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**Argon**

From Wikipedia, the free encyclopedia

[Jump to navigation](https://en.wikipedia.org/wiki/Argon#mw-head) [Jump to search](https://en.wikipedia.org/wiki/Argon#p-search)

This article is about the chemical element. For other uses, see [Argon (disambiguation)](https://en.wikipedia.org/wiki/Argon_(disambiguation)).

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| --- | --- |
| Argon,  18Ar | |
| [Vial containing a violet glowing gas](https://en.wikipedia.org/wiki/File:Argon_discharge_tube.jpg) | |
| **General properties** | |
| **Pronunciation** | [/ˈɑːrɡɒn/](https://en.wikipedia.org/wiki/Help:IPA/English) ​([*AR-gon*](https://en.wikipedia.org/wiki/Help:Pronunciation_respelling_key)) |
| **Appearance** | colorless gas exhibiting a lilac/violet glow when placed in an electric field |
| [**Standard atomic weight**](https://en.wikipedia.org/wiki/Standard_atomic_weight) **(*A*r, standard)** | [39.792, 39.963] conventional: 39.948 |
| **Argon in the** [**periodic table**](https://en.wikipedia.org/wiki/Periodic_table) | |
| |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 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[Neon](https://en.wikipedia.org/wiki/Neon) | | [Sodium](https://en.wikipedia.org/wiki/Sodium) | [Magnesium](https://en.wikipedia.org/wiki/Magnesium) |  | | | | | | | | | | | | | | | | | | | | | | | | [Aluminium](https://en.wikipedia.org/wiki/Aluminium) | [Silicon](https://en.wikipedia.org/wiki/Silicon) | [Phosphorus](https://en.wikipedia.org/wiki/Phosphorus) | [Sulfur](https://en.wikipedia.org/wiki/Sulfur) | [Chlorine](https://en.wikipedia.org/wiki/Chlorine) | Argon | | [Potassium](https://en.wikipedia.org/wiki/Potassium) | [Calcium](https://en.wikipedia.org/wiki/Calcium) | [Scandium](https://en.wikipedia.org/wiki/Scandium) |  | | | | | | | | | | | | | | [Titanium](https://en.wikipedia.org/wiki/Titanium) | [Vanadium](https://en.wikipedia.org/wiki/Vanadium) | [Chromium](https://en.wikipedia.org/wiki/Chromium) | [Manganese](https://en.wikipedia.org/wiki/Manganese) | [Iron](https://en.wikipedia.org/wiki/Iron) | [Cobalt](https://en.wikipedia.org/wiki/Cobalt) | [Nickel](https://en.wikipedia.org/wiki/Nickel) | [Copper](https://en.wikipedia.org/wiki/Copper) | [Zinc](https://en.wikipedia.org/wiki/Zinc) | [Gallium](https://en.wikipedia.org/wiki/Gallium) | [Germanium](https://en.wikipedia.org/wiki/Germanium) | [Arsenic](https://en.wikipedia.org/wiki/Arsenic) | [Selenium](https://en.wikipedia.org/wiki/Selenium) | [Bromine](https://en.wikipedia.org/wiki/Bromine) | [Krypton](https://en.wikipedia.org/wiki/Krypton) | | [Rubidium](https://en.wikipedia.org/wiki/Rubidium) | [Strontium](https://en.wikipedia.org/wiki/Strontium) | [Yttrium](https://en.wikipedia.org/wiki/Yttrium) |  |  | | | | | | | | | | | | | [Zirconium](https://en.wikipedia.org/wiki/Zirconium) | [Niobium](https://en.wikipedia.org/wiki/Niobium) | [Molybdenum](https://en.wikipedia.org/wiki/Molybdenum) | [Technetium](https://en.wikipedia.org/wiki/Technetium) | [Ruthenium](https://en.wikipedia.org/wiki/Ruthenium) | [Rhodium](https://en.wikipedia.org/wiki/Rhodium) | [Palladium](https://en.wikipedia.org/wiki/Palladium) | [Silver](https://en.wikipedia.org/wiki/Silver) | [Cadmium](https://en.wikipedia.org/wiki/Cadmium) | [Indium](https://en.wikipedia.org/wiki/Indium) | [Tin](https://en.wikipedia.org/wiki/Tin) | [Antimony](https://en.wikipedia.org/wiki/Antimony) | [Tellurium](https://en.wikipedia.org/wiki/Tellurium) | [Iodine](https://en.wikipedia.org/wiki/Iodine) | [Xenon](https://en.wikipedia.org/wiki/Xenon) | | [Caesium](https://en.wikipedia.org/wiki/Caesium) | [Barium](https://en.wikipedia.org/wiki/Barium) | [Lanthanum](https://en.wikipedia.org/wiki/Lanthanum) | [Cerium](https://en.wikipedia.org/wiki/Cerium) | [Praseodymium](https://en.wikipedia.org/wiki/Praseodymium) | [Neodymium](https://en.wikipedia.org/wiki/Neodymium) | [Promethium](https://en.wikipedia.org/wiki/Promethium) | [Samarium](https://en.wikipedia.org/wiki/Samarium) | [Europium](https://en.wikipedia.org/wiki/Europium) | [Gadolinium](https://en.wikipedia.org/wiki/Gadolinium) | [Terbium](https://en.wikipedia.org/wiki/Terbium) | [Dysprosium](https://en.wikipedia.org/wiki/Dysprosium) | [Holmium](https://en.wikipedia.org/wiki/Holmium) | [Erbium](https://en.wikipedia.org/wiki/Erbium) | [Thulium](https://en.wikipedia.org/wiki/Thulium) | [Ytterbium](https://en.wikipedia.org/wiki/Ytterbium) | [Lutetium](https://en.wikipedia.org/wiki/Lutetium) | [Hafnium](https://en.wikipedia.org/wiki/Hafnium) | [Tantalum](https://en.wikipedia.org/wiki/Tantalum) | [Tungsten](https://en.wikipedia.org/wiki/Tungsten) | [Rhenium](https://en.wikipedia.org/wiki/Rhenium) | [Osmium](https://en.wikipedia.org/wiki/Osmium) | [Iridium](https://en.wikipedia.org/wiki/Iridium) | [Platinum](https://en.wikipedia.org/wiki/Platinum) | [Gold](https://en.wikipedia.org/wiki/Gold) | [Mercury (element)](https://en.wikipedia.org/wiki/Mercury_(element)) | [Thallium](https://en.wikipedia.org/wiki/Thallium) | [Lead](https://en.wikipedia.org/wiki/Lead) | [Bismuth](https://en.wikipedia.org/wiki/Bismuth) | [Polonium](https://en.wikipedia.org/wiki/Polonium) | [Astatine](https://en.wikipedia.org/wiki/Astatine) | [Radon](https://en.wikipedia.org/wiki/Radon) | | [Francium](https://en.wikipedia.org/wiki/Francium) | [Radium](https://en.wikipedia.org/wiki/Radium) | [Actinium](https://en.wikipedia.org/wiki/Actinium) | [Thorium](https://en.wikipedia.org/wiki/Thorium) | [Protactinium](https://en.wikipedia.org/wiki/Protactinium) | [Uranium](https://en.wikipedia.org/wiki/Uranium) | [Neptunium](https://en.wikipedia.org/wiki/Neptunium) | [Plutonium](https://en.wikipedia.org/wiki/Plutonium) | [Americium](https://en.wikipedia.org/wiki/Americium) | [Curium](https://en.wikipedia.org/wiki/Curium) | [Berkelium](https://en.wikipedia.org/wiki/Berkelium) | [Californium](https://en.wikipedia.org/wiki/Californium) | [Einsteinium](https://en.wikipedia.org/wiki/Einsteinium) | [Fermium](https://en.wikipedia.org/wiki/Fermium) | [Mendelevium](https://en.wikipedia.org/wiki/Mendelevium) | [Nobelium](https://en.wikipedia.org/wiki/Nobelium) | [Lawrencium](https://en.wikipedia.org/wiki/Lawrencium) | [Rutherfordium](https://en.wikipedia.org/wiki/Rutherfordium) | [Dubnium](https://en.wikipedia.org/wiki/Dubnium) | [Seaborgium](https://en.wikipedia.org/wiki/Seaborgium) | [Bohrium](https://en.wikipedia.org/wiki/Bohrium) | [Hassium](https://en.wikipedia.org/wiki/Hassium) | [Meitnerium](https://en.wikipedia.org/wiki/Meitnerium) | [Darmstadtium](https://en.wikipedia.org/wiki/Darmstadtium) | [Roentgenium](https://en.wikipedia.org/wiki/Roentgenium) | [Copernicium](https://en.wikipedia.org/wiki/Copernicium) | [Nihonium](https://en.wikipedia.org/wiki/Nihonium) | [Flerovium](https://en.wikipedia.org/wiki/Flerovium) | [Moscovium](https://en.wikipedia.org/wiki/Moscovium) | [Livermorium](https://en.wikipedia.org/wiki/Livermorium) | [Tennessine](https://en.wikipedia.org/wiki/Tennessine) | [Oganesson](https://en.wikipedia.org/wiki/Oganesson) | | [Ne](https://en.wikipedia.org/wiki/Neon) ↑ **Ar** ↓ [Kr](https://en.wikipedia.org/wiki/Krypton) | | [chlorine](https://en.wikipedia.org/wiki/Chlorine) ← **argon** → [potassium](https://en.wikipedia.org/wiki/Potassium) | | | | |
