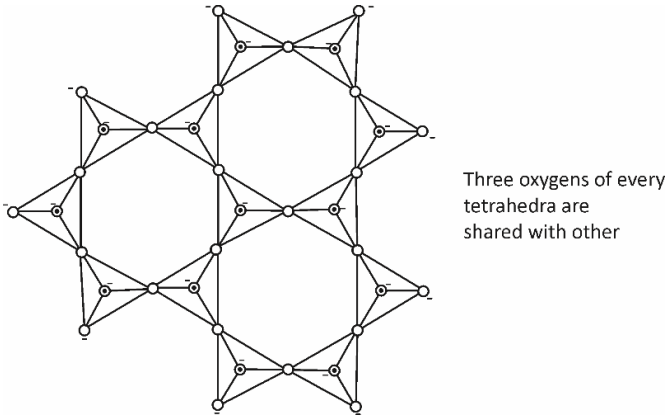
31.(B) In sheet silicates, three out of four oxygen of SiO_4^{4-} unit are shared as shown below



In pyrosilicates, there is only one shared oxygen, in linear chain silicates, two oxygen per tetrahedral are shared while in three-dimensional silicates, all four oxygen's are shared.

32. **(i)** $3SiCl_4 + 4Al \xrightarrow{\Delta} 3Si + 4AlCl_3$.

Mg or Zn can also be used.

(ii) $SiCl_4 + 2CH_3MgCl \longrightarrow (CH_3)_2SiCl_2 + 2MgCl_2$

$$(CH_3)_2SiCl_2 + H_2O \xrightarrow{-HCl} CH_3-\underset{\underset{OH}{|}}{\overset{\overset{OH}{|}}{Si}}-CH_3 \longrightarrow -O-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}-O-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}-O-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}}-O$$

(iii) $SiCl_4 + 4H_2O \longrightarrow \underset{\text{Unstable}}{Si(OH)_4} + 4HCl$

$Si(OH)_4 \xrightarrow{\text{heat}} SiO_2 + 2H_2O$

$SiO_2 + Na_2CO_3 \xrightarrow{\Delta} Na_2SiO_3 + CO_2$

33. **[A-q] [B-r] [C-p] [D-q, r]**

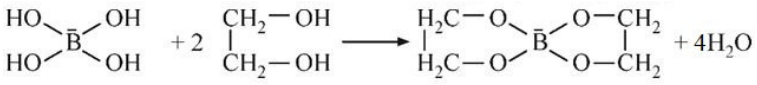
(A) Bi^{3+} hydrolyse to $(BiO)^+$ – q

(B) $[AlO_2]^-$ exist in basic medium, on acidification gives $Al(OH)_3$ – r

(C) Orthosilicate (SiO_4^{4-}) on heating changes into pyrosilicate $Si_2O_7^{6-}$ – p

(D) Tetraborate ion $[B_4O_7^{2-}]$ on treatment with dil. Acid hydrolysis gradually to orthoboric acid – q, r

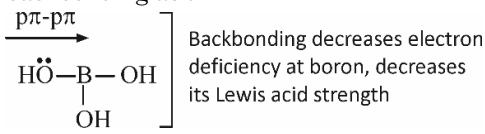
34.(A) Orthoboric acid is a very weak acid, direct neutralization does not complete. However, addition of *cis-diol* allow the reaction to go completion by forming a stable complex with $[B(OH)_4]^-$ as :



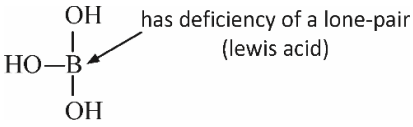
35.(A) Small size and high charge on B^{3+} makes it highly polarizing. Therefore, in most of its compounds, boron forms covalent bonds.

Hence, both statement-I and statement-II are correct and statement-II is a correct explanation of statement-I

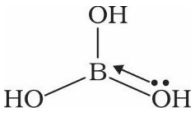
36.(A) Orthoboric acid is a weak, monobasic, Lewis acid and the poor acidic character is due to $p\pi - p\pi$ backbonding as :



37.(A) Orthoboric acid is a weak, monobasic, Lewis acid.



$p\pi - p\pi$ back bonding between 'B' and 'O' decreases acid strength greatly :

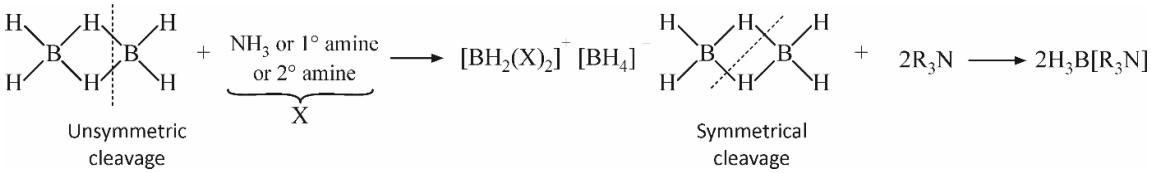


It does not undergo self ionization in water but accepts an electron pair from water, so it behaves as weak monobasic acid.

$$H_3BO + H_2O \rightleftharpoons B(OH)_4^- + H^+$$

38.(C) In group 13, 14, 15 as we descend down in group, the higher oxidation state become less stable due to inert pair effect. Therefore, lead show +2 as stable oxidation state. Hence, Pb^{4+} act as a strong oxidizing agent, itself reduced to Pb^{2+} very easily. Tendency to show lower oxidation state (+2) increases down the group in group-14.

