

## 1. GROUP OF 14 ELEMENTS: THE CARBON FAMILY

**Carbon (C), silicon (Si), germanium (Ge), tin (Sn) and lead (Pb) are members of Group 14.**

**Electronic Configuration:**  $ns^2np^2$   
**Oxidation states and trends in chemical reactivity:** Common oxidation states = +4 and +2. Carbon also exhibits the negative oxidation state. Oxidation state increases in the sequence:  $Ge < Sn < Pb$ .

### 1. **Reactivity towards oxygen:**

All members when heated in oxygen form oxides. There are mainly two types of oxides, i.e. monoxide and dioxide of the formulas  $MO$  and  $MO_2$ , respectively.

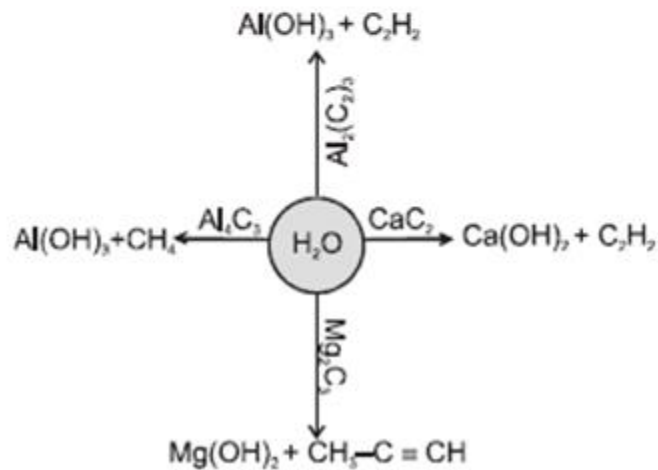
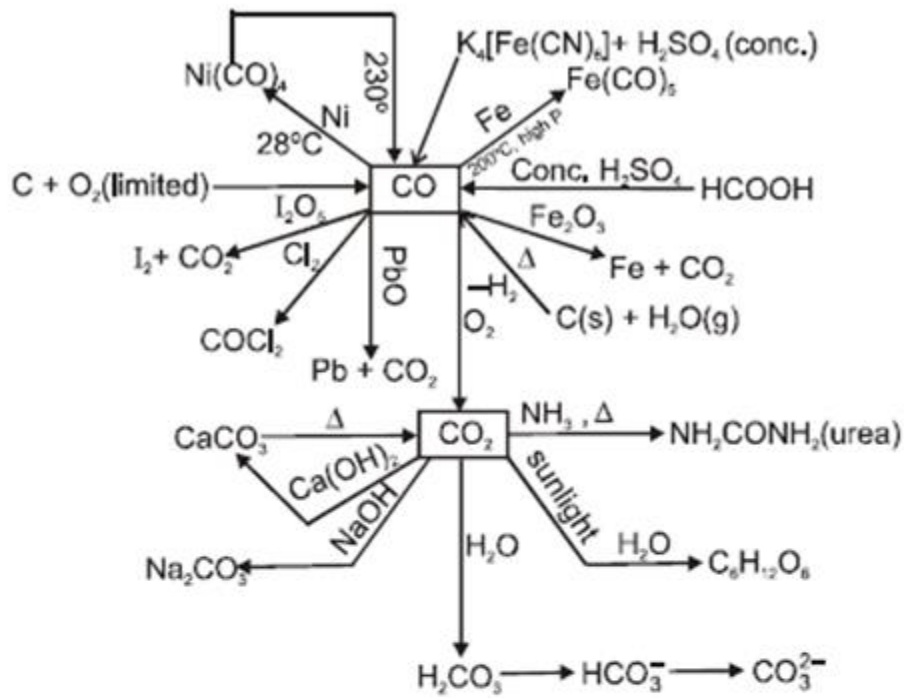
### 2. **Reactivity towards water:**

Tin decomposes steam to form dioxide and dihydrogen gas.

