

Argon (Ar) - Student Datasheet

Atomic number 18 - Noble gas - Group 18 - Period 3 - p-block

Argon is element 18, a closed-shell noble gas that makes up about 0.94% of Earth's atmosphere. It is chemically quiet in ordinary conditions yet technologically valuable as a protective gas and spectroscopic plasma.

Quick reference

Atomic number	18
Relative atomic mass	39.95
Electron configuration	[Ne] 3s ² 3p ⁶
State at 20 C	Colorless monatomic gas at 20 deg C
Density	0.001633 g/cm ³
Melting point	83.81 K
Boiling point	87.302 K
Common oxidation state	0 in ordinary elemental chemistry
Electronegativity	Unknown

Structure & orbitals

When frozen under ordinary low-pressure conditions, argon forms an FCC rare-gas crystal held mainly by dispersion forces. The viewer is a conventional-cell teaching schematic.

The filled 3p orbitals are atomic probability distributions. The visible glow in a discharge comes from excited-state transitions and is not a permanent colored electron cloud.

Temperature / phase context

At approximately standard pressure, argon is solid below about 83.81 K, liquid from 83.81 to 87.302 K, and gaseous above. The everyday atmospheric state is therefore gas.

Five things to remember

- Atomic number 18 means 18 protons.
- Neutral argon has a closed [Ne]3s²3p⁶ shell.
- Argon is colorless at ordinary conditions; glow requires excitation.
- Argon is about 0.94% of Earth's atmosphere.
- Most atmospheric argon is ⁴⁰Ar, strongly influenced by long-term ⁴⁰K decay in Earth materials.

Argon: Real World & Signature Science

Argon's familiar purple-blue glow is not the ordinary color of the gas. Unexcited argon is colorless; electrical excitation creates line emission from excited atoms.

Why this element matters

Welding shield gas Argon provides an inert atmosphere that protects hot weld metal from reactive air.	Metallurgy & manufacturing Argon is used as a protective atmosphere in processes involving reactive metals and high-temperature materials.
Lighting & plasma Electrical discharges in argon produce characteristic emission used in lamps and plasma systems.	Double glazing Argon between window panes reduces convective heat transfer relative to ordinary air gaps.
Geochronology Radiogenic ^{40}Ar is central to potassium-argon and argon-argon dating methods.	

From air to industrial argon: high-level separation context

1. Argon is naturally mixed through Earth's atmosphere rather than mined from localized ore deposits.
2. Large air-separation units cool and fractionate air to produce oxygen, nitrogen and argon-rich streams.
3. Further purification produces argon grades for welding, metallurgy, electronics and scientific systems.
4. Gas distribution and, where appropriate, recovery systems deliver argon without changing its elemental identity.

Where on Earth?

Atmospheric reservoir

Argon is globally mixed in air, so a conceptual atmosphere layer is more truthful than country occurrence pins.

History

1785 - Henry Cavendish observed a small residual fraction of air that resisted known reactions.

1894 - Lord Rayleigh and William Ramsay identified argon while resolving a density discrepancy between atmospheric and chemically prepared nitrogen.

Late 19th century - Spectroscopy confirmed argon as a distinct element and helped establish the noble-gas group.

Today - Argon is produced by cryogenic air separation for welding, metallurgy, lighting, glazing and scientific uses.

Uses

Welding Argon shields weld pools and arcs from oxygen, nitrogen and moisture in air.	Protective atmospheres Manufacturing and metallurgy use argon where chemical inertness is useful.
Lighting & plasma Argon is used in discharge lamps and plasma systems because excited atoms emit characteristic lines.	Insulating glazing Argon is used between panes in many insulated windows.

Argon: Isotopes, Questions & Evidence

Isotopes

⁴⁰Ar - Stable - dominant atmospheric isotope

Reference teaching nucleus: 18 protons and 22 neutrons. Much atmospheric ⁴⁰Ar has radiogenic origin from ⁴⁰K decay.

³⁶Ar - Stable natural isotope

A primordial component useful in atmospheric and geochemical studies.

³⁸Ar - Stable natural isotope

A minor stable isotope used in isotope and nuclear-science contexts.

Common questions

What is argon's atomic number?

18.

How many valence electrons does argon have?

Eight in the 3s²3p⁶ outer shell.

What is argon used for?

Major uses include welding shield gas, protective atmospheres, lighting/plasma systems and insulating glazing.

Is argon a noble gas?

Yes. It is the Period 3 member of Group 18.

Is argon naturally purple?

No. Ordinary argon gas is colorless; visible glow comes from electrical excitation.

Where does argon come from industrially?

It is separated from air, typically by large cryogenic air-separation systems.

Quick self-check

1. **Atomic number?** Answer: 18
2. **Valence-shell occupancy?** Answer: 3s² 3p⁶
3. **Ordinary color?** Answer: Colorless
4. **Industrial source?** Answer: Air separation
5. **Solid lattice at low pressure?** Answer: FCC

Evidence & provenance

Atomic, phase and atmospheric-abundance data are evaluated/measured. Atmospheric occurrence is shown conceptually because country pins would be scientifically misleading.

Core sources

Royal Society of Chemistry - Argon	https://periodic-table.rsc.org/element/18/argon
NIST - Atomic Data for Argon	https://physics.nist.gov/PhysRefData/Handbook/Tables/argontable1.htm
CIAAW - Argon isotopic/atomic-weight context	https://ciaaw.org/argon.htm