Class XII Session 2023-24
Subject - Chemistry
Sample Question Paper - 5

Time Allowed: 3 hours **Maximum Marks: 70**

General Instructions:

Read the following instructions carefully.

1. There are **33** questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case-based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. **All questions are compulsory.**
8. **Use of log tables and calculators is not allowed.**

Section A

1. When a haloalkane with β – hydrogen atom is heated with alcoholic solution of potassium hydroxide then: **[1]**

a) All of these

b) elimination of halogen atom from α – carbon

c) elimination of hydrogen atom from β– carbon

d) alkene is formed as a product

2. In nucleic acids, the sequence is: **[1]**

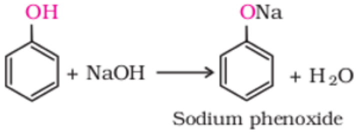
a) Base - sugar - phosphate

b) Base - phosphate - sugar

c) Phosphate - sugar - base

d) Sugar - base - phosphate

3. In the reaction **[1]**



a) Phenols are acidic in nature.

b) They can donate a proton to a stronger base

c) Cleavage of O - H bond

d) All of these

4. The reagent which can be used to distinguish acetophenone from benzophenone is: **[1]**

a) I_2 and NaOH

b) 2, 4-dinitrophenyl hydrazine

c) Tollen's reagent

d) Benedict solution

5. Which among the following is an example of first order reaction? **[1]**

a) Inversion of cane sugar
b) Formation and dissociation of ozone
c) Decomposition of nitrogen pentoxide
d) Acid catalysed hydrolysis of ethyl acetate

6. Match the types of solutions given Column I to the examples given in Column II. **[1]**

Column I	Column II
(a) Solution of gas in gas	(i) Brass
(b) Solution of solid in solid	(ii) Air
(c) Solution of liquid in gas	(iii) Zinc amalgam
(d) Solution of liquid in solid	(iv) Chloroform in Nitrogen

a) (a) - (iii), (b) - (iv), (c) - (i), (d) - (ii)
b) (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)
c) (a) - (i), (b) - (ii), (c) - (iii), (d) - (iv)
d) (a) - (ii), (b) - (i), (c) - (iv), (d) - (iii)

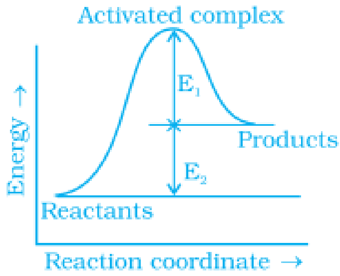
7. Ethylidene chloride is a/an ________. **[1]**

a) vic-dihalide
b) vinylic halide
c) gem-dihalide
d) allylic halide

8. The incorrect statement about interstitial compounds is: **[1]**

a) They retain metallic conductivity.
b) They are very hard.
c) They are chemically reactive.
d) They have high melting point.

9. According to the Arrhenius equation rate constant k is equal to $Ae^{-E_a/RT}$. Which of the following options represents the graph of ln k vs $\frac{1}{T}$? **[1]**

a)


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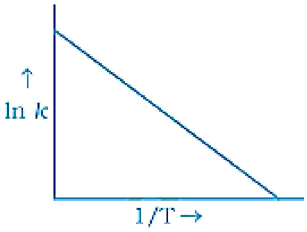
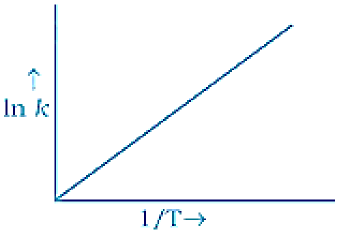
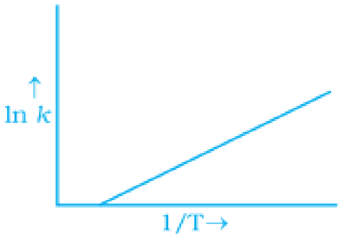


c)


d)


10. Clemmensen reduction of a ketone is carried out in the presence of which of the following? **[1]**

a) Zn – Hg with HCl
b) H_2 and Pt as catalyst
c) $LiAlH_4$
d) Glycol with KOH

11. One of the following alcohols do not undergo oxidation reaction: **[1]**

a) None of these
b) Tertiary alcohol
c) Secondary alcohol
d) Primary alcohol

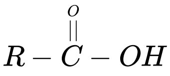
12. Which of the following reactions is given by only primary amines? **[1]**

a) Reaction with acetyl chloride
b) Reaction with HONO
c) Reaction with Grignard reagent
d) Reaction with chloroform and alcoholic KOH

