11 The p-Block Elements (Group 13 and Group 14)

1. Which of the following hydroxide is acidic?
(a) $Al(OH)_3$ (b) $Ca(OH)_3$
(c) $Tl(OH)_3$ (d) $B(OH)_3$

2. Al is more reactive than Fe but Al is less easily corroded than Fe because
(a) it is a noble metal
(b) oxygen forms a protective oxide layer
(c) iron undergoes reaction easily with water
(d) Fe form mono and divalent ions.

3. Often a ground glass stopper gets stuck in the neck of a glass bottle containing NaOH solution. This is due to :
(a) The presence of dirt particles in between.
(b) The formation of solid silicate in between by the reaction of SiO_2 of glass with NaOH.
(c) The formation of Na_2CO_3 in between by the reaction of CO_2 of air and NaOH.
(d) Glass contains a boron compound which forms a precipitate with the NaOH solution.

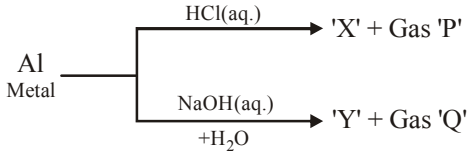
4. $Si_2O_5^{\ 2n-}_{\ n}$ anion is obtained when:

Toughnut

(a) no oxygen of a SiO_4^{4-} tetrahedron is shared with another SiO_4^{4-} tetrahedron
(b) one oxygen of a SiO_4^{4-} tetrahedron is shared with another SiO_4^{4-} tetrahedron
(c) two oxygen of a SiO_4^{4-} tetrahedron are shared with another SiO_4^{4-} tetrahedron
(d) three oxygen of a SiO_4^{4-} tetrahedron are shared with another SiO_4^{4-} tetrahedron

5. Boric acid is a weak monobasic acid and acts as Lewis acid
(a) By donating H
(b) By accepting OH^-
(c) By donating lone pair of electrons
(d) By accepting lone pair of electrons.

6.



The incorrect statement regarding above reactions is:

Critical Thinking

(a) Al shows amphoteric character
(b) Gas 'P' and 'Q' are different
(c) Both X and Y are water soluble
(d) Gas Q is inflammable

7. Ge(II)compounds are powerful reducing agents whereas Pb(IV)compounds are strong oxidants. It is because
(a) Pb is more electropositive than Ge
(b) ionization potential of lead is less than that of Ge
(c) ionic radii of Pb^{2+} and Pb^{4+} are larger than those of Ge^{2+} and Ge^{4+}
(d) of more pronounced inert pair effect in lead than in Ge

8. Which of the following conceivable structures for CCl_4 will have a zero dipole moment?
(a) Square planar
(b) Square pyramid (carbon at apex)
(c) Irregular tetrahedron
(d) None of these

9. Least thermally stable is – Tricky
(a) CCl_4 (b) $SiCl_4$ (c) $GeCl_4$ (d) $GeBr_4$

10. To a piece of charcoal, sulphuric acid is added. Then:
(a) there is no reaction
(b) water gas is formed
(c) SO_2 and CO_2 are evolved
(d) CO and SO_2 are evolved

11. The correct statement with respect to CO is
(a) it combines with H_2O to give carbonic acid
(b) it reacts with haemoglobin in RBC
(c) it is powerful oxidising agent
(d) it is used to prepare aerated drinks

12. CO_2 and N_2 are non-supporters of combustion. However for putting out fires CO_2 is preferred over N_2 because CO_2
(a) does not burn
(b) forms non-combustible products with burning substances
(c) is denser than nitrogen
(d) is a more reactive gas

13. Which of the following is not correct?
(a) $Ge(OH)_2$ is amphoteric
(b) $GeCl_2$ is more stable than $GeCl_4$
(c) GeO_2 is weakly acidic
(d) $GeCl_4$ in HCl forms $[GeCl_2]^{2-}$ ion

