Ga

   Eka-Silicon – Ge

3) Corrected atomic mass of element.

Drawbacks -

a) Position of hydrogen is not fixed.
b) Could not explain cause of periodicity

18 Groups 7 periods

4 Blocks

1) S-Block – G1 and G2 – ns^{1-2} — P4 – 3d series
2) P-Block – G13 to G18 – $ns^2 np^{1-6}$ — P5 – 4d series
3) D-Block – G3 to G12 – $(n-1)d^{1-10} ns^{0-2}$ — P6 – 5d series
4) F-Block – $(n-2)f^{1-14} (n-1)d^{0-1} ns^2$

4f series Lanthanoids series = Z = 58 to 71 P6 G3

5f series Actinoids series = Z = 90 to 103 P7 G3

Element { Lanthanum Z = 57 P6, G3
Actinium Z = 89 P7, G3

Diagonal Relationship:

Li → Na, Be → Mg, B → Al

- Similar $\frac{\text{charge}}{\text{size}}$ ratio

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PERIODIC TABLE SHORT NOTES

Nomenclature of elements having $Z \geq 100$

0 - nil	5 - pent	Suffix = ium
1 - un	6 - hex	105 unp
2 - bi	7 - sept	Unnilpentium
3 - tri	8 - oct	
4 - quad	9 - inn	

Effective nuclear charge $Z_{eff} = Z - \sigma$

Screening effect s > p > d > f

Trends - Along a period - $Z_{eff} \uparrow$

Along a group - Z_{eff} almost remains same or $Z_{eff} \downarrow$

- More the +ve charge, more is Z_{eff}

More the -ve charge, less is Z_{eff}

Ionisation energy

Energy required to remove electron from an isolated gaseous atom.

IE is always endothermic. $\Delta H = +ve$

$M_{(g)} \longrightarrow M^{+}_{(g)} + e^{-}$ IE_1

$M^{+}_{(g)} \longrightarrow M^{+2}_{(g)} + e^{-}$ IE_2

$M^{+2}_{(g)} \longrightarrow M^{+3}_{(g)} + e^{-}$ IE_3

$I.E = IE_1 < IE_2 < IE_3$

Trends $I.E \propto Z_{eff}$

Along a period : $Z_{eff} \uparrow$ = IE $\uparrow$

Along a group : $Z_{eff} \downarrow$ = IE $\downarrow$

G-13 - B > Tl > Ga > Al > In

G-14 - C > Si > Ge > Pb > Sn

Period 2 :

IE_1 = Li < B < Be < C < O < N < F < Ne

IE_2 = $Be^{+} < C^{+} < B^{+} < N^{+} < F^{+} < O^{+} < Ne^{+} < Li^{+}$

Atomic Radius :

Distance between nucleus and electron outermost shell

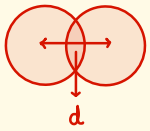
But it is impossible to find exact value of atomic radius.

Reason - 1) Atom is too small.

2) Atom does not have well defined boundary

Covalent Radius (Rc)

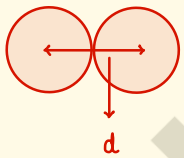
Half of the internuclear distance b/w 2 atoms bonded by covalent bond



$R_c = \frac{d}{2}$

Metallic radius (R_M)

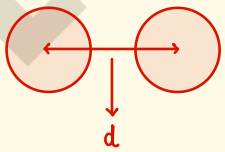
Half of the internuclear distance b/w 2 atoms bonded by a metallic bond.



$R_M = \frac{d}{2}$

Vanderwaal Radius : (R_{VR})

Half of the internuclear distance b/w 2 nearest molecules in non-Bonded state



$R_{VR} = \frac{d}{2}$

- Vander waal Radius is defined for gases.