13. **Assertion (A):** Cellulose is not digested by human beings. **[1]**

Reason (R): Cellulose is a polymer of β-D-glucose.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

14. **Assertion (A):** RMgX on reaction with CO_2 gives  $R-\overset{\overset{O}{||}}{C}-OH$ **[1]**

Reason (R): RMgX on reaction with carbonyl compounds give alcohols.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

15. **Assertion (A):** In comparison to ethyl chloride it is difficult to carry out nucleophilic substitution on vinyl chloride. **[1]**

Reason (R): Vinyl group is electron-donating.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

16. **Assertion (A):** t-Butyl methyl ether is not prepared by the reaction of t-butyl bromide with sodium methoxide. **[1]**

Reason (R): Sodium methoxide is a strong nucleophile.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

Section B

17. Give some example showing importance of complexes in biological system? **[2]**

18. Explain why does colour of $KMnO_4$ disappear when oxalic acid is added to its solution in acidic medium. **[2]**

19. **Answer the following:** **[2]**

(i) Define rate of reaction? **[1]**

(ii) For a reaction R → P, half-life ($t_{1/2}$) is observed to be independent of the initial concentration of reactants. What is the order of reaction? **[1]**

20. State Henry's law. Calculate the solubility of CO_2 in water at 298 K under 760 mm Hg. (K_H for CO_2 in water at 298 K is 1.25×10^6 mm Hg) **[2]**

OR

Define the term: Molality.

21. Draw the structural formula of hex-2-en-4-ynoic acid. **[2]**

Section C

22. Calculate the equilibrium constant for the reaction at T=298 K. **[3]**

$Fe(s) + Cd^{2+}(aq) \rightarrow \ Fe^{2+}(aq) + Cd(s)$

$\left[\text{Given, } \mathrm{E}^{\Theta}_{Cd^{2+}/cd} = -0.40V, E^{\Theta}_{Fe^{2+}/Fe} = -0.44V\right]$

23. In a pseudo first order hydrolysis of ester in water, the following results were obtained: **[3]**

t/s	**0**	**30**	**60**	**90**
[Ester] molL^{-1}	0.55	0.31	0.17	0.085

i. Calculate the average rate of reaction between the time interval 30 to 60 seconds.

ii. Calculate the pseudo first order rate constant for the hydrolysis of ester.

24. Write the mechanism of the reaction of HI with methoxymethane. **[3]**

OR

Name the reagents used in the following reactions:

i. Oxidation of a primary alcohol to carboxylic acid.

ii. Oxidation of a primary alcohol to an aldehyde.

iii. Bromination of phenol to 2, 4, 6-tribromophenol.

25. Complete the following reaction: **[3]**

$$CH_3CHO \ + \ CH_3CH_2CHO \ \xrightarrow[(ii)\ Heat]{(i)\ dil\ NaOH}$$

26. Calculate the emf of the cell Mg(s) || Mg^{2+}(0.1 M) || Cu^{2+} (1 × 10^{-3} M) | Cu(s) **[3]**

Given : $E^0(Cu^{2+}/Cu) = +0.34V$

$E^0(Mg^{2+}/Mg) = -2.37V$

27. How can you convert the following : **[3]**

i. Sodium phenoxide to o-hydroxybenzoic acid

ii. Acetone to propene

iii. Phenol to chlorobenzene

28. What is an electrochemical series? How does it help in calculating the e.m.f of a standard cell? **[3]**

Section D

29. **Read the text carefully and answer the questions:** **[4]**

Transition metal oxides are generally formed by the reaction of metals with oxygen at high temperatures. The highest oxidation number in the oxides coincides with the group number. In vanadium, there is a gradual change from the basic V_2O_3 to less basic V_2O_4 and to amphoteric V_2O_5. V_2O_4 dissolves in acids to give VO^{2+} salts.

Potassium dichromate is a very important chemical used in the leather industry and as an oxidant for the preparation of many azo compounds. Dichromates are generally prepared from chromate. Sodium dichromate is more soluble than potassium dichromate. The latter is, therefore, prepared by treating the solution of sodium dichromate with potassium chloride. Sodium and potassium dichromates are strong oxidising agents; sodium salt has a greater solubility in water and is extensively used as an oxidising agent in organic chemistry. Potassium dichromate is used as a primary standard in volumetric analysis.

