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1. General Information

- Symbol: K
- Atomic Number: 19
- Atomic Mass: 39.10 u
- Group: 1 (Alkali Metals)
- Period: 4
- Block: s-block
- Electron Configuration: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$
- Valence Electrons: 1
- Phase at Room Temperature: Solid

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2. Isotopes of Potassium

Isotope	Protons	Neutrons	Abundance	Notes
^{39}K	19	20	93.3%	Most abundant and stable.
^{40}K	19	21	0.0117%	Radioactive, used in dating rocks.
^{41}K	19	22	6.7%	Stable.

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3. Physical Properties

- Color: Silvery-white
- Odor: Odorless
- Density: 0.89 g/cm^3
- Melting Point: 63.5°C
- Boiling Point: 759°C
- State at STP: Solid
- Soft Metal: Can be cut with a knife.

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4. Chemical Properties

- Highly Reactive (Especially with Water):
  - Reacts violently, producing potassium hydroxide (KOH) and hydrogen gas (H_2).
- Oxidizes Rapidly in Air:
  - Forms potassium oxide (K_2O) or potassium peroxide (K_2O_2).
- Stored in Oil:
  - Prevents reaction with moisture and air.
- Flammable:
  - Burns with a lilac (purple) flame.

Reaction with Water:

$$2K + 2H_2O \rightarrow 2KOH + H_2\uparrow$$

Reaction with Oxygen:

$$4K + O_2 \rightarrow 2K_2O$$

5. Occurrence and Abundance

- 7th most abundant element in Earth’s crust.
- Found in:
  - Minerals: Sylvite (KCl), Carnallite ($KMgCl_3 \cdot 6H_2O$), Potash.
  - Seawater: As potassium ions (K^+).
- Essential for Biological Systems – Present in all living cells.

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6. Industrial Production of Potassium

- Electrolysis of Potassium Chloride (KCl):

  $2KCl \rightarrow 2K + Cl_2$ (Electrolysis)

- Thermal Reduction:

  $KCl + Na \rightarrow K + NaCl$ (at high temperatures)

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7. Uses of Potassium

Application	Description
Fertilizers	Potassium chloride (KCl) and potassium sulfate (K_2SO_4).
Glass and Ceramics	Improves durability and melting point.
Soap and Detergents	Potassium hydroxide (KOH) in liquid soaps.
Medicine and Supplements	Essential for nerve and muscle function.
Gunpowder and Fireworks	Potassium nitrate (KNO_3) as an oxidizer.
Electronics	Used in specialized batteries.

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8. Important Potassium Compounds

Compound	Formula	Use
Potassium Chloride	KCl	Fertilizer, salt substitute.
Potassium Hydroxide	KOH	Soaps, cleaning products.
Potassium Nitrate	KNO_3	Fertilizers, fireworks, gunpowder.
Potassium Carbonate	K_2CO_3	Glass, soap, and detergents.
Potassium Permanganate	$KMnO_4$	Disinfectant, water treatment.
Potassium Sulfate	K_2SO_4	Fertilizer.

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9. Biological Importance of Potassium

- Essential for Life:
  - Regulates nerve impulses, muscle contractions, and fluid balance.
  - Maintains cell membrane potential through the sodium-potassium pump.
- Daily Requirement:
  - Adults: 3,500–4,700 mg/day.
- Deficiency Symptoms (Hypokalemia):
  - Fatigue, muscle weakness, irregular heartbeat.

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10. Potassium in Environmental Chemistry

- Nutrient Cycle:
  - Potassium is essential for plant growth and is part of the soil nutrient cycle.
- Erosion and Weathering:
  - Releases potassium into soil from rocks.
- Fertilizer Runoff:
  - Excess potassium can disrupt aquatic ecosystems.

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11. Safety and Hazards

- Highly Flammable:
  - Potassium ignites easily and reacts violently with water.
- Corrosive (KOH):
  - Can cause burns upon contact.
- Asphyxiation Risk:
  - Hydrogen gas produced during reactions can ignite or displace oxygen.

Handling Precautions:

- Store in mineral oil or inert atmosphere.
- Use protective gloves and goggles.
- Keep away from water and open flames.

Fun Facts About Potassium:

- The name “potassium” comes from potash, an early source of potassium salts.
- Discovered in 1807 by Sir Humphry Davy through electrolysis.
- Potassium is responsible for the purple color in fireworks.
- Bananas are famous for their potassium content, but potatoes and avocados contain more!