Class: XII

SESSION : 2022-2023

SUBJECT: Chemistry

SAMPLE QUESTION PAPER - 10

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). Reaction of glucose with acetic anhydride indicates the presence of: [1]

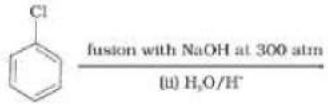
a) — CHO group
b) — CH_2 — group
c) five — OH groups
d) all of these

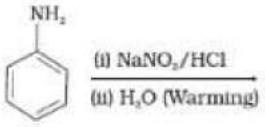
2. Which of the following is not considered a transition metal? [1]

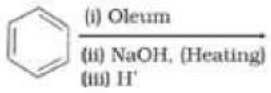
a) Zn b) Ac

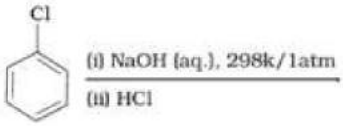
c) Y d) La

3. Which of the following reactions will yield phenol? [1]

i. 

ii. 

iii. 

iv. 

a) i, iii, iv b) ii, iii, iv

c) i, ii, iii d) i, ii, iv

4. The rate of reaction between two reactants A and B decreases by a factor 4 if the concentration of reactant B is doubled. The order of this reaction with respect to B is: [1]

a) 1 b) -1

c) 2 d) -2

5. What compound is produced when cyclohexene is treated with concentrated $KMnO_4$? [1]

a) Succinic acid
b) Adipic acid
c) Hexanoic acid
d) Cyclohexanecarboxylic acid

6. In electrolysis of NaCl when Pt electrode is taken then H_2 is liberated at cathode while with Hg cathode it gives sodium amalgam. [1]

a) Conc. of H^+ ions is larger when Pt electrode is taken
b) Hg is more inert than Pt
c) More voltage is required to reduce H^+ at Hg than the Pt
d) Na is dissolved in Hg while it does not dissolve in Pt

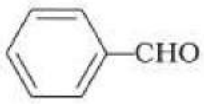
7. $KMnO_4 + HCl \longrightarrow H_2O + X(g)$, [1]
(Acidified)
X is a:

a) violet gas
b) yellow-brown gas
c) greenish-yellow gas
d) red liquid

8. If the starting amide has got four carbon atoms and the amine that is formed has got only 3 carbon atoms, then the reaction is called_____. [1]

a) Gabriel synthesis
b) Carbylamines reaction
c) Hoffmann bromamide reaction
d) Clemmensen reduction

9. Cannizaro's reaction is not given by _____. [1]

a) CH_3CHO
b) 

c) 

d) HCHO

10. The rate constant (K) for the reaction $2A + B \rightarrow$ Product was found to be 2.5×10^{-5} litre mol^{-1} sec^{-1} after 15 sec, 2.60×10^{-5} litre mol^{-1} sec^{-1} after 50 sec. The order of reaction is: [1]

a) 2
b) zero
c) 1
d) 3

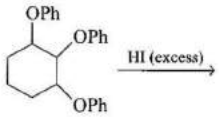
11. During electrolysis of H_2O, the molar ratio of H_2 and O_2 formed is: [1]

a) 2 : 1

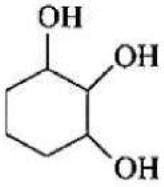
b) 1 : 2

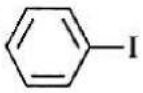
c) 1 : 1

d) 1 : 3

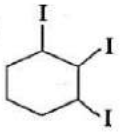
12.  [1]

Which of the following is a major product?

a) 

b) 

c) None of these

d) 

13. Proteins are found to have two different types of secondary structures viz. α-helix and β-pleated sheet structure. α-Helix structure of protein is established by: [1]

a) van der Waals forces

b) dipole-dipole interactions

c) hydrogen bonds

d) peptide bonds

14. What compound is produced when $(CH_3)_2\ CHCH_2Br$ is subjected to the following sequence of steps: [1]

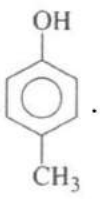
1. Mg, Et_2O,
2. CO_2,
3. H_3O^+?

a) 3 – methylbutanoic acid

b) 2 – methylpropanoic acid

c) 2 – methylhexanoic acid

d) 3 – methylpropanoic acid

15. **Assertion (A):** →  is more acidic than  . [1]

Reason (R): Electron donating groups (EDG) increase acidity while electron-withdrawing groups (EWG) decrease acidity.

