Inter (Part-II) 2018

Chemistry	Group-II	PAPER: II
Time: 2.40 Hours	(SUBJECTIVE TYPE)	Marks: 68

SECTION-I

2. Write short answers to any EIGHT (8) questions: (16)

(i) Why is the oxidation state of noble gases usually zero?

Ans Since the outermost shell of noble gases is completely filled *i.e.,* it has either one pair of electron or 4 pairs of electron. So, there is no vacancy for combination or bond formation. That is why, noble gases shows zero oxidation state.

(ii) Why does the ionization energy decrease down the group and increase along the period?

Ans **Variation within a group:**

The ionization energy decreases down a group due to addition of a shell in every successive member of group. The increased distance of the outermost shell decreases the influence of the nuclear charge and results in decrease in the value of ionization energy down the group.

Variation across a period:

The ionization energy increases across a period due to fact that the atomic size or atomic radius decreases across a period from left to right.

(iii) Why the aqueous solution of Na_2CO_3 is alkaline in nature?

Ans It is alkaline in nature because it contains sodium cations, which are strongly basic and carbonate anions which are weakly acidic. So, the basic ions win over acidic ions, making Na_2CO_3 alkaline.

(iv) Write two reactions of preparation of borax.

Ans Two reactions of preparation of borax are given below:

$$\underset{\text{Boric acid}}{4H_3BO_3} + Na_2CO_3 \longrightarrow \underset{\text{(Borax)}}{Na_2B_4O_7} + 6H_2O + CO_2$$

$$\underset{\text{(Colemanite)}}{Ca_2B_6O_{11}} + 2Na_2CO_3 \longrightarrow 2CaCO_3 + \underset{\text{(Borax)}}{Na_2B_4O_7} + 2NaBO_2$$

(v) What is chemical garden?

Ans When crystals of soluble coloured salt are placed in a solution of Na_2SiO_3, they produce a very beautiful growth like plant, which is called chemical garden.

(vi) Define semiconductors. Write its two properties.

Ans A semiconductor is a substance that has different resistances to the passages of an electric current under different circumstances. Semiconductors include the element germanium, silicon, etc.

Properties:

1. Semiconductor conduct electricity.
2. Another special property of semiconductors is the way they behave, when they are joined to another material, which may be a metal or a different semiconductor.

(vii) Write two reactions of preparation of nitrous acid.

Ans **Reactions:**

1. It begins to decompose almost as soon as it is formed even at ordinary temperature.

$$3HNO_{2(aq)} \longrightarrow HNO_{3(aq)} + 2NO_{(g)} + H_2O_{(g)}$$

2. It acts as an oxidizing agent and oxidizes HI.

$$2HNO_{2(aq)} + 2HI_{(aq)} \longrightarrow 2H_2O_{(l)} + 2NO_{(g)} + I_{2(s)}$$

(viii) What is the action of heat on orthophosphoric acid? Write chemical equation also.

Ans On heating, it loses water and converted into pyro and meta-phosphoric acid.

$$\underset{\text{Orthophosphoric acid}}{2H_3PO_4} \xrightarrow[-H_2O]{240^\circ C} \underset{\text{Pyrophosphoric acid}}{H_4P_2O_7} + \underset{\text{Metaphosphoric acid}}{2HPO_3}$$

(ix) Write four physical properties of sulphuric acid.

Ans **Physical Properties:**

1. Pure sulphuric acid is a colourless oily liquid without an odour.
2. Its specific gravity is 1.834 at 18°C.
3. It freezes at 10.5°C.
4. Its boiling point is 338°C.

(x) Name the four components of environment.

Ans Following are the four components of environment:

1. Atmosphere 2. Hydrosphere

3. Lithosphere 4. Biosphere

(xi) What is meant by dissolved oxygen (DO) to check the quality of water?

Ans It is an important parameter to find the quality of water. The water with good quality contains dissolved oxygen from 4-8 ppm. The polluted water contains dissolved oxygen less than 4 ppm. The dissolved oxygen helps in oxidation of organic matter present in water.

