Class: XII
SESSION : 2022-2023
SUBJECT: Chemistry
SAMPLE QUESTION PAPER - 8
with SOLUTION

MM: 70 **Time: 3 hours**

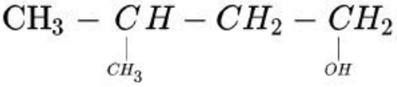
General Instructions:

Read the following instructions carefully.

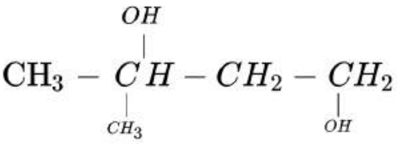
a) There are **35** questions in this question paper with internal choice.
b) SECTION A consists of 18 multiple-choice questions carrying 1 mark each.
c) SECTION B consists of 7 very short answer questions carrying 2 marks each.
d) SECTION C consists of 5 short answer questions carrying 3 marks each.
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

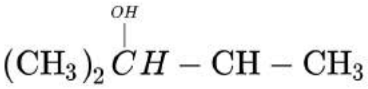
1. Arrange the following alkanols i, ii, and iii in order of their reactivity towards acid catalysed dehydration. **[1]**

i. 

$\mathrm{CH_3}-\underset{\underset{CH_3}{|}}{C}H-CH_2-\underset{\underset{OH}{|}}{C}H_2$

ii. 

$\mathrm{CH_3}-\overset{\overset{OH}{|}}{\underset{\underset{CH_3}{|}}{C}}H-CH_2-\underset{\underset{OH}{|}}{C}H_2$

iii. 

$(\mathrm{CH_3})_2\overset{\overset{OH}{|}}{C}H-\mathrm{CH}-\mathrm{CH_3}$

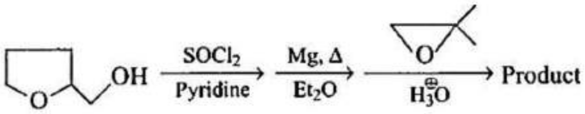
a) i > ii > iii
b) iii > ii > i
c) ii > i > iii
d) ii > iii > i

2. A gas X at 1 atm is passed through a solution containing a mixture of 1 M Y^- and 1 M Z^- at $25^{O}C$. If the reduction potential of Z > Y > X, then: **[1]**

a) Y will oxidise X and not Z
b) Y will oxidise both X and Z
c) Y will reduce both X and Z
d) Y will oxidise Z and not X

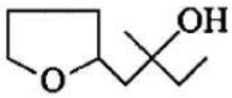
3. Starch is composed of two polysaccharides namely: **[1]**

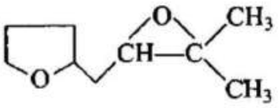
a) amylose and glycogen
b) amylose and amylopectin
c) glycogen and glycopectin
d) amylopectin and glycogen

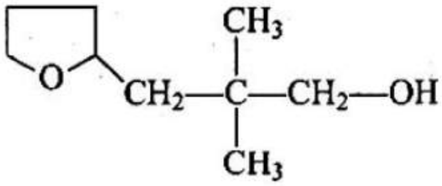
4. 

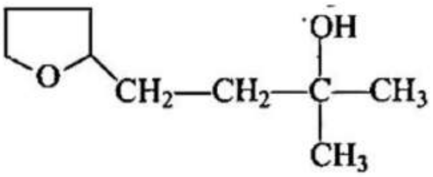
[1]

Product of reaction is:

a) 

b) 

c) 

d) 

5. The compound most suitable for the preparation of cyanohydrin is [1]

a) $C_6H_5NH_2$

b) C_2H_5COOH

c) C_2H_5-C_2H_5

d) $C_2H_5COC_2H_5$

6. Knowing that the chemistry of lanthanoids (Ln) is dominated by its +3 oxidation state, which of following statements is **incorrect**? [1]

a) Ln(III) compounds are generally colourless.

b) The ionic sizes of Ln(III) decrease in general with increasing atomic number.

c) Because of the large size of the Ln(III) ions the bonding in its compounds is predominantly ionic in character.

d) Ln(III) hydroxides are mainly basic in character.

7. Blood cells retain their normal shape in solution which are: [1]

a) isotonic to blood

b) hypertonic to blood

c) hypotonic to blood

d) equinormal to blood

8. The corrosion of the iron object is favoured by: [1]

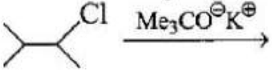
a) all of these

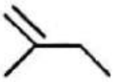
b) presence of H^+ ion and moisture air

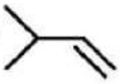
c) presence of CO_2 in air or saline water

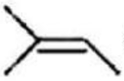
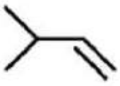
d) presence of impurities in iron object

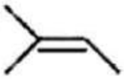
9. Find the major product of the reaction: [1]



a) 

b) 

c)  & 

d) 