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):** Only a small amount of HCl is required in the reduction of nitro compounds with iron scrap and HCl in the presence of steam. [1]
Reason (R): $FeCl_2$ formed gets hydrolyzed to release HCl during the reaction.

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.

17. **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 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.

18. **Assertion (A):** Transition metals are good catalysts. [1]
Reason (R): V_2O_5 or Pt is used in the preparation of H_2SO_4 by contact process.

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

1. For the reaction [2]
$Cl_2(g) + 2NO(g) \rightarrow 2NOCl(g)$
The rate law is expressed as: rate = k $[Cl_2]$ $[NO]^2$
What is the overall order of this reaction?

20. How is Limiting molar conductivity related to [2]
1. Degree of dissociation
2. Dissociation constant

OR

How is standard electrode potential of a cell related to:-
i. Equilibrium constant?
ii. Gibbs free energy change.

21. Resistance of a conductivity cell filled with 0.1 mol L^{-1} KCl solution is 100 Ω. If the resistance of the same cell when filled with 0.02 mol L^{-1} KCl solution is 520 [2]

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.

22. Amongst the following compounds, identify which are insoluble, partially soluble and highly soluble in water? **[2]**

i. Phenol

ii. Toluene

iii. Formic acid

iv. ethylene glycol

v. chloroform

vi. pentanol

23. Using the valence bond approach, deduce the shape and magnetic behaviour of $[Cr(NH_3)_6]^{3+}$ ion. [Atomic number of Cr = 24] **[2]**

OR

Using IUPAC norms write the formulae for the following :

i. Hexaamminecobalt (III) sulphate

ii. Potassium trioxalatochromate (III)

24. How would you obtain **[2]**

i. picric acid from phenol?

ii. 2-methyl propanol from 2-methyl propene?

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

$CH_3CH_2Br + NaI \rightarrow$

Section C

26. Arrange the following in increasing order of their basic strength in aqueous solution: **[3]**

1. $C_2H_5NH_2, C_6H_5NH_2, NH_3, C_6H_5CH_2NH_2$ and $(C_2H_5)_2NH$
2. $C_2H_5NH_2, (C_2H_5)_2NH, (C_2H_5)_3N, C_6H_5NH_2$
3. $CH_3NH_2, (CH_3)_2NH, (CH_3)_3N, C_6H_5NH_2, C_6H_5CH_2NH_2$

27. Formulate the galvanic cell in which the following reaction takes place. **[3]**

$Zn(s) + 2Ag^+(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s)$; $E^o(Zn^{2+}|Zn) = -0.76V$ and $E^o(Ag^+|Ag) = 0.80$ V

i. Which one of its electrodes is negatively charged?

ii. The reaction taking place at each of its electrode.

iii. The carriers of current within this cell.

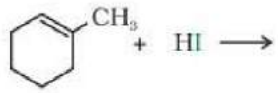
28. Show that in case of first order reaction, the time required for 99.9% of the reaction to complete its 10 times that required for half of the reaction to take **[3]**

place.
(Given: $log2 = 0.3010$)

29. A hydrocarbon C_5H_{10} does not react with chlorine in dark but gives a single monochloro compound C_5H_9Cl in bright sunlight. Identify the hydrocarbon. [3]

OR

Draw the structures of major monohalo products in each of the following reactions:

i. 

ii. $CH_3CH_2Br + NaI \longrightarrow$

iii. 

