

# Protactinium

**Pa**

## ***General Information***

### **Discovery**

Protactinium was discovered in 1917 by Hahn and Meitner in Berlin, Fajans in Germany and Fleck in Glasgow. It was initially named brevium, as the first isotope identified was very short-lived.

### **Appearance**

Protactinium is a radioactive, silvery metal.

### **Source**

Protactinium is found naturally in uranium ores and produced in gram quantities from uranium fuel elements.

### **Uses**

Protactinium is little used.

### **Biological Role**

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

### **General Information**

Protactinium is attacked by oxygen, steam and acids, but not by alkalis. It is the third rarest of the elements.

## Physical Information

Atomic Number	91
Relative Atomic Mass ( $^{12}\text{C}=12.000$ )	231.04
Melting Point/K	2113
Boiling Point/K	4300
Ground State Electron Configuration	$[\text{Rn}]5f^26d^17s^2$

## Key Isotopes

Nuclide	$^{231}\text{Pa}$	$^{233}\text{Pa}$	$^{234}\text{Pa}$
Atomic mass	231.04	233.04	234.04
Natural abundance	trace	0%	trace
Half-life	$3.26 \times 10^4$ yrs	27 days	6.75 h

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

M - M <sup>+</sup>	568
M <sup>+</sup> - M <sup>2+</sup>	
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> 16.7

Enthalpy of Vaporisation/kJ mol<sup>-1</sup> 481

### Oxidation States

Main Pa<sup>V</sup>

Others Pa<sup>III</sup>, Pa<sup>IV</sup>

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

Not applicable