

# Uranium

U

## ***General Information***

### **Discovery**

Uranium was discovered by M.H. Klaproth in 1789 in Berlin, Germany, and isolated by E.M. Peugot in Paris, France.

### **Appearance**

Uranium is a radioactive, silvery metal.

### **Source**

Uranium occurs naturally in several minerals such as pitchblende, uraninite and carnotite. It is also found in phosphate rock and monazite sands. It can be prepared by reducing uranium halides with Group I or Group II metals, or by reducing uranium oxides with calcium or carbon at high temperatures.

### **Uses**

Uranium is of great importance as it provides nuclear fuel. Uranium is allowed to decay into plutonium under controlled conditions in a breeder reactor, where a chain reaction is set up and maintained. During this process, large amounts of energy are released. This energy is used to generate electrical power, to make isotopes for peaceful purposes, and to make nuclear weapons.

### **Biological Role**

Uranium has no known biological role. It is toxic due to its radioactivity.

### **General Information**

Uranium is malleable, ductile and tarnishes in air. It is dissolved by acids but not by alkalis. In a finely divided state it is pyrophoric.

## Physical Information

Atomic Number	92
Relative Atomic Mass ( $^{12}\text{C}=12.000$ )	238.03
Melting Point/K	1405.5
Boiling Point/K	4018
Density/kg m <sup>-3</sup>	18950 (293K)
Ground State Electron Configuration	[Rn]5f <sup>3</sup> 6d <sup>1</sup> 7s <sup>2</sup>

## Key Isotopes

Nuclide	<sup>234</sup> U	<sup>235</sup> U	<sup>236</sup> U	<sup>238</sup> U
Atomic mass	234.04	235.04	236.05	238.05
Natural abundance	0.005%	0.720%	0%	99.28%
Half-life	2.47x10 <sup>5</sup> yrs	7x10 <sup>8</sup> yrs	2.39x10 <sup>7</sup> yrs	4.51x10 <sup>9</sup> yrs

## Ionisation Energies/kJ mol<sup>-1</sup>

M - M <sup>+</sup>	584
M <sup>+</sup> - M <sup>2+</sup>	1420
M <sup>2+</sup> - M <sup>3+</sup>	
M <sup>3+</sup> - M <sup>4+</sup>	
M <sup>4+</sup> - M <sup>5+</sup>	
M <sup>5+</sup> - M <sup>6+</sup>	
M <sup>6+</sup> - M <sup>7+</sup>	
M <sup>7+</sup> - M <sup>8+</sup>	
M <sup>8+</sup> - M <sup>9+</sup>	
M <sup>9+</sup> - M <sup>10+</sup>	

## Other Information

Enthalpy of Fusion/kJ mol<sup>-1</sup> 15.5

Enthalpy of Vaporisation/kJ mol<sup>-1</sup> 417.1

### Oxidation States

Main U<sup>VI</sup>

Others U<sup>II</sup>, U<sup>III</sup>, U<sup>IV</sup>, U<sup>V</sup>

### Covalent Bonds/kJ mol<sup>-1</sup>

Not applicable