LESSON -2 p- BLOCK ELEMENTS – I

ANSWER THE FOLLOWING QUESTIONS:

1. Write a short note on anamolous properties of the first element of p-block.

- Small size of atom
- high electronegativity
- non availability of d-orbitals in their valence shell.

2. Describe briefly allotropism in p- block elements with specific reference to carbon.

❖ Allotropy is the existence of an element in more than one form, having the ***same chemical properties but different physical properties***.
The various forms of an element are called allotropes.
Examples: Carbon exists as diamond, graphite, graphene, fullerenes.

3. Boron does not react directly with hydrogen. Suggest one method to prepare diborane from BF_3.

❖ Boron does not react directly with hydrogen.
❖ It forms a variety of hydrides called boranes.
❖ Treatment of gaseous boron trifluoride with sodium hydride around 450 K gives diborane.
❖ To prevent subsequent pyrolysis, the product diborane is trapped immediately.

$$2BF_3 + 6NaH \longrightarrow B_2H_6 + 6NaF$$

4. Give the uses of Borax.

i. It is used for the identification of coloured metal ions.
ii. In the manufacture optical and borosilicate glass, enamels and glazes for pottery.
iii. It is also used as a flux in metallurgy and also acts as a good preservative.

5. What is catenation ? describe briefly the catenation property of carbon.

❖ The atoms of some elements can link with one another through strong covalent bonds to form long chains or branches.
❖ This property is known as catenation.
❖ It is most common in carbon and quite significant in Si and S.
❖ **carbon has highest degree of catenation because:**

i) the valency of element is greater than or equal to two
(ii) element should have an ability to bond with itself
(iii) the self bond must be as strong as its bond with other elements
(iv) kinetic inertness of catenated compound towards other molecules.

6. Write a note on Fisher tropsch synthesis.

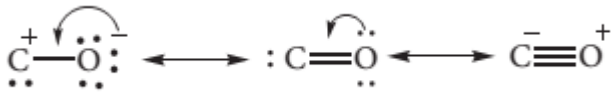
The Fischer-Tropsch process is a catalytic chemical reaction in which carbon monoxide (CO) and hydrogen (H_2) are converted into hydrocarbons of various molecular weights.

$$(2n+1)\,H_2 + n\,CO \rightarrow C_n H_{(2n+2)} + n\,H_2O$$

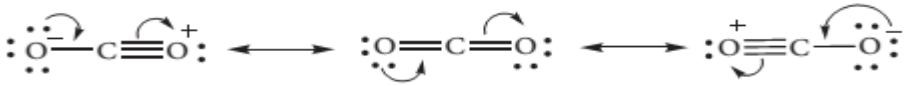
$$CO + H_2O \rightarrow H_2 + CO_2$$

7. Give the structure of CO and CO_2.

CO: It has a linear structure. In CO, three electron pairs are shared between carbon and oxygen.



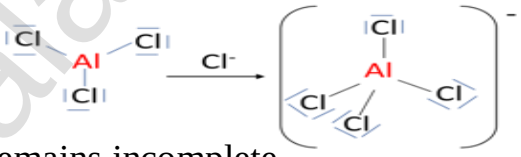
CO_2 : Carbon dioxide has a liner structure with equal bond distance for the both C-O bonds. In this molecule there is one C-O sigma bond. In addition there is 3c-4e bond covering all the three atoms.



8. Give the uses of silicones.

- Silicones are used for low temperature lubrication and in vacuum pumps.
- They are used for making water proofing clothes.
- They are used as insulting material in electrical motor and other appliances.
- They are mixed with paints and enamels to make them resistant towards high temperature, sunlight, dampness and chemicals.

9. $AlCl_3$ behaves like a lewis acid. Substantiate this statement.



- The electric configuration of Al is $ns^2 np^1$.
- It has three electrons in its valence shell.
- It can form only three covalent bonds.
- There are only six electrons around Al and its octet remains incomplete.
- When one atom of Al combines with three chlorine atoms, its octet remains incomplete.
- $AlCl_3$ remains electron-deficient and acts as a Lewis acid
- In this reaction Cl^- ion is the electron donor, therefore it is a Lewis base, and $AlCl_3$ is the electron acceptor.

10. Describe the structure of diborane.

Diborane

- Diborane is an electron deficient molecule.
- The structure of Diborane molecule consists of four hydrogen atoms and that of two boron atoms coming on the same plane.
- In between these planes, there are said to be two dividing atoms of hydrogen.
- The boron atom is known to be sp^3 hybridized and has four hybrid orbitals.
- From these four hybrid orbitals, three of the s orbitals have one electron each, and of which one is an empty orbital.
- The two electrons of the hybrid orbitals in each of the boron atoms form 2 bonds with the 1s hydrogen atoms.
- The two atoms of boron left with that of each unpaired electron orbital and empty orbital forms the two bridging (B–H–B) bonds with that of the two 1s hydrogen atoms, is also called as the banana bond.

11. Write a short note on hydroboration.

- **Hydroboration** refers to the addition of a hydrogen-boron bond to C-C.
- It is highly used for anti Markovnikov addition.
- Diborane adds on to alkenes and alkynes in ether solvent at room temperature.

