

# Sodium

**Sodium** is a [chemical element](#) with the [symbol](#) **Na** (from Latin *natrium*) and [atomic number](#) 11. It is a soft, silvery-white, highly reactive [metal](#). Sodium is an [alkali metal](#), being in [group 1](#) of the periodic table. Its only stable [isotope](#) is <sup>23</sup>Na. The free metal does not occur in nature, and must be prepared from compounds. Sodium is the [sixth most abundant element in the Earth's crust](#) and exists in numerous [minerals](#) such as [feldspars](#), [sodalite](#), and [halite](#) (NaCl). Many salts of sodium are highly water-soluble: sodium ions have been [leached](#) by the action of water from the [Earth's minerals](#) over eons, and thus sodium and [chlorine](#) are the most common dissolved elements by weight in the oceans.

## Sodium, $_{11}\text{Na}$



## Sodium

|  |  |
|--|--|
| <b>Appearance</b>                                    | silvery white metallic   |
| <b>Standard atomic weight</b> $A_r^\circ(\text{Na})$ | 22.989 769 28 ± 0.000 000 02<br>22.990 ± 0.001 (abridged) <sup>[1]</sup> |

## Sodium in the periodic table

□


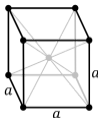
Li  
↑  
**Na**  
↓  
K

neon ← **sodium** → magnesium

|                        |   |
|------------------------|---|
| Atomic number (Z)      | 11  |
| Group                  | group 1: hydrogen and <a href="#">alkali metals</a> |
| Period                 | <a href="#">period 3</a>                            |
| Block                  | <input type="checkbox"/> <a href="#">s-block</a>    |
| Electron configuration | <a href="#">[Ne]</a> 3s <sup>1</sup>                |
| Electrons per shell    | 2, 8, 1   |

## Physical properties

|                            |                                      |
|----------------------------|--------------------------------------|
| <b>Phase</b> at STP        | solid                                |
| <b>Melting point</b>       | 370.944 K (97.794 °C, 208.029 °F)    |
| <b>Boiling point</b>       | 1156.090 K (882.940 °C, 1621.292 °F) |
| <b>Density</b> (near r.t.) | 0.968 g/cm <sup>3</sup>              |

|  |   |     |     |     |      |   |
|--|---|-----|-----|-----|------|---|
| when liquid (at m.p.)  | 0.927 g/cm <sup>3</sup>   |     |     |     |      |   |
| Critical point   | 2573 K, 35 MPa (extrapolated)   |     |     |     |      |   |
| Heat of fusion   | 2.60 kJ/mol   |     |     |     |      |   |
| Heat of vaporization   | 97.42 kJ/mol  |     |     |     |      |   |
| Molar heat capacity  | 28.230 J/(mol·K)  |     |     |     |      |   |
| Vapor pressure   |   |     |     |     |      |   |
| <i>P</i> (Pa)  | 1   | 10  | 100 | 1 k | 10 k | 100 k   |
| at <i>T</i> (K)  | 554   | 617 | 697 | 802 | 946  | 1153  |
| Atomic properties  |   |     |     |     |      |   |
| Oxidation states   | −1, 0, <sup>[2]</sup> +1 (a strongly basic oxide)                     |     |     |     |      |   |
| Electronegativity  | Pauling scale: 0.93   |     |     |     |      |   |
| Ionization energies  | 1st: 495.8 kJ/mol<br>2nd: 4562 kJ/mol<br>3rd: 6910.3 kJ/mol<br>(more) |     |     |     |      |   |
| Atomic radius  | empirical: 186 pm   |     |     |     |      |   |
| Covalent radius  | 166±9 pm  |     |     |     |      |   |
| Van der Waals radius   | 227 pm  |     |     |     |      |   |
|  |   |     |     |     |      |   |
| Spectral lines of sodium   |   |     |     |     |      |   |
| Other properties   |   |     |     |     |      |   |
| Natural occurrence   | primordial  |     |     |     |      |   |
| Crystal structure  | body-centered cubic (bcc)   |     |     |     |      |   |
|  |   |     |     |     |      |  |
| Speed of sound thin rod  | 3200 m/s (at 20 °C)   |     |     |     |      |   |

|                               |   |                                       |                |                  |
|-------------------------------|---|---------------------------------------|----------------|------------------|
| Thermal expansion             | 71 μm/(m·K) (at 25 °C)  |                                       |                |                  |
| Thermal conductivity          | 142 W/(m·K)   |                                       |                |                  |
| Electrical resistivity        | 47.7 nΩ·m (at 20 °C)  |                                       |                |                  |
| Magnetic ordering             | paramagnetic <sup>[3]</sup>   |                                       |                |                  |
| Molar magnetic susceptibility | +16.0 × 10 <sup>−6</sup> cm³/mol (298 K) <sup>[4]</sup>   |                                       |                |                  |
| Young's modulus               | 10 GPa  |                                       |                |                  |
| Shear modulus                 | 3.3 GPa   |                                       |                |                  |
| Bulk modulus                  | 6.3 GPa   |                                       |                |                  |
| Mohs hardness                 | 0.5   |                                       |                |                  |
| Brinell hardness              | 0.69 MPa  |                                       |                |                  |
| CAS Number                    | 7440-23-5   |                                       |                |                  |
| History                       |   |                                       |                |                  |
| Discovery and first isolation | Humphry Davy (1807)   |                                       |                |                  |
| Symbol                        | "Na": from <span>Blue</span> Latin <i>natrium</i> , coined from German <i>Natron</i> , 'natron' |                                       |                |                  |
| Main isotopes of sodium       |   |                                       |                |                  |
| Isotope                       | Abundance   | Half-life ( <i>t</i> <sub>1/2</sub> ) | Decay mode     | Product          |
| <sup>22</sup> Na              | trace   | 2.602 y                               | β <sup>+</sup> | <sup>22</sup> Ne |
| <sup>23</sup> Na              | 100%  |                                       | stable         |                  |
| <sup>24</sup> Na              | trace   | 14.96 h                               | β <sup>−</sup> | <sup>24</sup> Mg |

Sodium was first isolated by [Humphry Davy](#) in 1807 by the [electrolysis](#) of [sodium hydroxide](#). Among many other useful sodium compounds, [sodium hydroxide](#) (lye) is used in [soap manufacture](#), and [sodium chloride](#) (edible salt) is a [de-icing](#) agent and a nutrient for animals including humans.

Sodium is an [essential element](#) for all animals and some plants. Sodium ions are the major cation in the [extracellular fluid](#) (ECF) and as such are the major contributor to the ECF [osmotic pressure](#) and ECF compartment volume. Loss of water from the ECF compartment increases the sodium concentration, a condition called [hypernatremia](#). [Isotonic](#) loss of water and sodium from the ECF compartment decreases the size of that compartment in a condition called ECF [hypovolemia](#).

By means of the [sodium-potassium pump](#), living human cells pump three sodium ions out of the cell in exchange for two potassium ions pumped in; comparing ion concentrations across the cell membrane, inside to outside, [potassium](#) measures about 40:1, and sodium, about 1:10. In [nerve cells](#), the electrical charge across the cell membrane enables transmission of the nerve impulse—an [action potential](#)—when the charge is dissipated; sodium plays a key role in that activity.

## Characteristics

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## Chemistry

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## History

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## Occurrence

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## Commercial production

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## Uses

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## Biological role

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## Safety and precautions

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## See also

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References

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Bibliography

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External links

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