

# Copper

**Cu**

## ***General Information***

### **Discovery**

Copper was known to ancient civilisations, and is said to have been mined for more than 5000 years.

### **Appearance**

Copper is a reddish colour and takes on a bright sheen. It is malleable and ductile.

### **Source**

Copper metal does occur naturally, but by far the greatest source is in minerals such as chalcopyrite and bornite. Copper ores (copper sulfides, oxides and carbonates) are found in the USA and Canada, as well as several other places. From these ores and minerals copper is obtained by smelting, leaching and electrolysis.

### **Uses**

The greatest percentage of copper used is in electrical equipment such as wiring and motors. Brass and bronze are both copper alloys and are extensively used. All American coins are now copper alloys, and gun metals also contain copper.

Copper sulfate is used widely as an agricultural poison and as an algicide in water purification. Copper compounds such as Fehling's solution are used in chemical tests for sugar detection.

### **Biological Role**

Copper is an essential element although excess copper is toxic.

### **General Information**

Copper is a good conductor of heat and electricity - hence its use in the electrical industry.

It is resistant to air and water but slowly weathers to the green patina of the carbonate often seen on roofs and statues.

## Physical Information

Atomic Number	29
Relative Atomic Mass ( $^{12}\text{C}=12.000$ )	63.546
Melting Point/K	1357
Boiling Point/K	2840
Density/kg m <sup>-3</sup>	8960 (293K)
Ground State Electron Configuration	[Ar]3d <sup>10</sup> 4s <sup>1</sup>
Electron Affinity (M-M <sup>-</sup> )/kJ mol <sup>-1</sup>	-118.3

## Key Isotopes

Nuclide	<sup>63</sup> Cu	<sup>64</sup> Cu	<sup>65</sup> Cu	<sup>67</sup> Cu
Atomic mass	62.930	63.930	64.928	
Natural abundance	69.17%	0%	30.83%	
Half-life	stable	12.9 h	stable	61.88 h

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

M - M <sup>+</sup>	745.4
M <sup>+</sup> - M <sup>2+</sup>	1958
M <sup>2+</sup> - M <sup>3+</sup>	3554
M <sup>3+</sup> - M <sup>4+</sup>	5326
M <sup>4+</sup> - M <sup>5+</sup>	7709
M <sup>5+</sup> - M <sup>6+</sup>	9940
M <sup>6+</sup> - M <sup>7+</sup>	13400
M <sup>7+</sup> - M <sup>8+</sup>	16000
M <sup>8+</sup> - M <sup>9+</sup>	19200
M <sup>9+</sup> - M <sup>10+</sup>	22400

## Other Information

Enthalpy of Fusion/kJ mol <sup>-1</sup>	13.0
Enthalpy of Vaporisation/kJ mol <sup>-1</sup>	306.7

### Oxidation States

Main	Cu <sup>+2</sup>
Others	Cu <sup>-1</sup> , Cu <sup>0</sup> , Cu <sup>+1</sup> , Cu <sup>+3</sup> , Cu <sup>+4</sup>