Note - $R_{VR} > R_M > R_c$

Trends

Along a period : $Z_{eff} \uparrow$ = Atomic Radius $\downarrow$

Along a group : $Z_{eff} \downarrow$ = Atomic Radius $\uparrow$

Ionic Radius - $R_{cation} < R_{neutral} < R_{anion}$

Atomic Radius $\propto \frac{1}{Z_{eff}}$

Pauling scale

$X_P = \frac{X_M}{2.8} = \frac{IE + EA}{5.6}$ ev/atom

$= \frac{IE + EA}{540}$ KJ/mol

$= \frac{IE + EA}{130}$ Kcal/mol

Mullikan scale

$X_M = \frac{IE + EA}{2}$

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PERIODIC TABLE SHORT NOTES

Electron gain enthalpy :

Electron required or released when an electron is added to outermost orbit of an isolated gaseous atom is known as Electron gain enthalpy

$X(g) + e^- \longrightarrow X^-(g)$ $\Delta_{eg}H_1$

$X^-(g) + e^- \longrightarrow X^{2-}(g)$ $\Delta_{eg}H_2$

Note - In majority of cases $\Delta_{eg}H_1$ is -ve (exothermic)

Except - 1) Be, 2) N, 3) Noble gas } Stable configuration $\Delta_{eg}H_1 = +ve$

Note - Successive electron gain enthalpy is always +ve ($\Delta_{eg}H_2$, $\Delta_{eg}H_3$, ...)

Trends

$\Delta_{eg}H \propto Z_{eff}$

Along a period : $Z_{eff}\uparrow$ = $\Delta_{eg}H\uparrow$

Along a group : $Z_{eff}\downarrow$ = $\Delta_{eg}H\downarrow$

G-16 - S > Se > Te > Po > O

G-17 - Cl > F > Br > I

Exceptions of atomic size :

B < Ga < Al < In < Tl

d- Block contraction.

Ne > Li > Be > B > C > N > O > F

Electronegativity

Tendency of an atom to attract shared pair of electrons towards itself.

A — B

$(EN)_A > (EN)_B$: $A^{\delta-} \cdots B^{\delta+}$

$(EN)_A < (EN)_B$: $A^{\delta+} \cdots B^{\delta-}$

Trends $EN \propto Z_{eff}$

Along a period : $Z_{eff}\uparrow$ = EN ↑

Along a group : $Z_{eff}\downarrow$ = EN ↓

Entire periodic table F > O > N ≈ Cl

Inert pair effect

Due to poor screening effect of d and f orbitals.

$Z_{eff}\uparrow \longrightarrow ns^2$ becomes inert

∴ Does not participate in the reaction.

Down the group, ns^2 pair becomes inert.

1) Stability of lower OS ↑es down the group.
2) Stability of Higher OS ↓es down the group.

D- Block and F Block contraction.

Screening effect

s > p > d > f (contraction)

Poor screening ⟶ $Z_{eff}\uparrow$ ⟶ Size ↓

How to Find group, period and Block ?

	G-1		G-18	
			He^{2}	P_1
P_2	Li^{3}		Ne^{10}	P_2
P_3	Na^{11}		Ar^{18}	P_3
P_4	K^{19}		Kr^{36}	P_4
P_5	Rb^{37}	D-Block	Xe^{64}	P_5
P_6	Cs^{55}		Rn^{86}	P_6
P_7	Fr^{87}		118	P_7

S-Block - G1 and G2

P-Block - G13 to G18

D-Block - G3 to G12

F-Block - Lanthanoids series = Z = 58 to 71 P6 G3

Actinoids series = Z = 90 to 103 P7 G3

Nature of Oxides

1) Acidic oxide

Non metal SO_2 SO_3 P_4O_6 P_4O_{10} CO_2

Metal (+7) Mn_2O_7 (+6) CrO_3 (+5) V_2O_5

2) Basic oxide

Metal Na_2O K_2O MgO CaO

3) Amphoteric oxide

Be: BeO; Al: Al_2O_3; Ga: Ga_2O_3; Sn: SnO, SnO_2; Pb: PbO, PbO_2; Zn: ZnO

4) Neutral Oxide

N_2O NO H_2O CO

Note - Higher the % of oxygen, more is acidic strength

Acidic order - $N_2O_3 < N_2O_4 < N_2O_5$

$SO_2 < SO_3$

Acidic strength - $MnO < MnO_2 < MnO_3 < Mn_2O_7$

Trends :

Along a period = non-metallic character ↑ = Acidic strength ↑

Along a group = metallic character ↑ = Basic strength ↑

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