Chapter 11

The *p*-Block Elements

Solutions (Set-1)

Very Short Answer Type Questions :

1. Boron compounds are known as Lewis acid. Explain.

Sol. Boron forms three covalent bonds in its compounds hence need more electrons to complete its octet hence its compounds are Lewis acid.

2. Why does boron differ in properties from aluminium?

Sol. Boron has s^2-grouping (two electrons in penultimate shell) while aluminium has s^2p^6-grouping (eight electrons).

3. Write general electronic configuration of group 13 elements.

Sol. ns^2np^1.

4. The size of gallium is smaller than aluminium. Why?

Sol. Due to poor shielding of 3*d* orbital.

5. Give the names of two elements of boron family which do not react with alkali solutions.

Sol. Indium and thallium.

6. Why is there large decrease in ionization potential from carbon to silicon?

Sol. It is due to increase in size of atom.

7. Name any oxide of carbon which is neutral in nature.

Sol. CO (Carbon monoxide).

8. Tetrahalides cannot increase its co-ordination number, why?

Sol. Due to unavailability of vacant *d* orbitals.

9. Why does carbon show anomalous behaviour with the rest of the members of family?

Sol. Carbon shows anomalous behaviour due to its smaller size, higher electronegativity, higher ionization enthalpy and unavailability of *d* orbitals.

10. How can fullerene be prepared?

Sol. By strong heating of a sample of graphite in presence of inert atmosphere.

Short Answer Type Questions :

11. Why boron family is considered as most heterogeneous family?

Sol. It is most heterogeneous family as there is no regular trend in all properties, because of presence after *d*-block, Lanthanoid contraction, poor shielding of *d*-orbitals, they have large deviation in properties.

12. When we move down the group in boron family what is the change in stability of +3 oxidation state and stability of +1 oxidation state and why?

Sol. Stability of +3 oxidation decreases while stability of +1 oxidation state increases due to inert pair effect in boron family.

13. Why acidic strength increases from BF_3 to BI_3 in boron family?

Sol. Acidic strength is inversely proportional to back-bonding as back-bonding decreases from BF_3 to BI_3 as follows

$$BF_3 > BCl_3 > BBr_3 > BI_3$$

Hence Lewis acid *i.e.*, strength will increase as under

$$BF_3 < BCl_3 < BBr_3 < BI_3$$

14. The first ionization energy increases from Sn to Pb. Why?

Sol. First ionization energy increases from Sn to Pb slightly due to lanthanide contraction and increase of 32 units of nuclear charge in Pb over Sn.

15. What is the reason for decrease in catenation tendency down the group in carbon family?

Sol. Catenation tendency decreases down the group in carbon family because down the group size increases electronegativity decreases hence catenation tendency decreases, order is

$$C >> Si > Ge \approx Sn$$

16. Why diamond is a bad conductor of heat and electricity?

Sol. Diamond is a poor conductor of heat and electricity because all four electrons in carbon all involved in bonding. There is no free electron.

17. Why graphite is used as a lubricant at high temperature?

Sol. Graphite is used as a lubricant at high temperature because oil or grease burns or denatured at high temperature but graphite does not get denatured even at high temperature so preferred over oil and grease.

18. What kind of structure Buckminster fullerene have?

Sol. It has football-like structure. It contains 20 hexagonal six-membered ring and 12 pentagonal five-membered ring. Every ring in this structure is aromatic.

19. On what factors, the thermal stability of carbon family halide depend and how it changes?

Sol. Thermal stability decreases with increasing atomic size or molecular mass of tetrahalide or due to decreasing polarity.

$$CX_4 > SiX_4 > GeX_4 > SnX_4 > PbX_4$$

$$CF_4 > CCl_4 > CBr_4 > CI_4$$

20. Give chemical reactivity of carbon family towards water.

Sol. In this family, three members *i.e.*, carbon, silicon and germanium are affected by water while lead is not affected by water due to formation of protective oxide film but tin decomposes steam into tin dioxide and hydrogen gas.

21. What is the reason for decrease in oxidising power of carbon family?

Sol. On moving down the group from carbon to lead, stability of +4 oxidation state decreases while stability of +2 oxidation state increases and hence decreases oxidising power down the group due to inert pair effect.

