CBSE Class 12 - Chemistry
Sample Paper - 03 (2019-20)

Maximum Marks:70

Time Allowed: 3 hours

General Instructions:

a. All questions are compulsory.
b. Section A: Q.no. 1 to 16 are very short answer questions (objective type) and carry 1 mark each.
c. Section B: Q.no. 17 to 23 are short answer questions and carry 2 marks each.
d. Section C: Q.no. 24 to 30 are long answer questions and carry 3 marks each.
e. Section D: Q.no. 31 to 33 are also long answer questions and carry 5 marks each.
f. There is no overall choice. However an internal choice has been provided in two questions of two marks, two questions of three marks and all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.
g. Use log tables if necessary, use of calculators is not allowed.

Section A

1. Many chemical and biological processes depend on osmosis, the selective passage of solvent molecules through the porous membrane from a dilute solution to a more concentrated one. The osmotic pressure π depends on molar concentration of the solution (π = CRT). If two solutions are of equal solute concentration and, hence, have the same osmotic pressure, they are said to be isotonic. If two solutions are of unequal osmotic pressures, the more concentrated solution is said to be hypertonic and the more diluted solution is described as hypotonic.

   Osmosis is the major mechanism, for transporting water upward in the plants. Transpiration is the leaves supports the transport mechanism of water. The osmotic pressure of seawater is about 30 atm; this is the pressure that must be applied to the seawater (separated from pure water using a semi-permeable membrane) to get drinking water.

Answer the following questions:

   i. What will happen if a plant cell kept in a hypertonic solution?
   ii. Glucose solution to be injected into the bloodstream must have same _____ as that of the bloodstream.
   iii. What are the factors on which osmotic rise of a solution depends?
   iv. What type of solution has the same molarity?
   v. Which mechanisms helps in the transportation of water in a plant?

2. Out of C and CO, which is a better reducing agent for ZnO?

3. Write name of linkage joining two amino acids.

4. Name purines present in DNA?

5. Give example of elastomers.

6. Give IUPAC name of the compound

$$CH_3 - CH_2 - \overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle COOH}{|}}{C}} - CH_2 - CH_3$$

7. Alcohols are easily dehydrated in the following order

   a. None of these

   b. Primary> Secondary >Tertiary

   c. Tertiary > Secondary > Primary

   d. Secondary > Primary>Tertiary

8. The impurities associated with an ore is known as

   a. slag

   b. flux

   c. gangue

d. froth

9. The product of oxidation of I^- with MnO_4^- in acidic medium is

   a. I_2

   b. IO_3^-

   c. IO^-

   d. IO_4^-

10. In a coordination entity of the type $[PtCl_2(en)_2]^{2+}$ which isomer will show optical isomerism?

    a. mer-isomer

    b. fac-isomer

    c. cis-isomer

    d. trans-isomer

11. One of the statements below is not true for the classification of polymers that they can be classified on the basis of their

    a. resistance to different agents

    b. mode of polymerisation

    c. intermolecular forces

    d. structure of the polymers

12. **Assertion:** Insulin is a globular protein.
    Reason: Gum is a polymer of more than one type of monosaccharides.

    a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

c. Assertion is CORRECT but, reason is INCORRECT.

d. Assertion is INCORRECT but, reason is CORRECT.

13. **Assertion:** Addition of HBr to 1 - butene in the presence of peroxide gives 1-bromobutane.
Reason: It involves the formation of primary radical.

a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

c. Assertion is CORRECT but, reason is INCORRECT.

d. Assertion is INCORRECT but, reason is CORRECT.

14. **Assertion:** Iodine dissolves in aqueous solution of potassium iodide.
Reason: Potassium iodide behaves as an organic solvent and therefore, dissolves non-polar iodine.

a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

c. Assertion is CORRECT but, reason is INCORRECT.

d. Assertion is INCORRECT but, reason is CORRECT.

15. **Assertion:** Glycerol does not react with HI.
Reason: 2 - Iodopropane can be produced by treatment of glycerol with HI.

a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of

the assertion.

b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

c. Assertion is CORRECT but, reason is INCORRECT.

d. Assertion is INCORRECT but, reason is CORRECT.