14. Which of the following is similar to graphite?
(a) B (b) BN (c) B_2H_6 (d) B_4C

15. In the following sets of reactants which two sets best exhibit the amphoteric characters of $Al_2O_3.xH_2O$?

Toughnut

Set 1: $Al_2O_3.xH_2O$ (s) and OH^- (aq)
Set 2: $Al_2O_3.xH_2O$ (s) and H_2O (l)
Set 3: $Al_2O_3.xH_2O$ (s) and H^+ (aq)
Set 4: $Al_2O_3.xH_2O$ (s) and NH_3 (aq)
(a) 1 and 2 (b) 1 and 3
(c) 2 and 4 (d) 3 and 4

16. The gas evolved on heating CaF_2 and SiO_2 with concentrated H_2SO_4, on hydrolysis gives a white gelatinous precipitate. The precipitate is:
(a) hydrofluosilicic acid
(b) silica gel
(c) silicic acid
(d) calciumfluorosilicate

17. On adding ammonium hydroxide solution to $Al_2(SO_4)_3$(aq):

Tricky

(a) A precipitate is formed which does not dissolve in excess of ammonium hydroxide
(b) A precipitate is formed which dissolves in excess of ammonia solution
(c) No precipitate is formed
(d) None of these

18. Which of the following statements are correct?
(i) Aluminium forms $[AlF_6]^{3-}$ ion while boron forms only $[BF_4]^-$ ion due to presence of *d*-orbitals in aluminium.
(ii) The first member of a group differs from the heavier members in its ability to form $p\pi$-$p\pi$ multiple bonds to itself and to other second row elements. While heavier member forms $d\pi$-$p\pi$ bonds.
(iii) *d*-orbitals contribute more to the overall stability of molecules than $p\pi$-$p\pi$ bonding of second row elements.
(a) (i) (ii) (iii) (b) (i) (iii)
(c) (i) (ii) (d) (ii) (iii)

19. An aqueous solution of $FeSO_4$, $Al_2(SO_4)_3$ and chrome alum is heated with excess of Na_2O_2 and filtered. The materials obtained are :

Critical Thinking

(a) a colourless filtrate and a green residue
(b) a yellow filtrate and a green residue
(c) a yellow filtrate and a brown residue
(d) a green filtrate and a brown residue

20. Which statement is not true about potash alum?
(a) On heating it melts and loses its water of crystallization.
(b) It's aqueous solution is basic in nature.
(c) It is used in dyeing industries.
(d) It's empirical formula is $KAl(SO_4)_2.12H_2O$.

21. Anhydrous aluminium chloride (Al_2Cl_6) is covalent compound and soluble in water giving:
(a) Al^{3+} and Cl^- ions
(b) $[Al(H_2O)_6]^{3+}$ and Cl^- ions
(c) $[AlCl_2(H_2O)_4]^+$ and $[AlCl_4(H_2O)_2]^-$ ions
(d) none of the above

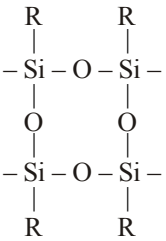
22. Borax is converted into crystalline boron by the following steps:

Critical Thinking

$$\text{Borax} \xrightarrow{X} H_3BO_3 \xrightarrow{\Delta} B_2O_3 \xrightarrow[\Delta]{Y} B$$

X and Y are respectively:
(a) HCl, Mg (b) HCl, C
(c) C, Al (d) HCl, Al

23. On controlled hydrolysis and condensation, R_3SiCl yields
(a) $R_3Si-O-SiR_3$
(b) $(R_3Si-O-SiR_3)_n$
(c) R_3SiOH
(d)



24. $B(OH)_3 + NaOH \rightarrow NaBO_2 + Na[B(OH)_4] + H_2O$
How can this reaction is made to proceed in forward direction?
(a) addition of cis 1, 2-diol
(b) addition of borax
(c) addition of trans 1, 2-diol
(d) addition of Na_2HPO_4