22. Give hydrolysis of silicon tetrafluoride.

Sol. Hydrolysis of silicon tetrafluoride gives silica and fluorosilicic acid

$$3SiF_4 + 2H_2O \longrightarrow \underset{\text{Silica}}{SiO_2} + \underset{\text{Fluorosilicic acid}}{2H_2SiF_6}$$

23. Write about structure of graphite.

Sol. It has layered structure. These layers are attracted by van der Waals force. Each carbon has one free electron in *p*-orbital. So, it is a good conductor of electricity. Each carbon is sp^2 hybridised. Carbon-carbon bond length is 141.5 pm and distance between adjacent graphite layer is 340 pm.

24. Give use of boron fibre.

Sol. It is mixed with plastic to form a material which is lighter than aluminium but tougher and stiffer than steel hence it is used in body armour, missiles and aircrafts.

25. Give few uses of alumina (Al_2O_3).

Sol. Uses of alumina are as follows.

(i) When heated strongly forms alundun which is used as abrasive.

(ii) It is used in chromatography.

(iii) It is used in making bauxite bricks which are used for lining furnaces.

26. Give reaction of boron with conc. H_2SO_4 and HNO_3.

Sol. (i) Reaction of boron with conc. H_2SO_4

$$2B(s) + 3H_2SO_4(aq) \longrightarrow 6H^+ + 2BO_3^-(aq) + 3SO_2(g)$$

(ii) Reaction of boron with conc. HNO_3

$$B(s) + 3HNO_3(aq) \longrightarrow 3H^+(aq) + BO_3^-(aq) + 3NO_2(g)$$

27. Reaction of BF_3 with NH_3 results in formation of $\overset{+}{N}H_3 — \overset{-}{B}F_3$. What is the change in structure and geometry?

Sol. During this reaction, hybridisation of BF_3 changes to sp^3 as one more bond *i.e.*, coordinate bond is formed with nitrogen. Here shape changes to tetrahedral (Irregular).

28. Identify acidic, basic or amphoteric oxide among the following.

B_2O_3, Al_2O_3, Ga_2O_3, In_2O_3, TlO_3

Sol. B_2O_3 — Acidic oxide

Al_2O_3 — Amphoteric oxide

Ga_2O_3 — Amphoteric oxide

In_2O_3 — Basic oxide

Tl_2O_3 — Basic oxide

29. Why is there irregularity in metallic character in gallium on moving down the group in boron family?

Sol. Irregularity in metallic character in gallium is because of shielding effect. In gallium, 10 electrons are filled in *d*-orbitals hence have less shielding so size decreases and metallic character decreases.

30. What is trend in first ionization energy on moving down the group in boron family?

Sol. Ionization enthalpy, the general trend do not decrease smoothly down the group. I^{st} ionization energy decreases from B to Al, but increases from Al to Ga.

Decreasing order of I^{st} ionization energy is as follows : B > Tl > Ga > Al > In

Long Answer Type Questions :

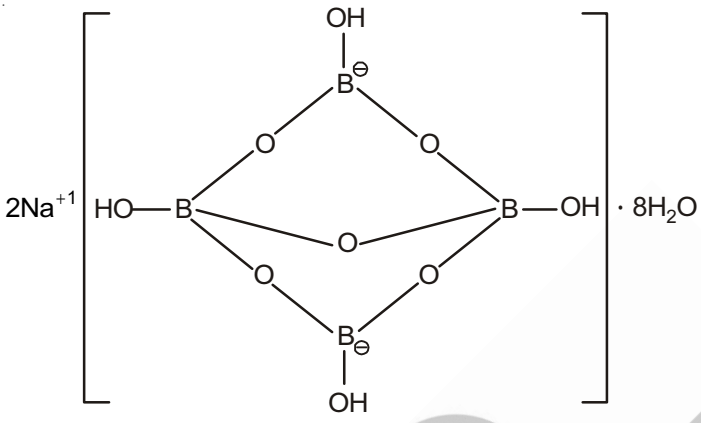
31. (i) Give the chemical formula and the structure of borax.

(ii) (a) How many boron atoms are involved in sp^2 hybridisation?

(b) How many boron atoms are having planar shape in the structure of borax?

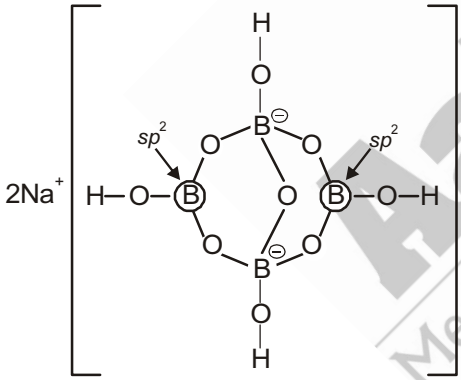
(c) How many boron atoms are involved in sp^3 hybridisation?

