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**Potassium**

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| --- | --- |
| Potassium,  19K | |
| [Potassium-2.jpg](https://en.wikipedia.org/wiki/File:Potassium-2.jpg)  Potassium pearls (in paraffin oil, ~5 mm each) | |
| **General properties** | |
| **Pronunciation** | [/pəˈtæsiəm/](https://en.wikipedia.org/wiki/Help:IPA/English) ​([*pə-TAS-ee-əm*](https://en.wikipedia.org/wiki/Help:Pronunciation_respelling_key)) |
| **Appearance** | silvery gray |
| [**Standard atomic weight**](https://en.wikipedia.org/wiki/Standard_atomic_weight) **(*A*r, standard)** | 39.0983(1)[[1]](https://en.wikipedia.org/wiki/Potassium#cite_note-CIAAW2016-1) |
| **Potassium 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](https://en.wikipedia.org/wiki/Argon) | | 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) | | [Na](https://en.wikipedia.org/wiki/Sodium) ↑ **K** ↓ [Rb](https://en.wikipedia.org/wiki/Rubidium) | | [argon](https://en.wikipedia.org/wiki/Argon) ← **potassium** → [calcium](https://en.wikipedia.org/wiki/Calcium) | | | | |
| [**Atomic number**](https://en.wikipedia.org/wiki/Atomic_number)(*Z*) | 19 |
| [**Group**](https://en.wikipedia.org/wiki/Group_(periodic_table)) | [group 1 (alkali metals)](https://en.wikipedia.org/wiki/Alkali_metal) |
| [**Period**](https://en.wikipedia.org/wiki/Period_(periodic_table)) | [period 4](https://en.wikipedia.org/wiki/Period_(periodic_table)#Period_4) |
| [**Block**](https://en.wikipedia.org/wiki/Block_(periodic_table)) | [s-block](https://en.wikipedia.org/wiki/S-block) |
| [**Element category**](https://en.wikipedia.org/wiki/Names_for_sets_of_chemical_elements#Category) | [alkali metal](https://en.wikipedia.org/wiki/Alkali_metal) |
| [**Electron configuration**](https://en.wikipedia.org/wiki/Electron_configuration) | [[Ar](https://en.wikipedia.org/wiki/Argon)] 4s1 |
| Electrons per shell | 2, 8, 8, 1 |
| **Physical properties** | |
| [**Phase**](https://en.wikipedia.org/wiki/Phase_(matter)) **at**[**STP**](https://en.wikipedia.org/wiki/Standard_conditions_for_temperature_and_pressure) | [solid](https://en.wikipedia.org/wiki/Solid) |
| [**Melting point**](https://en.wikipedia.org/wiki/Melting_point) | 336.7 [K](https://en.wikipedia.org/wiki/Kelvin) ​(63.5 °C, ​146.3 °F) |
| [**Boiling point**](https://en.wikipedia.org/wiki/Boiling_point) | 1032 K ​(759 °C, ​1398 °F) |
| [**Density**](https://en.wikipedia.org/wiki/Density)(near r.t.) | 0.862 g/cm3 |
| when liquid (at m.p.) | 0.828 g/cm3 |
| [**Critical point**](https://en.wikipedia.org/wiki/Critical_point_(thermodynamics)) | 2223 K, 16 MPa[[2]](https://en.wikipedia.org/wiki/Potassium#cite_note-2) |
| [**Heat of fusion**](https://en.wikipedia.org/wiki/Enthalpy_of_fusion) | 2.33 [kJ/mol](https://en.wikipedia.org/wiki/Kilojoule_per_mole) |
| [**Heat of vaporization**](https://en.wikipedia.org/wiki/Enthalpy_of_vaporization) | 76.9 kJ/mol |
| [**Molar heat capacity**](https://en.wikipedia.org/wiki/Molar_heat_capacity) | 29.6 J/(mol·K) |
| **Atomic properties** | |
| [**Oxidation states**](https://en.wikipedia.org/wiki/Oxidation_state) | −1, **+1** (a strongly [basic](https://en.wikipedia.org/wiki/Base_(chemistry)) oxide) |
| [**Electronegativity**](https://en.wikipedia.org/wiki/Electronegativity) | Pauling scale: 0.82 |
| [**Ionization energies**](https://en.wikipedia.org/wiki/Ionization_energy) | * 1st: 418.8 kJ/mol * 2nd: 3052 kJ/mol * 3rd: 4420 kJ/mol * ([more](https://en.wikipedia.org/wiki/Molar_ionization_energies_of_the_elements#potassium)) |
| [**Atomic radius**](https://en.wikipedia.org/wiki/Atomic_radius) | empirical: 227 [pm](https://en.wikipedia.org/wiki/Picometre) |
| [**Covalent radius**](https://en.wikipedia.org/wiki/Covalent_radius) | 203±12 pm |
| [**Van der Waals radius**](https://en.wikipedia.org/wiki/Van_der_Waals_radius) | 275 pm |
| [Color lines in a spectral range](https://en.wikipedia.org/wiki/File:Potassium_spectrum_visible.png)  [**Spectral lines**](https://en.wikipedia.org/wiki/Spectral_line) **of potassium** | |
| **Other properties** | |
| [**Crystal structure**](https://en.wikipedia.org/wiki/Crystal_structure) | ​[body-centered cubic](https://en.wikipedia.org/wiki/Cubic_crystal_system) (bcc)  [Body-centered cubic crystal structure for potassium](https://en.wikipedia.org/wiki/File:Cubic-body-centered.svg) |
| [**Speed of sound**](https://en.wikipedia.org/wiki/Speed_of_sound)thin rod | 2000 m/s (at 20 °C) |
| [**Thermal expansion**](https://en.wikipedia.org/wiki/Coefficient_of_thermal_expansion) | 83.3 µm/(m·K) (at 25 °C) |
| [**Thermal conductivity**](https://en.wikipedia.org/wiki/Thermal_conductivity) | 102.5 W/(m·K) |
| [**Electrical resistivity**](https://en.wikipedia.org/wiki/Electrical_resistivity_and_conductivity) | 72 nΩ·m (at 20 °C) |
| [**Magnetic ordering**](https://en.wikipedia.org/wiki/Magnetism) | paramagnetic[[3]](https://en.wikipedia.org/wiki/Potassium#cite_note-3) |
| [**Magnetic susceptibility**](https://en.wikipedia.org/wiki/Magnetic_susceptibility) | +20.8·10−6 cm3/mol (298 K)[[4]](https://en.wikipedia.org/wiki/Potassium#cite_note-4) |
| [**Young's modulus**](https://en.wikipedia.org/wiki/Young%27s_modulus) | 3.53 GPa |
| [**Shear modulus**](https://en.wikipedia.org/wiki/Shear_modulus) | 1.3 GPa |
| [**Bulk modulus**](https://en.wikipedia.org/wiki/Bulk_modulus) | 3.1 GPa |
| [**Mohs hardness**](https://en.wikipedia.org/wiki/Mohs_scale_of_mineral_hardness) | 0.4 |
| [**Brinell hardness**](https://en.wikipedia.org/wiki/Brinell_hardness_test) | 0.363 MPa |
| [**CAS Number**](https://en.wikipedia.org/wiki/CAS_Registry_Number) | 7440-09-7 |
| **History** | |
| [**Discovery**](https://en.wikipedia.org/wiki/Timeline_of_chemical_element_discoveries) **and first isolation** | [Humphry Davy](https://en.wikipedia.org/wiki/Humphry_Davy) (1807) |
| **Main** [**isotopes of potassium**](https://en.wikipedia.org/wiki/Isotopes_of_potassium) | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | [**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) | | **39K** | 93.258% | [stable](https://en.wikipedia.org/wiki/Stable_isotope) | | | | [**40K**](https://en.wikipedia.org/wiki/Potassium-40) | 0.012% | 1.248×109 y | [β−](https://en.wikipedia.org/wiki/Beta_decay) | [40Ca](https://en.wikipedia.org/wiki/Calcium-40) | | [ε](https://en.wikipedia.org/wiki/Electron_capture) | [40Ar](https://en.wikipedia.org/wiki/Argon-40) | | [β+](https://en.wikipedia.org/wiki/Positron_emission) | 40Ar | | **41K** | 6.730% | stable | | | | |
| * [view](https://en.wikipedia.org/wiki/Template:Infobox_potassium) * [talk](https://en.wikipedia.org/wiki/Template_talk:Infobox_potassium) * [edit](https://en.wikipedia.org/w/index.php?title=Template:Infobox_potassium&action=edit)   | [references](https://en.wikipedia.org/wiki/List_of_data_references_for_chemical_elements) | |

**Potassium** is a [chemical element](https://en.wikipedia.org/wiki/Chemical_element) with symbol **K** (from [Neo-Latin](https://en.wikipedia.org/wiki/New_Latin) [*kalium*](https://en.wiktionary.org/wiki/kalium#Latin)) and [atomic number](https://en.wikipedia.org/wiki/Atomic_number) 19. It was first isolated from [potash](https://en.wikipedia.org/wiki/Potash), the ashes of plants, from which its name derives. In the [periodic table](https://en.wikipedia.org/wiki/Periodic_table), potassium is one of the [alkali metals](https://en.wikipedia.org/wiki/Alkali_metal). All of the alkali metals have a single [valence electron](https://en.wikipedia.org/wiki/Valence_electron) in the outer electron shell, which is easily removed to create an ion with a positive charge – a [cation](https://en.wikipedia.org/wiki/Cation), which combines with [anions](https://en.wikipedia.org/wiki/Anion) to form [salts](https://en.wikipedia.org/wiki/Salt_(chemistry)). Potassium in nature occurs only in ionic salts. Elemental potassium is a soft silvery-white alkali metal that [oxidizes](https://en.wikipedia.org/wiki/Redox) rapidly in air and reacts vigorously with water, generating sufficient heat to ignite [hydrogen](https://en.wikipedia.org/wiki/Hydrogen) emitted in the reaction, and burning with a [lilac](https://en.wikipedia.org/wiki/Lilac)-[colored flame](https://en.wikipedia.org/wiki/Flame_color). It is found dissolved in sea water (which is 0.04% potassium by weight[[5]](https://en.wikipedia.org/wiki/Potassium#cite_note-seawaterconcentration-5)[[6]](https://en.wikipedia.org/wiki/Potassium#cite_note-6)), and is part of many [minerals](https://en.wikipedia.org/wiki/Mineral).