| [**Atomic number**](https://en.wikipedia.org/wiki/Atomic_number)(*Z*) | 18 |
| [**Group**](https://en.wikipedia.org/wiki/Group_(periodic_table)) | [group 18 (noble gases)](https://en.wikipedia.org/wiki/Noble_gas) |
| [**Period**](https://en.wikipedia.org/wiki/Period_(periodic_table)) | [period 3](https://en.wikipedia.org/wiki/Period_(periodic_table)#Period_3) |
| [**Block**](https://en.wikipedia.org/wiki/Block_(periodic_table)) | [p-block](https://en.wikipedia.org/wiki/P-block) |
| [**Element category**](https://en.wikipedia.org/wiki/Names_for_sets_of_chemical_elements#Category) | [noble gas](https://en.wikipedia.org/wiki/Noble_gas) |
| [**Electron configuration**](https://en.wikipedia.org/wiki/Electron_configuration) | [[Ne](https://en.wikipedia.org/wiki/Neon)] 3s2 3p6 |
| Electrons per shell | 2, 8, 8 |
| **Physical properties** | |
| [**Phase**](https://en.wikipedia.org/wiki/Phase_(matter)) **at**[**STP**](https://en.wikipedia.org/wiki/Standard_conditions_for_temperature_and_pressure) | [gas](https://en.wikipedia.org/wiki/Gas) |
| [**Melting point**](https://en.wikipedia.org/wiki/Melting_point) | 83.81 [K](https://en.wikipedia.org/wiki/Kelvin) ​(−189.34 °C, ​−308.81 °F) |
| [**Boiling point**](https://en.wikipedia.org/wiki/Boiling_point) | 87.302 K ​(−185.848 °C, ​−302.526 °F) |
| [**Density**](https://en.wikipedia.org/wiki/Density)(at STP) | 1.784 g/L |
| when liquid (at b.p.) | 1.3954 g/cm3 |
| [**Triple point**](https://en.wikipedia.org/wiki/Triple_point) | 83.8058 K, ​68.89 kPa[[1]](https://en.wikipedia.org/wiki/Argon#cite_note-b92-1) |
| [**Critical point**](https://en.wikipedia.org/wiki/Critical_point_(thermodynamics)) | 150.687 K, 4.863 MPa[[1]](https://en.wikipedia.org/wiki/Argon#cite_note-b92-1) |
| [**Heat of fusion**](https://en.wikipedia.org/wiki/Enthalpy_of_fusion) | 1.18 [kJ/mol](https://en.wikipedia.org/wiki/Kilojoule_per_mole) |
| [**Heat of vaporization**](https://en.wikipedia.org/wiki/Enthalpy_of_vaporization) | 6.53 kJ/mol |
| [**Molar heat capacity**](https://en.wikipedia.org/wiki/Molar_heat_capacity) | 20.85[[2]](https://en.wikipedia.org/wiki/Argon#cite_note-2) J/(mol·K) |
| [**Vapor pressure**](https://en.wikipedia.org/wiki/Vapor_pressure)   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | ***P***(Pa) | **1** | **10** | **100** | **1 k** | **10 k** | **100 k** | | **at *T***(K) |  | 47 | 53 | 61 | 71 | 87 | | |
| **Atomic properties** | |
| [**Oxidation states**](https://en.wikipedia.org/wiki/Oxidation_state) | **0** |
| [**Electronegativity**](https://en.wikipedia.org/wiki/Electronegativity) | Pauling scale: no data |
| [**Ionization energies**](https://en.wikipedia.org/wiki/Ionization_energy) | * 1st: 1520.6 kJ/mol * 2nd: 2665.8 kJ/mol * 3rd: 3931 kJ/mol * ([more](https://en.wikipedia.org/wiki/Molar_ionization_energies_of_the_elements#argon)) |
| [**Covalent radius**](https://en.wikipedia.org/wiki/Covalent_radius) | 106±10 [pm](https://en.wikipedia.org/wiki/Picometre) |
| [**Van der Waals radius**](https://en.wikipedia.org/wiki/Van_der_Waals_radius) | 188 pm |
| [Color lines in a spectral range](https://en.wikipedia.org/wiki/File:Argon_spectrum_visible.png)  [**Spectral lines**](https://en.wikipedia.org/wiki/Spectral_line) **of argon** | |
| **Other properties** | |
| [**Crystal structure**](https://en.wikipedia.org/wiki/Crystal_structure) | ​[face-centered cubic](https://en.wikipedia.org/wiki/Cubic_crystal_system) (fcc)  [Face-centered cubic crystal structure for argon](https://en.wikipedia.org/wiki/File:Cubic-face-centered.svg) |
| [**Speed of sound**](https://en.wikipedia.org/wiki/Speed_of_sound) | 323 [m/s](https://en.wikipedia.org/wiki/Metre_per_second) (gas, at 27 °C) |
| [**Thermal conductivity**](https://en.wikipedia.org/wiki/Thermal_conductivity) | 17.72×10−3  W/(m·K) |
| [**Magnetic ordering**](https://en.wikipedia.org/wiki/Magnetism) | [diamagnetic](https://en.wikipedia.org/wiki/Diamagnetic)[[3]](https://en.wikipedia.org/wiki/Argon#cite_note-3) |
| [**Magnetic susceptibility**](https://en.wikipedia.org/wiki/Magnetic_susceptibility) | −19.6·10−6 cm3/mol[[4]](https://en.wikipedia.org/wiki/Argon#cite_note-4) |
| [**CAS Number**](https://en.wikipedia.org/wiki/CAS_Registry_Number) | 7440-37-1 |
| **History** | |
| [**Discovery**](https://en.wikipedia.org/wiki/Timeline_of_chemical_element_discoveries) **and first isolation** | [Lord Rayleigh](https://en.wikipedia.org/wiki/Lord_Rayleigh) and [William Ramsay](https://en.wikipedia.org/wiki/William_Ramsay) (1894) |
| **Main** [**isotopes of argon**](https://en.wikipedia.org/wiki/Isotopes_of_argon) | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | [**Iso­tope**](https://en.wikipedia.org/wiki/Isotope) | [**Abun­dance**](https://en.wikipedia.org/wiki/Natural_abundance) | [**Half-life**](https://en.wikipedia.org/wiki/Half-life) **(*t*1/2)** | [**Decay mode**](https://en.wikipedia.org/wiki/Radioactive_decay) | [**Pro­duct**](https://en.wikipedia.org/wiki/Decay_product) | | **36Ar** | 0.334% | [stable](https://en.wikipedia.org/wiki/Stable_isotope) | | | | **37Ar** | [syn](https://en.wikipedia.org/wiki/Synthetic_radioisotope) | 35 d | [ε](https://en.wikipedia.org/wiki/Electron_capture) | [37Cl](https://en.wikipedia.org/wiki/Chlorine-37) | | **38Ar** | 0.063% | stable | | | | **39Ar** | [trace](https://en.wikipedia.org/wiki/Trace_radioisotope) | 269 y | [β−](https://en.wikipedia.org/wiki/Beta_emission) | [39K](https://en.wikipedia.org/wiki/Potassium-39) | | **40Ar** | 99.604% | stable | | | | **41Ar** | syn | 109.34 min | β− | [41K](https://en.wikipedia.org/wiki/Potassium-41) | | **42Ar** | syn | 32.9 y | β− | [42K](https://en.wikipedia.org/wiki/Potassium-42) | | |
| 36 Ar and 38 Ar content may be as high as 2.07% and 4.3% respectively in natural samples. 40 Ar is the remainder in such cases, whose content may be as low as 93.6%. | |
| * [view](https://en.wikipedia.org/wiki/Template:Infobox_argon) * [talk](https://en.wikipedia.org/wiki/Template_talk:Infobox_argon) * [edit](https://en.wikipedia.org/w/index.php?title=Template:Infobox_argon&action=edit)   | [references](https://en.wikipedia.org/wiki/List_of_data_references_for_chemical_elements) | |