10. The process of getting freshwater from sea water is known as: **[1]**

a) diffusion

b) filtration

c) reverse osmosis

d) osmosis

11. Subunits present in haemoglobin are **[1]**

a) 4

b) 2

c) 3

d) 5

12. 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) $Na_2Cr_2O7 \cdot 2H_2O$

13. The quantity of charge required to obtain one mole of aluminium from Al_2O_3 is ________. **[1]**

a) 2F

b) 3F

c) 1F

d) 6F

14. 3A → 2B, rate of reaction $\frac{+d[B]}{dt}$ is equal to: **[1]**

a) $-\frac{3}{2}\frac{d[A]}{dt}$

b) $-\frac{1}{3}\frac{d[A]}{dt}$

c) $-\frac{2}{3}\frac{d[A]}{dt}$

d) $+2\frac{d[A]}{dt}$

15. **Assertion (A):** p-Dichlorobenzene is less soluble in organic solvents than the corresponding o-isomer. **[1]**
Reason (R): o-Dichlorobenzene is polar while p-dichlorobenzene is not.

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:** 0.1 M glucose solution has higher increment in the freezing point than 0.1 M urea solution. **[1]**
Reason: K_f for both has different values.

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) Both assertion and reason are INCORRECT.

17. **Assertion (A):** With Br_2 - H_2O, phenol gives 2,4,6-tribromophenol but with Br_2-CS_2, it gives 4-bromophenol as the major product. **[1]**
Reason (R): In water, ionisation of phenol is enhanced but in CS_2, it is greatly suppressed.

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):** Zinc displaces copper from copper sulphate solution. **[1]**
Reason (R): The E^0_{298} of Zn is -0.76 volts and that of Cu is +0.34 volts.

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

19. Identify the compounds A, B and C in the following reaction. **[2]**

$$CH_3 - Br \xrightarrow{Mg/ether} (A) \xrightarrow[(ii)\ Water]{(i)\ CO_2} (B) \xrightarrow[\Delta]{CH_3OH/H^+} (C)$$

OR

What happens when calcium ethanoate is dry distilled?

20. On the basis of crystal field theory explain why Co(III) forms a paramagnetic octahedral complex with weak field ligands whereas it forms a diamagnetic octahedral complex with strong field ligands. **[2]**

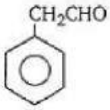
21. Write the formula of potassium trioxalato aluminate III. **[2]**

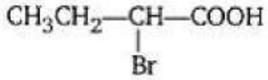
OR

The spin only magnetic moment of $[MnBr_4]^{2-}$ is 5.9 BM. Predict the geometry of the complex ion?

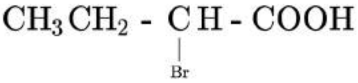
22. Define zero order reaction. Give its unit. **[2]**

23. Write the IUPAC names for the following: **[2]**

i. 

ii. 

$CH_3CH_2-\underset{\displaystyle Br}{\underset{|}{CH}}-COOH$



$CH_3CH_2-\underset{\displaystyle Br}{\underset{|}{CH}}-COOH$

24. Using the valence bond approach, predict the shape and magnetic character of $[Fe(CN)_6]^{3-}$ ion. **[2]**

25. Why are carbohydrates generally optically active? **[2]**

Section C

26. A chemical reaction $2A \Leftrightarrow 4B + C$ in gas phase occurs in a closed vessel. The concentration of B is found to be increased by $5 \times 10^{-3} mol L^{-1}$ in 10 second. Calculate **[3]**

i. the rate of appearance of B

ii. the rate of disappearance of A?

27. 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]**

28. An organic compound ' A ' having molecular formula C_3H_6 on treatment with aq. H_2SO_4 give 'B' which on treatment with Lucas reagent gives 'C'. The compound 'C' on treatment with ethanolic KOH gives back 'A' .Identify A, B, C . **[3]**

$$A(C_3H_6) \xrightarrow{aq.\ H_2SO_4} B \xrightarrow[reagent]{Lucas} C \xrightarrow{alc.KOH} A$$

29. Define the terms as related to proteins: **[3]**

i. Peptide linkage

ii. Primary structure

iii. Denaturation

OR

What is the difference between a nucleoside and a nucleotide?

30. Write the structures of the following compounds: **[3]**

i. $\propto -$ methoxypropionaldehyde

ii. 3-Hydroxylbutanol

iii. 2-Hydroxycylopentane carbaldehyde

iv. 4-Oxopentanal

v. Di-Sec. butyl ketone

Section D

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

The solutions which boil at a constant temperature like a pure liquid and possess the same composition in liquid, as well as vapour state are called azeotropes. The components of azeotropes cannot be separated by fractional distillation. Only non-ideal solutions form azeotropes. Solutions with negative deviation form maximum boiling azeotrope and the solutions with positive deviation form minimum boiling azeotrope. The boiling point of azeotrope is never equal to the boiling points of any of the components of the azeotrope.

(i) The azeotropic solutions of two miscible liquids show what type of deviation from Raoult's law?

