Inter (Part-II) 2018

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

SECTION-I

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

(i) Why diamond is a non-conductor and graphite is fairly a good conductor?

Ans Diamond and graphite are the allotropic forms of carbon. Diamond has a compact structure. All the electrons are busy in sigma framework due to sp^3-sp^3 overlapping. Electrons are not free, so diamond is a bad conductor of electricity.

Graphite has a layered structure. Loosely-held electrons are present in the layers, so electrical current can pass parallel, but not perpendicular to the layers.

(ii) The hydration energy of the ions are in the order, justify it: $Al^{+3} > Mg^{+2} > Na^{+1}$.

Ans Hydration energy of an ion depends upon the charge and the size of ion. It is directly proportional to ionic charge and inversely proportional to its size. Al^{3+}, Mg^{2+} and Na^{+} ions are iso-electronic and their size decreases in the following order:

$$Na^{+} > Mg^{2+} > Al^{3+}$$

So, hydration energy of Al^{3+} will be maximum among these ions. Hydration energies of these ions are given below:

$Na^{+} = -390$ kJ / mol

$Mg^{2+} = -1891$ kJ / mol

$Al^{3+} = -4613$ kJ / mol

(iii) Why lime water turns milky with CO_2 but becomes clear with excess of CO_2.

Ans Lime water turns milky due to the formation of $CaCO_3$.

$$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$$

But in the excess of CO_2, solution becomes clear due to the formation of $Ca(HCO_3)_2$ which is soluble in water.

$$CaCO_3 + CO_2 + H_2O \longrightarrow Ca(HCO_3)_2$$

(iv) Give any four uses of "Al".

Ans **Uses of Al:**

1. Aluminium is an excellent conductor of both electricity and heat. Thus, it is used as heat exchanger in chemical, oil and other industries. Heavy duty electrical cables are made of aluminium metal.
2. It is non-magnetic and is thus used in navigational equipment.
3. At homes, aluminium is found in the form of cooking utensils, windows frames and kitchen foil.
4. Aluminium readily forms alloys with other metals like copper, magnesium, nickel and zinc.

(v) What happens when ortho boric acid reacts with:
(i) NaOH (ii) Ethyl alcohol

Ans **(i) NaOH:**

$$4H_3BO_3 + 2NaOH \longrightarrow Na_2B_4O_7 + 7H_2O$$

(ii) Ethyl alcohol:

$$H_3BO_3 + 3C_2H_5OH \longrightarrow (C_2H_5)_3BO_3 + 3H_2O$$

(vi) What is vitreous silica? Give its two uses.

Ans When crystalline silica is heated, it melts to give a viscous liquid, which when cooled, is converted into rigid solid and not in a crystalline form. The solid formed is called vitreous silica.

(vii) NO_2 is a strong oxidizing agent, prove with the help of two reactions.

Ans It is a strong oxidizing agent and oxidizes H_2S to sulphur and KI to I_2.

Reactions:

$$H_2S_{(g)} + NO_{2(g)} \longrightarrow H_2O_{(l)} + S_{(s)} + NO_{(g)}$$

$$2KI_{(aq)} + 2NO_{2(g)} \longrightarrow 2KNO_{2(aq)} + I_{2(s)}$$

(viii) Give two reactions of H_2SO_4 which show its oxidizing behaviour.

Ans H_2SO_4 act as a strong oxidizing agent. It oxidizes C and S giving CO_2 and SO_2, respectively.

Reactions:

$$C_{(s)} + 2H_2SO_{4(aq)} \longrightarrow CO_{2(g)} + 2SO_{2(g)} + 2H_2O_{(l)}$$

$$S_{(s)} + 2H_2SO_{4(aq)} \longrightarrow 3SO_{2(g)} + 2H_2O_{(l)}$$

(ix) Give four dissimilarities of oxygen and sulphur.

Ans

	Oxygen		**Sulphur**
(i)	There are two allotropic forms of oxygen, *i.e.*, O_2 and O_3.	(i)	There are three allotropic forms of sulphur, *i.e.*, rhombic, monoclinic and plastic.
(ii)	Oxygen helps in combustion.	(ii)	Sulphur is itself combustible.
(iii)	It is a gas at ordinary temperature.	(iii)	It is solid at ordinary temperature.
(iv)	Oxygen is sparingly soluble in water.	(iv)	Sulphur is not soluble in water.

