

Chemistry

Time Allowed: 3 hours

Maximum : 70

General Instructions:

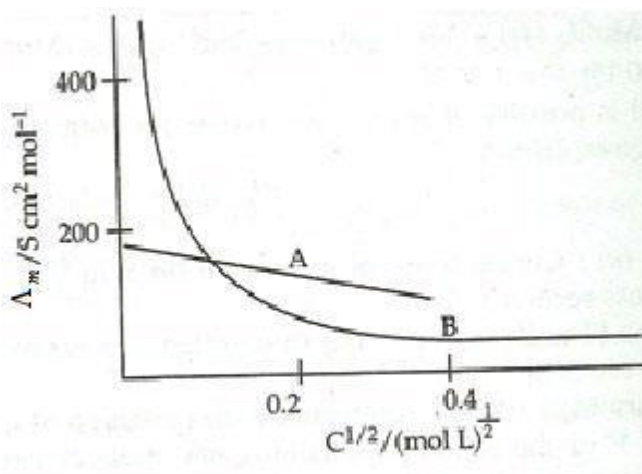
- (i) All the questions are compulsory.
- (ii) Q. No. 1 to 5 are very short answer type, carrying 1 mark each.
- (iii) Q. No. 6 to 10 are short answer type, carrying 2 marks each.
- (iv) Q. No. 11 to 22 are short answer type, carrying 3 marks each.
- (v) Q.No.23 is a value based question carrying 4 marks.
- (vi) Q. No. 24 to 26 are long answer type, carrying 5 marks each.
- (vii) Use of calculators is not allowed, use log tables wherever required.

SECTION A

- | | | |
|---|---|---|
| 1 | Name the non-stoichiometric point defect responsible for colour in alkali metal halides. | 1 |
| 2 | What is shape selective catalysis? | 1 |
| 3 | Amongst the isomeric alkanes of molecular formula C_5H_{12} , identify the one that on photochemical chlorination yields a single monochloride. | 1 |
| 4 | Give the IUPAC name and structure of the amine obtained when 3-chlorobutanamide undergoes Hoffmann –bromamide reaction. | 1 |
| 5 | How many ions are produced from the complex, $[Co(NH_3)_6]Cl_2$ in solution? | 1 |

6 Will the elevation in boiling point be same if 0.1 mol of Sodium chloride or 0.1 mol of sugar is dissolved in 1L of water? Explain. 2

7 The following curve is obtained when molar conductivity (Λ_m) is plotted against the square root of concentration, $c^{1/2}$ for two electrolytes A and B 2



(a) How do you account for the increase in the molar conductivity of the electrolyte A on dilution.

(b) As seen from the graph, the value of limiting molar conductivity (Λ_m^0) for electrolyte B cannot be obtained graphically. How can this value be obtained?

8 Name the following: 2

(a) A transition metal which does not exhibit variation in oxidation state in its compounds.

(b) A compound where the transition metal is in the +7 oxidation state.

(c) A member of the lanthanoid series which is well known to exhibit +4 oxidation state.

(d) Ore used in the preparation of Potassium dichromate.

- 9 Arrange the following in order of property indicated for each set: 2
(a) F_2 , Cl_2 , Br_2 , I_2 – increasing bond dissociation enthalpy
(b) PH_3 , AsH_3 , BiH_3 , SbH_3 , NH_3 – increasing base strength

- 10 (a) Predict the major product of acid catalysed dehydration of 1- 2
Methylcyclohexanol.
(b) You are given benzene, conc. H_2SO_4 , NaOH and dil.HCl. Write the preparation of phenol using these reagents.

OR

Draw the structures of any two isomeric alcohols (other than 1^o alcohols) having molecular formula $C_5H_{12}O$ and give their IUPAC names.

- 11 An element occurs in the bcc structure with cell edge of 288 pm. The 3
density of the element is 7.2 g cm^{-3} . How many atoms of the element does 208g of the element contain?