Sol. (i) Borax is $Na_2B_4O_7 \cdot 10\ H_2O$ / $Na_2\ [B_4O_5\ (OH)_4] \cdot 8\ H_2O$



(ii) (a) Number of B in sp^2 hybridisation = 2

(b) In borax structure, two boron atoms are sp^2 hybridized and other two boron atoms are sp^3 hybridized. So two boron atoms are having planner geometry & two boron atoms are having tetrahedral geometry.

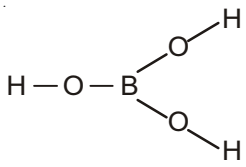


(c) Number of B in sp^3 hybridisation = 2

32. (i) Give structure of orthoboric acid and give its few physical properites.

(ii) Give reaction of orthoboric acid with water also explain its Lewis acid character.

Sol. (i) $H^{\oplus}\ [B(OH)_4]^{\ominus}$ has structure as below

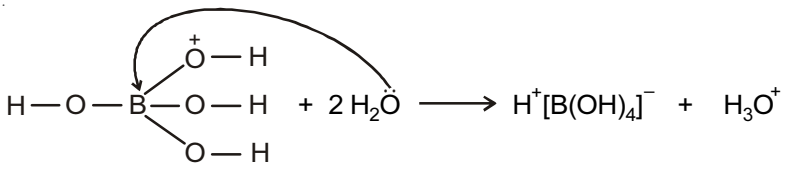


Physical properties of boric acid are :

(a) It is white, soft needle-like crystals.

(b) It has soapy touch.

(ii) Reaction with water

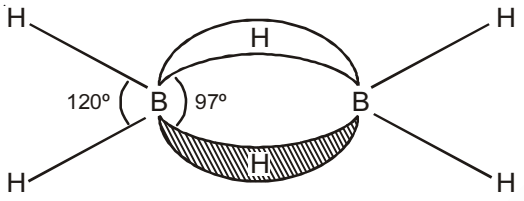


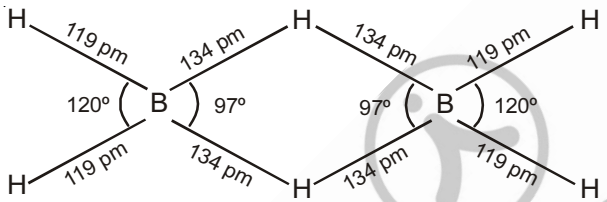
It is a Lewis acid as oxygen gives one electron to boron so it acquires positive charge and becomes unstable. So it furnishes $1H^+$ and get stable.

33. (i) Draw and explain structure of diborane.

(ii) Write any three preparations methods of diborane.

Sol. (i)





It is 3 centre 2 electron bonding called banana bonding or bridge bonding.

Number of bonds of bond length 119 pm = 4

Number of bonds of bond length 134 pm = 4

Number of bonds of bond angle 97º = 2

Number of bonds of bond angle 120º = 2

Number of atoms present in same plane = 4

(ii) Three preparation of diborane are :

(a) $LiAlH_4 + BF_3 \longrightarrow B_2H_6 + AlF_3 + LiF$

(b) $NaBH_4 + BF_3 \longrightarrow B_2H_6 + NaF$

(c) $NaH + BF_3 \longrightarrow B_2H_6 + NaF + H_2$

34. Give two uses each of

(i) Boron fibres

(ii) Borax

(iii) Boric acid

(iv) Alumina

(v) Alums

Sol. (i) **Boron fibers** : It is mixed with plastic to form a material which is lighter than aluminium but tougher and stiffer than steel.

(a) It is used in body armour.

(b) It is used in missiles and aircrafts.

(ii) **Borax :**

(a) It is used in manufacture of enamels and glazes for pottery and tiles.

(b) It is also used in making optical glasses and pyrosilicate glasses.

(iii) **Boric acid** :

(a) It is used in glass industry, food industry and as preservative.

(b) It is also used as an antiseptic and eye wash.

(iv) **Alumina :**

(a) Used in chromatography.

(b) Used in making bauxite bricks.

(v) **Alums :**

(a) Used in purification of water.

(b) Used as an antiseptic and as a mordant.

35. (i) What do you mean by allotrope?

