Class: XII
SESSION : 2022-2023
SUBJECT: Chemistry (043)
SAMPLE QUESTION PAPER - 5
with SOLUTION

**MM: 70**   **Time: 3 hours**

General Instructions:
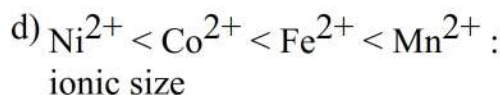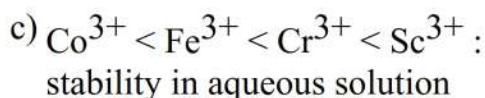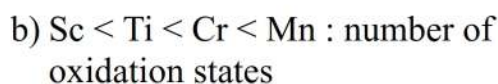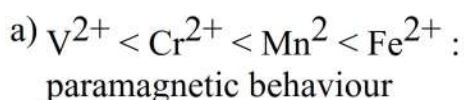
Read the following instructions carefully.

  a) There are **35** questions in this question paper with internal choice.

  b) SECTION A consists of 18 multiple-choice questions carrying 1 mark each.

  c) SECTION B consists of 7 very short answer questions carrying 2 marks each.

  d) SECTION C consists of 5 short answer questions carrying 3 marks each.

  e) SECTION D consists of 2 case- based questions carrying 4 marks each.

  f) SECTION E consists of 3 long answer questions carrying 5 marks each.

  g) **All questions are compulsory.**

  h) **Use of log tables and calculators is not allowed**

Section A

1. What is the structural formula of the monosaccharide that is used in Kiliani-Fischer **[1]**
    synthesis of:

   a)

   b)

   c)

   d)
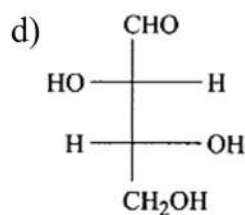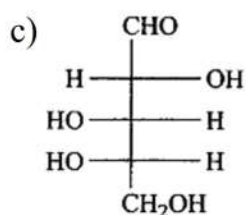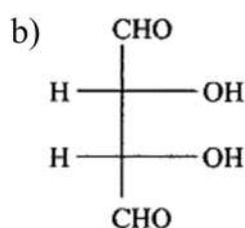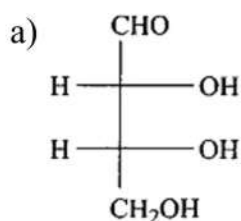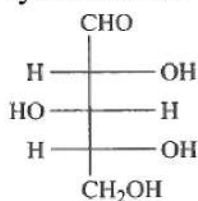
2. Which of the following arrangements does not represent the **correct** order of the **[1]**
    property stated against it?

   a) $V^{2+} < Cr^{2+} < Mn^2 < Fe^{2+}$:
      paramagnetic behaviour

   b) Sc < Ti < Cr < Mn : number of
      oxidation states

   c) $Co^{3+} < Fe^{3+} < Cr^{3+} < Sc^{3+}$:
      stability in aqueous solution

   d) $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$:
      ionic size

3. Addition of water to alkynes occurs in an acidic medium and in the presence of **[1]**

Hg^{2+} ions as a catalyst. Which of the following products will be formed on addition of water to but-1-yne under these conditions?

a)
$$CH_3 - CH_2 - CH_2 - \overset{\overset{O}{\|}}{C} - H$$

b)
$$CH_3 - CH_2 - \overset{\overset{O}{\|}}{C} - CH_3$$

c)
$$CH_3 - CH_2 - \overset{\overset{O}{\|}}{C} - OH + CO_2$$

d)
$$CH_3 - \overset{\overset{O}{\|}}{C} - OH + H - \overset{\overset{O}{\|}}{C} - H$$
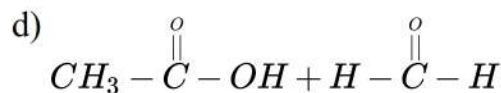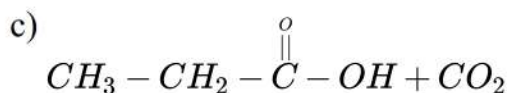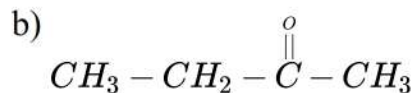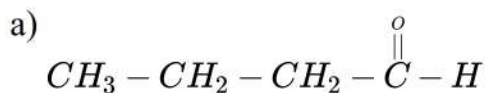
4. Which of the following alcohols will not give iodoform test? [1]

a) CH_3—CH_2—OH

b)

c)

d)

5. Reaction which takes place in one step is known as [1]

a) Elementary reaction

b) Unimolecular reaction

c) Reaction rate

d) Bimolecular reaction

6. Arrange the following nitrogen-containing compounds in decreasing order of basicity: [1]
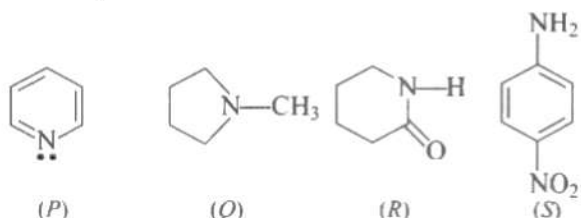
a) S > P > Q > R

b) Q > P > S > R
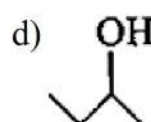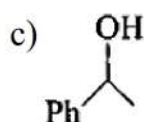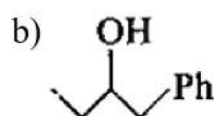
c) Q > P > R > S

d) P > Q > R > S

7. e.m.f. of a cell in terms of the reduction potential of its left and right electrode is: [1]