- 12 Calculate the boiling point of a 1M aqueous solution (density 1.04 g mL^{-1}) of Potassium chloride (K_b for water = $0.52 \text{ K kg mol}^{-1}$, Atomic masses: K=39u, Cl=39.9u) 3
Assume, Potassium chloride is completely dissociated in solution

- 13 A galvanic cell consists of a metallic zinc plate immersed in 0.1M 3
 $Zn(NO_3)_2$ solution and metallic plate of lead in 0.02M $Pb(NO_3)_2$ solution. Calculate the emf of the cell. Write the chemical equation for the electrode reactions and represent the cell.
(Given:) $E^0_{zn^{2+}/zn} = -0.76V$; $E^0_{Pb^{2+}/Pb} = -0.13V$)

- 14 Answer the following questions: 3
(a) What happens when a freshly precipitated $Fe(OH)_3$ is shaken

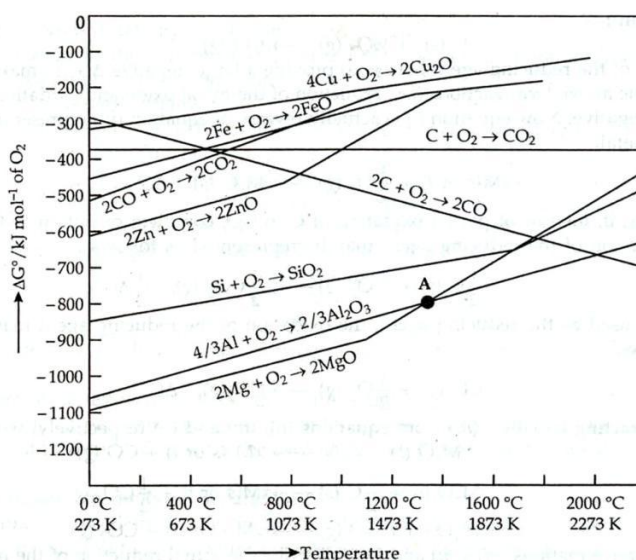
with a little amount of dilute solution of FeCl_3 ?

(b) Why are lyophilic colloidal sols more stable than lyophobic colloidal sols?

(c) What form Freundlich adsorption equation will take at high pressure?

- 15 What chemical principle is involved in choosing a reducing agent for getting the metal from its oxide ore? Consider the metal oxides, Al_2O_3 and FeO and justify the choice of reducing agent in each case.

3



OR

Account for the following facts:

- (a) The reduction of a metal oxide is easier if the metal formed is in the liquid state at the temperature of reduction.
- (b) Limestone is used in the manufacture of pig iron from haematite.
- (c) Pine oil is used in the froth floatation process used to concentrate sulphide ores.

- 16 (i) For M^{2+}/M and M^{3+}/M^{2+} systems, E° values for some metals are as follows: 3
- | | |
|----------------------|---------------------------|
| $Cr^{2+}/Cr = -0.9V$ | $Cr^{3+}/Cr^{2+} = -0.4V$ |
| $Mn^{2+}/Mn = -1.2V$ | $Mn^{3+}/Mn^{2+} = +1.5V$ |
| $Fe^{2+}/Fe = -0.4V$ | $Fe^{3+}/Fe^{2+} = +0.8V$ |

Use this data to comment upon

- (a) the stability of Fe^{3+} in acid solution as compared to that of Cr^{3+} and Mn^{3+}
 (b) the ease with which iron can be oxidised as compared to the similar process for either Cr or Mn metals
- (ii) What can be inferred from the magnetic moment of the complex $K_4[Mn(CN)_6]$ Magnetic moment: 2.2 BM?

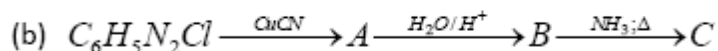
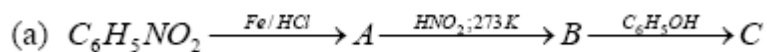
- 17 (i) Describe the type of hybridisation for the complex ion $[Fe(H_2O)_6]^{2+}$. 3

(ii) Write the IUPAC name of the ionisation isomer of the coordination compound $[Co(NH_3)_5Br]SO_4$. Give one chemical test to distinguish between the two compounds.