25. Anhydrous $AlCl_3$ cannot be obtained from which of the following reactions? Critical Thinking
(a) Heating $AlCl_3.6H_2O$
(b) By passing dry HCl over hot aluminium powder
(c) By passing dry Cl_2 over hot aluminium powder
(d) By passing dry Cl_2 over a hot mixture of alumina and coke

26. The role of fluorspar (CaF_2) which is added in small quantities in the electrolytic reduction of alumina dissolved in fused cryolite (Na_3AlF_6) is
(a) as a catalyst
(b) to make the fused mixture very conducting
(c) to increase the temperature of the melt.
(d) to decrease the rate of oxidation of carbon at the anode.

27. The correct order of increasing C – O bond length of CO, CO_2 and CO_3^{2-} is:
(a) $CO_3^{2-} < CO_2 < CO$ (b) $CO_2 < CO_3^{2-} < CO$
(c) $CO < CO_3^{2-} < CO_2$ (d) $CO < CO_2 < CO_3^{2-}$

28. In silicon dioxide
(a) there are double bonds between silicon and oxygen atoms
(b) silicon atom is bonded to two oxygen atoms
(c) each silicon atom is surrounded by two oxygen atoms and each oxygen atom is bonded to two silicon atoms
(d) each silicon atom is surrounded by four oxygen atoms and each oxygen atom is bonded to two silicon atoms.

29. Example of a three-dimensional silicate is:
(a) Zeolites (b) Ultramarines
(c) Feldspars (d) Beryls

30. Identify the incorrect statement : Tricky
(a) In $(Si_3O_9)^{6-}$, tetrahedral SiO_4 units share two oxygen atoms.
(b) Trialkylchlorosilane on hydrolysis gives R_3SiOH.
(c) $SiCl_4$ undergoes hydrolysis to give H_4SiO_4.
(d) $(Si_3O_9)^{6-}$ has cyclic structure.

31. Aluminium chloride exists as dimer, Al_2Cl_6 in solid state as well as in solution of non-polar solvents such as benzene. When dissolved in water, it gives
(a) $[Al(OH)_6]^{3-}$ 3HCl
(b) $[Al(H_2O)_6]^3$ $3Cl^-$
(c) Al^3 $3Cl^-$
(d) Al_2O_3 6HCl

32. When Al is added to NaOH solution
(a) No action takes place
(b) $NaAlO_2$ is formed and H_2 is evolved
(c) $Al(OH)_3$ is formed and H_2 is evolved
(d) Na_2AlO_2 is formed and H_2 is evolved

33. Which of the following statement(s) is / are incorrect for CO_2?
(i) In laboratory CO_2 is prepared by the action of dilute HCl on calcium carbonate
(ii) Carbon dioxide is a poisonous gas
(iii) Increase in carbon dioxide content in atmosphere lead to increase in green house effect.
(iv) CO_2 as dry ice is used as a refrigerant for ice cream and frozen food.
(a) (i) and (ii) (b) Only (ii)
(c) (i), (ii) and (iii) (d) (ii) and (iii)

34. A group 14 element is oxidised to form corresponding oxide which is gaseous in nature, when dissolved in water pH of the water decreases further addition of group 2 hydroxides leads to precipitation. This oxide can be Tricky
(a) GeO_2 (b) CO (c) CO_2 (d) SnO_2

35. PbF_4, $PbCl_4$ exist but $PbBr_4$ and PbI_4 do not exist because of
(a) large size of Br^- and I^-
(b) strong oxidising character of Pb^{4+}
(c) strong reducing character of Pb^{4+}
(d) low electronegativity of Br^- and I^-.

36. Which one of the following is a correct set for SiO_2?
(a) Linear acidic
(b) Linear,basic
(c) Tetrahedral, acidic
(d) Angular, basic.

