

## ***General Information***

### **Discovery**

Nickel was discovered by A.F. Cronstedt in 1751 in Stockholm, Sweden.

### **Appearance**

Nickel is a silvery-white metal which is lustrous, malleable and ductile. It is capable of taking on a high polish.

### **Source**

The minerals which contain the most nickel are garnierite and pentlandite. About 30% of these minerals are found in Ontario in North America.

### **Uses**

Nickel is chiefly used in the making of alloys such as stainless steel. A copper-nickel alloy is extensively used in making desalination plants for converting sea water into fresh water.

Nickel steel is used for armour plate.

Nickel has long been used in coins - the US five-cent piece is 25% nickel and 75% copper. Nickel plate protects softer metals. Finely-divided nickel is used as a catalyst for hydrogenating vegetable oils, and nickel imparts a green colour to glass.

### **Biological Role**

The biological role of nickel is uncertain, but both the metal and nickel sulphide are considered to be carcinogenic. Nickel carbonyl is very toxic.

### **General Information**

Nickel is very resistant to corrosion. It is soluble in all acids except concentrated nitric acid, and is not affected by alkalis. It is a fair conductor of heat and electricity.

## Physical Information

Atomic Number	28
Relative Atomic Mass ( $^{12}\text{C}=12.000$ )	58.69
Melting Point/K	1726
Boiling Point/K	3005
Density/kg m <sup>-3</sup>	8902 (298K)
Ground State Electron Configuration	[Ar]3d <sup>8</sup> 4s <sup>2</sup>
Electron Affinity (M-M <sup>-</sup> )/kJ mol <sup>-1</sup>	156

## Key Isotopes

Nuclide	<sup>58</sup> Ni	<sup>59</sup> Ni	<sup>60</sup> Ni	<sup>61</sup> Ni	<sup>62</sup> Ni	<sup>63</sup> Ni
Atomic mass	57.935	58.934	59.933	60.931	61.928	62.930
Natural abundance	68.27%	0%	26.10%	1.13%	3.59%	0%
Half-life	stable	8x10 <sup>4</sup> yrs	stable	stable	stable	92 yrs
Nuclide	<sup>64</sup> Ni					
Atomic mass	63.928					
Natural abundance	0.91%					
Half-life	stable					

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

M - M <sup>+</sup>	736.7
M <sup>+</sup> - M <sup>2+</sup>	1753.0
M <sup>2+</sup> - M <sup>3+</sup>	3393
M <sup>3+</sup> - M <sup>4+</sup>	5300
M <sup>4+</sup> - M <sup>5+</sup>	7280
M <sup>5+</sup> - M <sup>6+</sup>	10400
M <sup>6+</sup> - M <sup>7+</sup>	12800
M <sup>7+</sup> - M <sup>8+</sup>	15600
M <sup>8+</sup> - M <sup>9+</sup>	18600
M <sup>9+</sup> - M <sup>10+</sup>	21660

## Other Information

Enthalpy of Fusion/kJ mol <sup>-1</sup>	17.6
Enthalpy of Vaporisation/kJ mol <sup>-1</sup>	374.8

### Oxidation States

Main	Ni <sup>II</sup>
Others	Ni <sup>-I</sup> , Ni <sup>0</sup> , Ni <sup>I</sup> , Ni <sup>III</sup> , Ni <sup>IV</sup> , Ni <sup>VI</sup>

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

Not applicable