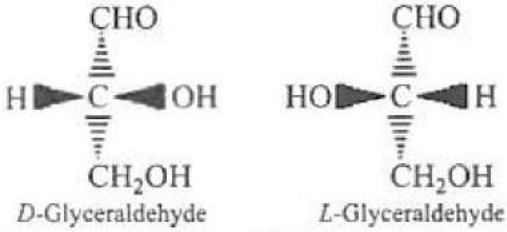
30. Complete and balance the given reaction [3]

$Cr_2O_7^{2} + 14H^{+} + 6Fe^{2+} \rightarrow$

Section D

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

Carbohydrates can exist in either of two conformations, as determined by the orientation of the hydroxyl group about the asymmetric carbon farthest from the carbonyl.



(Structures of glyceraldehyde enantiomers)

By convention, a monosaccharide is said to have D-configuration if the hydroxyl group attached to the asymmetric carbon atom adjacent to the - CH_2OH group is on the right-hand side irrespective of the positions of the other hydroxyl groups. On the other hand, the molecule is assigned L-configuration if the - OH group attached to the carbon adjacent to the - CH_2OH group is on the left-hand side.

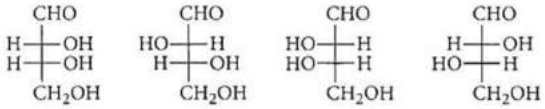
(i) D-Glyceraldehyde and L-Glyceraldehyde are

(ii) The two functional groups present in a typical carbohydrate are

(iii) Which of the monosaccharides, is the majority found in the human body?

OR

The correct corresponding order of names of four aldoses with configuration given below



respectively, is

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

To explain bonding in coordination compounds various theories were proposed. One of the important theories was valence bond theory. According to that, the central metal ion in the complex makes available a number of empty orbitals for the formation of coordination bonds with suitable ligands. The appropriate atomic orbitals of the metal hybridise to give a set of equivalent orbitals of definite geometry. The d - orbitals involved in the hybridisation may be either inner d-orbitals i.e., (n - 1) d or outer d - orbitals i.e. nd. For example, Co^{3+} forms both inner orbital and outer orbital complexes, with ammonia it forms $[Co(NH_3)_6]^{3+}$ and with fluorine it forms $[CoF_6]^{3-}$ complex ion.

(i) Which of the following is not true for $[CoF_6]^{3-}$?

a. It is paramagnetic.

b. It has coordination number of 6.

c. It is outer orbital complex.

d. It involves d^2sp^3 hybridisation.

(ii) Write the structure and magnetic character of $[Co(NH_3)_6]^{3+}$?

(iii) Why $[CoF_6]^{3-}$ is paramagnetic?

OR

Give one example for inner orbital or low spin complex?

Section E

33. How will you convert ethanal into the following compounds? **[5]**

i. Butane-1, 3-diol

ii. But-2-enal

iii. But-2-enoic acid

OR

Write the IUPAC names of the following ketones and aldehydes. Wherever possible, give also common names.

i. $CH_3CO(CH_2)_4CH_3$

ii. $CH_3CH_2CHBrCH_2(CH_3)CHO$

iii. $CH_3(CH_2)_5CHO$

iv. Ph - CH = CH - CHO

v. 

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

(i) Out of Cu_2Cl_2 and $CuCl_2$, which is more stable and why?

(ii) Predict the order of reactivity of four isomeric bromobutanes in S_N1 reaction.

(iii) Give chemical tests to distinguish between the following pair of compound Phenol and benzoic acid.

(iv) Define ambident nucleophile with an example.

(v) Name the base that is found in nucleotide of RNA only.

35. An aqueous solution of 2% non-volatile solute exerts a pressure of 1.004 bar at the normal boiling point of the solvent. What is the molar mass of the solute? **[5]**

OR

Heptane and octane form an ideal solution. At 373 K, the vapour pressures of the two liquid components are 105.2 kPa and 46.8 kPa respectively. What will be the vapour pressure of a mixture of 26.0 g of heptane and 35 g of octane?