**Argon** is a [chemical element](https://en.wikipedia.org/wiki/Chemical_element) with symbol **Ar** and [atomic number](https://en.wikipedia.org/wiki/Atomic_number) 18. It is in group 18 of the [periodic table](https://en.wikipedia.org/wiki/Periodic_table) and is a [noble gas](https://en.wikipedia.org/wiki/Noble_gas).[[5]](https://en.wikipedia.org/wiki/Argon#cite_note-5) Argon is the third-most abundant gas in the [Earth's atmosphere](https://en.wikipedia.org/wiki/Earth%27s_atmosphere), at 0.934% (9340 [ppmv](https://en.wikipedia.org/wiki/Parts-per_notation)). It is more than twice as abundant as [water vapor](https://en.wikipedia.org/wiki/Water_vapor) (which averages about 4000 ppmv, but varies greatly), 23 times as abundant as [carbon dioxide](https://en.wikipedia.org/wiki/Carbon_dioxide) (400 ppmv), and more than 500 times as abundant as [neon](https://en.wikipedia.org/wiki/Neon) (18 ppmv). Argon is the most abundant noble gas in Earth's crust, comprising 0.00015% of the crust.

Nearly all of the argon in the Earth's atmosphere is [radiogenic](https://en.wikipedia.org/wiki/Radiogenic) [argon-40](https://en.wikipedia.org/wiki/Argon-40), derived from the [decay](https://en.wikipedia.org/wiki/Radioactive_decay) of [potassium-40](https://en.wikipedia.org/wiki/Potassium-40) in the Earth's crust. In the universe, [argon-36](https://en.wikipedia.org/wiki/Argon-36) is by far the most common argon [isotope](https://en.wikipedia.org/wiki/Isotope), as it is the most easily produced by stellar [nucleosynthesis](https://en.wikipedia.org/wiki/Nucleosynthesis) in [supernovas](https://en.wikipedia.org/wiki/Supernova).

The name "argon" is derived from the [Greek](https://en.wikipedia.org/wiki/Greek_language) word ἀργόν, neuter singular form of ἀργός meaning "lazy" or "inactive", as a reference to the fact that the element undergoes almost no chemical reactions. The complete [octet](https://en.wikipedia.org/wiki/Octet_rule) (eight electrons) in the outer atomic shell makes argon stable and resistant to bonding with other elements. Its [triple point](https://en.wikipedia.org/wiki/Triple_point) temperature of 83.8058 [K](https://en.wikipedia.org/wiki/Kelvin) is a defining fixed point in the [International Temperature Scale of 1990](https://en.wikipedia.org/wiki/International_Temperature_Scale_of_1990).