(i) Which of the 3d series of the transition metals exhibits the largest number of oxidation and why?

OR

MnO is basic whereas Mn_2O_7 is acidic in nature. Give reason.

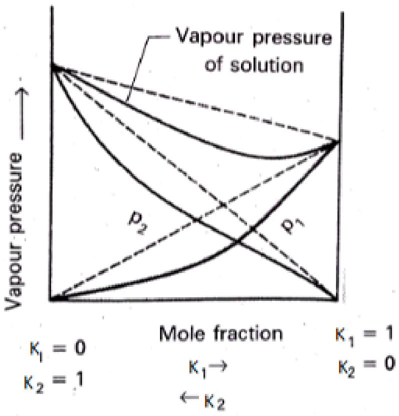
(ii) A transition metal exhibits highest oxidation state ih oxides and fluorides. Give reason.

(iii) How would you account for the increasing oxidising power in the series:

$VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$?

30. **Read the text carefully and answer the questions:** **[4]**

Raoult's law states that for a solution of volatile liquids, the partial vapour pressure of each component of the solution is directly proportional to its mole fraction present in solution. Dalton's law of partial pressure states that the total pressure (P_{total}) over the solution phase in the container will be the sum of the partial pressures of the components of the solution and is given as: $P_{total} = P_1 + P_2$



(i) Is the above-mentioned Raoult's law applicable for non-volatile liquids?

(ii) What type of deviation from Raoult's law does the above graph represent?

(iii) Give an example of such system.

OR

A solution of two liquids boils at a temperature more than the boiling point of either of them. What type of deviation will be shown by the solution formed in terms of Raoult's law?

Section E

31. **Attempt any five of the following:** **[5]**

(i) State a use of streptokinase in protein. **[1]**

(ii) What are any two good sources of vitamin A? **[1]**

(iii) What are heterocyclic bases? **[1]**

(iv) What is the information given by primary structure of proteins? **[1]**

(v) Deficiency of which vitamin causes night-blindness. **[1]**

(vi) Give an example of fibrous protein. **[1]**

(vii) Write the product obtained when D-glucose reacts with $H_2N\text{-}OH$. **[1]**

32. $FeSO_4$ solution mixed with $(NH_4)_2SO_4$ solution in 1:1 molar ratio gives the test of Fe^{2+} ion but $CuSO_4$ solution mixed with aqueous ammonia in 1:4 molar ratio does not give the test of Cu^{2+} ion. Explain why? **[5]**

OR

Write the IUPAC names of the following coordination compounds:

a. $[Pt(NH_3)_2Cl(NO_2)]$

b. $K_3[Cr(C_2O_4)_3]$

c. $[CoCl_2(en)_2]Cl$

d. $[Co(NH_3)_5(CO_3)]Cl$

e. $Hg[Co(SCN)_4]$

33. State the reactions and reaction conditions for the following conversions : **[5]**

i. Benzene diazonium chloride to nitrobenzene.

ii. Aniline to benzene diazonium chloride.
iii. Ethylamine to methylamine.

OR

Give the reasons for the following:

i. Aniline does not undergo Friedel-Crafts reaction.
ii. $(CH_3)_2NH$ is more basic than $(CH_3)_3.N$ in an aqueous solution.
iii. Primary amines have a higher boiling point than tertiary amines.

Solution

Section A

1. **(a)** All of these

   Explanation: When a haloalkane with β-hydrogen atom is heated with an alcoholic solution of potassium hydroxide, there is an elimination of hydrogen atom from β-carbon and a halogen atom from the α-carbon atom. As a result, an alkene is formed as a product. Since the β-hydrogen atom is involved in elimination, it is often called β-elimination.

2. **(c)** Phosphate - sugar - base

   Explanation: A unit formed by the attachment of a base to 1′ position of sugar is known as nucleoside. When nucleoside is linked to phosphoric acid at 5′-position of sugar moiety, we get a nucleotide. Nucleotides are joined together by phosphodiester linkage between 5′ and 3′ carbon atoms of the pentose sugar. So Phosphate - sugar - base is the sequence in nucleic acids.