a) $E = E_R - E_L$

b) $E = -[E_R + E_L]$

c) $E = E_L + E_R$

d) $E = E_L - E_R$

8. Fusion of chromite ore with sodium carbonate in excess of air gives a compound (X) (yellow solution) X when treated with sulphuric acid gives: [1]

a) $Na_2Cr_2O_7$

b) $Na_2Cr_2O_7 \cdot 5H_2O$

c) $Na_2Cr_2O_7 \cdot 10H_2O$

d) $Na_2Cr_2O_7 \cdot 2H_2O$

9. Which of the following compound will not give Cannizzaro's reaction? [1]

a) CH_3CHO b) $HCHO$

c) C_6H_5CHO d) $(Me)_3CCHO$

10. The slope of the line in the plot of concentration [A] Vs. time (s) indicate **[1]**

   a) +k   b) -k

   c) $\dfrac{+k}{2.303}$ d) $\dfrac{-k}{2.303}$

11. 3-Pentanol is an example of: **[1]**

   a) Primary alcohol   b) Secondary alcohol

   c) Tertiary alcohol   d) Aromatic alcohol
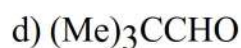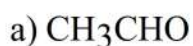
12. The standard reduction potentials at $25^O C$ of $Li^+|Li$, $Ba^{2+}|Ba$, $Na^+|Na$ and $Mg^{2+}|Mg$ are -3.05, -2.73, -2.71 and -2.37 V respectively. Which is strongest reducing agent? **[1]**

   a) Mg   b) Na

   c) Li   d) Ba

13. Identify Z in the following reaction sequence **[1]**

$$CH_3I \xrightarrow[Ether]{Mg} X \xrightarrow[Dry]{ice} Y \xrightarrow[(ii)\ H_2O]{(i)\ P+Cl_2} Z$$

   a) CH_3MgI b) CH_3COCl

   c) $ClCH_2COOH$ d) CH_3COOH
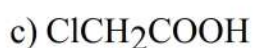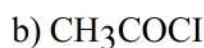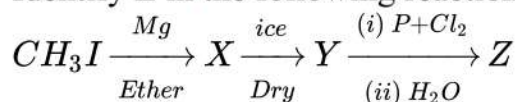
14. Methyl- α-D-glucoside and methyl- β-D-glucoside are **[1]**

   a) Enantiomers   b) Anomers

   c) Conformational diastereomers   d) Epimers

15. **Assertion (A):** N-Ethylbenzene sulphonamide is soluble in alkali. **[1]**
   Reason (R): Hydrogen attached to nitrogen in sulphonamide is strongly acidic.

   a) Both A and R are true and R is   b) Both A and R are true but R is
   the correct explanation of A.   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):** The complex ion trans-$[Co(en)_2Cl_2]^+$ is optically active. **[1]**
   Reason (R): It is an octahedral complex.

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

c) A is true but R is false.   d) A is false but R is true.

17. **Assertion (A):** Ether behaves as bases in the presence of mineral acids.   [1]
    Reason (R): Due to the presence of lone pairs of electrons on oxygen.

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

   c) A is true but R is false.   d) A is false but R is true.

18. **Assertion (A):** Cu^{2+} iodide is not known.   [1]

    Reason (R): Cu^{2+} oxidises I^- to iodine.

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

   c) A is true but R is false.   d) A is false but R is true.

Section B

19. Resistance of a conductivity cell filled with 0.1 mol L^{-1} KCl solution is 100 Ω. If   [2]
    the resistance of the same cell when filled with 0.02 mol L^{-1} KCl solution is 520 Ω,
    calculate the conductivity and molar conductivity of 0.02 mol L^{-1} KCl solution. The
    conductivity of 0.1 mol L^{-1} KCl solution is 1.29 S/m.

   OR

   i. Write anode and cathode reactions that occur in dry cell.
   ii. How does a dry cell differ from a mercury cell?

20. State the 'rate law' for chemical reactions.   [2]

21. When a coordination compound $CoCl_3 \cdot 6NH_3$ is mixed with $AgNO_3$, 3 moles of   [2]
    AgCl are precipitated per mole of the compound. Write
    i. structural formula of the complex.
    ii. IUPAC name of the complex.

   OR

   How is stability of coordination compounds determined in aqueous solution?

22. Why is osmotic pressure of 1 M KCl higher than that of 1 M urea solution?   [2]
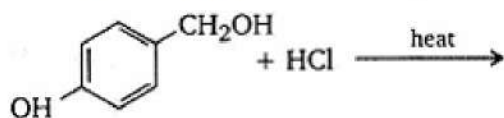
    [2]

23.

   In fig, identify the nature of electrolyte A & B. In which case it is not possible to

obtain value of limiting molar conductance?

24. Ortho-nitrophenol is more acidic than ortho-methoxyphenol. (reason) **[2]**

25. Draw the structure of the major monohalo product in the following reaction : **[2]**

Section C

26. Write reactions for the conversion of: **[3]**
    i. Aniline to benzene
    ii. Methyl amine to methyl cyanide
    iii. Propanenitrile to ethylamine.

27. Calculate the emf of the following cell: **[3]**

$Mg(s)|Mg^{2+}(0.2M) \parallel Ag^+(1 \times 10^{-3}M) \mid Ag(s)$

$E^0(Ag^+/Ag) = 0.80V$

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

28. Give reasons for the following: **[3]**

    a. Transition metals form complex compounds.

    b. E_O values for (Zn^{2+}/Zn) and (Mn^{2+}/Mn) are more negative than expected.

    c. Actinoids show wide range of oxidation states.