### 3. **Reactivity towards halogen:**

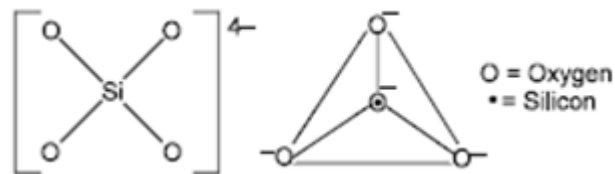
These elements can form halides of formula  $MX_2$  and  $MX_4$  (where  $X = F, Cl, Br, I$ ). Stability of dihalides increases down the group.

SOME IMPORTANT REACTIONS OF CO, CO<sub>2</sub> AND METAL CARBIDES:

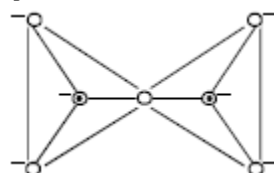


2. CLASSIFICATION OF SILICATES:

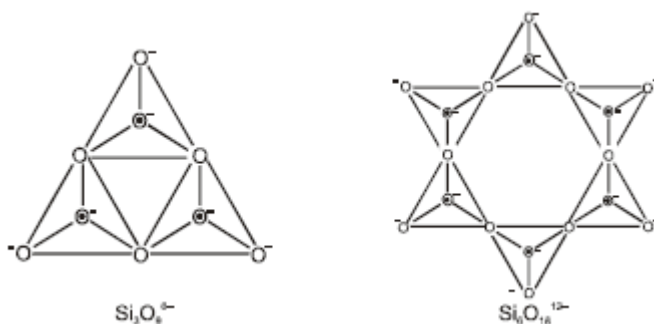
3. Orthosilicates



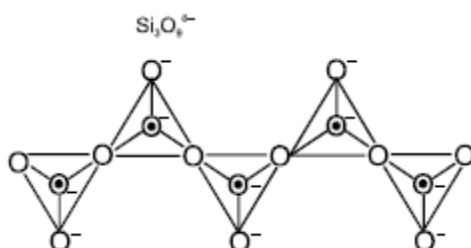
4. Pyrosilicates:



5. **Cyclic silicates:**



6. **Chain silicates:**



7. **Two-dimensional sheet silicates:**

In such silicates, the oxygen atoms of each tetrahedral are shared with adjacent  $\text{SiO}_4^{4-}$  tetrahedrals. Such sharing forms a two-dimension sheet structure with the general formula  $(\text{Si}_2\text{O}_5)_n^{2n}$ .

8. **Three-dimensional sheet silicates:**

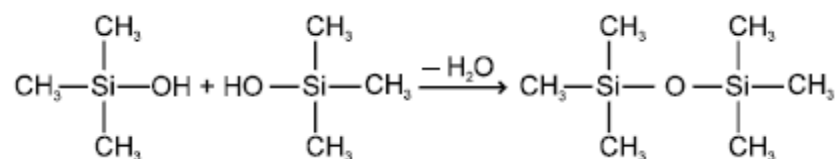
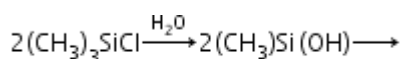
These silicates involve all four oxygen atoms in sharing with adjacent  $\text{SiO}_4^{4-}$  tetrahedral units.

9. **SILICONES:**

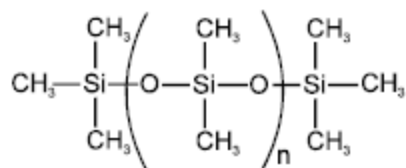
1. **Silicones can be prepared from the following types of compounds only.**