37. Which is not the use of orthoboric acid?
(a) As an antiseptic and eye wash.
(b) In glass industry.
(c) In glazes for pottery.
(d) In borax - bead test.

38. The factor responsible for weak acidic nature of B–F bonds in BF_3 is 

(a) large electronegativity of fluorine
(b) three centred two electron bonds in BF_3
(c) $p\pi$ - $d\pi$ back bonding
(d) $p\pi$ - $p\pi$ back bonding

39. Which of the following has the minimum heat of dissociation:
(a) $(CH_3)_3N: \rightarrow BF_3$
(b) $(CH_3)_3N: \rightarrow B(CH_3)_2F$
(c) $(CH_3)_3N: \rightarrow B(CH_3)_3$
(d) $(CH_3)_3N: \rightarrow B(CH_3)F_2$

40. Lead is not affected by dil. HCl in cold because
(a) Pb is less electronegative than H
(b) PbO film is formed which resists chemical attack by acid
(c) $PbCl_2$ protective coating gets formed on Pb surface
(d) PbO_2 film is always present on Pb surface, which resist chemical attack

41. The catenation tendency of C, Si and Ge is in the order Ge < Si < C. The bond energies (in kJ mol^{-1}) of C – C, Si – Si and Ge –Ge bonds are respectively 

(a) 348, 297, 260 (b) 297, 348, 260
(c) 348, 260, 297 (d) 260, 297, 348

42. The melting pt. of group 13 follows the order
(a) B > Al > Ga > In > Tl
(b) B > Al < Ga > In > Tl
(c) B > Al > Tl > In > Ga
(d) B > Al < Ga < In < Tl

43. AlI_3, when reacts with CCl_4, gives
(a) $AlCl_3$ (b) CI_4
(c) Al_4C_3 (d) both (a) and (b)

44. Which of the following properties of aluminium makes it useful for food packaging ?
(a) Good electrical conductivity
(b) Good thermal conductivity
(c) Low density
(d) Non toxicity

45. A metal, M forms chlorides in its +2 and +4 oxidation states. Which of the following statements about these chlorides is correct?
(a) MCl_2 is more ionic than MCl_4
(b) MCl_2 is more easily hydrolysed than MCl_4
(c) MCl_2 is more volatile than MCl_4
(d) MCl_2 is more soluble in anhydrous ethanol than MCl_4

46. Among the following substituted silanes the one which will give rise to cross linked silicone polymer on hydrolysis is 

(a) R_4Si (b) R_2SiCl_2
(c) $RSiCl_3$ (d) R_3SiCl

47. Which of the following statements is false?
(a) Water gas is a mixture of hydrogen and carbon monoxide
(b) Producer gas is a mixture of CO and nitrogen
(c) Water gas is a mixture of water vapour and hydrogen
(d) Natural gas consists of methane, ethane and gaseous hydrocarbons.

48. Lead pipes are not suitable for drinking water because
(a) lead forms basic lead carbonate
(b) lead reacts with water containing air to form $Pb(OH)_2$
(c) a layer of lead dioxide is deposited over pipes
(d) lead reacts with air to form litharge

49. Choose the correct sequence for the geometry of the given molecules
Borazone, Borazole, $B_3O_6^{3-}$
['P' stands for planar and 'N' stands for non-planar] 

(a) NP, NP, NP (b) P, P, NP
(c) NP, P, NP (d) NP, P, P

50. Which out of the following compounds does not exist?
(a) BF_3 (b) $TlCl_3$
(c) $TlCl_5$ (d) Both (b) and (c)

51. Anhydrous $AlCl_3$ is prepared from

Tricky

(a) conc. HCl and Al metal
(b) aluminium and Cl_2
(c) dry HCl gas + heated Al metal
(d) dil. HCl and Al metal

52. Boric acid is polymeric due to
(a) its acidic nature
(b) the presence of hydrogen bonds
(c) its monobasic nature
(d) its geometry