(ii) How many allotropes of carbon are there?

(iii) Write about fullerene (in short).

Sol. (i) Those compounds of carbon which have similar chemical properties but different physical properties are called allotropes of carbon.

(ii) Carbon exists in two allotropic forms – crystalline and amorphous

Crystalline forms are : Diamond and graphite

Amorphous forms are : Coal, charcoal and lamp black

Third form is fullerenes.

(iii) Most common fullerenes is C_{60} called Buckminster fullerene which has football-like structure. It contains 20 hexagonal six-membered rings and 12 pentagonal five-membered rings. Every ring in this structure is aromatic. It is used to make ball bearings.

36. (i) Why CO is called silent killer?

(ii) Give any three preparation methods of carbon monoxide.

Sol. (i) Carbon monoxide reacts 300 times with haemoglobin than O_2 that is why carbon monoxide is called silent killer.

(ii) **Preparations :**

(a) CO is formed due to incomplete combustion of carbon

$$2C + O_2 \xrightarrow{\Delta} 2CO$$

(b) Dehydration of formic acid

$$HCOOH \xrightarrow[\text{conc. } H_2SO_4]{373\ K} H_2O + CO$$

(c) Passing steam over coke

$$C + H_2O \xrightarrow{437-1273\ K} \underbrace{CO + H_2}_{\text{Water gas}}$$

37. (i) Give resonating structure of CO_2.

(ii) Why is this gas called greenhouse gas?

(iii) What is hybridisation of carbon in CO_2?

(iv) What is geometry of CO_2 molecule?

(v) Give number of sigma bonds involved in CO_2 formation.

Sol. (i) $\overset{-}{:\ddot{O}}-C\equiv O:^{+} \longleftrightarrow :\ddot{O}=C=\ddot{O}: \longleftrightarrow \overset{+}{:}O\equiv C-\ddot{O}:^{-}$

(ii) This gas contributes to raise the temperature of atmosphere hence increases greenhouse effect.

(iii) Hybridisation of carbon in carbon dioxide is sp^2.

(iv) Geometry of CO_2 molecule is linear.

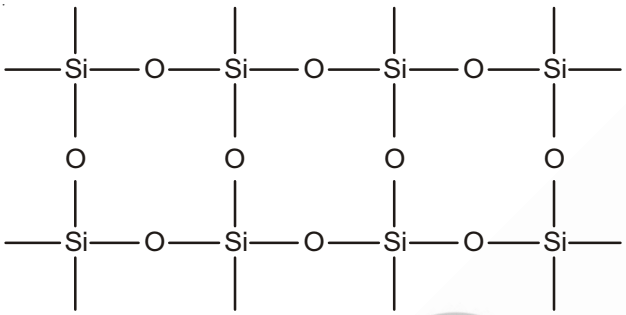
(v) Two sigma bonds.

38. (i) Why silica is almost non-reactive?

(ii) Draw and explain structure of silica.

Sol. (i) Because of very high silicon-oxygen bond enthalpy silica is nearly non-reactive.

(ii)



The entire crystal may be considered as giant molecule in which eight-membered rings are formed with alternate silicon and oxygen atoms.

39. Explain preparation of silicone with the help of chemical reaction.

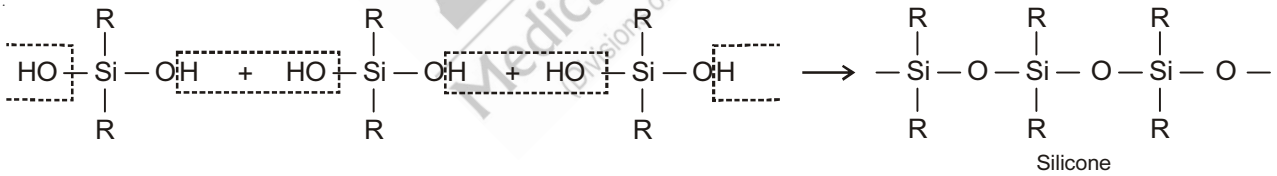
Sol. Alkyl chloride reacts with silicon at 573 K in presence of copper catalyst to given dialkyl dichlorosilane with other substituted chlorosilane.

$$2R_2Cl + Si \xrightarrow[570\ K]{Cu\ powder} R_2SiCl_2$$

Which on hydrolysis gives dialkyl dihydroxy silane.

$$R_2SiCl_2 \xrightarrow[-2HCl]{+2H_2O} R_2Si(OH)_2$$

Which on polymerisation gives silicones. Alkyl here is methyl.