SOLUTION

Section A

1. **(c)** five — OH groups
   Explanation: five — OH groups

2. **(a)** Zn

   Explanation: Zinc, cadmium, and mercury of group 12 have full d^{10} configuration in their ground state as well as in their common oxidation states and hence, are not regarded as transition metals. However, being the end members of the three transition series, their chemistry is studied along with the chemistry of the transition metals.

3. **(c)** i, ii, iii
   Explanation:
   - **Preparation of phenols from haloarenes**: Chlorobenzene is an example of haloarenes which is formed by monosubstitution of the benzene ring. When chlorobenzene is fused with sodium hydroxide at 623K and 320 atm sodium phenoxide is produced. Finally, sodium phenoxide on acidification gives phenols.
   - **Preparation of phenols from diazonium salts:** When an aromatic primary amine is treated with nitrous ($NaNO_2$ + HCl) acid at 273 - 278 K, diazonium salts are obtained.

     These diazonium salts are highly reactive in nature. Upon warming with water, these diazonium salts finally hydrolyse to phenols. Phenols can also be obtained from diazonium salts by treating it with dilute acids.
   - **Preparation of phenols from benzene sulphonic acid**: Benzenesulphonic acid can be obtained from benzene by reacting it with oleum. Benzenesulphonic acid thus formed is treated with molten sodium hydroxide at high temperature which leads to the formation of sodium phenoxide. Finally, sodium phenoxide on acidification gives phenols.

4. **(d)** -2
   Explanation: $r = K[A]^m[B]^n$;
   Also, $\frac{r}{4} = K[A]^m [2B]^n$
   $4 = \left(\frac{1}{2}\right)^n$ or $2^2 = 2^{-n}$
   2

5. **(b)** Adipic acid
Explanation: Conc. $KMnO_4$ will cause oxidative ozonolysis and ring-opening forming adipic acid.
Cyclohexene + conc. $KMnO_4 \rightarrow HOOC(CH_2)_4COOH$

6. **(c)** More voltage is required to reduce H^+ at Hg than the Pt
Explanation: More voltage is required to reduce H^+ at Hg than the Pt

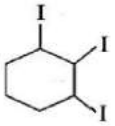
7. **(c)** greenish-yellow gas
Explanation: greenish-yellow gas

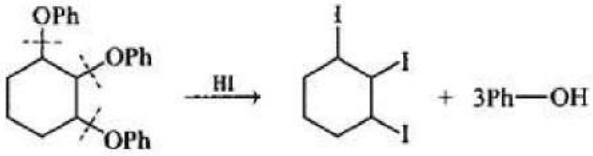
8. **(c)** Hoffmann bromamide reaction
Explanation: In Hoffmann bromamide degradation reaction, the amine formed has one carbon less than the amide.
$RCONH_2 + Br_2 + 4NaOH \rightarrow RNH_2 + Na_2CO_3 + 2NaBr + 2H_2O$

9. **(a)** CH_3CHO
Explanation: Acetaldehyde (CH_3CHO) have alpha hydrogen hence will undergo aldol reaction in presence of base rather than cannizaro reaction. Cannizaro reaction is given when there is no alpha hydrogen present on carbonyl group.

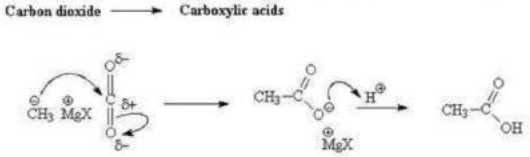
10. **(a)** 2
Explanation: K does not change with time; also unit of K suggest it to be II order.