53. Al_2O_3 can be converted to anhydrous $AlCl_3$ by heating

Toughnut

(a) Al_2O_3 with NaCl in solid state
(b) a mixture of Al_2O_3 and carbon in dry Cl_2 gas
(c) Al_2O_3 with Cl_2 gas
(d) Al_2O_3 with HCl gas

54. In which of the following, a salt of the type KMO_2 is obtained?
(a) $B_2H_6 + KOH(aq) \rightarrow$
(b) $Al + KOH(aq) \rightarrow$
(c) Both
(d) None

55. Bauxite ore is generally contaminated with impurity of oxides of two elements X and Y. Which of the following statement is correct?

Critical Thinking

(a) X is a non-metal and belongs to the third period while Y is a metal and belongs to the fourth period.
(b) One of two oxides has three-dimensional polymeric structure.
(c) Both (a) and (b) are correct.
(d) None of the above.

56. A solid element (symbol Y) conducts electricity and forms two chlorides YCl_n (colourless volatile liquid) and YCl_{n-2} (a colourless solid). To which one of the following groups of the periodic table does Y belong?
(a) 13 (b) 14 (c) 15 (d) 16

57. The structure and hybridization of $Si(CH_3)_4$ is
(a) Bent, sp (b) Trigonal, sp^2
(c) Octahedral, d^2sp^3 (d) Tetrahedral, sp^3

58. When steam reacts with red hot coke to form CO_2 and hydrogen :
(a) Water acts as an oxidising agent.
(b) Water acts as a reducing agent.
(c) Carbon acts as an oxidising agent.
(d) There is no oxidation or reduction.

59. Which of the following is/are not correctly matched?
(i) GeO_2 – Acidic
(ii) PbO_2– Amphoteric
(iii) CO – Neutral
(iv) SiO_2 – Amphoteric
(a) (i) and (iv) (b) (iv) only
(c) (ii) only (d) (iii) only

60. The shape of gaseous $SnCl_2$ is
(a) tetrahedral (b) linear
(c) angular (d) T-shaped

Answer KEY

1	(d)	**7**	(d)	**13**	(b)	**19**	(c)	**25**	(a)	**31**	(b)	**37**	(d)	**43**	(d)	**49**	(d)	**55**	(c)
2	(b)	**8**	(d)	**14**	(b)	**20**	(b)	**26**	(b)	**32**	(b)	**38**	(d)	**44**	(c)	**50**	(c)	**56**	(b)
3	(b)	**9**	(d)	**15**	(b)	**21**	(c)	**27**	(d)	**33**	(b)	**39**	(c)	**45**	(a)	**51**	(c)	**57**	(d)
4	(d)	**10**	(c)	**16**	(d)	**22**	(d)	**28**	(d)	**34**	(c)	**40**	(c)	**46**	(c)	**52**	(b)	**58**	(a)
5	(b)	**11**	(b)	**17**	(a)	**23**	(a)	**29**	(c)	**35**	(b)	**41**	(a)	**47**	(a)	**53**	(b)	**59**	(b)
6	(b)	**12**	(c)	**18**	(c)	**24**	(a)	**30**	(b)	**36**	(c)	**42**	(c)	**48**	(b)	**54**	(c)	**60**	(c)

Hints & Solutions

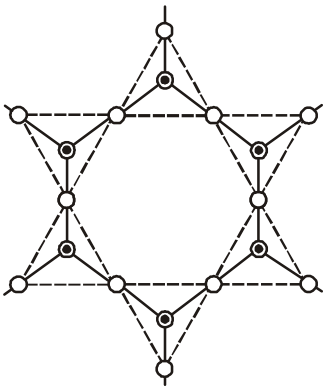
1. (d) $B(OH)_3$ is acid because it can take OH^- ions.

H_3BO_3 or $B(OH)_3 + OH^- \rightarrow B(OH)_4^-$

2. (b) The protective oxide layer prevents Al from further corrosion.

