Boron - B

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Chemical properties of boron - Health effects of boron - Environmental effects of boron

Atomic number	5
Atomic mass	10.81 g.mol $^{-1}$
Electronegativity according to Pauling	2.0
Density	2.3 g.cm^{-3} at 20°C
Melting point	2076 °C
Boiling point	3927 °C
Vanderwaals radius	0.098 nm
Ionic radius	0.027 nm
Isotopes	2
Electronic shell	[He] $2s^2 2p^1$
Energy of first ionisation	800.5 kJ.mol $^{-1}$
Energy of second ionisation	2426.5 kJ.mol $^{-1}$
Energy of third ionisation	3658.7 kJ.mol $^{-1}$
Discovered by	Sir Humphry Davy and J.L Gay-Lussac in 1808

Boron

Boron is a non metallic element and the only non-metal of the group 13 of the periodic table the elements. Boron is electron-deficient, possessing a vacant p-orbital. It has several forms, the most common of which is amorphous boron, a dark powder, unreactive to oxygen, water, acids and alkalis. It reacts with metals to form borides.
At standard temperatures boron is a poor electrical conductor but is a good conductor at high temperatures.

Applications

The most economically important compound of boron is sodium tetraborate decahydrate $Na_2B_4O_7 \cdot 10H_2O$, or borax, used for insulating fiberglass and sodium perborate bleach. Boric acid is an important compound used in textile products.
Compounds of boron are used in organic synthesis, in the manufacture of a perticular type of glasses, and as wood preservatives. Boron filaments are used for advanced aerospace structures, due to their high-strenght and light weight.
An early use of borax was to make perborate, the beaching agent once widely used in household detergents. Boron compound also came into the average home in the guise of food preservatives, expecialy for margarine and fish.

Boron in the environment

Boron is not present in nature in elemental form. It is found combined in borax, boric acid, kernite, ulexite, colemanite and borates. Vulcanic spring waters sometime contains boric acids.
Borates are mined in US, Tibet, Chile and Turkey, with world production being about 2 million tonnes per year.

Health effects of boron

Humans can be exposed to boron through fruit and vegetables, water, air and consumer products. we have a regular daily intake of about 2 mg and about 18 mg in out body in total.

When humans consume large amounts of boron-containing food, the boron concentrations in their bodies may rise to levels that can cause health problems. Boron can infect the stomach, liver, kidneys and brains and can eventually lead to death. When exposure to small amounts of boron takes place irritation of the nose, throat or eyes may occur. It takes 5 g of borc acid to make a person ill and 20 grams or more to put its life in danger.

Eating fish or meat will not increase the boron concentrations in our bodies, as boron does not accumulate within the tissues of animals.

Environmental effects of boron

Boron is an element that occurs in the environment mainly through natural processes.

Boron occurs naturally in the environment due to the release into air, soil and water through weathering. It may also occur in groundwater in very small amounts. Humans add boron by manufacturing glass, combusting coal, melting copper and through the addition of agricultural fertilizers. The concentrations of boron that are added by humans are smaller that the naturally added concentrations through natural weathering.

Boron exposure through air and drinking water is not very likely to occur, but the risk of exposure to borate dust in the workplace does exist. Boron exposure may also occur from consumer products such as cosmetics and laundry products.

Plants absorb boron from the ground and through plant-consuming animals it can end up in food chains. Boron has been found in animal tissue, but it is not likely to accumulate.

When animals absorb large amounts of boron over a relatively long period of time through food or drinking water the male reproductive organs will be affected. When animals are exposed to boron during pregnancy their offspring may suffer from birth defects or delayed development. Furthermore, animals are likely to suffer from nose irritation when they breathe in boron.

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Recommended daily intake of boron

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