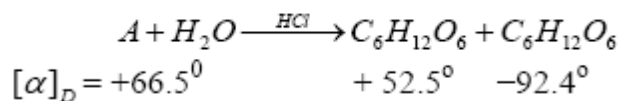
- 18 (a) Explain why the dipole moment of chlorobenzene is lower than that of cyclohexyl chloride. 3

(b) An optically active compound having molecular formula $C_7H_{15}Br$ reacts with aqueous KOH to give a racemic mixture of products. Write the mechanism involved in this reaction.

- 19 Give the structures of A, B and C in the following reactions: 3



- 20 (a) A non reducing disaccharide 'A' on hydrolysis with dilute acid gives an equimolar mixture of D-(+)-glucose and D-(-)-Fructose. 3

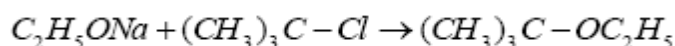


Identify A. What is the mixture of D-(+)- glucose and D-(-)-Fructose known as? Name the linkage that holds the two units in the disaccharide.

(b) -amino acids have relatively higher melting points than the corresponding halo acids. Explain.

- 21** (a) Pick out the odd one from among the following on the basis of their medicinal properties mentioning the reason: Luminal, Seconal, Phenacetin, Equanil. 3
- (b) Give an example of a substance that can act as a disinfectant as well as antiseptic depending upon its concentration. (Specify concentration)
- (c) Name any two macromolecules chosen as drug targets.

- 22** The following is not an appropriate reaction for the preparation of tert.-butyl ethyl ether: 3



- (i) What would be the major product of the given reaction?
- (ii) Write a suitable reaction for the preparation of tert.-butyl ethyl ether, specifying the names of reagents used.

Justify your answer in both cases.

- 23** Study the given passage carefully and answer the questions that follow: 4

Shalini studied a chapter on Polymers in school and came across the following paragraph:

The durability, strength, low cost, water and chemicals resistance, welding properties, lesser energy, fewer atmosphere emissions and light weight are advantages of plastic bags.

Shalini is confused as she has been reading in the newspaper about the ban on the usage of plastic substances.

She further finds that despite the durability, the use of these materials has presented mankind with serious waste disposal problem as these materials do not disintegrate by themselves. In view of this, certain polymers are being developed which are broken down rapidly by microorganisms. Shalini feels relaxed that such kinds of biomaterials are being developed.

- (a) Name the class of these useful polymers which do not harm the environment.
- (b) Give any one example of these polymers and name its monomers.
- (c) Comment on the qualities of Shalini.

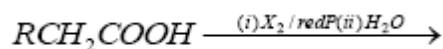
24

- (a) Give a plausible explanation for each one of the following:
 - (i) Although phenoxide ion has more number of resonating structures than carboxylate ion, carboxylic acid is a stronger acid than phenol.
 - (ii) There are two -NH_2 groups in semicarbazide. However, only one is involved in the formation of semicarbazones.
- (b) Carry out the following conversions in not more than two steps:
 - (i) Phenyl magnesium bromide to benzoic acid.
 - (ii) Acetaldehyde to But-2-enal.
 - (iii) Benzene to m-Nitroacetophenone

5

OR

- (a) Give a simple chemical test to distinguish between the pair of organic compounds: Ethanal and Propanal
- (b) Name and complete the following chemical reaction:



- (c) Draw the structures of the following derivatives:

- (i) The 2,4-Dinitrophenylhydrazone of benzaldehyde
- (ii) Acetaldehydedimethyl acetal
- (iii) Cyclopropanone oxime

- 25** (a) Write the rate law for a first order reaction. Justify the statement that half life for a first order reaction is independent of the initial concentration of the reactant. 5
- (b) For a first order reaction, show that the time required for 99% completion of a first order reaction is twice the time required for the completion of 90%.