3. (b) $SiO_2 + 2NaOH \rightarrow \underset{\text{Sodium silicate}}{Na_2SiO_3} \quad H_2O$

4. (d)



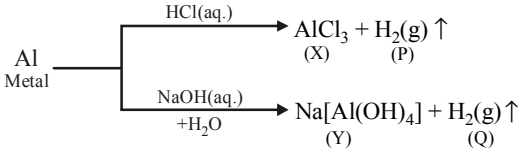
Total No. oxygen atoms per silicon atom

$= \frac{1}{2} \quad \frac{1}{2} \quad \frac{1}{2} \quad 1 \quad 2.5$

$\therefore$ Formula $Si_2O_5^{2-}$.

5. (b) $B\ OH\ _3 \quad 2H_2O \rightleftharpoons \left[B\ OH\ _4\right]^- \quad H_3O$

6. (b)



7. (d) Ge(II) tends to acquire Ge (IV) state by loss of electrons. Hence it is reducing in nature. Pb (IV) tends to acquire Pb (II) O.S. by gain of electrons. Hence it is oxidising in nature. This is due to inert pair effect.

8. (d) CCl_4 is tetrahedral in nature.

9. (d) The thermal stability of tetrahalides decreases in order

$CX_4 > SiX_4 > GeX_4 > SnX_4$ and in terms of same metal with different halides is in order of $MF_4 > MCl_4 > MBr_4 > MI_4$.

10. (c) Charcoal is a pure form of carbon, its reaction with hot conc. H_2SO_4 is as follows:

$C + 2H_2SO_4 \longrightarrow 2H_2O + 2SO_2 + CO_2$

11. (b) CO react with haemoglobin, forms carboxy haemoglobin and stopes the supply of O_2

12. (c) CO_2 being more dense covers the igniting material more effectively than N_2.

13. (b) Ge^4 is more stable than Ge^{2+}. Hence $GeCl_4$ is more stable than $GeCl_2$

14. (b) Graphite and boron nitride have similar structure.

15. (b) Aluminium oxide is amphoteric oxide because it shows the properties of the both acidic and basic oxides. It reacts with both acids and bases to form salt and water.

$Al_2O_3.xH_2O + 2NaOH \longrightarrow NaAlO_2 + H_2O$

$Al_2O_3.xH_2O + HCl \longrightarrow AlCl_3 + H_2O$

16. (d) $2CaF_2 \quad SiO_2 \quad H_2SO_4 \longrightarrow$

$SiF_4 \quad H_2O \quad CaSO_4 \xrightarrow{\text{hydrolysis}} CaSiF_4$

17. (a) $Al_2(SO_4)_3 + 6NH_4OH \longrightarrow 2Al(OH)_3 \quad 3(NH_4)_2SO_4$

$Al(OH)_3 + NaOH \longrightarrow \underset{\text{Soluble complex}}{Na^+[Al(OH)_4]^-}$

It is insoluble in NH_4OH.

18. (c) *d*-orbitals are of higher energy than the *p* -orbitals, they contribute less to the overall stability of molecules than $p\pi$-$p\pi$ bonding of the second row elements.

19. (c) The filtrate is yellow due to CrO_4^{2-} ion and residue is brown due to $Fe(OH)_3$.

20. **(b)** Alum form acidic solution due to hydrolysis of Al^3 .

21. **(c)** $AlCl_3.6H_2O \xrightarrow{\text{dissociation}} [AlCl_2(H_2O)_4]^+ [AlCl_4(H_2O)_2]^-$

22. **(d)** $\text{Borax} \xrightarrow{HCl} H_3BO_3$

$B_2O_3 \xrightarrow[\Delta]{Al} B(\text{crystalline})$

$B_2O_3 \xrightarrow[\Delta]{Mg} B(\text{Amorphous})$

23. **(a)** R_3SiCl on hydrolysis forms only a dimer.
$R_3SiOH + HOSiR_3 \rightarrow R_3Si-O-SiR_3$.

