

p-Block – Lecture – II

Q. in the following reaction,



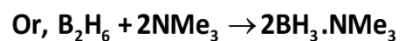
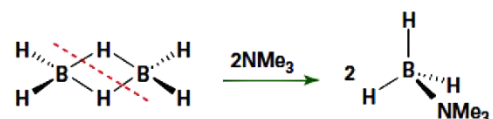
The amine(s) X can't be

[IIT 2009]

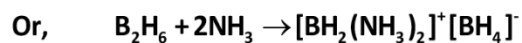
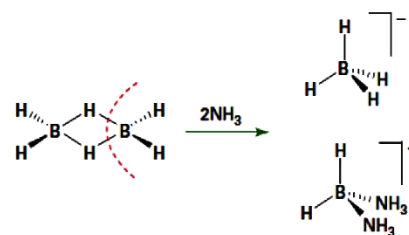
- (a). NH_3
- (b). CH_3NH_2
- (c). $(CH_3)_2NH$
- (d). $(CH_3)_3N$

a. Diborane cleavage reaction:

i. Symmetrical:



ii. Unsymmetrical:



Q. Which one of the following is the correct statement

[IIT 2008]

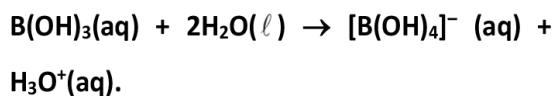
- (a). Boric acid is protonic acid
- (b). Beryllium exhibits coordination number of six
- (c). chlorides of both Beryllium and aluminum have bridged structure in solid phase
- (d). $B_2H_6 \cdot 2NH_3$ is known as inorganic benzene

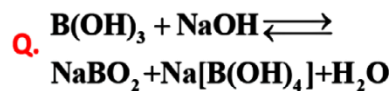
H_3BO_3 (Boric Acid)

It is a weak monobasic acid Lewis acid and not as a proton donor.

Boric acid is white crystalline waxy solid (soapy touch).

Sparingly soluble in cold water and highly soluble in hot water.



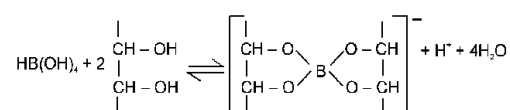


How can this reaction be made to proceed in the forward direction

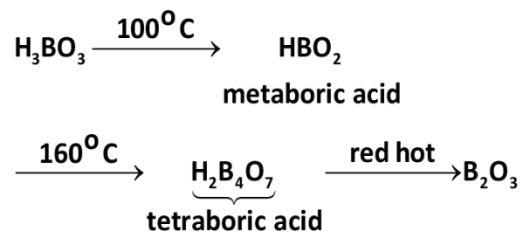
[IIT 2004]

- (a). by addition of cis-1,2-diol
- (b). by addition of borax
- (c). by addition of trans-1,2-diol
- (d). by addition of Na_2HPO_4

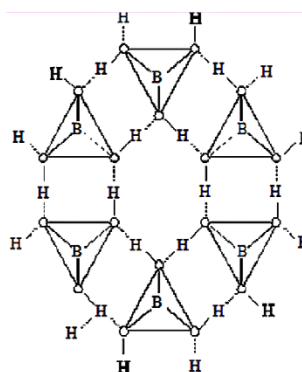
It behaves as strong acid when a polyhydroxy compound such as glycol or glycerol is added to its aqueous solution. The acidity is due to the high stability of the conjugate borate chelate complex.



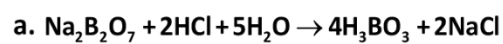
When heated it first forms metaboric acid (HBO_2) and then boron trioxide.



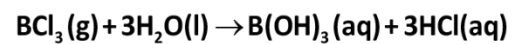
It has a layered structure in which planar BO_3 units are joined by hydrogen bonds.



Prep:

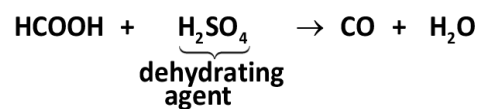


b. Hydrolysis of boron compounds:



Group 14

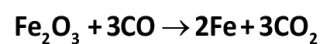
Carbon monoxide (CO):



CO burns with blue colour.