Potassium is chemically very similar to [sodium](https://en.wikipedia.org/wiki/Sodium), the previous element in group 1 of the periodic table. They have a similar first [ionization energy](https://en.wikipedia.org/wiki/Ionization_energy), which allows for each atom to give up its sole outer electron. That they are different elements that combine with the same [anions](https://en.wikipedia.org/wiki/Anion) to make similar salts was suspected in 1702,[[7]](https://en.wikipedia.org/wiki/Potassium#cite_note-1702Suspect-7) and was proven in 1807 using [electrolysis](https://en.wikipedia.org/wiki/Electrolysis). Naturally occurring potassium is composed of three [isotopes](https://en.wikipedia.org/wiki/Isotope), of which [40  
K](https://en.wikipedia.org/wiki/Potassium-40) is [radioactive](https://en.wikipedia.org/wiki/Radioactive). Traces of 40  
K are found in all potassium, and it is the most common [radioisotope](https://en.wikipedia.org/wiki/Radioisotope) in the human body.

Potassium ions are vital for the functioning of all living cells. The transfer of potassium ions through nerve cell membranes is necessary for normal nerve transmission; potassium deficiency and excess can each result in numerous signs and symptoms, including an abnormal heart rhythm and various [electrocardiographic](https://en.wikipedia.org/wiki/Electrocardiography) abnormalities. Fresh fruits and vegetables are good dietary sources of potassium. The body responds to the influx of dietary potassium, which raises [serum](https://en.wikipedia.org/wiki/Serum_(blood)) potassium levels, with a shift of potassium from outside to inside cells and an increase in potassium excretion by the kidneys.

Most industrial applications of potassium exploit the high [solubility](https://en.wikipedia.org/wiki/Solubility) in water of potassium compounds, such as [potassium](https://en.wikipedia.org/wiki/Saltwater_soap) [soaps](https://en.wikipedia.org/wiki/Soap). Heavy crop production rapidly depletes the soil of potassium, and this can be remedied with agricultural fertilizers containing potassium, accounting for 95% of global potassium chemical production.[[8]](https://en.wikipedia.org/wiki/Potassium#cite_note-g73-8)



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**Etymology**

The English name for the element *potassium* comes from the word "[potash](https://en.wikipedia.org/wiki/Potash)",[[9]](https://en.wikipedia.org/wiki/Potassium#cite_note-9) which refers to an early method of extracting various potassium salts: placing in a *pot* the *ash* of burnt wood or tree leaves, adding water, heating, and evaporating the solution. When [Humphry Davy](https://en.wikipedia.org/wiki/Humphry_Davy) first isolated the pure element using [electrolysis](https://en.wikipedia.org/wiki/Electrolysis) in 1807, he named it *potassium*, which he derived from the word potash.

The symbol "K" stems from *kali*, itself from the root word [*alkali*](https://en.wikipedia.org/wiki/Alkali), which in turn comes from [*Arabic*](https://en.wikipedia.org/wiki/Arabic_language)*: القَلْيَه‎* *al-qalyah* "plant ashes." In 1797, the German chemist [Martin Klaproth](https://en.wikipedia.org/wiki/Martin_Heinrich_Klaproth) discovered "potash" in the minerals [leucite](https://en.wikipedia.org/wiki/Leucite) and [lepidolite](https://en.wikipedia.org/wiki/Lepidolite), and realized that "potash" was not a product of plant growth but actually contained a new element, which he proposed to call *kali*.[[10]](https://en.wikipedia.org/wiki/Potassium#cite_note-10) In 1807, [Humphry Davy](https://en.wikipedia.org/wiki/Humphry_Davy) produced the element via electrolysis: in 1809, [Ludwig Wilhelm Gilbert](https://en.wikipedia.org/wiki/Ludwig_Wilhelm_Gilbert) proposed the name *Kalium* for Davy's "potassium".[[11]](https://en.wikipedia.org/wiki/Potassium#cite_note-11) In 1814, the Swedish chemist [Berzelius](https://en.wikipedia.org/wiki/J%C3%B6ns_Jacob_Berzelius) advocated the name *kalium* for potassium, with the chemical symbol "K".[[12]](https://en.wikipedia.org/wiki/Potassium#cite_note-12)

The English and French speaking countries adopted Davy and Gay-Lussac/Thénard's name Potassium, while the Germanic countries adopted Gilbert/Klaproth's name Kalium.[[13]](https://en.wikipedia.org/wiki/Potassium#cite_note-13) The "Gold Book" of the International Union of Physical and Applied Chemistry has designated the official chemical symbol as **K**.[[14]](https://en.wikipedia.org/wiki/Potassium#cite_note-14)

**Properties**

**Physical**

[](https://en.wikipedia.org/wiki/File:Flammenf%C3%A4rbungK.png)

The [flame test](https://en.wikipedia.org/wiki/Flame_test) of potassium.

Potassium is the second least dense metal after [lithium](https://en.wikipedia.org/wiki/Lithium). It is a soft solid with a low [melting point](https://en.wikipedia.org/wiki/Melting_point), and can be easily cut with a knife. Freshly cut potassium is silvery in appearance, but it begins to tarnish toward gray immediately on exposure to air.[[15]](https://en.wikipedia.org/wiki/Potassium#cite_note-g76-15) In a [flame test](https://en.wikipedia.org/wiki/Flame_test), potassium and its compounds emit a lilac color with a peak emission wavelength of 766.5 nanometers.[[16]](https://en.wikipedia.org/wiki/Potassium#cite_note-16)

**Chemical**

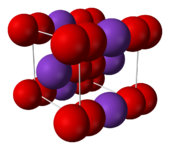
Neutral potassium atoms have 19 electrons, one more than the extremely stable configuration of the [noble gas](https://en.wikipedia.org/wiki/Noble_gas) [argon](https://en.wikipedia.org/wiki/Argon). Because of this and its low first [ionization energy](https://en.wikipedia.org/wiki/Ionization_energy) of 418.8 kJ/mol, the potassium atom is much more likely to lose the last electron and acquire a positive charge than to gain one and acquire a negative charge (though negatively charged [alkalide](https://en.wikipedia.org/wiki/Alkalide) K−  
ions are not impossible).[[17]](https://en.wikipedia.org/wiki/Potassium#cite_note-K--17)[[18]](https://en.wikipedia.org/wiki/Potassium#cite_note-K+++-18) This process requires so little energy that potassium is readily oxidized by atmospheric oxygen. In contrast, the second ionization energy is very high (3052 kJ/mol), because removal of two electrons breaks the stable noble gas electronic configuration (the configuration of the inert argon).[[18]](https://en.wikipedia.org/wiki/Potassium#cite_note-K+++-18) Potassium therefore does not form compounds with the oxidation state of +2 or higher.[[17]](https://en.wikipedia.org/wiki/Potassium#cite_note-K--17)

Potassium is an extremely active metal that reacts violently with oxygen in water and air. With oxygen it forms [potassium peroxide](https://en.wikipedia.org/wiki/Potassium_peroxide), and with water potassium forms [potassium hydroxide](https://en.wikipedia.org/wiki/Potassium_hydroxide). The reaction of potassium with water is dangerous because of its violent [exothermic](https://en.wikipedia.org/wiki/Exothermic) character and the production of [hydrogen](https://en.wikipedia.org/wiki/Hydrogen) gas. Hydrogen reacts again with atmospheric oxygen, producing water, which reacts with the remaining potassium. This reaction requires only traces of water; because of this, potassium and the liquid sodium-potassium ([NaK](https://en.wikipedia.org/wiki/NaK)) alloy are potent [desiccants](https://en.wikipedia.org/wiki/Desiccant) that can be used to dry [solvents](https://en.wikipedia.org/wiki/Solvent) prior to distillation.[[19]](https://en.wikipedia.org/wiki/Potassium#cite_note-b35-19)

Because of the sensitivity of potassium to water and air, reactions with other elements are possible only in an inert atmosphere such as [argon](https://en.wikipedia.org/wiki/Argon) gas using [air-free techniques](https://en.wikipedia.org/wiki/Air-free_technique). Potassium does not react with most hydrocarbons such as mineral oil or [kerosene](https://en.wikipedia.org/wiki/Kerosene).[[20]](https://en.wikipedia.org/wiki/Potassium#cite_note-HollemanAF-20) It readily dissolves in liquid [ammonia](https://en.wikipedia.org/wiki/Ammonia), up to 480 g per 1000 g of ammonia at 0 °C. Depending on the concentration, the ammonia solutions are blue to yellow, and their electrical conductivity is similar to that of liquid metals. In a pure solution, potassium slowly reacts with ammonia to form [KNH  
2](https://en.wikipedia.org/wiki/Potassium_amide), but this reaction is accelerated by minute amounts of transition metal salts.[[21]](https://en.wikipedia.org/wiki/Potassium#cite_note-b32-21) Because it can reduce the [salts](https://en.wikipedia.org/wiki/Salt_(chemistry)) to the metal, potassium is often used as the reductant in the preparation of finely divided metals from their salts by the [Rieke method](https://en.wikipedia.org/wiki/Rieke_metal).[[22]](https://en.wikipedia.org/wiki/Potassium#cite_note-22) For example, the preparation of magnesium by this method employs potassium as the reductant:

[MgCl  
2](https://en.wikipedia.org/wiki/Magnesium_chloride) + 2 K → Mg + 2 KCl

**Compounds**

[](https://en.wikipedia.org/wiki/File:Potassium-superoxide-unit-cell-3D-ionic.png)

Structure of solid potassium superoxide (KO  
2).

