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1. General Information

- Symbol: Ar
- Atomic Number: 18
- Atomic Mass: 39.95 u
- Group: 18 (Noble Gases)
- Period: 3
- Block: p-block
- Electron Configuration: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$
- Valence Electrons: 8 (Full outer shell)
- Phase at Room Temperature: Gas

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2. Isotopes of Argon

Isotope	Protons	Neutrons	Abundance	Notes
^{36}Ar	18	18	0.34%	Stable.
^{38}Ar	18	20	0.06%	Stable.
^{40}Ar	18	22	99.6%	Most abundant.

3. Physical Properties

- Color: Colorless
- Odor: Odorless
- Density: 1.784 g/L (at STP)
- Melting Point: -189.3°C
- Boiling Point: -185.8°C
- State at STP: Gas
- Conductivity: Poor conductor of heat and electricity.

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4. Chemical Properties

- Inert and Non-Reactive:
  - Full outer electron shell makes argon chemically stable.
  - Does not form compounds under normal conditions.
- Non-Flammable and Non-Toxic.
- Under Extreme Conditions:
  - Can form argon fluorohydride (HArF) at extremely low temperatures.

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5. Occurrence and Abundance

- Third most abundant gas in Earth’s atmosphere (0.93%).
- Found in:
  - Air (by volume): Extracted during liquid air distillation.
  - Mineral Decay: Produced through the radioactive decay of potassium-40 (K-40).
- In the Universe: 12th most abundant element.

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6. Industrial Production of Argon

- Fractional Distillation of Liquid Air:
  - Argon is separated during the production of liquid oxygen and nitrogen.

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Air → Argon + Oxygen + Nitrogen (Distillation)
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7. Uses of Argon

Application	Description
Welding and Metalworking	Provides inert atmosphere for arc welding.
Lighting	Fills incandescent and fluorescent bulbs.
Lasers	Argon-ion lasers used in surgery and optics.
Food Preservation	Replaces oxygen to prevent spoilage.
Electronics	Protects silicon crystals during manufacturing.
Fire Suppression Systems	Displaces oxygen to smother fires.
Scientific Research	Used in cryogenics and particle detection.

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8. Important Argon Applications

- Incandescent Bulbs: Extends the life of the filament by preventing oxidation.
- Double-Glazed Windows: Argon gas between panes improves insulation.
- 3D Printing: Creates inert environments for metal printing.
- Medical Lasers: Argon lasers are used in eye surgery and dermatology.

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9. Biological Role of Argon

- No known biological function.
- Non-toxic and inert – Safe for use in food and medical applications.

10. Argon in Environmental Chemistry

- Stable in the Environment: Argon does not react or degrade.
- Radioactive Decay Product: Argon-40 forms through potassium-40 decay, important in geological dating.

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11. Safety and Hazards

- Asphyxiation Risk:
  - Argon can displace oxygen in confined spaces, leading to suffocation.
- Handling Precautions:
  - Use in well-ventilated areas.
  - Store in pressurized cylinders.
- Non-Flammable: No risk of fire or explosion.

Fun Facts About Argon:

- Argon means “lazy” in Greek, referencing its inert nature.
- Discovered in 1894 by Lord Rayleigh and Sir William Ramsay.
- Argon lasers are used in holography and surgery.
- The blue glow in neon signs is often from argon gas, not neon!