OR

- (a) For the reaction $A \rightarrow B$, the rate of reaction becomes twenty seven times when the concentration of A is increased three times. What is the order of the reaction?
- (b) The activation energy of a reaction is 75.2 kJmol^{-1} in the absence of a catalyst and it lowers to 50.14 kJmol^{-1} with a catalyst. How many times will the rate of reaction grow in the presence of a catalyst if the reaction proceeds at 25°C ?
- 26** (a) Write balanced chemical equations for the following: 5
- (i) Complete hydrolysis of XeF_6 .
 - (ii) Disproportionation reaction of orthophosphorus acid.
- (b) Draw the structure of a noble gas species which is isostructural with BrO_3^- .
- (c) Considering the parameters such as bond dissociation enthalpy, electron gain enthalpy and hydration enthalpy, compare the oxidising power of F_2 and Cl_2 .
- (d) Why is $K_{a2} \ll K_{a1}$ for H_2SO_4 in water?

OR

Explain the following:

- (a) Hydrogen fluoride is a weaker acid than hydrogen chloride in aqueous solution..
- (b) PCl_5 is ionic in nature in the solid state.
- (c) SF_6 is inert towards hydrolysis.
- (d) H_3PO_3 is diprotic.
- (e) Out of noble gases only Xenon is known to form established chemical compounds.

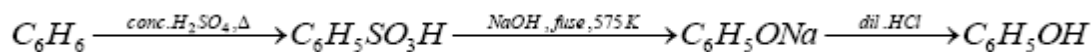
Answer Key

- 1 Metal excess or anionic vacancies or F-centres
- 2 Catalysis by zeolites which depends on the shape and size of the reactants and the products as compared to those of the pores and cavities of zeolites.
- 3 Neopentane or 2,2-Dimethylpropane
- 4 3-Chloropropanamine, $\text{CH}_3\text{CH}(\text{Cl})\text{CH}_2\text{NH}_2$
- 5 Three ions $[\text{Co}(\text{NH}_3)_6]^{2+}$, 2Cl^-
- 6 No, the elevation in boiling point is not the same.
Elevation in boiling point is a colligative property which depends on the number of particles. NaCl is an ionic compound which dissociates in solution to give more number of particles whereas sugar is made up of molecules and thus does not dissociate
- 7 (a) As seen from the graph, electrolyte A is a strong electrolyte which is completely ionised in solution. With dilution, the ions are far apart from each other and hence the molar conductivity increases.
(b) To determine the value of limiting molar conductivity for electrolyte B, indirect method based upon Kohlrausch law of independent migration of ions is used.
- 8 (a) Scandium (Sc)
(b) KMnO_4 or any other suitable example
(c) Cerium (Ce) or any other example.
(d) Chromite ore
- 9 (a) $\text{I}_2 < \text{F}_2 < \text{Br}_2 < \text{Cl}_2$

(b) $\text{BiH}_3 < \text{SbH}_3 < \text{AsH}_3 < \text{PH}_3 < \text{NH}_3$

10 (a) 1-Methylcyclohexene

(b)



OR

Any two isomers out of the following:

- (i) $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH(OH)-CH}_3$ Pentan-2-ol
- (ii) $\text{CH}_3\text{-CH}_2\text{-CH(OH)-CH}_2\text{-CH}_3$ Pentan-3-ol
- (iii) $\text{CH}_3\text{-CH(CH}_3\text{)-CH(OH)-CH}_3$ 3-Methylbutan-2-ol
- (iv) $\text{CH}_3\text{-CH}_2\text{-C(CH}_3\text{)(OH)-CH}_3$ 2-Methylbutan-2-ol

