

Bismuth

Bi

General Information

Discovery

Bismuth has been known since the fifteenth century, although it was often confused with tin and lead. Claude Geoffrey the Younger showed it to be distinct from lead in 1753.

Appearance

Bismuth is a white brittle metal with a pinkish tinge.

Source

Bismuth occurs as the native metal, and in ores such as bismuthinite and bismite. The major commercial source of bismuth is as a by-product of refining lead, copper, tin, silver and gold ores.

Uses

Bismuth is used widely in low-melting alloys with tin and cadmium, which are used in products such as fire detectors and extinguishers, electric fuses and solders. Otherwise bismuth does not find wide application.

Biological Role

Bismuth has no known biological role, and is non-toxic.

General Information

Bismuth is stable to oxygen and water, and dissolves in concentrated nitric acid. Its soluble salts are characterised by forming insoluble basic salts on the addition of water. This property has been used in forensic work.

Physical Information

Atomic Number	83
Relative Atomic Mass ($^{12}\text{C}=12.000$)	208.98
Melting Point/K	544.5
Boiling Point/K	1833
Density/kg m ⁻³	9747 (293K)
Ground State Electron Configuration	[Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ³
Electron Affinity (M-M ⁻)/kJ mol ⁻¹	101

Key Isotopes

Nuclide	²⁰⁶ Bi	²⁰⁷ Bi	²⁰⁹ Bi
Atomic mass			208.98
Natural abundance	0%	0%	100%
Half-life	6.3 days	30.2 yrs	stable

Ionisation Energies/kJ mol⁻¹

M - M ⁺	703.2
M ⁺ - M ²⁺	1610
M ²⁺ - M ³⁺	2466
M ³⁺ - M ⁴⁺	4372
M ⁴⁺ - M ⁵⁺	5400
M ⁵⁺ - M ⁶⁺	8520
M ⁶⁺ - M ⁷⁺	10300
M ⁷⁺ - M ⁸⁺	12300
M ⁸⁺ - M ⁹⁺	14300
M ⁹⁺ - M ¹⁰⁺	16300

Other Information

Enthalpy of Fusion/kJ mol⁻¹ 10.48

Enthalpy of Vaporisation/kJ mol⁻¹ 179.1

Oxidation States

Main Bi^{III}

Others Bi^{-III}, Bi^I, Bi^V

Covalent Bonds/kJ mol⁻¹

Bi - H 194

Bi - C 143

Bi - O 339

Bi - F 314

Bi - Cl 285

Bi - Bi 200