16. **Assertion:** True solutions do not exhibit the Tyndall effect.
    Reason: In true solution the size of solute particles is small.

   a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

   b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

   c. Assertion is CORRECT but, reason is INCORRECT

   d. Assertion is INCORRECT but, reason is CORRECT

Section B

17. How does vulcanization change the character of natural rubber?

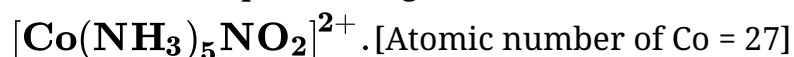18. State the 'rate law' for chemical reactions.
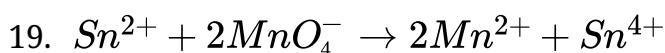
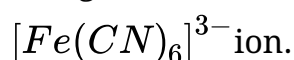19. $Sn^{2+} + 2MnO_4^- \rightarrow 2Mn^{2+} + Sn^{4+}$
    $E^0_{(Mn^{-4}/Mn^{2+})} = 1.51V$
    $E^0_{(Sn^{+4}/Sn^{+2})} = -0.15$ V

    Will the reaction will proceed?

20. Deduce the shape and magnetic behaviour of the complex ion $[Co(NH_3)_5NO_2]^{2+}$. [Atomic number of Co = 27]

21. Using the valence bond approach, predict the shape and magnetic character of $[Fe(CN)_6]^{3-}$ ion.

i. Write down the IUPAC name of the following complex:

[Cr (NH$_3$)$_2$ Cl$_2$(en)]Cl (where en =ethylene diamine)

ii. Write the formula for the following complex:

Penta ammine nitrito-O-cobalt (III) ion

22. Give the names of two chief ores of aluminium.

OR

Why is the extraction of copper from pyrites more difficult than that from its oxide ore through reduction?
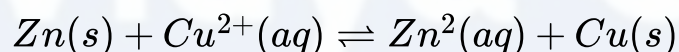
23. Account for the following:

i. The boiling points of alcohols decrease with increase in branching of the alkyl chain.

ii. Phenol does not give protonation reaction readily.

Section C

24. Calculate the equilibrium constant for the reaction.

$Zn(s) + Cu^{2+}(aq) \rightleftharpoons Zn^{2}(aq) + Cu(s)$

Given: $E^0_{Zn^{2+}/Zn} = -0.763V$

and $E^0_{cu^{2+}/cu} = +0.34V$

25. For a decomposition reaction the values of rate constant K at two different temperatures are given below:

$K_1 = 2.15 \times 10^{-8} L\, mol^{-1}s^{-1}$ at 650 K

$K_2 = 2.39 \times 10^{-7} L\, mol^{-1}s^{-1}$ at 700 K

Calculate the value of activation energy for this reaction. (R = 8.314 JK^{-1} mol^{-1})

OR

Hydrogen peroxide, $H_2O_2(aq)$ decomposes to H_2O and O_2 in a reaction which is first order in H_2O_2 and has a rate constant, $k = 1.06 \times 10^{-3} min^{-1}$. Then:

i. How long will it take 15% of a sample of H_2O_2 to decompose?

ii. How long will it take 85% of a sample of H_2O_2 to decompose?

26. Calculate $E^0(Ni^{2+}|Ni)$, if emf of the cell, $Ni(s)|Ni^{2+}(0.01M) || Cu^{2+}(0.1M)|Cu(s)$ is 0.059 V. [Given, $E^\circ_{Cu^{2+}/Cu}$ = + 0.34 V].

27. Why does NH_3 form hydrogen bond but PH_3 does not?

28. Write the chemical equations when,

i. methyl chloride is treated with $AgNO_2$.

ii. bromobenzene is treated with CH_3Cl in the presence of anhydrous $AlCl_3$.

29. Acetic acid can be halogenated in the presence of red P and Cl_2 but formic acid cannot be halogenated in the same way. Why?

OR

What is meant by the Hemiacetal? Give an example.

30. a. What are antihistamines?

b. Mention the name of a substance which can be used both as an antiseptic as well as disinfectant.
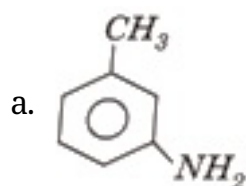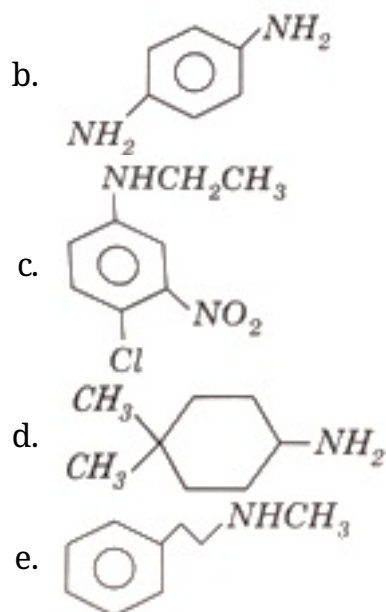
Section D

31. What role does adsorption play in heterogeneous catalysis?

OR

Define conductivity and molar conductivity for the solution of an electrolyte. Discuss their variation with concentration.