11 For the bcc structure, $z = 2$

$$\text{Density } \rho = \frac{Z \times M}{a^3 \times N_0}$$

$$7.2 \text{ g cm}^{-3} = \frac{2 \times M}{(288 \times 10^{-10} \text{ cm})^3 \times (6.022 \times 10^{23}) \text{ mol}^{-1}}$$

$$\text{Or } M = 51.8 \text{ g mol}^{-1}$$

By mole concept,

51.8 g of the element contains 6.022×10^{23} atoms

$$\begin{aligned} 208 \text{ g of the element will contain } & \frac{6.022 \times 10^{23} \times 208}{51.8} \text{ atoms} \\ & = 24.17 \times 10^{23} \text{ atoms.} \end{aligned}$$

- 12 Molar mass of KCl = 39+35.5 = 74.5 g mol⁻¹
 As KCl dissociates completely, number of ions produced are 2.
 Therefore, van't Hoff factor, $i=2$
 Mass of KCl solution = 1000 × 1.04 = 1040 g
 Mass of solvent = 1040 – 74.5 = 965.5 g = 0.9655 kg
 Molality of the solution:

$$\frac{\text{No. of moles of solute}}{\text{Mass of solvent in kg}} = \frac{1 \text{ mol}}{0.9655 \text{ kg}} = 1.0357 \text{ m}$$

$$\Delta T_b = i \times K_b \times m$$

$$= 2 \times 0.52 \times 1.0357 = 1.078^\circ \text{C}$$

Therefore, boiling point of solution = 100 + 1.078 = 101.078 °C
 (deduct ½ mark if unit not written/incorrect)

- 13 Anode reaction: $\text{Zn}(s) \rightarrow \text{Zn}^{2+}(aq) + 2e^-$
 Cathode reaction: $\text{Pb}^{2+}(aq) + 2e^- \rightarrow \text{Pb}(s)$
 Cell representation: $\text{Zn}(s) / \text{Zn}^{2+}(aq) // \text{Pb}^{2+}(aq) / \text{Pb}(s)$
 According to Nernst equation:

$$E_{\text{cell}} = E^\circ_{\text{cell}} - \frac{0.059}{n} \log \frac{[\text{Zn}^{2+}]}{[\text{Pb}^{2+}]}$$

$$\begin{aligned} E_{\text{cell}} &= [-0.13 - (-0.76)] - \frac{0.059}{2} \log \frac{0.1}{0.02} \\ &= 0.63 - 0.02955 \times \log 5 \\ &= 0.63 - 0.02955 \times 0.6990 \\ &= 0.63 - 0.0206 = 0.6094 \text{ V} \end{aligned}$$

- 14 (a) A reddish brown coloured colloidal solution is obtained.
 (b) Stability of lyophilic sols is due to:
 (i) same charge on all the colloidal particles.
 (ii) solvation of the colloidal particles.
 (c) At high pressures, amount of gas adsorbed (x/m) becomes independent of pressure (P)

$$\frac{x}{m} = k \times P^\circ$$

- 15 The feasibility of thermal reduction can be predicted on the basis of Ellingham diagram. Metals for which the standard free energy of formation ($\Delta_f G^\circ$) is more negative can reduce those metals for which $\Delta_f G^\circ$ is less negative. At a given temperature, any metal will reduce the oxide of other metals which lie above it in the Ellingham diagram.
- (a) Below the temperature approx 1623K, corresponding to the point of intersection of Al_2O_3 and MgO curves, Mg can reduce alumina.
- (b) At temperatures below 1073K, the CO, CO_2 line lies Fe, FeO line, thus CO is a better reducing agent.
- At temperatures above 1073K, Coke will reduce FeO and itself get oxidised to CO.

