Lithium (Li) – The Lightest Metal and Highly Reactive Alkali Element

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1. General Information

- Symbol: Li
- Atomic Number: 3
- Atomic Mass: 6.94 u
- Group: 1 (Alkali Metals)
- Period: 2
- Block: s-block
- Electron Configuration: $1s^2\ 2s^1$
- Valence Electrons: 1
- Phase at Room Temperature: Solid

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2. Isotopes of Lithium

Isotope	Protons	Neutrons	Abundance
^{6}Li	3	3	7.5%
^{7}Li	3	4	92.5%

- ^{7}Li is the most stable and abundant isotope.

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3. Physical Properties

- Color: Silvery-white
- Density: 0.534 g/cm³ (Lowest of all metals)
- Melting Point: 180.5°C
- Boiling Point: 1,342°C
- State at STP: Solid
- Soft and Malleable: Can be cut with a knife.
- Lightest Metal: Floats on water.

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4. Chemical Properties

- Highly Reactive:
  - Reacts vigorously with water to form lithium hydroxide (LiOH) and hydrogen gas (H_2).
  - Reacts with oxygen to form lithium oxide (Li_2O).
- Corrodes Quickly in Air – Forms a dull oxide layer.
- Alkali Metal: Very reactive, stored in oil to prevent oxidation.

Reaction with Water:

$$2Li + 2H_2O \rightarrow 2LiOH + H_2\uparrow$$

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5. Occurrence and Abundance

- Rare in Earth’s Crust: 0.002% by weight.
- Found in:
  - Minerals: Spodumene ($LiAlSi_2O_6$), Lepidolite.
  - Salt Flats (Brine Pools): Extracted from lithium-rich brine.
  - Seawater: In trace amounts.

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6. Production and Extraction

Source	Method
Minerals (Spodumene)	Mining and chemical processing.
Brine Pools	Evaporation and extraction.
Seawater	Experimental extraction methods.

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7. Uses of Lithium

Application	Description
Batteries	Lithium-ion (Li-ion) batteries for electronics and EVs.
Medicine	Treats bipolar disorder (mood stabilizer).
Alloys	Strengthens aluminum and magnesium alloys.
Lubricants	Lithium greases withstand high temperatures.
Glass and Ceramics	Increases durability and thermal resistance.
Nuclear Industry	Lithium-6 used in thermonuclear reactions.
Air Purification	Removes carbon dioxide from the air (Lithium hydroxide).

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8. Unique Properties of Lithium

- Flammable in Air – Ignites when exposed to moist air.
- Low Density – Half as dense as water.
- High Electrochemical Potential – Essential for rechargeable batteries.

9. Lithium-Ion Batteries

- Rechargeable and Lightweight – Used in laptops, smartphones, and electric vehicles.
- High Energy Density – Provides longer-lasting power.
- Components:
  - Anode: Lithium-based compound.
  - Cathode: Typically cobalt, nickel, or manganese oxides.
  - Electrolyte: Lithium salt dissolved in a solvent.

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10. Safety and Handling

- Highly Flammable: Can ignite in moist air.
- Stored in Oil or Inert Atmosphere: Prevents oxidation.
- Water Reaction Risk: Produces hydrogen gas and heat, potentially explosive.
- Skin Irritant: Can cause burns upon contact.

Fun Facts About Lithium:

- Lithium salts were once used in soft drinks (e.g., 7Up).
- Stars can produce lithium during certain phases of their lifecycle.
- Lithium-ion batteries power over 75% of portable electronics globally.
- Lithium is one of the few metals that floats on water.