32. Give the IUPAC names of the following compounds

a.

b.

c.

d.

e.

OR

How will you convert:

  i. Ethanoic acid into methanamine
  ii. Hexanenitrile into 1-aminopentane
  iii. Methanol to ethanoic acid
  iv. Ethanamine into methanamine
  v. Ethanoic acid into propanoic acid

33. a. In the titration of $FeSO_4$ with $KMnO_4$ in the acidic medium why is dil H_2SO_4 used instead of dil HCl?

    b. Give reason:
       i. Among transition metals, the highest oxidation states is exhibited on oxoanions of a metal.
       ii. Ce^{4+} is used as an oxidizing agent in volumetric analysis.
       iii. Transition metals form a number of interstitial compounds.
       iv. Zn^{2+} salts are white while Cu^{2+} salts are blue.

OR

    a. Write one difference between transition elements and p-block elements with reference to variability of oxidation states.

    b. Why do transition metals exhibit higher enthalpies of atomization?

c. Name an element of lanthanoid series which is well known to shown +4 oxidation state. Is it a strong oxidising agent or reducing agent?
d. What is lanthanoid contraction? Write its one consequence.
e. Write the ionic equation showing the oxidation of Fe(II) salt by acidified dichromate solution.

Solution

Section A

1. i. A plant cell gets shrink when it is kept in a hypertonic solution.
    ii. Osmotic pressure.
    iii. Osmotic rise of a solution depends upon density & temperature.
    iv. Isotonic solutions have the same molarity.
    v. In an upward direction, osmosis helps in the transportation of water in a plant.

2. Carbon is a better reducing agent than CO for ZnO. This is because the standard free energy of formation $\left(\Delta_f G^o\right)$ of CO_2 from CO is higher than that of the formation of ZnO from Zn. Therefore, CO cannot be used to reduce ZnO to Zn.

3. Peptide linkage

4. Adenine and guanine

5. Buna-S

6. 2-Ethyl-2-methylbutanoic acid

7. (c) Tertiary > Secondary > Primary

    Explanation: The rate of dehydration is related to the ease of formation of Carbocation and the energy of the carbocation intermediate. -.

    Dehydration involves the formation of carbocation 1st and since tertiary carbocation is more stable than secondary and primary therefore 3° is dehydrated first.
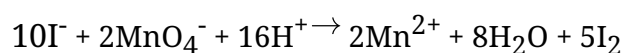
    The ease of formation of Carbocation is Tertiary>Secondary>Primary.

8. (c) gangue

    Explanation: Rarely an ore contains only desired substance. It is generally contaminated with earthly or non-desired materials like gangue.
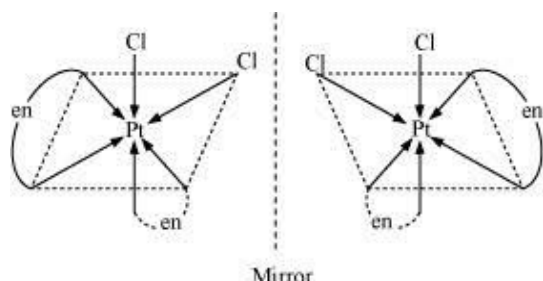
9. (a) I_2

Explanation: Iodine is liberated from potassium iodide.

$$10I^- + 2MnO_4^- + 16H^+ \rightarrow 2Mn^{2+} + 8H_2O + 5I_2$$

10. (c) cis-isomer

Explanation:

Mirror

We can see that in the cis isomer the mirror images are non-superimposable whereas in trans-isomer the mirror images will be superimposable and hence will not show optical activity.

11. (a) resistance to different agents

Explanation: Polymers can be classified based on their structure as linear, branched and cross-linked polymers. They can also be classified based on mode of polymerisation as addition and condensation polymers. Also the classification can be made based on the intermolecular forces as elastomers, fibres, thermoplastic and thermosetting polymers. So polymers cannot be classified on the basis of their resistance to different agents.

12. (b) Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

Explanation: Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

13. (c) Assertion is CORRECT but, reason is INCORRECT.

Explanation: Assertion is CORRECT but, reason is INCORRECT.

14. (c) Assertion is CORRECT but, reason is INCORRECT.

Explanation: Assertion is CORRECT but, reason is INCORRECT.

15. (d) Assertion is INCORRECT but, reason is CORRECT.

Explanation: Assertion is INCORRECT but, reason is CORRECT.