(xii) Write the destructive distillation of coal.

Ans When coal is heated at 500-1000°C in absence of air, then it is converted into coke, coal tar and coal gas. It is called carbonization or destructive distillation of coal.

3. Write short answers to any EIGHT (8) questions: (16)

(i) $KMnO_4$ acts as oxidizing agent, show with two examples.

Ans $KMnO_4$ acts as an oxidizing agent:

Example:

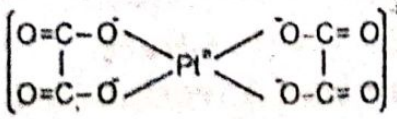
1. $2KMnO_4 + 3H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 3H_2O + 5[O]$

   $5H_2S + 5[O] \rightarrow 5H_2O + 5S$

2. $2KMnO_4 + 3H_2SO_4 + 5H_2S \rightarrow K_2SO_4 + 2MnSO_4 + 5S + 8H_2O$

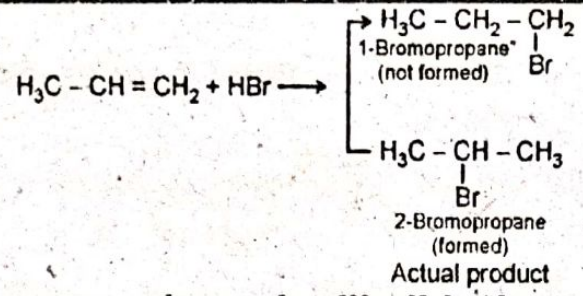
(ii) What are chelates? Give one example.

Ans When all the donor atoms get coordinated with same metal ion, a complex compound is formed which contains one or more ring in its structure and hence is called chelate.



(iii) What is the statement of Markownikov's rule? Also give example.

Ans This rule states that: In the addition of an unsymmetrical reagent to an unsymmetrical alkene, the negative part of the adding reagent goes to that carbon, constituting the double bond, which has least number of hydrogen atoms. *e.g.*,



(iv) What happens when vic-dihalide is treated with Zn-dust?

Ans Dehalogenation occurs when dihalide is treated with zinc dust in an anhydrous solvent like methanol or acetic acid.

$$H_3C-\underset{Br}{CH}-\underset{Br}{CH}-CH_3 + Zn \xrightarrow{CH_3OH} H_3C-CH=CH-CH_3 + ZnBr_2$$

2-Butene

(v) What happens when benzene is burnt in free supply of air? Write equation.

Ans When benzene is burnt in free supply of air, it is completely oxidized to CO_2 and H_2O.

$$2C_6H_6 + 15O_2 \longrightarrow 12CO_2 + 6H_2O$$

(vi) Describe the best method for preparation of alkyl halides.

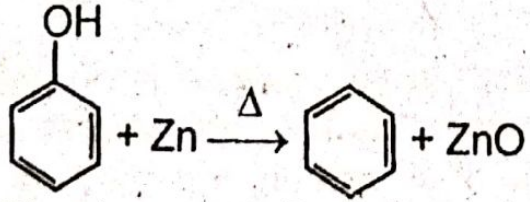
Ans An excellent method for the preparation of simple alkyl iodide, is the treatment of alkyl chloride or alkyl bromide with sodium iodide. This method is particularly useful because alkyl iodides cannot be prepared by the direct iodination of alkanes.

$$RCl + NaI \longrightarrow RI + NaCl$$

$$RBr + NaI \longrightarrow RI + NaBr$$

(vii) How phenol can be converted into benzene?

