## Discovery of Calcium

People have used calcium’s compounds for thousands of years – in cement, for example.

Limestone [calcium carbonate] was called calx by the Romans. The Romans heated calx, driving off carbon dioxide to leave calcium oxide. To make cement, all you have to do is mix calcium oxide with water. The Romans built vast amphitheaters and aqueducts using calcium oxide cement to bond stones together. (1)

Calcium was first isolated by Sir Humphry Davy in 1808 in London. In a lecture to the Royal Society in June 1808,

## Interesting Facts about Calcium

* Calcium is the most abundant of the metallic elements in the human body. The average adult body contains about 1 kg or 2 lb of calcium, 99% of which is in the bones and teeth. Only oxygen, carbon, hydrogen and nitrogen are more abundant in our bodies than calcium.
* Calcium not only builds the structures that support our bodies, many of us also live in homes built using structural concrete or cement made with lime (calcium oxide). Snails and many shellfish use another calcium compound – calcium carbonate – to build their own homes too – their shells.
* Modern humans were not the first people to make use of calcium to build things. Egypt’s pyramids were built using limestone blocks. Limestone is crystalline calcium carbonate. In the later pyramids, the blocks were held together with gypsum or lime based mortar. Gypsum is calcium sulfate dihydrate and lime is calcium oxide.
* Have you ever wanted to be ‘in the limelight?’ Lime is calcium oxide, which produces a brilliant, intense light when burnt in an oxyhydrogen flame. It was used to light the stage in theaters during the 1800s until electricity took over – hence the saying.
* Cells in animals and plants must communicate with other cells. This is called signaling. Calcium ions are the most important messengers between cells in living things and are absolutely vital for the existence of multicellular life forms.

### **Characteristics**

Non-toxic and an [essential metal](http://www.chemicool.com/elements/foods-high-in-calcium.html) for living organisms.

Calcium is reactive and, for a metal, soft. With a bit of effort, it can be cut with a sharp knife.

In contact with air, calcium develops a mixed oxide and nitride coating, which protects it from further corrosion.

Calcium reacts easily with water and acids and the metal burns brightly in air, forming mainly the nitride.

## Uses of Calcium

Calcium is used in many applications in the chemical industry, such as treatment of drinking water

**Discovery of Sodium**

**Interesting Facts about Sodium**

* It’s possible this page could have been titled ‘Sodagen.’ This is the name Sir Humphry Davy gave the new metallic element in his laboratory notebook, before deciding he preferred ‘Sodium.’ (5)
* Sodium and its close periodic table neighbor potassium are solids at room temperature. Their alloys however are not. NaK alloys containing 10 to 60 percent of sodium by weight are liquids at room temperature. The commercially available 78% K, 22% Na alloy stays liquid at temperatures as low as -12.6 oC (9.3 oF).
* Humans and other animals need sodium to maintain the correct fluid balance in their cells. An immediate effect of low sodium can be seen in heat cramping, when athletes’ muscles seize up after exertion. Heat cramping is caused by the loss of sodium ions when salt is removed from the body in sweat.
* Sodium is produced in heavy stars, mainly when atoms of [neon](http://www.chemicool.com/elements/neon.html) gain a proton. (The neon atoms were themselves produced by [carbon](http://www.chemicool.com/elements/carbon.html) atoms coming together in nuclear fusion reactions.)
* If all the sodium chloride (table salt) in the oceans could be extracted and dried, it would cover the entire surface of the USA to a depth of almost a mile and a half (about 2.3 km). The same salt could cover all the land on Earth to a depth of almost 500 feet (150 m).

**Appearance and Characteristics**

**Harmful effects:**

Sodium is considered to be non-toxic. Contact with the skin may, however, cause irritation and burns.

**Characteristics:**

Sodium is a soft, silvery-white metal. It is soft enough to cut with the edge of a coin.

Freshly cut surfaces oxidize rapidly in air to form a dull, oxide coating.

Sodium burns in air with a brilliant yellow flame.

Sodium floats on water, because its density is lower than water’s. It also reacts vigorously with water Explosions occur when the heat generated by the sodium-water reaction ignites the resulting hydrogen gas.

**Uses of Sodium**

Sodium vapor lamps are highly efficient in producing light from electricity and are often used for street lighting in cities.

Sodium chloride (table salt, NaCl) is vital for good nutrition. Sodium ions facilitate transmission of electrical signals in the nervous system and regulate the water balance between body cells and body fluids.

**Discovery of Lithium**

Lithium was discovered by Johan Arfvedson in 1817 in Stockholm, Sweden. Lithium’s name is derived from the Greek word ‘lithos’ meaning, ‘stone.’

**Interesting Facts about Lithium**

* Lithium is believed to be one of only three elements – the others are hydrogen and helium – produced in significant quantities by the Big Bang. Synthesis of these elements took place within the first three minutes of the universe’s existence.
* Lithium is the only alkali metal that reacts with nitrogen.
* Humphrey Davy produced some of the world’s first lithium metal from lithium carbonate. Today lithium carbonate – or more precisely the lithium ions in lithium carbonate – are used to inhibit the manic phase of bipolar (manic-depressive) disorder.
* Lithium based batteries have revolutionized consumer devices such as computers and cell phones. For a given battery weight, lithium batteries deliver more energy than batteries based on other metals; in other words, lithium batteries have high energy density.