(x) What is BOD?

Ans The value of BOD is the amount of oxygen consumed as a result of biological oxidation of dissolved organic matter in the sample. It is the biochemical oxygen demand.

(xi) What is the role of chlorofluorocarbons in destroying ozone?

Ans Chlorofluorocarbons are used as refrigerants in air-conditioning and in aerosol sprays are inert in the troposphere but slowly diffuse into stratosphere, where they are subjected to ultraviolet radiation generating $Cl^{\cdot}$ free radicals. Chlorofluorocarbons (CFCs) play an effective role in removing O_3 in the stratosphere due to following reactions:

$$CFCl_3 \longrightarrow CFCl_2 + Cl^{\cdot}$$

$$Cl^{\cdot} + O_3 \longrightarrow ClO^{\cdot} + O_2$$

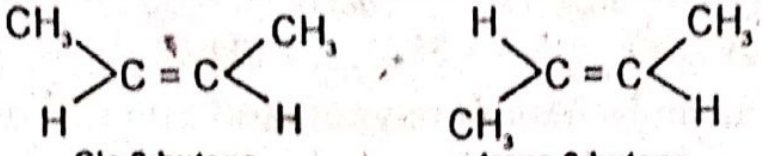
$$ClO^{\cdot} + O \longrightarrow Cl^{\cdot} + O_2$$

(xii) Explain cis-trans isomerism, give one example.

Ans The isomerism due to which compounds have same structural formula but different position of identical groups in space is called cis-trans isomerism.

Example:

2-butene shows cis-trans isomerism.



Cis 2-butene trans 2-butene

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

(i) Define ligand with an example.

Ans The atoms or ions or neutral molecules, which surround the central metal atom or ion and donate electron pairs to it, are called ligands. They may be anions or neutral molecules, *e.g.*,

$K_4[Fe(CN)_6]$. $[Ag(NH_3)_2]Cl$

(ii) What is the percentage(%) of carbon in different types of steel?

Ans **1. Mid steel:**

In mid steel, 0.1 to 0.2 percent of carbon is present.

2. Medium carbon steel:

In this type of steel, 0.2 to 0.7 percent of carbon is present.

3. High carbon steel:

In this type of steel, 0.7 to 1.5 percent of carbon is present.

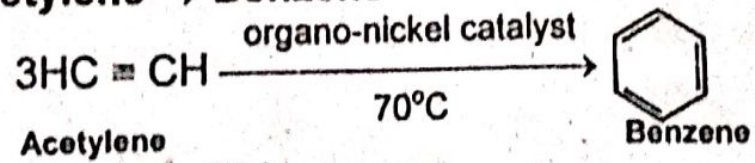
(iii) Why alkanes are less reactive organic compounds?

Ans Alkanes are less reactive because they contain σ bond between carbon atoms, which is a strong bond and it is difficult to break it and hence to make a reaction.

(iv) Convert: (a) Acetylene → Benzene

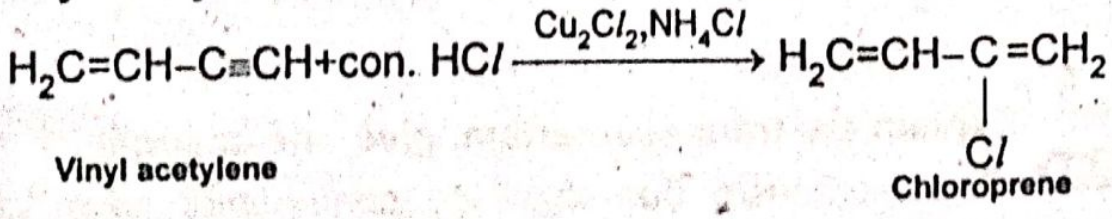
(b) Vinyl acetylene → Chloroprene

Ans **(a) Acetylene → Benzene**



Acetylene Benzene

(b) Vinyl acetylene → Chloroprene

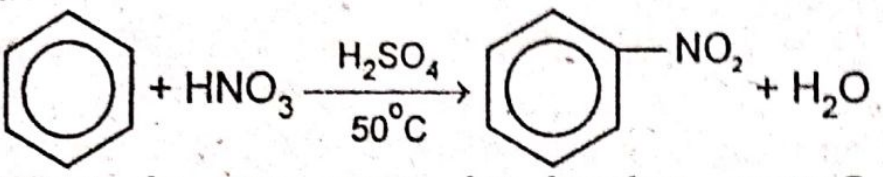


Vinyl acetylene Chloroprene

(v) What is meant by nitration of benzene? Write its reaction.

Ans The introduction of $-NO_2$ group in benzene ring is called nitration. It takes place when benzene is heated with 1 : 1 mixture of conc. HNO_3 and conc. H_2SO_4.

Reaction:



(vi) What do you mean by leaving group? Give an example.

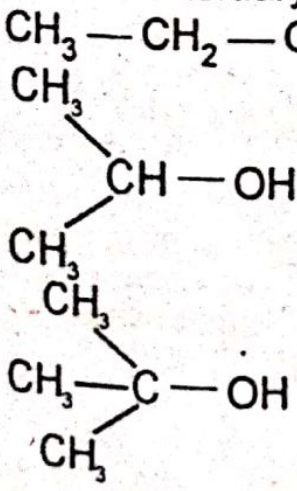
Ans Leaving group (L) is also a nucleophile. It departs with an unshared pair of electrons. If we wish a S_N reaction to proceed in the forward direction, the incoming nucleophile must be stronger than the departing one. Cl^-, Br^-, I^-, HSO_4^- are good leaving groups. Poor leaving groups are OH^-, OR^- and NH_2^-. Iodine ion is a good nucleophile as well as a good leaving group.

(vii) What is denaturing of alcohol?

Ans Ethyl alcohol is made unfit for drinking by adding 10% methyl alcohol. It is called denatured alcohol (Methylated spirit) and process is called denaturing of alcohol.

(viii) How Lucas test is used to distinguish between primary, secondary and tertiary alcohol?

Ans In primary alcohols, –OH functional group is attached with primary carbon atom, in secondary alcohols, it is attached with secondary carbon atom and in tertiary alcohols, it is attached with a tertiary carbon atom.



(ix) Write any four uses of acetaldehyde.

Ans Following are four uses of Acetaldehyde:

1. It is used in the production of acetic acid, acetic anhydride, n-butanol, ethanol, 2-ethyl-1-hexanol, vinyl acetate, paraldehyde, ethylacetate, etc.
2. It is used to make acetaldehyde ammonia used as a rubber-accelerator.
3. It is used to make chloral hydrate, ethanol trimer and tetramer. Chloral hydrate and ethanol trimer are both used as hypnotic drugs whereas ethanol tetramer is used as a slug poison.
4. It is used as an antiseptic inhalant in nasal infections.

(x) How iodoform test can be used to distinguish methyl ketones from other ketones?

Ans The haloform reaction using iodine and aqueous NaOH is called iodoform test. In iodoform test, yellow precipitates of iodoform are used. By iodoform test, we distinguish between methyl ketone and any other ketone.

$$C_2H_5OH + 4I_2 + 6NaOH \xrightarrow{\Delta} \underset{\text{(Iodoform)}}{CHI_3} + HCOONa + 5H_2O + 5NaI$$

(xi) What is the difference between essential and non-essential amino acids?

Ans The amino acids which can be synthesized within the body are called non-essential amino acids.

The amino acids which cannot be synthesized within the body are called essential amino acids. These must be present in one diet. Their deficiency may cause diseases.

(xii) How acetic acid reacts with: (a) PCl_3 (b) $SOCl_2$

Ans **(a) PCl_3**

$$CH_3COOH + PCl_3 \longrightarrow CH_3 - \overset{\overset{O}{\|}}{C} - Cl + H_3PO_3$$

(b) $SOCl_2$

$$CH_3COOH + SOCl_2 \longrightarrow CH_3COCl + SO_2 + HCl$$

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

(i) What is denaturation of proteins?

Ans The process in which structure of proteins is disrupted by heat, change of pH or by strong conditions is called denaturation of proteins.

For example, white component of egg albumin shows denaturation on cooking.

(ii) What are thermosetting polymers?

Ans A thermosetting polymer is one which becomes hard on heating and cannot be softened again. For example, epoxy resins, synthetic varnish, etc.

(iii) What is acid number?

Ans 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.

(iv) What is clinker formation?

Ans The resulting product obtained from the kiln is known as cement clinker. This has the appearance of greenish-black or grey coloured balls, varying in size from small nuts to peas.

(v) Name two woody and two non-woody raw materials.

Ans **Woody raw materials:**

1. Poplar (hard wood) 2. Douglas fir (soft wood)

Non-woody raw materials:

1. Wheat straw 2. Rice straw

(vi) Give significance of potash fertilizer.

Ans These fertilizers provide potassium to the plant or soil. These fertilizers are required during the formation of starch, sugar, seeds and fruits. These fertilizers are very useful for tobacco, coffee, potato and corn.

(vii) Write down the reactions of chlorine with cold and hot NaOH.

Ans

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

$$3Cl_2 + 6NaOH \xrightarrow{\text{hot}} 5NaCl + NaClO_3 + 3H_2O$$

(viii) Write two uses of each helium and argon.

Ans **Uses of Argon:**

1. Argon is used in electric light bulbs, in fluorescent tubes, in radio tubes, and in Geiger counters (used to detect radioactivity).
2. Argon is also used for arc welding and cutting.

Uses of Helium:

1. Helium is used in weather balloons, in welding and in traffic signal lights.
2. Helium is used as cooling medium for nuclear reactors.

(ix) Why iodine has metallic luster?

Ans Iodine shows excitation of electrons at room temperature. When excited electrons come back, they emit radiation of particular wavelength. Due to bigger size, electrons are excited at room temperature. So, iodine is a metallic-appearing shiny grayish-black solid.

SECTION-II

NOTE: Attempt any Three (3) questions.

Q.5.(a) How do you justify the position of hydrogen at the top of IA and VIIA groups of periodic table? (4)

Ans For Answer see Paper 2017 (Group-II), Q.5.(a).

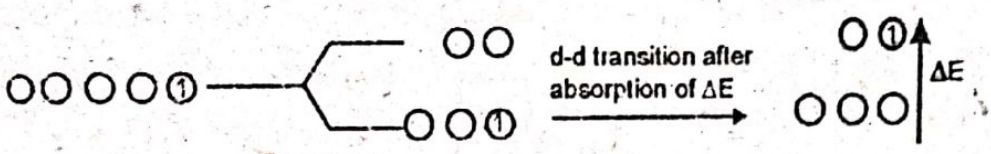
(b) Describe the manufacturing of Na metal by Down's cell, give advantages of this process. (4)

Ans For Answer see Paper 2017 (Group-I), Q.5.(b).

Q.6.(a) Explain the following properties of transition elements: (4)
(i) Colour (ii) Chelate formation.

Ans (i) Colour:

In transition elements, the d-orbitals are responsible for the colour development in their compounds. When these orbitals are involved in bonding, they split up into two energy levels, one set has a higher energy than the other. The electrons residing in low energy d-orbitals absorb a part of the visible light and jump to high energy d-orbitals. The process is called d-d transition. The energy difference of d-orbitals varies from ion to ion. Thus, every ion absorbs a different wavelength and transmits the remaining set of wavelengths that gives different colours to the ions.

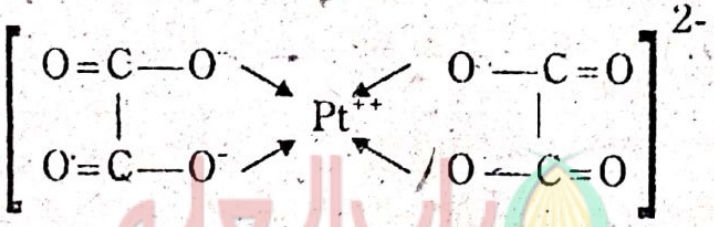


In $[Ti(H_2O)_6]^{3+}$, yellow light is absorbed, while most of the blue and red lights are transmitted. Therefore, the solution of $[Ti(H_2O)_6]^{3+}$ ions looks violet in colour.

(ii) Chelate formation:

When all the donor atoms of a polydentate ligand get coordinated with the same metal ion, a complex compound is formed which contains one or more rings in its structure and hence is called a Chelate. Metal chelates are more stable metal complexes.

When two oxalato ligands $C_2O_4^{2-}$ (bidentate ligand) get coordinated with Pt^{2+} ion, dioxalato platinate (II) ion is obtained. Each oxalate ligand forms a five-membered ring with the cation.



or $[Pt(C_2O_4)_2]^{2-}$

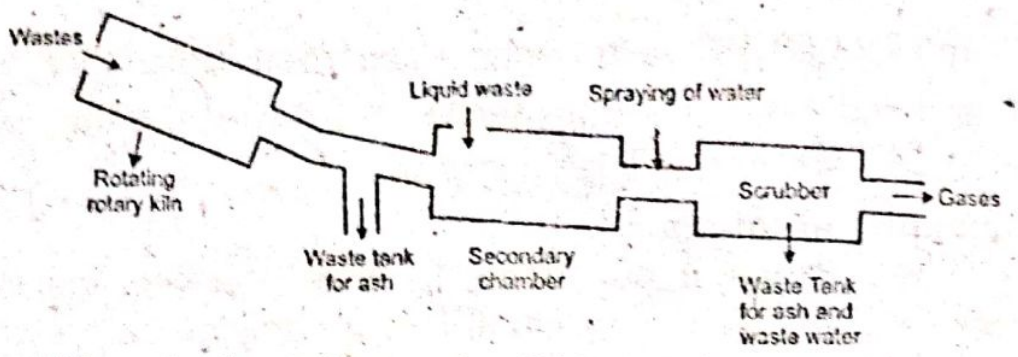
Dioxalato-platinate (II) ion

(b) Explain the process of incineration of industrial waste. **(4)**

Ans **Incineration of Industrial and Hazardous Waste:**

A general process of high temperature incineration system consists of a rotary kiln which accepts all types of wastes including liquid, solid or sludge. The wastes are burned at temperatures between 650° to 1100°C. Ash from the rotating chamber is collected at waste tank and the remaining liquid gaseous materials are passed to the secondary chamber. This chamber is non-rotating and hence the temperature range of 950° to 1300°C is maintained. In this chamber, organic molecules are completely destroyed. The gases produced are then cooled to 230°C by evaporating water spray. The cooled gases are then passed through scrubber system which eliminates the surviving particulates and acid forming

components like CO_2. Ash residues and waste water produced in the rotating and secondary chambers are disposed off in the land fills.



Although, the volume of solid waste is reduced to a much lesser extent by burning it in the incinerator, it is not a clean process of the disposal of solid wastes, as it produces air pollution and also toxic ash. Incineration of the solid waste is a significant source of dioxins, which is a class of carcinogen compounds. Smoke stacks from incineration may emit oxides of nitrogen and sulphur which lead to acid rain. Heavy metals such as lead, cadmium, mercury, etc., may also be present in the leachate of the incinerators.

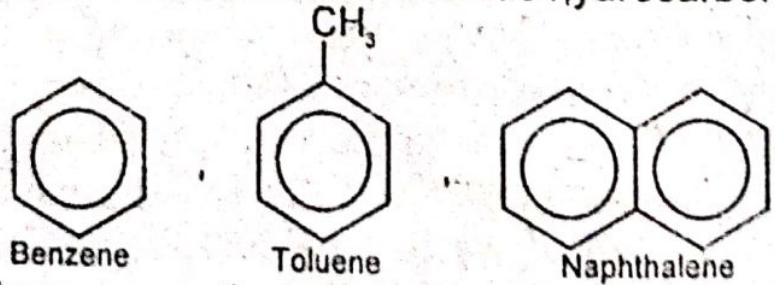
Q.7.(a) Define cracking and give its types. (4)

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

(b) Write down the classification of aromatic hydrocarbons giving one example each. (4)

Ans **Aromatic Hydrocarbons:**

The hydrocarbons which contain at least one benzene ring in their structure are called aromatic hydrocarbons. *e.g.*,



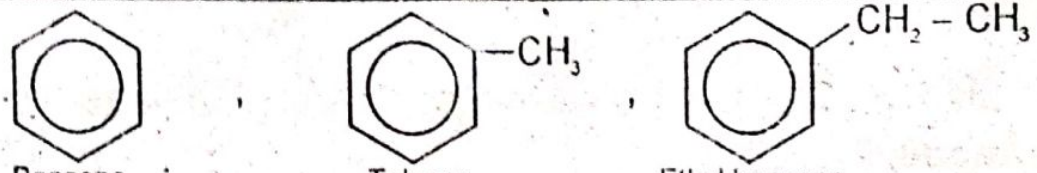
The term aromatic has been derived from Greek word "aroma" which means "Fragrant".

Classification of Aromatic Hydrocarbons:

There are two classes of aromatic hydrocarbons:

(i) Monocyclic Aromatic hydrocarbons:

The hydrocarbons which cotain one benzene ring in their molecules are called monocyclic aromatic hydrocarbons *e.g.*,

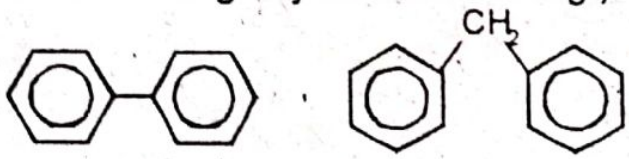


Benzene Toluene Ethyl benzene

(ii) Polycyclic Aromatic hydrocarbons:

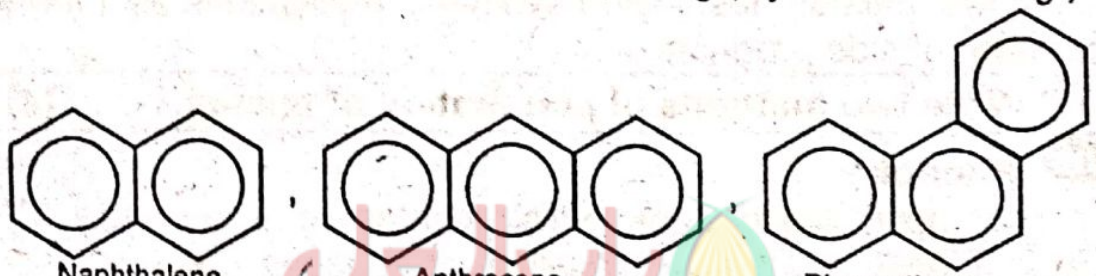
The hydrocarbons which contain two or more benzene rings in their molecules are called polycyclic aromatic hydrcarbons. They have further two classes:

(a) Those in which benzene rings are isolated are called isolated benzene rings hydrocarbons. *e.g.*,



Biphenyl Diphenyl methane

(b) Those in which benzene rings are fused together at ortho positions are called fused benzene rings hydrocarbons. *e.g.*,



Naphthalene Anthracene Phenanthrene

Q.8.(a) How is ethane prepared by Kolbe's electrolytic method? Write its mechanism. **(4)**

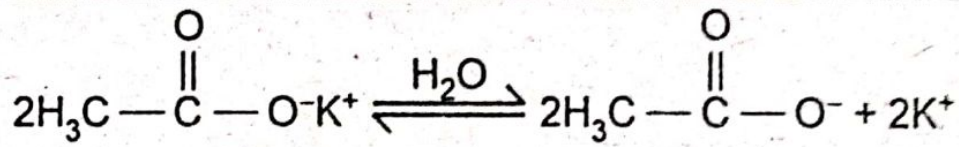
Ans **Kolbe's Electrolytic Method:**

When a concentrated solution of sodium or potassium salt of a monocarboxylic acid is electrolysed, an alkane is produced. This method is only suitable for the preparation of symmetrical alkanes *i.e.*, those of the type R—R. Methane cannot be prepared by this method.

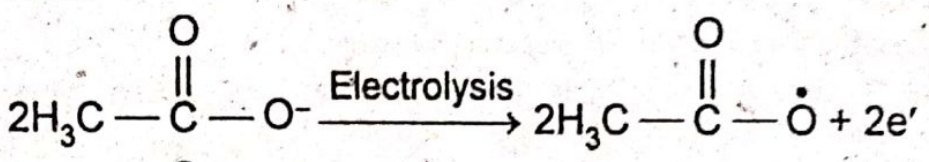
$$2RCOO^-Na^+ + 2H_2O \xrightarrow{\text{Electrolysis}} R—R + 2CO_2 + 2NaOH + H_2$$

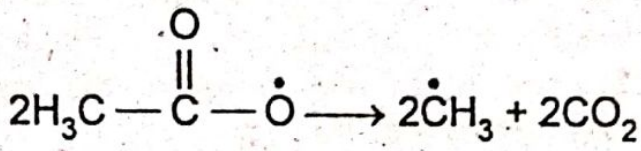
It is known to involve the following mechanism:

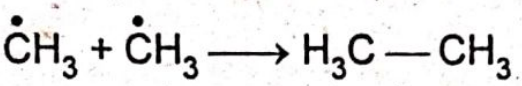
When potassium salt of acetic acid is electrolysed, acetate ion migrates towards the anode and gives up one electron to produce acetate free radical $(CH_3COO^{\bullet})$, which decomposes to give a methyl free radical $(CH_3^{\bullet})$ and CO_2. Two such methyl radicals combine to give ethane.



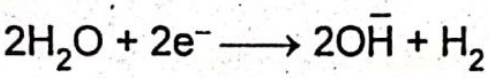
At Anode:

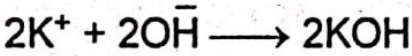






At Cathode:





This reaction has limited synthetic applications as it forms a number of side products.

(b) Write two methods of preparation of phenol. (4)

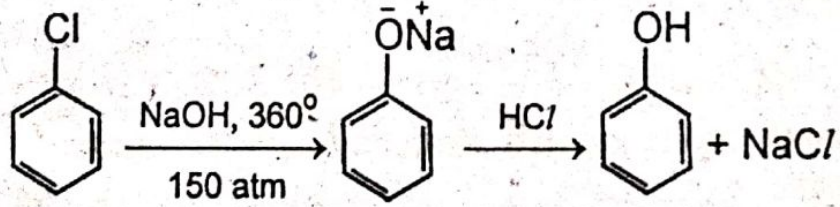
Ans Phenol:

Aromatic compounds which contain one or more OH groups directly attached with carbon of benzene ring are called Phenols. The simplest example is phenol which is also known as Carbolic acid *i.e.*, C_6H_5OH. It was first obtained from coaltar by Runge in 1834.

Preparation of Phenol:

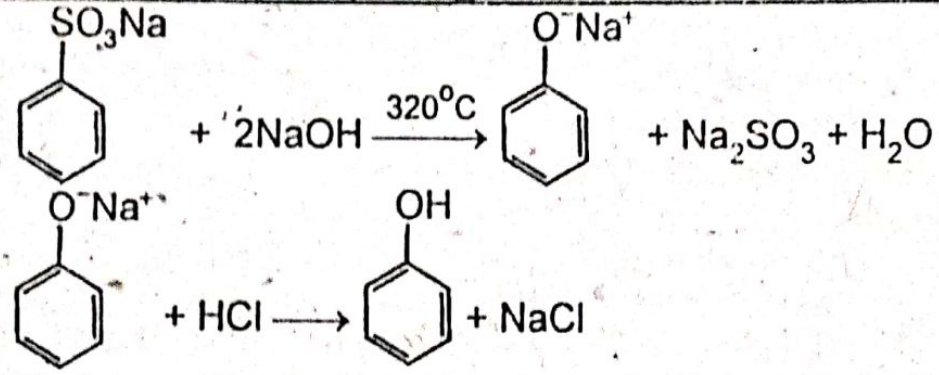
1. From Chlorobenzene (Dow's Method):

In this method, chlorobenzene is treated with 10% NaOH at 360°C and 150 atmospheres pressure. Sodium phenoxide is produced, which on treating with HCl gives phenol.



2. From Sodium Salt of Benzene Sulphonic Acid:

Sodium salt of benzene sulphonic acid reacts with NaOH at 320°C to give sodium phenoxide which on treatment with HCl gives phenol.



The phenol is recovered by steam distillation.

Q.9.(a) Give the four points of difference between S_N1 and S_N2 reactions. **(4)**

Ans

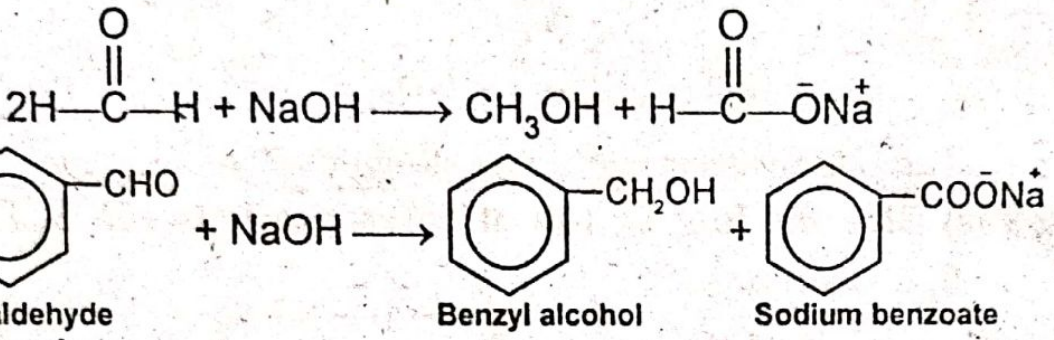
	S_N2		S_N1
(i)	The S_N-reaction in which breaking and formation of bonds take place simultaneously is called S_N2 reaction. It is a single-step reaction.	(i)	The S_N-reaction in which breaking and formation of bonds do not take place at a time is called S_N1 reaction. It is a two-step reaction.
(ii)	In S_N2 reaction, the direction of attacking nucleophile is opposite to that of leaving group.	(ii)	In S_N1 reaction, the attacking nucleophile can attack from both directions easily.
(iii)	In S_N2 reaction, the configuration of alkyl halide is 100% inverted.	(iii)	In S_N1 reaction, the configuration of alkyl halide is 50% inverted.
(iv)	Rate of S_N2 reaction depends upon both the concentration of alkyl halide and attacking nucleophile.	(iv)	Rate of S_N1 reaction depends upon the concentration of alkyl halide only.
	Rate = K [Alkyl halide][Nucleophile]		Rate = K [Alkyl halide]

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

Ans **Cannizzaro's Reaction:**

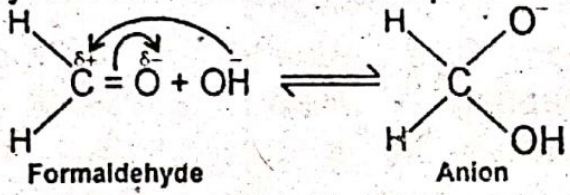
Aldehydes that have no α-hydrogen atoms, undergo cannizzaro's reaction. It is a disproportionation (self-oxidation-reduction) reaction. Two molecules of the aldehyde are

involved, one molecule being converted into the corresponding alcohol (the reduced product) and the other into the acid in the salt form (the oxidation product). The reaction is carried out with 50 percent aqueous solution of sodium hydroxide at room temperature.

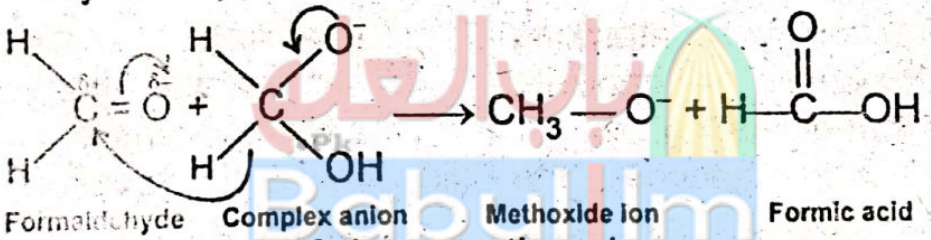


Mechanism:

The hydroxide ion acts as a nucleophile. It attacks on the electrophilic carbonyl carbon to form a complex anion.

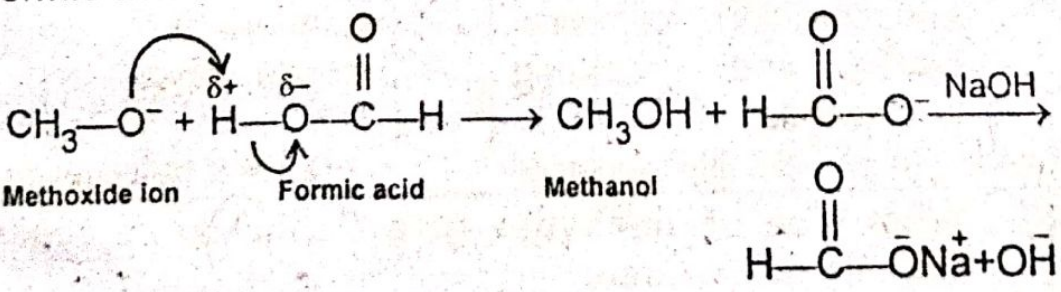


The anion transfers a hydride ion to second molecule of formaldehyde.



The presence of the negative charge on oxygen of the anion helps in the loss of hydride ion.

The methoxide ion acts as a base and abstracts a proton from formic acid to form methanol and formate ion.



The formate ion in the presence of alkali gives a salt of the acid.