11. **(a)** 2 : 1
Explanation: $2H^+ + 2e \longrightarrow H_2$;
$2OH^- \longrightarrow H_2O + \frac{1}{2}O_2 + 2e$

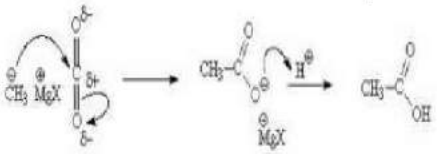
12. **(d)** 

Explanation: 

13. **(c)** hydrogen bonds
Explanation: hydrogen bonds
14. **(a)** 3 – methylbutanoic acid
Explanation:
Firstly, alkyl bromide will react with Mg/ether to form Grignard reagent
$(CH_3)_2CHCH_2Br + Mg/ether \rightarrow (CH_3)_2CHCH_2MgBr$
Now Grignard reagent formes will act as a nucleophile and attack O=C=O, followed by hydrolysis will form acid.
$(CH_3)_2CHCH_2MgBr + CO_2 + H_3O^+ \rightarrow (CH_3)_2CHCH_2COOH$
The general reaction of grignard (CH_3MgX) with CO_2 is as shown:



Carbon dioxide ⟶ Carboxylic acids



15. **(c)** A is true but R is false.
Explanation: A is true but R is false.
16. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation: $Fe + 2HCl > FeCl_2 + 3[H]$
Nascent hydrogen reduces nitro compounds
$FeCl_2 + H_2O(g) > FeO + 2HCl$
17. **(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.
18. **(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.

Section B

1. Overall order of this reaction.
$= 1 + 2 = 3$

20. 1. **Degree of dissociation:-** At any concentration c, if α is the degree of dissociation then it can be approximated to the ratio of molar conductivity Λ_m at the concentration c to limiting molar conductivity, Λ_m^o. Thus,

$$\alpha = \frac{\Lambda_m}{\Lambda_m^o}$$

2. **Dissociation Constant:-** For weak electrolyte like acetic acid, dissociation constant at concentration c is given by

$$K_a = \frac{c\Lambda_m^2}{\Lambda_m^o(\Lambda_m^o - \Lambda_m)}$$

OR

i. Standard electrode potential and equilibrium constant

$E^0_{cell} = \frac{2.303RT}{nF}\log k_c$

Where E^0_{cell} = standard electrode potential of cell

R = Gas constant

T = temperature in Kelvin

n = no. of electrons.

F = Faraday's constant and

K_c = Equilibrium constant

ii. Standard electrode potential and Gibbs free energy change-

$\Delta G^0 = -nFE^0cell$

Where ΔG^0 = Change in Gibbs' free energy

n = No. of electrons

F = Faraday's Constant

E^0_{cell} = Standard electrode Potential of cell.

21. 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

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

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

Molar conductivity = $A_m = \frac{K}{c} = \frac{248\times10^{-3}Sm^{-1}}{20mol\ m^{-3}} = 124 \times 10^{-4}$ S m^2mol^{-1}

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

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

$= \frac{0.248\times10^{-2}Scm^{-1}\times1000cm^3L^{-1}}{0.02molL^{-1}}$

= 124 S cm^2 mol^{-1}

22. i. Phenol - Partially soluble in water

ii. Toluene - Insoluble in water

iii. Formic acid - Soluble in water

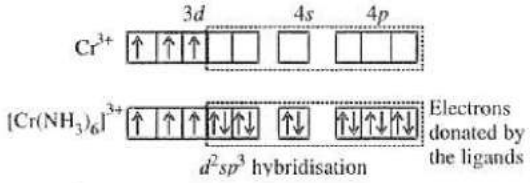
iv. Ethylene glycol - Soluble in water

v. $CHCl_3$ - Insoluble in water

vi. Pentanol - Partially soluble in water

23. Cr has electronic configuration $[Ar]4s^13d^5$

Cr^{3+} has electronic configuration $[Ar]4s^03d^5$



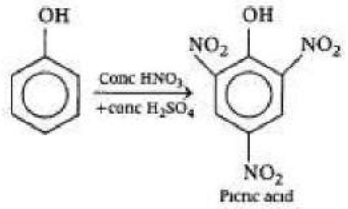
d^5 sp^3, hybridisation gives octahedral shape. The complex is paramagnetic due to the presence of unpaired electrons.