Silicone

40. (i) Define silicates.

(ii) What is hybridisation of Si in SiO_4^{-4}?

(iii) Draw the structure of SiO_4^{-4}.

(iv) Give any two examples of orthosilicates.

Sol. (i) Oxide anion of silicon is known as silicates.

(ii) Hybridisation of Si in SiO_4^{4-} in sp^3.

(iii) Two examples of orthosilicates are sodium orthosilicate (Na_4SiO_4) and calcium orthosilicate (Ca_2SiO_4).

41. (i) Give any three uses of zeolites.

(ii) Explain structure of zeolites.

Sol. (i) When in 3-D structure of silicon dioxide some aluminium atoms replace few silicon atoms and then Na^+, K^+, Ca^{2+} etc. balance negative charge produced then they given zeolites.

(ii) Uses of zeolites are :

(a) Softening hard water by ion-exchanging.

(b) Converting alcohols directly into gasoline (ZSM-5).

(c) As catalyst in petrochemical industries.

42. (i) Name a crude form of carbon.

(ii) How is it formed?

(iii) What are its successive stages of transformation?

(iv) Name its superior quality.

Sol. (i) Crude form of carbon is coal.

(ii) It has been formed in nature as a result of slow decomposition of vegetable matter under the influence of heat pressure and limited supply of air.

(iii) Successive stages of transformation are : peat, lignite, bituminous, steam, coal and anthracite.

(iv) The superior quality is anthracite which burns with non-sooty flame.

43. (i) Why is graphite used as lubricant?

(ii) What are its type and how are they different from each other?

Sol. (i) Graphite has layered structure. These layers are attracted by weak van der Waals force hence these layers can slip over one another. Therefore, graphite is used as a lubricant.

(ii) Graphite has two forms : α-graphite and β-graphite.

α-graphite : In α-graphite layers are arranged in sequence ABAB with the third layer exactly above first layer.

β-graphite : In β-graphite the layers are arranged as ABCABC... the two forms are interconvertible.

44. (i) Name second most abundant element in earth crust.

(ii) Why do properties of silicon differ from germanium inspite of same electronegativity?

(iii) Why does properties of tin different from germanium inspite of same electronegativity?

Sol. (i) Second most abundant element in earth crust is silicon.

(ii) Properties of silicon differs from germanium due to poor shielding effect of 3*d* subshell.

(iii) Properties of germanium is different from tin due to poor shielding effect of 4*f* subshell (lanthanoid contraction).

45. Write the following reactions with products.

(i) Reaction of boron with oxygen.

(ii) Reaction of aluminium with nitrogen.

(iii) Reaction of boron with conc. H_2SO_4.

(iv) Reaction of aluminium with aq. NaOH and H_2O.

(v) Reaction of boron with chlorine.

Sol. (i) $2B(s) + 3O_2(g) \xrightarrow{\Delta} 2B_2O_3(s)$

(ii) $2Al(s) + N_2(g) \xrightarrow{\Delta} 2AlN$

(iii) $2B(s) + 3H_2SO_4(aq) \longrightarrow 6H^+(aq) + 2BO_3^-(aq) + 3SO_2(g)$

(iv) $2Al(s) + 2NaOH(aq) + 2H_2O \longrightarrow 2NaMO_2(s) + 3H_2(g)$

(v) $B(s) + Cl_2(g) \longrightarrow BCl_3$

❑ ❑ ❑

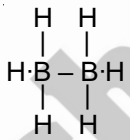
Chapter 11

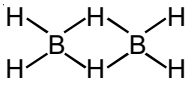
The *p*-Block Elements

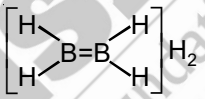
Solutions (Set-2)

1. The correct structural representation of diborane is

(1) $[BH_2]^+ [BH_4]^-$

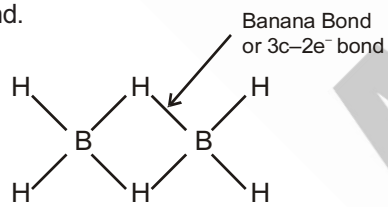
(2) 

(3) 

(4) 

Sol. Answer (3)

Diborane is an electron deficient compound to minimize electronic deficiency it forms. 2 electron- three center bond.



