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S-Block Elements

Group 1: Alkali Metals and Their Compounds

Group 1 includes: Lithium (Li), Sodium (Na), Potassium (K), Rubidium (Rb), Caesium (Cs), and Francium (Fr).

Electronic Configuration

Element	Configuration (ns^1)
Li	$[He]2s^1$
Na	$[Ne]3s^1$
K	$[Ar]4s^1$
Rb	$[Kr]5s^1$
Cs	$[Xe]6s^1$
Fr	$[Rn]7s^1$

Occurrence: These metals are highly reactive and readily form alkaline hydroxides and oxides.

Physical Characteristics

- Atomic and ionic sizes increase down the group.
- Densities increase, though K is lighter than Na.
- Melting/boiling points decline due to weaker metallic bonding.
- Ionization energies and electronegativity decrease.
- Metallic nature enhances down the group.
- Oxidation state is consistently +1.
- **Flame Tests:** Li - crimson, Na - golden yellow, K - lilac, Rb - red-violet, Cs - blue.
- **Photoelectric Property:** Cs and K used in photoelectric cells.
- **Hydration Enthalpy:** $Li^+ > Na^+ > K^+ > Rb^+ > Cs^+$
- Strong reducing agents; Li is strongest.

Chemical Behavior

- React with air: Li forms oxide, Na forms peroxide, others form superoxides.
- React with water vigorously to form hydroxides and release H_2 .
- Form ionic hydrides, halides, and dissolve in liquid NH_3 forming blue paramagnetic solutions.

Important Sodium Compounds

- **Sodium Carbonate** ($Na_2CO_3 \cdot 10H_2O$): Made via Solvay process, used in glass, soap, water softening.
- **Sodium Hydroxide** (NaOH): Made by electrolysis of brine, used in soap, textile, refining.
- **Sodium Bicarbonate** ($NaHCO_3$): Formed in Solvay process, used in baking powders, antacids, extinguishers.

Group 2: Alkaline Earth Metals and Their Compounds

Elements include: Beryllium (Be), Magnesium (Mg), Calcium (Ca), Strontium (Sr), Barium (Ba), and Radium (Ra). Configuration: ns^2 .

Electronic Configuration

Element	Configuration (ns^2)
Be	[He] $2s^2$
Mg	[Ne] $3s^2$
Ca	[Ar] $4s^2$
Sr	[Kr] $5s^2$
Ba	[Xe] $6s^2$
Ra	[Rn] $7s^2$

Physical Properties

- Atomic/ionic radii increase down the group.
- Density increases (Ca > Mg).
- Lower melting/boiling points as we go down.
- Ionization enthalpy and electronegativity decline.
- Metallic and reducing characteristics strengthen.
- **Oxidation state:** +2
- **Flame Colors:** Ca - brick red, Sr - crimson, Ba - apple green; Be and Mg show none.
- **Hydration Enthalpy:** $Be^{2+} > Mg^{2+} > Ca^{2+} > Sr^{2+} > Ba^{2+}$

Chemical Behavior

- Form oxides (MO) and peroxides (MO_2), depending on metal.
- Form hydrides (MH_2) with H_2 (except Be).
- Carbonates are insoluble in neutral media, soluble in acids.
- Halides (MX_2) form directly with halogens or via HX.

- Dissolve in liquid NH_3 forming $M(NH_3)_6$ complexes.
- React with N_2 to form nitrides (M_3N_2).
- Sulphates (MSO_4) form acids and carbonates.
- Nitrates are water soluble.