29. Why is sulphuric acid not used during the reaction of alcohols with KI? **[3]**

OR

Discuss the role of Lewis acids in the preparation of aryl bromides and chlorides in the dark.

30. The rate of a particular reaction triples when temperature changes from 50°C to 100°C. Calculate the activation energy of the reaction. **[3]**

    [Given log 3 = 0.4771; R = 8.314 K^{-1} mol^{-1}]

Section D

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

Pentose and hexose undergo intramolecular hemiacetal or hemiketal formation due to combination of the -OH group with the carbonyl group. The actual structure is either of five or six membered ring containing an oxygen atom. In the free state all pentoses and hexoses exist in pyranose form (resembling pyran). However, in the combined state some of them exist as five membered cyclic structures, called fiiranose (resembling furan).

The cyclic structure of glucose is represented by Haworth structure:
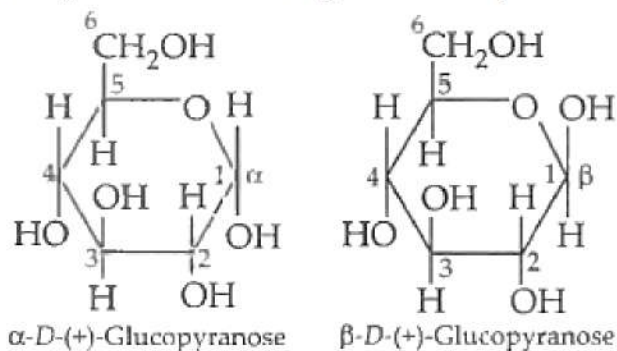
α-D-(+)-Glucopyranose   β-D-(+)-Glucopyranose

α and β-D-glucose have different configurations at anomeric (C-1) carbon atom, hence are called anomers and the C-1 carbon atom is called anomeric carbon (glycosidic carbon).
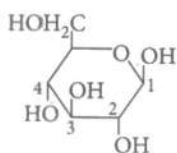
The six-membered cyclic structure of glucose is called the pyranose structure.

(i)   What percentage of β-D-(+) glucopyranose is found at equilibrium in the aqueous solution?

(ii) The following carbohydrate is
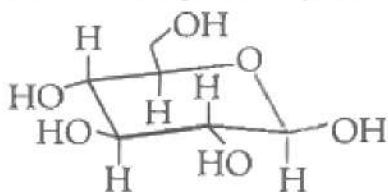
(iii)

In the carbon structure, anomeric carbon is

OR

What are α-D(+)-glucose and β-D(+)glucose?

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

Isomers are two or more compounds that have the same chemical formula but a different arrangement of atoms. Due to the different arrangements of atoms, they differ in one or more physical or chemical properties. Two principal types of isomerism are known among coordination compounds. Stereoisomerism includes geometrical isomerism, optical isomerism while Structural isomerism consists of linkage isomerism, coordination isomerism, Ionisation isomerism and Solvate isomerism. Isomerism arises in heteroleptic complexes due to different possible geometric arrangements of the ligands. In a square planar complex of formula $[MX_2L_2]$ X and L are unidentate, the two ligands X may be arranged adjacent to each other in a cis isomer, or opposite to each other in a trans isomer. Solvate form of isomerism is known as 'hydrate isomerism' in the case where water is involved as a solvent. This is similar to ionisation isomerism.

(i)   Optical isomers are called chiral. Explain

(ii) Draw one of the geometrical isomers of the complex $[Pt(en)_2Cl_2]^{2+}$ which is

optically active.

(iii) Why thiocyanate is an ambidentate ligand?

OR

Why molecular shape of $Ni(CO)_4$ is not the same as that of $[Ni(CN)_4]^{2-}$?

Section E

33. An alkene A (Mol. formula C_5H_{10}) on ozonolysis gives a mixture of two **[5]** compounds B and C. Compound B gives positive Fehling's test and also forms iodoform on treatment with I_2 and NaOH. Compound C does not give Fehling's test but forms iodoform. Identify the compounds A, B and C. Write the reaction for ozonolysis and formation of iodoform from B and C.

OR

   a. Write the main product formed when propanal reacts with the following reagents:
      i. 2 moles of CH_3OH in presence of dry HCl

      ii. Dilute NaOH

      iii. $H_2N - NH_2$ followed by heating with KOH in ethylene glycol

   b. Arrange the following compounds in increasing order of their property as indicated :
      i. F - CH_2COOH, O_2N - CH_2COOH, CH_3COOH, HCOOH - acidic character

      ii. Acetone, Acetaldehyde, Benzaldehyde, Acetophenone - reactivity towards addition of HCN

34. State Raoult's law for a solution containing volatile components. What is the **[5]** similarity between Raoult's law and Henry's law?

OR

   What is meant by positive and negative deviations from Raoult's law and how is the sign of $\Delta_{mix}H$ sol related to positive and negative deviations from Raoult's law?

35. Answer the following questions: **[5]**

   (i) How would you account for the following? Among lanthanoids, Ln (III) compounds are predominant. However, occasionally in solutions or in solid compounds, +2 and +4 ions are also obtained.

   (ii) Convert: Benzene to o-chlorotoluene.

   (iii) Write the structure of the compound whose IUPAC name is: 2-Methylbutane - 2 -ol

   (iv) Why does NH_3 act as a Lewis base?

   (v) Deficiency of which vitamin causes scurvy?

