Chemical properties:

- **Reactivity:** These are highly reactive metals. Reactivity increases down the group. As they vigorously react with air and water they are stored in kerosene.
- **Oxides:** When alkali metals are heated in air, Li mainly gives Li_2O, sodium mainly gives sodium peroxide (Na_2O_2) and others give super oxides. (KO_2, RbO_2, CsO_2).
- Their oxides dissolve in water to give strong bases. $O^{2-} + H_2O \rightarrow 2OH^-$
- Oxides can be neutralised by acids

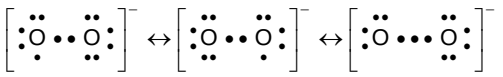
  $O^{2-} + 2H^+ \rightarrow H_2O$
- Peroxides (O_2^{2-}) are the salts of H_2O_2. Therefore metal peroxides will give H_2O_2 on reaction with water or dil. acids.

  $Na_2O_2 + 2H_2O \rightarrow 2NaOH + H_2O_2$
- Concentrated peroxide solutions will give O_2 on reaction with water

  $2Na_2O_2 + 2H_2O \rightarrow 4NaOH + O_2$
- Na_2O_2 forms octahydrate crystals ($Na_2O_2.8H_2O$)
- Na_2O_2 absorbs CO_2 and releases O_2. Therefore it is used to purify air in crowded places, and in submarines.

  $2Na_2O_2 + 2CO_2 \rightarrow 2Na_2CO_3 + O_2$
- Even K_2O_2 can be used for the same purpose and it is much better than Na_2O_2.
- Na_2O_2 is used in qualitative analysis in the identification of chromium salts as it forms yellow colored chromate salts.
- Na_2O_2 can be used as oxidising agent.
- Super oxides are colored and paramagnetic due to the presence of unpaired electron or odd electron bond.

  Resonance structures of superoxide ion (O_2^-):

  
- The ease of formation and stability of super oxides increases down the group.
- **Hydroxides:** Hydroxides are formed when the metals or their oxides react with water.
- These are strongly basic.
- Solubility and basic strength increase from LiOH to CsOH.
- These are colourless and hygroscopic substances.
- They readily absorb moisture and CO_2 from atmosphere forming white carbonates.

  $2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$
- With alcohols they form alkoxides.
- Alcoholic potash is widely used in organic chemistry.
- **Halides:** Halides of Na and K are present in sea water.

- They can be prepared by the direct combination of the elements.
- They are also produced by the action of hydrogen halides on their hydroxides or carbonates.

  $NaOH + HCl \rightarrow NaCl + H_2O$

  $Na_2CO_3 + 2HCl \rightarrow 2NaCl + CO_2 + H_2O$
- Alkali metal halides are ionic compounds.
- Except cesium halides they have face centred cubic lattice and Cesium halides have body centred cubic lattice.
- They have high melting and boiling points.
- They are good electrolytes and conduct electricity in aqueous or molten states.
- The extent of hydration decreases with the increase in size of the ion.
- The ionic mobility increases and conductivity increases due to decrease in the size of hydrated ion.

Carbonates & bicarbonates:

- H_2CO_3 is a weak dibasic acid and it forms two series of salts bicarbonates and carbonates.

  $NaOH + H_2CO_3 \rightarrow NaHCO_3 + H_2O$

  $2NaOH + H_2CO_3 \rightarrow Na_2CO_3 + H_2O$
- Alkali metals form solid bicarbonates while the bicarbonates of other group elements exist in solution and do not exist in solid state.
- Except Li_2CO_3 the other carbonates are stable and they decompose only at very high temperatures.

  $$Li_2CO_3 \rightarrow Li_2O + CO_2$$
- The stability of carbonates and existence of solid bicarbonates reflect their strong electropositive nature.
- Solubility increases from Li_2CO_3 to Cs_2CO_3.
- Bicarbonates are formed by saturating carbonate solutions with CO_2.

  $Na_2CO_3 + H_2O + CO_2 \rightarrow 2NaHCO_3$
- Acids stronger than H_2CO_3 liberate CO_2 from carbonates and bicarbonates

  $Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$

  $NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2$
- Carbonates and bicarbonates of alkali metals show basic properties in aqueous solution due to hydrolysis (anion hydrolysis).

  $CO_3^{-2} + H_2O \rightarrow HCO_3^- + OH^-$

  $HCO_3^- + H_2O \rightarrow H_2CO_3 + OH^-$