CH11 – P BLOCK ELEMENTS

Question 1. Discuss the pattern of variation in the oxidation states of (i) B to Tl (ii) C to Pb.

Answer: (i) B to Tl

Common oxidation states are +1 and +3. The stability of +3 oxidation state decreases from B to Tl. +1 oxidation state increases from B to Tl.

(ii) C to Pb

The common oxidation states are +4 and +2. Stability of +4 oxidation state decreases from C to Pb.

Details can be seen from the text part.

Question 2. How can you explain higher stability of BCl3 as compared to $TlCl_3$?

Answer: BCl_3 is quite stable. Because there is absence of d- and f-electrons in boron three valence electrons ($2s^2\ 2p_{x1}$) are there for bonding with chlorine atom. In Tl the valence s-electron ($6s^2$) are experiencing maximum inert pair effect. Thus, only $6p^1$ electron is available for bonding. Therefore, BCl_3 is stable but $TlCl_3$ is comparatively unstable.

Question 3. Why does borontrifluori.de behave as a Lewis acid?

Answer: In BF_3, central atom has only six electrons after sharing with the electrons of the F

atoms. It is an electron-deficient compound and thus behaves as a Lewis acid.

Question 4. Consider the compounds, BCl_3, and CCl_4. How will they'behave with water justify?

Answer: In BCl_3, there is only six electrons in the valence shell of B atom. Thus, the octet is incomplete and it can accept a pair of electrons from water and hence BCl_3 undergoes hydrolysis. Whereas, in CCl_4, C atom has 8 electrons and its octet is complete. That's why it has no tendency to react with water.

$CCl_4 + H_20$ ————————> No reaction

Question 5. Is boric acid a protonic acid? Explain.

Answer: Boric acid is a Lewis acid, it is not a protonic acid.

Boric acid accepts electrons from hydroxyl ion of H_2O molecule.

$B(OH)_3 + 2HOH \longrightarrow [B(OH)_4]^- + H_3O^+$

Question 6. Explain what happens when boric acid is heated.

Answer: On heating boric acid above 370 K, it forms metaboric acid, HB02 which on further heating yields boric oxide B_2O_3.

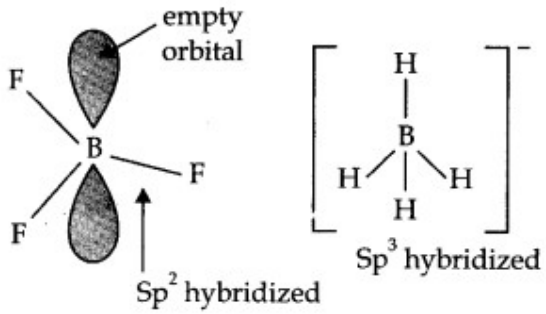
$$H_3BO_3 \xrightarrow{\Delta} HBO_2 \xrightarrow{\Delta} B_2O_3$$

Question 7. Describe the shapes of BF_3 and BH_4^-. Assign the hybridisation of boron in these species.

Answer: In BF_3, boron is SP^2 hybridized.

$\therefore$ shape of BF_3 = planar.

In $[BH_4]^-$, boron is sp3 hybridized, thus the shape is tetrahedral.



Question 8. Write reactions to justify amphoteric nature of aluminium.

Answer: Aluminium reacts with acid as well as base. This shows amphoteric nature of aluminium.

$2Al(s) + 6HCl(dil.) \longrightarrow 2AlCl_3(aq) + 3H_2(g)$

$2Al(s) + 2NaOH(aq) + 6H_2O(l) \longrightarrow 2Na + [Al(OH)_4]^-(aq) + 3H_2(g)$

Question 9. What are electron deficient compounds? Are BCl_3 and $SiCl_4$ electron deficient species? Explain.

Answer: Electron deficient species are those in which the central atom in their molecule has the tendency to accept one or more electron pairs. They are also known as Lewis acid. BCl_3 and $SiCl_4$ both are electron deficient species.

Since, in BCl_3, B atom has only six electrons. Therefore, it is an electron

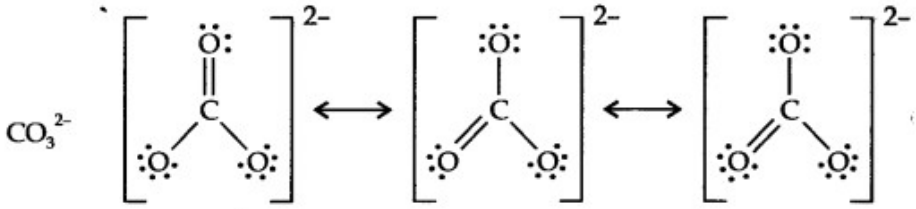
deficient compound.

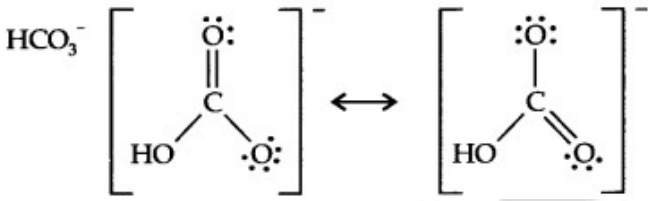
In $SiCl_4$ the central atom has 8 electrons but it can expand its covalency beyond 4 due to the presence of d-orbitals.

