

S-Block Elements (Group 1 & 2)

GROUP 1 Alkali Metals

Elements

Li, Na, K, Rb, Cs, Fr

Hydration Enthalpy

- Decreases down group (size ↑)
- $\text{Li}^+ > \text{Na}^+ > \text{K}^+ > \text{Rb}^+ > \text{Cs}^+$
- Li^+ : maximum hydration
- Most Li salts hydrated ($\text{LiCl} \cdot 2\text{H}_2\text{O}$)

Physical Properties

- Soft, low density, low m.p./b.p.
- Large size → weak metallic bonding
- Characteristic flame colours

Flame Colours

Metal	Colour
Li	Crimson red
Na	Yellow
K	Violet/Lilac
Rb	Red-violet
Cs	Blue

Chemical Properties

Reactivity: Highly reactive (large size, low IE)

With O_2 :

$\text{Li} \rightarrow \text{Li}_2\text{O}$ $\text{Na} \rightarrow \text{Na}_2\text{O}_2$ $\text{K/Rb/Cs} \rightarrow \text{MO}_2$

Reducing Nature:

Strong reducing agents Order: $\text{Li} > \text{Na}$ (Li strongest)

In Liquid NH_3 :

$\text{M} + (\text{x}+\text{y})\text{NH}_3 \rightarrow [\text{M}(\text{NH}_3)_x]^+ + [\text{e}(\text{NH}_3)_y]^-$

Blue colour (ammoniated e^-), conducting, paramagnetic

On standing:

$\text{M}^+(\text{am}) + \text{e}^- + \text{NH}_3 \rightarrow \text{MNH}_2 + \frac{1}{2}\text{H}_2$

Conc. solution: bronze, diamagnetic

Anomalous Behaviour of Li

- Very small size
- High polarising power

Diagonal Relationship (Li–Mg)

Property	Li	Mg
Atomic radius (pm)	152	160
Ionic radius (pm)	76	72

GROUP 2 Alkaline Earth Metals

Elements

Be, Mg, Ca, Sr, Ba, Ra

Key Points

- Harder, higher m.p./b.p. than Group 1
- Strongly electropositive
- Be differs from rest
- Diagonal relationship: Be–Al

Hydration Enthalpy

- $\text{Be}^{2+} > \text{Mg}^{2+} > \text{Ca}^{2+} > \text{Sr}^{2+} > \text{Ba}^{2+}$
- Greater than Group 1 ions
- $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$, $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$
- NaCl, KCl: no hydrates

Physical Properties

- Silvery, lustrous
- Smaller size → stronger metallic bonding

Flame Test

- Be, Mg: no colour
- Ca, Sr, Ba: characteristic colours

Metal	Colour
Be	None
Mg	None
Ca	Brick red
Sr	Crimson
Ba	Apple green

Chemical Properties

With Air & Water:

Be, Mg: inert (protective layer)

$2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$

$3\text{Mg} + \text{N}_2 \rightarrow \text{Mg}_3\text{N}_2$

Ca, Sr, Ba: oxides/nitrides

Reducing Nature:

Strong reducing agents Large negative reduction potential

In Liquid NH_3 :

Deep blue-black solution

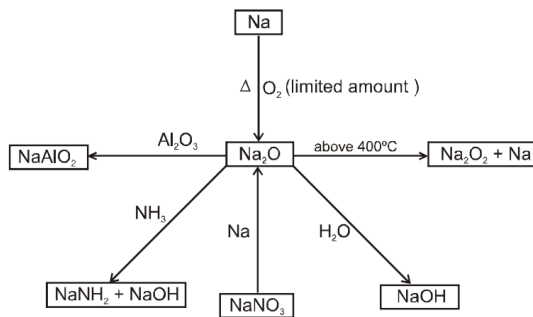
$\text{M} + (\text{x}+\text{y})\text{NH}_3 \rightarrow [\text{M}(\text{NH}_3)_x]^{2+} + 2[\text{e}(\text{NH}_3)_y]^-$
 $[\text{M}(\text{NH}_3)_6]^{2+}$

Anomalous Behaviour of Be

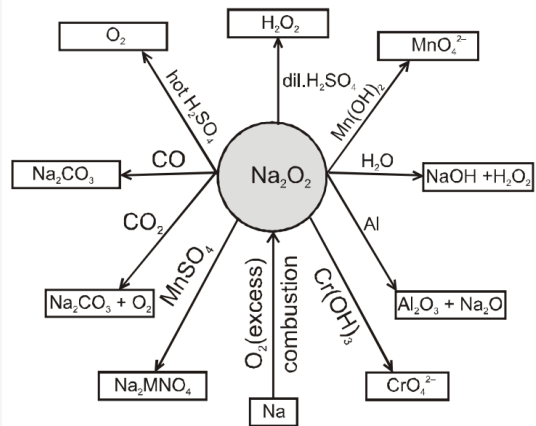
- Very small size
- $\text{Be}^{2+} \approx 31 \text{ pm}$
- High charge/radius ratio
- Diagonal relationship with Al (similar charge density)

Compounds of s-Block Elements

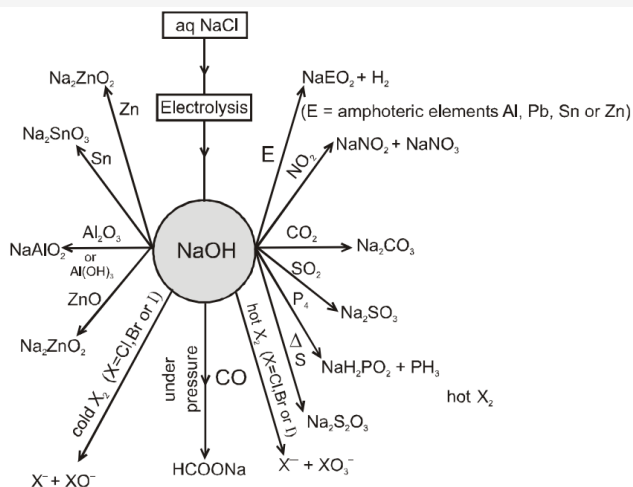
1. Sodium Oxide (Na_2O)



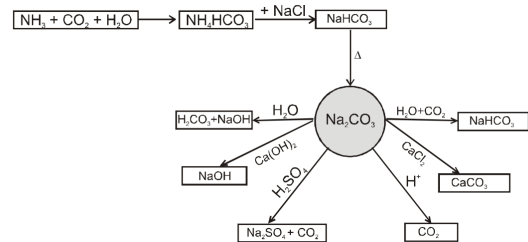
2. Sodium Peroxide (Na_2O_2)



3. Sodium Hydroxide (NaOH)



4. Sodium Carbonate (Na_2CO_3)



5. Quick Lime, Slaked Lime and Lime Water

