

Fluorine - F

Chemical properties of fluorine - Health effects of fluorine - Environmental effects of fluorine

Atomic number	9
Atomic mass	18.998403 g.mol ⁻¹
Electronegativity according to Pauling	4
Density	1.8*10 ⁻³ g.cm ⁻³ at 20°C
Melting point	-219.6 °C
Boiling point	-188 °C
Vanderwaals radius	0.135 nm
Ionic radius	0.136 nm (-1) ; 0.007 (+7)
Isotopes	2
Electronic shell	[He] 2s ² 2p ⁵
Energy of first ionisation	1680.6 kJ.mol ⁻¹
Energy of second ionisation	3134 kJ.mol ⁻¹
Energy of third ionisation	6050 kJ mol ⁻¹
Standard potential	- 2.87 V
Discovered by	Moissan in 1886



Fluorine

Fluorine is an univalent poisonous gaseous halogen, it is pale yellow-green and it is the most chemically reactive and electronegative of all the elements. Fluorine readily forms compounds with most other elements, even with the noble gases krypton, xenon and radon. It is so reactive that glass, metals, and even water, as well as other substances, burn with a bright flame in a jet of fluorine gas.

In aqueous solution, fluorine commonly occurs as the fluoride ion F⁻. Fluorides are compounds that combine fluoride with some positively charged counterpart.

Applications

Atomic fluorine and molecular fluorine are used for plasma etching in semiconductor manufacturing, flat panel display production and MEMs fabrication.

Fluorine is indirectly used in the production of low friction plastics such as teflon and in halons such as freon, in the production of uranium. Fluorochlorohydrocarbons are used extensively in air conditioning and in refrigeration.

Fluorides are often added to toothpaste and, somewhat controversially, to municipal water supplies to prevent dental cavities. For more information visit our page on mineral water.

Fluorine in the environment

Annual world production of the mineral fluorite is around 4 million tonnes, and there are around 120 million tonnes of mineral reserves. The main mining areas for fluorite are China, Mexico and Western Europe.

Fluorine occurs naturally in the earth's crust where it can be found in rocks, coal and clay. Fluorides are released into the air in wind-blown soil. Fluorine is the 13th most abundant element in the Earth's crust: 950 ppm are contained in it. Soils contain approximately 330 ppm of fluorine, ranging from 150 to 400 ppm. Some soils can have as much as 1000 ppm and contaminated soils have been found with 3500 ppm. Hydrogen fluorides can be released into air through combustion processes in the industry. Fluorides that are found in air will eventually drop onto land or into water. When fluorine is attached to very small particles it can remain in the air for a long period of time.

In the atmosphere 0.6 ppb of fluorine are present as salt spray and organochloride compounds. Up to 50 ppb has been recorded in city environments.

Health effects of fluorine

Small amounts of fluorine are naturally present in water, air, plants and animals. As a result humans are exposed to fluorine through food and drinking water and by breathing air. Fluorine can be found in any kind of food in relatively small quantities. Large quantities of fluorine can be found in tea and shellfish.

Fluorine is essential for the maintenance of solidity of our bones. Fluorine can also protect us from dental decay, if it is applied through toothpaste twice a day. If fluorine is absorbed too frequently, it can cause teeth decay, osteoporosis and harm to kidneys, bones, nerves and muscles.

Fluorine gas is released in the industries. This gas is very dangerous, as it can cause death at very high concentrations. At low concentrations it causes eye and nose irritations.