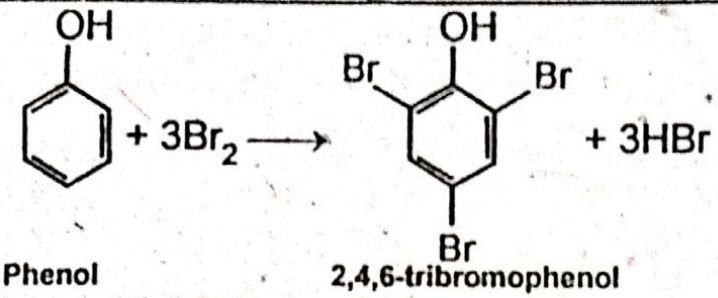
Ans **Reaction with Zn:**



Phenol Benzene

(viii) How does phenol react with bromine water?

Ans An aqueous solution of phenol reacts with bromine water to give white ppt. of 2,4,6-tribromophenol.



Phenol 2,4,6-tribromophenol

(ix) What are aldehydes and ketones? Give examples.

Ans Organic compounds containing carbonyl group $\left(\rangle C=O\right)$ are called carbonyl compounds. In aldehydes, the carbonyl group is bonded to at least one hydrogen atom. Its general formula is $R-\overset{O}{\overset{\|}{C}}-H$. *e.g.*, $H-\overset{O}{\overset{\|}{C}}-H$, (formaldehyde).

In ketones, the carbonyl group is bonded to two carbon atoms. Its general formula is $R-\overset{O}{\overset{\|}{C}}-R$.

e.g., $CH_3-\overset{O}{\overset{\|}{C}}-CH_3$ (acetone).

(x) How formaldehyde is prepared on large scale?

Ans On industrial scale, formaldehyde is prepared by passing a mixture of methanol vapours and air over iron oxide-molybdenum oxide or silver catalyst at 500°C.

$$2CH_3OH + O_2 \xrightarrow[500^\circ C]{FeO,\ MO_2O_3} 2H-\overset{O}{\overset{\|}{C}}-H + 2H_2O$$

(xi) How carboxylic acid can be obtained from alkene?

Ans Alkenes when heated with alkaline $KMnO_4$ are cleaved at the double bond to form carboxylic acids.

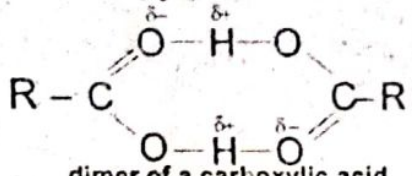
$$\underset{\text{Symmetrical alkene}}{R-CH=CH-R} + 4[O] \xrightarrow[\Delta]{KMnO_4/OH^-} \underset{\text{Carboxylic acid}}{2RCOOH}$$

$$\underset{\text{2-Butene}}{H_3C-CH=CH-CH_3} + 4[O] \xrightarrow[\Delta]{KMnO_4/OH^-} \underset{\text{Ethanoic acid}}{2CH_3COOH}$$

(xii) Why does mostly carboxylic acid exist as dimers?

Ans The boiling points of carboxylic acids are relatively high due to intermolecular hydrogen bonding.

The molecular mass determination in non-polar solvent like benzene shows that carboxylic acids exists as cyclic dimers.



dimer of a carboxylic acid

4. Write short answers to any SIX (6) questions: (12)

(i) Why is cement named as Portland cement?

Ans Cement was first introduced by an English Mason Joseph Aspdin. He found it, when strongly heated mixture of limestone and clay was mixed with water and allowed to stand, it hardened to a stone like mass which resembled Portland rock; a famous building stone of England. Since then the name of Portland cement is given to a mixture of a lime, silica, iron oxide and alumina.

(ii) Write about digestion process for preparation of pulp.

Ans Digestion of the raw material is main unit of paper manufacturing. The digestion of material is done in a steel digester. It is 10 meters long and 2 meters in diameter. When raw material enters into the digester, the steam and sodium sulphite liquor are introduced in. The pH is maintained at 7–9 by adding NaOH or Na_2CO_3. The digester is closed like a pressure cooker. The digester revolves at 2.5 R.P.M and its temperature is kept at 160-180°C. The process of digestion completes in 45 minutes after which pressure is released.

(iii) Define DAP. Write reaction for its preparation.