Thus, $SiCl_4$ should also be considered as electron-deficient species.

Question 10. Write the resonance structure of CO_3^{2-} and HCO_3^- .

Answer:





Question 11. What is the state of hybridisation of carbon in
(a) CO_3^{2-} (b) diamond (c) graphite?

Answer: (a) CO_3^{2-} (sp^2) (b) Diamond (sp^3) (c) Graphite (sp^2)

Question 12. Explain the difference in properties of diamond and graphite on the basis of their structures.

Answer:

- Since diamond exists as a three dimensional network solid, it is the hardest substance known with high density and high melting point.
  Whereas in graphite, any two successive layers are held together by weak forces of attraction. This makes graphite soft.
- In graphite, carbon atom is sp^2 hybridized whereas in diamond, carbon atom is sp^3 hybridized.
- Unlike diamond, graphite is good conductor of heat and electricity.

Question 13.

- **Rationalise the given statements and give chemical reactions:**

- **Lead (II) chloride reacts with Cl_2 to give $PbCl_4$.**
- **Lead (IV) chloride is highly unstable towards heat.**
- **Lead is known not to form an iodide PbI_4.**

Answer:

- $PbCl_2 + Cl_2$ ———> $PbCl_4$.
  This is because Pb can show +2 oxidation state more easily than +4 due to inert pair effect.
  heat
- $PbCl_4$ ———> $PbCl_2 + Cl_2$
  Because Pb2+ is more stable than Pb^{4+} due to inert pair effect.
- PbI_4 does not exist because I- ion being a powerful reducing agent reduces Pb^{4+} ion to Pb^{2+} ion in solution.
- $Pb4+ + 2I^-$ ——-> $Pb^{2+} + I_2$
  Pb(IV) Pb(II)

Question 14. Suggest reason why the B-F bond lengths in BF_3 (130 pm) and BF^- (143 pm) differ.

Answer: In BF_3 'B' is sp^2 hybridised and in BF_4^- 'B' is sp^3 hybridised. Thus, the difference in bond length is due to the state of hybridisation.

Question 15. If B-Cl bond has a dipole moment, explain why BCl_3 molecule has zero dipole moment.

Answer: B-Cl bond has dipole moment because of polarity. In BCl_3 since the molecule is symmetrical (planar). Thus the polarities cancel out.

Question 16. Aluminium tri fluoride is insoluble in anhydrous HF but dissolves on addition of NaF. Aluminium trifluoride precipitates out of the resulting solution when gaseous BF_3 is bubbled through. Give reason.

Answer: Since, anhydrous HF is covalent compound and weak acid due to high bond dissociation energy. AlF_3 does not dissolve in HF.
Whereas NaF is ionic compound.
$3NaF + AlF_3$ ———> $Na_3[AlF_6]$
$Na_3[AlF_6] + 3BF_3(g)$ ——-> $AlF_3 + 3Na+ [BF]^-$

Question 17. Suggest a reason as to why CO is poisonous.

Answer: CO reacts with haemoglobin to form carboxyhaemoglobin which

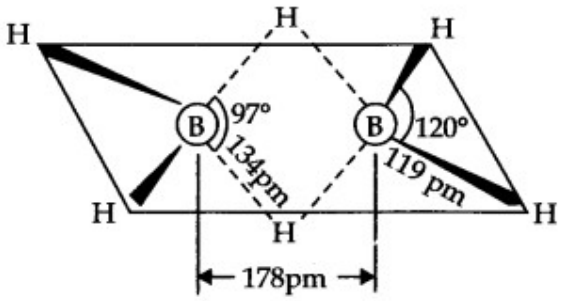
can destroy the oxygen carrying capacity of haemoglobin and the man dies of suffocation.

Question 18. How is excessive content of $C0_2$ responsible for global warming?

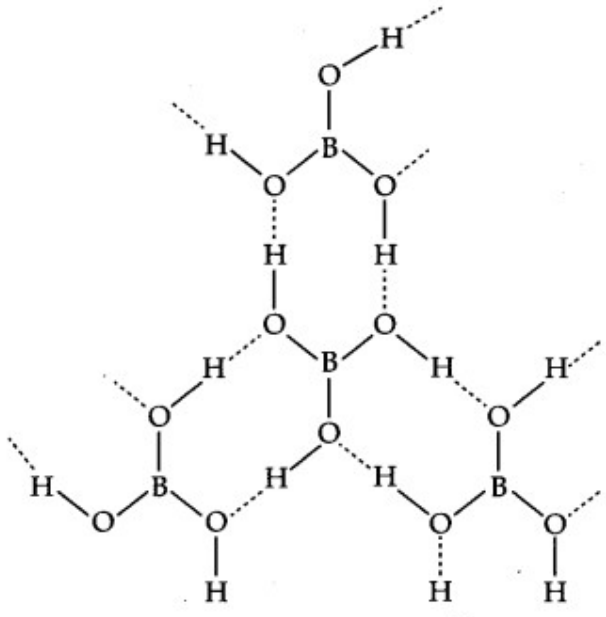
Answer: Excess of $C0_2$ absorbs heat radiated by the earth. Some of it is dissipated into the atmosphere while the remaining part is radiated back to the earth. As a result, temperature of the earth increases. This is the cause of global warming.

