

# Cobalt - Co

## Chemical properties of cobalt - Health effects of cobalt - Environmental effects of cobalt

Atomic number	27
Atomic mass	58.9332 g.mol <sup>-1</sup>
Electronegativity according to Pauling	1.8
Density	8.9 g.cm <sup>-3</sup> at 20°C
Melting point	1495 °C
Boiling point	2927 °C
Vanderwaals radius	0.125 nm
Ionic radius	0.078 nm (+2) ; 0.063 nm (+3)
Isotopes	8
Electronic shell	[ Ar ] 3d <sup>7</sup> 4s <sup>2</sup>
Energy of first ionisation	757 kJ.mol <sup>-1</sup>
Energy of second ionisation	1666.3 kJ.mol <sup>-1</sup>
Energy of third ionisation	3226 kJ.mol <sup>-1</sup>
Standard potential	- 0.28 V ( Co <sup>2+</sup> / Co ) ; +1.84 V ( Co <sup>3+</sup> / Co <sup>2+</sup> )
Discovered by	George Brandt in 1737



## Cobalt

Cobalt is a hard ferromagnetic, silver-white, hard, lustrous, brittle element. It is a member of group VIII of the periodic table. Like iron, it can be magnetized. It is similar to iron and nickel in its physical properties. The element is active chemically, forming many compounds. Cobalt is stable in air and unaffected by water, but is slowly attacked by dilute acids.

### Applications

Cobalt is used in many alloys (superalloys for parts in gas turbine aircraft engines, corrosion resistant alloys, high-speed steels, cemented carbides), in pigments and magnetic recording media, as catalysts for the petroleum and chemical industries, as drying agents for paints and inks. Cobalt blue is an important part of artists' palette and is used by craft workers in porcelain, pottery, stained glass, tiles and enamel jewellery. The radioactive isotopes, cobalt-60, is used in medical treatment and also to irradiate food, in order to preserve the food and protect the consumer.

### Cobalt in the environment

Most of the Earth's cobalt is in its core. Cobalt is of relatively low abundance in the Earth's crust and in natural waters, from which it is precipitated as the highly insoluble cobalt sulfide CoS.

Although the average level of cobalt in soils is 8 ppm, there are soils with as little as 0.1 ppm and others with as much as 70 ppm. In the marine environment cobalt is needed by blue-green algae (cyanobacteria) and other nitrogen fixing organisms. Cobalt is not found as a free metal and is generally found in the form of ores. Cobalt is usually not mined alone, and tends to be produced as a by-product of nickel and copper mining activities. The main ores of cobalt are cobaltite, erythrite, glaucodot, and skutterudite. The world's major producers of cobalt are the Democratic Republic of the Congo, mainland China, Zambia, Russia and Australia. It is also found in Finland, Azerbaijan, and Kazakhstan.

World production is 17,000 tonnes per year.

## Health effects of cobalt

As cobalt is widely dispersed in the environment humans may be exposed to it by breathing air, drinking water and eating food that contains cobalt. Skin contact with soil or water that contains cobalt may also enhance exposure.

Cobalt is not often freely available in the environment, but when cobalt particles are not bound to soil or sediment particles the uptake by plants and animals is higher and accumulation in plants and animals may occur.

Cobalt is beneficial for humans because it is a part of vitamin B<sub>12</sub>, which is essential for human health. Cobalt is used to treat anaemia with pregnant women, because it stimulates the production of red blood cells. The total daily intake of cobalt is variable and may be as much as 1 mg, but almost all will pass through the body unadsorbed, except that in vitamin B<sub>12</sub>.

However, too high concentrations of cobalt may damage human health. When we breathe in too high concentrations of cobalt through air we experience lung effects, such as asthma and pneumonia. This mainly occurs with people that work with cobalt.