The only common oxidation state for potassium is +1. Potassium metal is a powerful [reducing agent](https://en.wikipedia.org/wiki/Reducing_agent) that is easily oxidized to the monopositive [cation](https://en.wikipedia.org/wiki/Cation), K+  
. Once oxidized, it is very stable and difficult to reduce back to the metal.[[17]](https://en.wikipedia.org/wiki/Potassium#cite_note-K--17)

Potassium oxidizes faster than most metals and often forms [oxides](https://en.wikipedia.org/wiki/Oxide) containing oxygen-oxygen bonds, as do all alkali metals except lithium. There are three possible oxides of potassium: [potassium oxide](https://en.wikipedia.org/wiki/Potassium_oxide) (K2O), [potassium peroxide](https://en.wikipedia.org/wiki/Potassium_peroxide) (K2O2), and [potassium superoxide](https://en.wikipedia.org/wiki/Potassium_superoxide) (KO2);[[23]](https://en.wikipedia.org/wiki/Potassium#cite_note-23) they contain three different oxygen-based ions: [oxide](https://en.wikipedia.org/wiki/Oxide) (O2−  
), [peroxide](https://en.wikipedia.org/wiki/Peroxide) (O2−  
2), and [superoxide](https://en.wikipedia.org/wiki/Superoxide) (O−  
2). The latter two species, especially the [superoxide](https://en.wikipedia.org/wiki/Superoxide), are rare and are formed only in reaction of very [electropositive](https://en.wikipedia.org/wiki/Electronegativity) metals (Na, K, Rb, Cs, etc.) with oxygen; these species contain oxygen-oxygen bonds.[[21]](https://en.wikipedia.org/wiki/Potassium#cite_note-b32-21) All potassium-oxygen binary compounds are known to react with water violently, forming [potassium hydroxide](https://en.wikipedia.org/wiki/Potassium_hydroxide).

Potassium hydroxide (KOH) is a very strong alkali, and up to 1.21 [kg](https://en.wikipedia.org/wiki/Kilogram) of it can dissolve in a single liter of water.[[24]](https://en.wikipedia.org/wiki/Potassium#cite_note-24)[[25]](https://en.wikipedia.org/wiki/Potassium#cite_note-25) KOH reacts readily with carbon dioxide to produce [potassium carbonate](https://en.wikipedia.org/wiki/Potassium_carbonate), and is used to remove traces of the gas from air.

In general, potassium compounds are highly ionic and, owing to the high hydration energy of the K+  
ion, have excellent water solubility. The main species in water solution are the aquated complexes [K(H  
2O)  
n]+  
where n = 6 and 7.[[26]](https://en.wikipedia.org/wiki/Potassium#cite_note-Lincoln-26) The potassium ion is colorless in water and is very difficult to [precipitate](https://en.wikipedia.org/wiki/Precipitation_(chemistry)); possible precipitation methods include reactions with [sodium tetraphenylborate](https://en.wikipedia.org/wiki/Sodium_tetraphenylborate), [hexachloroplatinic acid](https://en.wikipedia.org/wiki/Hexachloroplatinic_acid), and [sodium cobaltinitrite](https://en.wikipedia.org/wiki/Sodium_cobaltinitrite) into [potassium tetraphenylborate](https://en.wikipedia.org/wiki/Potassium_tetraphenylborate), [potassium hexachloroplatinate](https://en.wikipedia.org/wiki/Potassium_hexachloroplatinate), and [potassium cobaltinitrite](https://en.wikipedia.org/wiki/Potassium_cobaltinitrite).[[20]](https://en.wikipedia.org/wiki/Potassium#cite_note-HollemanAF-20)

**Isotopes**

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

There are 24 known [isotopes](https://en.wikipedia.org/wiki/Isotope) of potassium, three of which occur naturally: 39  
K (93.3%), 40  
K (0.0117%), and 41  
K (6.7%). Naturally occurring [40  
K](https://en.wikipedia.org/wiki/Potassium-40) has a [half-life](https://en.wikipedia.org/wiki/Half-life) of 1.250×109 years. It decays to stable [40  
Ar](https://en.wikipedia.org/wiki/Argon) by [electron capture](https://en.wikipedia.org/wiki/Electron_capture) or [positron emission](https://en.wikipedia.org/wiki/Positron_emission) (11.2%) or to stable [40  
Ca](https://en.wikipedia.org/wiki/Calcium) by [beta decay](https://en.wikipedia.org/wiki/Beta_decay) (88.8%).[[27]](https://en.wikipedia.org/wiki/Potassium#cite_note-NUBASE-27) The decay of 40  
K to 40  
Ar is the basis of a common method for dating rocks. The conventional [K-Ar dating method](https://en.wikipedia.org/wiki/Potassium-argon_dating) depends on the assumption that the rocks contained no argon at the time of formation and that all the subsequent radiogenic argon (40  
Ar) was quantitatively retained. [Minerals](https://en.wikipedia.org/wiki/Mineral) are dated by measurement of the concentration of potassium and the amount of radiogenic 40  
Ar that has accumulated. The minerals best suited for dating include [biotite](https://en.wikipedia.org/wiki/Biotite), [muscovite](https://en.wikipedia.org/wiki/Muscovite), metamorphic [hornblende](https://en.wikipedia.org/wiki/Hornblende), and volcanic [feldspar](https://en.wikipedia.org/wiki/Feldspar); [whole rock](https://en.wikipedia.org/wiki/Petrography) samples from volcanic flows and shallow [instrusives](https://en.wikipedia.org/wiki/Igneous_rock) can also be dated if they are unaltered.[[27]](https://en.wikipedia.org/wiki/Potassium#cite_note-NUBASE-27)[[28]](https://en.wikipedia.org/wiki/Potassium#cite_note-28) Apart from dating, potassium isotopes have been used as [tracers](https://en.wikipedia.org/wiki/Radioactive_tracer) in studies of [weathering](https://en.wikipedia.org/wiki/Weathering) and for [nutrient cycling](https://en.wikipedia.org/wiki/Nutrient_cycling) studies because potassium is a [macronutrient](https://en.wikipedia.org/wiki/Macronutrient_(ecology)) required for [life](https://en.wikipedia.org/wiki/Life).[[29]](https://en.wikipedia.org/wiki/Potassium#cite_note-29)

40  
K occurs in natural potassium (and thus in some commercial salt substitutes) in sufficient quantity that large bags of those substitutes can be used as a radioactive source for classroom demonstrations. 40  
K is the radioisotope with the largest abundance in the body. In healthy animals and people, 40  
K represents the largest source of radioactivity, greater even than [14  
C](https://en.wikipedia.org/wiki/Carbon-14). In a human body of 70 kg mass, about 4,400 nuclei of 40  
K decay per second.[[30]](https://en.wikipedia.org/wiki/Potassium#cite_note-30) The activity of natural potassium is 31 [Bq](https://en.wikipedia.org/wiki/Becquerel)/g.[[31]](https://en.wikipedia.org/wiki/Potassium#cite_note-31)

**Cosmic formation and distribution**

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

Potassium in [feldspar](https://en.wikipedia.org/wiki/Feldspar)

Potassium is formed in [supernovae](https://en.wikipedia.org/wiki/Supernova) by [nucleosynthesis](https://en.wikipedia.org/wiki/Nucleosynthesis) from lighter atoms. Potassium is principally created in Type II supernovae via an [explosive oxygen-burning process](https://en.wikipedia.org/wiki/Supernova_nucleosynthesis).[[32]](https://en.wikipedia.org/wiki/Potassium#cite_note-32) 40  
K is also formed in [s-process](https://en.wikipedia.org/wiki/S-process) nucleosynthesis and the [neon burning process](https://en.wikipedia.org/wiki/Neon_burning_process).[[33]](https://en.wikipedia.org/wiki/Potassium#cite_note-33)

Potassium is the 20th most abundant element in the solar system and the 17th most abundant element by weight in the earth. It makes up about 2.6% of the weight of the [earth's crust](https://en.wikipedia.org/wiki/Earth%27s_crust) and is the seventh most abundant element in the crust.[[34]](https://en.wikipedia.org/wiki/Potassium#cite_note-34) The potassium concentration in seawater is 0.39 g/L[[5]](https://en.wikipedia.org/wiki/Potassium#cite_note-seawaterconcentration-5) (0.039 wt/v%), about one twenty-seventh the concentration of sodium.[[35]](https://en.wikipedia.org/wiki/Potassium#cite_note-geo-35)[[36]](https://en.wikipedia.org/wiki/Potassium#cite_note-indus-36)

**Potash**

Main article: [Potash](https://en.wikipedia.org/wiki/Potash)

Potash is primarily a mixture of potassium salts because plants have little or no sodium content, and the rest of a plant's major mineral content consists of calcium salts of relatively low solubility in water. While potash has been used since ancient times, it was not understood for most of its history to be a fundamentally different substance from sodium mineral salts. [Georg Ernst Stahl](https://en.wikipedia.org/wiki/Georg_Ernst_Stahl) obtained experimental evidence that led him to suggest the fundamental difference of sodium and potassium salts in 1702,[[7]](https://en.wikipedia.org/wiki/Potassium#cite_note-1702Suspect-7) and [Henri Louis Duhamel du Monceau](https://en.wikipedia.org/wiki/Henri_Louis_Duhamel_du_Monceau) was able to prove this difference in 1736.[[37]](https://en.wikipedia.org/wiki/Potassium#cite_note-37) The exact chemical composition of potassium and sodium compounds, and the status as chemical element of potassium and sodium, was not known then, and thus [Antoine Lavoisier](https://en.wikipedia.org/wiki/Antoine_Lavoisier) did not include the alkali in his list of chemical elements in 1789.[[38]](https://en.wikipedia.org/wiki/Potassium#cite_note-weeks-38)[[39]](https://en.wikipedia.org/wiki/Potassium#cite_note-disco-39) For a long time the only significant applications for potash were the production of glass, bleach, soap and [gunpowder](https://en.wikipedia.org/wiki/Gunpowder) as potassium nitrate.[[40]](https://en.wikipedia.org/wiki/Potassium#cite_note-40) Potassium soaps from animal fats and vegetable oils were especially prized because they tend to be more water-soluble and of softer texture, and are therefore known as soft [soaps](https://en.wikipedia.org/wiki/Soap).[[8]](https://en.wikipedia.org/wiki/Potassium#cite_note-g73-8) The discovery by [Justus Liebig](https://en.wikipedia.org/wiki/Justus_Liebig) in 1840 that potassium is a necessary element for plants and that most types of soil lack potassium[[41]](https://en.wikipedia.org/wiki/Potassium#cite_note-41) caused a steep rise in demand for potassium salts. Wood-ash from fir trees was initially used as a potassium salt source for fertilizer, but, with the discovery in 1868 of mineral deposits containing [potassium chloride](https://en.wikipedia.org/wiki/Potassium_chloride) near [Staßfurt](https://en.wikipedia.org/wiki/Sta%C3%9Ffurt), Germany, the production of potassium-containing fertilizers began at an industrial scale.[[42]](https://en.wikipedia.org/wiki/Potassium#cite_note-42)[[43]](https://en.wikipedia.org/wiki/Potassium#cite_note-43)[[44]](https://en.wikipedia.org/wiki/Potassium#cite_note-44) Other potash deposits were discovered, and by the 1960s Canada became the dominant producer.[[45]](https://en.wikipedia.org/wiki/Potassium#cite_note-45)[[46]](https://en.wikipedia.org/wiki/Potassium#cite_note-46)