Question 19. Explain structures of diborane and boric acid.

Answer: Boric acid contains planar BO_3^{3-} ions which are linked together through hydrogen bonding shown in the fig.



Structure of Diborane (B_2H_6) molecule



Structure of boric acid

Question 20. What happens when

(a) Borax is heated strongly

(b) Boric acid is added to water

(c) Aluminium is treated with dilute NaOH

(d) BF_3 is reacted with ammonia?

Answer:

(a) $Na_2B_4O_7 \cdot 10H_2O \xrightarrow[-10H_2O]{\Delta} Na_2B_4O_7 \xrightarrow{\Delta} 2NaBO_2 + B_2O_3$

(b) $B(OH)_3 + H_2O \longrightarrow [B(OH)_4]^- + H^+$

(c) $2Al + 2NaOH + H_2O \longrightarrow 2NaAlO_2 + 3H_2$

(d) $BF_3 + NH_3 \longrightarrow [H_3N \longrightarrow BF_3]$

Question 21. Explain the following reactions.

(a) Silicon is heated with methyl chloride at high temperature in the presence of copper.

(b) Silicon dioxide is treated with hydrogen fluoride.

(c) CO is heated with ZnO.

(d) Hydrated alumina is treated with aqueous NaOH solution.

Answer:

(a) A mixture of mono-, di- and trimethyl chlorosilianes along with a small amount of tetramethyl silane is formed.

$$\underset{\text{Methyl chloride}}{CH_3Cl} + Si \xrightarrow[373K]{\text{Cu powder}} CH_3SiCl_3 + (CH_3)_2SiCl_2 + (CH_3)_3SiCl + (CH_3)_4Si$$

(b) The initially formed silicon tetrafluoride dissolves in HF to form hydrofluorosilicic acid.

$$SiO_2 + 4HF \longrightarrow SiF_4 + 2H_2O$$
$$SiF_4 + 2HF \longrightarrow H_2SiF_6$$

(c) ZnO is reduced to zinc metal

$$ZnO + CO \longrightarrow Zn + CO_2$$

(d) Alumina dissolves to form sodium meta-aluminate

$$\underset{\substack{\text{Hydrated alumina}\\ \text{or Bauxite}}}{Al_2O_3 \cdot 2H_2O(s)} + 2NaOH(aq) \xrightarrow{\text{Heat}} \underset{\text{Sod. meta-aluminate}}{2NaAlO_2} + 3H_2O$$

Question 22. Give reasons:

(i) Cone. HNO_3 can be transported in aluminium container.

(ii) A mixture of dilute NaOH and aluminium pieces is used to open drain.

(iii) Graphite is used as lubricant.

(iv) Diamond is used as an abrasive.
(v) Aluminium alloys are used to make aircraft body.
(vi) Aluminium utensils should not be kept in water overnight.
(vii) Aluminium wire is used to make transmission cables.

Answer: (i) Al reacts with cone. HNO_3 to form a very thin film of aluminium oxide on its surface which protects it from further reaction.

$2Al(s) + 6HNO_3(conc.) \longrightarrow Al_2O_3(s) + 6NO_2(g) + 3H_2O(l)$

(ii) NaOH reacts with Al to evolve H_2 gas. Thus the pressure of the gas produced can be used for clogged drains.

$2Al(s) + 2NaOH(aq) + 2H_2O(l) \longrightarrow 2NaAlO_2(aq) + 3H_2(g)$

(iii) Graphite has layered structure which are held by weak van der Waals forces. Thus, graphite cleaves easily between the layers, therefore it is very soft and slippery. That's why it is used as lubricant.

(iv) Diamond is used as an-abrasive because it is an extremely hard substance.

(v) Alloys of aluminium, like duralumin, is used to make aircraft body due to some of its property like toughness, lightness and resistant to corrosion.

(vi) Generally, aluminium metal does not react with water quickly but, when it is kept overnight, it reacts slowly with water in presence of air.

$2Al(s) + O_2(g) + H_2O(l) \longrightarrow Al2O_3(S) + H_2(g)$

a very small amount of (in ppm) Al^{3+} produced in the solution is injurious to health if the water is used for drinking purposes.

(vii) Aluminium is generally unaffected by air and moisture and it is also good conductor of electricity. That's why it is used in transmission cables.

Question 23. Explain why is there a phenomenal decrease in ionization enthalpy from carbon to silicon.