16. (a) Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

Explanation: Both assertion and reason are CORRECT and reason is the
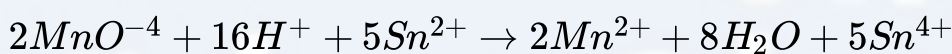
CORRECT explanation of the assertion.

Section B

17. The process involving more cross links in a rubber and altering its structure so that it becomes less plastic and sticky, more resistant to swelling by organic liquids and has enhanced elasticity.

18. Rate law is the expression in which reaction rate is given in terms of molar concentration of reactants with each term raised to some power, which may or may not be same as the stoichiometric coefficient of the reacting species in a balanced chemical equation. For the reaction: aA + bB → cC + dD, the rate law is: Rate = k [A]^X [B]^y ; where a may or may be equal to x; and b may or may be equal to y. Rate law is experimentally determined.

19. Galvanic cell for the reaction is:
$$pt|Sn^{2+}(aq)|Sn^{4+}(aq)||MnO_4^-(aq)|Mn^{2+}(aq)|pt$$
Call reaction is:
$$2MnO^{-4} + 16H^+ + 5Sn^{2+} \rightarrow 2Mn^{2+} + 8H_2O + 5Sn^{4+}$$
$$\therefore E^0_{cell} = E^0_{(Mn^{-4}/Mn^{2+})} - /E^0_{(Sn^{4+}/Sn^{2+})}$$
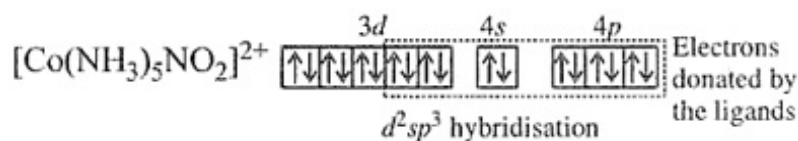= 1.51V - (-0.15V)
$$E^0_{cell} = 1.66V$$
As we know $\Delta G^0 = -nFE^0$

on putting the values in above equation,

ΔG^0 for the reaction will be negative, therefore the reaction is product favoured.
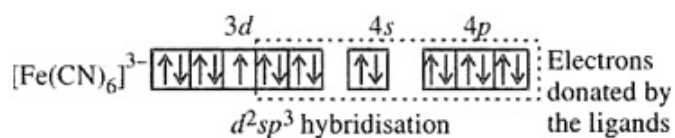
20. Co: $ls^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$

    Co^{3+} ion has outer electronic configuration: $4s^0 3d^6$ .NH_3 causes pairing of electrons in d-orbital as shown below:

    It has octahedral shape. It is diamagnetic because it does not have unpaired electrons.
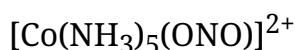
21. Fe(26): [Ar]4^3d6, Fe^{3+} : [Ar]$4s^0 3d^5$

It has octahedral shape and is paramagnetic in nature due to presence of one unpaired electron.

OR

i. The IUPAC name of $[Cr(NH_3)_2Cl_2(en)]$ Cl is diamminedichlorido (ethane -1, 2-diamine) chromium (III) chloride.

ii. The formula for the complex, penta ammine nitrito-O-cobalt ion is $[Co(NH_3)_5(ONO)]^{2+}$

22. i. Bauxite : $Al_2O_3 \cdot 2H_2O$

ii. Cryolite : Na_3AlF_6

OR

In the graph of $\Delta_r G^0$ vs T for formation of oxides, the Cu_2O line is almost at the top. So it is quite easy to reduce oxide ores of copper directly to the metal by heating with coke (both the lines of C, CO and C, CO_2 are at much lower positions in the graph particularly after 500 – 600K). However, most of the ores (like copper pyrites $CuFeS_2$) are sulphide and some may also contain iron. The sulphide ores are roasted/smelted to give the oxide. The oxide can be easily reduced to copper using coke.

23. i. Since, branched chain alcohols have minimum surface area, therefore, minimum force of attraction occur between them, hence boiling point decreases with increase in branching of alkyl chain.

ii. In phenols, the lone pairs of electrons on the oxygen atom are delocalised over the benzene ring due to resonance and hence, are not easily available for protonation.