24. **(a)** H_3BO_3 acts as weak monobasic Lewis acid.
$B(OH)_3 + NaOH \rightarrow Na[B(OH)_4]$
On addition of cis-1, 2-diol in H_3BO_3 solution, acidic strength of H_3BO_3 increases due to chelation effect.

25. **(a)** $2Al + 6HCl \xrightarrow{\Delta, \text{air}} 2AlCl_3 \quad 3H_2$

$2Al + 3Cl_2 \longrightarrow 2AlCl_3$

$Al_2O_3 \quad 3C \quad 3Cl_2 \xrightarrow[\text{vapours}]{1000\ C} 2AlCl_3 \quad 3CO$

$\downarrow$ Cooling

Anhydrous $AlCl_3$

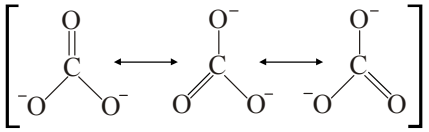
$AlCl_3.6H_2O \xrightarrow{\Delta} Al(OH)_3 \quad 3HCl \quad 3H_2O$

Thus $AlCl_3$ cannot be obtained by this method.

26. **(b)** CaF_2 when added to fused cryolite, lowers the m.p. and increases the conductivity.

27. **(d)** Structures of CO, CO_2 and CO_3^{2-} are :

$C \equiv \ddot{O} \quad O = C = O$



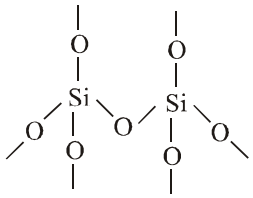
Compound	CO	CO_2	CO_3
Bond order	3	2	1.33

$\text{Bond order} \quad \frac{1}{\text{Bond length}}$

Hence, the decreasing (C — O) bond length is :

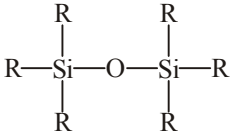
$CO < CO_2 < CO_3^{2-}$

28. **(d)** In SiO_2 (quartz), each of O-atom is shared between two SiO_4^{4-} tetrahedra.



29. **(c)** The feldspars are most abundant aluminosilicate minerals in the Earth surface. The silicon atoms and aluminium atoms occupy the centres of interlinked tetrahedra of SiO_4^{4-} and AlO_4^{5-}. These tetrahedra connect at each corner to other tetrahedra forming an intricate, three dimesional, negatively charged framework. The sodium cations sit within the voids in this structure.

30. **(b)** The hydrolysis of Trialkylchlorosilane R_3SiCl yields dimer :



31. **(b)** $Al_2Cl_6 \quad 12H_2O \rightleftharpoons$

$2[Al(H_2O)_6]^{3+} \quad 6Cl^-$

32. **(b)** $Al \quad NaOH \quad H_2O \rightarrow NaAlO_2 + H_2 \uparrow$.

33. **(b)** Carbon dioxide is not a poisonous gas.

34. **(c)** CO_2 forms carbonic acid H_2CO_3, when dissolved in water, CO is neutral, whereas other two GeO_2 and SnO_2 are solids.

35. **(b)** F and Cl are more oxidising in nature and can achieve Pb in (IV) O.S. but Br_2 and I_2 can not achieve Pb in (IV) O.S. secondly Pb^4 is strong in oxidising nature and in its presence, Br^- and I^- can not exist.

36. **(c)** SiO_2 being oxide of non metal is acidic in nature and silicon is bonded to O atoms tetrahedrally. It has giant structure.

37. **(d)** Borax on heating gives B_2O_3 and $NaBO_2$ which is glassy mass and used for borax-bead test.

38. **(d)** It is $p\pi - p\pi$ back bonding involving B and F. The smaller atoms show more back bonding.