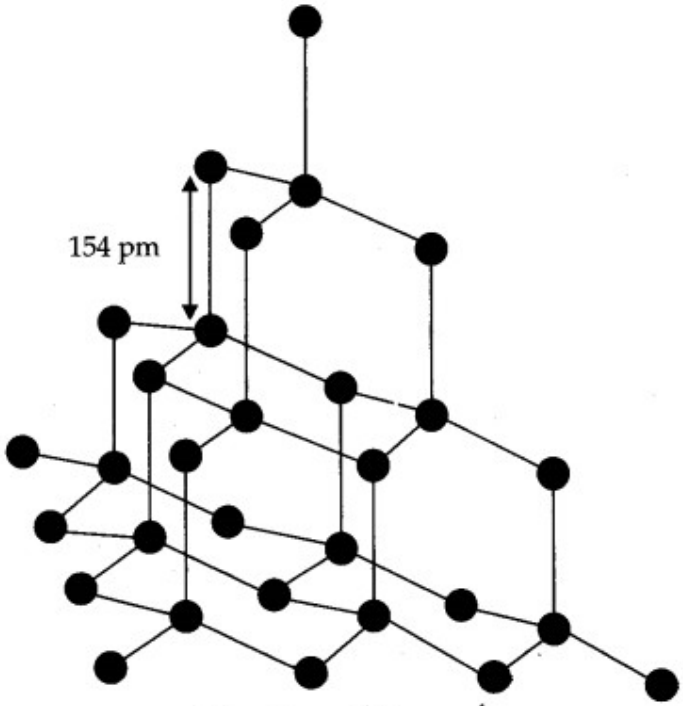
Answer: Because there is increase in atomic size on moving from carbon to silicon, the screening effect increases. Thus the force of attraction of nucleus for the valence electron decreases as compared to carbon. Thus the ionization enthapy decreases from carbon to silicon.

Question 24. How would you explain the lower atomic radius of Ga as compared to Al?

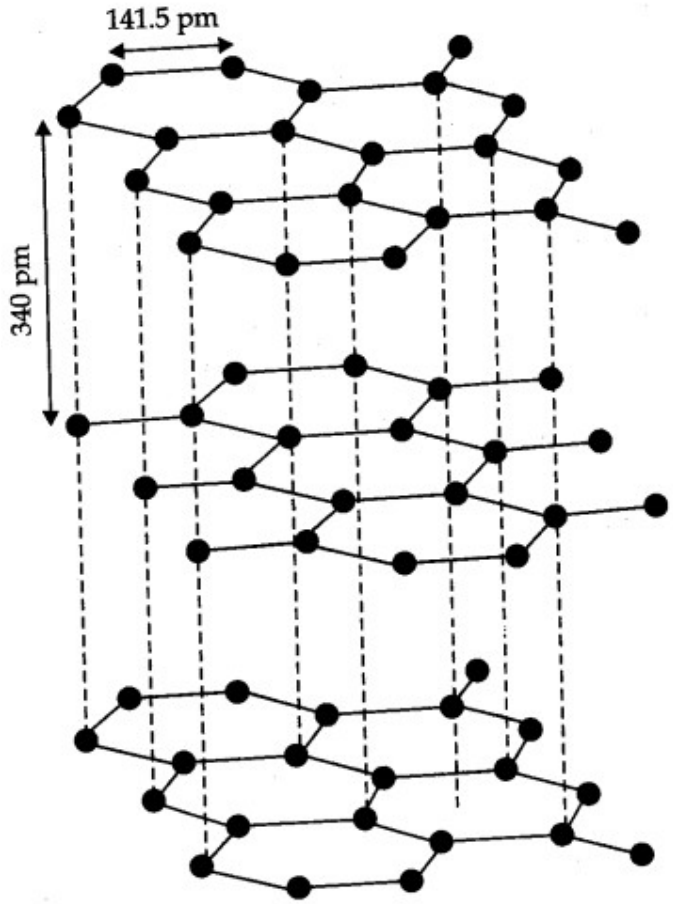
Answer: Due to poor shielding effect of d-electrons in Ga, the electrons in gallium experience great force of attraction by nucleus as compared to Al.

Question 25. What are allotropes? Sketch the structure of two allotropes of carbon namely diamond and graphite. What is the impact of structure on physical properties of two allotropes?

Answer: Allotropes: Allotropes are the different forms of an element which are having same chemical properties but different physical properties due to their structures.



Structure of diamond



Structure of Graphite

In diamond, carbon is SP^3 -hybridized. Since, diamond is three dimensional network solid, it is hardest substance with high density whereas graphite has a layered structure. The various layers are formed by van der Waals forces of attraction that's why graphite is soft and slippery.

Question 26. (a) Classify the following oxides as neutral, acidic, basic or amphoteric

CO, B_2O_2, $Si0_2$, $C0_2$, Al_2O_3, PbO_2, Tl_2O_3

(b) Write suitable equations to show their nature.

Answer: (a) Neutral — CO

Acidic — B_2O_2, $Si0_2$, $C0_2$ Basic — Tl_2O_3 Amphoteric — Tl_2O_3, PbO_2

(b)-CO does not react with acid as well as base at room temperature.