3. **(d)** All of these

   Explanation: Phenol reacts with sodium hydroxide solution to give a colourless solution containing sodium phenoxide. In this reaction, the hydrogen ion has been removed by the strongly basic hydroxide ion in the sodium hydroxide solution.

4. **(a)** I_2 and NaOH

   Explanation: Acetophenone and benzophenone both are ketones so, cannot be distinguished on the basis of Tollen's or Benedicts test. Acetophenone has -$COCH_3$ great which gives a positive iodoform test while benzophenone doesn't give iodoform test thus I_2 + NaOH can be used.

5. **(c)** Decomposition of nitrogen pentoxide

   Explanation: Decomposition of N_2O_5 is 1st order reaction as follows

   $$N_2O_5 \rightleftharpoons NO_2 + NO_3$$
   $$NO_2 + NO_3 \to NO_2 + O_2 + NO \text{ slow step}$$
   $$NO + N_2O_5 \to 3NO_2 \text{ fast step}$$

   as we know slow step is the rate-determining step, rate =k[N_2O_5]

6. **(d)** (a) - (ii), (b) - (i), (c) - (iv), (d) - (iii)

   Explanation: (a) - (ii), (b) - (i), (c) - (iv), (d) - (iii)

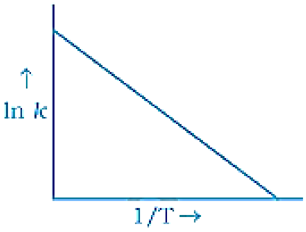
7. **(c)** gem-dihalide

   Explanation: Gem-dihalides are dihaloalkanes that have two halogen atoms of the same type attached to the same carbon atom in a molecule. The common naming system of gem-dihalides (geminal halide) is alkylidene dihalides. Ethylidene dichloride thus is a gem-dihalide. The chemical formula of ethylidene dichloride is $C_3H_6Cl_2$.

8. **(c)** They are chemically reactive.

   Explanation: Interstitial compounds are obtained when small atoms like H, B, C, resemble N, etc. fit into the lattice of other elements. They are chemically inert.

9. **(b)**



Explanation: According to Arrhenius equation $k = Ae^{-E_a/RT}$

Taking log on both sides in $k = \ln\left(A \cdot e^{-\frac{E_2}{RT}}\right)$

$\ln k = \ln A - \frac{E_a}{RT}$

$\ln k = -\frac{-E_a}{R} \times \frac{1}{T} + \ln A$

$y = mx + c$

This equation can be related to the equation of a straight line.

From the graph, it is very clearly shown that the slope of the plot $= \frac{-E_a}{R}$ and intercept = ln A.

10. **(a)** Zn – Hg with HCl

Explanation: For Clemmenson we use Zn-Hg(conc. HCl). This reduction reduces carbonyl groups to an alkane. This reduction cannot be used when an acid-sensitive group is present.

11.

(b) Tertiary alcohol

Explanation: The outcome of oxidation reactions of alcohol depends on the substituents on the carbinol carbon. In order for each oxidation step to occur, there must be H on the carbinol carbon.

- Primary alcohols can be oxidized to aldehydes or further to carboxylic acids. In aqueous media, the carboxylic acid is usually the major product. PCC or PDC, which are used in dichloromethane, allow the oxidation to be stopped at the intermediate aldehyde.
- Secondary alcohols can be oxidized to ketones but no further:
- Tertiary alcohols cannot be oxidized (no carbinol C-H).

12.

(d) Reaction with chloroform and alcoholic KOH

Explanation: Only primary amines react with $CHCl_3$ and alc. KOH to produce foul-smelling isocyanide. This test is known as Carbylamine Test (Hoffman's Isocyanide Test) for primary amines.

13.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation: Both A and R are true but R is not the correct explanation of A.

14.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation: Both A and R are true but R is not the correct explanation of A.

15.

(c) A is true but R is false.

Explanation: $CH_2{=}CH{-}Cl$ has some partial double bond character between carbon and a chlorine atom. So, nucleophilic substitution is difficult to carry as it is difficult to break the partial double bond in vinyl chloride than ethyl chloride $CH_3CH_2{-}Cl$ where there is no double bond character.

The vinyl group is not electron-donating. The carbon halogen bond in vinyl halides has some double-bond character and thus a little difficult to break.

16.

(b) Both A and R are true but R is not the correct explanation of A.