39.(ABC) Diborane (B_2H_6) undergoes unsymmetric cleavage with NH_3, primary and secondary amine while tertiary amine brings about symmetrical cleavage of B_2H_6 as:



40.(3) $Be_nAl_2Si_6O_{18}$. $2n + 6 + 24 - 36 = 0 \quad \Rightarrow \quad n = 3$

41.(BD) Diamond has a three-dimensional network structure, a hard substance where graphite is soft due to layered structure.

In graphite, only three valence electrons are involved in bonding and one electron remain free giving electrical conductivity. In diamond, all the four valence electrons are covalently bonded hence, insulator.

Diamond is better thermal conductor than graphite. Electrical conductivity is due to availability of free electrons, thermal conduction is due to transfer of thermal vibration energy from one atom to another atom. A compact and precisely aligned crystals like diamond thus facilitate better movement of heat.

In graphite $C - C$ bond acquire some double bond character, hence, higher bond order than in diamond.

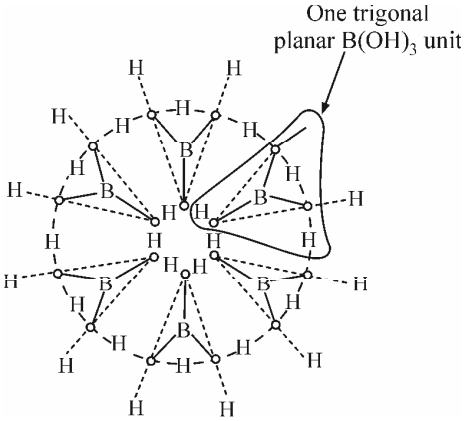
42.(BD) **(a)** It does not undergo self ionization in water but accepts an electron pair from water, so it behaves as weak monobasic acid.

$$H_3BO + H_2O \rightleftharpoons B(OH)_4^- + H^+$$

Hence, (a) is incorrect.

(b) When treated with 1, 2-dihydroxy or polyhydroxy compounds, they form chelate (ring complex) which effectively remove $[B(OH)_4]^-$ species from solution and thereby produce maximum number of H_3O^+ or H^+ ions. i.e. results in increased acidity.

(c) Boric acid crystallizes in a layer structure in which planar triangular $B(OH)_3$ are bonded together through hydrogen bonds.



(d) In water the pK_a value of H_3BO_3 is 9.25.

$H_3BO_3 + H_2O \rightleftharpoons B(OH)_4^- + H^+$; $pK_a = 9.25$

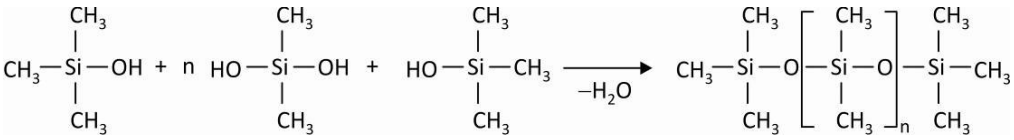
So, it is a weak electroyte in water.

43.(6) $1B_2H_6 + 6CH_3OH \longrightarrow 2B(OCH_3)_3 + 6H_2$

1 mole 2 moles

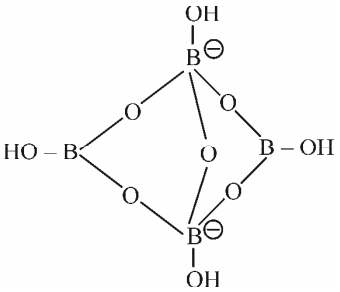
3 moles 6 moles

44.(B) $(CH_3)_2SiCl_2$ is used for preparation of linear polymer and $(CH_3)_3SiCl$ is used for chain termination.



45.(B) B < Ga < Al < In < Tl (size)

46.(ACD) Borax :



(a) Borax can be represented as $[B_4O_5(OH)_4]^{2-}$

(b) Incorrect as two Boron are sp^2 hybridised and two Boron are sp^3 hybridised.

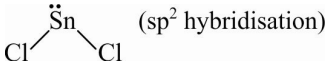
(c) Correct

(d) Correct

47.(ABD) A, B, D are correct

C is incorrect because $AlCl_3$ has three centre four electron bonds in its dimeric structure.

48.(CD) Here Q = $SnCl_2$



(sp^2 hybridisation)

$SnCl_2 + Cl^- \longrightarrow$ $\underset{(X)}{\ddot{S}nCl_3^-}$ (sp^3 hybrid, pyramidal)

$SnCl_2 + Me_3N \longrightarrow \underset{(Y)}{Me_3N \rightarrow SnCl_2}$ (Coordination compound)

$SnCl_2 + 2CuCl_2 \longrightarrow \underset{(Z)}{SnCl_4} + 2CuCl$