Argon is produced industrially by the [fractional distillation](https://en.wikipedia.org/wiki/Fractional_distillation) of [liquid air](https://en.wikipedia.org/wiki/Liquid_air). Argon is mostly used as an [inert](https://en.wikipedia.org/wiki/Inert_gas) [shielding gas](https://en.wikipedia.org/wiki/Shielding_gas) in welding and other high-temperature industrial processes where ordinarily unreactive substances become reactive; for example, an argon atmosphere is used in [graphite](https://en.wikipedia.org/wiki/Graphite) electric furnaces to prevent the graphite from burning. Argon is also used in [incandescent](https://en.wikipedia.org/wiki/Incandescent_light_bulb), [fluorescent lighting](https://en.wikipedia.org/wiki/Fluorescent_lighting), and other gas-discharge tubes. Argon makes a distinctive [blue-green gas laser](https://en.wikipedia.org/wiki/Ion_laser#Argon_laser). Argon is also used in fluorescent glow starters.



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**Characteristics**

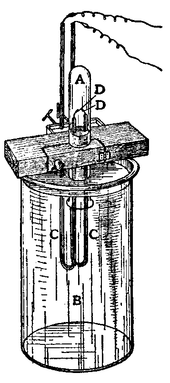
[](https://en.wikipedia.org/wiki/File:Argon_ice_1.jpg)

A small piece of rapidly melting solid argon

Argon has approximately the same [solubility](https://en.wikipedia.org/wiki/Solubility) in water as oxygen and is 2.5 times more soluble in water than [nitrogen](https://en.wikipedia.org/wiki/Nitrogen). Argon is colorless, odorless, nonflammable and nontoxic as a solid, liquid or gas.[[6]](https://en.wikipedia.org/wiki/Argon#cite_note-6) Argon is chemically [inert](https://en.wikipedia.org/wiki/Inert_gas) under most conditions and forms no confirmed stable compounds at room temperature.

Although argon is a [noble gas](https://en.wikipedia.org/wiki/Noble_gas), it can form some compounds under various extreme conditions. [Argon fluorohydride](https://en.wikipedia.org/wiki/Argon_fluorohydride) (HArF), a compound of argon with [fluorine](https://en.wikipedia.org/wiki/Fluorine) and [hydrogen](https://en.wikipedia.org/wiki/Hydrogen) that is stable below 17 K (−256.1 °C; −429.1 °F), has been demonstrated.[[7]](https://en.wikipedia.org/wiki/Argon#cite_note-7)[[8]](https://en.wikipedia.org/wiki/Argon#cite_note-sciencenews-harf-8) Although the neutral ground-state chemical compounds of argon are presently limited to HArF, argon can form [clathrates](https://en.wikipedia.org/wiki/Clathrates) with [water](https://en.wikipedia.org/wiki/Water_(molecule)) when atoms of argon are trapped in a lattice of water molecules.[[9]](https://en.wikipedia.org/wiki/Argon#cite_note-9) [Ions](https://en.wikipedia.org/wiki/Ions), such as ArH+  
, and [excited-state complexes](https://en.wikipedia.org/wiki/Exciplex), such as ArF, have been demonstrated. Theoretical calculation predicts several more argon compounds that should be stable[[10]](https://en.wikipedia.org/wiki/Argon#cite_note-10) but have not yet been synthesized.

**History**

[](https://en.wikipedia.org/wiki/File:Isolation_of_Argon.png)

[Lord Rayleigh](https://en.wikipedia.org/wiki/John_William_Strutt,_3rd_Baron_Rayleigh)'s method for the isolation of argon, based on an experiment of [Henry Cavendish](https://en.wikipedia.org/wiki/Henry_Cavendish)'s. The gases are contained in a test-tube (A) standing over a large quantity of weak [alkali](https://en.wikipedia.org/wiki/Alkali) (B), and the current is conveyed in wires insulated by U-shaped glass tubes (CC) passing through the liquid and round the mouth of the test-tube. The inner platinum ends (DD) of the wire receive a current from a battery of five [Grove cells](https://en.wikipedia.org/wiki/Grove_cell) and a [Ruhmkorff coil](https://en.wikipedia.org/wiki/Ruhmkorff_coil) of medium size.

*Argon* ([Greek](https://en.wikipedia.org/wiki/Greek_language) ἀργόν, neuter singular form of ἀργός meaning "lazy" or "inactive"), is named in reference to its chemical inactivity. This chemical property of this first [noble gas](https://en.wikipedia.org/wiki/Noble_gas) to be discovered impressed the namers.[[11]](https://en.wikipedia.org/wiki/Argon#cite_note-lazyone1-11)[[12]](https://en.wikipedia.org/wiki/Argon#cite_note-lazyone2-12) An unreactive gas was suspected to be a component of air by [Henry Cavendish](https://en.wikipedia.org/wiki/Henry_Cavendish) in 1785. Argon was first isolated from air in 1894 by [Lord Rayleigh](https://en.wikipedia.org/wiki/John_William_Strutt,_3rd_Baron_Rayleigh) and Sir [William Ramsay](https://en.wikipedia.org/wiki/William_Ramsay) at [University College London](https://en.wikipedia.org/wiki/University_College_London) by removing [oxygen](https://en.wikipedia.org/wiki/Oxygen), [carbon dioxide](https://en.wikipedia.org/wiki/Carbon_dioxide), water, and [nitrogen](https://en.wikipedia.org/wiki/Nitrogen) from a sample of clean air.[[13]](https://en.wikipedia.org/wiki/Argon#cite_note-13)[[14]](https://en.wikipedia.org/wiki/Argon#cite_note-lazyone3-14)[[15]](https://en.wikipedia.org/wiki/Argon#cite_note-15) They had determined that nitrogen produced from chemical compounds was 0.5% lighter than nitrogen from the atmosphere. The difference was slight, but it was important enough to attract their attention for many months. They concluded that there was another gas in the air mixed in with the nitrogen.[[16]](https://en.wikipedia.org/wiki/Argon#cite_note-16) Argon was also encountered in 1882 through independent research of H. F. Newall and W. N. Hartley.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] Each observed new lines in the [emission spectrum](https://en.wikipedia.org/wiki/Emission_spectrum) of air that did not match known elements.