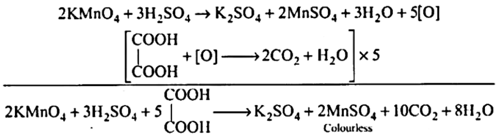
Explanation: Being a strong nucleophile sodium methoxide can cause an elimination reaction with a tertiary halide.

Section B

17. Examples of complexes in biological system.-

    1. Chlorophyll is a complex of Mg.
    2. Haemoglobin is a complex of iron.
    3. Cyanocobalamine , Vitamin B_{12},is a complex of cobalt.

18. The acidified solution of (potassium permanganate) $KMnO_4$ acts as an oxidising agent. It oxidises oxalic acid into CO_2 and itself changes to Mn^{2+} ion which is colourless.



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

$$\left[\begin{matrix}COOH\\ |\\ COOH\end{matrix} + [O] \longrightarrow 2CO_2 + H_2O\right] \times 5$$

$$2KMnO_4 + 3H_2SO_4 + 5\begin{matrix}COOH\\ |\\ COOH\end{matrix} \longrightarrow K_2SO_4 + \underset{\text{Colourless}}{2MnSO_4} + 10CO_2 + 8H_2O$$

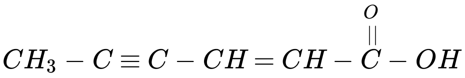
19. Answer the following:
    (i) Rate of reaction is defined as change in concentration of reactants or products per unit time. For example, the reaction A →B has the rate expressed as:
    rate of reaction $= \frac{dx}{dt} = \frac{-[dA]}{dt} = \frac{[dB]}{dt}$
    (ii) For a reaction R → P, half-life ($t_{1/2}$) is observed to be independent of the initial concentration of reactants. Thus, it follows first order reaction.
20. Henry's Law states that "the partial pressure of the gas in vapour phase (p) is proportional to the mole fraction of the gas (x) in the solution" and is expressed as:
    $p = K_H x$
    Here K_H is the Henry's law constant.
    Given, T = 298 K, $K_H = 1.25 \times 10^6$, p = 760 mm Hg
    We know by Henry's Law, $p = K_H \times x$, where x is mole fraction of the gas in the solution.
    $760 = 1.25 \times 10^6 \times x$
    $x = \frac{760}{1.25\times10^6}$
    $x = 6.08 \times 10^{-4}$

OR

Molality: Molality of a solution is defined as the number of moles of the solute dissolved in 1000 g (1 Kg) of the solvent. It is denoted as 'm'.

Molality (m) $= \frac{\text{Moles of solute}}{\text{Mass of solvent in Kg}}$ Unit of molality = mol/kg

For example, 1.00 mol Kg^{-1}(or 1.00 m) solution of KCl means that 1 mol of KCl dissolved in 1 Kg of water.

21. 

$CH_3 - C \equiv C - CH = CH - \overset{\overset{O}{||}}{C} - OH$

Section C

22. We have,
    $Fe(s) + Cd^{2+}(aq) \rightarrow Fe^{2+}(aq) + Cd(s)$
    In this reaction, iron is oxidized and cadmium is reduced.
    Half cell reaction of this cell is:
    At Cathode (reduction):
    $Cd^{2+}(aq) + 2e^- \rightarrow Cd(s)$
    At Anode (oxidation):
    $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$
    For this reaction, **n = 2 moles of electrons** takes place.
    Now, we have
    $E^\Theta_{cell} = E^\Theta_{Cd^{2+}/Cd} - E^\Theta_{Fe^{2+}/Fe}$
    = -0.40 - (-0.44) = 0.04 V
    We know that,
    $E^\ominus_{cell} = \frac{2.303RT}{nF}\log K_c$
    for n=2 and at T=298 K
    $E^\theta{}_{cell} = \frac{0.059}{2}\log K_c = 0.04$
    $or \log K_c = \frac{2\times0.04}{0.059} = 1.356$
    K_c = Antilog 1.356
    $K_c = 2.270 \times 10^1 = 22.7$
23. i. Average rate of reaction between the time interval, 30 to 60 seconds,$= \frac{d[Ester]}{dt}$
    $= \frac{0.31-0.17}{60-30} = \frac{0.14}{30} = 4.67 \times 10^{-3} mol\, L^{-1} s^{-1}$

ii. For a pseudo first order reaction,

$k = \frac{2.303}{t}\log\frac{[R]_0}{[R]}$

For t= 30s,$k_1 = \frac{2.303}{30}\log\frac{0.55}{0.31} = 1.911 \times 10^{-2}s^{-1}$

