COMMON REACTIONS

With Oxygen to Form Oxides

Example: $Sn(s) + O_2(g) \longrightarrow SnO_2(s)$

Pb follows this pattern, as do C, Si, and Ge at high temperatures.

With Acids to Form Salts and Hydrogen Gas

Only the metallic elements of this group react slowly with aqueous acids.

Example: $Sn(s) + 2HCl(aq) \longrightarrow SnCl_2(aq) + H_2(g)$

Both Sn and Pb can also react to form tin(IV) and lead(IV) salts, respectively.

With Halogens to Form Halides

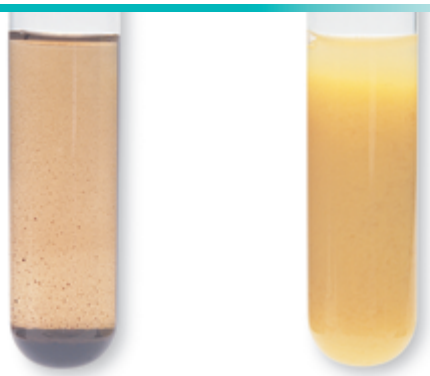
Example: $Sn(s) + 2Cl_2(g) \longrightarrow SnCl_4(s)$

Si, Ge, and Pb follow this pattern, reacting with F_2, Cl_2, Br_2, and I_2.

ANALYTICAL TEST

Ionic compounds of tin and lead can be identified in aqueous solutions by adding a solution containing sulfide ions. The formation of a yellow precipitate indicates the presence of Sn^{4+}, and the formation of a black precipitate indicates the presence of Pb^{2+}.

$$Sn^{4+}(aq) + 2S^{2-}(aq) \longrightarrow SnS_2(s)$$
$$Pb^{2+}(aq) + S^{2-}(aq) \longrightarrow PbS(s)$$



PbS *SnS_2*

PROPERTIES OF THE GROUP 14 ELEMENTS

	C	Si	Ge	Sn	Pb
Melting point (°C)	3500/3652*	1410	937.4	231.88	327.502
Boiling point (°C)	4827	2355	2830	2260	1740
Density (g/cm^3)	3.51/2.25*	2.33 ± 0.01	5.323	7.28	11.343
Ionization energy (kJ/mol)	1086	787	762	709	716
Atomic radius (pm)	77	118	122	140	175
Ionic radius (pm)	260 (C^{4-} ion)	—	—	118 (Sn^{2+} ion)	119 (Pb^{2+} ion)
Common oxidation number in compounds	+4, –4	+4	+2, +4	+2, +4	+2, +4
Crystal structure	cubic/hexagonal*	cubic	cubic	tetragonal	fcc
Hardness (Mohs' scale)	10/0.5*	6.5	6.0	1.5	1.5

* The data are for two allotropic forms: diamond/graphite.