Until 1957, the symbol for argon was "A", but now is "Ar".[[17]](https://en.wikipedia.org/wiki/Argon#cite_note-17)

**Occurrence**

Argon constitutes 0.934% by volume and 1.288% by mass of the [Earth's atmosphere](https://en.wikipedia.org/wiki/Earth%27s_atmosphere),[[18]](https://en.wikipedia.org/wiki/Argon#cite_note-18) and air is the primary industrial source of purified argon products. Argon is isolated from air by fractionation, most commonly by [cryogenic](https://en.wikipedia.org/wiki/Cryogenics) [fractional distillation](https://en.wikipedia.org/wiki/Fractional_distillation), a process that also produces purified [nitrogen](https://en.wikipedia.org/wiki/Nitrogen), [oxygen](https://en.wikipedia.org/wiki/Oxygen), [neon](https://en.wikipedia.org/wiki/Neon), [krypton](https://en.wikipedia.org/wiki/Krypton) and [xenon](https://en.wikipedia.org/wiki/Xenon).[[19]](https://en.wikipedia.org/wiki/Argon#cite_note-19) The Earth's crust and seawater contain 1.2 ppm and 0.45 ppm of argon, respectively.[[20]](https://en.wikipedia.org/wiki/Argon#cite_note-emsley-20)

**Isotopes**

Main article: [Isotopes of argon](https://en.wikipedia.org/wiki/Isotopes_of_argon)

The main [isotopes](https://en.wikipedia.org/wiki/Isotope) of argon found on Earth are 40  
Ar (99.6%), 36  
Ar (0.34%), and 38  
Ar (0.06%). Naturally occurring 40  
[K](https://en.wikipedia.org/wiki/Potassium), with a [half-life](https://en.wikipedia.org/wiki/Half-life) of 1.25×109 years, decays to stable 40  
Ar (11.2%) by [electron capture](https://en.wikipedia.org/wiki/Electron_capture) or [positron emission](https://en.wikipedia.org/wiki/Positron_emission), and also to stable 40  
Ca (88.8%) by [beta decay](https://en.wikipedia.org/wiki/Beta_decay). These properties and ratios are used to determine the age of [rocks](https://en.wikipedia.org/wiki/Rock_(geology)) by [K–Ar dating](https://en.wikipedia.org/wiki/K%E2%80%93Ar_dating).[[20]](https://en.wikipedia.org/wiki/Argon#cite_note-emsley-20)[[21]](https://en.wikipedia.org/wiki/Argon#cite_note-iso-21)

In the Earth's atmosphere, 39  
Ar is made by [cosmic ray](https://en.wikipedia.org/wiki/Cosmic_ray) activity, primarily by neutron capture of 40  
Ar followed by two-neutron emission. In the subsurface environment, it is also produced through [neutron capture](https://en.wikipedia.org/wiki/Neutron_capture) by 39  
K, followed by proton emission. 37  
Ar is created from the [neutron capture](https://en.wikipedia.org/wiki/Neutron_capture) by 40  
Ca followed by an [alpha particle](https://en.wikipedia.org/wiki/Alpha_particle) emission as a result of subsurface [nuclear explosions](https://en.wikipedia.org/wiki/Nuclear_testing). It has a half-life of 35 days.[[21]](https://en.wikipedia.org/wiki/Argon#cite_note-iso-21)

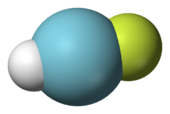
Between locations in the [Solar System](https://en.wikipedia.org/wiki/Solar_System), the isotopic composition of argon varies greatly. Where the major source of argon is the decay of [40  
K](https://en.wikipedia.org/wiki/Potassium-40) in rocks, 40  
Ar will be the dominant isotope, as it is on Earth. Argon produced directly by [stellar nucleosynthesis](https://en.wikipedia.org/wiki/Stellar_nucleosynthesis), is dominated by the [alpha-process](https://en.wikipedia.org/wiki/Alpha_process) nuclide 36  
Ar. Correspondingly, solar argon contains 84.6% 36  
Ar (according to [solar wind](https://en.wikipedia.org/wiki/Solar_wind) measurements),[[22]](https://en.wikipedia.org/wiki/Argon#cite_note-22) and the ratio of the three isotopes 36Ar : 38Ar : 40Ar in the atmospheres of the outer planets is 8400 : 1600 : 1.[[23]](https://en.wikipedia.org/wiki/Argon#cite_note-23) This contrasts with the low abundance of [primordial](https://en.wikipedia.org/wiki/Primordial_nuclide) 36  
Ar in Earth's atmosphere, which is only 31.5 ppmv (= 9340 ppmv × 0.337%), comparable with that of neon (18.18 ppmv) on Earth and with interplanetary gasses, measured by [probes](https://en.wikipedia.org/wiki/Interplanetary_probe).

The atmospheres of [Mars](https://en.wikipedia.org/wiki/Atmosphere_of_Mars), [Mercury](https://en.wikipedia.org/wiki/Mercury_(planet)) and [Titan](https://en.wikipedia.org/wiki/Titan_(moon)) (the largest moon of [Saturn](https://en.wikipedia.org/wiki/Saturn)) contain argon, predominantly as 40  
Ar, and its content may be as high as 1.93% (Mars).[[24]](https://en.wikipedia.org/wiki/Argon#cite_note-24)

The predominance of [radiogenic](https://en.wikipedia.org/wiki/Radiogenic) 40  
Ar is the reason the [standard atomic weight](https://en.wikipedia.org/wiki/Standard_atomic_weight) of terrestrial argon is greater than that of the next element, [potassium](https://en.wikipedia.org/wiki/Potassium), a fact that was puzzling when argon was discovered. [Mendeleev](https://en.wikipedia.org/wiki/Dmitri_Mendeleev) positioned the elements on his [periodic table](https://en.wikipedia.org/wiki/Periodic_table) in order of atomic weight, but the inertness of argon suggested a placement *before* the reactive [alkali metal](https://en.wikipedia.org/wiki/Alkali_metal). [Henry Moseley](https://en.wikipedia.org/wiki/Henry_Moseley) later solved this problem by showing that the periodic table is actually arranged in order of [atomic number](https://en.wikipedia.org/wiki/Atomic_number) (see [History of the periodic table](https://en.wikipedia.org/wiki/History_of_the_periodic_table)).

