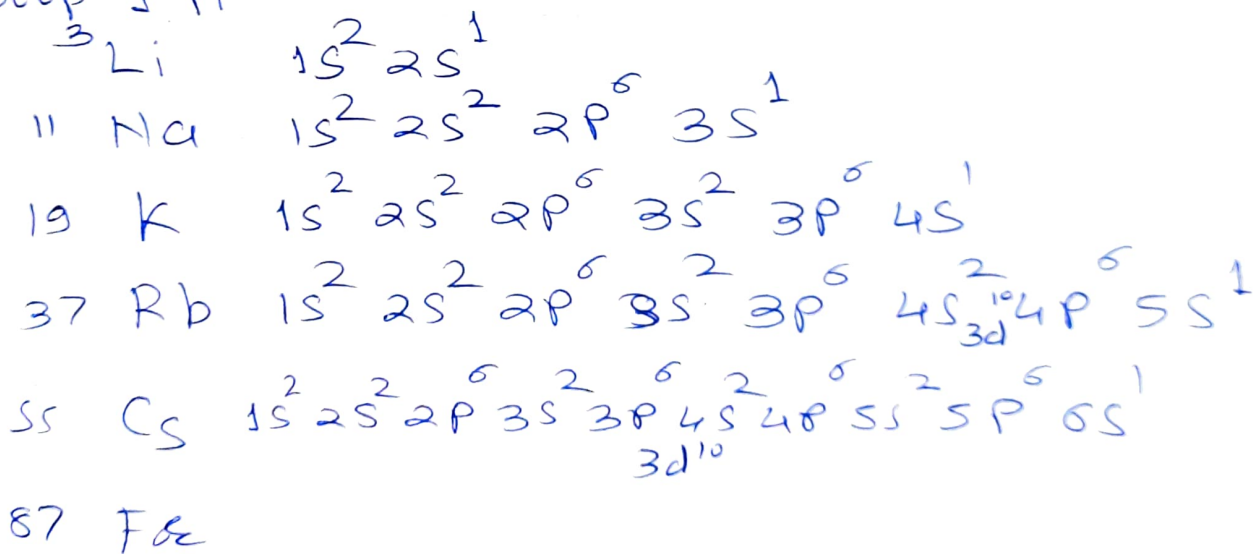


S-Block element

Introduction:

- The S-block element constitute a group of element in which differentiating electron enters into outermost 's' orbital.
- s-orbital can accommodate one or two electrons.
- There are two group IA & IIA in S-block.
- Group IA is called alkali metals & Group IIA is called alkaline earth metals.

Group I A



Group II A

Be

Mg

Ca

Sr

Ba

Ra

- general electronic configuration of alkali metal is ns^1 while alkaline earth metal is ns^2 .
- Last electron enters in the outermost s-orbital & hence they belongs to s-block of periodic table.
- Due to similar outer electronic configuration these elements resemble closely in their physical & chemical properties.

General properties of s-block

1] Flame colouration :-

Due to their low ionisation energy electron easily excited to higher energy state by absorbing heat energy from non luminous flame. At excited state e^- is unstable & fall back to ground state emitting energy in the visible region.

In oxidising flame metal shows colour

metal	Li	Na	K	Rb	Cs
colour	Crimson	yellow	violet	Red violet	blue

S-Block element

3

* General characteristics of s-block element \Rightarrow

- In Group IA of the periodic table contains six elements (except Hydrogen) which are

Li, Na, K, Rb, Cs and Fr.

- These elements are collectively called as alkali metals since they form strongly alkaline oxide and hydroxide.

Fr is radioactive element.

- In Group IIA of the periodic table contain six elements which are

Be, Mg, Ca, Sr, Ba, Ra. These elements are called as alkaline earth metals.

General properties \Rightarrow characteristics

1] Metallic properties :-

The 's'-block elements have typical metallic properties. They show good metallic luster and electrical as well as thermal conductivity.

All elements of s-block have highly electropositive. Ex: Cs

2] Ionisation potential \Rightarrow

It decreases as we move down the group & increases as we move from left to right in periodic table.

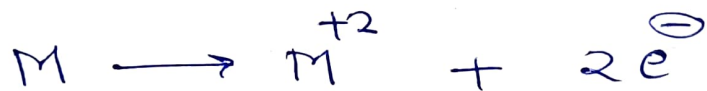
3] Electron affinity :- on moving down a group the increase atomic size, tends to decrease the electron affinity values.

4] Melting point & Boiling point :-

The melting & boiling point do not show regular trends. However, these are higher than those of alkali metals. The M.P. decrease as atomic size increase down the group.
∴ weak metallic bonding & soft in nature.

5] Electropositive (Metallic) character :-

on moving down the group increases the electropositive character.



6] Hydration of ions :-

The extent of hydration of these ion decreases with increase in atomic number & molar mass.

