One Two academy | p-Block Elements - 1

Maximum Mark: 25 **Chemistry** **Time: 50 minutes**

Choose the correct answer: **3 x 1 = 3**

1. **Assertion:** Aqueous solution of potash Alum is acidic.
   Reason: Aluminium sulphate undergoes hydrolysis.
2. Carbon atoms in fullerene with formula C60 have
   a) sp^3hybridised b) sp hybridized
   c) sp^2hybridised d) partially $sp^2$and partially sp^3 hybridized
3. Bauxite has the composition of
   a) $Al_2O_3.nH_2O$ b) $Fe_2O_3.2H_2O$ c) Al_2O_3 d) None of the Above

Answer Any four of the following: **4 x 2 = 8**

4. What is catenation? describe briefly the catenation property of carbon.
5. Write a note on Fisher tropsch synthesis.
6. Give one example for each of the following
   (i) icosagens (ii) tetragens (iii) pnictogens (iv) chalcogens.
7. How is carbon monoxide prepared?
8. Explain Alcoholysis.

Answer any three of the following: **3 x 3 = 9**

9. Explain McAfee Process.
10. Explain the types of silicones.
11. Write a note on metallic structure of p-block elements.
12. Complete the following reactions:

$$B_2H_6 + 2NaOH + 2H_2O \longrightarrow$$

$$B_2H_6 + CH_3OH \longrightarrow$$

$$BF_3 + 9\,H_2O \longrightarrow$$

Answer the following: **1 x 5 = 5**

13. a) Explain the structure of i) Diamond ii) Graphite.

(Or)

b) i) 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.

ii) Write a note on Zeolites.

All the Best

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Answer Key attached in the next page !!!

This page is to prevent seeing answer key

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Answer Key

Choose the Correct answer:

1. – Both A and R are true and R Explains A. 2.-c) 3.-a)

Answer any four of the following:

4. **Catenation:** Catenation is an ability of an element to form chain of atoms. The following conditions are necessary for catenation.
   (i) valency of the element should be greater than or equal to two
   (ii) element should have the 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.
5. **Fischer Tropsch Synthesis:** The reaction of carbon monoxide with hydrogen at a pressure of less than 50 atm using metal catalysts at 500 - 700 K yields saturated and unsaturated hydrocarbons.

$$nCO + (2n+1)\,H_2 \rightarrow C_n H_{(2n+2)} + nH_2O$$
$$nCO + 2nH_2 \rightarrow C_n H_{2n} + nH_2O$$

6. (i) icosagens - Boron
   (ii) tetragens - Carbon
   (iii) pnictogens - Nitrogen
   (iv) chalcogens - Oxygen

7. **Preparation of Carbon monoxide:**

On industrial scale carbon monoxide is produced by the reaction of carbon with air. The carbon monoxide formed will contain nitrogen gas also and the mixture of nitrogen and carbon monoxide is called producer gas.

$$2C + O_2/N_2\ (air) \rightarrow 2CO + N_2$$
(Producers Gas)

8. **Alcoholysis:**

The chloride ion in silicon tetrachloride can be substituted by nucleophile such as OH, OR, etc.. using suitable reagents. For example, it forms silicic esters with alcohols.

$$SiCl_4 + 4C_2H_5OH \rightarrow Si(OC_2H_5)_4 + 4HCl$$
(Tetraethoxy silane)

Answer any three of the following:

9. **McAfee Process:** Aluminium chloride is obtained by heating a mixture of alumina and coke in a current of chlorine.

$$2Al_2O_3 + 3C + 6Cl_2 \rightarrow 4AlCl_3 + 3CO_2$$

On industrial scale it is prepared by chlorinating aluminium around 1000 K.

$$2Al + 3Cl_2 \xrightarrow[1000K]{} 2AlCl_3$$

10. **Types of silicones:**

(i) Linear silicones: They are obtained by the hydrolysis and subsequent condensation of dialkyl or diaryl silicon chlorides.

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a) Silicone rubbers: These silicones are bridged together by methylene or similar groups

b) Silicone resins: They are obtained by blending silicones with organic resins such as acrylic esters.

(ii) Cyclic silicones: These are obtained by the hydrolysis of $R_2 SiCl_2$.

(iii) Cross linked silicones: They are obtained by hydrolysis of $RSiCl_3$

11. **Metallic nature:**
    - 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.
    - Generally, on descending a group the ionisation energy decreases and hence the metallic character increases.
    - In p-block, thr elements prese in lower left part are metals.

12. i) $B_2 H_6 + 2NaOH + 2H_2 O \rightarrow 2NaBO_2 + 6H_2$
    ii) $B_2 H_6 + 6CH_3 OH \rightarrow 2B(OCH_3)_3 + 6H_2$
    iii) $4BF_3 + 9H_2 O \rightarrow 4H_3 BO_3 + 3H^+ + 3[BF_4]^-$

Answer the following:

13. a)

i) Structure of Diamond:

- Unlike graphite the other allotrope diamond is very hard. The carbon atoms in diamond are sp^3 hybridised and bonded to four neighbouring carbon atoms by σ bonds with a C-C bond length of 1.54 Å. This results in a tetrahedral arrangement around each carbon atom that extends to the entire lattice. Since all four valance electrons of carbon are involved in bonding there is no free electrons for conductivity. Being the hardest element, it used for sharpening hard tools, cutting glasses, making bores and rock drilling.

ii) Structure of Graphite:

- Graphite is the most stable allotropic form of carbon at normal temperature and pressure. It is soft and conducts electricity. It is composed of flat two dimensional sheets of carbon atoms. Each sheet is a hexagonal net of sp^2 hybridised carbon atoms with a C-C bond length of 1.41 Å which is close to the C-C bond distance in benzene (1.40 Å). Each carbon atom forms three σ bonds with three neighbouring carbon atoms using three of its valence electrons and the fourth electron present in the unhybridised p orbital forms a π-bond. These π electrons are delocalised over the entire sheet which is responsible for its electrical conductivity. The successive carbon sheets are held together by weak vander Waals forces. The distance between successive sheets is 3.40 Å. It is used as a lubricant either on its own or as a graphited oil.

(OR)

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b) i) A double salt which contains fourth period alkali metal (A) is $K_2SO_4.Al_2(SO_4)_3.24H_2O$

$$\underset{(A)}{K_2SO_4.Al_2(SO_4)_3.24H_2O} \xrightarrow{475\ K} \underset{(B)}{K_2SO_4.Al_2(SO_4)_3} + 24H_2O$$

Hence,

(A) - $K_2SO_4.Al_2(SO_4)_3.24H_2O$ - Potash Alum

(B) - $K_2SO_4.Al_2(SO_4)_3$ - Burnt alum

ii) **Zeolites:**

- Zeolites are three-dimensional crystalline solids containing aluminium, silicon, and oxygen in their regular three dimensional framework.
- They are hydrated sodium alumino silicates with general formula $Na_2O.(Al_2O_3).x(SiO_2).yH_2O$ (x=2 to 10; y=2 to 6).
- Zeolites have porous structure in which the monovalent sodium ions and water molecules are loosely held.
- Zeolites are similar to clay minerals, but they differ in their crystalline structure.

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