SOLUTION

Section A

1. **(d)**
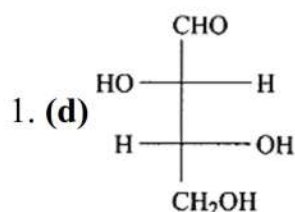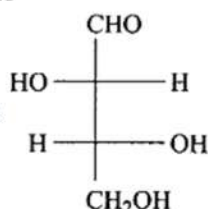
Explanation:

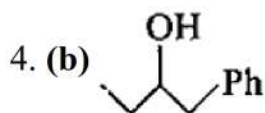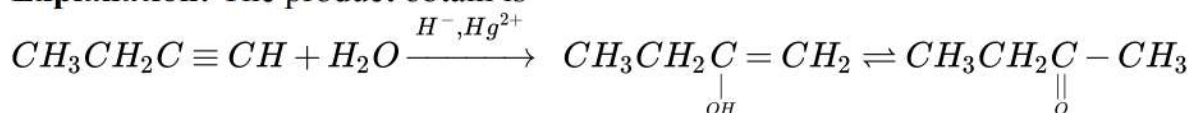2. **(a)** $V^{2+} < Cr^{2+} < Mn^2 < Fe^{2+}$: paramagnetic behaviour

   Explanation: $V^{2+} < Cr^{2+} < Mn^2 < Fe^{2+}$: paramagnetic behaviour

3. **(b)** $CH_3 - CH_2 - \overset{\overset{O}{\|}}{C} - CH_3$

   Explanation: The product obtain is

   $$CH_3CH_2C \equiv CH + H_2O \xrightarrow{H^-, Hg^{2+}} CH_3CH_2\underset{OH}{C} = CH_2 \rightleftharpoons CH_3CH_2\overset{\overset{O}{\|}}{C} - CH_3$$

4. **(b)**
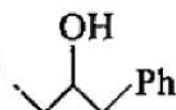
   Explanation:

5. **(a)** Elementary reaction

   Explanation: An elementary reaction is a chemical reaction in which one or more chemical species react directly to form products in a single reaction step and with a single transition state.

6. **(c)** Q > P > R > S

   Explanation: Q is most basic as it is an aliphatic amine, P is more basic than R and S as lp e^- of P is delocalize.

7. **(a)** $E = E_R - E_L$

   Explanation: $E_{cell} = E_{OP_L} + E_{RP_R = -E_{RP_L} + E_{RP_R}}$

8. **(d)** $Na_2Cr_2O_7 \cdot 2H_2O$

   Explanation: $4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \longrightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$

   $2Na_2CrO_4 + 2H^+ \longrightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$.

9. **(a)** CH_3CHO

   Explanation: Cannizzaro reaction is given by aldehydes that do not contain an alpha hydrogen atom. In this reaction, a molecule of carbonyl compound is oxidized to carboxylic acid and another molecule is reduced to an alcohol.
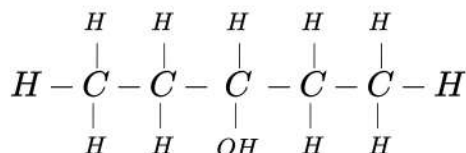   Acetaldehyde does not give Cannizaro's reaction as it contains an alpha hydrogen atom. Instead, it undergoes the aldol condensation reaction.

10. **(b) -k**

Explanation: Slop of the line indicates = -k while the intercept represents $[R]_0$.

11. **(b) Secondary alcohol**

Explanation: Secondary alcohol is a compound in which a hydroxy group, –OH, is attached to a saturated carbon atom which has two other carbon atoms attached to it.

$$H-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle OH}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-H$$

12. **(c) Li**

Explanation: E°_{OP} for Li is more,

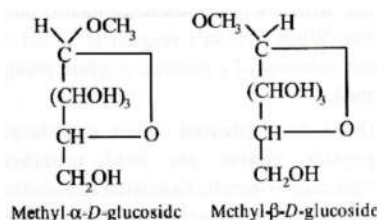$Li \longrightarrow Li + e$

Thus, Li is strong oxidant.

13. **(c) $ClCH_2COOH$**

Explanation: $ClCH_2COOH$

14. **(b) Anomers**

Explanation: Methyl-α-D-glucoside and methyl-β-D- glucoside differ at C-1, hence are called anomers.

Methyl-α-D-glucoside   Methyl-β-D-glucoside

15. **(a) Both A and R are true and R is the correct explanation of A.**

Explanation: $C_2H_5-\underset{\underset{\displaystyle H}{|}}{N}-SO_2C_6H_5 + NaOH \rightarrow \underset{So lub le \ salt}{C_2H_5-N-SO_2C_6H_5} + H_2O$

Ethylbezene sulphonamide

Ethylbenzene sulphonamide is soluble in alkali because it has acidic hydrogen.

16. **(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.

17. **(a) Both A and R are true and R is the correct explanation of A.**

Explanation: Both A and R are true and R is the correct explanation of A.

18. **(a) Both A and R are true and R is the correct explanation of A.**

Explanation: Cu^{2+} oxidizes iodide to iodine hence cupric iodide is converted to cuprous iodide.