OR

- (a) Entropy is higher when a metal is in the liquid state than when it is in the solid state. Thus $T\Delta S$ increases, thus ΔG° becomes more negative and the reduction becomes easier. ($\Delta G = \Delta H - T\Delta S$)
- (b) Limestone provides the flux (CaO) which combines with the impurities (SiO_2) to form slag (CaSiO_3). Thus it helps in the removal of impurities.
- (c) Pine oil (Collector) enhances the non wettability of the ore particles, which become lighter and hence rise to the surface along with the froth.
-
- 16 (i)(a) $\text{Cr}^{3+}/\text{Cr}^{2+}$ has a negative reduction potential. Hence Cr^{3+} cannot be reduced to Cr^{2+} . Cr^{3+} is most stable. $\text{Mn}^{3+}/\text{Mn}^{2+}$ have large positive E° values. Hence Mn^{3+} can be easily reduced to Mn^{2+} . Thus Mn^{3+} is least stable. $\text{Fe}^{3+}/\text{Fe}^{2+}$ couple has a positive E° value but small. Thus the stability of Fe^{3+} is more than Mn^{3+} but less stable than Cr^{3+} .
- (b) If we compare the reduction potential values, Mn^{2+}/Mn has the most negative value i.e its oxidation potential value is most positive. Thus its most easily oxidised. Thus the decreasing order for their ease of oxidation is $\text{Mn} > \text{Cr} > \text{Fe}$.
- (ii) $\text{K}_4[\text{Mn}(\text{CN})_6]$
- Mn is in +2 oxidation state. Magnetic moment 2.2 indicates that it has one unpaired electron and hence forms inner orbital or low spin complex. In presence of CN^- is a strong ligand, hybridisation involved is d^2sp^3 (octahedral complex)
- 17 (i) Fe exists as Fe^{2+} . There are 4 unpaired electrons. Water is a weak ligand. Thus the hybridisation involved is sp^3d^2 . It is an octahedral outer orbital complex.
- (marks to be granted if hybridisation is depicted diagrammatically)

(ii) The ionisation isomer is $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$. The IUPAC name is

Pentaamminesulphatocobalt(III)bromide.

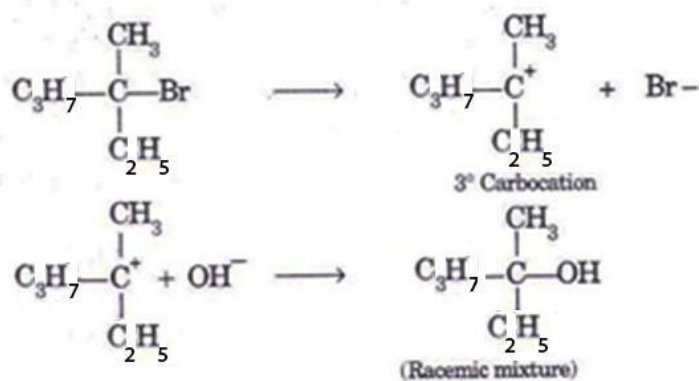
The isomer $[\text{Co}(\text{NH}_3)_5 \text{Br}] \text{SO}_4$ gives a white precipitate of BaSO_4 with BaCl_2 solution whereas the isomer $[\text{Co}(\text{NH}_3)_5 \text{SO}_4]\text{Br}$ does not form this precipitate.

(or any other relevant test)

- 18 (a) Due to greater s-character, a sp^2 hybrid carbon is more electronegative than a sp^3 hybrid carbon. Therefore, the sp^2 hybrid carbon of C-Cl bond in chlorobenzene has less tendency to release electrons to Cl than a sp^3 hybrid carbon of cyclohexyl chloride.

(marks to be granted if shown with the help of a figure)

(b) Since the alkyl halide reacts with KOH to form a racemic mixture, it must be a 3° alkyl halide and the reaction will follow SN_1 mechanism.



- 19 (a) A - $\text{C}_6\text{H}_5\text{NH}_2$ B - $\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^-$ C - $\text{C}_6\text{H}_5-\text{N}_2-\text{C}_6\text{H}_4-\text{OH}$
(b) A - $\text{C}_6\text{H}_5\text{CN}$ B - $\text{C}_6\text{H}_5\text{COOH}$ C - $\text{C}_6\text{H}_5\text{CONH}_2$

- 20 (a) A - Sucrose ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$)

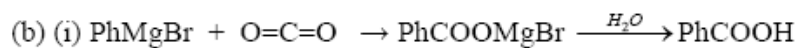
The mixture of D-(+)- glucose and D-(-)-Fructose is known as invert sugar.