For t= 60s, $k_2 = \frac{2.303}{60}\log\frac{0.55}{0.17} = 1.957 \times 10^{-2}s^{-1}$

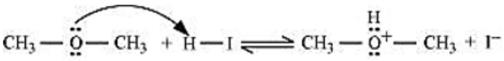
For t= 90s,

$k_3 = \frac{2.303}{90}\log\frac{0.55}{0.085} = 2.075 \times 10^{-2}s^{-1}$

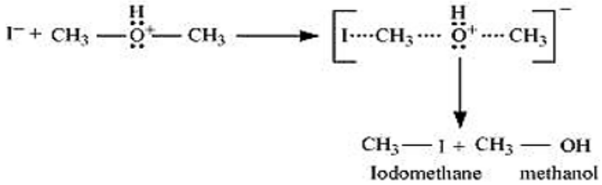
Then, average rate constant,$k = \frac{k_1+k_2+k_3}{3}$ = 1.981 X 10^{-2} s^{-1}

24. The mechanism of the reaction of HI with methoxymethane involves the following steps:

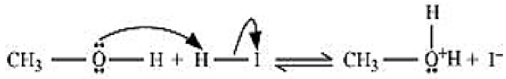
Step1: Protonation of methoxymethane:



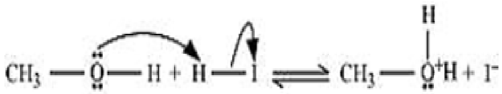
Step2: Nucleophilic attack of I^- :



Step3: When HI is in excess and the reaction is carried out at a high temperature, the methanol formed in the second step reacts with another HI molecule and gets converted to methyl iodide



$I^- + CH_3 - \overset{+}{O}H_2 \longrightarrow CH_3 - I + H_2O$



$I^- + CH_3 - OH_2 \longrightarrow CH_3 - I + H_2O$

OR

i. $KMnO_4$/KOH(alkaline $KMnO_4$)

ii. Cu/573 K (Hot reduced copper)

iii. Br_2(aq)(Bromine water)

25. This is cross aldol condensation reaction.

$$CH_3CHO \ + \ CH_3CH_2CHO \ \xrightarrow[(ii)\ Heat]{(i)\ dil\ NaOH} \ CH_3CH = CHCHO \ + \ CH_3CH_2CH = \underset{\underset{CH_3}{|}}{C} - CHO \ +$$

$$CH_3CH = \underset{\underset{CH_3}{|}}{C} - CHO \ + \ CH_3CH_2CH = CHCHO$$

26.

$$Mg(s) \longrightarrow Mg^{2+}(aq) + 2e^-$$

$$Cu^{2+}(aq) + 2e^- \longrightarrow Cu(s)$$

$$\overline{Mg(s) + Cu^{2+}(aq) \longrightarrow Mg^{2+}(aq) + Cu(s)}$$

$E_{cell} = E^0_{cell} - \frac{0.0591}{2}\log\frac{[Mg^{2+}]}{[Cu^{2+}]}$

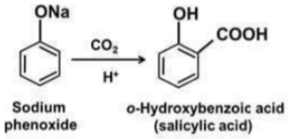
$E^0_{cell} = \left[E^0\frac{(Cu^{2+})}{(Cu)} - E^0(Mg^{2+}/Mg)\right]$

$E_{cell} = [+0.34V - (-2.37V)] - \frac{0.0591}{2}\log 10^2$

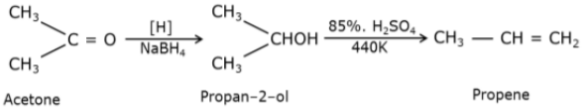
= (0.271 V - 0.0591)V

= 2.65 V

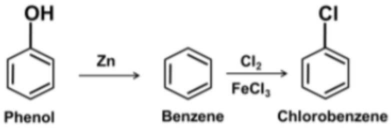
27. i. Conversion of Sodium phenoxide to o-hydroxybenzoic acid involve following step:



ii. Conversion of Acetone to propene involve following step:



iii. Conversion of Phenol to chlorobenzene involve following steps:



28. The series of elements which have been arranged on the basis of their electrode potential is called electrochemical series or activity series.