Section B

19. The cell constant is given by the equation:

Cell constant = G* = conductivity × resistance

= 1.29 S/m × 100 Ω = 129 m^{-1} = 1.29 cm^{-1}

Conductivity of 0.02 mol L^{-1} KCl solution = cell constant / resistance

$= \frac{G^*}{R} = \frac{129 m^{-1}}{520 \Omega} = 0.248$ S m^{-1}

Concentration = 0.02 mol L^{-1} = 1000 × 0.02 mol m^{-3} = 20 mol m^{-3}

Molar conductivity = $A_m = \frac{K}{c} = \frac{248 \times 10^{-3} Sm^{-1}}{20 mol \ m^{-3}} = 124 \times 10^{-4}$ S m^{2}mol^{-1}

Alternatively, conductivity of solution K $= \frac{1.29 cm^{-1}}{520 \Omega} = = 0.248 \times 10^{-2}$ S cm^{-1}

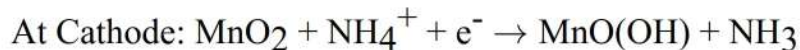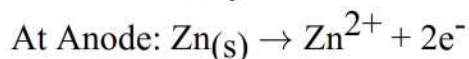and molar conductivity of solution $A_m = K \times 1000 \, cm^3 \, L^{-1}$ molarity^{-1}

$= \dfrac{0.248 \times 10^{-2} \, S cm^{-1} \times 1000 \, cm^3 L^{-1}}{0.02 \, mol L^{-1}}$

$= 124 \, S \, cm^2 \, mol^{-1}$

<div align="center">OR</div>

  i. Reactions in dry cell:

    At Anode: $Zn_{(s)} \rightarrow Zn^{2+} + 2e^-$

    At Cathode: $MnO_2 + NH_4^+ + e^- \rightarrow MnO(OH) + NH_3$

  ii. Dry cell has shorter life than mercury cell. Cell potential in mercury cell remains constant but not in dry cell.

20. 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: $aA + bB \rightarrow cC + dD$, 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.

21. i. When one mole of $CoCl_3.6NH_3$ is mixed with $AgNO_3$, three moles of AgCl are precipitated which indicates that three ionisable chloride ions in the complex are present. Hence, its structural formula is $[Co(NH_3)_6]Cl_3$.

  ii. IUPAC name of the complex $[Co(NH_3)_6]Cl_3$ is Hexa ammine cobalt (III) chloride.

<div align="center">OR</div>

The stability of coordination compound is measured in terms of stability constant.
Thus if we have a reaction of the type
$M + 4L \rightleftharpoons ML_4$
$\beta_4 = \dfrac{[ML_4]}{[M][L]^4}$

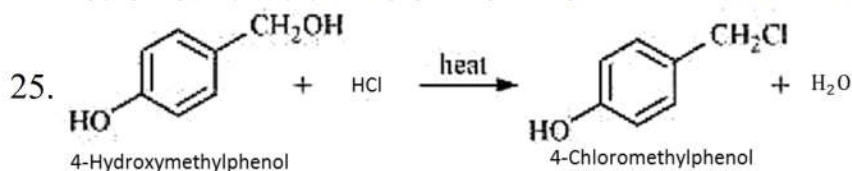22. 1 M KCl solution dissociates in solution to give K^+ and Cl$^-$ ions. $KCl \rightarrow K^+ + Cl^-$
Therefore its osmotic pressure (which depends on number of solute particles) is higher than that of 1 M solutions of urea which does not dissociate or associate in solution.

23. A = strong Electrolyte.
B = weak Electrolyte.
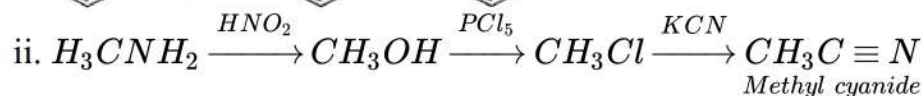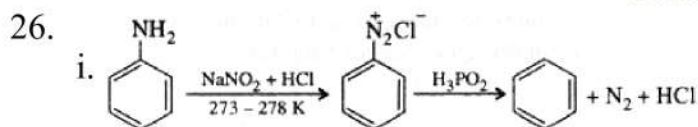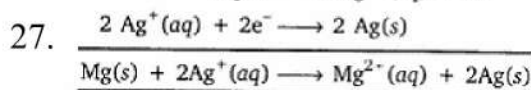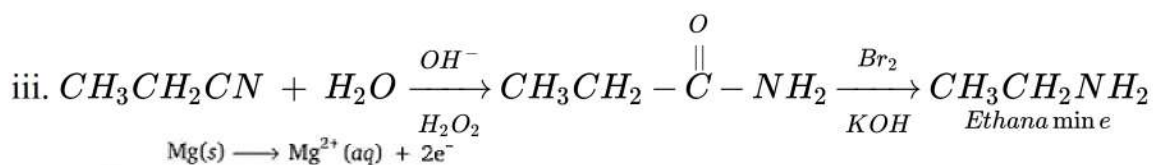In case of B , it is not possible to get an exact value of limiting molar conductance.

24. It is because nitro group is electron withdrawing which increases acidic character due to stabilization of o-nitrophenoxide ion whereas -OCH$_3$ group is electron releasing which decreases acidic character due to destabilization of o-methoxy phenoxide ion.

25.

Section C

26. i.

  ii.

iii. $CH_3CH_2CN + H_2O \xrightarrow[H_2O_2]{OH^-} CH_3CH_2-\overset{\displaystyle O}{\overset{\displaystyle \|}{C}}-NH_2 \xrightarrow[KOH]{Br_2} CH_3CH_2NH_2$ *Ethanamine*

27.

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

applying nernst equation

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

$E^0(Ag^+/Ag) - E^0(Mg^{2+}/Mg) - \frac{0.0591}{2} \log \frac{0.2}{(10^{-3})^2}$

$= +0.80V - (-2.37V) - \frac{0.0591}{2} \log(2 \times 10^5)$

$= +3.17V - \frac{0.0591}{2}\left[\log 2 + \log 10^5\right]$

$= +3.17V - \frac{0.0591}{2} \times 5.3010$

$= +3.17V - 0.1566V$

$= 3.0134$ V

28. a. Transition metals form complex compounds due to small size, high ionic charge and availabilty of d-orbital.

b. E_O values for (Zn^{2+}/Zn) and (Mn^{2+}/Mn) are more negative than expected due to stable $3d^{10}$ configuration in Zn^{2+} and $3d^5$ configuration in Mn^{2+}.

c. Actinoids show wide range of oxidation states due to comparable energies of 5f ,6d and 7s orbitals.

