

5.1. The Elements of Group IA

The IA sub-group of the periodic table consists of six elements *viz.*, Lithium (Li), Sodium (Na), Potassium (K), Rubidium (Rb), Caesium (Cs) and Francium (Fr). They are known as **alkali metals**, since they form strongly alkaline oxides and hydroxides. Francium is a radioactive element.

Similarities in Physical Properties :

1. Electronic Configuration : The electronic configuration of these elements are as follows :

Li ₃	=	1s ² , 2s ¹
Na ₁₁	=	1s ² , 2s ² 2p ⁶ , 3s ¹
K ₁₉	=	1s ² , 2s ² 2p ⁶ , 3s ² 3p ⁶ , 4s ¹
Rb ₃₇	=	1s ² , 2s ² 2p ⁶ , 3s ² 3p ⁶ 3d ¹⁰ , 4s ² 4p ⁶ , 5s ¹
Cs ₅₅	=	1s ² , 2s ² 2p ⁶ , 3s ² 3p ⁶ 3d ¹⁰ , 4s ² 4p ⁶ 4d ¹⁰ , 5s ² 5p ⁶ , 6s ¹
Fr ₈₇	=	1s ² , 2s ² 2p ⁶ , 3s ² 3p ⁶ 3d ¹⁰ , 4s ² 4p ⁶ 4d ¹⁰ 4f ¹⁴ , 5s ² 5p ⁶ 5d ¹⁰ , 6s ² 6p ⁶ , 7s ¹

From the above electronic configuration it may be concluded that these elements have the general outermost electronic configuration as ns^1 . Since all these elements possess similar electronic configuration, they show similarity and gradual gradation in their properties. This justify their inclusion in IA sub-group of the periodic table.

2. Physical State : All the elements are soft silver white metal. Lithium though hardest of the alkali metals can be cut with a knife.

3. Melting and Boiling Points : Their melting and boiling points are low and decrease from lithium to caesium.

4. Atomic and Ionic Radii : Atomic and ionic radii of alkali metal atoms are largest. Their values gradually increases on going down the group from lithium to caesium. However ionic radii are smaller than atomic radii.

▶▶ Similarities in Chemical Properties :

13. Chemical reactivity : Since ionisation potentials of alkali metals are very low, they are very reactive metals. Their reactivity increases from lithium to caesium.

14. Action of Water : They react vigorously with cold water evolving H_2 .



The reactivity towards water increases from lithium to caesium.

15. Action of Alcohols : Like water they also evolve H_2

when added to alcohol *e.g.*,



The reactivity increases from lithium to caesium.

16. Action with hydrogen : They react with hydrogen forming ionic hydrides of the type MH in which hydrogen is present as anion. The ease of hydride formation decreases from lithium to caesium.

17. Action of Air : They tarnish in air due to formation of an oxide film on the surface which absorbs moisture forming a coating of hydroxide. For this they are kept under kerosene or paraffin oil.

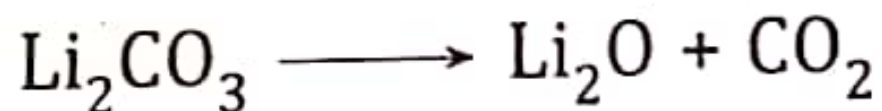
18. Action of halogens : They combine with halogens forming ionic halides. They also form polyhalides *e.g.*, KI_3 , RbI_3 etc. The ease of halide formation increases from lithium to caesium.

5.3. Anomalous Behaviour of Lithium :

Lithium differs from other alkali metals in the following respects :

- (1) It is more hard and ductile.
- (2) It is not affected by air easily unlike other alkali metals.
- (3) It forms nitride even at room temperature.
- (4) It is least reactive of alkali metals.
- (5) It reacts with bromine very slowly while other alkali metals react with violently.
- (6) Li_2O is much less basic than oxides of other alkali metals.

(15) Li_2CO_3 decomposes on heating whereas carbonates of other alkali metals are stable.



(16) It's nitrate on heating gives Li_2O and NO_2 whereas nitrates of other alkali metals give nitrites and O_2 .