Section C

24. $Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$
$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$
$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$
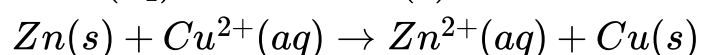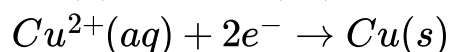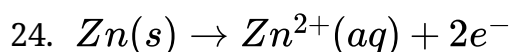
$$E_{cell} = E^0_{Cu^{+2}/Cu} - E^0_{Zn^{+2}/Zn}$$

= + 0.34V - (-0.763V)

= 1.103 V

$$\log K = \frac{nE^0}{0.0591}$$
$$= \frac{2 \times 1.103}{0.0591}$$
$$\log K = \frac{2.206}{0.0591} = 37.326$$

k = Antilog 37.326

$$= 2.118 \times 10^{37}$$

25. Here $K_1 = 2.15 \times 10^{-8} L\,mol^{-1}\,s^{-1}$

$K_2 = 2.39 \times 10^{-7} L\,mol^{-1}\,s^{-1}$

$T_1 = 650\,K$, $T_2 = 700K$ and

$R = 8.314\,JK^{-1}\,mol^{-1}$

Using the formula

$$\log \frac{K_2}{K_1} = \frac{E_a}{2.303R}\left(\frac{T_2-T_1}{T_1T_2}\right)$$

$$\log = \frac{2.39 \times 10^{-7}}{2.15 \times 10^{-8}} = \frac{E_a}{2.303 \times 8.314}\left(\frac{700-650}{650 \times 700}\right)$$

$$\log 1.11 \times 10 = \frac{E_a}{19.147} \times \frac{50}{455000}$$

$$1.0457 = \frac{E_a}{19.147} \times \frac{1}{9100}$$

E_a = 182200.365 J mol^{-1}

OR

i. For 15% decomposition of H_2O_2

$[R]_0$ = 100 M, [R] = 100 - 15 = 85 M

k = 1.06 $\times$ 10^{-3} min^{-1}

For first order reaction

$$t = \frac{2.303}{k}\log\frac{[R_0]}{[R]}$$

$$t = \frac{2.303}{1.06 \times 10^{-3}} \times \log\left[\frac{100}{85}\right]$$

$$t = \frac{2.303}{1.06 \times 10^{-3}} \times [\log 100 - \log 85]$$

$$t = \frac{2.303}{1.06 \times 10^{-3}} \times \log(2 - 1.9292)$$

$$t = \frac{2.303}{1.06 \times 10^{-3}} \times (0.0706)$$

t = 153.38 min.

ii. Similarly, for 85% decomposition of reaction

$$t = \left(\frac{2.303}{1.06 \times 10^{-3}}\right) \log\left(\frac{100}{15}\right)$$

t = 1790.325 min.

26. Given, E_{cell} = 0.059 V: $E^{\circ}_{Cu^{2+}/Cu}$ = +0.34 and E^0 (Ni^{2+} | Ni) = ?

[Ni^{2+}] = 0.01M and [Cu^{2+}] = 0.1M

By applying Nernst equation, We have

E_{cell} = $E^{\circ}_{cell} - \frac{0.059}{n} \log \frac{[Ni^{2+}(aq)]}{[Cu^{2+}(aq)]}$

$0.059 = E^{\circ}_{cell} - \frac{0.059}{2} \log \frac{(0.01)}{0.1}$ ($\because$ n = 2)

$0.059 = E^{\circ}_{cell} - \frac{0.059}{2} \log \frac{1}{10}$ [$\because$ log10^{-1} = -1]

$\therefore 0.059 = E^{\circ}_{cell} + 0.0295 \times 1$

E°_{cell} = 0.059 - 0.0295 = 0.0295 V $\approx$ 0.03 V

Also, We have, $E^{\circ}_{cell} = E^0_{cathode} - E^0_{anode}$

0.03 = 0.34 - E^0_{anode}

or $E^0_{anode} = E^{\circ}_{Ni^{2+}/Ni}$ = 0.34 - 0.03 = 0.31 V

27. The electronegativity of N (3.0) is much higher than that of H (2.1) as a result, N - H bond is quite polar and hence NH_3 undergoes intermolecular H-bonding.

In contrast, both P and H have an electronegativity of 2.1. Therefore P - H bond is not polar and hence PH_3 does not undergo H - bonding.

28. i. When methyl chloride react with silver nitrite (covalent molecule), nitrite ion (nucleophile) undergoes nucleophilic substitution reaction to give methyl nitrite.

$$\underset{Methylchloride}{CH_3Cl} + AgNO_2 \rightarrow CH_3NO_2 + AgCl$$
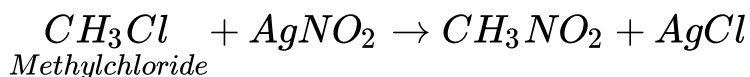
ii. Since, bromobenzene is ortho- para- directing for electrohilic substitution reaction, Therefore, During Friedel Craft's alkylation ortho- and para- product will be formed.