OR

i. Formula of Hexaamminecobalt (III) sulphate is $[Co(NH_3)_6]_2(SO_4)_3$.

ii. Formula of Potassium trioxalatochromate (III) is $K_3[Cr(C_2O_4)_3]$.

24. i.



ii. $3\underset{\substack{2-methyl\ propene}}{CH_3-\overset{CH_3}{\overset{|}{C}}=CH_2}+BH_3 \xrightarrow[Hydroboration]{} B[(CH_3)_2CHCH_2]_3 \xrightarrow[OH^-,-H_3BO_3]{H_2O_2} \underset{\substack{2-methyl\ propanol}}{H_3C-\underset{CH_3}{\overset{|}{C}}H-CH_2OH}$

25. $\underset{Bromoethane}{CH_3CH_2-Br}+NaI \xrightarrow{acetone,\Delta} \underset{Iodoethane}{CH_3CH_2-I}+NaBr$

Section C

26. i. $C_6H_5NH_2 < NH_3 < C_6H_5CH_2NH_2 < C_2H_5NH_2 < (C_2H_5)_2NH$

ii. $C_6H_5NH_2 < C_2H_5NH_2 < (C_2H_5)_3N < (C_2H_5)_2NH$

iii. $C_6H_5NH_2 < C_6H_5CH_2NH_2 < (CH_3)_3N < CH_3NH_2 < (CH_3)_2NH$

27. The cell reaction is $Zn(s) + 2Ag^+(aq) \rightleftharpoons Zn^{2+}(aq) + 2Ag(s)$.

The cell is represented as $Zn(s)\,|Zn^{2+}(aq)||Ag^+(aq)|\,Ag(s)$; $E^o\,(Zn^{2+}|Zn) = -0.76V$ and $E^o\,(Ag^+|Ag) = 0.80$ V.

i. Since zinc (Zn) is more reactive than silver (Ag). So, Zn electrode is negatively charged.

ii. At anode : Oxidation will takes place; $Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$ (oxidation)

At cathode: Reduction will takes place; $Ag^+(aq) + e^- \rightarrow Ag(s)$ (reduction)

iii. Ions are the carriers of current within the cell.

28. For a first order reaction

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

For 99.9% completion of reaction

$[R]_0 = 100M$, $[R] = 100 - 99.9 = 0.1M$

$\therefore\ t_{99.99\%} = \frac{2.303}{t}\log\left[\frac{100}{0.1}\right]$...(i)

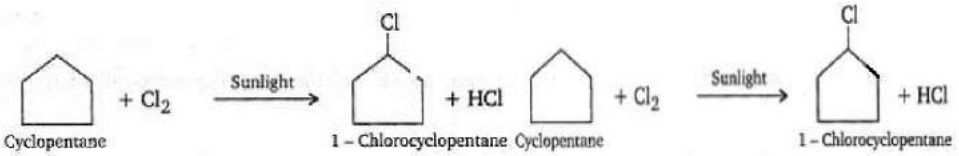
Simiarly, $t_{1/2} = \frac{2.303}{k}\log\left[\frac{100}{50}\right]$...(ii)

Divide equation (i) by equation (ii)

$\frac{t_{99.9}}{t_{1/2}} = \frac{\log[1000]}{\log[2]} = \frac{3.0}{0.3010} \approx 10$

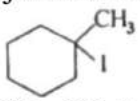
Hence $t_{99.9\%} = 10t_{1/2}$

29. Since the hydrocarbon gives only one monochloro compound, it indicates that all hydrogen atoms in the hydrocarbon are equivalent. Thus, the compound is cyclopentane with the molecular formula C_5H_{10}.

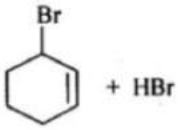


OR

Major monohalo product formed are;

i. 

ii. $CH_3CH_2I + NaBr$

iii. 