Being acidic B_2O_3, SiO_2 and CO_2 reacts with alkalis to form salts.

$$B_2O_3 + 2NaOH \longrightarrow 2NaBO_2 + H_2O$$

Boric anhydride — Sod. metaborate

$$SiO_2 + 2NaOH \xrightarrow{\Delta} Na_2SiO_3 + H_2O$$

Sod. silicate

$$CO_2 + 2NaOH \longrightarrow Na_2CO_3 + H_2O$$

Sod. carbonate

Being amphoteric, Al_2O_3, and PbO_2 react with acids and bases.

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

$$Al_2O_3 + 3H_2SO_4 \longrightarrow Al_2(SO_4)_3 + 3H_2O$$

$$PbO_2 + 2NaOH \longrightarrow Na_2PbO_3 + H_2O$$

$$2PbO_2 + 2H_2SO_4 \longrightarrow 2PbSO_4 + 2H_2O + O_2$$

Being Basic Tl_2O_3 dissolves in acids.

$$Tl_2O_3 + 6HCl \longrightarrow 2TlCl_3 + 3H_2O$$

Question 27. In some of the reactions thallium resembles aluminium, whereas in others it resembles with group 1 metals. Support this statement by giving some evidences.

Answer: Tl shows both the oxidation state +1 and +3 due to inert pair effect. Tl forms basic oxide like group I elements. TlO_2 is strongly basic.

Question 28. When metal X is treated with sodium hydroxide, a white precipitate (A) is obtained, which is soluble in excess of NaOH to give soluble complex (B). Compound (A) is soluble in dilute HCl to form compound (C). The compound (A) when heated strongly gives (D), which is used to extract metal. Identify (X), (A), (B), (C) and (D). Write suitable equations to support their identities.

Answer:

$$\underset{(X)}{Al} + 3NaOH \longrightarrow \underset{(A)}{Al(OH)_3}\downarrow + 3Na$$

$$\underset{(A)}{Al(OH)_3} + NaOH \longrightarrow \underset{\substack{\text{Soluble}\\ \text{'B'}\\ \text{Sod. tetrahydroxoaluminate}\\ (III)}}{Na^+[Al(OH)_4]^-}$$

Since *A* is amphoteric in nature.

$$\underset{(A)}{Al(OH)_3} + \text{dil. } HCl \longrightarrow \underset{(C)}{AlCl_3} + 3H_2O$$

$$\underset{(A)}{2Al(OH)_3} \xrightarrow{\Delta} \underset{(D)}{Al_2O_3} + 3H_2O$$

Question 29. What do you understand by (a) inert pair effect (b) allotropy and (c) catenation?

Answer: (a) Inert pair effect: The pair of electron in the valence shell does not take part in bond formation is called inert pair effect.

(b)Allotropy: It is the property of the element by which an element can exist in two or more forms which have same chemical properties but different physical properties due to their structures.

(c)Catenation: The property to form chains or rings not only with single bonds but also with multiple bonds with itself is called catenation.
For example, carbon forms chains with (C-C) single bonds and also with multiple bonds (C = C or C = C).

Question 30. A certain salt X, gives the following results.

(i) Its aqueous solution is alkaline to litmus.

(ii) It swells up to a glassy material Y on strong heating.

(iii) When cone.$H_2SO_4$is added to a hot solution of X, white crystal of an acid Z separates out.

Answer:

(*i*) $$Na_2B_4O_7 + 10H_2O \xrightarrow{\text{water}} 2NaOH + H_2B_4O_7 + 8H_2O$$

(*ii*) $$Na_2B_4O_7 \xrightarrow{\text{heat}} 2NaBO_2 + B_2O_3$$

(*iii*) $$Na_2B_4O_7 \cdot 10H_2O + H_2SO_4 \longrightarrow 4H_3BO_3 + Na_2SO_4 + 5H_2O$$

Question 31. Write balanced equations for:

(i) $BF_3 + LiH \longrightarrow$ (ii) $B_2H_6 + H_2O \longrightarrow$ (iii) $NaH + B_2H_6 \longrightarrow$

(iv) $H_3BO_3 \xrightarrow{\Delta}$ (v) $Al + NaOH \longrightarrow$ (vi) $B_2H_6 + NH_3 \longrightarrow$

Answer:

(i) $2BF_3 + 6LiH \longrightarrow \underset{\text{Diborane}}{B_2H_6} + 6LiF$

(ii) $\underset{\text{Diborane}}{B_2H_6} + 6H_2O \longrightarrow \underset{\text{Orthoboric acid}}{2H_3BO_3} + 6H_2$

(iii) $2NaH + B_2H_6 \longrightarrow \underset{\text{Sod. borohydride}}{2Na^+[BH_4]^-}$

(iv) $\underset{\text{Orthoboric acid}}{H_3BO_3} \xrightarrow{\Delta} \underset{\text{Metaboric acid}}{HBO_2} + H_2O$

$\underset{\text{Metaboric acid}}{4HBO_2} \xrightarrow[-H_2O]{\Delta} \underset{\text{Tetraboric acid}}{H_2B_4O_7} \longrightarrow \underset{\text{Boron trioxide}}{2B_2O_3} + H_2O$

(v) $2Al + 2NaOH + 6H_2O \longrightarrow \underset{\text{Sod. tetrahydroxoaluminate (III)}}{2Na^+[Al(OH)_4]^-} + 3H_2$

(vi) $B_2H_6 + 2NH_3 \longrightarrow \underset{\text{Borane-ammonia complex}}{2BH_3 \cdot NH_3}$

Question 32. Give one method for industrial preparation and one for laboratory preparation of CO and $C0_2$ each.