Ans DAP stands for Diammonium phosphate. This compound is prepared by continuous process. In this process, anhydrous ammonia gas is reacted with phosphoric acid at 60–70°C and pH 5.8 to 6.

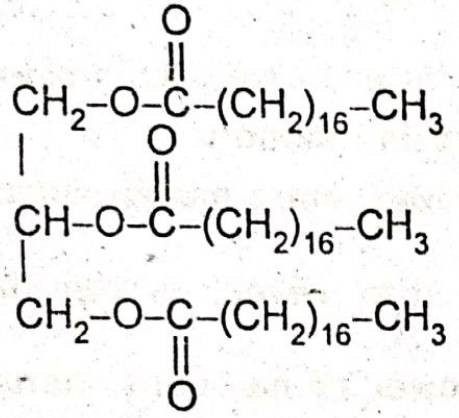
$$2NH_3 + H_3P_4 \longrightarrow (NH_4)_2HPO_4 + Heat$$

(iv) What is difference between fat and oil?

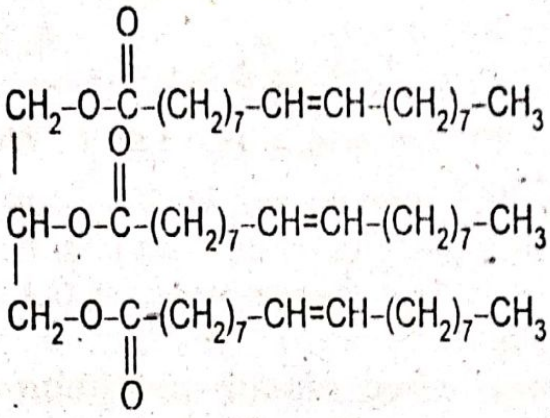
Ans

	Fats	Oils
1.	The glycerides in which long-chain saturated acid compounds predominate tend to be solid or semi-solid and are termed as fats.	Oils are glycerol esters which contain higher proportion of unsaturated fatty acids components.

2. Its structural formula is:



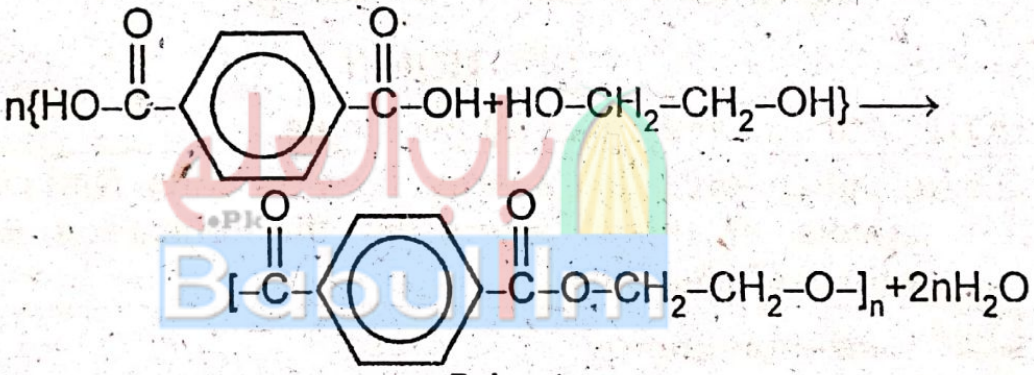
2. Its structural formula is:



(v) Write note on condensation polymer.

Ans **Condensation Polymerization:**

This type of polymerization results from the mutual reaction of two functional groups. The reaction usually involves the removal of a water molecule or a methanol molecule. It takes place at both ends of the growing chain. For example, dicarboxylic acids or esters combine with diols to get the desired polymer like nylon and polyester fibre. Such polymerizations are generally ionic in nature.



Polyester

(vi) Define iodine number and acid number.

Ans **Iodine number:**

The number of grams of iodine which will add to 100 g fats or oil is called iodine number.

Acid number:

The number of milligrams of KOH required to neutralize one gram of an oil or fat is called acid number. The acid number of an oil or fat indicates the amount of free fatty acids in oil or fat.