**Metal**

[](https://en.wikipedia.org/wiki/File:Sir_Humphry_Davy,_Bt_by_Thomas_Phillips.jpg)

[Humphry Davy](https://en.wikipedia.org/wiki/Humphry_Davy)

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

Pieces of potassium metal

Potassium *metal* was first isolated in 1807 by Sir [Humphry Davy](https://en.wikipedia.org/wiki/Humphry_Davy), who derived it from [caustic potash](https://en.wikipedia.org/wiki/Potassium_hydroxide) (KOH, potassium hydroxide) by electrolysis of molten KOH with the newly discovered [voltaic pile](https://en.wikipedia.org/wiki/Voltaic_pile). Potassium was the first metal that was isolated by electrolysis.[[47]](https://en.wikipedia.org/wiki/Potassium#cite_note-Enghag2004-47) Later in the same year, Davy reported extraction of the metal [sodium](https://en.wikipedia.org/wiki/Sodium) from a mineral derivative ([caustic soda](https://en.wikipedia.org/wiki/Caustic_soda), NaOH, or lye) rather than a plant salt, by a similar technique, demonstrating that the elements, and thus the salts, are different.[[38]](https://en.wikipedia.org/wiki/Potassium#cite_note-weeks-38)[[39]](https://en.wikipedia.org/wiki/Potassium#cite_note-disco-39)[[48]](https://en.wikipedia.org/wiki/Potassium#cite_note-Davy1807-48)[[49]](https://en.wikipedia.org/wiki/Potassium#cite_note-200disco-49) Although the production of potassium and sodium metal should have shown that both are elements, it took some time before this view was universally accepted.[[39]](https://en.wikipedia.org/wiki/Potassium#cite_note-disco-39)

**Geology**

Elemental potassium does not occur in nature because of its high reactivity. It reacts violently with water (see section Precautions below)[[20]](https://en.wikipedia.org/wiki/Potassium#cite_note-HollemanAF-20) and also reacts with oxygen. [Orthoclase](https://en.wikipedia.org/wiki/Orthoclase) (potassium feldspar) is a common rock-forming mineral. [Granite](https://en.wikipedia.org/wiki/Granite) for example contains 5% potassium, which is well above the average in the Earth's crust. [Sylvite](https://en.wikipedia.org/wiki/Sylvite) (KCl), [carnallite](https://en.wikipedia.org/wiki/Carnallite) (KCl·MgCl  
2·6(H  
2O)), [kainite](https://en.wikipedia.org/wiki/Kainite) (MgSO  
4·KCl·3H  
2O) and [langbeinite](https://en.wikipedia.org/wiki/Langbeinite) (MgSO  
4·K  
2SO  
4) are the minerals found in large [evaporite](https://en.wikipedia.org/wiki/Evaporite) deposits worldwide. The deposits often show layers starting with the least soluble at the bottom and the most soluble on top.[[36]](https://en.wikipedia.org/wiki/Potassium#cite_note-indus-36) Deposits of niter ([potassium nitrate](https://en.wikipedia.org/wiki/Potassium_nitrate)) are formed by decomposition of organic material in contact with atmosphere, mostly in caves; because of the good water solubility of niter the formation of larger deposits requires special environmental conditions.[[50]](https://en.wikipedia.org/wiki/Potassium#cite_note-50)

**Biological role**

Main article: [Potassium in biology](https://en.wikipedia.org/wiki/Potassium_in_biology)

Potassium is the eighth or ninth most common element by mass (0.2%) in the human body, so that a 60 kg adult contains a total of about 120 g of potassium.[[51]](https://en.wikipedia.org/wiki/Potassium#cite_note-51) The [body](https://en.wikipedia.org/wiki/Composition_of_the_human_body) has about as much potassium as sulfur and chlorine, and only calcium and phosphorus are more abundant (with the exception of the ubiquitous [CHON](https://en.wikipedia.org/wiki/CHON) elements).[[52]](https://en.wikipedia.org/wiki/Potassium#cite_note-52) Potassium ions are present in a wide variety of proteins and enzymes.[[53]](https://en.wikipedia.org/wiki/Potassium#cite_note-53)

**Biochemical function**

Potassium levels influence multiple physiological processes, including[[54]](https://en.wikipedia.org/wiki/Potassium#cite_note-54)[[55]](https://en.wikipedia.org/wiki/Potassium#cite_note-55)[[56]](https://en.wikipedia.org/wiki/Potassium#cite_note-56)

* resting cellular-membrane potential and the propagation of action potentials in neuronal, muscular, and cardiac tissue. Due to the electrostatic and chemical properties, K+  
  ions are larger than Na+  
  ions, and ion channels and pumps in cell membranes can differentiate between the two ions, actively pumping or passively passing one of the two ions while blocking the other.[[57]](https://en.wikipedia.org/wiki/Potassium#cite_note-57)
* hormone secretion and action
* vascular tone
* systemic blood pressure control
* gastrointestinal motility
* acid–base homeostasis
* glucose and insulin metabolism
* mineralocorticoid action
* renal concentrating ability
* fluid and electrolyte balance

**Homeostasis**

Potassium homeostasis denotes the maintenance of the total body potassium content, plasma potassium level, and the ratio of the intracellular to extracellular potassium concentrations within narrow limits, in the face of pulsatile intake (meals), obligatory renal excretion, and shifts between intracellular and extracellular compartments.

**Plasma levels**

Plasma potassium is normally kept at 3.5 to 5.0 millimoles (mmol) [or milliequivalents (mEq)] per liter by multiple mechanisms. Levels outside this range are associated with an increasing rate of death from multiple causes,[[58]](https://en.wikipedia.org/wiki/Potassium#cite_note-58) and some cardiac, kidney,[[59]](https://en.wikipedia.org/wiki/Potassium#cite_note-59) and lung diseases progress more rapidly if serum potassium levels are not maintained within the normal range.

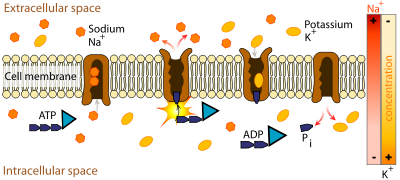
An average meal of 40-50 mmol presents the body with more potassium than is present in all plasma (20-25 mmol). However, this surge causes the plasma potassium to rise only 10% at most as a result of prompt and efficient clearance by both renal and extra-renal mechanisms.[[60]](https://en.wikipedia.org/wiki/Potassium#cite_note-60)

[Hypokalemia](https://en.wikipedia.org/wiki/Hypokalemia), a deficiency of potassium in the plasma, can be fatal if severe. Common causes are increased gastrintestinal loss ([vomiting](https://en.wikipedia.org/wiki/Vomiting), [diarrhea](https://en.wikipedia.org/wiki/Diarrhea)), and increased renal loss ([diuresis](https://en.wikipedia.org/wiki/Polyuria)).[[61]](https://en.wikipedia.org/wiki/Potassium#cite_note-61) Deficiency symptoms include muscle weakness, [paralytic ileus](https://en.wikipedia.org/wiki/Paralytic_ileus), ECG abnormalities, decreased reflex response; and in severe cases, respiratory paralysis, [alkalosis](https://en.wikipedia.org/wiki/Alkalosis), and [cardiac arrhythmia](https://en.wikipedia.org/wiki/Cardiac_arrhythmia).[[62]](https://en.wikipedia.org/wiki/Potassium#cite_note-62)

**Control mechanisms**

Potassium content in the plasma is tightly controlled by four basic mechanisms, which have various names and classifications. The four are 1) a reactive negative-feedback system, 2) a reactive feed-forward system, 3) a predictive or [circadian](https://en.wikipedia.org/wiki/Circadian) system, and 4) an internal or cell membrane transport system. Collectively, the first three are sometimes termed the "external potassium homeostasis system";[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] and the first two, the "reactive potassium homeostasis system".

* The reactive negative-feedback system refers to the system that induces renal secretion of potassium in response to a rise in the plasma potassium (potassium ingestion, shift out of cells, or intravenous infusion.)
* The reactive feed-forward system refers to an incompletely understood system that induces renal potassium secretion in response to potassium ingestion prior to any rise in the plasma potassium. This is probably initiated by gut cell potassium receptors that detect ingested potassium and trigger [vagal](https://en.wikipedia.org/wiki/Vagal) [afferent](https://en.wikipedia.org/wiki/Afferent_nerve_fiber) signals to the pituitary gland.
* The predictive or circadian system increases renal secretion of potassium during mealtime hours (e.g. daytime for humans, nighttime for rodents) independent of the presence, amount, or absence of potassium ingestion. It is mediated by a [circadian oscillator](https://en.wikipedia.org/wiki/Circadian_oscillator) in the [suprachiasmatic nucleus](https://en.wikipedia.org/wiki/Suprachiasmatic_nucleus) of the brain (central clock), which causes the kidney (peripheral clock) to secrete potassium in this rhythmic circadian fashion.