Answer:

Carbon monoxide

Industrial: $2C(s) + O_2(g) \xrightarrow[\text{air}]{\text{Limited}} 2CO(g)$

Laboratory: $\underset{\text{Formic acid}}{HCOOH} \xrightarrow{H_2SO_4} CO + H_2O$

Carbon dioxide

Industrial: $C(s) + O_2(g) \xrightarrow[\text{air}]{\text{Excess}} CO_2(g)$

Laboratory: $CaCO_3(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$

Question 33. An aqueous solution of borax is

(a) neutral (b) amphoteric (c) basic (d) acidic

Answer: Borax is a salt of a strong base (NaOH) and a weak acid (H_3BO_3), therefore, it is basic in nature, i.e., option (c) is correct.

Question 34. Boric acid is polymeric due to

(a) its acidic nature (b) the presence of hydrogen bonds

(c) its monobasic nature (d) its geometry

Answer: Boric acid is polymeric due to the presence of H-bonds. Therefore, option (b) is correct.

Question 35. The type of hybridisation of boron in diborane is

(a) sp (b) sp^2 (c) sp^3 (d) dsp^2

Answer: In B_2H_6, B is sp^3-hybridized. Therefore, option (c) is correct.

Question 36. Thermodynamically the most stable form of carbon is

(a)diamond (b) graphite (c) fullerenes (d) coal

Answer: Thermodynamically the most stable form of carbon is graphite, i.e., option (b) is correct.

Question 37. Elements of group 14

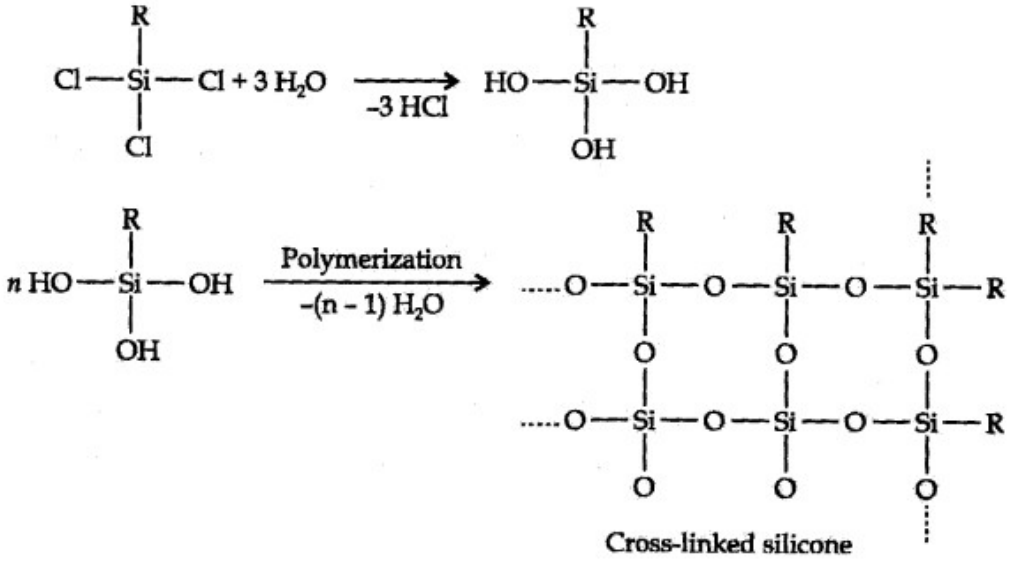
(a) exhibit oxidation state of +4 only (b) exhibit oxidation state of +2 and +4

(c) form M^{2-} and M^{4+} ion (d) form M^{2+} and M^{4+} ions.

Answer: Due to inert pair effect, elements of group 14 exhibit oxidation states of +2 and +4. Thus, option (b) is correct.

Question 38. If the starting material for the manufacture of silicons is $RSiCl_3$ write the structure of the product formed.

Answer: Hydrolysis of aikyltrichlorosilanes gives cross-linked silicons.



MORE QUESTIONS SOLVED

NCERT Solutions for Class 11 Chemistry Chapter 11 Very Short Answer Type Questions

Question 1. Why is boron used in nuclear reactions?

Answer: Because Boron can absorb neutrons.

Question 2. Why does boron form stable electron deficient compounds?

Answer: Boron has three electrons in its valence shell that boron show three electrons with other elements and form an electron-deficient compound.

Question 3. By giving a balanced equation show how $B(OH)_3$ behaves as an acid in water.

Answer: $B(OH)_3 + 2HOH \longrightarrow [B(OH)_4]^- + H_3O^+$.

Question 4. What is dry ice? Why is it so called?