2. The following sequence of reactions is used to convert Borax into Boron (B)

$$\underset{\text{Borax}}{Na_2[B_4O_5(OH)_4].8H_2O} \xrightarrow{X} H_3BO_3 \xrightarrow{\Delta} B_2O_3 \xrightarrow{Y} \underset{\text{Boron}}{B}$$

Reagents X and Y are respectively

(1) Acid, Al (2) Base, C (3) Base, Fe (4) Acid, Mg

Sol. Answer (4)

Borax in acidic medium give Boric acid, which on heating forms B_2O_3. B_2O_3 when reduced with some reactive metal forms boron.

$$B_2O_3 \xrightarrow[\text{or Mg}]{\text{Na}} B + MgO$$

3. Which of the following reaction represents the correct product formation?

(1) $Al_4C_3 + H_2O \longrightarrow CH_4$ (2) $Mg_2C_3 + H_2O \longrightarrow CH \equiv CH$

(3) $CaC_2 + H_2O \longrightarrow C_2H_4$ (4) $Be_2C + H_2O \longrightarrow CH_3 - C \equiv CH$

Sol. Answer (1)

$Al_4C_3 + H_2O \rightarrow CH_4 + Al(OH)_3$

4. Stability of trivalent cation of group 13 will be in order

(1) $Ga^{3+} > In^{3+} > Tl^{3+}$ (2) $Tl^{3+} > In^{3+} > Ga^{3+}$ (3) $In^{3+} > Ga^{3+} > Tl^{3+}$ (4) $In^{3+} > Tl^{3+} > Ga^{3+}$

Sol. Answer (1)

As we go down the group higher oxidation states becomes less stable due to inert pair effect.

5. Ionisation of boric acid in aqueous medium gives which one of the following?

(1) $[B(OH)_4]^-$ (2) $[B(OH)_2O]^-$ (3) $[B(OH)O_2]^{2-}$ (4) $[BO_3]^{3-}$

Sol. Answer (1)

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

6. Boron compounds behave as Lewis acids because of their

(1) Ionisation property (2) Electron deficient nature

(3) Acidic nature (4) Covalent nature

Sol. Answer (2)

Boron compounds behave as Lewis acid because of their electron deficient nature.

7. From B_2H_6 all the following can be prepared, except

(1) H_3BO_3 (2) $B_2(CH_3)_4H_2$ (3) $B_2(CH_3)_6$ (4) $NaBH_4$

Sol. Answer (3)

From B_2H_6, only four terminal hydrogen can be substituted by (CH_3) group, so we cannot prepare $B(CH_3)_6$. While other compounds can be prepared.

8. The type of hybridisation of boron in diborane is

(1) *sp*-hybridisation (2) sp^2-hybridisation (3) sp^3-hybridisation (4) sp^3d^2-hybridisation

Sol. Answer (3)

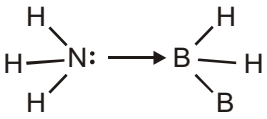
sp^3 hybridisation is present in B_2H_6.

9. Specify the co-ordination geometry around and hybridisation of N and B atoms in a 1 : 1 complex of BF_3 and NH_3

(1) N is tetrahedral, sp^3; B is tetrahedral, sp^3 (2) N is pyramidal, sp^3; B is pyramidal, sp^3

(3) N is pyramidal, sp^3; B is planar, sp^2 (4) N is pyramidal, sp^3; B is tetrahedral sp^3

Sol. Answer (1)



Both are tetrahedral and sp^3 hybridised.

10. Boron nitride on reacting with steam gives

(1) NH_3 (2) N_2O (3) Na_2BO_2 (4) NO_2

Sol. Answer (1)

$(BN)_x$ decompose with steam under high pressure to from ammonia.

11. Borax is written as

(1) $Na_2[B_4O_5(OH)_4]\cdot 8H_2O$ (2) $Na_2B_4(OH)_7O_2\cdot 3H_2O$

(3) $Na_2OB_4O_8H_2$ (4) $Na_2B_4O_{17}H_2O$

Sol. Answer (1)

$Na_2[B_4O_5(OH)_4].8H_2O$.