**Compounds**

Main article: [Argon compounds](https://en.wikipedia.org/wiki/Argon_compounds)

[](https://en.wikipedia.org/wiki/File:Argon-fluorohydride-3D-vdW.png)

[Space-filling model](https://en.wikipedia.org/wiki/Space-filling_model) of [argon fluorohydride](https://en.wikipedia.org/wiki/Argon_fluorohydride)

Argon's complete octet of [electrons](https://en.wikipedia.org/wiki/Electron) indicates full s and p subshells. This full [valence shell](https://en.wikipedia.org/wiki/Valence_shell) makes argon very stable and extremely resistant to bonding with other elements. Before 1962, argon and the other noble gases were considered to be chemically inert and unable to form compounds; however, compounds of the heavier noble gases have since been synthesized. The first argon compound with tungsten pentacarbonyl, W(CO)5Ar, was isolated in 1975. However it was not widely recognised at that time.[[25]](https://en.wikipedia.org/wiki/Argon#cite_note-25) In August 2000, another argon compound, [argon fluorohydride](https://en.wikipedia.org/wiki/Argon_fluorohydride) (HArF), was formed by researchers at the [University of Helsinki](https://en.wikipedia.org/wiki/University_of_Helsinki), by shining ultraviolet light onto frozen argon containing a small amount of [hydrogen fluoride](https://en.wikipedia.org/wiki/Hydrogen_fluoride) with [caesium iodide](https://en.wikipedia.org/wiki/Caesium_iodide). This discovery caused the recognition that argon could form weakly bound compounds, even though it was not the first.[[8]](https://en.wikipedia.org/wiki/Argon#cite_note-sciencenews-harf-8)[[26]](https://en.wikipedia.org/wiki/Argon#cite_note-26)[[27]](https://en.wikipedia.org/wiki/Argon#cite_note-27) It is stable up to 17 [kelvin](https://en.wikipedia.org/wiki/Kelvin)[s](https://en.wikipedia.org/wiki/Kelvin#Usage_conventions) (−256 °C). The [metastable](https://en.wikipedia.org/wiki/Metastable) ArCF2+  
2 dication, which is valence-[isoelectronic](https://en.wikipedia.org/wiki/Isoelectronicity) with [carbonyl fluoride](https://en.wikipedia.org/wiki/Carbonyl_fluoride) and [phosgene](https://en.wikipedia.org/wiki/Phosgene), was observed in 2010.[[28]](https://en.wikipedia.org/wiki/Argon#cite_note-28) [Argon-36](https://en.wikipedia.org/wiki/Argon-36), in the form of argon hydride ([argonium](https://en.wikipedia.org/wiki/Argonium)) ions, has been detected in [interstellar medium](https://en.wikipedia.org/wiki/Interstellar_medium) associated with the [Crab Nebula](https://en.wikipedia.org/wiki/Crab_Nebula) [supernova](https://en.wikipedia.org/wiki/Supernova); this was the first [noble-gas molecule](https://en.wikipedia.org/wiki/Noble_gas) detected in [outer space](https://en.wikipedia.org/wiki/Outer_space).[[29]](https://en.wikipedia.org/wiki/Argon#cite_note-29)[[30]](https://en.wikipedia.org/wiki/Argon#cite_note-NYT-20131213-30)

Solid argon [hydride](https://en.wikipedia.org/wiki/Hydride) (Ar(H2)2) has the same crystal structure as the MgZn2 [Laves phase](https://en.wikipedia.org/wiki/Laves_phase). It forms at pressures between 4.3 and 220 GPa, though Raman measurements suggest that the H2 molecules in Ar(H2)2 dissociate above 175 GPa.[[31]](https://en.wikipedia.org/wiki/Argon#cite_note-31)

**Production**

**Industrial**

Argon is produced industrially by the [fractional distillation](https://en.wikipedia.org/wiki/Fractional_distillation) of [liquid air](https://en.wikipedia.org/wiki/Liquid_air) in a [cryogenic](https://en.wikipedia.org/wiki/Cryogenic) [air separation](https://en.wikipedia.org/wiki/Air_separation) unit; a process that separates [liquid nitrogen](https://en.wikipedia.org/wiki/Liquid_nitrogen), which boils at 77.3 K, from argon, which boils at 87.3 K, and [liquid oxygen](https://en.wikipedia.org/wiki/Liquid_oxygen), which boils at 90.2 K. About 700,000 [tonnes](https://en.wikipedia.org/wiki/Tonne) of argon are produced worldwide every year.[[20]](https://en.wikipedia.org/wiki/Argon#cite_note-emsley-20)[[32]](https://en.wikipedia.org/wiki/Argon#cite_note-32)

**In radioactive decays**

[40Ar](https://en.wikipedia.org/wiki/Isotopes_of_argon), the most abundant [isotope](https://en.wikipedia.org/wiki/Isotope) of argon, is produced by the decay of 40[K](https://en.wikipedia.org/wiki/Potassium) with a half-life of 1.25×109 years by [electron capture](https://en.wikipedia.org/wiki/Electron_capture) or [positron emission](https://en.wikipedia.org/wiki/Positron_emission). Because of this, it is used in [potassium–argon dating](https://en.wikipedia.org/wiki/Potassium%E2%80%93argon_dating) to determine the age of rocks.

**Applications**

[](https://en.wikipedia.org/wiki/File:Argon.jpg)

Cylinders containing argon gas for use in extinguishing fire without damaging server equipment

Argon has several desirable properties:

* Argon is a chemically [inert gas](https://en.wikipedia.org/wiki/Inert_gas).
* Argon is the cheapest alternative when [nitrogen](https://en.wikipedia.org/wiki/Nitrogen) is not sufficiently inert.
* Argon has low [thermal conductivity](https://en.wikipedia.org/wiki/Thermal_conductivity).
* Argon has electronic properties (ionization and/or the emission spectrum) desirable for some applications.

Other [noble gases](https://en.wikipedia.org/wiki/Noble_gas) would be equally suitable for most of these applications, but argon is by far the cheapest. Argon is inexpensive, since it occurs naturally in air and is readily obtained as a byproduct of [cryogenic](https://en.wikipedia.org/wiki/Cryogenic) [air separation](https://en.wikipedia.org/wiki/Air_separation) in the production of [liquid oxygen](https://en.wikipedia.org/wiki/Liquid_oxygen) and [liquid nitrogen](https://en.wikipedia.org/wiki/Liquid_nitrogen): the primary constituents of air are used on a large industrial scale. The other noble gases (except [helium](https://en.wikipedia.org/wiki/Helium)) are produced this way as well, but argon is the most plentiful by far. The bulk of argon applications arise simply because it is inert and relatively cheap.

**Industrial processes**

Argon is used in some high-temperature industrial processes where ordinarily non-reactive substances become reactive. For example, an argon atmosphere is used in graphite electric furnaces to prevent the graphite from burning.

For some of these processes, the presence of nitrogen or oxygen gases might cause defects within the material. Argon is used in some types of [arc welding](https://en.wikipedia.org/wiki/Arc_welding) such as [gas metal arc welding](https://en.wikipedia.org/wiki/Gas_metal_arc_welding) and [gas tungsten arc welding](https://en.wikipedia.org/wiki/Gas_tungsten_arc_welding), as well as in the processing of [titanium](https://en.wikipedia.org/wiki/Titanium) and other reactive elements. An argon atmosphere is also used for growing crystals of [silicon](https://en.wikipedia.org/wiki/Silicon) and [germanium](https://en.wikipedia.org/wiki/Germanium).