[](https://en.wikipedia.org/wiki/File:Scheme_sodium-potassium_pump-en.svg)

* The action of the [sodium-potassium pump](https://en.wikipedia.org/wiki/Sodium-potassium_pump) is an example of primary [active transport](https://en.wikipedia.org/wiki/Active_transport). The two carrier proteins embedded in the cell membrane on the left are using [ATP](https://en.wikipedia.org/wiki/Adenosine_triphosphate) to move sodium out of the cell against the concentration gradient; The two proteins on the right are using secondary active transport to move potassium into the cell: this process results in reconstitution of ATP.
* The ion transport system moves potassium across the cell membrane using two mechanisms. One is active and pumps sodium out of, and potassium into, the cell. The other is passive and allows potassium to leak out of the cell. Potassium and sodium cations influence fluid distribution between intracellular and extracellular compartments by [osmotic](https://en.wikipedia.org/wiki/Osmotic) forces. The movement of potassium and sodium through the cell membrane is mediated by the [Na+/K+-ATPase](https://en.wikipedia.org/wiki/Na%2B/K%2B-ATPase) pump.[[63]](https://en.wikipedia.org/wiki/Potassium#cite_note-63) This [ion pump](https://en.wikipedia.org/wiki/Ion_transporter) uses [ATP](https://en.wikipedia.org/wiki/Adenosine_triphosphate) to pump three sodium ions out of the cell and two potassium ions into the cell, creating an electrochemical gradient and electromotive force across the cell membrane. The highly selective [potassium ion channels](https://en.wikipedia.org/wiki/Potassium_ion_channels) (which are [tetramers](https://en.wikipedia.org/wiki/Tetramer)) are crucial for [hyperpolarization](https://en.wikipedia.org/wiki/Hyperpolarization_(biology)) inside [neurons](https://en.wikipedia.org/wiki/Neuron) after an action potential is triggered, to cite one example. The most recently discovered potassium ion channel is KirBac3.1, which makes a total of five potassium ion channels (KcsA, KirBac1.1, KirBac3.1, KvAP, and MthK) with a determined structure. All five are from [prokaryotic](https://en.wikipedia.org/wiki/Prokaryotic) species.[[64]](https://en.wikipedia.org/wiki/Potassium#cite_note-pmid16253415-64)

**Renal filtration, reabsorption, and excretion**

Renal handling of potassium is closely connected to sodium handling. Potassium is the major cation (positive ion) inside animal cells [150 mmol/L, (4.8 g)], while sodium is the major cation of extracellular fluid [150 mmol/L, (3.345 g)]. In the kidneys, about 180 liters of plasma is filtered through the [glomeruli](https://en.wikipedia.org/wiki/Glomeruli) and into the [renal tubules](https://en.wikipedia.org/wiki/Renal_tubules) per day.[[65]](https://en.wikipedia.org/wiki/Potassium#cite_note-Potts1964-65) This filtering involves about 600 g of sodium and 33 g of potassium. Since only 1–10 g of sodium and 1–4 g of potassium are likely to be replaced by diet, renal filtering must efficiently reabsorb the remainder from the plasma.

Sodium is reabsorbed to maintain extracellular volume, osmotic pressure, and serum sodium concentration within narrow limits; potassium is reabsorbed to maintain serum potassium concentration within narrow limits.[[66]](https://en.wikipedia.org/wiki/Potassium#cite_note-66) [Sodium pumps](https://en.wikipedia.org/wiki/Sodium_pump) in the renal tubules operate to reabsorb sodium. Potassium must be conserved also, but, because the amount of potassium in the blood plasma is very small and the pool of potassium in the cells is about thirty times as large, the situation is not so critical for potassium. Since potassium is moved passively[[67]](https://en.wikipedia.org/wiki/Potassium#cite_note-67)[[68]](https://en.wikipedia.org/wiki/Potassium#cite_note-68) in counter flow to sodium in response to an apparent (but not actual) [Donnan equilibrium](https://en.wikipedia.org/wiki/Donnan_equilibrium),[[69]](https://en.wikipedia.org/wiki/Potassium#cite_note-69) the urine can never sink below the concentration of potassium in serum except sometimes by actively excreting water at the end of the processing. Potassium is excreted twice and reabsorbed three times before the urine reaches the collecting tubules.[[70]](https://en.wikipedia.org/wiki/Potassium#cite_note-70) At that point, urine usually has about the same potassium concentration as plasma. At the end of the processing, potassium is secreted one more time if the serum levels are too high.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

With no potassium intake, it is excreted at about 200 mg per day until, in about a week, potassium in the serum declines to a mildly deficient level of 3.0–3.5 mmol/L.[[71]](https://en.wikipedia.org/wiki/Potassium#cite_note-71) If potassium is still withheld, the concentration continues to fall until a severe deficiency causes eventual death.[[72]](https://en.wikipedia.org/wiki/Potassium#cite_note-72)

The potassium moves passively through pores in the cell membrane. When ions move through pumps there is a gate in the pumps on either side of the cell membrane and only one gate can be open at once. As a result, approximately 100 ions are forced through per second. Pores have only one gate, and there only one kind of ion can stream through, at 10 million to 100 million ions per second.[[73]](https://en.wikipedia.org/wiki/Potassium#cite_note-73) The pores require calcium to open[[74]](https://en.wikipedia.org/wiki/Potassium#cite_note-74) although it is thought that the calcium works in reverse by blocking at least one of the pores.[[75]](https://en.wikipedia.org/wiki/Potassium#cite_note-75) Carbonyl groups inside the pore on the amino acids mimic the water hydration that takes place in water solution[[76]](https://en.wikipedia.org/wiki/Potassium#cite_note-76) by the nature of the electrostatic charges on four carbonyl groups inside the pore.[[77]](https://en.wikipedia.org/wiki/Potassium#cite_note-77)

**Nutrition**

**Dietary recommendations**

The U.S. Institute of Medicine (IOM) sets Estimated Average Requirements (EARs) and Recommended Dietary Allowances (RDAs), or [Adequate Intakes](https://en.wikipedia.org/wiki/Adequate_Intake) (AIs) for when there is not sufficient information to set EARs and RDAs. Collectively the EARs, RDAs, AIs and ULs are referred to as [Dietary Reference Intakes](https://en.wikipedia.org/wiki/Dietary_Reference_Intake). The AIs for potassium are: 400 mg of potassium for 0-6-month-old males, 700 mg of potassium for 7-12-month-old males, 3,000 mg of potassium for 1-3-year-old males, 3,800 mg of potassium for 4-8-year-old males, 4,500 mg of potassium for 9-13-year-old males, and 4,700 mg of potassium for males that are 14 years old and older. The AIs for potassium are: 400 mg of potassium for 0-6-month-old females, 700 mg of potassium for 7-12-month-old females, 3,000 mg of potassium for 1-3-year-old females, 3,800 mg of potassium for 4-8-year-old females, 4,500 mg of potassium for 9-13-year-old females, and 4,700 mg of potassium for females that are 14 years old and older. The AIs for potassium are: 4,700 mg of potassium for 14-50-year-old pregnant females; furthermore, 5,100 mg of potassium for 14-50-year-old lactating females. As for safety, the IOM also sets [Tolerable upper intake levels](https://en.wikipedia.org/wiki/Tolerable_upper_intake_level) (ULs) for vitamins and minerals, but for potassium the evidence was insufficient, so no UL established.[[78]](https://en.wikipedia.org/wiki/Potassium#cite_note-78)

Most Americans consume only half that amount per day.[[79]](https://en.wikipedia.org/wiki/Potassium#cite_note-iom_panel2005-79)

Likewise, in the [European Union](https://en.wikipedia.org/wiki/European_Union), in particular in [Germany](https://en.wikipedia.org/wiki/Germany) and [Italy](https://en.wikipedia.org/wiki/Italy), insufficient potassium intake is somewhat common.[[80]](https://en.wikipedia.org/wiki/Potassium#cite_note-80) However, the [British National Health Service](https://en.wikipedia.org/wiki/National_Health_Service) recommends a lower intake, saying that adults need 3,500 mg per day and that excess amounts may cause health problems such as stomach pain and diarrhoea.[[81]](https://en.wikipedia.org/wiki/Potassium#cite_note-81)

**Food sources**

Potassium is present in all fruits, vegetables, meat and fish. Foods with high potassium concentrations include [yam](https://en.wikipedia.org/wiki/Yam_(vegetable)), [parsley](https://en.wikipedia.org/wiki/Parsley), dried [apricots](https://en.wikipedia.org/wiki/Apricot), [milk](https://en.wikipedia.org/wiki/Milk), [chocolate](https://en.wikipedia.org/wiki/Chocolate), all [nuts](https://en.wikipedia.org/wiki/Nut_(fruit)) (especially [almonds](https://en.wikipedia.org/wiki/Almond) and [pistachios](https://en.wikipedia.org/wiki/Pistachio)), [potatoes](https://en.wikipedia.org/wiki/Potato), [bamboo shoots](https://en.wikipedia.org/wiki/Bamboo_shoot), [bananas](https://en.wikipedia.org/wiki/Banana), [avocados](https://en.wikipedia.org/wiki/Avocado), [coconut water](https://en.wikipedia.org/wiki/Coconut_water), [soybeans](https://en.wikipedia.org/wiki/Soybean), and [bran](https://en.wikipedia.org/wiki/Bran).[[82]](https://en.wikipedia.org/wiki/Potassium#cite_note-82)

The [USDA](https://en.wikipedia.org/wiki/United_States_Department_of_Agriculture) lists [tomato paste](https://en.wikipedia.org/wiki/Tomato_paste), [orange juice](https://en.wikipedia.org/wiki/Orange_juice), [beet greens](https://en.wikipedia.org/wiki/Beet_greens), [white beans](https://en.wikipedia.org/wiki/White_beans), [potatoes](https://en.wikipedia.org/wiki/Potato), [plantains](https://en.wikipedia.org/wiki/Cooking_banana), [bananas](https://en.wikipedia.org/wiki/Banana), apricots, and many other dietary sources of potassium, ranked in descending order according to potassium content. A day's worth of potassium is in 5 plantains or 11 bananas.[[83]](https://en.wikipedia.org/wiki/Potassium#cite_note-83)

**Deficient intake**

Diets low in potassium can lead to [hypertension](https://en.wikipedia.org/wiki/Hypertension)[[84]](https://en.wikipedia.org/wiki/Potassium#cite_note-84) and [hypokalemia](https://en.wikipedia.org/wiki/Hypokalemia).