12. General oxidation state shown by group 13 elements is

(1) +1 and +3 (2) +1, +2 and +3 (3) +2, +3 and +4 (4) +1 and +4

Sol. Answer (1)

13. Which one of the following elements of group 13 can react with alkali solutions to give H_2 gas?

(1) Boron (2) Aluminium (3) Gallium (4) All of these

Sol. Answer (4)

14. Order of boiling point of boron trihalides is as follows

(1) $BI_3 > BBr_3 > BCl_3 > BF_3$ (2) $BF_3 > BCl_3 > BBr_3 > BI_3$

(3) $BCl_3 > BF_3 > BBr_3 > BI_3$ (4) $BI_3 > BBr_3 < BF_3 < BCl_3$

Sol. Answer (1)

15. When we heat borax strongly then it will yield the following compound

(1) $NaBO_2$ (2) B_2O_3 (3) $Na_2B_4O_7$ (4) Both (1) & (2)

Sol. Answer (4)

16. Carbon and silicon belong to (14) group. The maximum coordination number of carbon in commonly occurring compounds is 4, whereas that of silicon is 6. This is due to

(1) Availability of low lying *d*-orbitals in silicon (2) Large size of silicon

(3) More electropositive nature of silicon (4) Both (2) & (3)

Sol. Answer (1)

Silicon can show a coordination number of six because of availability of low lying *d* orbitals for hybridization.

17. Shortest C – O bond is present in

(1) Carbon monoxide (2) Carbon dioxide (3) Carbonate ion (4) Acetone

Sol. Answer (1)

Bond order in Carbon mono-oxide is 3. Therefore, C — O bond is shortest in CO. $\left(\text{B.O.} \propto \frac{1}{\text{Bond length}}\right)$.

18. In graphite, electrons are

(1) Localised on each carbon-atom (2) Localised on every third C-atom

(3) Delocalised within the layer (4) Present in anti-bonding orbital

Sol. Answer (3)

Graphite forms sheet like structure where each carbon is sp^2 hybridized and it has conjugated π bonds which result into delocalization of electrons and hence graphite conducts electricity.

19. Thermodynamically the most stable form of carbon is

(1) Diamond (2) Graphite (3) Peat (4) Coal

Sol. Answer (2)

Graphite is taken as thermodynamically most stable.

20. Carbon dioxide is used for extinguishing fire because

(1) It has a relatively high critical temperature

(2) In solid state, it is called dry ice

(3) It is neither combustible nor a supporter of combustion

(4) It is a colourless gas

Sol. Answer (3)

CO_2 is neither combustible nor a supporter of combustion.

21. Which one of the following elements forms double or triple bond involving $p\pi$-$p\pi$ bonding?

(1) Carbon (2) Silicon (3) Germanium (4) Tin

Sol. Answer (1)

22. Allotropy is due to

(1) Difference in the number of atoms in the molecules

(2) Difference in the arrangement of atoms in the molecules in the crystal

(3) Difference in physical properties

(4) All of these

Sol. Answer (4)

23. Which one of the following elements of group 14 have maximum allotropes?

(1) Tin (2) Germanium (3) Silicon (4) Lead

Sol. Answer (1)

24. Organosilicon polymers containing Si—O—Si linkage is called

(1) Silicates (2) Silicones (3) Glass (4) Silica

Sol. Answer (2)

25. Number of points at which tetrahedral units are linked in pyrosilicates is

(1) Five point (2) Six point (3) Two point (4) One point

Sol. Answer (4)

26. Correct among the following.

(1) Trimethylamine is better base than trisilylamine

(2) BF_3 does not form dimer as B – F bond is less polar

(3) Hydrides are the only species which may form 3 centre 2 e^- bond

(4) All the hydrides of 14^{th} group form 3 centre 2 electron bonds

Sol. Answer (1)

Due to backbonding BF_3 becomes poorer acid.

27. Chain silicates can be represented as

(1) $(Si_2O_7^{6-})$ (2) $(SiO_4^{4-})_n$ (3) $(Si_2O_6)_n^{-4}$ (4) $(Si_2O_5)_n^{2-}$

Sol. Answer (3)

As two ortho-silicate units share two common oxygen atoms.

28. Identify correct order of 1st Ionization energy of Boron family.

(1) B > Al > Ga > In (2) B > Ga > In > Al (3) B > Ga > Al > In (4) In > Al > B > Ga

Sol. Answer (3)

B = 800.6 kJ/mol

Al = 577.6 kJ/mol

Ga = 578.8 kJ/mol

29. Which of the following Property is not similar for Beryllium and Aluminium?

(1) Amphoteric nature of oxide (2) Reaction of carbide with water

(3) Formation of Polymeric structure by chloride (4) Formation dimer of chloride

Sol. Answer (3)

Only $BeCl_2$ form polymer.