CO is toxic because it forms a complex with hemoglobin in the blood and this complex is more stable than oxy-hemoglobin.

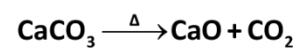
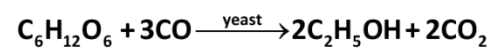
CO is a good reducing agent; it can reduce many metals to the metal.



CO is an important ligand

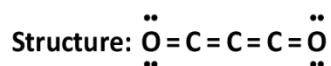
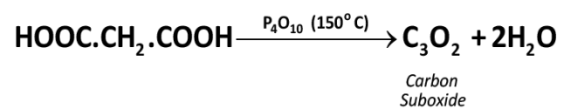
Carbon dioxide (CO₂):

CO₂ is colourless, odorless gas



Carbon suboxide (C₃O₂):

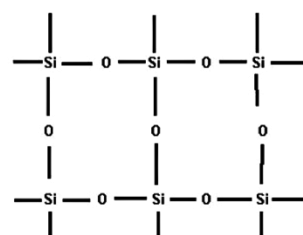
Prepared by dehydrating malonic acid by P₄O₁₀



SiO₂:

SiO₂, silica. Quartz, cristobalite are some crystalline form of silica.

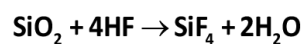
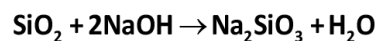
SiO₂ is a covalent three dimensional network solid.



Q. CO₂ exist as discrete molecule but SiO₂ exist as network solid. Why?

Note:

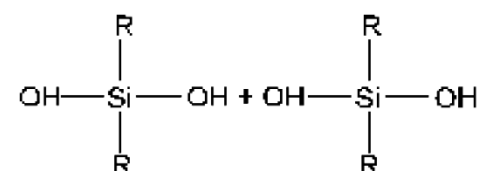
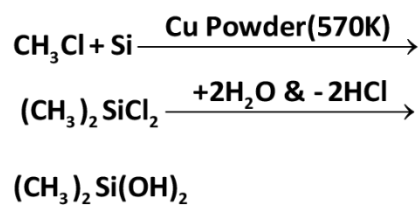
SiO₂ is generally chemically inert but attacked by HF and NaOH



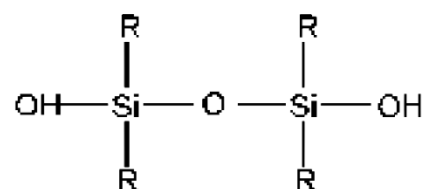
Silicones

Silicones are synthetic organosilicon compounds having repeated $(-\text{R}_2\text{SiO}-)$ units held by Si – O – Si linkages. These compounds have the general formula $(\text{R}_2\text{SiO})_n$ where R = alkyl or aryl group.

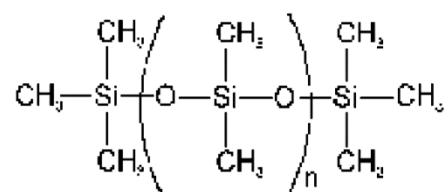
The silicones are formed by the hydrolysis of alkyl or aryl substituted chlorosilanes and their subsequent polymerisation. The alkyl or aryl substituted chlorosilanes are prepared by the following reactions.



condensation polymerisation →



The dichloro derivative will form a long chain polymer as usual. But the growth of this polymer can be blocked at any stage by the hydrolysis product of mono-chloro derivative.



Property & Use:

Water repelling in nature, high thermal stability, chemical inert in nature, used as electrical insulator and water proofing fabric.

Silicones are biocompatible so used in surgical and cosmetic plants.

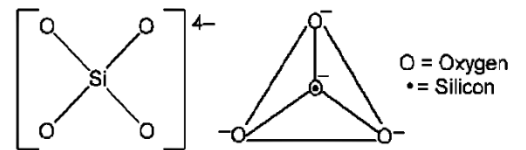
Silicates :

SiO_4^{-4} tetrahedral units may exist as discrete units or may polymerise into larger units by sharing corners.

