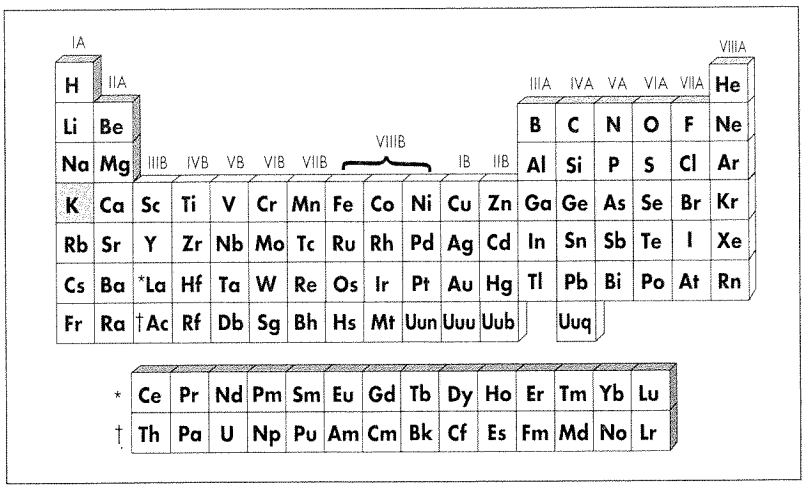


POTASSIUM

K

Potassium is a silvery-white metal with a putty- or wax-like consistency that is so soft it can easily be cut with a knife. It is a member of the alkali metals, the group that contains such elements as lithium and sodium. Like them, it is extremely reactive, and so is never found in the free state in nature.

Potassium occupies the position just below sodium in the periodic table. It is therefore not surprising that sodium and potassium are chemically rather similar and about equally abundant in nature. Both of these elements occur in silicate minerals and in seawater. Interestingly, the oceans contain much more sodium than potassium. Potassium is essential for plant growth, while sodium is not, so that plants take up much of the potassium in minerals as it filters, dissolved in water, through soils before entering streams and rivers on its way to the sea.

Potassium was first isolated by Sir Humphry Davy in 1807. As in so many of his previous discoveries, Davy used electrolysis as a means of separating elements from their compounds.

Almost all of the potassium chloride that is mined is used as plant fertilizer. In fact, plants and trees themselves were an early source of potassium for human use. Wood and other plant materials were burned in pots to give an ash, called potash (potassium-rich ash), which consists primarily of potassium carbonate. The name *potassium* has its origin in the word *potash* from this early source of the element.

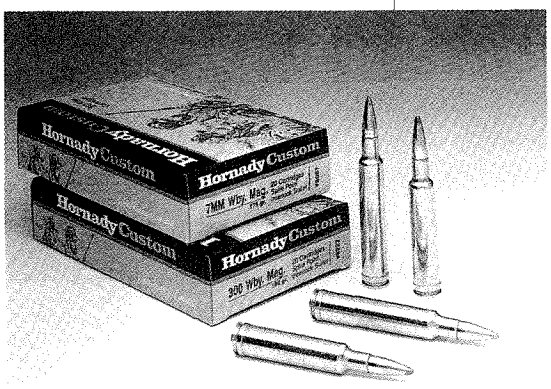
Like all of the alkali metals, potassium reacts violently with water to produce hydrogen. This reaction generates so much heat that it can ignite the hydrogen that bubbles off, causing flames to be produced. To prevent this from happening, it is usually stored immersed in a liquid such as kerosene or naphtha.

Atomic Number **19**

Chemical Symbol **K**

Group **IA—The Alkali Metals**

Potassium burns in air to produce potassium superoxide, whose chemical formula is KO_2. This is an interesting compound that reacts with both water and carbon dioxide to produce oxygen. These properties of potassium superoxide are utilized in self-contained breathing devices. They permit a diver to breathe naturally, using the oxygen generated internally by the superoxide from exhaled carbon dioxide, without any exposure to outside fumes.



Modern high-powered rifle bullets no longer use black gunpowder made with potassium, which produces a great deal of smoke, leaves a heavy residue, and requires frequent cleaning of the rifle bore. Gun cartridges use "smokeless" powder today, which consists basically of nitrocellulose.

Several compounds of potassium are of commercial interest. Potassium hydroxide, KOH, is an extremely strong base that is very soluble in water. It is used chiefly as an electrolyte in certain types of storage batteries and in the manufacture of liquid soap.

Potassium nitrate, KNO_3, is an important compound that has been known for centuries. It is better known as saltpeter, which really means "rocksalt." The name derives from the Greek word *petra*, for rock. It resembles ordinary table salt in appearance. When saltpeter is dissolved in water, it has a slightly salty taste, which explains its name. It is used as a preservative and as an important component of potassium-containing fertilizers. Perhaps its most spectacular use is as an explosive. Potassium nitrate decomposes when heated, releasing large quantities of nitrogen gas. Gunpowder consists of potassium nitrate, wood charcoal, and sulfur. When gunpowder is heated, large volumes of carbon dioxide, and nitrogen gas are released. The sudden expansion of these hot gases causes an explosion.

A naturally occurring isotope of potassium is the radioactive isotope potassium-40. It occurs naturally in many rocks and has an unusually long half-life of 1.25 billion years. Potassium-40 is used extensively to date rocks. This technique depends on the fact that when potassium-40 decays, it transforms itself into the noble gas argon. Consequently, to determine the age of a rock, one need only determine how much argon is present in the rock. The oldest rocks on Earth have been dated by this method as being 3.8 billion years old.

Potassium-40 is also an important source of normal background radiation. Each human body contains about 140 grams of potassium distributed throughout the body. Since the natural abundance of potassium-40 is about 0.012 percent, we are all partially made up of this radioactive isotope. There is no escaping its radiation, and it is a major contributor to our lifetime dose of radiation.