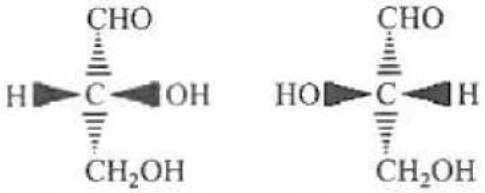
30. Acidified potassium dichromate act as a strong oxidising agents. It can oxidise iodides to iodine, sulphides to sulphur, tin(II) to tin(IV) and iron(II) salts to iron(III). In acidic medium dichromate ion will itself reduces to Cr^{3+} ions.

$$Cr_2O_7^{\ 2} + 14H^+ + 6Fe^{2+} \rightarrow 2Cr^{3+} + 6Fe^{3+} + 7H_2O$$

Section D

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

Carbohydrates can exist in either of two conformations, as determined by the orientation of the hydroxyl group about the asymmetric carbon farthest from the carbonyl.



(Structures of glyceraldehyde enantiomers)

By convention, a monosaccharide is said to have D-configuration if the hydroxyl group attached to the asymmetric carbon atom adjacent to the - CH_2OH group is on the right-hand side irrespective of the positions of the other hydroxyl groups. On the other hand, the molecule is assigned L-configuration if the - OH group attached to the carbon adjacent to the - CH_2OH group is on the left-hand side.

(i) enantiomer

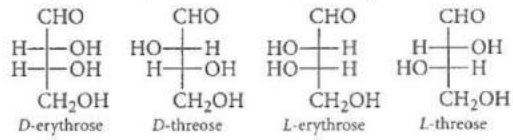
(ii) >C = O and -OH

Carbohydrates are essentially polyhydroxy aldehydes and polyhydroxy ketones. Thus, the two functional groups present are >C = 0 (aldehyde or ketone) and -OH.

(iii) D-type is mainly found in human body.

OR

D-erythrose, D-threose, L-erythrose, L-threose



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

To explain bonding in coordination compounds various theories were proposed. One of the important theories was valence bond theory. According to that, the central metal ion in the complex makes available a number of empty orbitals for the formation of coordination bonds with suitable ligands. The appropriate atomic orbitals of the metal hybridise to give a set of equivalent orbitals of definite geometry. The d - orbitals involved in the hybridisation may be either inner d-orbitals i.e., (n - 1) d or outer d - orbitals i.e. nd. For example, Co^{3+} forms both inner orbital and outer orbital complexes, with ammonia it forms $[Co(NH_3)_6]^{3+}$ and with fluorine it forms $[CoF_6]^{3-}$ complex ion.

(i) It involves d^2sp^3 hybridization.
(ii) It is an octahedral, diamagnetic, and inner orbital complex.
(iii) Due to presence of 4 unpaired electrons.

OR

$[Co(CN)_6]^{3-}$

Section E

33. i. On treatment with dilute alkali, ethanal produces 3-hydroxybutanal (Aldol Condensation) gives butane-1, 3-diol on reduction.

$$\underset{Ethanal}{CH_3CHO} \xrightarrow{dil\ NaOH} \underset{3-Hydroxybutanal}{CH_3-\overset{OH}{\overset{|}{C}}H-CH_2-CHO} \xrightarrow[(Reduction)]{NaBH_4} \underset{Butane-1,3-diol}{CH_3-\overset{OH}{\overset{|}{C}}H-CH_2-CH_2-OH}$$

ii. On treatment with dilute alkali, ethanal gives 3-hydroxybutanal (Aldol Condensation) which on heating produces but-2-enal.

$$\underset{Ethanal}{CH_3CHO} \xrightarrow{dil\ NaOH} \underset{3-Hydroxybutanal}{CH_3-\overset{OH}{\overset{|}{C}}H-CH_2-CHO} \xrightarrow[-H_2O]{\Delta} \underset{But-2-enal}{CH_3-CH=CH-CHO}$$

iii. When treated with Tollen's reagent, But-2-enal produced in the above reaction produces but-2-enoicacid.