Classification of Silicates

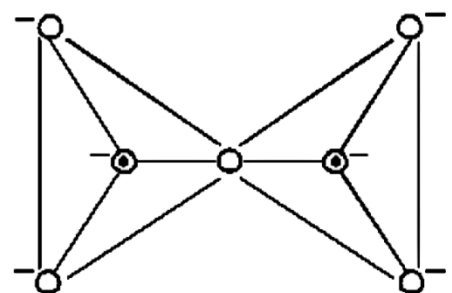
Orthosilicates (neso - silicates):

These contain discrete $[\text{SiO}_4]^{4-}$ units i.e., there is no sharing of corners with one another as shown in figure.



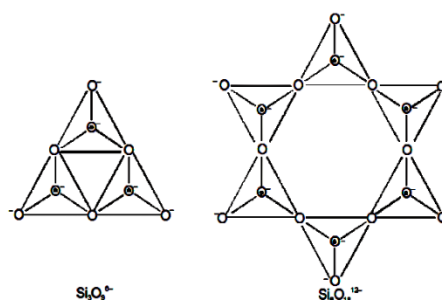
Pyrosilicate (soro-silicates, disilicates) :

In these silicates two tetrahedral units are joined by sharing oxygen at one corner thereby giving $[\text{Si}_2\text{O}_7]^{6-}$ units.



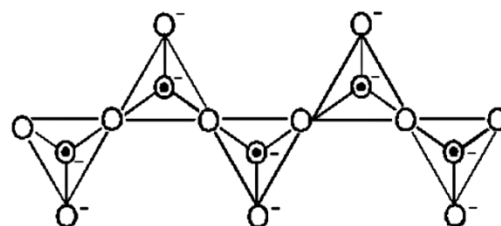
Cyclic silicates

If two oxygen atoms per tetrahedron are shared to form closed rings such that the structure with general formula $(\text{SiO}_3^{2-})_n$ or $(\text{SiO}_3)_n^{2n-}$ is obtained, the silicates containing these anions are called cyclic silicates. $\text{Si}_3\text{O}_9^{6-}$ and $\text{Si}_6\text{O}_{18}^{12-}$ anions are the typical examples of cyclic silicates.

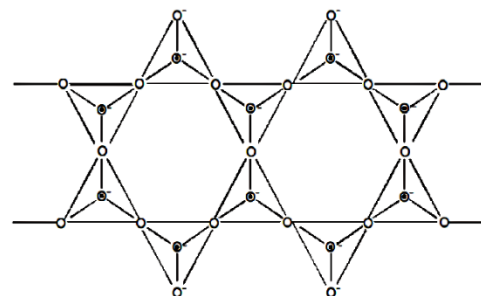


Chain silicates

Chain silicates may be further classified into simple chain (pyroxenes) & double chain (amphiboles) compounds. In case of simple chains two corners of each tetrahedron are shared & they form a long chain of tetrahedron. Their general formula is also same as the cyclic silicates i.e. $(\text{SiO}_3)_n^{2n-}$



Similarly, double chain silicates can be drawn in which two simple chains are joined together by shared oxygen. Such compounds are also known as amphiboles. The asbestos mineral is a well known example of double chain silicates. The anions of double chain silicates have general formula $(\text{Si}_4\text{O}_{11})_n^{6n-}$



E. Two dimensional sheet silicates

(phyllo-silicates):

In such silicates, three oxygen atoms of each tetrahedral are shared with adjacent SiO_4^{4-} tetrahedrals. Such sharing forms two dimension sheet structure with general formula $(\text{Si}_2\text{O}_5)_n^{2n-}$

e.g. mica, white asbestos

F. Three dimensional sheet silicates :

These silicates involve all four oxygen atom in sharing with adjacent SiO_4^{4-} tetrahedral units.

e.g. Quartz, Tridymite, Cristobalite, Feldspar, Zeolite and Ultramarines.