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1. General Information

- Symbol: Na
- Atomic Number: 11
- Atomic Mass: 22.99 u
- Group: 1 (Alkali Metals)
- Period: 3
- Block: s-block
- Electron Configuration: $1s^2 2s^2 2p^6 3s^1$
- Valence Electrons: 1
- Phase at Room Temperature: Solid

2. Isotopes of Sodium

Isotope	Protons	Neutrons	Abundance	Notes
^{23}Na	11	12	100%	Stable and naturally occurring.

Isotope	Protons	Neutrons	Abundance	Notes
^{22}Na	11	11	Trace	Radioactive, used in medicine.

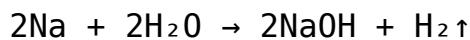
3. Physical Properties

- Color: Silvery-white
- Odor: Odorless
- Density: 0.97 g/cm³
- Melting Point: 97.8°C
- Boiling Point: 882.8°C
- State at STP: Solid (soft, can be cut with a knife)
- Conductivity: Excellent conductor of electricity and heat.

4. Chemical Properties

- Highly Reactive:
 - Reacts vigorously with water to form sodium hydroxide (NaOH) and hydrogen gas.
 - Combines easily with halogens to form salts (e.g., NaCl).
- Oxidizes Quickly: Forms a white oxide layer (Na₂O) in air.
- Stored in Oil: Prevents reaction with moisture and air.

Reaction with Water:



5. Occurrence and Abundance

- Sixth most abundant element in Earth's crust.
- Common Sources:
 - Seawater (NaCl) – Primary source of sodium compounds.
 - Minerals: Halite (rock salt), soda ash, and cryolite.

- Soil and Rocks – Sodium-containing minerals are widespread.

6. Industrial Production of Sodium

- Electrolysis of Molten Sodium Chloride (NaCl):



- Downs Cell Process:

- Sodium is produced by electrolyzing molten NaCl with calcium chloride to lower melting point.

7. Uses of Sodium

Application	Description
Salt (NaCl)	Essential for food and preservation.
Glass Production	Sodium carbonate (soda ash) used in glassmaking.
Chemical Manufacturing	Produces sodium hydroxide, bleach, and detergents.
Batteries	Sodium-ion batteries for energy storage.
Metallurgy	Reduces metals from their ores (e.g., titanium).
Lighting	Sodium vapor lamps for streetlights.
Medicine	Sodium compounds regulate bodily functions.

8. Important Sodium Compounds

Compound	Formula	Use
Sodium Chloride	NaCl	Table salt, food preservation.
Sodium Hydroxide (Lye)	NaOH	Soap, paper, cleaning products.
Sodium Bicarbonate	NaHCO ₃	Baking soda, antacids.
Sodium Carbonate	Na ₂ CO ₃	Glass production, detergents.
Sodium Nitrate	NaNO ₃	Fertilizers, explosives.

Compound	Formula	Use
Sodium Sulfate	Na ₂ SO ₄	Paper, detergents, textiles.

9. Biological Importance of Sodium

- Essential for Life:
 - Regulates fluid balance and nerve signaling in the body.
 - Critical for muscle contractions and blood pressure control.
- Sodium-Potassium Pump (Na⁺/K⁺): Maintains cell membrane potential.
- Daily Requirement: 1,500 – 2,300 mg for adults.

10. Sodium in Environmental Chemistry

- Seawater: Contains 1.08% sodium by mass.
- Salinity Regulation: Sodium ions contribute to ocean salinity.
- Role in Weathering: Sodium compounds break down rocks and minerals over time.

11. Safety and Hazards

- Highly Reactive:
 - Reacts violently with water and air.
 - Releases flammable hydrogen gas and heat.
- Corrosive in Solution (NaOH): Causes burns upon contact.
- Fire Hazard: Burns with a bright yellow flame when ignited.

Handling Precautions:

- Store in mineral oil or inert gas.
- Use protective gloves and eyewear.
- Ventilation Required – Prevent accumulation of hydrogen gas.

Fun Facts About Sodium:

- Sodium burns with a bright yellow flame – the same color as sodium vapor streetlights.
- Sodium was first isolated by Sir Humphry Davy in 1807 through electrolysis.
- Table salt (NaCl) is the most well-known sodium compound, essential to human health.
- Sodium ions play a crucial role in neural communication and hydration.