(vii) How NaOH reacts with Cl_2 in hot and cold state?

Ans The reactions of chlorine with hot and cold NaOH are examples of "Disproportionation reactions".

$$Cl_2 + 2NaOH \xrightarrow{cold} NaCl + NaClO + H_2O$$

$$3Cl_2 + 6NaOH \xrightarrow{hot} 5NaCl + Na_2ClO_3 + 3H_2O$$

(viii) What is iodized salt? Write its function.

Ans Iodized salt is table salt mixed with a minute amount of various salts of element iodine.

This salt is used in our food to prevent us from thyroid gland.

(ix) Give reason oxidation power of halogens increases $F_2 > Cl_2 > Br_2 > I_2$.

Ans The order of oxidizing power as oxidizing agents as:

$$F_2 > Cl_2 > Br_2 > I_2$$

The oxidizing power of halogens depends upon the following factors:

1. Energy of dissociation
2. Electron affinities of atoms
3. Hydration energies of ions
4. Heat of vaporization (for Br_2 and I_2)

SECTION-II

NOTE: Attempt any Three (3) questions.

Q.5.(a) Define ionization energy. Give its units. Discuss the effects of three factors on the ionization energy values of elements. (4)

Ans Ionization Energy:

Definition:

The minimum energy required to remove one valence electron from an isolated ground state atom of an element in gaseous form is called ionization energy, *e.g.*,

$$Na_{(g)} \longrightarrow Na^+_{(g)} + e^- \qquad I.E = 513\ kJ/mol$$

The ionization energy of sodium is 513 kJ/mole.

Explanation:

Elements with greater atomic number have more than one value of ionization energy. The energy required to remove the first electron is called first ionization energy and second ionization energy is the energy required to remove the second electron from a mono positive ion to form a dipositive ion. The

second ionization energy is greater because of greater attraction of nuclear charge on the remaining electrons.

$$Mg \longrightarrow Mg^{+} + e \qquad I_1 = 738 \text{ kJ mol}^{-1}$$

$$Mg^{+} \longrightarrow Mg^{+2} + e \qquad I_2 = 1457 \text{ kJ mol}^{-1}$$

(a) Variation within a Group:

The ionization energy decrease down a group due to the following reasons:

(i) Increase in Atomic Size (Atomic Radius):

'Due to the addition of a shell in every successive member of the group, the increased distance of the outermost shell decreases the influence of the nuclear charge and results in decrease in the value of ionization energy down a group.

(ii) Shielding Effect:

With the increase in the number of inner shells, attraction of nuclear charge on the outermost orbit decreases. So the ionization energy decreases down a group due to shielding effect of inner electrons down a group.

(b) Variation Across a Period:

The ionization energy increases across a period because the atomic size or atomic radius decreases across a period from left to right. As the nuclear charge increases, the outer shell electrons become more strongly bound to the nucleus and difficult to remove. It results in increase in ionization energy across a period.

The inert gases at the end of each period have the highest ionization energy due to their complete and stable electronic configuration. It makes the removal of electron extremely difficult.

(b) Explain the peculiar behaviour of beryllium. (4)

Ans **Peculiar Nature of Beryllium (Be):**

1. Beryllium metal is almost as hard as iron. The other alkaline earth metals are much softer than beryllium.
2. The melting and boiling points of Be are higher than that of other alkaline earth metals.
3. Beryllium in particular is quite resistant towards complete oxidation, even by acids, because of its BeO coating.
4. Beryllium is the only member of its group which reacts with alkalies to give hydrogen.
   The other members do not react with alkalies.

$$Be + 2NaOH \rightarrow Na_2BeO_2 + H_2$$

Sodium beryllate

Q.6.(a) Describe the manufacture of wrought iron from cast iron. **(4)**

Ans **Manufacture of Wrought Iron from Cast Iron:**

It is manufactured from cast iron by puddling *i.e.*, by heating cast iron in a special type of reverberatory furnace called puddling furnace. This furnace has a low roof to deflect the hot gases and flames downwards and to melt cast iron. The hearth of the furnace is lined with haematite (Fe_2O_3). The cast iron is placed on the hearth, melted by hot gases and stirred or puddled with long iron rods called rabbles through the doors to bring it in, thorough contact with the lining of the hearth, *i.e.*, Fe_2O_3.

