

The alkali metals make up Group 1 of the periodic table. This family consists of the elements lithium, sodium, potassium, rubidium, cesium, and francium (Li, Na, K, Rb, Cs, and Fr, respectively). Group one elements share common characteristics. They are all soft, silver metals. Due to their low ionization energy, these metals have low melting points and are highly reactive. The reactivity of this family increases as you move down the table. Alkali metals are noted for how vigorously they react with water. Due to this, they are often stored in mineral oil and are not found in their elemental forms in nature. These characteristics can be explained by examining the electronic structure of each element in this group. Alkali metals have one valence electron. They readily give up this electron to assume the noble gas configuration as a cation. This makes the elements in this group highly reactive.

## History

Explore the discoverer's biography, including general facts about his life and anecdotes regarding how he made this particular discovery. Also see other significant scientific discoveries built largely on this concept and other real-world applications in history that may not still be relevant.

### Discoverer/Developer

See each tab for individual information about the discoverer of each element.

## Lithium

Lithium was discovered in 1817 by Johan August Arfwedson.

Arfwedson was born in 1792 to a wealthy family in Sweden. At a young age he attended the University of Uppsala and earned degrees in law and mineralogy. His interest in minerals is what led to his discovery of lithium. In 1817 Johan was analyzing the mineral petalite when he discovered lithium. Although he did not discover the elemental, isolated form of lithium, he is still credited with the discovery. Johan Arfwedson passed away in 1841 at his estate in Sweden.

## Sodium

Sodium was discovered in 1807 by Sir Humphry Bartholomew Davy.

Davy was born in 1778 in England. He was originally apprenticed as a surgeon, but instead took up chemistry in the pharmacy. Many of his early experiments took place in the home of his grandfather John Tonkin. Davy is best known for his research in the field of electrochemistry

and his discovery and isolation of the alkali metals potassium and sodium in 1807. Davy also discovered the physiological action of nitrous oxide (1794), isolated boron in 1808, and later prepared barium, calcium, strontium, and magnesium in the metallic state. Davy discovered sodium while passing an electric current through sodium hydroxide.

### **Potassium**

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### **Rubidium**

Rubidium was discovered in 1861 by two German scientists, Robert Bunsen and Gustav Kirchoff.

Bunsen was born in 1811 to the chief librarian at the University of Göttingen. He would obtain a degree in chemistry from Göttingen in 1828. In 1832 he obtained his Ph.D. He began to teach after he obtained his Ph.D. Bunsen had two tragic accidents that almost cost him his life. He almost died of arsenic poisoning and lost the sight of his right eye after a laboratory explosion. Bunsen is most well known for his invention of a piece of laboratory equipment that is found in any chemistry lab, the Bunsen burner.

Kirchoff was born in 1824 to a librarian and his wife. Gustav studied physics at the University of Königsberg. He married the daughter of a mathematics professor. In 1854 Gustav and his wife moved to Heidelberg where the discovery of rubidium would take place. It was at Heidelberg where he became colleagues with Robert Bunsen. During his life, Kirchoff laid out many laws relating to physics.

Using Bunsen's new spectrometer and the method of flame spectroscopy, the two men discovered rubidium in 1861.

### **Cesium**

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Using Bunsen's new spectrometer and the method of flame spectroscopy, the two men discovered cesium in 1860.

### **Francium**

Francium was discovered in 1939 by Marguerite Perey.

Perey was born in 1909 in France. Her original ambitions were to become a medical doctor, but due to financial woes following her father's death, she abandoned this dream. She did, however, receive a degree in chemistry in 1929. With this degree, she joined the Radium Institute where she served as a personal assistant to Marie Curie. She discovered the element in 1939 and named it after her native country of France.

### Concept Definition

Study the primary definition of this concept, broken into general, basic, and advanced English definitions. Also see the mathematical definition and any requisite background information, such as conditions or previous definitions.

#### General Science

The alkali metals are the elements located in Group 1 of the periodic table.

### Real World Application

Discover processes or disciplines in the natural or man-made worlds that employ the concept.

#### Lithium

Lithium salts burn an intense shade of red and are used in fireworks and pyrotechnics. Lithium is also used in the preparation of synthetic rubber and plastics. Lithium is a main component of the lithium-ion battery. This battery is used in many electronics and can be recharged. Lithium is used aboard spaceships and submarines for air purification.

#### Sodium

Sodium is useful in a variety of different ways. Perhaps the most common use, to many people, is in NaCl, or table salt. Sodium makes an appearance in other household items such as borax and baking soda. Sodium is also used in the paper, textile, and petroleum industries. Sodium lamps are used to light highways.

#### Potassium

Potassium is used in fertilizers and matches. KCl, a salt, is also useful to people who require low sodium diets. High doses of potassium will stop the heart and are a main component of the solution used in executions via lethal injection. Due to its yellow color in compounds, it is used in fireworks, inks, and dyes.

#### Rubidium

Rubidium reacts quickly with O<sub>2</sub> and is useful in vacuum tubes and photocells. Rubidium burns

purple and is sometimes used in fireworks. Rubidium is also used in laser cooling devices.

### Cesium

Cesium has been used in vacuum tubes and photocells due to the chemical properties it possesses. Cesium is mainly used in research of ion propulsion engines that are used in space.

### Francium

Due to the unstable nature and rarity of francium, there are no known real world applications of this metal.

## Vocabulary

Learn important vocabulary for this concept, including words that might appear in assessments (tests, quizzes, homework, etc.) that indicate the use of this concept.

Important Vocabulary	Term	Context
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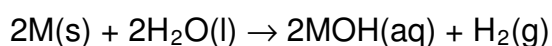
## Videos

Browse relevant videos from the Journal of Chemical Education's (JCE) Chemistry Comes Alive! library and other video sources.

### Alkali Metals in Water

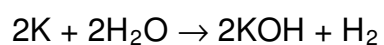
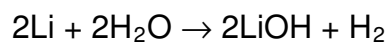
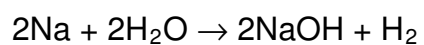
This video shows the reaction of each alkali metal in water, excluding Francium.

Balanced chemical reaction:



M= alkali metal

## Reactivity of Alkali Metals- 3 Metals



[URL: <http://www.jce.divched.org/JCESoft/JCESoftsubscriber/CCA/CCA2/MOVIES/ALKALI/3METH2O.MOV>]