**Appearance and Characteristics**

**Harmful effects:**

Lithium is corrosive, causing skin burns as a result of the caustic hydroxide produced in contact with moisture. Women taking lithium carbonate for bi-polar disorder may be advised to vary their treatment during pregnancy as lithium may cause birth defects.

**Characteristics:**

Lithium is soft and silvery white and it is the least dense of the metals. It is highly reactive and does not occur freely in nature. Freshly cut surfaces oxidize rapidly in air to form a black oxide coating..

**Uses of Lithium**

Pure lithium metal is used in rechargeable lithium ion batteries and the metal is used as an alloy with [aluminum](http://www.chemicool.com/elements/aluminum.html), [copper](http://www.chemicool.com/elements/copper.html), [manganese](http://www.chemicool.com/elements/manganese.html), and [cadmium](http://www.chemicool.com/elements/cadmium.html) to make high performance aircraft parts.

Lithium also has various nuclear applications.

Lithium carbonate is used as a mood-stabilizing drug.

Lithium chloride and bromide are used as desiccants.

Lithium stearate is used as an all-purpose and high-temperature lubricant.

**Discovery of Potassium**

In 1806 English chemist Sir Humphry Davy discovered Potassium

The name potassium is from the English word ‘potash’, originally meaning an alkali extracted with water in a pot of ash of burned wood or tree leaves. Potassium’s symbol K comes from ‘kalium’ the name of the element in Germany and Scandinavia. (4)

**Interesting Facts about Potassium**

* Potassium and its close periodic table neighbor sodium are solids at room temperature. Their alloys however are not. NaK alloys containing 40 to 90 percent of potassium by weight are liquids at room temperature. The commercially available 78% K, 22% Na alloy stays liquid at temperatures as low as -12.6 oC (9.3 oF).
* All living cells need potassium to maintain fluid balance, therefore we and all other forms of life on Earth need potassium minerals to survive. Potassium is available in all meats, plants and dairy products. Fruit and vegetables are the best sources of potassium.
* Several neurotoxins work by disrupting our cells’ biological use of potassium. This can result in severe pain, or even death. These neurotoxins include agitoxin, charybdotoxin and margatoxin (scorpion stings), apamin (bee stings), and dendrotoxin (mamba snake bites).
* Most of the universe’s potassium atoms were made in the final moments of giant stars as they exploded in supernovae. Potassium is made in the oxygen burning shell of stars when they explode. This is not normal burning, of course; it is nuclear fusion. Potassium is made, along with several other elements including sulfur, and silicon, during explosive oxygen burning in supernovae.
* All plants need potassium to survive; over 90% of all human use of potassium compounds is in the manufacture of plant fertilizers.
* People whose diets are low in potassium can suffer from hypokalemia. Severe hypokalemia can be life threatening. Symptoms include irregular heartbeat, fatigue, muscle cramps and constipation. It is unusual for people to be deficient in potassium solely as a result of getting too little in their diets. Usually hypokalemia is caused by other issues such as diarrhea and/or vomiting, use of antibiotics, and kidney disease.
* Most people are familiar with carbon dating, which uses the decay of the radioactive carbon-14 isotope to find the ages of once-living things such as animal and plant matter. The radioactive isotope potassium-40 gives us a way of dating rocks. Potassium-40 decays to argon-40 and calcium-40 with a half-life of 1.25 billion years. The ratio of potassium-40 to argon-40 trapped in rock is used to determine how long it is since the rock has solidified.

**Appearance and Characteristics**

**Harmful effects:**

In healthy people with normal kidney function, a potassium intake from foods does not seem to pose potential for increased risk, because excess potassium is readily excreted in the urine. In people whose urinary excretion of potassium is impaired, a potassium intake below 4.7 g (120 mmol)/day is appropriate because of adverse cardiac effects. If the digestive system is bypassed and potassium salts are injected into a vein, the heart can be stopped. (5) (6) (7)

Due to its highly reactive nature, elemental potassium must be handled with extreme care.

**Characteristics:**

Potassium is silvery-white, low melting, metal soft enough to be easily cut with a knife. It tarnishes rapidly in air, forming a dull oxide coating.

Potassium burns with a lilac colored flame. It is extremely reactive, reacting violently with water, for example, to produce [hydrogen](http://www.chemicool.com/elements/hydrogen.html) gas and potassium hydroxide.

Potassium is a very light metal (the second least dense metal after [lithium](http://www.chemicool.com/elements/lithium.html)) and would float on water if it were not so reactive.

**Uses of Potassium**

Potassium is vital for plant growth. Plants use it, for example, to make proteins, hence the greatest demand for potassium compounds is in fertilizers.

Potassium hydroxide is a strong alkali and an important industrial chemical. It is used in the manufacture of soft soaps and as an electrolyte in alkaline batteries.

Potassium chloride is used as a healthier alternative to table salt.

Potassium nitrate is the main explosive ingredient in gunpowder.