The haematite (Fe_2O_3) lining supplies oxygen, necessary for the oxidation of carbon, sulphur, silicon, manganese and phosphorus present in the cast iron. Oxides of carbon and sulphur, being volatile escape out at high temperature.

$$3C + Fe_2O_3 \longrightarrow 2Fe + 3CO$$

$$3S + 2Fe_2O_3 \longrightarrow 4Fe + 3SO_2$$

While those of manganese, silicon and phosphorous form slags. Thus

$$3Si + 2Fe_2O_3 \longrightarrow 4Fe + 3SiO_2$$

$$2Mn + O_2 \longrightarrow 2MnO$$

$$MnO + SiO_2 \longrightarrow MnSiO_3(Slag)$$

$$4P + 5O_2 \longrightarrow 2P_2O_5$$

$$Fe_2O_3 + P_2O_5 \longrightarrow 2FePO_4(Slag)$$

With the removal of impurities, the melting point of the metal rises and it becomes a semi-solid mass. At this stage, it is taken out in the form of balls or blooms on the ends of rabbles. While still hot, these balls are subjected to hammering to squeeze out, as much of slag as possible. The product so obtained is known as wrought iron.

(b) Describe the natural and human sources of nitrogen oxides and sulphur oxides. **(4)**

Ans **Nitrogen Oxides (NO_x):**

The gases nitric oxide, NO and nitrogen dioxide, NO_2 are represented by NO_x.

Sources:

(a) Natural:

Bacterial action produces NO_x mainly NO.

(b) Human Activities:

Nitrogen oxides are generally produced by combustion of coal, oil, natural gas and gasoline. Both oxides result from the oxidation of nitrogeneous compounds present in fossil fuel. The burning of fuel in the presence of air in internal combustion engine also produces NO.

$$N_2 + O_2 \xrightarrow{\text{high temperature}} 2NO$$

Nitrogen dioxide is produced when nitric oxide reacts with oxygen.

$$2NO + O_2 \longrightarrow 2NO_2$$

The residence time of NO and NO_2 in the atmosphere are 4 and 3 days, respectively. Due to photochemical reactions, NO_x are converted to HNO_3 which is carried down in either rainfall or as dust.

Sulphur Oxides, SO_z:

Sources:

(a) Natural:

On global scale, most of sulphur dioxide is produced by volcanoes (67%) and by oxidation of sulphur containing gases produced by decomposition of organic matter.

(b) Human Activities:

Air is polluted with SO_2 due to combustion of coal (containing 1-9%S), crude oil and other fossil fuel in power plants and petroleum industry, etc.

$$S + O_2 \longrightarrow SO_2$$

$$2SO_2 + O_2 \longrightarrow 2SO_3$$

These gases (SO_2 and SO_3) because of their pungent odour are very irritant and suffocating. Through various reactions in the atmosphere, they form sulphate aerosols. These aerosols cause severe respiratory troubles, particularly among older people. Sulphur dioxide is the major source of acid deposition in the atmosphere.