Answer: Carbon dioxide can be obtained as a solid in the form of dry ice by allowing the liquified CO_2 to expand rapidly.

Unlike ordinary ice it does not melt and hence does not wet the surface on which it is kept. Thus it is called dry ice.

Question 5. Name the element of group 14 which exhibits maximum tendency for catenation.

Answer: Carbon.

Question 6. What is the basic building unit of all silicates?

Answer: SiO_4^{4-} is the basic unit of all silicates.

Question 7. Why do boron halides form addition compounds with NH_3?

Answer: Boron halides are lewis acids and can accept a pair of electrons from amines to form addition product.

Question 8. What happens when $NaBH_4$ reacts with iodine?

Answer: $2NaBH_4 + I_2 \longrightarrow B_2H_6 + 2NaI + H_2$.

Question 9. Out of CCl_4 and $SiCl_4$ which one react with water and why?

Answer: Due to the presence of d-orbitals in Si, $SiCl_4$ reacts with water. CCl_4 does not react with water due to the absence of d-orbitals in C atom.

Question 10. Which oxide of carbon is regarded as anhydride of carbonic acid?

Answer: CO_2 is regarded as anhydride of carbonic acid.

H_2CO_3 ———> $H_2O + CO_2$

Question 11. What happens when boric acid is heated?

Answer:

$$H_3BO_3 \xrightarrow{\Delta} HBO_2 \xrightarrow{\Delta} B_2O_3$$

Question 12. CO_2 is gas while SiO_2 is solid at room temperature. Give reason.

Answer: The molecules of CO_2 are held together by weak van der Waals forces of attraction which can be easily overcome by collisions of the molecules at room temperature. Consequently CO_2 is a gas.

On the other hand silicon atom forms four single covalent bonds with O-atom which are tetrahedrally arranged and form a three-dimensional structure. Thus SiO_2 is a high melting solid.

Question 13. What is producer gas ?

Answer: Producer gas is a mixture of CO and N_2 in the ratio of 2 :1

Question 14. Write the state of hybridisation of'B' in BF_3.

Answer: Hybridisation of 'B' in BF_3 is sp^2 .

Question 15. Mention the state of hybridisation of B in BH_4.

Answer: sp^2.

NCERT Solutions for Class 11 Chemistry Chapter 11 Short Answer Type Questions

Question 1. What is meant by catenation? Why does 'C show the property of catenation to maximum extent?

Answer: It is the phenomenon of an atom to form a strong covalent bond with the atoms of itself. Carbon shares the property of catenation to maximum extent because it is small in size and can form Pπ -Pπ multiple bonds to itself.

Question 2. Give the chemical reactions as evidence for each of the following observations.

(i) Tin (II) is a reducing agent whereas lead (II) is not.

(ii) Gallium (I) undergoes disproportionation reaction.

Answer: (i) Due to inert pair effect Pb^{2+} is more stable than Pb^{4+}. Whereas

Sn^{4+} is more stable than Sn^{2+}.

Thus Sn^{2+} is a good reducing agent and Pb^{2+} is not.

(ii) $3Ga^{+} \longrightarrow 2Ga + Ga^{3+}$

This is because Ga^{3+} is more stable than Ga^{+}.

Question 3. Describe two similarities and two dissimilarities between B and Al.

Answer: Similarities:

- Both have same number of valence electrons.
- Both have similar electronic configuration.

Dissimilarities:

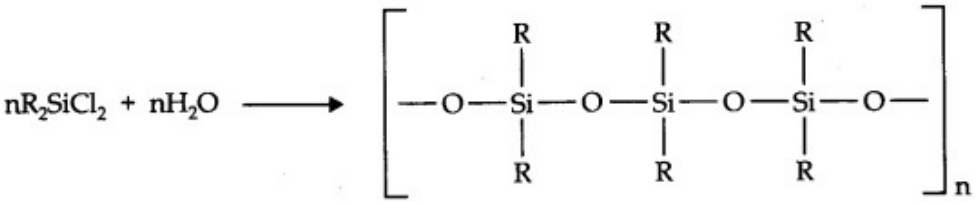
- B is a non-metal where Al is a metal.
- B forms acidic oxide whereas Al forms amphoteric oxides.

Question 4. (a) What is general formula of silicons?

(b) How are linear silicons obtained?

Answer: (a) R_2SiO

(b) Linear silicons are obtained by the hydrolysis of R_2SiCl_2 (chlorosilanes).



Linear silicons

Question 5. What happens when

(i) Quick lime is heated with coke?

(ii) Carbon monoxide reacts with Cl_2?

Answer: (i) $CaO + 3C \longrightarrow CaC_2 + CO$

(ii) $CO + Cl_2 \longrightarrow COCl_2$

Question 6. What are Fullerenes ? How are they prepared ?

Answer: Fullerenes are the allotropes of carbon. Its structure is like a soccer ball.

They are prepared by heating graphite in electric arc in presence of inert gases such as helium or argon.

Question 7.Give reason.

(i) C and Si are always tetravalent but Ge, Sn, Pb show divalency.