The linkage which holds the two monosaccharide units through oxygen atom is called glycosidic linkage.

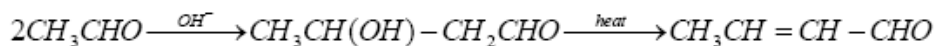
(b) The amino acids exist as dipolar zwitter ion. Due to this dipolar salt like character they have strong dipole dipole attractions Thus their melting

points are higher than the corresponding haloacids which do not exist as zwitter ions.

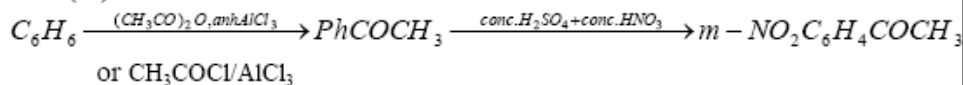
- 21 (a) Phenacetin is an antipyretic, while the rest are tranquilizers.
(b) 0.2% solution of phenol acts as antiseptic whereas 1% solution of phenol acts as disinfectant.
(c) Carbohydrates, proteins, nucleic acids, lipids
- 22 (i) Since the alkyl halide is a 3° halide and C₂H₅ONa is a strong base, therefore elimination occurs preferably. The product obtained is 2-Methylprop-1-ene. CH₃-C(CH₃)=CH₂
(ii) To prepare t-Butyl ethyl ether, the alkyl halide should be 1° i.e. chloroethane and the nucleophile should be sodium t-butoxide because the 3° nucleophile is able to attack 1° alkyl halide.
- $$(CH_3)_3C - O^- Na^+ + CH_3CH_2 - Cl \rightarrow (CH_3)_3C - OCH_2CH_3$$
- 23 (a) The class of polymers is Biodegradable polymers.
(b) One example of biodegradable polymers is **PHBV** (Poly--hydroxybutyrate-co--hydroxyvalerate).
The names of its monomers are: 3-hydroxybutanoic acid and 3-hydroxypentanoic acid
(c) Care for environment, concern for the health of the people or any other **two** relevant points.
- 24 (a) (i) The delocalisation of benzene electrons contributes little towards the stability of phenoxide ion. The carboxylate ion is much more resonance stabilized than phenoxide ion.
(ii) Semicarbazide has two -NH₂ groups. One of them, which is directly attached to C=O is involved in resonance. Thus electron density on this group decreases and it does not act as a nucleophile. In contrast, the lone pair of electrons on the other -NH₂ group is available for nucleophilic attack.



(ii)



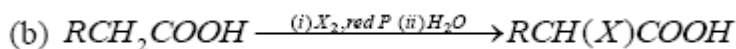
(iii)



OR

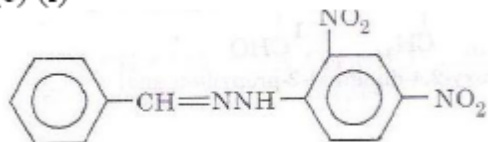
(a) Ethanal and propanal can be distinguished by Iodoform test.

Ethanal gives a yellow precipitate of iodoform with an alkaline solution of NaOH. Propanal does not give this test.

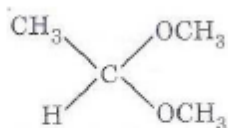


The name of the reaction is Hell Vohlard Zelinsky reaction

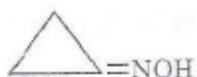
(c) (i)



(ii)



(iii)



25 (a) For a first order reaction

$$k = \frac{2.303}{t} \log \frac{[R]_o}{[R]} \quad \text{where } [R]_o = \text{initial concentration, } [R] = \text{conc. after time } t$$

When half of the reaction is completed, $[R] = [R]_o/2$. Representing, the time taken for half of the reaction to be completed, by $t_{1/2}$, equation becomes:

$$k = \frac{2.303}{t_{1/2}} \log \frac{[R]_o}{[R]_o/2}$$

$$t_{1/2} = \frac{2.303}{k} \log 2$$

$$t_{1/2} = \frac{2.303}{k} \times 0.3010$$

$$t_{1/2} = \frac{0.693}{k}$$

The above equation shows that half life first order reaction is independent of the initial concentration of the reactant.

