CONCEPT **MAP**

PERIODICITY IN PROPERTIES

The basic object of classification is to arrange the facts regarding elements and their compounds in such a way so that we may have greatest control over their characteristics with least possible effort. The repetition of similar physical and chemical properties of elements after regular intervals is known as periodicity in properties.

Class XI

Periodicity in Physical Properties

Ionic Radius

- Across a period : The ionic radii of ions having same charge decreases as atomic number increases.
- Down a group : Increases

$Li^+ < Na^+ < K^+ < Rb^+ < Cs^+$ (Cations)

$F^- < Cl^- < Br^- < I^-$ (Anions)

- Cationic radius < Atomic radius < Anionic radius (For isoelectronic species)
- Z/e ratio increases, size decreases and vice-versa.

Atomic Volume

- Across a period : First decreases and then increases.

	Li	Be	B	C	N	O	F	Ne
(cc/mol)	13	5	5	5	14	11	15	17

- Down a group : Increases

	Li	Na	K
(cc/mol)	13	24	46

Density

- Across a period : First increases and then decreases.

	Na	Mg	Al	Si	P	S
(g/cm^3)	1.0	1.7	2.7	2.3	1.8	2.1

- Down a group : Decreases

  Be(1.8) , Mg(1.7)
- Highest density solid : Os (22.6)
- Highest density liquid : Hg (13.6)

Electron Gain Enthalpy

- Across a period : More negative

	Li	Be	B	C	N
(kJ/mol)	–60	+66	–83	–122	+31

	O	F
	–141	–328

- Down a group : Less negative

	H	Li	Na	K	Rb	Cs
(kJ/mol)	–73	–60	–53	–48	–47	–46

Atomic Radius

- Across a period : Decreases

  Atomic radius $\propto 1/Z_{eff}$

  $Li > Be > B > C > N > O > F$
- Down a group : Increases

  $H < Li < Na < K < Rb < Cs$
- van der Waals' radius > Metallic radius > Covalent radius

Electronegativity

- Across a period : Increases

  $Li < Be < B < C < N < O < F$
- Down a group : Decreases

  $H > Li > Na > K = Rb > Cs$
- F is most electronegative element.

Ionic Character

- Across a period : First decreases and then increases.
- Down a group : Increases

Metallic Character

- Across a period : Decreases
- Down a group : Increases

Ionisation Enthalpy

- Across a period : Increases

  $Li < Be > B < C < N > O < F$
- Down a group : Decreases

  $H > Li > Na > K > Rb > Cs$

Periodicity in Chemical Properties

Valency

- Across a period : Increases

  $NaH < MgH_2 < AlH_3 < SiH_4$
- Down a group : Same

Reducing Nature

- Across a period : Decreases
- Down a group : Increases

Oxidising Nature

- Across a period : Increases
- Down a group : Decreases

Strength of Oxyacids

- Across a period : Increases

  $H_3BO_3 < H_2CO_3 < HNO_3$
- Down a group : Decreases

  $HNO_3 > H_3PO_4 > H_3AsO_4$

Acidity of Oxides

- Across a period : Increases

  $Na_2O < MgO < Al_2O_3 < SiO_2 < P_2O_5 < SO_3 < Cl_2O_7$
- Down a group : Decreases

  $N_2O_3 > P_2O_3$

Acidity of Hydrides

- Across a period : Increases

  $CH_4 < NH_3 < H_2O < HF$
- Down a group : Increases

  $HF < HCl < HBr < HI$

Melting and Boiling Points

- Across a period : M.pt. and B.pt. first increase and then decrease.

Element :	Na	Mg	Al	Si	P	S
M.pt. (K):	370.8	924	933	1693	317	392
B.pt. (K) :	1165	1396	2075	2815	557	717.6

- Down a group : They do show regular gradation but pattern of variation is different in different groups.

Element :	Li	Na	K	Rb	Cs
M.pt. (K) :	454	370.8	335	312	302
B.pt. (K) :	1609	1165	1063	973	943