Standard EMF of the cell = [standard reduction potential of the right hand side electrode] - [Standard reduction potential of the left hand side electrode]

$emf = E^0_{cathode} - E^0_{anode}$

Section D

29. **Read the text carefully and answer the questions:**

Transition metal oxides are generally formed by the reaction of metals with oxygen at high temperatures. The highest oxidation number in the oxides coincides with the group number. In vanadium, there is a gradual change from the basic V_2O_3 to less basic V_2O_4 and to amphoteric V_2O_5. V_2O_4 dissolves in acids to give VO^{2+} salts. Potassium dichromate is a very important chemical used in the leather industry and as an oxidant for the preparation of many azo compounds. Dichromates are generally prepared from chromate. Sodium dichromate is more soluble than potassium dichromate. The latter is, therefore, prepared by treating the solution of sodium dichromate with potassium chloride. Sodium and potassium dichromates are strong oxidising agents; sodium salt has a greater solubility in water and is extensively used as an oxidising agent in organic chemistry. Potassium dichromate is used as a primary standard in volumetric analysis.

(i) Manganese (Z = 25) shows maximum number of O.S. This is because its outer EC is $3d^5 4s^2$. As 3d and 4s are close in energy, it has maximum number of e-1 s to loose or share. Hence, it shows O.S. from +2 to +7 which is the maximum number.

OR

When a metal is in a high oxidation state, its oxide is acidic and when a metal is in a low oxidation state its oxide is basic.

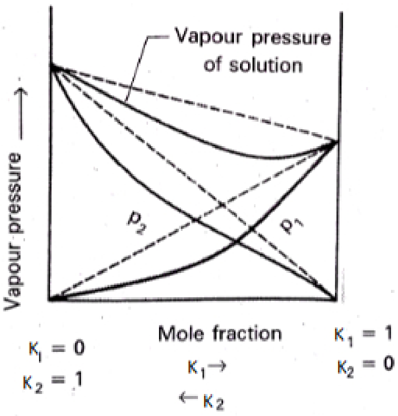
(ii) A transition metal exhibits higher oxidation states in oxides and fluorides because oxygen and fluorine are highly electronegative elements, small in size and strongest oxidising agents.

(iii) This is due to the increasing stability of the lower species to which they are reduced.

30. **Read the text carefully and answer the questions:**

Raoult's law states that for a solution of volatile liquids, the partial vapour pressure of each component of the solution is directly proportional to its mole fraction present in solution. Dalton's law of partial pressure states that the total pressure (P_{total}) over the solution phase in the container will be the sum of the partial pressures of the components of the solution and is given as: P_{total} =

$P_1 + P_2$



(i) KCl in a kg of water would be expected to increase the boiling point by 2×0.52 K = 1.04 K. This could led us to conclude that mass of 2 moles of particles is 74.5 g hence mass of 1 mole of KCl would be 37.25 g. Hence, in case of KCl where dissociation occurs experimentally determined molar mass is always lower than true value.

(ii) Negative Deviation.

(iii) A liquid mixture consisting of 20 % acetone and 80%. chloroform by mass.

OR

Negative Deviation.

Section E

31. Attempt any five of the following:

(i) It dissolves blood clots and used in the treatment of heart diseases.

(ii) Milk, carrot

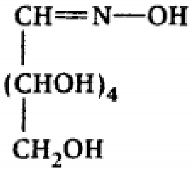
(iii) Cyclic compound containing element other than carbon i.e.,N, S, O at ring position are called heterocyclic bases.

(iv) Primary structure of proteins tells about the sequence in which various amino acids are linked with each other.

(v) Vitamin A

(vi) Keratin and Myosin

(vii) D-glucose on reaction with NH_2OH (hydroxylamine) yield glucose oxime.



$$\begin{array}{l} CH{=}N{-}OH \\ \quad | \\ (CHOH)_4 \\ \quad | \\ CH_2OH \end{array}$$

32. $(NH_4)_2SO_4 + FeSO_4 + 6H_2O \rightarrow FeSO_4.(NH_4)_2SO_4.6H_2O$ (Mohr's Salt)