See also: [shielding gas](https://en.wikipedia.org/wiki/Shielding_gas)

Argon is used in the poultry industry to [asphyxiate](https://en.wikipedia.org/wiki/Asphyxiant_gas) birds, either for mass culling following disease outbreaks, or as a means of slaughter more humane than the electric bath. Argon is denser than air and displaces oxygen close to the ground during [gassing](https://en.wikipedia.org/wiki/Inert_gas_asphyxiation).[[33]](https://en.wikipedia.org/wiki/Argon#cite_note-33)[[34]](https://en.wikipedia.org/wiki/Argon#cite_note-ShieldsRaj2010-34) Its non-reactive nature makes it suitable in a food product, and since it replaces oxygen within the dead bird, argon also enhances shelf life.[[35]](https://en.wikipedia.org/wiki/Argon#cite_note-FraquezaBarreto2009-35)

Argon is sometimes used for [extinguishing fires](https://en.wikipedia.org/wiki/Gaseous_fire_suppression) where valuable equipment may be damaged by water or foam.[[36]](https://en.wikipedia.org/wiki/Argon#cite_note-SuKim2001-36)

**Scientific research**

Liquid argon is used as the target for neutrino experiments and direct [dark matter](https://en.wikipedia.org/wiki/Dark_matter) searches. The interaction between the hypothetical [WIMPs](https://en.wikipedia.org/wiki/Weakly_interacting_massive_particles) and an argon nucleus produces [scintillation](https://en.wikipedia.org/wiki/Scintillation_(physics)) light that is detected by [photomultiplier tubes](https://en.wikipedia.org/wiki/Photomultiplier_tubes). Two-phase detectors containing argon gas are used to detect the ionized electrons produced during the WIMP–nucleus scattering. As with most other liquefied noble gases, argon has a high scintillation light yield (about 51 photons/keV[[37]](https://en.wikipedia.org/wiki/Argon#cite_note-37)), is transparent to its own scintillation light, and is relatively easy to purify. Compared to [xenon](https://en.wikipedia.org/wiki/Xenon), argon is cheaper and has a distinct scintillation time profile, which allows the separation of electronic recoils from nuclear recoils. On the other hand, its intrinsic beta-ray background is larger due to 39  
Ar contamination, unless one uses argon from underground sources, which has much less 39  
Ar contamination. Most of the argon in the Earth's atmosphere was produced by electron capture of long-lived 40  
K (40  
K + e− → 40  
Ar + ν) present in natural potassium within the Earth. The 39  
Ar activity in the atmosphere is maintained by cosmogenic production through the knockout reaction 40  
Ar(n,2n)39  
Ar and similar reactions. The half-life of 39  
Ar is only 269 years. As a result, the underground Ar, shielded by rock and water, has much less 39  
Ar contamination.[[38]](https://en.wikipedia.org/wiki/Argon#cite_note-38) Dark-matter detectors currently operating with liquid argon include [DarkSide](https://en.wikipedia.org/wiki/DarkSide), [WArP](https://en.wikipedia.org/wiki/WIMP_Argon_Programme), [ArDM](https://en.wikipedia.org/wiki/ArDM), [microCLEAN](https://en.wikipedia.org/wiki/Cryogenic_Low-Energy_Astrophysics_with_Neon) and [DEAP](https://en.wikipedia.org/wiki/DEAP). Neutrino experiments include [ICARUS](https://en.wikipedia.org/wiki/ICARUS_(experiment)) and [MicroBooNE](https://en.wikipedia.org/wiki/MicroBooNE), both of which use high-purity liquid argon in a [time projection chamber](https://en.wikipedia.org/wiki/Time_projection_chamber) for fine grained three-dimensional imaging of neutrino interactions.

**Preservative**

[](https://en.wikipedia.org/wiki/File:CsCrystals.JPG)

A sample of [caesium](https://en.wikipedia.org/wiki/Caesium) is packed under argon to avoid reactions with air

Argon is used to displace oxygen- and moisture-containing air in packaging material to extend the shelf-lives of the contents (argon has the [European food additive code](https://en.wikipedia.org/wiki/E_numbers) E938). Aerial oxidation, hydrolysis, and other chemical reactions that degrade the products are retarded or prevented entirely. High-purity chemicals and pharmaceuticals are sometimes packed and sealed in argon.

In [winemaking](https://en.wikipedia.org/wiki/Winemaking), argon is used in a variety of activities to provide a barrier against oxygen at the liquid surface, which can spoil wine by fueling both microbial metabolism (as with [acetic acid bacteria](https://en.wikipedia.org/wiki/Acetic_acid_bacteria)) and standard [redox](https://en.wikipedia.org/wiki/Redox) chemistry.

Argon is sometimes used as the propellant in [aerosol](https://en.wikipedia.org/wiki/Aerosol) cans for such products as [varnish](https://en.wikipedia.org/wiki/Varnish), [polyurethane](https://en.wikipedia.org/wiki/Polyurethane), and paint, and to displace air when preparing a container for storage after opening.[[39]](https://en.wikipedia.org/wiki/Argon#cite_note-39)

Since 2002, the American [National Archives](https://en.wikipedia.org/wiki/National_Archives) stores important national documents such as the [Declaration of Independence](https://en.wikipedia.org/wiki/United_States_Declaration_of_Independence) and the [Constitution](https://en.wikipedia.org/wiki/United_States_Constitution) within argon-filled cases to inhibit their degradation. Argon is preferable to the helium that had been used in the preceding five decades, because helium gas escapes through the intermolecular pores in most containers and must be regularly replaced.[[40]](https://en.wikipedia.org/wiki/Argon#cite_note-40)

**Laboratory equipment**

[](https://en.wikipedia.org/wiki/File:Glovebox.jpg)

[Gloveboxes](https://en.wikipedia.org/wiki/Glovebox) are often filled with argon, which recirculates over scrubbers to maintain an [oxygen](https://en.wikipedia.org/wiki/Oxygen)-, [nitrogen](https://en.wikipedia.org/wiki/Nitrogen)-, and moisture-free atmosphere

See also: [Air-free technique](https://en.wikipedia.org/wiki/Air-free_technique)

Argon may be used as the [inert gas](https://en.wikipedia.org/wiki/Inert_gas) within [Schlenk lines](https://en.wikipedia.org/wiki/Schlenk_line) and [gloveboxes](https://en.wikipedia.org/wiki/Glovebox). Argon is preferred to less expensive nitrogen in cases where nitrogen may react with the reagents or apparatus.