7] Density :-

Group IA - The density increase from Li - Cs on moving down a group.

Group II A - Density slightly decreases on moving down the group upto Ca but increase considerably up to Ra.

∴ Density of K is less than 'Na'. i.e. K is lighter than Na.

5) Flame colouration \Rightarrow When energy is supplied to these elements in a flame, their electrons are excited to higher energy state, as is the case with alkali metals under similar conditions.

Ca - Flame colour
Ca - Brick Red

Ra - crimson

Na - yellow

Se - crimson

Li - crimson Red

K - } - violet
Ce }
Rb }

9) Atomic radii :-

The ~~largest~~ alkali metals

atoms have the largest atomic radii in their respective periods.

In alkali metals, on moving down group, a new shell is being added, so atomic size increases. Hence, atomic radii also increase from Li to Cs.

e.g. $Cs > Rb > K > Na > Li$

9) conductivity :-

The alkali metals are good conductors of heat & electricity. Due to presence of loosely held valence electrons which are free to move throughout the metal structure.

10) Oxidation state :-

Group-I element shows only +1 oxidⁿ state. due to their first low ionisation energy. These metals lose outer most s-electron to form unipositive ion & acquire noble gas configuration. so there is no unpaired electron. so they are diamagnetic & colourless. in fact all comp. are colourless except paramagnetic.

Group II element show +2 oxidation

state. ex:- Mg^{+2} , Ca^{+2} , Be^{+2}

11) Hydration (energy) of ion :->

All alkali metal salts are ionic (except Li) & soluble in water (a solvent of high dielectric constant) because cation (M^+) get hydrated by water molecules.

Hydration of ions is exothermic process. The energy is released in the hydration of ions. is known as hydration energy.

Degree of hydration depend on size of cation i.e. smaller size of cation greater is hydration energy.

∴ Hydration energy of alkali metal ions decrease from Li^+ to Cs^+ .



Variation in properties.

I] Variation of atomic radius :- ✓

- The alkali metals have largest atomic radii in their respective periods & those of alkaline earth are smaller than alkali metal.
- Ex: \rightarrow Na (Sodium) has maximum atomic radius than Mg.
- As we move down the group atomic radii increase.

Element	Li	Be	B	C	N
Atomic radius in A°	1.23	0.90	0.85	0.77	0.70
	Na 1.54				
	K 1.03				
	Rb 2.19				
	Cs 2.35				

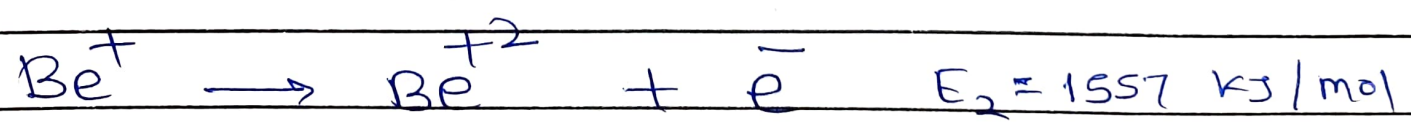
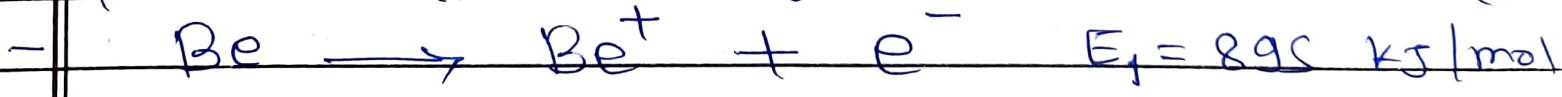
* Variation in Ionisation energy

Def: "A minimum amount of energy required to remove the most loosely bound electron from an isolated gaseous neutral atom to form a positive ion."

- The most loosely electrons lie in the outermost shell.
- On moving down the group as atomic radius increases, the outer electron gets away from nucleus & \therefore ionisation energy decreases on moving down from Li to Cs.

Element	Li	Na	K	Rb	Cs
Ionisation energy kJ/mol	520	495	418	403	375

- In case of alkaline earth metals, two electrons from 's' orbital of outer level two ionisation energies are involved.

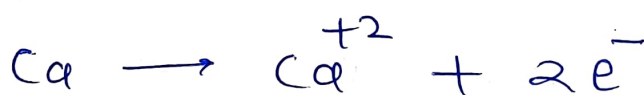
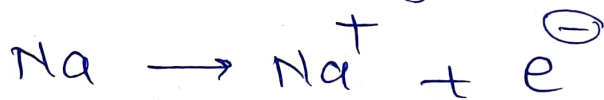


- Alkaline earth metals prefer to form +1 ion (M^+) rather than M^{+2} ions.
e.g. Mg^{+2} , Ca^{+2} etc.