(ii) Gallium has higher ionization enthalpy than Al. Explain.

Answer: (i) Ge, Sn and Pb show divalency due to inert pair effect, Pb^{2+} is more stable than Pb^{4+} .

(ii) Due to poor shielding effect of d-electrons in Ga, effective nuclear charge increases as compared to Al. Thus the I.E of Ga is higher than Al.

Question 8. Give reason why boron and aluminium tend to form covalent compounds.

Answer: Sum of the three ionization enthalpies of both the elements are very high. Thus they have no tendency to lose electrons to form ioriic compound. Instead they form covalent compounds.

NCERT Solutions for Class 11 Chemistry Chapter 11 Long Answer Type Questions

Question 1. Explain the differences in properties of diamond and graphite based upon their structures.

Answer:

Diamond	*Graphite*
(*i*) Diamond is the hardest substance on earth.	(*i*) Graphite is soft and slippery
(*ii*) In diamond carbon is sp^3 – hybridised	(*ii*) In Graphite carbon is sp^2 – hybridized.
(*iii*) Since all the electrons in diamond are firmly held in C – C, 6 bonds there are no free electrons in diamond crystal. Therefore diamond is bad conductor of electricity.	(*iii*) Since only three electrons of each carbon are used in making hexagonal rings of graphite, fourth valence electron is free to move thus graphite is a good conductor of electricity.
(*iv*) Because of high refractive index diamond can reflect and refract the light.	(*iv*) Graphite is a black substance and possess a metallic lustre.

Question 2. Give reasons:

(a) Why do Boron halides form an additional compounds with NH_3?

(b) The tendency for catenation decreases down the group in Group 14.

(c) PbO_2 is a stronger oxidizing agent than SnO_2.

Answer: (a) It is because BX_3 is an electron-deficient compound and NH_3 is an electron-rich compound.

(b) As we move down group 14, the atomic size increases and thus the strength of the element decreases down the group thus the bond dissociation enthalpy decreases steadily consequently the tendency for catenation decreases down the group.

(c) PbO_2 and SnO_2 both are present in +4 oxidation state. But due to stronger inert pair effect Pb^{2+} ion is more stable than Sn^{2+} ion.

In other way Pb^{4+} ions is more easily reduced to Pb^{2+}ions. Thus PbO_2 acts as a stronger oxidising agent than SnO_2.

Question 3. How is boron obtained from borax? Give chemical equations with reaction conditions.

Answer:

$$\underset{\text{Borax}}{Na_2B_4O_7 \cdot 10H_2O} + H_2SO_4\ (\text{conc.}) \longrightarrow Na_2SO_4 + H_2B_4O_7 + 10H_2O$$

$$H_2B_4O_7 + 5H_2O \longrightarrow \underset{\text{Boric acid}}{4H_3BO_3}$$

$$2H_3BO_3 \xrightarrow{\text{Heat}} \underset{\text{Boric oxide}}{B_2O_3} + 3H_2O$$

$$B_2O_3 + 3Mg \xrightarrow{\Delta} 2B + 3MgO$$

NCERT Solutions for Class 11 Chemistry Chapter 11 Multiple Choice Questions

Question 1. Boron has an extremely high melting point because of

(a) its ionic crystal structure

(b) the strong binding forces in the covalent polymer

(c) atomic size (d) allotropy

Question 2. Which of the following compound is an important catalyst as well as a Lewis acid?

(a) Al_2S_2 (b) BF_3 (C) S_4N_4 (d) N_2H_4

Question 3. Carbon-60 contains

(a) 20 pentagons and 12 hexagons (b) 12 pentagons and 20 hexagons

(c) 30 pentagons and 30 hexagons (d) 24 pentagons and 36 hexagons

Question 4. The diamond molecule contains

(a) sp^2-hybridized carbon atoms connected by single bonds

(b) sp^2-hybridized carbon atoms connected by double bonds

(c) sp^3-hybridized carbon atoms connected by single bonds
(d) sp^3-and sp^2-hybridized carbon atoms connected by single bonds

Question 5. Which of the following is the most ionic?
(a) CCl_4 (b) $PbCl_2$ (c) $PbCl_4$ (d) $SiCl_4$

Question 6. Silicon carbide (SiC) is known as
(a) quartz (b) tridynite (c) corundum (d) carborundum

Question 7. Which of the following is a purely acidic oxide?
(a) SiO_2 (b) SnO_2 (c) PbO (d) MnO_2

Question 8. Silicones are a group of organosilicon polymers containing
(a) Si – O – Si linkages (b) O – Si – O linkages
(c) Si – C – Si linkages (d) Si – Si – O linkages

Question 9. Which of the following molecules have zero dipole moment?
(a) CS_2 (b) CO_2 (c) CCl_2 (d) CH_2Cl_2

Question 10. Silicon shows a diagonal relation with
(a) magnesium (b) phosphorous (c) carbon (d) boron

Answer: 1.(b) 2.(d) 3.(b) 4.(c) 5.(b)
6.(d) 7.(a) 8.(a) 9.(a) and(b) 10.(d)

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