

Osmium

Os

General Information

Discovery

Osmium was discovered by S. Tennant in 1803 in London.

Appearance

Osmium is lustrous, bluish-white, extremely hard and has a pungent smell.

Source

Osmium occurs in the free state and in the mineral osmiridium, but commercial recovery is from the wastes of nickel refining.

Uses

Osmium is almost entirely used to produce very hard alloys for fountain pen tips, instrument pivots, needles and electrical contacts.

Biological Role

Osmium has no known biological role, but is very toxic, and can cause lung, skin and eye damage.

General Information

Osmium metal is unaffected by air, water and acids, but reacts with molten alkalis. The powdered metal slowly gives off osmium(VIII) oxide, the source of its pungent odour.

Physical Information

Atomic Number	76
Relative Atomic Mass ($^{12}\text{C}=12.000$)	190.2
Melting Point/K	3327
Boiling Point/K	5300
Density/kg m ⁻³	22590 (293K)
Ground State Electron Configuration	[Xe]4f ¹⁴ 5d ⁶ 6s ²
Electron Affinity (M-M ⁻)/kJ mol ⁻¹	-139

Key Isotopes

Nuclide	¹⁸⁴ Os	¹⁸⁵ Os	¹⁸⁶ Os	¹⁸⁷ Os	¹⁸⁸ Os	¹⁸⁹ Os
Atomic mass	184		186	187	188	189
Natural abundance	0.02%	0%	1.58%	1.6%	13.3%	16.1%
Half-life	stable	97 days	stable	stable	stable	stable
Nuclide	¹⁹⁰ Os	¹⁹¹ Os	¹⁹² Os			
Atomic mass	190		191.9			
Natural abundance	26.4%	0%	41%			
Half-life	stable	15 days	stable			

Ionisation Energies/kJ mol⁻¹

M - M ⁺	840
M ⁺ - M ²⁺	1600
M ²⁺ - M ³⁺	2400
M ³⁺ - M ⁴⁺	3900
M ⁴⁺ - M ⁵⁺	5200
M ⁵⁺ - M ⁶⁺	6600
M ⁶⁺ - M ⁷⁺	8100
M ⁷⁺ - M ⁸⁺	9500
M ⁸⁺ - M ⁹⁺	
M ⁹⁺ - M ¹⁰⁺	

Other Information

Enthalpy of Fusion/kJ mol⁻¹ 29.3

Enthalpy of Vaporisation/kJ mol⁻¹ 738

Oxidation States

Main Os⁺⁴

Others Os⁻², Os⁰, Os⁺¹, Os⁺²,
Os⁺³, Os⁺⁵, Os⁺⁶, Os⁺⁷,
Os⁺⁸