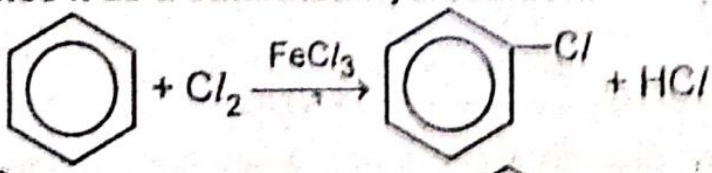
Q.7.(a) Differentiate between homocyclic and heterocyclic compounds with two examples each. (4)

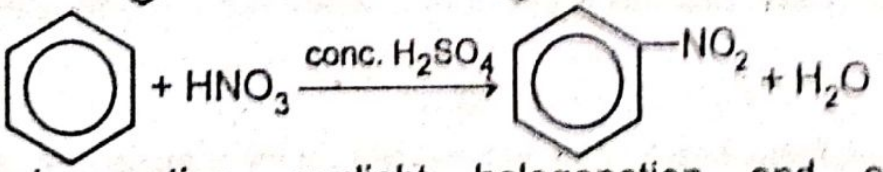
Ans For Answer see Paper 2017 (Group-II), Q.7.(a).

(b) Write down two reactions in which benzene behaves as saturated hydrocarbon and two reactions in which benzene behaves as unsaturated hydrocarbon. (4)

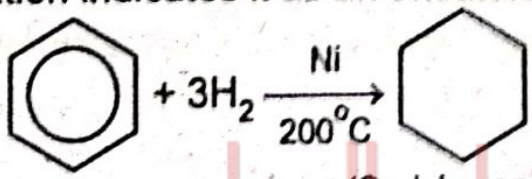
Ans

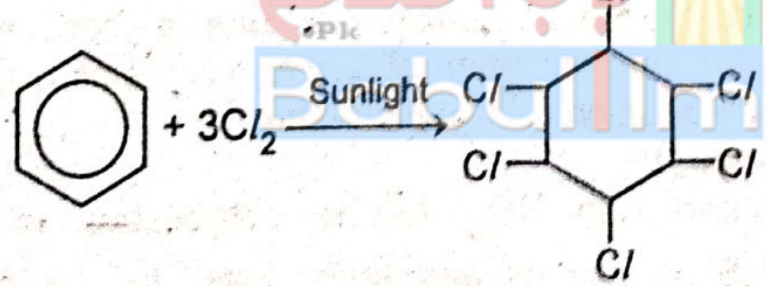
(a) Halogenation, nitration and sulphonation of benzene indicates it as a saturated hydrocarbon.





(b) Hydrogenation, sunlight halogenation and ozonide formation indicates it as an unsaturated hydrocarbon.



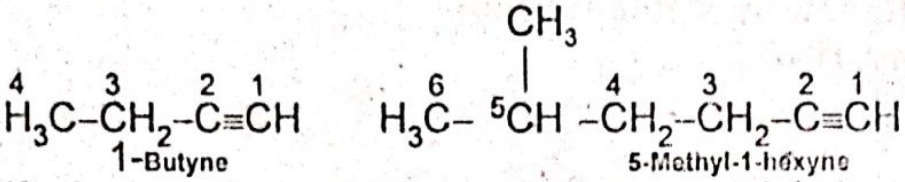


Q.8.(a) What are rules for naming alkynes? Explain with suitable examples. (4)

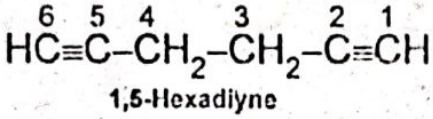
Ans **Nomenclature of Alkynes:**

1. The largest continuous carbon chain containing triple bond is selected. The name of the identical alkane is changed from ane to -yne. *e.g.*,

2. The position of triple bond is shown by numbering the alkyne, so that minimum number is assigned to the triple bond.

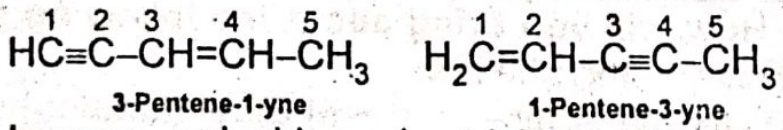


3. If a hydrocarbon contains more than one triple bonds, it is named as alkadiyne and triyne etc. depending on the number of triple bonds.