Argon may be used as the carrier gas in [gas chromatography](https://en.wikipedia.org/wiki/Gas_chromatography) and in [electrospray ionization mass spectrometry](https://en.wikipedia.org/wiki/Electrospray_ionization_mass_spectrometry); it is the gas of choice for the plasma used in [ICP](https://en.wikipedia.org/wiki/Inductively_coupled_plasma) [spectroscopy](https://en.wikipedia.org/wiki/Spectroscopy). Argon is preferred for the sputter coating of specimens for [scanning electron microscopy](https://en.wikipedia.org/wiki/Scanning_electron_microscopy). Argon gas is also commonly used for [sputter deposition](https://en.wikipedia.org/wiki/Sputter_deposition) of thin films as in [microelectronics](https://en.wikipedia.org/wiki/Microelectronics) and for [wafer cleaning in microfabrication](https://en.wikipedia.org/wiki/Microfabrication).

**Medical use**

[Cryosurgery](https://en.wikipedia.org/wiki/Cryosurgery) procedures such as [cryoablation](https://en.wikipedia.org/wiki/Cryoablation) use liquid argon to destroy tissue such as [cancer](https://en.wikipedia.org/wiki/Cancer) cells. It is used in a procedure called "argon-enhanced coagulation", a form of argon [plasma beam](https://en.wikipedia.org/wiki/Plasma_torch) [electrosurgery](https://en.wikipedia.org/wiki/Electrosurgery). The procedure carries a risk of producing [gas embolism](https://en.wikipedia.org/wiki/Gas_embolism) and has resulted in the death of at least one patient.[[41]](https://en.wikipedia.org/wiki/Argon#cite_note-41)

Blue [argon lasers](https://en.wikipedia.org/wiki/Argon_laser) are used in surgery to weld arteries, destroy tumors, and correct eye defects.[[20]](https://en.wikipedia.org/wiki/Argon#cite_note-emsley-20)

Argon has also been used experimentally to replace nitrogen in the breathing or decompression mix known as [Argox](https://en.wikipedia.org/wiki/Argox_(breathing_gas)), to speed the elimination of dissolved nitrogen from the blood.[[42]](https://en.wikipedia.org/wiki/Argon#cite_note-42)

**Lighting**

[](https://en.wikipedia.org/wiki/File:ArTube.jpg)

Argon [gas-discharge lamp](https://en.wikipedia.org/wiki/Gas-discharge_lamp) forming the symbol for argon "Ar"

[Incandescent lights](https://en.wikipedia.org/wiki/Incandescent_light) are filled with argon, to preserve the [filaments](https://en.wikipedia.org/wiki/Electrical_filament) at high temperature from oxidation. It is used for the specific way it ionizes and emits light, such as in [plasma globes](https://en.wikipedia.org/wiki/Plasma_globe) and [calorimetry](https://en.wikipedia.org/wiki/Calorimeter_(particle_physics)) in experimental [particle physics](https://en.wikipedia.org/wiki/Particle_physics). [Gas-discharge lamps](https://en.wikipedia.org/wiki/Gas-discharge_lamp) filled with pure argon provide lilac/violet light; with argon and some mercury, blue light. Argon is also used for blue and green [argon-ion lasers](https://en.wikipedia.org/wiki/Argon_laser).

**Miscellaneous uses**

Argon is used for [thermal insulation](https://en.wikipedia.org/wiki/Thermal_insulation) in [energy-efficient windows](https://en.wikipedia.org/wiki/Insulated_glazing).[[43]](https://en.wikipedia.org/wiki/Argon#cite_note-43) Argon is also used in technical [scuba diving](https://en.wikipedia.org/wiki/Scuba_diving) to inflate a [dry suit](https://en.wikipedia.org/wiki/Dry_suit) because it is inert and has low thermal conductivity.[[44]](https://en.wikipedia.org/wiki/Argon#cite_note-IEEE2008-44)

Argon is used as a propellant in the development of the [Variable Specific Impulse Magnetoplasma Rocket](https://en.wikipedia.org/wiki/Variable_Specific_Impulse_Magnetoplasma_Rocket) (VASIMR). Compressed argon gas is allowed to expand, to cool the seeker heads of some versions of the [AIM-9 Sidewinder](https://en.wikipedia.org/wiki/AIM-9_Sidewinder) missile and other missiles that use cooled thermal seeker heads. The gas is [stored at high pressure](https://en.wikipedia.org/wiki/AIM-9_Sidewinder#Design).[[45]](https://en.wikipedia.org/wiki/Argon#cite_note-45)

Argon-39, with a half-life of 269 years, has been used for a number of applications, primarily [ice core](https://en.wikipedia.org/wiki/Ice_core) and [ground water](https://en.wikipedia.org/wiki/Ground_water) dating. Also, [potassium–argon dating](https://en.wikipedia.org/wiki/Potassium%E2%80%93argon_dating) and related [argon-argon dating](https://en.wikipedia.org/wiki/Argon_argon_dating) is used to date [sedimentary](https://en.wikipedia.org/wiki/Sedimentary_rock), [metamorphic](https://en.wikipedia.org/wiki/Metamorphic_rock), and [igneous rocks](https://en.wikipedia.org/wiki/Igneous_rock).[[20]](https://en.wikipedia.org/wiki/Argon#cite_note-emsley-20)

Argon has been used by athletes as a doping agent to simulate [hypoxic](https://en.wikipedia.org/wiki/Hypoxia_(environmental)) conditions. In 2014, the [World Anti-Doping Agency](https://en.wikipedia.org/wiki/World_Anti-Doping_Agency) (WADA) added argon and [xenon](https://en.wikipedia.org/wiki/Xenon) to the list of prohibited substances and methods, although at this time there is no reliable test for abuse.[[46]](https://en.wikipedia.org/wiki/Argon#cite_note-46)

**Safety**

Although argon is non-toxic, it is 38% [denser](https://en.wikipedia.org/wiki/Density) than air and therefore considered a dangerous [asphyxiant](https://en.wikipedia.org/wiki/Asphyxiant_gas) in closed areas. It is difficult to detect because it is colorless, odorless, and tasteless. A 1994 incident, in which a man was [asphyxiated](https://en.wikipedia.org/wiki/Asphyxia) after entering an argon-filled section of oil pipe under construction in [Alaska](https://en.wikipedia.org/wiki/Alaska), highlights the dangers of argon tank leakage in confined spaces and emphasizes the need for proper use, storage and handling.[[47]](https://en.wikipedia.org/wiki/Argon#cite_note-47)

**See also**

* [Industrial gas](https://en.wikipedia.org/wiki/Industrial_gas)
* [Oxygen–argon ratio](https://en.wikipedia.org/wiki/Oxygen%E2%80%93argon_ratio), a ratio of two physically similar gases, which has importance in various sectors.

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* [USGS Periodic Table – Argon](http://wwwrcamnl.wr.usgs.gov/isoig/period/ar_iig.html)
* Diving applications: [Why Argon?](http://www.decompression.org/maiken/Why_Argon.htm)

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