

Potassium

K

General Information

Discovery

Potassium was discovered by Sir Humphry Davy in 1807 in London, by the electrolysis of potassium hydroxide (potash). This was the first metal to be isolated by electrolysis.

Appearance

Potassium is a soft, white metal which is silvery when cut but which rapidly oxidises.

Source

Potassium is the seventh most abundant metal and makes up 2.4% by mass of the Earth's crust. Most minerals containing potassium are sparingly soluble and the metal is difficult to obtain from them. Certain minerals, however, such as sylvite, sylvinit and carnallite, are found in deposits formed by evaporation of old seas or lakes, and potassium salts can be easily recovered from these. Potassium is also found in the ocean in small amounts compared with sodium.

Uses

The greatest demand for potassium compounds is in fertilisers. Many other potassium salts are of great importance, including the nitrate, carbonate, chloride, bromide, cyanide and sulphate.

Biological Role

Potassium is essential to life, and non-toxic. One of its natural isotopes is radioactive, and although this radioactivity is mild, it may be one natural cause of genetic mutation in man.

General Information

Potassium is the least dense metal known. It is also one of the most reactive and electropositive of metals, and as it oxidises rapidly in air it must be preserved in a mineral oil such as kerosene. Its reaction with water is vigorous - it catches fire spontaneously and decomposes with the evolution of hydrogen. Potassium and its salts give a violet colour to a suitable flame.

Physical Information

| | |
|--|---------------------|
| Atomic Number | 19 |
| Relative Atomic Mass ($^{12}\text{C}=12.000$) | 39.098 |
| Melting Point/K | 336 |
| Boiling Point/K | 1047 |
| Density/kg m ⁻³ | 862 (293K) |
| Ground State Electron Configuration | [Ar]4s ¹ |
| Electron Affinity (M-M ⁻)/kJ mol ⁻¹ | -43.8 |

Key Isotopes

| Nuclide | ³⁹ K | ⁴⁰ K | ⁴¹ K | ⁴² K | ⁴³ K |
|-------------------|-----------------|--------------------------|-----------------|-----------------|-----------------|
| Atomic mass | 38.964 | 39.974 | 40.962 | 41.963 | 42.964 |
| Natural abundance | 93.258% | 0.0117% | 6.730% | 0% | 0% |
| Half-life | stable | 1.28x10 ⁹ yrs | stable | 12 h | 22.4 h |

Ionisation Energies/kJ mol⁻¹

| | |
|------------------------------------|--------|
| M - M ⁺ | 418.8 |
| M ⁺ - M ²⁺ | 3051.4 |
| M ²⁺ - M ³⁺ | 4411 |
| M ³⁺ - M ⁴⁺ | 5877 |
| M ⁴⁺ - M ⁵⁺ | 7975 |
| M ⁵⁺ - M ⁶⁺ | 9649 |
| M ⁶⁺ - M ⁷⁺ | 11343 |
| M ⁷⁺ - M ⁸⁺ | 14942 |
| M ⁸⁺ - M ⁹⁺ | 16964 |
| M ⁹⁺ - M ¹⁰⁺ | 48575 |

Other Information

Enthalpy of Fusion/kJ mol⁻¹ 2.40

Enthalpy of Vaporisation/kJ mol⁻¹ 79.1

Oxidation States

Main K⁺¹

Others K⁻¹ (in NH₃ liq)