$$\underset{But-2-enal}{CH_3-CH=CH-CHO} \xrightarrow[Tollen's\ reagent]{[Ag(NH_3)_2]^+OH^-} \underset{But-2-enoic\ acid}{CH_3CH=CHCOOH}$$

OR

i. IUPAC name: Heptan-2-one Common name: Methyl n-propyl ketone
ii. IUPAC name: 4-Bromo-2-methylhexanal Common name: $\gamma - Bromo - \alpha -$ methylcaproaldehyde
iii. IUPAC name: Heptanal Common name: heptanaldehyde
iv. IUPAC name: 3-phenylprop-2-enal Common name: β-Pheynolacrolein
v. IUPAC name: Cyclopentanecarbaldehyde Common name: Cyclopentanealdehyde

34. Answer the following questions:
(i) $CuCl_2$ is more stable than Cu_2Cl_2. The stability of compound $CuCl_2$ is because of high enthalpy of hydration of $Cu^{2+}(aq)$ than that of $Cu^+(aq)$.
(ii) Order of reactivity of four isomeric bromobutanes in S_N1 reaction is:
$(CH_3)_3CBr > CH_3CH_2\underset{Br}{\overset{|}{C}}HCH_3 > (CH_3)_2CHCH_2CH_2Br > CH_3CH_2CH_2CH_2Br$

(iii)Add neutral $FeCl_3$ solution, phenol gives violet colour whereas benzoic acid does not.

(iv)**Ambident nucleophile:** Nucleophiles having two nucleophilic centres are called ambident nucleophiles.

Examples: CN^- , SCN^- , NO_2^-.

(v) Uracil.

35. Vapour pressure of the solution at normal boiling point (p_1) = 1.004 bar
Vapour pressure of pure water at normal boiling point $\left(p_1^0\right) = 1.013\,bar$
Mass of solute, (w_2) = 2 g
Mass of solvent (water), (w_1) = 98 g
Molar mass of solvent (water), $(M_1) = 18 gmol^{-1}$
According to Raoult's law,

$\frac{p_1^0 - p_1}{p_1^0} = \frac{w_2 \times M_1}{M_2 \times w_1}$

$\frac{1.013 - 1.004}{1.013} = \frac{2 \times 18}{M_2 \times 98}$

$\frac{0.009}{1.013} = \frac{2 \times 18}{M_2 \times 98}$

$M_2 = \frac{1.013 \times 2 \times 18}{0.009 \times 98}$

$= 41.346 gmol^{-1}$

Hence, the molar mass of the solute is $41.346 gmol^{-1}$

OR

Vapour pressure of heptanes $\left(p_1^0\right) = 105.2\,kPa$
Vapour pressure of octane $\left(p_2^0\right)$ = 46.8 kPa
We know that,
Molar mass of heptane $(C_7H_{16}) = (7 \times 12) + (16 \times 1)$
$= 100 gmol^{-1}$
Therefore, Number of moles of heptane = $\frac{26}{100} mol$
= 0.26 mol
Molar mass of octane $(C_8H_{18}) = (8 \times 12) + (18 \times 1)$
$= 114 gmol^{-1}$
Therefore, Number of moles of octane = $\frac{35}{114} mol$
= 0.31 mol
Mole fraction of heptane, $x_1 = \frac{0.26}{0.26 + 0.31}$
= 0.456
And, mole fraction of octane, x_2 = 1 - 0.456
= 0.544
Now, partial pressure of heptane, $p_1 = x_1 p_1^0$
= 0.456 × 105.2
= 47.97 kPa
Partial pressure of octane, $p_2 = x_2 p_2^0$
= 0.544 × 46.8
= 25.46 kPa
Hence, vapour pressure of solution, $p_{total} = p_1 + p_2$
= 47.97 + 25.46
= 73.43 kPa