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1. General Information

- Symbol: Mg
- Atomic Number: 12
- Atomic Mass: 24.305 u
- Group: 2 (Alkaline Earth Metals)
- Period: 3
- Block: s-block
- Electron Configuration: $1s^2\ 2s^2\ 2p^6\ 3s^2$
- Valence Electrons: 2
- Phase at Room Temperature: Solid

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2. Isotopes of Magnesium

Isotope	Protons	Neutrons	Abundance	Notes
^{24}Mg	12	12	79%	Most abundant.
^{25}Mg	12	13	10%	Stable.
^{26}Mg	12	14	11%	Stable, used in dating rocks.

3. Physical Properties

- Color: Silvery-white
- Odor: Odorless
- Density: 1.74 g/cm³
- Melting Point: 650°C
- Boiling Point: 1,090°C
- State at STP: Solid
- Lightweight and Malleable – Can be easily shaped and machined.

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4. Chemical Properties

- Highly Reactive (Especially with Water and Acids):
  - Reacts slowly with cold water and vigorously with hot water.
  - Burns with a bright white flame when ignited.
- Forms a Protective Oxide Layer (MgO): Prevents further corrosion.
- Reacts with Oxygen: Forms magnesium oxide (MgO).

Reaction with Water:

$$Mg + 2H_2O \rightarrow Mg(OH)_2 + H_2\uparrow$$

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5. Occurrence and Abundance

- Eighth most abundant element in Earth's crust.
- On Earth:
  - Found in Minerals: Dolomite ($CaMg(CO_3)_2$), Magnesite ($MgCO_3$), and Olivine.
  - Seawater: Contains magnesium chloride ($MgCl_2$).
- In the Human Body: Present in bones and cells, crucial for biochemical reactions.

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6. Industrial Production of Magnesium

- Electrolysis of Magnesium Chloride ($MgCl_2$):

  $MgCl_2 \rightarrow Mg + Cl_2$

- Thermal Reduction of Dolomite:

  $2CaO + 2MgO + Si \rightarrow 2Mg + Ca_2SiO_4$

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7. Uses of Magnesium

Application	Description
Aerospace and Automotive	Lightweight alloys reduce vehicle weight.
Construction	Used in structural alloys and beams.
Medicine	Magnesium supplements and antacids.
Fireworks and Flares	Burns with bright white light.
Electronics	Laptop and camera casings.
Biological	Essential for muscle function and energy production.
Batteries	Used in magnesium-ion batteries.

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8. Important Magnesium Compounds

Compound	Formula	Use
Magnesium Oxide	MgO	Refractory bricks, insulation.
Magnesium Hydroxide	$Mg(OH)_2$	Antacid, laxative (milk of magnesia).
Magnesium Sulfate	$MgSO_4$	Epsom salt, muscle relaxation.
Magnesium Chloride	$MgCl_2$	De-icing, dust control, supplements.
Magnesium Carbonate	$MgCO_3$	Gym chalk, food additive.

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9. Biological Importance of Magnesium

- Essential for Life:
  - Involved in Over 300 Enzymatic Reactions.
  - Critical for ATP (energy) production and muscle function.
- Bone Health:
  - 60% of the body's magnesium is stored in bones.
- Daily Requirement:
  - Men: 400-420 mg/day
  - Women: 310-320 mg/day
- Deficiency Symptoms: Muscle cramps, fatigue, and irregular heartbeat.

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10. Magnesium in Environmental Chemistry

- Seawater Desalination: Magnesium is extracted as a byproduct.
- Soil Health: Magnesium is a key component of chlorophyll in plants.
- Role in Photosynthesis:

  $\text{Chlorophyll } (C_{55}H_{72}MgN_4O_5)$

  - Without magnesium, plants cannot produce food through photosynthesis.

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11. Safety and Hazards

- Highly Flammable: Burns intensely at high temperatures.
- Water Reaction: Can generate hydrogen gas, posing explosion risks.
- Handling Precautions:
  - Store in a dry, cool place.
  - Use protective gloves when handling.
  - Avoid exposing to open flames.