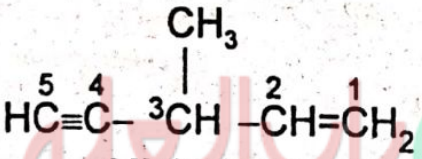


4. If both double and triple bonds are present in the compound, then ending enyne is given to the root.

(a) Lowest possible number is assigned to a double or a triple bond irrespective of whether ene or yne gets the lower number.

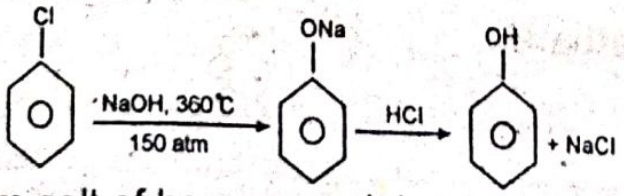


(b) In case, a double and a triple bond are present at identical positions, the double bond is given the lower number.

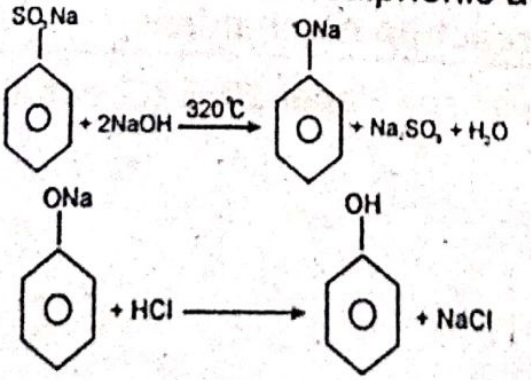


(b) Write down Dow's method for preparing phenol. What is action of following on phenol: (4)
(i) Bromine water (ii) HNO_3 at different temperatures

Ans (i) Dow's Method:

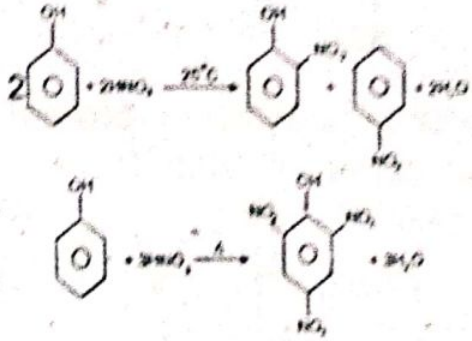


(ii) From sodium salt of benzene sulphonic acid:

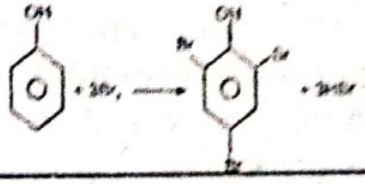


Reaction of Phenol with:

(i) Conc. HNO_3:



(ii) With Br_2 water:



Q.9.(a) How will you bring about the following conversions from an alkyl halide: (4)

(i) Diethyl ether (ii) Ethyl thioalcohol

(iii) Ethyl acetate (iv) Nitroethane

Ans (i) Diethyl ether:

$$2C_2H_5Br + Ag_2O \longrightarrow \underset{\text{Diethyl ether}}{C_2H_5OC_2H_5} + 2AgBr$$

(ii) Ethyl thioalcohol:

$$CH_3-\overset{\delta+}{C}H_2-Br^{\delta-} + \bar{S}H \longrightarrow \underset{\text{Ethyl thioalcohol}}{C_2H_5SH} + Br^-$$

(iii) Ethyl acetate:

$$CH_3-\overset{\delta+}{C}H_2-Br^{\delta-} + CH_3COONa^+ \longrightarrow \underset{\text{Ethyl acetate}}{CH_3COOC_2H_5} + NaBr$$

(iv) Nitroethane:

$$CH_3-\overset{\delta+}{C}H_2-Br^{\delta-} + N\bar{O}_2 \longrightarrow \underset{\text{Nitroethane}}{C_2H_5NO_2} + Br^-$$

(b) What type of aldehydes give Cannizzaro's reaction? Give its reaction mechanism. (4)

Ans For Answer see Paper 2018 (Group-I), Q.9.(b).