**Supplementation**

Supplements of potassium are most widely used in conjunction with [diuretics](https://en.wikipedia.org/wiki/Diuretic) that block reabsorption of sodium and water upstream from the [distal tubule](https://en.wikipedia.org/wiki/Distal_tubule) ([thiazides](https://en.wikipedia.org/wiki/Thiazide) and [loop diuretics](https://en.wikipedia.org/wiki/Loop_diuretics)), because this promotes increased distal tubular potassium secretion, with resultant increased potassium excretion. A variety of prescription and over-the counter supplements are available. Potassium chloride may be dissolved in water, but the salty/bitter taste make liquid supplements unpalatable.[[85]](https://en.wikipedia.org/wiki/Potassium#cite_note-bitter-85) Typical doses range from 10 mmol (400 mg), to 20 mmol (800 mg). Potassium is also available in tablets or capsules, which are formulated to allow potassium to leach slowly out of a matrix, since very high concentrations of potassium ion that occur adjacent to a solid tablet can injure the gastric or intestinal mucosa. For this reason, non-prescription potassium pills are limited by law in the US to a maximum of 99 mg of potassium.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

Since the kidneys are the site of potassium excretion, individuals with impaired kidney function are at risk for [hyperkalemia](https://en.wikipedia.org/wiki/Hyperkalemia) if dietary potassium and supplements are not restricted. The more severe the impairment, the more severe is the restriction necessary to avoid hyperkalemia.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

A [meta-analysis](https://en.wikipedia.org/wiki/Meta-analysis) concluded that a 1640 mg increase in the daily intake of potassium was associated with a 21% lower risk of stroke.[[86]](https://en.wikipedia.org/wiki/Potassium#cite_note-86) [Potassium chloride](https://en.wikipedia.org/wiki/Potassium_chloride) and [potassium bicarbonate](https://en.wikipedia.org/wiki/Potassium_bicarbonate) may be useful to control mild [hypertension](https://en.wikipedia.org/wiki/Hypertension).[[87]](https://en.wikipedia.org/wiki/Potassium#cite_note-87)

**Detection by taste buds**

Potassium can be detected by taste because it triggers three of the five types of taste sensations, according to concentration. Dilute solutions of potassium ions taste sweet, allowing moderate concentrations in milk and juices, while higher concentrations become increasingly bitter/alkaline, and finally also salty to the taste. The combined bitterness and saltiness of high-potassium solutions makes high-dose potassium supplementation by liquid drinks a palatability challenge.[[85]](https://en.wikipedia.org/wiki/Potassium#cite_note-bitter-85)[[88]](https://en.wikipedia.org/wiki/Potassium#cite_note-88)

**Commercial production**

**Mining**

[](https://en.wikipedia.org/wiki/File:Museo_de_La_Plata_-_Silvita.jpg)

[Sylvite](https://en.wikipedia.org/wiki/Sylvite) from New Mexico

Potassium salts such as [carnallite](https://en.wikipedia.org/wiki/Carnallite), [langbeinite](https://en.wikipedia.org/wiki/Langbeinite), [polyhalite](https://en.wikipedia.org/wiki/Polyhalite), and [sylvite](https://en.wikipedia.org/wiki/Sylvite) form extensive [evaporite](https://en.wikipedia.org/wiki/Evaporite) deposits in ancient lake bottoms and [seabeds](https://en.wikipedia.org/wiki/Seabed),[[35]](https://en.wikipedia.org/wiki/Potassium#cite_note-geo-35) making extraction of potassium salts in these environments commercially viable. The principal source of potassium – [potash](https://en.wikipedia.org/wiki/Potash) – is mined in [Canada](https://en.wikipedia.org/wiki/Canada), [Russia](https://en.wikipedia.org/wiki/Russia), [Belarus](https://en.wikipedia.org/wiki/Belarus), [Kazakhstan](https://en.wikipedia.org/wiki/Kazakhstan), [Germany](https://en.wikipedia.org/wiki/Germany), [Israel](https://en.wikipedia.org/wiki/Israel), [United States](https://en.wikipedia.org/wiki/United_States), [Jordan](https://en.wikipedia.org/wiki/Jordan), and other places around the world.[[89]](https://en.wikipedia.org/wiki/Potassium#cite_note-89)[[90]](https://en.wikipedia.org/wiki/Potassium#cite_note-USGSCS2008-90)[[91]](https://en.wikipedia.org/wiki/Potassium#cite_note-USGSYB2006-91) The first mined deposits were located near Staßfurt, Germany, but the deposits span from [Great Britain](https://en.wikipedia.org/wiki/Great_Britain) over Germany into Poland. They are located in the [Zechstein](https://en.wikipedia.org/wiki/Zechstein) and were deposited in the Middle to Late [Permian](https://en.wikipedia.org/wiki/Permian). The largest deposits ever found lie 1,000 meters (3,300 feet) below the surface of the Canadian province of [Saskatchewan](https://en.wikipedia.org/wiki/Saskatchewan). The deposits are located in the [Elk Point Group](https://en.wikipedia.org/wiki/Elk_Point_Group) produced in the [Middle Devonian](https://en.wikipedia.org/wiki/Middle_Devonian). Saskatchewan, where several large mines have operated since the 1960s pioneered the technique of freezing of wet sands (the Blairmore formation) to drive mine shafts through them. The main potash mining company in Saskatchewan is the [Potash Corporation of Saskatchewan](https://en.wikipedia.org/wiki/Potash_Corporation_of_Saskatchewan).[[92]](https://en.wikipedia.org/wiki/Potassium#cite_note-92) The water of the [Dead Sea](https://en.wikipedia.org/wiki/Dead_Sea) is used by Israel and Jordan as a source of potash, while the concentration in normal oceans is too low for commercial production at current prices.[[90]](https://en.wikipedia.org/wiki/Potassium#cite_note-USGSCS2008-90)[[91]](https://en.wikipedia.org/wiki/Potassium#cite_note-USGSYB2006-91)

[](https://en.wikipedia.org/wiki/File:Wintershall_Monte_Kali_12.jpg)

[Monte Kali](https://en.wikipedia.org/wiki/Monte_Kali_(Heringen)), a potash mining and [beneficiation](https://en.wikipedia.org/wiki/Beneficiation) waste heap in [Hesse, Germany](https://en.wikipedia.org/wiki/Hesse), consisting mostly of [sodium chloride](https://en.wikipedia.org/wiki/Sodium_chloride).

**Chemical extraction**

Several methods are used to separate potassium salts from sodium and magnesium compounds. The most-used method is fractional precipitation using the solubility differences of the salts at different temperatures. Electrostatic separation of the ground salt mixture is also used in some mines. The resulting sodium and magnesium waste is either stored underground or piled up in [slag heaps](https://en.wikipedia.org/wiki/Slag_heap). Most of the mined potassium mineral ends up as [potassium chloride](https://en.wikipedia.org/wiki/Potassium_chloride) after processing. The mineral industry refers to potassium chloride either as potash, muriate of potash, or simply MOP.[[36]](https://en.wikipedia.org/wiki/Potassium#cite_note-indus-36)

Pure potassium metal can be isolated by [electrolysis](https://en.wikipedia.org/wiki/Electrolysis) of its [hydroxide](https://en.wikipedia.org/wiki/Potassium_hydroxide) in a process that has changed little since it was first used by [Humphry Davy](https://en.wikipedia.org/wiki/Humphry_Davy) in 1807. Although the electrolysis process was developed and used in industrial scale in the 1920s, the thermal method by reacting sodium with [potassium chloride](https://en.wikipedia.org/wiki/Potassium_chloride) in a chemical equilibrium reaction became the dominant method in the 1950s.

The production of [sodium potassium alloys](https://en.wikipedia.org/wiki/NaK) is accomplished by changing the reaction time and the amount of sodium used in the reaction. The Griesheimer process employing the reaction of [potassium fluoride](https://en.wikipedia.org/wiki/Potassium_fluoride) with [calcium carbide](https://en.wikipedia.org/wiki/Calcium_carbide) was also used to produce potassium.[[36]](https://en.wikipedia.org/wiki/Potassium#cite_note-indus-36)[[93]](https://en.wikipedia.org/wiki/Potassium#cite_note-93)

Na + KCl → NaCl + K                      (Thermal method)

2 KF + CaC  
2 → 2 K + CaF  
2 + 2 C    (Griesheimer process)

[Reagent-grade](https://en.wikipedia.org/wiki/Reagent) potassium metal costs about $10.00/[pound](https://en.wikipedia.org/wiki/Pound_(mass)) ($22/[kg](https://en.wikipedia.org/wiki/Kg)) in 2010 when purchased by the [tonne](https://en.wikipedia.org/wiki/Tonne). Lower purity metal is considerably cheaper. The market is volatile because long-term storage of the metal is difficult. It must be stored in a dry [inert gas](https://en.wikipedia.org/wiki/Inert_gas) atmosphere or [anhydrous](https://en.wikipedia.org/wiki/Anhydrous) [mineral oil](https://en.wikipedia.org/wiki/Mineral_oil) to prevent the formation of a surface layer of [potassium superoxide](https://en.wikipedia.org/wiki/Potassium_superoxide), a pressure-sensitive [explosive](https://en.wikipedia.org/wiki/Explosive) that [detonates](https://en.wikipedia.org/wiki/Detonation) when scratched. The resulting explosion often starts a fire difficult to extinguish.[[94]](https://en.wikipedia.org/wiki/Potassium#cite_note-94)[[95]](https://en.wikipedia.org/wiki/Potassium#cite_note-fire-95)

