(5) Diff. b/w Li and other Alkali metals

(i) Li is harder; MP, BP are high.

(ii) Li is least reactive. Highest reducing power. On combustion, forms nitride

$Li + O_2 \rightarrow Li_2O + Li_3N$
$+ N_2$

(iii) LiCl is deliquescent, forms $LiCl.2H_2O$ crystals (other alkali metal don't form hydrates).

(iv) Lithium hydrogencarbonate does not exist in solid form but other alkali metals form solid hydrogencarbonates.

(v) Lithium forms no ethynide with ethyne

(vi)
$4LiNO_3 \xrightarrow{\Delta} 2Li_2O + 4NO_2 + O_2$

$2MNO_3 \xrightarrow{\Delta} 2MNO_2 + O_2$
M = Na, K, Rb, Cs

(vii) LiF and Li_2O are less soluble in water.

(6) Diagonal Relationship (Li – Mg) ⇒ similar size.

(i) Li and Mg are harder and lighter than other elements of their group.

(ii) Li and Mg react slowly with water.
→ oxides and hydroxides less soluble in water.
→ hydroxides decompose on heating.
→ form Li_3N, Mg_3N_2 with N_2.

(iii) Li_2O_2 and MgO don't combine with excess oxygen to give superoxides.

(iv) Solid hydrogencarbonates are not formed.
→ Carbonates decompose to give oxide and CO_2.

(v) LiCl and $MgCl_2$ are deliquescent ($LiCl.2H_2O$, $MgCl_2.8H_2O$)

(vi) LiCl and $MgCl_2$ are soluble in ethanol.

(7) Compounds of Sodium

(i) Sodium Carbonate ($Na_2CO_3.10H_2O$)

Prepared by "Solvay Process"

(1) $2NH_3 + H_2O + CO_2 \rightarrow (NH_4)_2CO_3$

(2) $(NH_4)_2CO_3 + H_2O + CO_2 \rightarrow 2(NH_4)HCO_3$

(3) $NH_4HCO_3 + NaCl \rightarrow NH_4Cl + NaHCO_3\downarrow$

(4) $2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + CO_2 + H_2O$

→ NH_3 can be recovered as :-

$2NH_4Cl + Ca(OH)_2 \rightarrow 2NH_3 + CaCl_2 + H_2O$
(By-product)

* K_2CO_3 cannot be formed by Solvay process.

$KHCO_3$ is too soluble to be precipated.

Properties :-
→ Crystalline solid.
→ Exist as decahydrate.
→ on heating at 373K or below, forms monohydrate.

$Na_2CO_3.10H_2O \xrightarrow{<373K} Na_2CO_3.H_2O + 9H_2O$

$Na_2CO_3.H_2O \xrightarrow{>373K} Na_2CO_3 + H_2O$

Soda Ash

→ Carbonate part get hydrolysed to form an alkaline solution.

Uses :-
(1) Softening of water, cleaning.
(2) Manufacture of glass, soap and caustic soda
(3) Paper, textile and paint industries.
(4) Laboratory reagent (Both Qualitative and Quantitative analysis).
→ Called washing soda.
→ Soluble in water.

(ii) Sodium Chloride (NaCl)

→ Sea water 2.7 to 2.9% salt by mass.
→ Produced by evaporation of sea water (in tropical countries).
→ Crude NaCl is obtained by crystallisation of brine solution.
→ Crude NaCl contain impurities $MgSO_4$, Na_2SO_4, $CaSO_4$, $MgCl_2$, $CaCl_2$.
→ $MgCl_2$ and $CaCl_2$ are impurities because they are deliquescent.
→ Crude NaCl is dissolved in minimum amount of H_2O and filtered to remove insoluble impurities.
→ Solution is then saturated with HCl gas.
→ Crystals of pure NaCl separate out.
→ $MgCl_2$, $CaCl_2$ remains in solution being more soluble than NaCl.
→ Melts at 1081K
→ Solubility 36g in $100g\ H_2O$ (at 293).
→ Use as table salt.
→ Preparation of NaOH, Na_2CO_3, Na_2O_2

...m Hydroxide

(NaOH) "Caustic Soda"

...pared by electrolysis of brine solution in Castner – Kellner cell.

→ Mercury Cathode, Carbon Anode.

→ Cathode:-

$Na^+ + e^- \xrightarrow{Hg}$ Na-amalgam

Anode :-

$Cl^- \longrightarrow \frac{1}{2}Cl_2 + e^-$

→ Na-amalgam + H_2O → $NaOH + Hg + H_2$

→ White, translucent solid, melts at 591k.

→ Soluble in water gives alkaline solution.

→ Deliquescent

→ NaOH at surface reacts with CO_2 to form Na_2CO_3.

→ Uses:-

1. In manufacture of soap, paper, artificial silk.
2. Laboratory.
3. Petroleum Refining
4. Purification of Bauxite.
5. Textile industry (mercerising cotton fabrics)
6. Preparation of fats and oils.

(iv) Sodium Hydrogencarbonate

($NaHCO_3$) "Baking Soda"

It decomposes on heating to give bubbles of CO_2 which makes cakes and pastries fluffy

Prepared by saturating Na_2CO_3 solution with CO_2.

$Na_2CO_3 + H_2O + CO_2 \rightarrow NaHCO_3$

White crystalline powder separates out being less soluble.

→ Used as an mild antiseptic for skin infections

→ Used in fire extinguishers.

(8) Biological importance of Sodium and Potassium

→ Normally a 70kg man contains 90g Na and 170g K. [0.06g Cu, 5g Fe]

→ Sodium ions are found on the outside of cells in blood plasma and interstitial fluid.

→ Participate in transmission of nerve signals, in regulating flow of water across cell membrane, and in transport of amino acids and sugars.

→ K differ quantitatively from Na^+ in ability to penetrate cell membrane, transport mechanisms and in their efficiency to activate enzymes.

→ K in cell fluids activates enzymes, participates in oxidation of glucose to ATP and transmission of nerve signals.

→ Variation in conc. of K^+ and Na^+ on the opposite sides of cell membrane;

→ 143 mmol/L Na^+ — 5 mmol/L K^+ in Blood Plasma.

which changes to 10 mmol/L Na^+ — 105 mmol/L K^+.

→ These conc gradient demonstrate sodium-potassium pump (diff. in mechanism). This operates across cell membranes.