29. In the presence of sulphuric acid (H_2SO_4),KI produces HI

$2KI + H_2SO_4 \rightarrow 2KHSO_4 + 2HI$
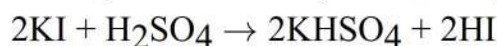
Since H_2SO_4 is an oxidizing agent, it oxidizes HI (produced in the reaction to I_2).

$2HI + H_2SO_4 \rightarrow I_2 + SO_2 + H_2O$
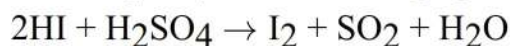
As a result, the reaction between alcohol and HI to produce alkyl iodide cannot occur. Therefore, sulphuric acid is not used during the reaction of alcohols with KI. Instead, a non-oxidizing acid such as H_3PO_4 is used.

OR

Aryl bromides and chlorides can be prepared from arenes by electrophilic substitution reaction by Chlorine and Bromine respectively. This reaction is carried out by treating the arene with chlorine or bromine in the presence of iron (III) chloride in the absence of light. Iron (III) chloride, that is, $FeCl_3$ is a Lewis acid, which generates the electrophile required to take the reaction forward. $FeCl_3$ forms a coordination compound with Cl_2, making the complex $Cl^+[FeCl_4^-]$. The chloride ion gains a partial positive charge, acting as an electrophile, and attacking the ϖ bonds. The final products are o-aryl halide and p-aryl halide isomers which can be separated easily.

o-halotoluene   p-halotoluene
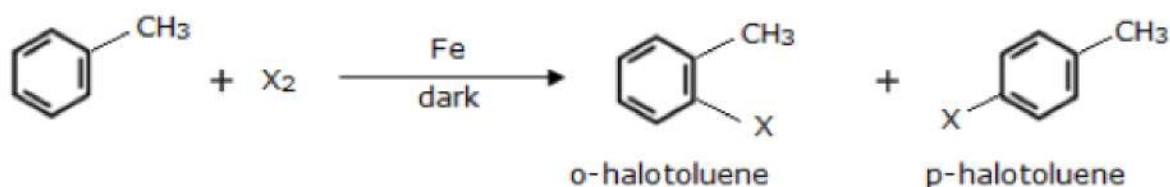
30. T_1= 273 + 50 = 323 K
T_2= 273 + 100 = 373 K

$K_1 = K$

$K_2 = 3K$

Using the formula,

$$log \frac{K_2}{K_1} = \frac{E_a}{2.303R} \left[\frac{T_2 - T_1}{T_1 T_2} \right]$$

$$log \frac{3K}{K} = \frac{E_a}{2.303 \times 8.314} \left[\frac{373 - 323}{373 \times 323} \right]$$

$$log\, 3 = \frac{E_a \times 50}{2.303 \times 8.314 \times 373 \times 323}$$

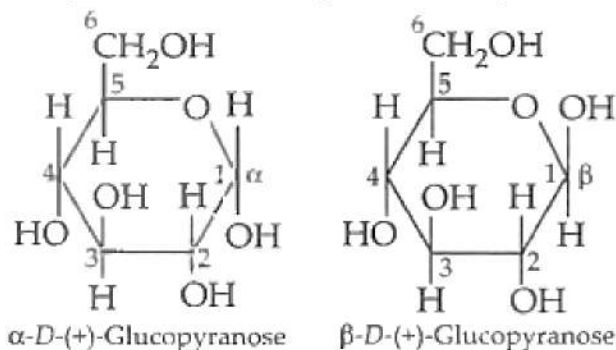$$E_a = 22011.76\, J\, mol^{-1}$$

Section D

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

    Pentose and hexose undergo intramolecular hemiacetal or hemiketal formation due to combination of the -OH group with the carbonyl group. The actual structure is either of five or six membered ring containing an oxygen atom. In the free state all pentoses and hexoses exist in pyranose form (resembling pyran). However, in the combined state some of them exist as five membered cyclic structures, called fiiranose (resembling furan).

Pyran   Furan

The cyclic structure of glucose is represented by Haworth structure:


α-D-(+)-Glucopyranose   β-D-(+)-Glucopyranose

α and β-D-glucose have different configurations at anomeric (C-1) carbon atom, hence are called anomers and the C-1 carbon atom is called anomeric carbon (glycosidic carbon). The six-membered cyclic structure of glucose is called the pyranose structure.

(i) Ordinary glucose is α-glucose, with a fresh aqueous solution having specific rotation, $[\alpha]_D = +111°$. On keeping the solution for some time, α-glucose slowly changes into an equilibrium mixture of α-glucose (36%) and β-glucose (64%) and the mixture has specific rotation + 52.5°.

(ii) This structure is an example of pyranose and aldohexose. Here, the structure of the carbohydrate is of the β-pyranose form.

(iii) C-1 is the anomeric carbon.

OR

α-D-(+)-glucose and β-D-(+)-glucose differ in configuration at C_1 (i.e., anomeric or glycosidic carbon) and hence are called anomers.