30. Identify the correct statement about diborane.

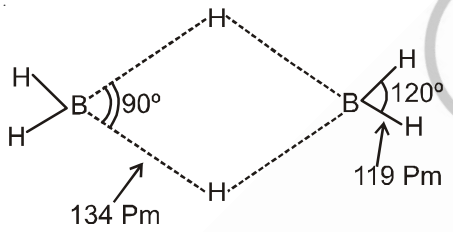
(1) 4 terminal B–H bond length is greater than the Bridged B–H bond length

(2) The bridged BHB bonds lie in a plane made by the other 6 atoms

(3) Terminal HBH bond angle is 120º.

(4) Bridged HBH bond angle is 90º

Sol. Answer (3)



31. Select the incorrect statement.

(1) Naturally occurring carbon contains two stable isotopes C^{12} and C^{13}

(2) C^{14} is a radioactive isotope with a half life of 5770 years

(3) Si is the second most abundant element on earth's crust by mass

(4) $SiCl_4$ cannot be hydrolysed as its *p*-orbitals are completely filled

Sol. Answer (4)

$SiCl_4$ is hydrolysed to give $Si(OH)_4$. The hydrolysis occur by donation of lone pair of electrons to vacant *d*-orbitals in Si.

32. Which of the following is correct representation of cyclic silicate?

(1) $Si_2O_7^{-6}$ (2) $\left(Si_2O_5^{-2}\right)_n$ (3) $\left(SiO_3\right)_n^{-2n}$ (4) $\left(Si_2O_3^{-2}\right)_n$

Sol. Answer (3)

Cyclic silicate is $\left(SiO_3\right)_n^{-2n}$.

33. Identify the incorrect statement about tin or its compound.

(1) Tin cry is cracking sound produced during its bending

(2) Tin disease (plague) is related to the conversion of white tin to grey tin

(3) Tin remain unaffected by hot alkali solution

(4) Stannous chloride is solid whereas stannic chloride is liquid

Sol. Answer (3)

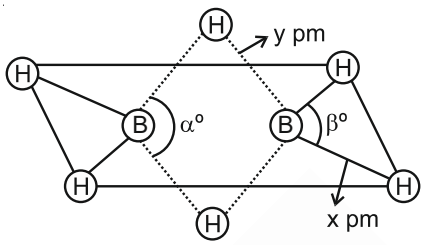
$Sn + 2NaOH + H_2O \rightarrow Na_2SnO_3 + 2H_2$

Sodium Stannate

$\underset{\text{(Grey)}}{\alpha\text{-tin}} \underset{}{\overset{15.2^\circ C}{\rightleftharpoons}} \underset{\text{(White)}}{\beta\text{-tin}}$

$SnCl_2$ is more ionic whereas $SnCl_4$ is more covalent according to Fajan rule.

34. Consider the structure of diborane and identify the correct option.



(1) x = y (2) x > y (3) $\beta > \alpha$ (4) $\alpha > \beta$

Sol. Answer (3)

$\alpha = 97^\circ$, $\beta = 120^\circ$, x = 119 pm, y = 134 pm

35. In which of the following reaction, $H_2(g)$ is not obtained as one of the products?

(1) $Al(s) + HCl\ (aq) \longrightarrow$ (2) $Al(s) + NaOH(aq) \longrightarrow$

(3) $3B_2H_6 + 6NH_3 \xrightarrow{heat}$ (4) $B_2H_6 + 3O_2 \longrightarrow$

Sol. Answer (4)

$B_2H_6 + 3O_2 \longrightarrow B_2O_3 + 3H_2O$

36. Which of the following is correct order of stability of + 1 oxidation state for Boron family elements?

(1) B > Al > Ga > In > Tl (2) Tl > In > Ga > Al > B

(3) B < Al < Ga < In = Tl (4) B = Al < Ga < In < Tl

Sol. Answer (2)

Stability of +1 oxidation number increases down the group and +3 decreases down the group.

37. Identify the incorrect statement regarding Buckminster fullerene.

(1) It is the only pure form of carbon

(2) It has smooth structure without dangling bonds

(3) It has 20 six-membered rings and 12 five-membered rings

(4) It is not aromatic in nature

Sol. Answer (4)

Fullerene is aromatic in nature.

38. Which of the following element shows maximum tendency of catenation?

(1) C (2) Si (3) Ge (4) Sn

Sol. Answer (1)

Catenation power decreases down the group.

❑ ❑ ❑