

# Chromium - Cr

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

Atomic number	24
Atomic mass	51.996 g.mol <sup>-1</sup>
Electronegativity	1.6
Density	7.19 g.cm <sup>-3</sup> at 20°C
Melting point	1907 °C
Boiling point	2672 °C
Vanderwaals radius	0.127 nm
Ionic radius	0.061 nm (+3) ; 0.044 nm (+6)
Isotopes	6
Electronic shell	[Ar] 3d <sup>5</sup> 4s <sup>1</sup>
Energy of first ionisation	651.1 kJ.mol <sup>-1</sup>
Energy of second ionisation	1590.1 kJ.mol <sup>-1</sup>
Energy of first ionisation	2987 kJ.mol <sup>-1</sup>
Standard potential	- 0.71 V (Cr <sup>3+</sup> / Cr )
Discovered by	Vaughlin in 1797



## Chromium

Chromium is a lustrous, brittle, hard metal. Its colour is silver-gray and it can be highly polished. It does not tarnish in air, when heated it burns and forms the green chromic oxide. Chromium is unstable in oxygen, it immediately produces a thin oxide layer that is impermeable to oxygen and protects the metal below.

### Applications

Chromium main uses are in alloys such as stainless steel, in chrome plating and in metal ceramics. Chromium plating was once widely used to give steel a polished silvery mirror coating. Chromium is used in metallurgy to impart corrosion resistance and a shiny finish; as dyes and paints, its salts colour glass an emerald green and it is used to produce synthetic rubies; as a catalyst in dyeing and in the tanning of leather; to make molds for the firing of bricks. Chromium (IV) oxide (CrO<sub>2</sub>) is used to manufacture magnetic tape.

### Chromium in the environment

Chromium is mined as chromite (FeCr<sub>2</sub>O<sub>4</sub>) ore. Chromium ores are mined today in South Africa, Zimbabwe, Finland, India, Kazakhstan and the Philippines. A total of 14 million tonnes of chromite ore is extracted. Reserves are estimated to be of the order of 1 billion tonnes with unexploited deposits in Greenland, Canada and USA.

## Health effects of chromium

People can be exposed to chromium through breathing, eating or drinking and through skin contact with chromium or chromium compounds. The level of chromium in air and water is generally low. In drinking water the level of chromium is usually low as well, but contaminated well water may contain the dangerous chromium(IV); hexavalent chromium. For most people eating food that contains chromium(III) is the main route of chromium uptake, as chromium(III) occurs naturally in many vegetables, fruits, meats, yeasts and grains. Various ways of food preparation and storage may alter the chromium contents of food. When food is stored in steel tanks or cans chromium concentrations may rise.

Chromium(III) is an essential nutrient for humans and shortages may cause heart conditions, disruptions of metabolisms and diabetes. But the uptake of too much chromium(III) can cause health effects as well, for instance skin rashes.

Chromium(VI) is a danger to human health, mainly for people who work in the steel and textile industry. People who smoke tobacco also have a higher chance of exposure to chromium.

Chromium(VI) is known to cause various health effects. When it is a compound in leather products, it can cause allergic reactions, such as skin rash. After breathing it in chromium(VI) can cause nose irritations and nosebleeds.

Other health problems that are caused by chromium(VI) are:

- Skin rashes
- Upset stomachs and ulcers
- Respiratory problems
- Weakened immune systems
- Kidney and liver damage
- Alteration of genetic material
- Lung cancer