α-D(+)-glucose   β-D(+)-glucose
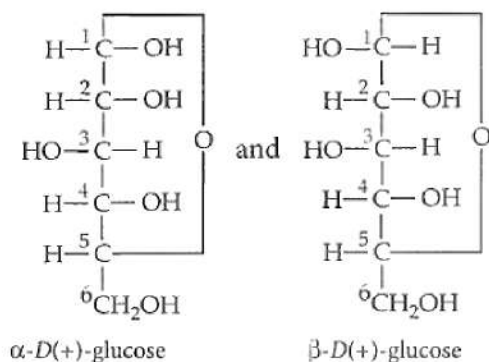
32. **Read the text carefully and answer the questions:**

Isomers are two or more compounds that have the same chemical formula but a different arrangement of atoms. Due to the different arrangements of atoms, they differ in one or more physical or chemical properties. Two principal types of isomerism are known among coordination compounds. Stereoisomerism includes geometrical isomerism, optical isomerism while Structural isomerism consists of linkage isomerism, coordination isomerism, Ionisation isomerism and Solvate isomerism. Isomerism arises in heteroleptic complexes due to different possible geometric arrangements of the ligands. In a square planar complex of formula $[MX_2L_2]$ X and L are unidentate, the two ligands X may be arranged adjacent to each other in a cis isomer, or opposite to each other in a trans isomer. Solvate form of isomerism is known as 'hydrate isomerism' in the case where water is involved as a solvent. This is similar to ionisation isomerism.

(i) Optical isomers are mirror images that cannot be superimposed on one another. While the molecules or ions that cannot be superimposed are called chiral.

(ii)

mirror
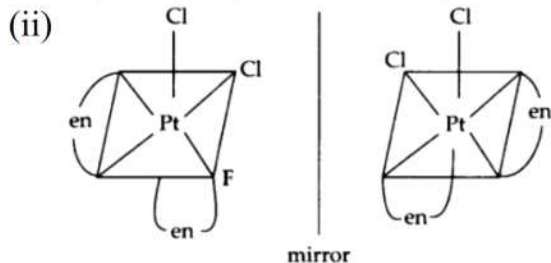
(iii) Thiocyanate ligand, NCS^- is present which can bind through the nitrogen to give M–NCS or through sulphur to give M–SCN.
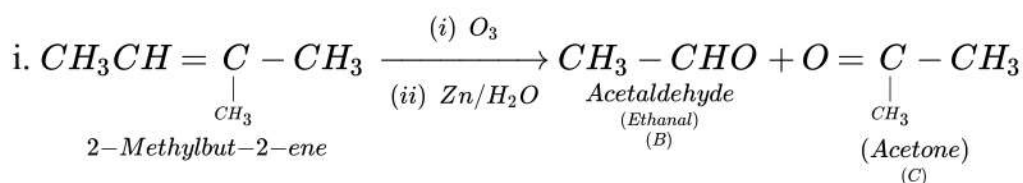
OR

The molecular shape of $[Ni(CO)_4]$ is tetrahedral because this complex nickel involves sp^3 hybridisation. In $[Ni(CN)_4]^{2-}$, nickel involves dsp^2 and its shape is square planer.

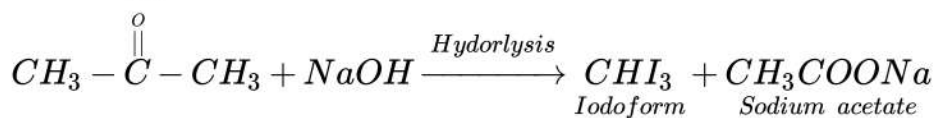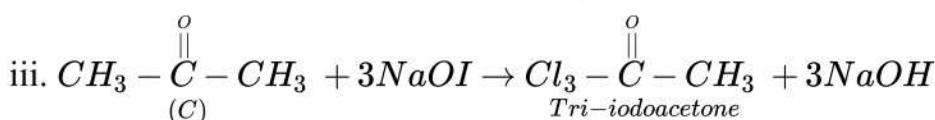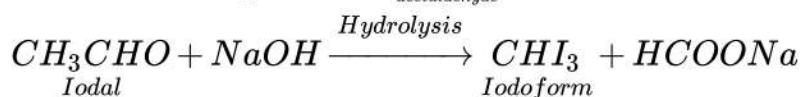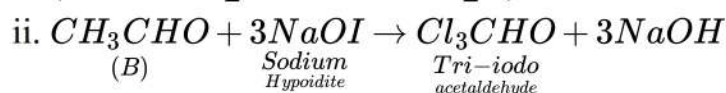**Section E**

33. Compound B gives positive Fehling's test. It shows that it is an aldehyde and gives an iodoform test which shows it has $-COCH_3$ group. Compounds C is a ketone because it does not give Fehling's test but gives the iodoform test which shows it also has $-COCH_3$ groups. Hence compound A is $CH_3CH = \underset{CH_3}{C} - CH_3$, B is CH_3-CHO and compound C is

$O=C(CH_3)CH_3$

i. $CH_3CH = \underset{\underset{2-Methylbut-2-ene}{\overset{|}{CH_3}}}{C} - CH_3 \xrightarrow[\text{(ii) } Zn/H_2O]{\text{(i) } O_3} \underset{\underset{(B)}{\underset{(Ethanal)}{Acetaldehyde}}}{CH_3 - CHO} + O = \underset{\underset{(C)}{\underset{(Acetone)}{C}}}{\overset{|}{\underset{CH_3}{C}}} - CH_3$
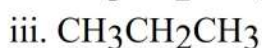
other isomers of (A) will not give products corresponding to the given test
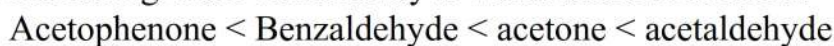$(2NaOH + I_2 \longrightarrow NaOI + H_2O)$

ii. $\underset{(B)}{CH_3CHO} + \underset{\underset{Hypoidite}{Sodium}}{3NaOI} \rightarrow \underset{\underset{acetaldehyde}{Tri-iodo}}{Cl_3CHO} + 3NaOH$