$B_2H_6 + 3RCH_2 = CH_2R \longrightarrow B(CH_2\text{-}CH_2R)_3 + 6H_2$

12. Give one example for each of the following

(i) Icosogens : Boron **(ii) Tetragen :** Carbon

(iii) Pnictogen : Nitrogen **(iv) Chalcogen:** Oxygen

13. Write a note on metallic nature of p-block elements.

- ❖ The tendency of an element to form a cation by loosing electrons is known as electropositive or metallic character.
- ❖ This character depends on the ionisation energy.
- ❖ Descending a group the ionisation energy decreases and hence the metallic character increases.
- ❖ p-block is the only one which contains metals, non-metals and metalloids.
- ❖ The common metal among p block elements are : aluminium ,gallium, indium and thallium(group 13), tin and lead (group 14) and bismuth (group 15).
- ❖ The common metalloidsare silicon, Germanium, Arsenic, Antimony, and Tellurium.
- ❖ While all the remaining elements are non metals.

14. Complete the following reactions

1) $B(OH)_3 + NH_3 \longrightarrow BN + 3H_2O$
2) $Na_2B_4O_7 + H_2SO_4 + 5H_2O \longrightarrow Na_2SO_4 + 4H_3BO_3$
3) $B_2H_6 + 2NaOH + 2H_2O \longrightarrow 2NaBO_2 + 4H_3BO_3$
4) $B_2H_6 + 6CH_3OH \longrightarrow 2B(OCH_3)_3 + 6H_2$
5) $4BF_3 + 3H_2O \longrightarrow H_3BO_3 + 3HBF_4$
6) $HCOOH + H_2SO_4 \longrightarrow CO + H_2O + H_2SO_4$
7) $2SiCl_4 + NH_3 \longrightarrow Cl_3Si\text{–}NH\text{-}SiCl_3$
8) $SiCl_4 + C_2H_5OH \longrightarrow Si(OC_2H_5)_4 + 2Cl_2$
9) $2B + 6NaOH \longrightarrow 2Na_3BO_3 + 3H_2$
10) $H_2B_4O_7 \longrightarrow 2B_2O_3 + H_2O$

15. How will you identify borate radical?

- ❖ Boric is heated with ethyl alcohol in presence of con.H_2SO_4, an ester trialkyl borate is formed.
- ❖ The vapour of this ester burns with a green flame.

$H_3BO_3 + 3C_2H_5OH \longrightarrow B(OC_2H_5)_3 + 3H_2O$

16. Write a note on zeolites.

- ❖ Zeolites are porous hydrated aluminosilicate minerals made from interlinked tetrahedra of Alumina(AlO4) and Silica (SiO4).
- ❖ In Zeolites the pore sizes are nearly uniform, allowing the crystal to act as a molecular sieve.
- ❖ Zeolite does not change its crystal structure even after undergoing dehydration.

- Its easy movement of water and ions within the structure make it suitable for various applications.
- This makes it possible to reverse dehydration and positive ion exchange (cation exchange).
- This is utilized for Water softening and purification processes, Catalysts.

17. How will you convert boric acid to boron nitride?

Fusion of urea with $B(OH)_3$, in an atmosphere of ammonia at 800 - 1200 K gives boron nitride.

$$\underset{\text{Boric acid}}{B(OH)_3} + \underset{\text{Ammonia}}{NH_3} \longrightarrow \underset{\text{Boron nitride}}{BN} + 3H_2O$$

18. A hydride of 2nd period alkali metal (A) on reaction with compound of Boron (B) to give a reducing agent (C). Identify A , B and C.

- Hydride of 2nd period alkali metal (A) is **LiH (Lithium Hydride)**
- LiH reacts with compound of Boron (B) B_2H_6 to give reducing agent (C) Lithium boro hydride.
- Compound B is **Diborane.**
- Compound C is **Lithium boro hydride**.

$$\underset{\text{(B)}}{B_2H_6} + 2LiH \xrightarrow{\text{ether}} \underset{\text{(C)}}{2LiBH_4}$$

19. A double salt which contains fourth period alkali metal (A) on heating at 500K gives (B).aqueous solution of (B) gives white precipitate with $BaCl_2$ and gives a red colour compound with alizarin. Identify A and B.

A double salt which contains fourth period alkali metal (A) is **Potash alum.** $[K_2SO_4.Al_2(SO_4)_3.24.H_2O]$

(A) on heating at 500 K gives $K_2SO_4.Al_2(SO_4)_3$ (B) which is **burnt alum**.

$$\underset{\text{(A)}}{K_2SO_4.Al_2(SO_4)_3.24\,H_2O} \xrightarrow{500\ K} \underset{\text{(B)}}{K_2SO_4.Al_2(SO_4)_3} + 24\,H_2O$$

20. CO is a reducing agent . justify with an example.

- CO is a strong reducing agent.
- It reduces metallic oxide into metals.
- Ex: **$3CO + Fe_2O_3 \rightarrow 2\,Fe + 3CO_2$**

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