Bromo benzene + CH_3Cl $\xrightarrow[\text{AlCl}_3]{\text{Anhyd}}$ 1-bromo-2-methyl benzene + 1-bromo-4-methyl benzene
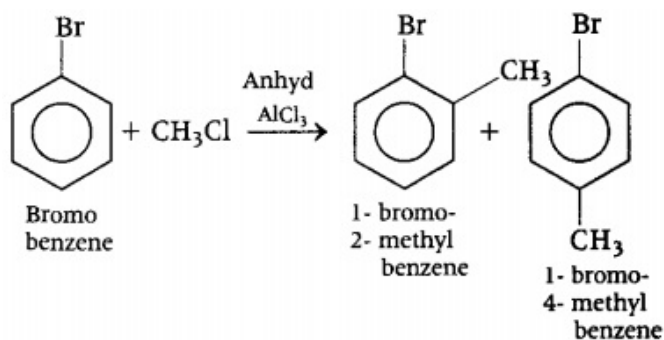
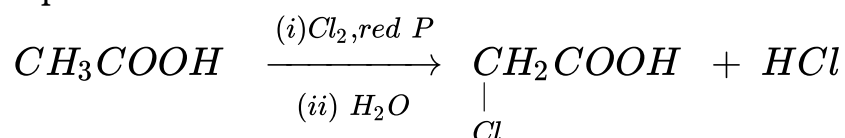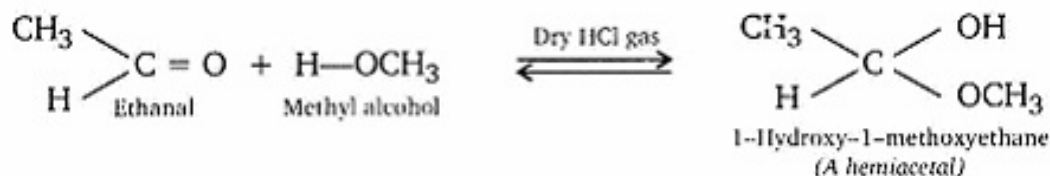29. Acetic acid is halogenated in the presence of red P in which substitution occurs at alpha-carbon atom. This is known as **Hell-Volhard-Zelinsky reaction:**

$$CH_3COOH \xrightarrow[\text{(ii) } H_2O]{(i)Cl_2,red\ P} \underset{Cl}{CH_2COOH} + HCl$$

However, formic acid (HCOOH) has no alpha-hydrogen atom and therefore, cannot undergo **Hell-Volhard-Zelinsky** reaction.

OR

α-Alkoxyalcohols are called hemiacetals. These are produced by addition of one molecule of a monohydric alcohol to an aldehyde in presence of dry HCl gas.

$$\underset{\text{Ethanal}}{\overset{CH_3}{\underset{H}{>}}C=O} + \underset{\text{Methyl alcohol}}{H\text{—}OCH_3} \rightleftharpoons \underset{\substack{\text{1-Hydroxy-1-methoxyethane} \\ \text{(A hemiacetal)}}}{\overset{CH_3}{\underset{H}{>}}C\overset{OH}{\underset{OCH_3}{<}}}$$

30. a. Antihistamines are chemical substances which diminish or abolish the main actions of histamine released in the body and hence prevent the allergic reactions.
    b. Bromopheniramine (dimetapp) and terefenadine (seldane) act as antihistamines. They interfere with the natural action of histamine by competing with histamine for binding sites of receptor where histamine exerts its effect.

Section D

31. Heterogeneous catalysis:

A catalytic process in which the catalyst and the reactants are present in different phases is known as a heterogeneous catalysis. This heterogeneous catalytic action can be explained in terms of the adsorption theory. The mechanism of catalysis involves the following steps:

i. Adsorption of reactant molecules on the catalyst surface.
ii. Occurrence of a chemical reaction through the formation of an intermediate.
iii. De-sorption of products from the catalyst surface
iv. Diffusion of products away from the catalyst surface.

In this process, the reactants are usually present in the gaseous state and the catalyst is present in the solid state. Gaseous molecules are then adsorbed on the surface of the catalyst. As the concentration of reactants on the surface of the catalyst increases, the rate of reaction also increases. In such reactions, the products have very less affinity for the catalyst and are quickly desorbed, thereby making the surface free for other reactants.
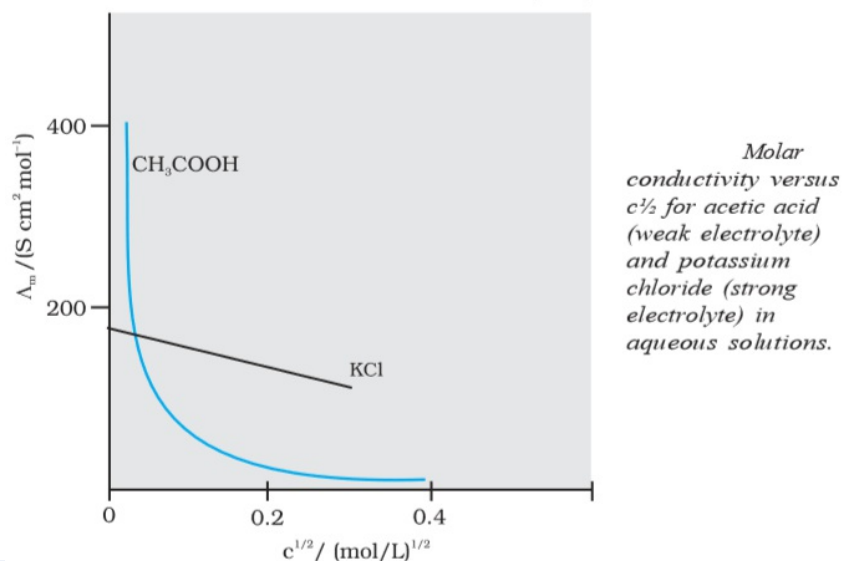
OR

Both conductivity and molar conductivity change with the concentration of the electrolyte. Conductivity always decreases with decrease in concentration both, for weak and strong electrolytes. This can be explained by the fact that the number of ions per unit volume that carry the current in a solution decreases on dilution. The conductivity of a solution at any given concentration is the conductance of one unit volume of solution kept between two platinum electrodes with unit area of cross section and at a distance of unit length. This is clear from the equation:
$G = \frac{\kappa A}{l} = \kappa$ (both A and l are unity in their appropriate units in m or cm)
Molar conductivity of a solution at a given concentration is the conductance of the volume V of solution containing one mole of electrolyte kept between two electrodes with area of cross section A and distance of unit length. Since l = 1 and A = V (Volume containing 1 mole of electrolyte). Therefore, $\Lambda_m = \frac{\kappa A}{l} = \kappa V$
Molar conductivity increases with decrease in concentration. This is because the total volume, V, of solution containing one mole of electrolyte also increases. It has been found that decrease in κ on dilution of a solution is more than compensated by increase in its volume. Physically, it means that at a given concentration, Λ_m can be defined as the conductance of the electrolytic solution kept between the electrodes of a conductivity cell at unit distance but having area of cross section large enough to accommodate sufficient volume of solution that contains one mole of the electrolyte. When concentration approaches zero, the molar conductivity is known as limiting

molar conductivity and is represented by the symbol Λ_m° . The variation in Λ_m with concentration is different for strong and weak electrolytes as shown in the figure.

Molar conductivity versus c½ for acetic acid (weak electrolyte) and potassium chloride (strong electrolyte) in aqueous solutions.
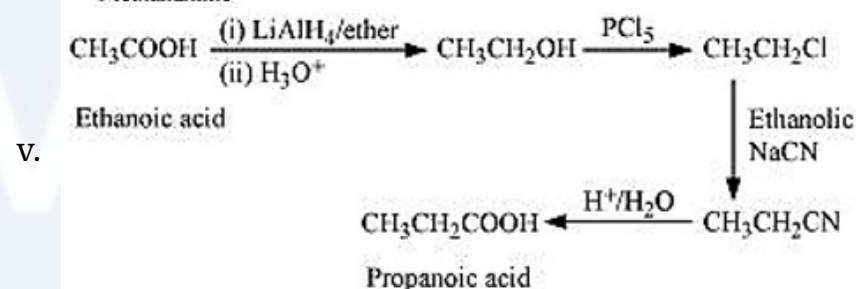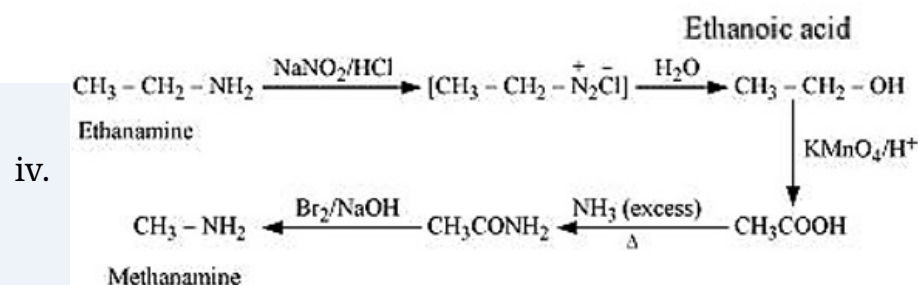
For strong electrolytes, Λ_m increases slowly with dilution and can be represented by the equation: $\Lambda_m = \Lambda_m^\circ - Ac^{1/2}$

Weak electrolytes like acetic acid have lower degree of dissociation at higher concentrations and hence for such electrolytes, the change in Λ_m with dilution is due to increase in the degree of dissociation and consequently the number of ions in total volume of solution that contains 1 mol of electrolyte. In such cases Λ_m increases steeply on dilution, especially near lower concentrations as shown in the given figure above.