1.  $\text{R}_3\text{SiCl}$
2.  $\text{R}_2\text{SiCl}_2$
3.  $\text{RSiCl}_3$

2. Silicones from the hydrolysis of  $(\text{CH}_3)_3\text{SiCl}$ :

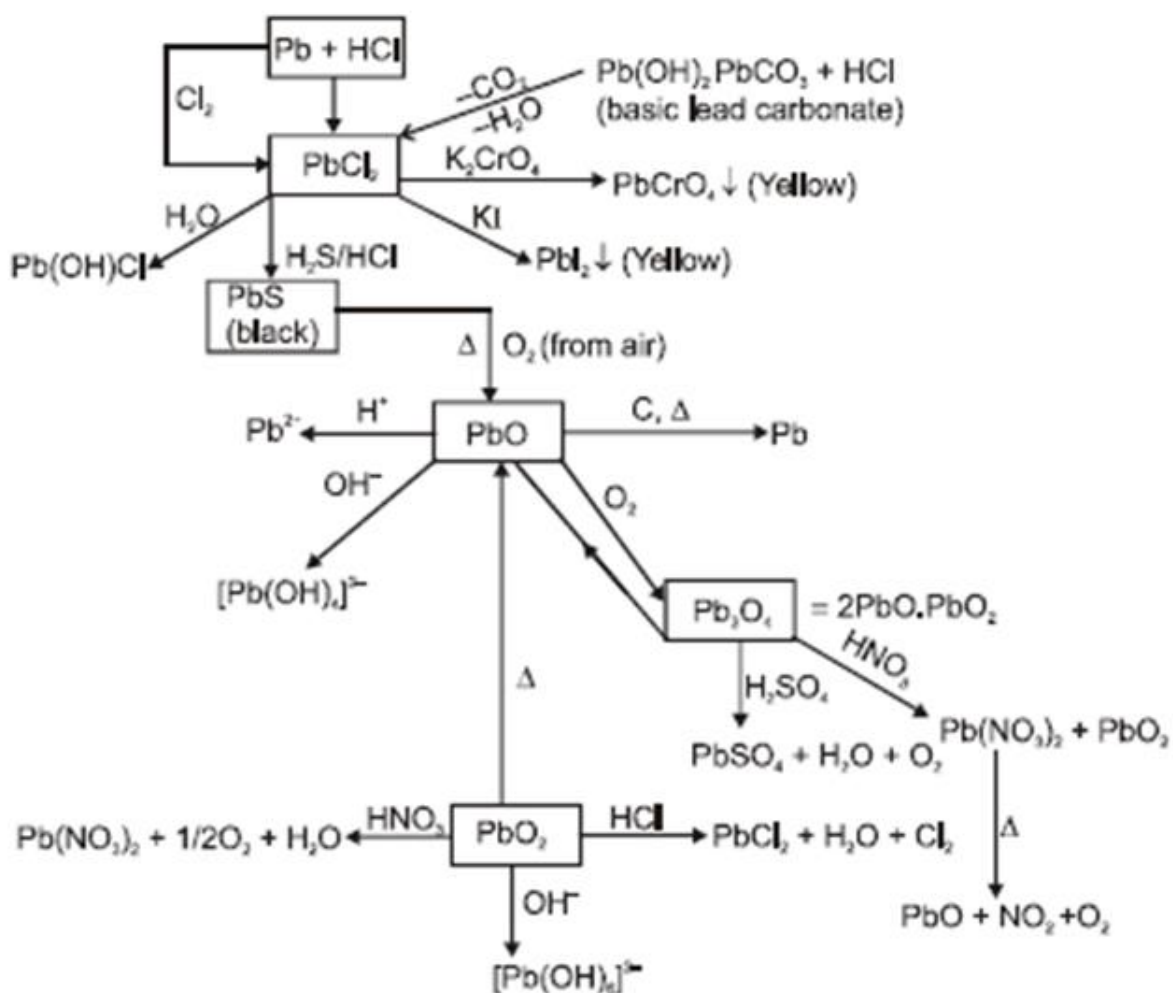


3. Silicones from the hydrolysis of a mixture of  $(\text{CH}_3)_3\text{SiCl}$  and  $(\text{CH}_3)_2\text{SiCl}_2$ :



4. When a compound like  $\text{CH}_3\text{SiCl}_3$  undergoes hydrolysis, a complex cross-linked polymer is obtained.
5. The hydrocarbon layer along the silicon-oxygen chain makes silicones water-repellent.

#### COMPOUNDS OF LEAD:



#### COMPOUNDS OF TIN:

