CLASS – 10+2 (March 2018) SERIES-C
CAREER ACADEMY,NAHAN CHEMISTRY

Q.1 Volume occupied fcc is [1]

(a) 74% (b) 68% (c) 52.4% (d) 65%

Ans. (a) 74%

Q.2 Which of the following is an insulator [1]

(a) Graphite (b) Al (c) Diamond (d) Si

Ans. (c) Diamond

Q.3 Blood may be purified by [1]

(a) Dialysis (b) electro-osmosis (c) coagulation (d) Filtration

Ans. (a) Dialysis

Q.4 The most abundant element in earth crust is [1]

(a) Si (b) Al (c) O (d) Fe

Ans. (c) O

Q.5 Which does not belong to First Transition series? [1]

(a) Fe (b) V (c) Ag (d) Cu

Ans. (c) Ag

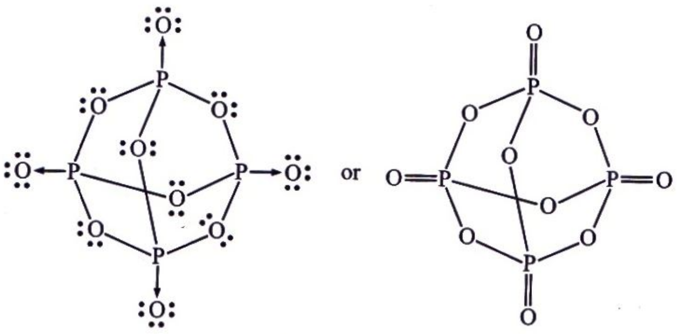
Q.6 Pencillin is [1]

(a) An Analagsics (b) a Transquillizer (c) An antibiotics (d) an Antiseptics

Ans. (c) An antibiotics

Q.7 Draw the structure of P_4O_{10}. [1]

Ans. Structure of P_4O_{10}:



Structure of P_4O_{10}

Q.8 Define order of the reaction. [1]

Ans. It is the sum of the power of the concentration terms in the rate law expression.

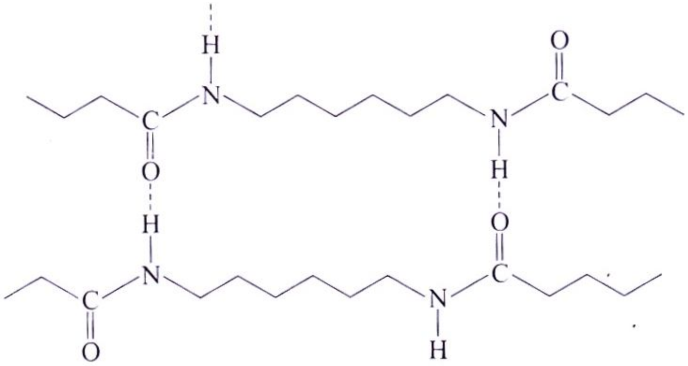
It is experimental determined quantity.

It may be whole numbe ra fractional number or even zero.

It applies to a reaction as a whole, irrespective of all the intermediate steps involved for its completion.

Q.9 What are fibres? [1]

Ans. Fibres: These are the polymers which have quite dipole-dipole interactions.These polymers can be used for making fibres as their molecules are long and thread like and hence, can be easily packed. Due to strong intermolecular forces of attraction, fibres have high tensile strength and least elasticity. As a result, they have high melting points and low solubility. Some important examples of this type of polymers are Nylon-6, 6, polyester (terylene or dacron) and polyacrylonitrile (orlon), etc.



Hydrogen bonding in Nylon-6,6

Q.10 Whatis the name of bidentate ligand "dmg"? [1]

Ans. Dimethyl glyoxime.

Q.11 Explain Handy-Schulz Rule. [2]

Ans. **Handy-Schulz Rule:**Accoding to Hardy Schulze rule, greater the valency of the active ion, greater will be its coagulating power.

For example, to coagulate negative sol of As_2S_3, the coagulating power of different cation has been found to decrease in the order:

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

Minimum amount of an electrolyte in millmoles which is required to cause the coagulation of one of a colloidal solution in two hours is known as coagulating value. It is expressed as millimoles per litre.

Q.12 Define collligative properties and give its types. [2]

Ans. **Collligative properties:** The properties, which depend upon the number of moles of solute in solution and not at all on their nature or composition are called colligative properties.

Types of Colligative Properties:

(a) Realtive lowering of vapour pressure

(b) Osmotic pressure

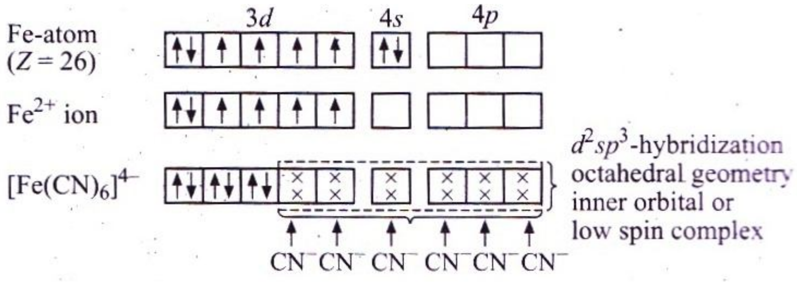
(c) Elevation in boiling point

(d) Depression in freezing pont

Q.13 Discuss the geometery, Nature and Magnetic bahaviour of $[Fe(CN)_6]^{-4}$ ion on the basis of VBT.

[2]

Ans. $[Fe(CN)_6]^{-4}$ complex: The electronic configuration of $Fe(Z = 26)$ is $[Ar]3d^{6}4s^{2}$. The oxidation state of iron in this complex is +2, i.e., Fe^{2+} is formed by loss of two electrons of 4s. There is rearrangement of electrons in 3d-orbitals in order to make two orbitals vacant.



The hybridization of two 3d, one 4s and three 4p-orbitals $(d^{2}sp^{3})$ occurs to form six hybrid orbitals. Six pairs of electrons, one from each CN^{-} ion, occupy the six hybrid orbitals. The complex has octahedral geometry. It is diamagnetic as it does not contain any unpaired electron.

Q.14 Write short note on: [2]

(i) F-Centre

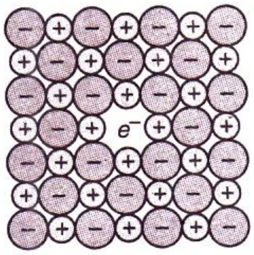
(ii) Doping

Ans. **(i) F-Centre:** The anionic sites occupied by unpaired electron and responsible for the colour of the crystal are called F-centres.

For example, when crystal of NaCl are heated in an atmosphere of sodium vapour, the Na atom are deposited on the surface of the crystal. The CN^{-} ions diffuse to the surface of the crystal and combine with Na atoms to form NaCl. This happens with the loss of electron by Na atoms to form Na^{+} ions. The released electron

$$Na \rightarrow Na^{+} + e^{-}$$

Diffuse into the crystal and occupy the anionic sites. As a result the crystal now has excess of sodium. The anionic sites occupied by unpaired electrons are called F-centres.

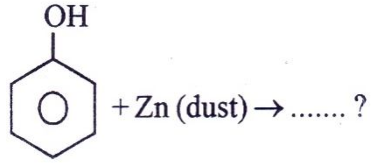


An F-centre in a crystal

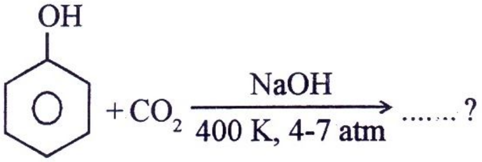
(ii) Doping: It is defined as the process of introducing a small but known amount of desired impurity such as B, P, As etc., (Called dopant) into pure crystal of a Si or Ge.

Q.15 Complelte the following reactions: [2]

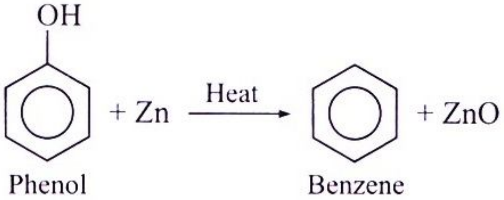
(a)



(b)



Ans. (a)



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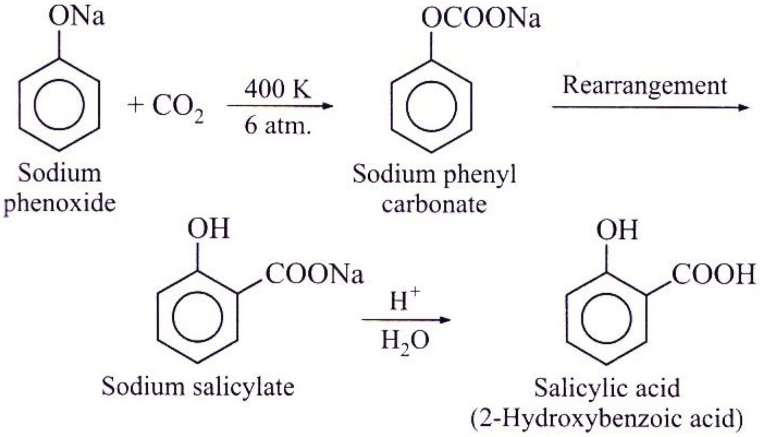
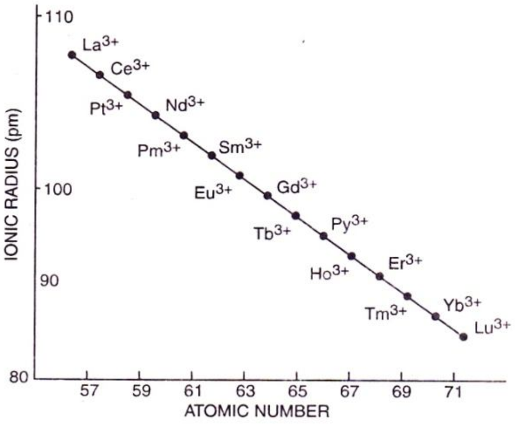


Q.16 Define lanthanoid contraction. Give its cause. [2]

Ans. **Lanthanoid contraction: In** lanthanoid there is a regular decrease in the size of atoms and ions with increasing atomic number. Lanthanoid contraction may be defined as the steady decrease in the size of lanthanide ions (Ln^{3+}) with the increase in atomic number. Due to lanthanide contraction ionic radii decrease from Ce^{3+} (111 pm) to Lu^{3+}(93 pm).



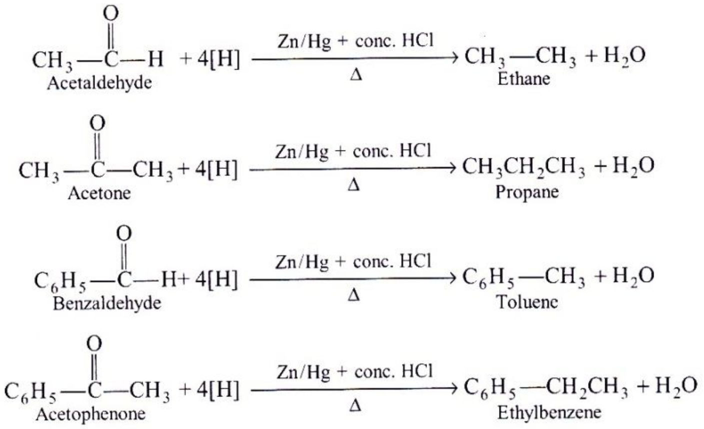
Cause of Lanthanide contraction: As we move through the lanthanide series, 4f-electrons are being added one at each step. The mutual shielding effect of 4f-electrons is very little. This is due to shape of f-orbitals, as they are much diffused. The nuclear charge however, increases by one at each atep. Hence, the inward pull experienced by the 4f-electrons increases. This causes a reduction in the size of entire $4f^n$ subshell. The sum of successive reductions give the total lanthanide contraction. The decrease in atomic size is not so regular, it is more in case of first six elements. However, the decrease in ionic size of tripositive ion M^{3+} with atomic number is quite regular along the series.

Q.17 Explain: [1+1]

(i) Clemmensen's Reduction

(ii) Nitration of Benzaldehyde.

Ans. **(i) Clemmensen's Reduction:** The reduction of aldehydes and ketones to the corresponding hydrocarbons with amalgamated zinc and concentrated hydrochloric acid is called Clemmensen reduction. $>C{=}O \xrightarrow[\Delta]{Zn/Hg\ +\ conc.\ HCl} >CH_2$



$$CH_3-\overset{O}{\overset{\|}{C}}-H + 4[H] \xrightarrow[\Delta]{Zn/Hg\ +\ conc.\ HCl} CH_3-CH_3 + H_2O$$

Acetaldehyde Ethane

$$CH_3-\overset{O}{\overset{\|}{C}}-CH_3 + 4[H] \xrightarrow[\Delta]{Zn/Hg\ +\ conc.\ HCl} CH_3CH_2CH_3 + H_2O$$

Acetone Propane

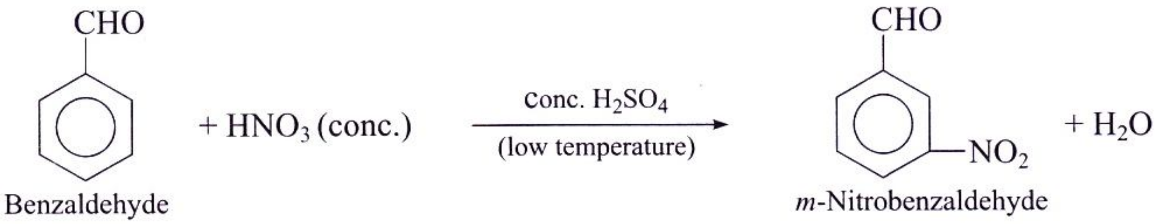
$$C_6H_5-\overset{O}{\overset{\|}{C}}-H + 4[H] \xrightarrow[\Delta]{Zn/Hg\ +\ conc.\ HCl} C_6H_5-CH_3 + H_2O$$

Benzaldehyde Toluene

$$C_6H_5-\overset{O}{\overset{\|}{C}}-CH_3 + 4[H] \xrightarrow[\Delta]{Zn/Hg\ +\ conc.\ HCl} C_6H_5-CH_2CH_3 + H_2O$$

Acetophenone Ethylbenzene

(ii) Nitration of Benzaldehyde: It is carried out by nitrating a mixture of conc. HNO_3 and conc. H_2SO_4.



Q.18 (a) Define the following: [2+1]

(i) Molality

(ii) Molarity

(b) H_2O has higher boiling point than H_2S. Why?

Or

(i) Out of 0.1 M NaCl solution and 0.1 M Glucose which has higher freezing point?

(ii) Define antipyretics.

Ans. (a) **(i) Molality:** It is defined as number of moles of the solute dissolved in 1 kg (1000g) of the solvent. It is denoted by 'm'.

$$\text{Molality (m)} = \frac{Number\ of\ moles\ of\ solute}{Number\ of\ kilograms\ of\ the\ solvent}$$

$$= \frac{Number\ of\ moles\ of\ solute}{Mass\ of\ solvent\ in\ grams} \times 1000$$

Let w_B grams of solute of molecular mass 'mg' are present in w_A grams of the solvent: then

$$\text{Molality 'm'} = \frac{n_B \times 1000}{w_A} = \frac{w_B \times 1000}{m_B \times w_A}$$

Where, n_B is no. of moles of solute,

$$n_B = \frac{w_B}{m_B}.$$

(ii) Molarity: It is defined as the number of moles of the solute per litre or per dm^3 of the solution.

i.e., $$\text{Molarity (M)} = \frac{Number\ of\ moles\ of\ solute}{Number\ of\ litres\ of\ solution}$$

or Molarity ×numberof litres of solution = Number of moles of solute

Let w_B g of the solute of molecular mass m_B are dissolved in V litre os solution.

Or Molarity× m_B = $\frac{w_B}{V}$ = Strength of the solution

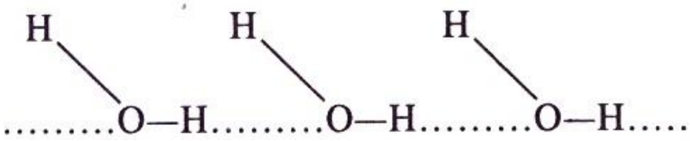
If V is taken in mL (cm^3), then

Molarity of the solution = $\frac{w_B}{m_B \times V} \times 1000$

i.e., $M = \frac{w_B \times 1000}{m_B \times V}$

This unit of molarity is mol $litre^{-1}$ or mol dm^{-3}.

(b) Since atomic size of oxygen is less than sulphur, and electronegativity of oxygen ismore than sulphur, water shows inter-molecular hydrogen bonding but hydrogen sulphide does not. As such a larger number of water molecules are associated with each other to form a cluster of molecules. Thus a larger amount of energy is required for their separation.

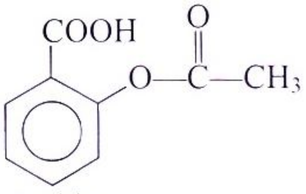


Due to extensive hydrogen bonding in H_2O and its absence in H_2S, boiling point of water is much more than the boiling point of H_2S.

Or

(i) Glucose.

(ii) Antipyretics: Chemical sunstances which are used to bring down the body temperature in high fevers are called antipyretics.



Aspirin
(Acetyl salicylic acid)

Aspirin (2-acetoxybenzoic acid) is a common antipyretic (temperature lowering) properties. Aspirin now finds use in the prevention of heart attacks as it has antiblood clothing action.

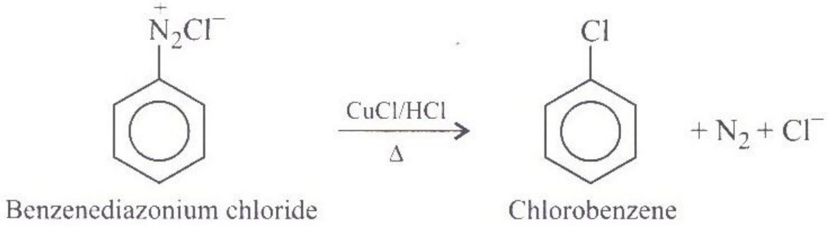
Q.19 Explain: [1+1+1]

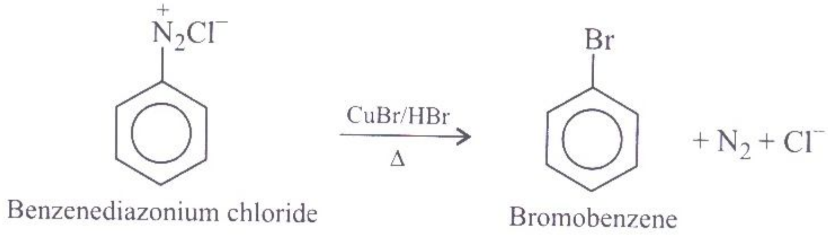
(a) Sandmeyer's Reaction

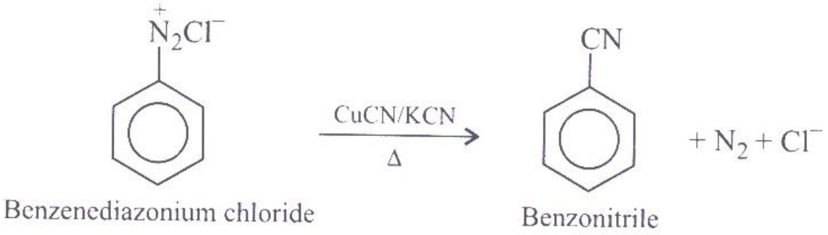
(b) Wurtz Reaction

(c) Willismson Synthesis.

Ans. **(a) Sandmeyer's Reaction:** Arenediazonium salts react with cuprous chloride, cuprous bromide solution dissolved in the corresponding halogen acid and cuprous cyanide to give products in which the diazonium group is replaced by $-Cl. -Br\ and - CN$, respectively. These reactions are known as Sandmeyer reactions.







(b) Wurtz Reaction: The reaction involves the treatment of two molecules of alkyl halide (preferably bominde or iodine) with metallic soldium in the presence of dry ether. In this reaction, halogen of the alkyl halide $(R - X)$ is removed and two alkyl radicals combine together to form a molecule of symmetrical alkane $(R - R)$.

$$\underset{\text{Haloalkane}}{R—X} + 2Na + X—R \xrightarrow{\text{Dry ether}} \underset{\text{Alkane}}{R—R} + 2NaX$$

$$\underset{\text{Methyl iodide}}{CH_3—I} + 2Na + I—CH_3 \xrightarrow{\text{Dry ether}} \underset{\text{Ethane}}{CH_3—CH_3} + 2NaI$$

$$\underset{\text{Bromoethane}}{CH_3—CH_2—Br} + 2Na + \underset{\text{Bromoethane}}{Br—CH_2—CH_3} \xrightarrow{\text{Dry ether}} \underset{\text{Butane}}{CH_3—CH_2—CH_2—CH_3} + 2NaBr$$

However, if two different alkyl halides are used, a mixture of three alkanes is actually obtained. For example,

$$\underset{\text{Bromomethane}}{CH_3—Br} + 2Na + \underset{\text{Bromoethane}}{Br—CH_2—CH_3} \xrightarrow{\text{Dry ether}} \underset{\text{Propane}}{CH_3—CH_2—CH_3} + 2NaBr$$

$$\underset{\text{Bromomethane}}{CH_3—Br} + 2Na + Br—CH_3 \xrightarrow{\text{Dry ether}} \underset{\text{Ethane}}{CH_3—CH_3} + 2NaBr$$

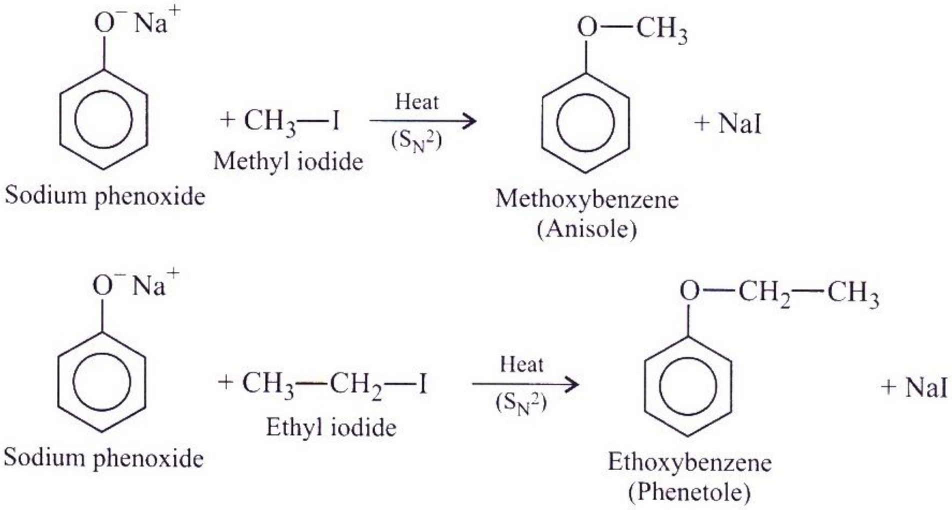
$$\underset{\text{Bromoethane}}{C_2H_5—Br} + 2Na + Br—C_2H_5 \xrightarrow{\text{Dry ether}} \underset{\text{Butane}}{C_2H_5—C_2H_5} + 2NaBr$$

(c) Willismson Synthesis: It involves the heating of alkyl halides with sodium alkoxide or sodium phenoxide to form ether. This is a very good method for the preparation of symmetrical and unsymmetrical ethers.

$$\underset{\text{Sodium alkoxide}}{R\text{—ONa}} + \underset{\text{Alkyl halide}}{X\text{—}R'} \xrightarrow{\text{Heat}} \underset{\text{Ether}}{R\text{—O—}R'} + \text{Na}X$$

$$\underset{\text{Sodium methoxide}}{CH_3O^-Na^+} + \underset{\text{Ethyl bromide}}{CH_3\text{—}CH_2\text{—}Br} \xrightarrow[(S_N2)]{\text{Heat}} \underset{\substack{\text{Methoxyethane}\\\text{(Ethyl methyl ether)}}}{CH_3\text{—}CH_2\text{—}O\text{—}CH_3} + NaBr$$

$$\underset{\text{Sodium ethoxide}}{CH_3CH_2O^-Na^+} + \underset{\text{Ethyl bromide}}{CH_3\text{—}CH_2\text{—}Br} \xrightarrow[(S_N2)]{\text{Heat}} \underset{\substack{\text{Ethoxyethane}\\\text{(Diethyl ether)}}}{CH_3\text{—}CH_2\text{—}O\text{—}CH_2CH_3} + NaBr$$



Q.20 (a) Differentiate between order and Molecularity of the Reaction. [2+1]

(b) Write units of rate constant for zero order Reaction.

Ans. (a) **Differentiate between order and Molecularity of the Reaction**

Sr. No	Molecularity	Order of reaction
1.	It is the total numberof reacting speices (molecules, atoms or ions) which bring the chemical change.	It is the sum of powers of molar concentrations of the reacting species in the rate equation of the reaction.
2.	It is always a whole number.	It may be a whole number, zero, fractional, positive or negative.
3.	It is a theoretical concept.	It is experimentally determined.
4.	It is meaningful only for simple reactions or individual steps of a complex reaction. It is meaningless for overall complex reaction.	It is meantfor the reaction and not for its individual steps.

(b) Units of rate constant for zero order Reaction: $Mol\ l^{-1}S^{-1}$.

Q.21 (a) Molecular N_2 is unreactive, why? [1+1+1]

(b) Bond Angle in H_2S is lower than H_2O, why?

(c) ClF_3 exits but ClF_3 does not, why?

Or

(a) Interhalogen are more reactive than Halogen why?

(b) Out of HclO and HBrO which is more acidic?

(c) Draw the shape of ClF_3.

Ans. **(a) Molecular N_2 is unreactive:** Nitrogen exists as a diatomic molecule $(N \equiv N)$. Due to the presence of a triple bond between the two N-atoms, the bond dissociation energy is large. As a result, nitrogen is inert and unreactive in its elemental state.

(b) Bond Angle in H_2S is lower than H_2O because sp^3-hybridization of the central atom becomes less and less distnict with increasing size, i.e., pure p-orbitals are utilised in $M-H$ bonding.

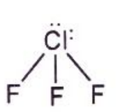
(c) ClF_3 exists because chlorine can exhibit oxidation state of + 3 because of the presence of vacant d-orbitals in its valence shell. However, in the case of fluorine, there are no vacant d-orbital in the valence shell and, therefore, it cannot shoe oxidation state other than-1.

Or

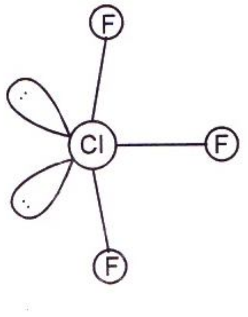
(a) In interhalogen compounds different halogen atoms are linked by covalent bonds (e.g., ICl, ClF_3, lF_7). In other words, these are heteroatomic in nature. Due to the difference in the electronegativites of the halogen atom involved, these compounds are polar in nature and are in general, more reactive than pure halogens in which bonds are non-polar in nature.

(b) Out of HclO and HBrO, HclO is more acidic because more is the electronegative element in the molecule, more acidic is the molecule.

(c) Shape of ClF_3: Both Cl and F has 7 electrons in their valence shell. The Lewis dot structure of ClF_3 indicates that Cl atom indicates a trigonal bipyramid geometry with two equatorial positions occupied by lone pairs. The molecular shape of ClF_3 is slightly bent 'T' –shape or distorted 'T'-shape.



Lewis dot structure of ClF_3
3 bond pairs + 2 lone pairs
Total = 5 electron pairs



Q.22 (a) Explain lead-storage cell. [2+1]

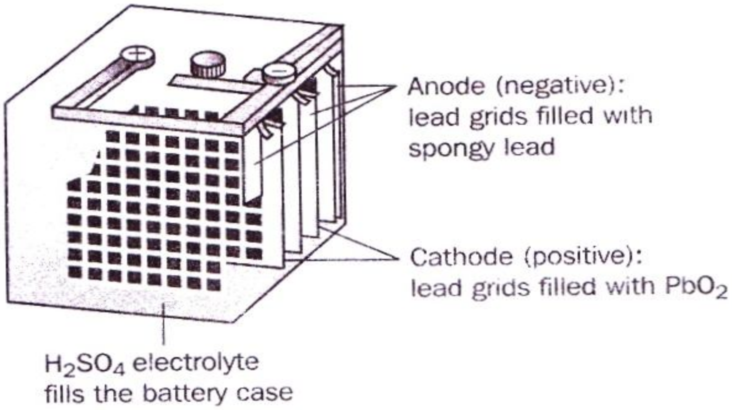
(b) Define Primary cell.

Or

(a) Explain Electrochemical Theory of Rusting of Iron.

(b) Define fuel cell.

Ans. **(a) Lead-storage cell:** It consists of a group of lead plates hearing compressed spongy lead, alternating with a group of lead plates hearing lead dioxide PbO_2. These plates are immesed in a Solution of about 38% H_2SO_4. When the cell discharge, it operates as a voltaic cell. The spongy lead is oxidized to Pb^{2+} ions and lead plates acquire a negative charge.



A lead storage battery

$$Pb \longrightarrow Pb^{2+} + 2e^- \qquad \text{(Anode reaction)}$$

Pb^{2+} ions combine with sulphate ions to form insoluble lead sulphate, $PbSO_4$, which begins to coat lead electrode.

$$Pb^{2+} + SO_4^{2-} \longrightarrow PbSO_4 \qquad \text{(Precipitation)}$$

The electrons are utilized at PbO_2 electrode.

$$PbO_2 + 4H^+ + 2e^- \longrightarrow Pb^{2+} + 2H_2O$$

(Cathode reaction)

$$Pb^{2+} + SO_4^{2-} \longrightarrow PbSO_4 \qquad \text{(Precipitation)}$$

Overall cell reaction is:

$$Pb + PbO_2 + 4H^+ + 2SO_4^{2-} \longrightarrow 2PbSO_4 + 2H_2O$$

E_{cell} is 2.041 volt.

A battery consisting of six such cells gives voltage of about 12 volt.

(b) **Primary Cells**: In this cell, once the chemicals have been consumed, further reaction is not possible. It cannot be regenerated or recharged by reversing the current flow through the cell using an external direct current source of electrical energy. The most common example of this cell is a dry cell.

Or

(a) Electrochemical Theory of Rusting of Iron: In this theory the processs of rusting can be explained on the basis o formation of electrochemical cell on the surface of an iron object. Rusting of iron involves the following steps:

Step 1: The water vapours present in contact with iron surface have dissolved CO_2 and O_2 from air.

$$H_2O(l) + CO_2(g) \longrightarrow H_2CO_3(l)$$

Thus, the surface of iron is covered with an aqueous solution of carbonic acid, which undergoes dissociation to a small extent.

$$H_2CO_3 \rightleftharpoons 2H^+ + CO_3^{2-} \quad \text{(Ionisation of carbonic acid)}$$

$$H_2O \rightleftharpoons H^+ + OH^- \quad \text{(Ionisation of water)}$$

Step 2: Second step involves oxidation of iron. Oxidation of metal takes place at the point of strain. For example, a steel nail first corrodes at the tip and head. The tip of the nail acts as anode where iron is oxidised to ferrous ion.

$$Fe(s) \longrightarrow Fe^{2+} + 2e^- \quad \text{(Anodic process, oxidation)} \ldots \text{(i)}$$

$$(E^\circ_{Fe^{2+}/Fe} = -0.44 \text{ volt})$$

Step 3: The electrons flow along the nail to the areas containing impurities which act as cathode where oxygen (dissolved in water) is reduced to hydroxyl ions.

$$O_2(g) + 2H_2O(l) + 4e^- \longrightarrow 4OH^-$$

(Cathodic process, reduction)

$$(E^\circ_{red} = 1.23 \text{ volt})$$

The process of reduction involves the following two steps: First of all H^+ ions are reduced to hydrogen atoms.

$$H^+ + e^- \longrightarrow [H] \quad \ldots \text{(ii)}$$

These hydrogen atoms combine with oxygen dissolved in water or from air.

$$4[H] + O_2 \longrightarrow 2H_2O \quad \ldots \text{(iii)}$$

Combining equations (ii) and (iii), we get

$$O_2 + 4H^+ + 4e^- \longrightarrow 2H_2O(l) \quad \ldots \text{(iv)}$$

$$(E^\circ_{red} = 1.23 \text{ volt})$$

As the concentration of H^+ ions is lowered (pH is raised), the reduction of oxygen becomes less probable and less favourable. It is experimentaly found that iron does not rust when it is in contact with a solution of pH above 9 or 10.

Adding equations (i) and (iv), we get, the overall reaction of microcells established on the surface of iron.

$$2Fe(s) + O_2(g) + 4H^+(aq) \longrightarrow 2Fe^{2+}(aq) + 2H_2O(l)$$

$$(E^\circ_{cell} = 1.67 \text{ volt})$$

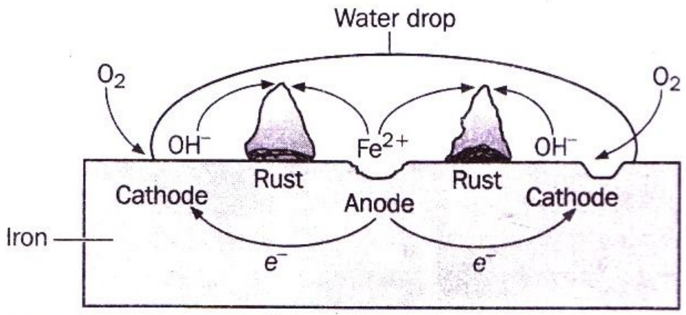
Step 4: The ferrous ions (Fe^{2+}) formed in the previous step react with dissolved oxygen or oxygen from air to form ferric oxide (Fe_2O_3).

$$4Fe^{2+} + O_2 + 4H_2O \longrightarrow 2Fe_2O_3 + 8H^+(aq)$$

Hydration of ferric oxide gives rust.

$$Fe_2O_3 + xH_2O \longrightarrow Fe_2O_3 \cdot xH_2O$$

The process of rusting may be diagrammatically represented as in Fig.



Oxidation : $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$

Reduction : $O_2 + 4H^+(aq) + 4e^- \rightarrow 2H_2O(l)$

Atmospheric : $4Fe^{2+} + O_2 + 4H_2O(l) \rightarrow 2Fe_2O_3(s) + 8H^+(aq)$

Oxidation : $Fe_2O_3 + xH_2O \rightarrow \underset{\text{Rust}}{Fe_2O_3 \cdot xH_2O}$

Rusting of iron

(b) Fuel Cell: A fuel cell is a device used to convert chemical energy present in a fuel, directly into electrical energy.

Construction and Working: The figure shows the working of a $H_2 - O_2$ fuel cell. It consists of porous carbon electrodes. Suitable catalysts are added to these porous carbon electrodes to accelerate the electrode reactions, as reaction between hydrogen and oxygen at the operating temperature (400 K) of the cell is not very fast. These catalysts are mixed in and pressed with the carbon. At anode, suitable catalysts are finely divided platinum or palladium, at cathode cobaltous oxide (CoO), platinum or silver. Concentrated KOH or NAOH solution placed between electrodes acts as an electrolyte. Hydrogen and oxygen are bubbled through the porous electrodes, at high pressure into the electrolyte. The following electrode reactions take place.

At anode: $2H_2 + 4OH^-(aq) \rightarrow 4H_2O(I) + 4e^-$

At cathode: $O_2(g) + 2H_2O(I) + 4e^- \rightarrow 4OH^-(aq)$

Overrall reation: $2H_2(g) + O_2(g) \rightarrow 2H_2O(I)$

The gases being consumed are continuosly supplied.

The construction of fuel cell is, however, faced with certain difficulties. A few of these are as follows.

(i) Providing contact between gaseous fuel, liquid electrolyte and solid electrode.

(ii) High cost of the catast used in the electrodes (e.g., Pt, Pd, Ag, etc.)

(iii) Problem off handling gaseous fuels at low temperature and high pressures.

Advantages over other cells:

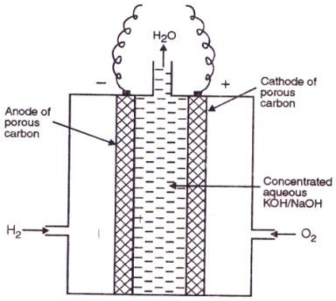
(i) Pollution free working

(ii) high efficiency

(iii) compactness

(iv) light in weight

(v) higher reliability



(no moving parts as in generators). Thus they are extremely suitable for certain applications like long manned space flights.

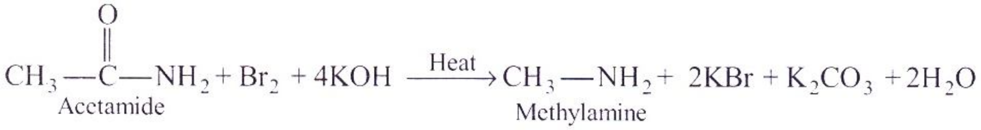
Q.23 Explain: [1+1+1]

(i) Hoffmann Bromoamide Reaction.

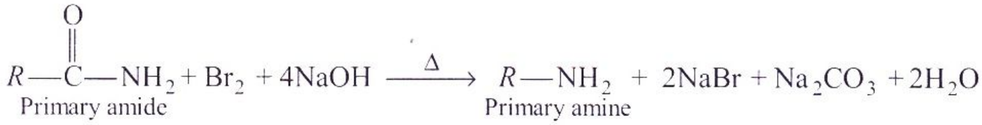
(ii) Clemmensen Reduction.

(iii) HVZ Reaction.

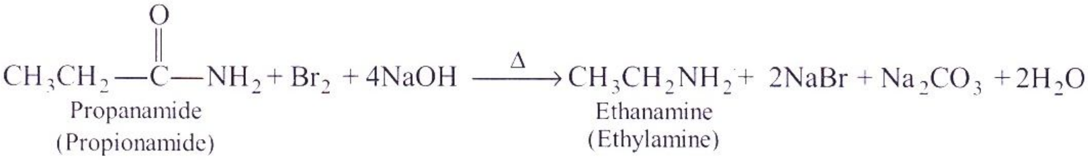
Ans. **(i) Hoffmann Bromoamide Reaction:** The conversion of a primary amide $(-CONH_2)$ to primary amine $(-NH_2)$ group containing one atom less (loss of carbonyl carbon atom) than the original amide on heating with a mixture of bromine (Br_2) in presence of NaOH or KOH (i.e., NaOBr or KOBr) solution is called Hofmann bromamide reaction.



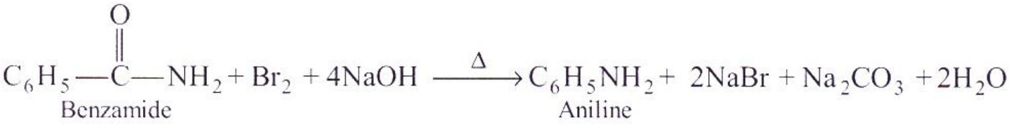
$$\underset{\text{Acetamide}}{CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-NH_2} + Br_2 + 4KOH \xrightarrow{\text{Heat}} \underset{\text{Methylamine}}{CH_3-NH_2} + 2KBr + K_2CO_3 + 2H_2O$$



$$\underset{\text{Primary amide}}{R-\overset{\overset{\displaystyle O}{\|}}{C}-NH_2} + Br_2 + 4NaOH \xrightarrow{\Delta} \underset{\text{Primary amine}}{R-NH_2} + 2NaBr + Na_2CO_3 + 2H_2O$$

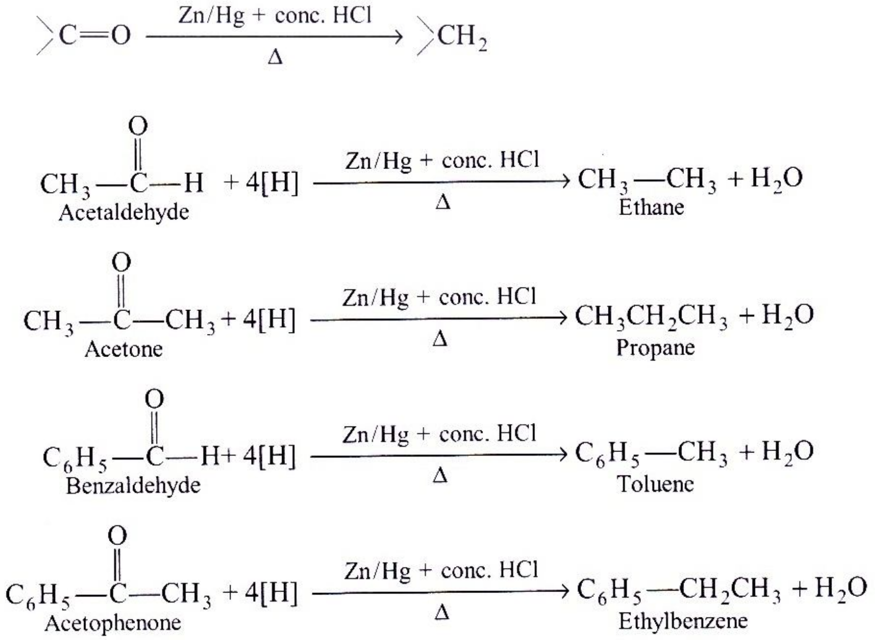


$$\underset{\substack{\text{Propanamide}\\ \text{(Propionamide)}}}{CH_3CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-NH_2} + Br_2 + 4NaOH \xrightarrow{\Delta} \underset{\substack{\text{Ethanamine}\\ \text{(Ethylamine)}}}{CH_3CH_2NH_2} + 2NaBr + Na_2CO_3 + 2H_2O$$



$$\underset{\text{Benzamide}}{C_6H_5-\overset{\overset{\displaystyle O}{\|}}{C}-NH_2} + Br_2 + 4NaOH \xrightarrow{\Delta} \underset{\text{Aniline}}{C_6H_5NH_2} + 2NaBr + Na_2CO_3 + 2H_2O$$

(ii) Clemmensen Reduction: The reduction of aldehydes and ketones to the corresponding hydrocarbons with amalgamated zinc and concentrated hydrochloric acid is called Clemmensen reduction.



$$>C=O \xrightarrow[\Delta]{Zn/Hg\ +\ conc.\ HCl} >CH_2$$

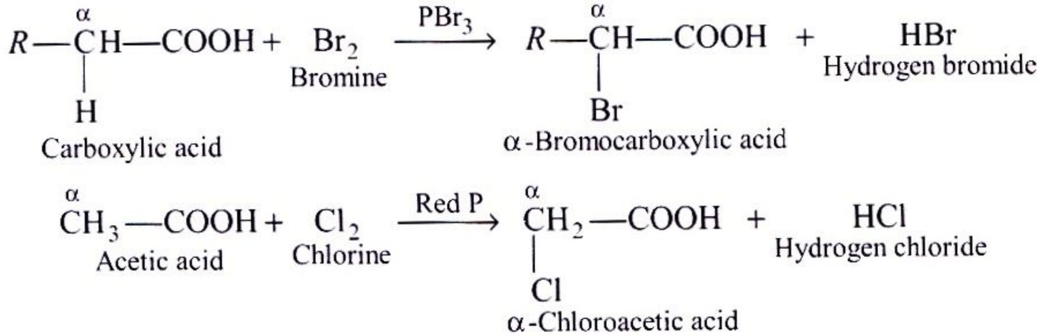
$$\underset{\text{Acetaldehyde}}{CH_3-\overset{\overset{O}{\|}}{C}-H} + 4[H] \xrightarrow[\Delta]{Zn/Hg\ +\ conc.\ HCl} \underset{\text{Ethane}}{CH_3-CH_3} + H_2O$$

$$\underset{\text{Acetone}}{CH_3-\overset{\overset{O}{\|}}{C}-CH_3} + 4[H] \xrightarrow[\Delta]{Zn/Hg\ +\ conc.\ HCl} \underset{\text{Propane}}{CH_3CH_2CH_3} + H_2O$$

$$\underset{\text{Benzaldehyde}}{C_6H_5-\overset{\overset{O}{\|}}{C}-H} + 4[H] \xrightarrow[\Delta]{Zn/Hg\ +\ conc.\ HCl} \underset{\text{Toluene}}{C_6H_5-CH_3} + H_2O$$

$$\underset{\text{Acetophenone}}{C_6H_5-\overset{\overset{O}{\|}}{C}-CH_3} + 4[H] \xrightarrow[\Delta]{Zn/Hg\ +\ conc.\ HCl} \underset{\text{Ethylbenzene}}{C_6H_5-CH_2CH_3} + H_2O$$

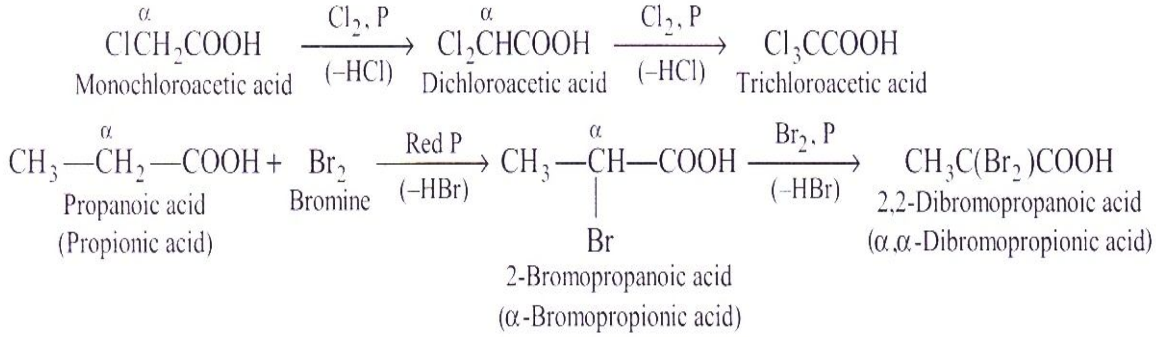
(iii) HVZ Reaction: This reaction ivovles the treatment of a carboxylic acid with Cl_2 or Br_2 in the presence of the catalytic quantity of phosphorus trihalide or red phosphorus to give α –haloacid.



$$\underset{\text{Carboxylic acid}}{R-\overset{\alpha}{\underset{H}{\underset{|}{C}}}H-COOH} + \underset{\text{Bromine}}{Br_2} \xrightarrow{PBr_3} \underset{\alpha\text{-Bromocarboxylic acid}}{R-\overset{\alpha}{\underset{Br}{\underset{|}{C}}}H-COOH} + \underset{\text{Hydrogen bromide}}{HBr}$$

$$\underset{\text{Acetic acid}}{\overset{\alpha}{C}H_3-COOH} + \underset{\text{Chlorine}}{Cl_2} \xrightarrow{\text{Red P}} \underset{\alpha\text{-Chloroacetic acid}}{\overset{\alpha}{\underset{Cl}{\underset{|}{C}}}H_2-COOH} + \underset{\text{Hydrogen chloride}}{HCl}$$

With excess of halogen, all the α –hydrogen atoms of aliphatic carboxylic acid are replaced by halogen atoms.



$$\underset{\text{Monochloroacetic acid}}{Cl\overset{\alpha}{C}H_2COOH} \xrightarrow[(-HCl)]{Cl_2,\ P} \underset{\text{Dichloroacetic acid}}{Cl_2\overset{\alpha}{C}HCOOH} \xrightarrow[(-HCl)]{Cl_2,\ P} \underset{\text{Trichloroacetic acid}}{Cl_3CCOOH}$$

$$\underset{\substack{\text{Propanoic acid}\\ \text{(Propionic acid)}}}{CH_3-\overset{\alpha}{C}H_2-COOH} + \underset{\text{Bromine}}{Br_2} \xrightarrow[(-HBr)]{\text{Red P}} \underset{\substack{\text{2-Bromopropanoic acid}\\ (\alpha\text{-Bromopropionic acid})}}{CH_3-\overset{\alpha}{\underset{Br}{\underset{|}{C}}}H-COOH} \xrightarrow[(-HBr)]{Br_2,\ P} \underset{\substack{\text{2,2-Dibromopropanoic acid}\\ (\alpha,\alpha\text{-Dibromopropionic acid})}}{CH_3C(Br_2)COOH}$$

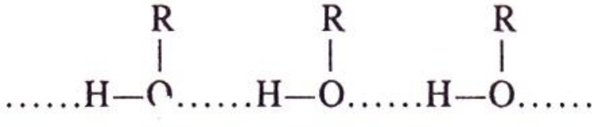
Q.24 (a) Most of the Transition elements are coloured, why? [1+1+1]

(b) Dimethyl ether has less boiling point than ethyl alcohol. Explain.

(c) Transition elements show variable oxidation states, why?

Ans. (a) Transition metal ions are coloured both in the solid state and in aqueous solutions. The colour of these ions is due to the presence of incomplete $(n-1)$ $d-$subshell. When anions/ligands approach the transition metal ions, their d –orbitals do not remain degenerate. They split up into two sets of energy levels, one with lower energy and the other with higher energy. Theis is called Crystal Field Splitting. The d –electrons in these metal ions can be easily promoted from one set of energy level to another in the same dd-subshell. The amount of energy required to excite the electrons to higher energy states within the same d –subshell corresponds to energy of certain colours of visible light. Therefore, when white light falls on a transition metal compound, some of its energy corresponding to a certain colour, is absorbed causing promotion of d –electrons. This is known as d-d transitions. The remaining coloures of white light are transmitted and the compound appears coloured.

(b) The higher boiling point of ethyl alcohol than corresponding dimethyl ether due to intermolecular hydrogen bonding.



H-bonding in 1° alcohol

No such hydrogen bonding is present in hydrocarbons.

(c) The variable oxidation states of transition elements are due to the availablilty of both $(n-1)$ d and ns- electrons for bond formation, as the energies of penultimate d-orbitals and ultimate s –orbital are nearly same. The sum total of ns and unpaired $(n-1)$ d-electrons determines the highest oxidation stte shown by a transition element.

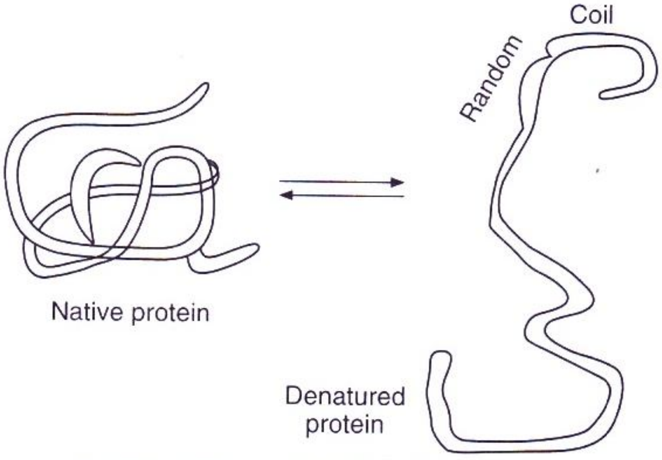
Q.25 (a) Differentiate between RNA and DNA. [2+1]

(b) What is denaturation of Protein?

Ans. (a) **Differentiate between RNA and DNA**

Sr. No	RNA	Sr. No	DNA
1.	The pentose sugar present in RNA is D-reibose	1.	The pentose sugar present in DNA is D-2-deoxyribose
2.	RNA is a single chain of polynucleotides	2.	DNA is a double chain of polynucleotides
3.	RNA molecules are relatively short with low molecular mass (ranging from 20,000 to 40,000)	3.	DNA molecules are very large (ranging from $6 \times 10^6 to\ 16 \times 10^6 u$, i.e., from six to sixteen millions.)
Fundtional Differences			
1.	RNA controls protein synthesis and mainly occurs in the cytoplasm of the cell.	1.	DNA controls the transimission hereditary effect.
2.	RNA usually does not replicate.	2.	DNA has unique property of replication.

(b) Denaturation of Protein: The process that brings about changes in physical as well as biological properties of the proteins is called denaturation proteins.

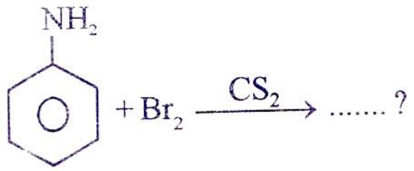


Denaturation of Globular proteins

Q.26 (a) Why Primary ammines have higher boiling point than Tertiary ammines. [1+1+1+1]

(b) $C_6H_5NH_2 + CHCl_3 + KOH(alc.) \rightarrow$…………?

(c)



(d) What are thermosetting polymers?

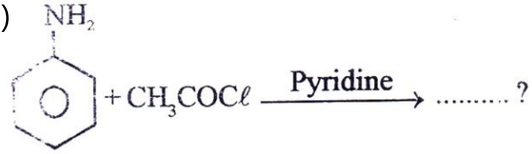
Or

(a) Why are alkylamine are stronger base than arylamines.

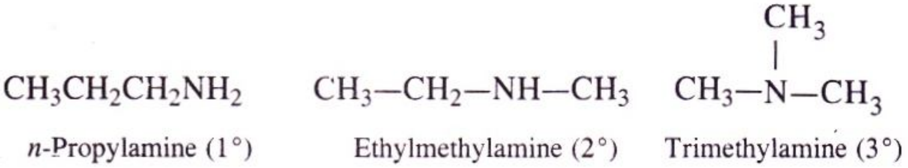
(b) $RCONH_2 + Br_2 + 4KOH \rightarrow$………..?

(c) What is diazotization Reaction?

(d)



Ans. (a) Out of $1^0, 2^0$ *and* 3^0 amines (of equal molecular masses), 1^0 amines have highest boiling point while 3^0 amines have lowest boiling point. For example



$CH_3CH_2CH_2NH_2$ — n-Propylamine (1°)

$CH_3—CH_2—NH—CH_3$ — Ethylmethylamine (2°)

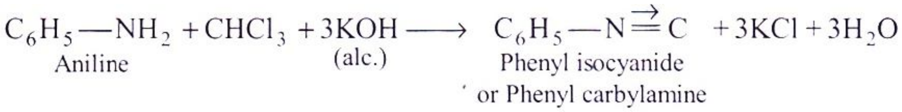
$CH_3—\overset{\overset{\displaystyle CH_3}{|}}{N}—CH_3$ — Trimethylamine (3°)

Have equal molecular masses (59 g mol^-1).

Out of these three amines, n-propylamine have hi

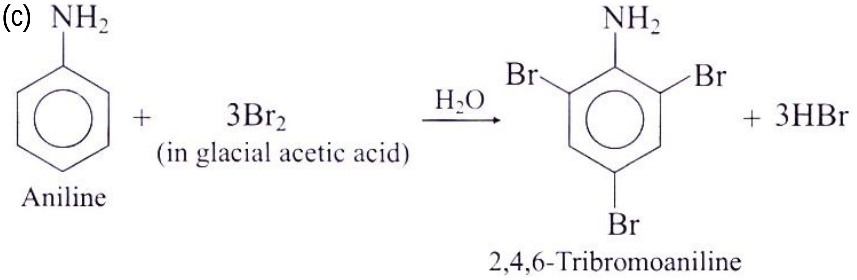
ghest boiling point while trimethyl amine have lowest boiling point. This is because H-bonding is most extension in 1^0 amines in which two H-atoms are firectly attached to N which take part in H-bonding. In case of 3^0 amine no H-bonding is possible as no H-atom is directly attached to nitrogen. As we know H-bonding leads to stronger intermolecular forces and hence higher boiling points.

(b)



$$\underset{\text{Aniline}}{C_6H_5-NH_2} + CHCl_3 + \underset{\text{(alc.)}}{3KOH} \longrightarrow \underset{\substack{\text{Phenyl isocyanide} \\ \text{or Phenyl carbylamine}}}{C_6H_5-N\overset{\rightarrow}{=}C} + 3KCl + 3H_2O$$

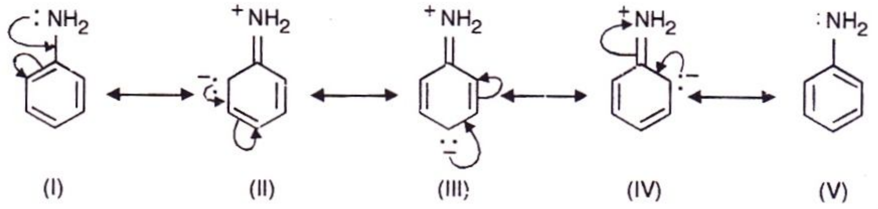
(c)



(d) Thermosetting polymers: These are the polymers which become hard, infusible and insoluble mass on heating. They are normally made from semi-fluid substances with low molecular masses by heating in a mould. This hardening on heating is due to extensive cross-linking between different polymer chains to give a three-dimensional network solid. Thus, such polymers are prepared in two steps. The first step is the formation of long chain molecules which are capable of further reaction with each other. The second step is the application of heat which causes a reaction to occur between the cahins, thus, producing a complex cross-linked polymer. Bakelite is an example of thermosetting polymers.

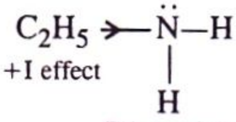
Or

(a) Aniline may be regarded as a resonanace hybrid of the following five contributing structures $(I - V)$.



Due to resonance, the lone of electron on the nitrogen atom gets delocalised over the benzene ring and thus it is less easily available for protonation. At the same time nitrogen acquires some positive charge (II to IV) and this repels the incoming proton.

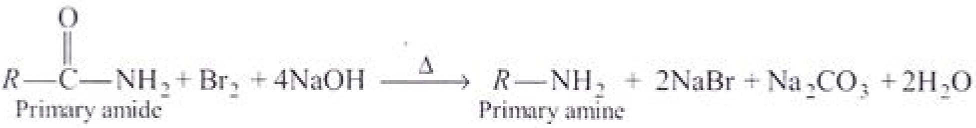
On the other hand, in ethylamine, the delocalization of lone pair of electrons on the nitrogen atom by resonance is not possible. Moreever, the electron density on the nitrogen is increased by the electron releasing inductive effect (+1 effect) of ethyl group.



Ethylamine

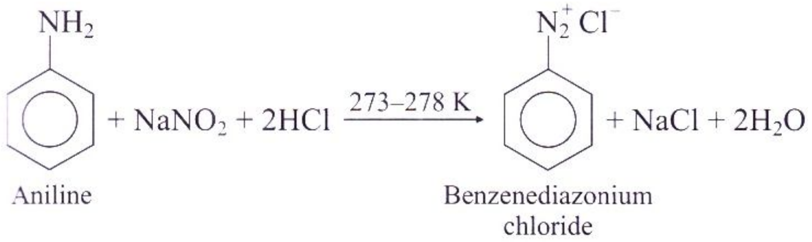
Hence aniline is weaker base than ethylamine.

(b)

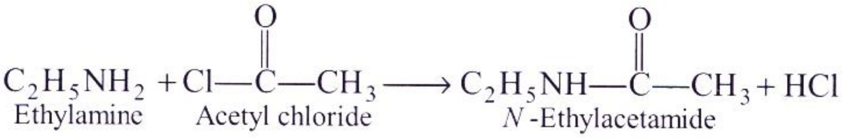


$$\underset{\text{Primary amide}}{R-\overset{O}{\overset{\|}{C}}-NH_2} + Br_2 + 4NaOH \xrightarrow{\Delta} \underset{\text{Primary amine}}{R-NH_2} + 2NaBr + Na_2CO_3 + 2H_2O$$

(c) Diazotization Reaction: Aromatic primary amine (having $-NH_2$ group directly attached to nucleus) reacs with cold aqueous solution of sodium nitric in presence of dilute mineral acid at 273-278 K to form aromatic diazonium salts.



(d)



$$\underset{\text{Ethylamine}}{C_2H_5NH_2} + \underset{\text{Acetyl chloride}}{Cl-\overset{O}{\overset{\|}{C}}-CH_3} \longrightarrow \underset{N\text{-Ethylacetamide}}{C_2H_5NH-\overset{O}{\overset{\|}{C}}-CH_3} + HCl$$

Q.27 (a) Which electrodes are used in fuel cell? [1+1+1+1]

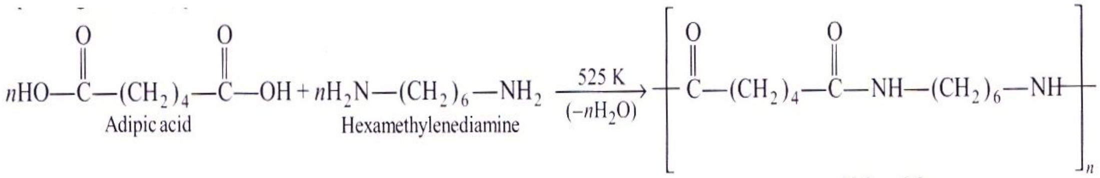
(b) Give synthesis of Nylon-66.

(c) Name the ore of Aluminium.

(d) Give Reaction of HCHO with HCN.

Ans. (a) Porus-Nickel.

(b) Synthesis of Nylon-66: It is obtained by condensation polymerization of hexamethylene diamine (a diamine with six carbon atoms) and adipic acid (a dibasic acid having six carbon atoms) at about 525 K under high pressure, when water is lost as steam and the nylon is produced in the molten state. It can then be cast into a sheet or fibres by passing through a spinning devices (spinneret).



$$\underset{\text{Adipic acid}}{nHO-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-OH} + \underset{\text{Hexamethylenediamine}}{nH_2N-(CH_2)_6-NH_2} \xrightarrow[(-nH_2O)]{525\text{ K}} \left[-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-NH-(CH_2)_6-NH-\right]_n$$

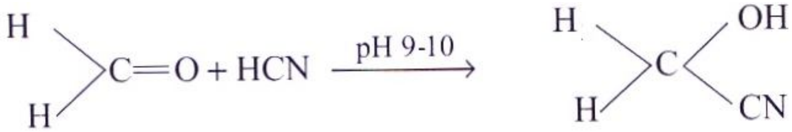
Nylon-6,6

Nylon finds uses in making brushes, synthetic fibres, ropes,carpets, parachutes, etc.

(c) Ore of Aluminium:

Bauxite	$Al_2O_3.2H_2O$
Corundum	Al_2O_3
Diaspore	$Al_2O_3.H_2O$
Cryolite	Na_3AlF_6
China clay	$Al_2O_3.2SiO_2.2H_2O$
Fledspar	$KAlSi_3O_8$

(d) Reaction of HCHO with HCN:



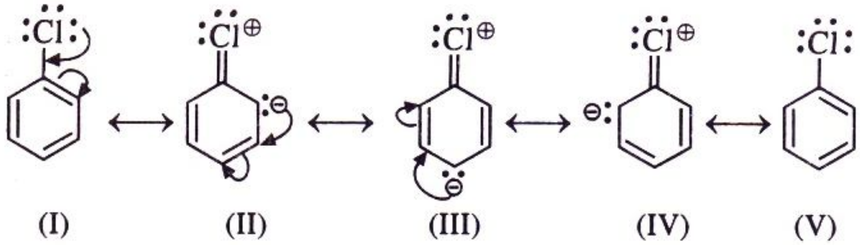
Q.28 (a) Aryl halides are less reactive than alkyl halides, explain why? [2+1+1]

(b) Which substance removes As_2O_3 in contact process?

(c) Whatis tincture of Iodine?

Ans. (a) The lesser reactivity of haloarenes say chlorobenzene than haloalances say chloromethane in nucleophilic substitution reactions can be explained as follows:

(i) Resonance effect: Haloarenes are resonance stabilised. For example chlorobenzene is a resonanace hybrid of variouscontributing structures (I) to (V) as shown below:



As a result of resonance, in structure (II) to (IV), C-Cl bond acquires some double bond character. On the otherhand, no such resosnance occurs in alkyl halides. There fore, C-Cl bond in aryl halides is stronger than carbon – halogen bond in haloakanes and hence can not eaily broken, so chlorobenzene is less reactive.

(ii) Hybridisationof carbon bearing the halogen atom: In haloalkanes, the carbon atom attached to the halogen atom $(C-X)$ is sp^3-hybridised whereas in haloarenes, the carbon atom attached to the halogen atom is sp^2-hybridised. Now sp^2-hybrid orbital of carbon is slightly smaller in size than the sp^3-hybrid orbital. Therefore, the carbon-halogen bond in haloarenes is shorter and stronger than the carbon – halogen bond in haloalkanes. This also justify the low reactilvity of haloarenes as compared to haloalkanes.

(b) V_2O_5 (Vanadium-oxide) is used to removes As_2O_3 in contact process,.

(c) tincture of Iodine: A 2-3% solution of iodine in alcohol and water is called tincture of iodine. It is a powerful antiseptic. It is applied on wounds.