**Commercial uses**

**Fertilizer**

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

Potassium sulfate/magnesium sulfate fertilizer

Potassium ions are an essential component of [plant](https://en.wikipedia.org/wiki/Plant) nutrition and are found in most [soil](https://en.wikipedia.org/wiki/Soil) types.[[8]](https://en.wikipedia.org/wiki/Potassium#cite_note-g73-8) They are used as a [fertilizer](https://en.wikipedia.org/wiki/Fertilizer) in [agriculture](https://en.wikipedia.org/wiki/Agriculture), [horticulture](https://en.wikipedia.org/wiki/Horticulture), and [hydroponic](https://en.wikipedia.org/wiki/Hydroponic) culture in the form of [chloride](https://en.wikipedia.org/wiki/Potassium_chloride) (KCl), [sulfate](https://en.wikipedia.org/wiki/Potassium_sulfate) (K  
2SO  
4), or [nitrate](https://en.wikipedia.org/wiki/Potassium_nitrate) (KNO  
3). Agricultural fertilizers consume 95% of global potassium chemical production, and about 90% of this potassium is supplied as KCl.[[8]](https://en.wikipedia.org/wiki/Potassium#cite_note-g73-8) The potassium content of most plants range from 0.5% to 2% of the harvested weight of crops, conventionally expressed as amount of K  
2O. Modern high-[yield](https://en.wikipedia.org/wiki/Crop_yield) agriculture depends upon fertilizers to replace the potassium lost at harvest. Most agricultural fertilizers contain potassium chloride, while potassium sulfate is used for chloride-sensitive crops or crops needing higher sulfur content. The sulfate is produced mostly by decomposition of the complex minerals [kainite](https://en.wikipedia.org/wiki/Kainite) (MgSO  
4·KCl·3H  
2O) and [langbeinite](https://en.wikipedia.org/wiki/Langbeinite) (MgSO  
4·K  
2SO  
4). Only a very few fertilizers contain potassium nitrate.[[96]](https://en.wikipedia.org/wiki/Potassium#cite_note-Kent-96) In 2005, about 93% of world potassium production was consumed by the fertilizer industry.[[91]](https://en.wikipedia.org/wiki/Potassium#cite_note-USGSYB2006-91)

**Medical use**

See also: [Potassium chloride (medical use)](https://en.wikipedia.org/wiki/Potassium_chloride_(medical_use))

Potassium, in the form of [potassium chloride](https://en.wikipedia.org/wiki/Potassium_chloride) is used as a medication to treat and prevent [low blood potassium](https://en.wikipedia.org/wiki/Low_blood_potassium).[[97]](https://en.wikipedia.org/wiki/Potassium#cite_note-WHO2008-97) Low blood potassium may occur due to [vomiting](https://en.wikipedia.org/wiki/Vomiting), [diarrhea](https://en.wikipedia.org/wiki/Diarrhea), or certain medications.[[98]](https://en.wikipedia.org/wiki/Potassium#cite_note-MTM2017-98) It is given by [slow injection into a vein](https://en.wikipedia.org/wiki/Intravenous_infusion) or by mouth.[[99]](https://en.wikipedia.org/wiki/Potassium#cite_note-BNF69-99)

**Food additives**

Potassium sodium tartrate (KNaC  
4H  
4O  
6, [Rochelle salt](https://en.wikipedia.org/wiki/Rochelle_salt)) is the main constituent of [baking powder](https://en.wikipedia.org/wiki/Baking_powder); it is also used in the [silvering](https://en.wikipedia.org/wiki/Silvering) of mirrors. [Potassium bromate](https://en.wikipedia.org/wiki/Potassium_bromate) (KBrO  
3) is a strong oxidizer (E924), used to improve dough strength and rise height. [Potassium bisulfite](https://en.wikipedia.org/wiki/Potassium_bisulfite) (KHSO  
3) is used as a food preservative, for example in [wine](https://en.wikipedia.org/wiki/Wine) and [beer](https://en.wikipedia.org/wiki/Beer)-making (but not in meats). It is also used to [bleach](https://en.wikipedia.org/wiki/Bleach) textiles and straw, and in the tanning of [leathers](https://en.wikipedia.org/wiki/Leather).[[100]](https://en.wikipedia.org/wiki/Potassium#cite_note-100)[[101]](https://en.wikipedia.org/wiki/Potassium#cite_note-101)

**Industrial**

Major potassium chemicals are potassium hydroxide, potassium carbonate, potassium sulfate, and potassium chloride. Megatons of these compounds are produced annually.[[102]](https://en.wikipedia.org/wiki/Potassium#cite_note-102)

[Potassium hydroxide](https://en.wikipedia.org/wiki/Potassium_hydroxide) KOH is a strong base, which is used in industry to neutralize strong and weak [acids](https://en.wikipedia.org/wiki/Acid), to control [pH](https://en.wikipedia.org/wiki/PH) and to manufacture potassium [salts](https://en.wikipedia.org/wiki/Salt_(chemistry)). It is also used to [saponify](https://en.wikipedia.org/wiki/Saponification) [fats](https://en.wikipedia.org/wiki/Fat) and [oils](https://en.wikipedia.org/wiki/Oils), in industrial cleaners, and in [hydrolysis](https://en.wikipedia.org/wiki/Hydrolysis) reactions, for example of [esters](https://en.wikipedia.org/wiki/Esters).[[103]](https://en.wikipedia.org/wiki/Potassium#cite_note-103)[[104]](https://en.wikipedia.org/wiki/Potassium#cite_note-104)

[Potassium nitrate](https://en.wikipedia.org/wiki/Potassium_nitrate) (KNO  
3) or saltpeter is obtained from natural sources such as [guano](https://en.wikipedia.org/wiki/Guano) and [evaporites](https://en.wikipedia.org/wiki/Evaporites) or manufactured via the [Haber process](https://en.wikipedia.org/wiki/Haber_process); it is the [oxidant](https://en.wikipedia.org/wiki/Oxidant) in [gunpowder](https://en.wikipedia.org/wiki/Gunpowder) ([black powder](https://en.wikipedia.org/wiki/Black_powder)) and an important agricultural fertilizer. [Potassium cyanide](https://en.wikipedia.org/wiki/Potassium_cyanide) (KCN) is used industrially to dissolve [copper](https://en.wikipedia.org/wiki/Copper) and precious metals, in particular [silver](https://en.wikipedia.org/wiki/Silver) and [gold](https://en.wikipedia.org/wiki/Gold), by forming [complexes](https://en.wikipedia.org/wiki/Complex_(chemistry)). Its applications include [gold mining](https://en.wikipedia.org/wiki/Gold_mining), [electroplating](https://en.wikipedia.org/wiki/Electroplating), and [electroforming](https://en.wikipedia.org/wiki/Electroforming) of these [metals](https://en.wikipedia.org/wiki/Metal); it is also used in [organic synthesis](https://en.wikipedia.org/wiki/Organic_synthesis) to make [nitriles](https://en.wikipedia.org/wiki/Nitriles). [Potassium carbonate](https://en.wikipedia.org/wiki/Potassium_carbonate) (K  
2CO  
3 or potash) is used in the manufacture of glass, soap, color TV tubes, fluorescent lamps, textile dyes and pigments.[[105]](https://en.wikipedia.org/wiki/Potassium#cite_note-105) Potassium permanganate (KMnO  
4) is an oxidizing, bleaching and purification substance and is used for production of [saccharin](https://en.wikipedia.org/wiki/Saccharin). [Potassium chlorate](https://en.wikipedia.org/wiki/Potassium_chlorate) (KClO  
3) is added to matches and explosives. [Potassium bromide](https://en.wikipedia.org/wiki/Potassium_bromide) (KBr) was formerly used as a sedative and in photography.[[8]](https://en.wikipedia.org/wiki/Potassium#cite_note-g73-8)

[Potassium chromate](https://en.wikipedia.org/wiki/Potassium_chromate) (K  
2CrO  
4) is used in [inks](https://en.wikipedia.org/wiki/Ink), [dyes](https://en.wikipedia.org/wiki/Dye), [stains](https://en.wikipedia.org/wiki/Stain) (bright yellowish-red color); in [explosives](https://en.wikipedia.org/wiki/Explosive) and [fireworks](https://en.wikipedia.org/wiki/Fireworks); in the tanning of leather, in [fly paper](https://en.wikipedia.org/wiki/Fly_paper) and [safety matches](https://en.wikipedia.org/wiki/Safety_match),[[106]](https://en.wikipedia.org/wiki/Potassium#cite_note-106) but all these uses are due to the chemistry of the [chromate](https://en.wikipedia.org/wiki/Chromate) ion, rather than the potassium ion.[[107]](https://en.wikipedia.org/wiki/Potassium#cite_note-107)

**Niche uses**

There are thousands of uses of various potassium compounds. One example is [potassium superoxide](https://en.wikipedia.org/wiki/Potassium_superoxide), KO  
2, an orange solid that acts as a portable source of oxygen and a carbon dioxide absorber. It is widely used in [respiration systems](https://en.wikipedia.org/wiki/Rebreather#Rebreathers_whose_absorbent_releases_oxygen) in mines, submarines and spacecraft as it takes less volume than the gaseous oxygen.[[108]](https://en.wikipedia.org/wiki/Potassium#cite_note-108)[[109]](https://en.wikipedia.org/wiki/Potassium#cite_note-109)

4 KO  
2 + 2 CO2 → 2 K  
2CO  
3 + 3 O  
2

Another example is [potassium cobaltinitrite](https://en.wikipedia.org/wiki/Potassium_cobaltinitrite), K  
3[Co(NO  
2)  
6], which is used as artist's pigment under the name of [Aureolin](https://en.wikipedia.org/wiki/Aureolin) or Cobalt Yellow.[[110]](https://en.wikipedia.org/wiki/Potassium#cite_note-Getts-110)

The stable isotopes of potassium can be [laser cooled](https://en.wikipedia.org/wiki/Laser_cooling) and used to probe fundamental and [technological](https://en.wikipedia.org/wiki/Quantum_technology) problems in [quantum physics](https://en.wikipedia.org/wiki/Quantum_mechanics). The two [bosonic](https://en.wikipedia.org/wiki/Boson) isotopes possess convenient [Feshbach resonances](https://en.wikipedia.org/wiki/Feshbach_resonance) to enable studies requiring tunable interactions, while 40K is one of only two stable [fermions](https://en.wikipedia.org/wiki/Fermion) amongst the alkali metals.[[111]](https://en.wikipedia.org/wiki/Potassium#cite_note-111)

**Laboratory uses**

An [alloy](https://en.wikipedia.org/wiki/Alloy) of sodium and potassium, [NaK](https://en.wikipedia.org/wiki/NaK) is a liquid used as a heat-transfer medium and a [desiccant](https://en.wikipedia.org/wiki/Desiccant) for producing [dry and air-free solvents](https://en.wikipedia.org/wiki/Air-free_technique). It can also be used in [reactive distillation](https://en.wikipedia.org/wiki/Reactive_distillation).[[112]](https://en.wikipedia.org/wiki/Potassium#cite_note-112) The ternary alloy of 12% Na, 47% K and 41% Cs has the lowest melting point of −78 °C of any metallic compound.[[15]](https://en.wikipedia.org/wiki/Potassium#cite_note-g76-15)