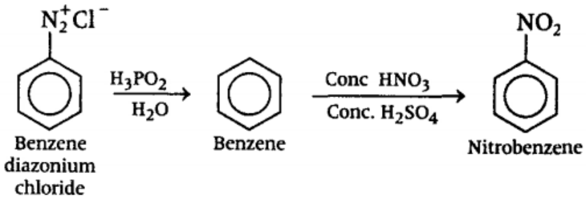
$CuSO_4 + 4NH_3 + 5H_2O \rightarrow [Cu(NH_3)_4]SO_4.5H_2O$ (tetramminocopper(ii) sulphate)

Both the compounds i.e., $FeSO_4.(NH_4)_2SO_4.6H_2O$ and $[Cu(NH_3)_4]SO_4.5H_2O$ fall under the category of addition compounds with only one major difference i.e., the former is an example of a double salt, while the latter is a coordination compound. A double salt is an addition compound that is stable in the solid state but that which breaks up into its constituent ions in the dissolved state. These compounds exhibit individual properties of their constituents. For e.g. $FeSO_4.(NH_4)_2SO_4.6H_2O$ breaks into Fe^{2+}, NH^{4+} and SO_4^{2-} ions. Hence, it gives a positive test for Fe^{2+} ions.A coordination compound is an addition compound which retains its identity in the solid as well as in the dissolved state. However, the individual properties of the constituents are lost. This happens because $[Cu(NH_3)_4]SO_4.5H_2O$ does not show the test for Cu^{2+}.The ions present in the solution of $[Cu(NH_3)_4]SO_4.5H_2O$ are $[Cu(NH_3)_4]^{2+}$ and SO_4^{2-}.

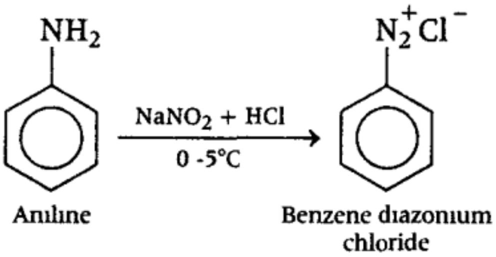
OR

a. The IUPAC name of $[Pt (NH_3)_2 Cl(NO_2]$ is Diamminechloridonitrito-N-platinum(II).
b. The IUPAC name of $K_3 [Cr (C_2O_4)_3]$ is Potassium trioxalatochromate(III).
c. The IUPAC name of $[CoCl_2 (en)_2]Cl$ is Dichloridobis (ethane-1,2-diamine)cobalt(III) chloride.
d. The IUPAC name of $[Co(NH_3)_5 (CO_3)]Cl$ is Pentaamminecarbonatocobalt(III) chloride.
e. The IUPAC name of $Hg [Co (SCN)_4]$ is Mercury (I) tetrathiocyanatocobaltate(III).

33. i.



ii.



iii. $\underset{Ethyla\min e}{C_2H_5CH_2NH_2} \xrightarrow{HNO_2} \mathrm{CH_3CH_2OH} \xrightarrow[K_2Cr_2O_7/H_2SO_4]{} \mathrm{CH_3CHOOH} \xrightarrow[\Delta]{NH_3} \mathrm{CH_3CH_2NOH_2} \xrightarrow{Br_2/KOH} \underset{\text{Methylamine}}{\mathrm{CH_3NH_2}}$

OR

i. Aniline is a Lewis base and forms a salt with Lewis acid.
Aniline being a Lewis base reacts with Lewis acid ($AlCl_3$)to form a salt.

$\mathrm{C_6H_5NH_2} + \mathrm{AlCl_3} \longrightarrow C_6H_5\overset{+}{N}H_2AlCl_3^-$

As a result, N acquires a positive charge so, it acts as a strong deactivating group for electrophilic substitution reaction. Thus, aniline does not undergo Friedel-Crafts reaction.

ii. In aqueous solution, basic nature depends on + I-effect, H-bonding, and steric-effect.
The combined effect shows that $(CH_3)_2$·NH is more basic than $(CH_3)_3$·N as H-bonding is more in case of $(CH_3)_2$·NH than in $(CH_3)_3N$, which predominates over the stability due to +I- effect of three -CH_3 groups.

iii. Large pK_b value means a weak base

In aniline, the lone pair of electrons on N-atom is delocalized over the benzene ring. As a result, electron density on the nitrogen decreases and electrons are not available for donation. In contrast, in CH_3-NH_2, +I effect of -CH_3 group increases the electron density on the N-atom. Therefore, aniline is a weaker base than methylamine and hence, its pKb value is higher than that of methylamine.