Manganese *Mn*

General Information

Discovery

Manganese was recognised as an element by Scheele, Bergman and others and isolated by J.G. Grahn in 1774 in Stockholm, Sweden.

Appearance

Manganese is a grey-white metal, resembling iron, but is harder and very brittle.

Source

Manganese minerals are widely distributed, pyrolusite and rhodochrosite being the most common. Manganese nodules have been found on the floor of the oceans. These nodules contain about 24% manganese together with many other elements in lesser abundance.

Uses

Manganese is used to form many important alloys. It gives steel a hard yet pliant quality, and with aluminium and antimony it forms highly ferromagnetic alloys.

Manganese (IV) oxide is used as a depolariser in dry cells, and to decolorise glass coloured green by iron impurities. Manganese (II) oxide is a powerful oxidising agent and is used in quantitative analysis and in medicine.

Biological Role

Manganese is an essential element. Without it, bones grow spongier and break more easily. It activates many enzymes and may be essential for utilization of vitamin B. Exposure to manganese dust, fumes and compounds is to be avoided as it is a suspected carcinogen.

General Information

Manganese is reactive chemically, and decomposes cold water slowly. It is reactive even when impure, and will burn in oxygen.

Physical Information

Atomic Number	25
Relative Atomic Mass (^{12}C=12.000)	54.938
Melting Point/K	1517
Boiling Point/K	2235
Density/kg m^{-3}	7440 (293K)
Ground State Electron Configuration	$[Ar]3d^5 4s^2$
Electron Affinity (M-M^-)/kJ mol^{-1}	-94

Key Isotopes

Nuclide	^{53}Mn	^{54}Mn	^{55}Mn	^{56}Mn
Atomic mass	52.941	53.940	54.938	
Natural abundance	0%	0%	100%	0%
Half-life	$2x10^6$ yrs	303 days	stable	2.576 h

Ionisation Energies/kJ mol^{-1}

$M - M^+$	717.4
$M^+ - M^{2+}$	1509.0
$M^{2+} - M^{3+}$	3248.4
$M^{3+} - M^{4+}$	4940
$M^{4+} - M^{5+}$	6990
$M^{5+} - M^{6+}$	9200
$M^{6+} - M^{7+}$	11508
$M^{7+} - M^{8+}$	18956
$M^{8+} - M^{9+}$	21400
$M^{9+} - M^{10+}$	23960

Other Information

Enthalpy of Fusion/kJ mol^{-1}	14.4
Enthalpy of Vaporisation/kJ mol^{-1}	220.5

Oxidation States

Main	Mn^{II}
Others	Mn^{-III}, Mn^{-II}, Mn^{-I}, Mn^{O}, Mn^{I}, Mn^{III}, Mn^{IV}, Mn^{V}, Mn^{VI}, Mn^{VII}

Covalent Bonds/kJ mol^{-1}

Not applicable