What is sodium used for

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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 at standard temperature and pressure is a soft silvery metal that combines with oxygen in the air, forming sodium oxides. Bulk sodium is usually stored in oil or an inert gas. Sodium metal can be easily cut with a knife. It is a good conductor of electricity and heat. Due to having low atomic mass and large atomic radius, sodium is third-least dense of all elemental metals and is one of only three metals that can float on water, the other two being lithium and potassium.[11]

In a flame test, sodium and its compounds glow yellow[14] because the excited 3s electrons of sodium emit a photon when they fall from 3p to 3s; the wavelength of this photon corresponds to the D line at about 589.3 nm. Spin-orbit interactions involving the electron in the 3p orbital split the D line into two, at 589.0 and 589.6 nm; hyperfine structures involving both orbitals cause many more lines.[15]

Twenty isotopes of sodium are known, but only 23Na is stable. 23Na is created in the carbon-burning process in stars by fusing two carbon atoms together; this requires temperatures above 600 megakelvins and a star of at least three solar masses.[16] Two radioactive, cosmogenic isotopes are the byproduct of cosmic ray spallation: 22Na has a half-life of 2.6 years and 24Na, a half-life of 15 hours; all other isotopes have a half-life of less than one minute.[17]

Two nuclear isomers have been discovered, the longer-lived one being 24mNa with a half-life of around 20.2 milliseconds. Acute neutron radiation, as from a nuclear criticality accident, converts some of the stable 23Na in human blood to 24Na; the neutron radiation dosage of a victim can be calculated by measuring the concentration of 24Na relative to 23Na.[18]

Sodium atoms have 11 electrons, one more than the stable configuration of the noble gas neon. The first and second ionization energies are 495.8 kJ/mol and 4562 kJ/mol, respectively. As a result, sodium usually forms ionic compounds involving the Na+ cation.[19]

Metallic sodium is generally less reactive than potassium and more reactive than lithium.[20] Sodium metal is highly reducing, with the standard reduction potential for the Na+/Na couple being -2.71 volts,[21] though potassium and lithium have even more negative potentials.[22]

Most soaps are sodium salts of fatty acids. Sodium soaps have a higher melting temperature (and seem "harder") than potassium soaps.[24]

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Like all the alkali metals, sodium reacts exothermically with water. The reaction produces caustic soda (sodium hydroxide) and flammable hydrogen gas. When burned in air, it forms primarily sodium peroxide with some sodium oxide.[26]

Sodium tends to form water-soluble compounds, such as halides, sulfates, nitrates, carboxylates and carbonates. The main aqueous species are the aquo complexes [Na(H2O)n]+, where n = 4-8; with n = 6 indicated from X-ray diffraction data and computer simulations.[27]

Sodium content of samples is determined by atomic absorption spectrophotometry or by potentiometry using ion-selective electrodes.[32]

Like the other alkali metals, sodium dissolves in ammonia and some amines to give deeply colored solutions; evaporation of these solutions leaves a shiny film of metallic sodium. The solutions contain the coordination complex [Na(NH3)6]+, with the positive charge counterbalanced by electrons as anions; cryptands permit the isolation of these complexes as crystalline solids. Sodium forms complexes with crown ethers, cryptands and other ligands.[33]