

PERIODIC TABLE SHORT NOTES

Dobernier triads

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

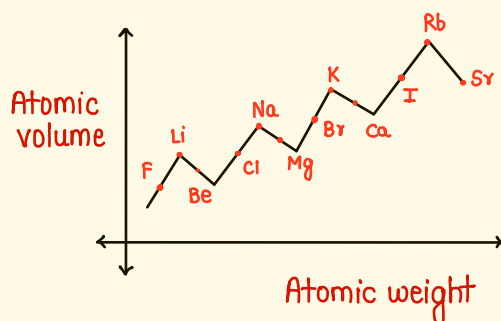
e.g. Li, Na, K

7, 23, 29

Drawbacks:

All known elements were not grouped in triads.

Lothar 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.

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

- 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** - Repetition 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 work for heavier elements.

Mendeleev's periodic table:

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

Merits:

- 1) Simplified study.
- 2) Some vacant spaces were 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 Be B - Similar charge ratio
Na Mg Al size



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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 $Z_{\text{eff}} = Z - \sigma$

Screening effect $s > p > d > f$

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

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

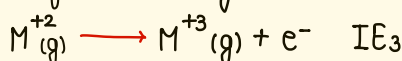
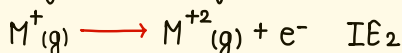
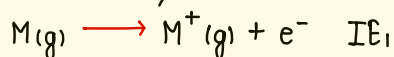
- More the +ve charge, more is Z_{eff}

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

Ionisation energy

Energy required to remove electron from an isolated gaseous atom.

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



$$I.E = IE_1 < IE_2 < IE_3$$

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

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

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

Gr-13 - $B > Tl > Ga > Al > In$

Gr-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

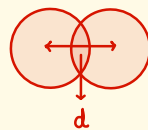
But it is impossible to find exact value of atomic radius.

Reason - 1) Atom is too small.

2) Atom does not have well defined boundary

Covalent Radius (R_c)

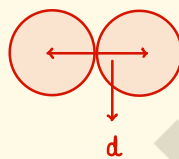
Half of the internuclear distance b/w 2 atoms bonded by covalent bond



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

Metallic radius (R_m)

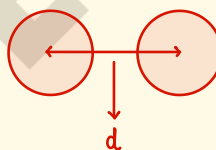
Half of the internuclear distance b/w 2 atoms bonded by a metallic bond.



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

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: $Z_{\text{eff}} \uparrow = \text{Atomic Radius} \downarrow$

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

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

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

Pauling scale

$$X_P = \frac{X_M}{2.8} = \frac{IE + EA}{5.6} \quad \text{eV/atom}$$

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

$$= \frac{IE + EA}{130} \quad \text{kcal/mol}$$

Mullikan scale

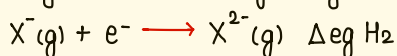
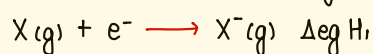
$$X_M = \frac{IE + EA}{2}$$



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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



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

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

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

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

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

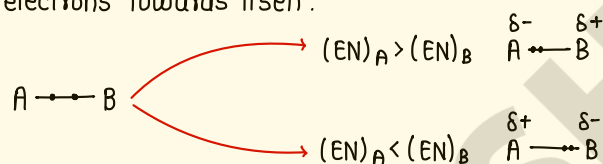
Along a group: $Z_{\text{eff}} \downarrow = \Delta_{\text{eg}} H \downarrow$

Gr-16 - $S > Se > Te > Po > D$

Gr-17 - $Cl > F > Br > I$

Electronegativity

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



Trends $EN \propto Z_{\text{eff}}$

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

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

Entire periodic table
 $F > O > N \approx Cl$

Inert pair effect

Due to poor screening effect of d and f orbitals.

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

$\therefore$ Does not participate in the reaction.

Down the group, ns^2 pair becomes inert.

1) Stability of lower OS $\uparrow$ es down the group.

2) Stability of Higher OS $\downarrow$ es down the group.

D-Block and F Block contraction.

Screening effect

$s > p > d > f$ (contraction)
Poor screening $\rightarrow Z_{\text{eff}} \uparrow \rightarrow \text{Size} \downarrow$

How to find group, period and Block?

		Gr-18	
Gr-1		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	Xe ⁵⁴	P ₅
P ₆	Cs ⁵⁵	Rn ⁸⁶	P ₆
P ₇	Fr ⁸⁷	118	P ₇

D-Block

S-Block - Gr1 and Gr2

P-Block - Gr13 to Gr18

D-Block - Gr3 to Gr12

F-Block - Lanthanoids series = Z = 58 to 71 P₆ Gr3

Actinoids series = Z = 90 to 103 P₇ Gr3

Nature of Oxides

1) Acidic oxide

Non metal SO_2 SO_3 P_4O_6 P_4O_{10} CO_2

Metal Mn_2O_7 CrO_3 V_2O_5

2) Basic oxide

Metal Na_2O K_2O MgO CaO

3) Amphoteric oxide

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

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 $\uparrow$ = Acidic strength $\uparrow$

Along a group = metallic character $\uparrow$ = Basic strength $\uparrow$