$\underset{Iodal}{CH_3CHO} + NaOH \xrightarrow{Hydrolysis} \underset{Iodoform}{CHI_3} + HCOONa$

iii. $\underset{(C)}{CH_3 - \overset{\overset{O}{\|}}{C} - CH_3} + 3NaOI \rightarrow \underset{Tri-iodoacetone}{Cl_3 - \overset{\overset{O}{\|}}{C} - CH_3} + 3NaOH$

$CH_3 - \overset{\overset{O}{\|}}{C} - CH_3 + NaOH \xrightarrow{Hydorlysis} \underset{Iodoform}{CHI_3} + \underset{Sodium\ acetate}{CH_3COONa}$

<div align="center">OR</div>

a. i. CH₃CH₂CH (OCH₃)₂

   ii. CH₃CH₂CH (OH) CH (CH₃) CHO

   iii. CH₃CH₂CH₃

b. i. Increasing order of acidic character:
   CH₃COOH < HCOOH < FCH₂COOH < O₂N-CH₂COOH

   ii. Increasing order of reactivity towards addition of HCN:
   Acetophenone < Benzaldehyde < acetone < acetaldehyde

34. The partial pressures are related to the mole fractions x₁ and x₂ of the two components 1 and 2 this relation is known as **Raoult's law** which state 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. Thus, for any component, partial vapour pressure,

$p \alpha \chi \Rightarrow p = p^o\chi$

Where P^o is the vapour pressure of pure component and χ is the mole fraction of that component.

The similarity between Raoult's law and Henry's law: Both laws state that the partial pressure of the volatile component is directly proportional to its mole fraction in the solution. In the case of Raoult's law, it is liquid and in the case of Henry's law, it is gas.

<div align="center">OR</div>

According to Raoult's law, the partial vapour pressure of each volatile component in any solution is directly proportional to its mole fraction. The solutions which obey Raoult's law over the entire range of concentration are known as ideal solutions. The solutions that do not obey Raoult's law (non-ideal solutions) have vapour pressures either higher or lower than that predicted by Raoult's law. If the vapour pressure is higher,(ie A....B interaction is less than A...A and B...B interaction) then the solution is said to exhibit positive deviation, and if it is lower(A...B interaction is more than A...A and B...B interaction), then the solution is said to exhibit negative deviation from Raoult's law.
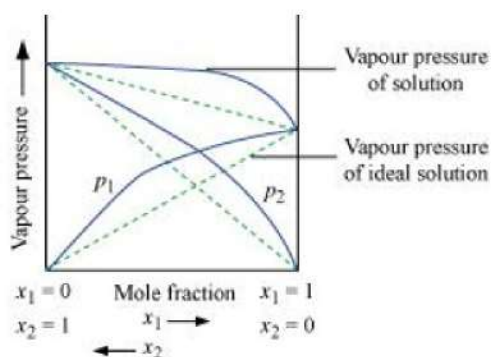
Vapour pressure of a two-component solution showing positive deviation from Raoult's law
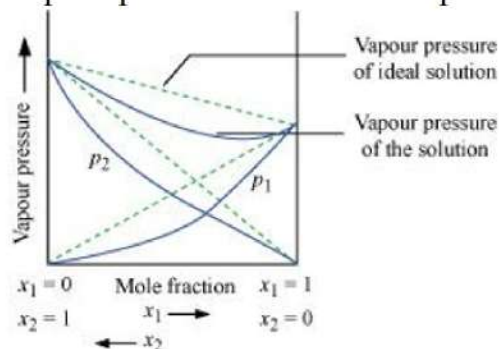
Vapour pressure of a two-component solution showing negative deviation from Raoult's law.

In the case of an ideal solution, the enthalpy of the mixing of the pure components for forming the solution is zero.

$\Delta Sol\ H = 0$

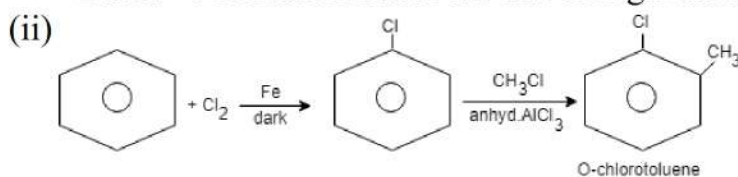In the case of solutions showing positive deviations, absorption of heat takes place.

Therefore, $\Delta Sol\ H = Positive$

In the case of solutions showing negative deviations, evolution of heat takes place.
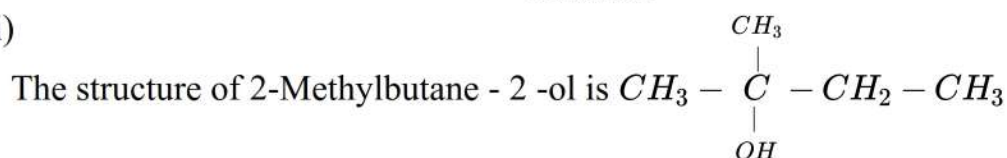
Therefore, $\Delta Sol\ H = Negative$

35. Answer the following questions:

(i) +2 and +4 oxidation states are due to high stabilities of f^0, f^7 and f^{14} configuration.

(ii)

(iii)
The structure of 2-Methylbutane - 2 -ol is $CH_3 - \overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle OH}{|}}{C}} - CH_2 - CH_3$

(iv) NH_3 act as a Lewis base due to the presence of lone pair of electrons on the nitrogen atom of NH_3 molecule.

(v) Vitamin C