32. a. m-Toluidine or 3-Methylbenzenamine

    b. 1, 4-Benzenediamine

    c. 4-chloro-3-nitro-N-ethyl aniline

    d. 4, 4-Dimethylcyclohexanamine

    e. N-Methyl-2-phenylethanamine

OR

i.

ii.

$$C_5H_{11}CN \xrightarrow{H^+/H_2O} C_5H_{11}-COOH \xrightarrow{SOCl_2} C_5H_{11}-COCl$$

Hexanenitrile

$$\downarrow NH_3(\text{excess})$$

$$C_5H_{11}-NH_2 \xleftarrow{Br_2/KOH} C_5H_{11}-CONH_2$$

1-Aminopentane

iii.

$$CH_3OH \xrightarrow{PCl_5} CH_3Cl \xrightarrow{\text{Ethanolic NaCN}} CH_3CN$$

Methanol

$$\downarrow H^+/H_2O$$

$$CH_3COOH$$

Ethanoic acid

iv.

$$CH_3-CH_2-NH_2 \xrightarrow{NaNO_2/HCl} [CH_3-CH_2-\overset{+}{N_2}\overset{-}{Cl}] \xrightarrow{H_2O} CH_3-CH_2-OH$$

Ethanamine

$$\downarrow KMnO_4/H^+$$

$$CH_3-NH_2 \xleftarrow{Br_2/NaOH} CH_3CONH_2 \xleftarrow[\Delta]{NH_3 \text{ (excess)}} CH_3COOH$$

Methanamine

v.

$$CH_3COOH \xrightarrow[\text{(ii) } H_3O^+]{\text{(i) LiAlH}_4/\text{ether}} CH_3CH_2OH \xrightarrow{PCl_5} CH_3CH_2Cl$$

Ethanoic acid

$$\downarrow \text{Ethanolic NaCN}$$

$$CH_3CH_2COOH \xleftarrow{H^+/H_2O} CH_3CH_2CN$$

Propanoic acid

33. a. $KMnO_4$ is a strong oxidising agent, it oxidises Cl^- ions coming from dil HCl to Cl_2 gas thus, a part of $KMnO_4$ is utilised in oxidation of HCl rather than oxidation of $FeSO_4$. Thus, H_2SO_4 is preferred rather than dil HCl in the titration of $KMnO_4$ with $FeSO_4$.

b. i. In these oxoanions, the oxygen atoms are directly bonded to the transition metal. Since oxygen is highly electronegative, and good oxidising agent the oxoanions bring out the highest oxidation state of the metal.

ii. Ce^{4+} has the tendency to attain +3 oxidation state and so it is used as an oxidizing agent in volumetric analysis.

iii. This is due to the presence of voids of appropriate sizes in their crystal lattices

where small metal atoms like H,C,N get trapped forming interstitial compounds.

iv. Zn^{2+} ion has all its orbitals completely filled whereas in Cu^{2+} ion there is one half filled 3d-orbital. It therefore has a tendency to form coloured salts . The unpaired electron of Cu^{2+} undergo d-d- transition thus imparting colur. Whereas Zn^{2+} has no such tendency.

OR

a. Transition elements show variable oxidation states that differ by 1 unit. p-block elements show variable oxidation states that differ by 2 units.
Heavier transition elements are stable in higher oxidation state whereas p-block elements are stable in lower oxidation state.

b. Transition metals exhibit higher enthalpies of atomization because of strong interatomic interactions and strong metallic bonding between atoms.

c. Element: Cerium or Terbium. It is a strong oxidizing agent.

d. The steady decrease in atomic radii with an increase in the atomic number due to the poor shielding effect of 4f orbital electrons is known as lanthanoid contraction. Consequence: 5d series have almost same size as 4d series.

e. Ionic equation: $Cr_2O_7^{2-} + 14\ H^+ + 6\ Fe^{2+}\ 2\ Cr^{3+} + 6\ Fe^{3+} + 7\ H_2O$