(b) For a first order reaction

$$t = \frac{2.303}{k} \log \frac{a}{a-x}$$

$$t_{99\%} = \frac{2.303}{k} \log \frac{a}{a-0.99a}$$

$$t_{90\%} = \frac{2.303}{k} \log \frac{a}{a-0.90a}$$

$$\frac{t_{99\%}}{t_{90\%}} = \left(\frac{2 \times 2.303}{k} \right) / \frac{2.303}{k} = 2$$

$$t_{99\%} = 2 \times t_{90\%}$$

OR

(a) $r = k[R]^n$

When concentration is increased three times, $[R] = 3a$

$$27r = k(3a)^n$$

$$\frac{27r}{r} = \frac{k(3a)^n}{ka^n} \quad \text{or} \quad 27 = 3^n \quad \text{or} \quad 3^3 = 3^n$$

$$n = 3$$

(b)

According to Arrhenius equation,

$$\log k = \log A - \frac{E_a}{2.303RT}$$

For uncatalysed reaction

$$(i) \quad \log k_1 = \log A - \frac{E_a(1)}{2.303RT}$$

For catalysed reaction

$$(ii) \quad \log k_2 = \log A - \frac{E_a(2)}{2.303RT}$$

A is equal for both the reactions.

Subtracting equation(i) from equation(ii)

$$\log \frac{k_2}{k_1} = \frac{E_a(1) - E_a(2)}{2.303RT}$$

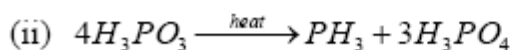
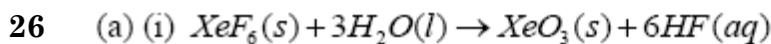
$$\log \frac{k_2}{k_1} = \frac{(75.2 - 50.14) \text{ kJ mol}^{-1}}{2.303 \times 8.314 \text{ JK}^{-1} \text{ mol}^{-1} \times 298 \text{ K}}$$

$$\log \frac{k_2}{k_1} = 4.39$$

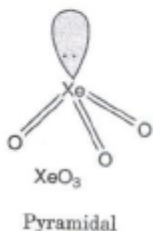
$$\frac{k_2}{k_1} = \text{anti log}(4.39)$$

$$= 2.45 \times 10^4$$

Rate of reaction increases by 2.45×10^4 times.



(b) XeO_3 is isostructural with BrO_3^- . (pyramidal structure)



(c) The bond dissociation enthalpy of F-F bond is lower than that of Cl-Cl bond and hydration enthalpy of F^- ion is much higher than that of Cl^- ion. These two factors more than compensate the less negative electron gain enthalpy of F_2 . Thus, F_2 is a stronger oxidizing agent than Cl_2 .

(d) H_2SO_4 ionises in two stages and hence has two dissociation constants.

$$K_{a_2} \ll K_{a_1}$$

This is because the negatively charged HSO_4^- ion has much less tendency to donate a proton to H_2O as compared to neutral H_2SO_4 .

OR

(a) Due to stronger H-F bond than HCl bond, HF ionises less readily than HCl in aqueous solution to give H^+ ions. Therefore HF is a weaker acid than HCl.

(b) In solid state, PCl_5 consists of ions $[PCl_4]^+[PCl_6]^-$. On melting these ions become free to move and hence conducts electricity in the molten state.

(c) In SF_6 , S is sterically protected by six F atoms and hence does not allow H_2O molecules to attack the S molecule. Also, F does not have d-orbitals to accept the electrons donated by H_2O molecules.

(d) In the structure of H_3PO_3 , it contains only two ionisable H-atoms which are present as -OH groups, thus it behaves as a dibasic acid.

(e) Except radon which is radioactive, Xenon has least ionisation energy among noble gases and hence it readily forms chemical compounds particularly with O_2 and F_2 .