

Lead

Pb

General Information

Discovery

Lead was known to ancient civilisations, and is mentioned in Exodus.

Appearance

Lead is a soft, weak, ductile metal with a pale grey sheen.

Source

Lead is obtained chiefly from the mineral galena by a roasting process. At least 40% of lead in the UK comes from secondary lead sources such as scrap batteries and pipes.

Uses

Lead is very resistant to corrosion - lead pipes from Roman times are still in use today - and is often used to store corrosive liquids. Great quantities of lead, both as the metal and the dioxide, are used in batteries. Lead is also used in cable covering, plumbing and ammunition. Tetraethyl lead is used as an anti-knock agent in petrol, and as an additive in paints. The use of lead in plumbing, petrol and paints has been reduced in the past few years because of environmental concern, as lead is a cumulative poison and is thought to affect brain development and function, especially in young children. Lead is an effective shield around X-ray equipment and nuclear reactors. Lead oxide is used in the production of fine crystal glass.

Biological Role

Lead has no known biological role. It is toxic in a cumulative way, teratogenic and carcinogenic.

General Information

Lead is stable to air and water, but will tarnish in moist air over long periods. It dissolves in nitric acid. Lead is a poor conductor of electricity.

Physical Information

Atomic Number	82
Relative Atomic Mass ($^{12}\text{C}=12.000$)	207.2
Melting Point/K	600.65
Boiling Point/K	2013
Density/kg m ⁻³	11350 (293K)
Ground State Electron Configuration	[Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ²
Electron Affinity (M-M ⁻)/kJ mol ⁻¹	-35.2

Key Isotopes

Nuclide	²⁰⁴ Pb	²⁰⁵ Pb	²⁰⁶ Pb	²⁰⁷ Pb	²⁰⁸ Pb	²¹⁰ Pb
Atomic mass	203.97		205.97	206.98	207.98	
Natural abundance	1.4%	0%	24.1%	22.1%	52.3%	trace
Half-life	stable	3x10 ⁷ yrs	stable	stable	stable	20.4 yrs
Nuclide	²¹⁴ Pb					
Atomic mass						
Natural abundance	trace					
Half-life	10.6 h					

Ionisation Energies/kJ mol⁻¹

M - M ⁺	715.5
M ⁺ - M ²⁺	1450.4
M ²⁺ - M ³⁺	3081.5
M ³⁺ - M ⁴⁺	4083
M ⁴⁺ - M ⁵⁺	6640
M ⁵⁺ - M ⁶⁺	8100
M ⁶⁺ - M ⁷⁺	9900
M ⁷⁺ - M ⁸⁺	11800
M ⁸⁺ - M ⁹⁺	13700
M ⁹⁺ - M ¹⁰⁺	16700

Other Information

Enthalpy of Fusion/kJ mol ⁻¹	5.12
Enthalpy of Vaporisation/kJ mol ⁻¹	177.8

Oxidation States

Pb⁺², Pb⁺⁴

Covalent Bonds/kJ mol⁻¹

Pb - H	180
Pb - C	130
Pb - O	398
Pb - F	314
Pb - Cl	244
Pb - Pb	100