39. **(c)** Due to + I effect of methyl groups the Lewis character of $B(CH_3)_3$ decreases and coordination becomes weaker.

40. **(c)** Pb with dil. HCl forms protective coating of $PbCl_2$.

41. **(a)** The linking of identical atoms with each other to form long chains is called catenation. However, this property decreases from carbon to lead. Decrease of this property is associated with M-M bond energy which decreases from carbon to lead.

42. **(c)** Due to structural changes, melting point, increases from Ga to Tl and Ga has the lowest melting point.

43. **(d)** AlI_3, on reaction with CCl_4, gives the $AlCl_3$

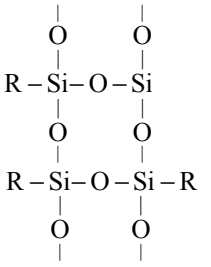
$$4AlI_3 + 3CCl_4 \longrightarrow 4AlCl_3 \quad 3CI_4$$

44. **(c)** Due to the low density of aluminium, it is useful for food packaging.

45. **(a)** Metal atom in the lower oxidation state forms the ionic bond and in the higher oxidation state the covalent bond because higher oxidation state means small size and great polarizing power and hence greater the covalent character. Hence MCl_2 is more ionic than MCl_4.

46. **(c)** The cross linked polymers will be formed by $RSiCl_3$

$$nRSiCl_3 \xrightarrow[-3nHCl]{3nH_2O} nR-Si(OH)_2-OH \longrightarrow$$



(Cross linked polymer)

47. **(a)** Water gas is $CO \quad H_2$

48. **(b)** $2Pb \quad 2H_2O \quad O_2 \rightarrow 2Pb(OH)_2$

49. **(d)** Borazone : A crystalline form of boron nitride which has diamond like structure. (Non-planar)
Borazole : Inorganic benzene : $B_3N_3H_6$ (planar)

50. **(c)** Because TI^{+5} does not exist

51. **(c)** $2Al + 3Cl_2 \xrightarrow{\Delta} 2AlCl_3$ (anhydrous)

52. **(b)** In Boric acid each B atom is sp^2 hybridized and contains BO_3^{3-} units which are held together by hydrogen bonds.

53. **(b)** Al_2O_3 can be converted to anhydrous $AlCl_3$ by heating a mixture of Al_2O_3 and carbon in dry Cl_2

$$Al_2O_3 + 3C + 3Cl_2 \xrightarrow{1000°C} \underset{\text{vapours}}{2AlCl_3} + 3CO$$

$\xrightarrow{\text{cooled}}$ Solid anhydrous aluminium chloride

54. **(c)** $B_2H_6 \quad 2KOH \quad 2H_2O \rightarrow \underset{\text{Potassium metaborate}}{2KBO_2} \quad 6H_2$

$2Al \quad 2KOH \quad 2H_2O \rightarrow \underset{\text{Potassium meta aluminate}}{2KAlO_2} \quad 3H_2$

55. **(c)** Two oxides present in bauxite as an impurity are SiO_2 and Fe_2O_3. Si belongs to the third period and Fe to the fourth period. SiO_2 has a three dimensional structure.

56. **(b)** $SnCl_4$ is colourless volatile liquid and $SnCl_2$ is colourless solid Sn conducts electricity and it belongs to 14 group.

57. **(d)** Hybridisation $\frac{1}{2}(4 \quad 4 \quad 0-0) \quad 4$, sp^3 tetrahedral.

58. **(a)** $\underset{\text{Steam}}{H_2O} + C \longrightarrow CO_2 \quad H_2$

H_2O oxidises $C \longrightarrow CO_2$,
hence H_2O acts as oxidising agent.

59. **(b)** SiO_2 is acidic oxide.

60. **(c)** Shape of $SnCl_2$ is angular due to sp^2 hybridisation and having the following structure