Metallic potassium is used in several types of [magnetometers](https://en.wikipedia.org/wiki/Magnetometer).[[113]](https://en.wikipedia.org/wiki/Potassium#cite_note-113)

**Precautions**

|  |  |
| --- | --- |
| Potassium | |
| **Hazards** | |
| [GHS pictograms](https://en.wikipedia.org/wiki/GHS_hazard_pictograms) | [The flame pictogram in the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)](https://en.wikipedia.org/wiki/File:GHS-pictogram-flamme.svg)[The corrosion pictogram in the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)](https://en.wikipedia.org/wiki/File:GHS-pictogram-acid.svg) |
| [GHS signal word](https://en.wikipedia.org/wiki/Globally_Harmonized_System_of_Classification_and_Labelling_of_Chemicals) | Danger |
| [GHS hazard statements](https://en.wikipedia.org/wiki/GHS_hazard_statement) | H260, H314 |
| [GHS precautionary statements](https://en.wikipedia.org/wiki/GHS_precautionary_statements) | P223, P231+232, P280, P305+351+338, P370+378, P422[[114]](https://en.wikipedia.org/wiki/Potassium#cite_note-114) |
| [NFPA 704](https://en.wikipedia.org/wiki/NFPA_704) | NFPA 704 four-colored diamond  [3](https://en.wikipedia.org/wiki/NFPA_704#Red)  [3](https://en.wikipedia.org/wiki/NFPA_704#Blue)  [2](https://en.wikipedia.org/wiki/NFPA_704#Yellow)  [~~W~~](https://en.wikipedia.org/wiki/NFPA_704#White) |

[Play media](https://upload.wikimedia.org/wikipedia/commons/4/43/Potassium_water_20.theora.ogv)

A reaction of potassium metal with water. Hydrogen is produced, and with potassium vapor, burns with a pink or lilac flame. Strongly alkaline potassium hydroxide is formed in solution.

Potassium metal reacts violently with water producing [potassium hydroxide](https://en.wikipedia.org/wiki/Potassium_hydroxide) (KOH) and [hydrogen](https://en.wikipedia.org/wiki/Hydrogen) gas.

2 K (s) + 2  [H2O](https://en.wikipedia.org/wiki/Water) (l) → 2 KOH (aq) + H  
2↑ (g)

This reaction is exothermic and releases enough heat to ignite the resulting hydrogen in the presence of oxygen. Potassium tends to explode in contact with water and without the the oxygen presence. It is called [coulombic explosion](https://en.wikipedia.org/wiki/Coulomb_explosion), possibly splashing onlookers with [potassium hydroxide](https://en.wikipedia.org/wiki/Potassium_hydroxide), which is a strong [alkali](https://en.wikipedia.org/wiki/Alkali) that destroys living tissue and causes skin burns. Finely grated potassium ignites in air at room temperature. The bulk metal ignites in air if heated. Because its density is 0.89 g/cm3, burning potassium floats in water that exposes it to atmospheric oxygen. Many common fire extinguishing agents, including water, either are ineffective or make a potassium fire worse. [Nitrogen](https://en.wikipedia.org/wiki/Nitrogen), [argon](https://en.wikipedia.org/wiki/Argon), [sodium chloride](https://en.wikipedia.org/wiki/Sodium_chloride) (table salt), [sodium carbonate](https://en.wikipedia.org/wiki/Sodium_carbonate) (soda ash), and [silicon dioxide](https://en.wikipedia.org/wiki/Silicon_dioxide) (sand) are effective if they are dry. Some [Class D](https://en.wikipedia.org/wiki/Fire_extinguisher) dry powder extinguishers designed for metal fires are also effective. These agents deprive the fire of oxygen and cool the potassium metal.[[115]](https://en.wikipedia.org/wiki/Potassium#cite_note-115)

Potassium reacts violently with [halogens](https://en.wikipedia.org/wiki/Halogens) and detonates in the presence of [bromine](https://en.wikipedia.org/wiki/Bromine). It also reacts explosively with [sulfuric acid](https://en.wikipedia.org/wiki/Sulfuric_acid). During combustion, potassium forms peroxides and superoxides. These peroxides may react violently with [organic compounds](https://en.wikipedia.org/wiki/Organic_compound) such as oils. Both peroxides and superoxides may react explosively with metallic potassium.[[116]](https://en.wikipedia.org/wiki/Potassium#cite_note-116)

Because potassium reacts with water vapor in the air, it is usually stored under anhydrous mineral oil or kerosene. Unlike lithium and sodium, however, potassium should not be stored under oil for longer than six months, unless in an inert (oxygen free) atmosphere, or under vacuum. After prolonged storage in air dangerous shock-sensitive peroxides can form on the metal and under the lid of the container, and can detonate upon opening.[[117]](https://en.wikipedia.org/wiki/Potassium#cite_note-117)

Because of the highly reactive nature of potassium metal, it must be handled with great care, with full skin and eye protection and preferably an explosion-resistant barrier between the user and the metal. Ingestion of large amounts of potassium compounds can lead to [hyperkalemia](https://en.wikipedia.org/wiki/Hyperkalemia), strongly influencing the cardiovascular system.[[118]](https://en.wikipedia.org/wiki/Potassium#cite_note-hyper-118)[[119]](https://en.wikipedia.org/wiki/Potassium#cite_note-119) Potassium chloride is used in the [United States](https://en.wikipedia.org/wiki/United_States) for [lethal injection](https://en.wikipedia.org/wiki/Lethal_injection) executions.[[118]](https://en.wikipedia.org/wiki/Potassium#cite_note-hyper-118)

**See also**

|  |  |
| --- | --- |
| [**Books**](https://en.wikipedia.org/wiki/Wikipedia:Books) View or order collections of articles | * https://upload.wikimedia.org/wikipedia/commons/thumb/a/a8/Office-book.svg/30px-Office-book.svg.png[***Potassium***](https://en.wikipedia.org/wiki/Book:Potassium) * https://upload.wikimedia.org/wikipedia/commons/thumb/a/a8/Office-book.svg/30px-Office-book.svg.png[***Period 4 elements***](https://en.wikipedia.org/wiki/Book:Period_4_elements) * https://upload.wikimedia.org/wikipedia/commons/thumb/a/a8/Office-book.svg/30px-Office-book.svg.png[***Alkali metals***](https://en.wikipedia.org/wiki/Book:Alkali_metals) * https://upload.wikimedia.org/wikipedia/commons/thumb/a/a8/Office-book.svg/30px-Office-book.svg.png[***Chemical elements (sorted alphabetically)***](https://en.wikipedia.org/wiki/Book:Chemical_elements_(sorted_alphabetically)) * https://upload.wikimedia.org/wikipedia/commons/thumb/a/a8/Office-book.svg/30px-Office-book.svg.png[***Chemical elements (sorted by number)***](https://en.wikipedia.org/wiki/Book:Chemical_elements_(sorted_by_number)) |
|  | |
| [**Portals**](https://en.wikipedia.org/wiki/Portal:Contents/Portals) Access related topics | * [Papapishu-Lab-icon-6.svg](https://en.wikipedia.org/wiki/File:Papapishu-Lab-icon-6.svg)[***Chemistry portal***](https://en.wikipedia.org/wiki/Portal:Chemistry) * [WHO Rod.svg](https://en.wikipedia.org/wiki/File:WHO_Rod.svg)[***Medicine portal***](https://en.wikipedia.org/wiki/Portal:Medicine) |
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| Find out more on Wikipedia's [**Sister projects**](https://en.wikipedia.org/wiki/Wikipedia:Wikimedia_sister_projects) | * https://upload.wikimedia.org/wikipedia/en/thumb/4/4a/Commons-logo.svg/22px-Commons-logo.svg.png[Media](https://commons.wikimedia.org/wiki/Special:Search/Potassium) from Commons * https://upload.wikimedia.org/wikipedia/en/thumb/0/06/Wiktionary-logo-v2.svg/30px-Wiktionary-logo-v2.svg.png[Definitions](https://en.wiktionary.org/wiki/Special:Search/potassium#English) from Wiktionary * https://upload.wikimedia.org/wikipedia/commons/thumb/f/fa/Wikibooks-logo.svg/30px-Wikibooks-logo.svg.png[Textbooks](https://en.wikibooks.org/wiki/Special:Search/Wikijunior:The_Elements/Potassium) from Wikibooks * https://upload.wikimedia.org/wikipedia/commons/thumb/9/91/Wikiversity-logo.svg/30px-Wikiversity-logo.svg.png[Learning resources](https://en.wikiversity.org/wiki/Special:Search/Potassium_atom) from Wikiversity |

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La dénomination de* Potasche *(potasse) que la nouvelle nomenclature françoise a consacrée comme nom de tout le genre, ne sauroit faire fortune auprès des chimistes allemands, qui sentent à quel point la dérivation étymologique en est vicieuse. Elle est prise en effet de ce qu'anciennement on se servoit pour la calcination des lessives concentrées des cendres, de pots de fer (*pott *en dialecte de la Basse-Saxe) auxquels on a substitué depuis des fours à calciner.  
Je propose donc ici, de substituer aux mots usités jusqu'ici d'alcali des plantes, alcali végétal, potasse, &c. celui de* kali*, & de revenir à l'ancienne dénomination de* natron*, au lieu de dire alcali minéral, soude &c."*  
(This alkali [i.e., potash] — [which] therefore can no longer be viewed as a product of growth in plants — occupies a proper place in the originally simple series of the mineral realm, and it becomes necessary to assign it a name that is better suited to its nature.  
The name of "potash" (*potasse*), which the new French nomenclature has bestowed as the name of the entire species [i.e., substance], would not find acceptance among German chemists, who feel to some extent [that] the etymological derivation of it is faulty. Indeed, it is taken from [the vessels] that one formerly used for the roasting of washing powder concentrated from cinders: iron pots (*pott* in the dialect of Lower Saxony), for which roasting ovens have been substituted since then.  
Thus I now propose to substitute for the until now common words of "plant alkali", "vegetable alkali", "potash", etc., that of *kali* ; and to return to the old name of *natron* instead of saying "mineral alkali", "soda", etc.)

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