* Reducing Nature of 's' block element

Alkali metals Good Reducing agents

- A substance easily impart its electron can act as good reducing agents.
- Electron donating tendency of a metal depend on its ionisation energy.
- Smaller ionisation energy, greater is reducing power.
- \therefore alkali metals possess smaller value of I.E., they are good reducing agents.



- Some of reducing properties are give below



- Reducing character is related to high oxidation potential which represents tendency to release electrons & get oxidised.
- Group-1 element have higher oxidation potential than group-2 elements.

* Variation of Metallic character in period & down group in 's' block element

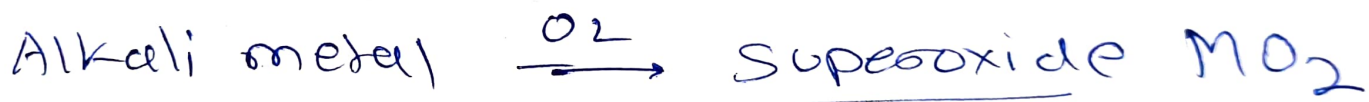
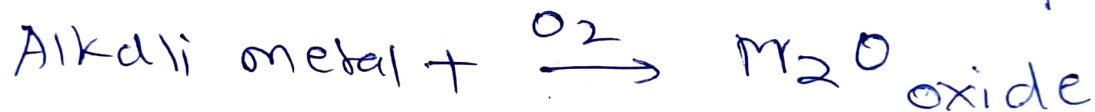
- Alkali metals are highly electropositive elements
- They form ionic compounds e.g. NaCl, KCl
- Electropositive character & metallic character increase as we go down group 1 & 2.
- Cs is more electropositive than Li.
Ba —|— —|— —|— Mg
- Cs is most electropositive element in periodic table.
- All s block element are soft, malleable metals
- They are good conductors of heat & electricity. They are characteristic of metallic nature
- Along a period, metallic properties decrease.

point of difference betⁿ

Lithium & other alkali metals.

- Lithium possesses higher melting & boiling points.
- Lithium is much harder than other alkali metals.
- Lithium & Li^+ has smallest size (152 pm) in group than other alkali metals.
- It has high ionisation energy & ~~low~~ Li does not react with O_2 below 0°C .
- Li is least reactive metals of all alkali metals.
- Li has high polarising power due to high charge density.
- Strong metallic bond in lithium due to small size.
- Lithium has greatest polarising power of Li^+ ion & form covalent bond. Thus salt of Li are covalent & soluble in non polar solvent (e.g. organic solvent). The salt of other alkali metals are insoluble in organic solvents & ionic.

— Li is only alkali metal react with nitrogen & silicon.



— Li react with NH_3 to form imide & Li_2NH .

— Other alkali metal react with NH_3 form amide $\text{M}\cdot\text{NH}_2$.

— LiOH is less soluble in H_2O & much weaker base than NaOH & KOH .

Diagonal Relationship betⁿ

Li and Mg.

The diagonal relationship betⁿ Li & Mg is due to 2 reasons.

1] Both the element have almost same atomic & ionic radii

Li - 134 pm, Mg - 145 pm

Li⁺ - 90 pm (C.N. = 6), Mg²⁺ = 86 pm (C.N. = 6)

2] Li & Mg have almost similar electronegativity
Li = 1 Mg = 1.2

II row	Li	Be	B	
III row	Na	Mg	Al	Si

Diagonal Relationship.

3] Like Mg metal, Lithium is hard and ductile metal.

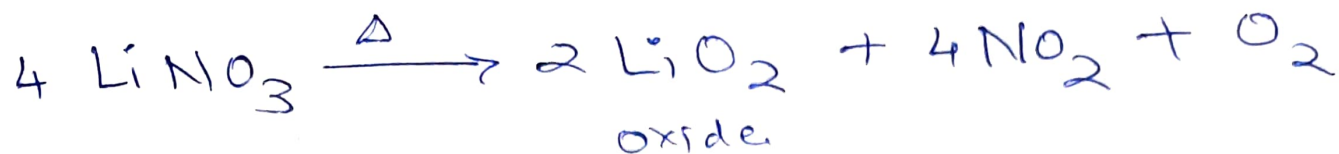
4] LiF & MgF₂ are partially soluble in water.

5] Formation of Hydrated salts :-

Li & Mg are give many hydrated salts like LiCl · 2H₂O, MgCl₂ · 6H₂O, LiNO₃ · H₂O

6] LiOH & Mg(OH)₂ are both weak bases.

7.] Action of heat :-



8.] Action of O₂ & H₂O :-

Li & Mg react with O₂ in air form normally Li₂O & MgO, both these oxides are sparingly soluble in water.

Both metal react with H₂O slowly & form hydroxide.