(ii) The azeotropic mixture of water & HCI boils at $108.5^{\circ} C$. What type of deviation is shown by the solution? Does this solution behave as ideal or non-ideal?

(iii) Do ideal solutions form azeotropes?

OR

Out of pure liquid and azeotrope showing positive deviation, Which one has a higher boiling point?

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

The d-block of the periodic table contains the elements of the groups 3 to 12 and are known as transition elements. In general, the electronic configuration of these elements is (n - 1)$d^{1\text{-}10}$ $ns^{1\text{-}2}$. The d-orbitals of the penultimate energy level in their atoms receive electrons giving rise to the three rows of the transition metals i.e. 3d, 4d and 5d series. However, Zn, Cd and Hg are not regarded as transition elements. Transition elements exhibit certain characteristic properties like variable oxidation stables, complex formation, formation of coloured ions, alloys, catalytic activity etc. Transition metals are hard (except Zn, Cd and Hg) and have a high melting point.

(i) Why are Zn, Cd and Hg non-transition elements?

(ii) Which transition metal of 3d series does not show variable oxidation state?

(iii) Why do transition metals and their compounds show catalytic activity?

OR

Why are melting points of transition metals high?

Section E

33. A hydrocarbon ‘A’, (C_4H_8) on reaction with HCl gives a compound ‘B’, (C_4H_9Cl), which on reaction with 1 mol of NH 3 gives compound ‘C’, ($C_4H_{11}N$). On reacting with $NaNO_2$ and HCl followed by treatment with water, compound ‘C’ yields optically active alcohol, ‘D’. Ozonolysis of ‘A’ gives 2 mols of acetaldehyde. Identify compounds ‘A’ to ‘D’. Explain the reactions involved. **[5]**

OR

i. Write the structures of main products when benzene diazonium chloride ($C_6H_5N_2^+Cl^-$) reacts with the following reagents :

a. HBF_4/Δ

b. Cu /HBr

ii. Write the structures of A, B and C in the following reactions :

a. $C_6H_5NO_2 \xrightarrow{Sn/HCl} A \xrightarrow[273K]{NaNO_2 + HCl} B \xrightarrow[\Delta]{H_2O} C$

b. $CH_3Cl \xrightarrow{KCN} A \xrightarrow{LiAlH_4} B \xrightarrow[273K]{HNO_2} C$

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

(i) In a pseudo-first-order reaction in water, the following results were obtained:

$\frac{t}{s}$	0	30	60	90
$\frac{[A]}{mol^{-1}}$	0.55	0.31	0.17	0.085

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

(ii) Define oxidation state of a metal.

(iii) Name the enzymes and write the reactions involved in the preparation of ethanol from sucrose by fermentation.

(iv) Write a short note on coupling reactions.

(v) What are interstitial compounds. Give two examples

35. Explain construction and working of standard Hydrogen electrode? **[5]**

OR

a. Represent the cell in which the following reaction takes place :

$2\ Al\ (s) + 3\ Ni^{2+}\ (0.1\ M) \longrightarrow 2\ Al^{3+}\ (0.01\ M) + 3\ Ni\ (s)$

Calculate its emf if $E^o cell = 1.41\ V$.

b. How does molar conductivity vary with increase in concentration for strong electrolyte and weak electrolyte? How can you obtain limiting molar conductivity $\left(\Lambda_m^0\right)$ for weak electrolyte?

SOLUTION

Section A

1. **(d)** ii > iii > i

   Explanation: As the stability of cation increases rate of dehydration increases.

2. **(a)** Y will oxidise X and not Z

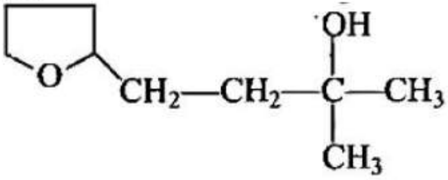
   Explanation: The tendency to gain electron is in the order Z > Y > X

   Thus, $Y + e \longrightarrow Y^{-}$, $X \longrightarrow X^{+} + e$

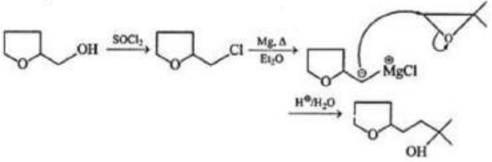
3. **(b)** amylose and amylopectin

   Explanation: Starch is a polymer of $\alpha - D - (+) -$ glucose and consists of two components-Amylose and Amylopectin. Natural starch has approximately 10 - 20% of amylose and 80 - 90% of amylopectin. Amylose is water-soluble component which gives blue color with iodine. Chemical amylose (polysaccharide) is a long straight (unbranched) chain having only $\alpha - D - (+) -$ glucose units joined together by α-glycosidic linkages involving C_1 of one glucose and C_4 of the next.it can have 100 - 3000 D - glucose units i.e., its molecular mass can range from 10,000 to 5000,000. Amylopectin is a branched-chain polysaccharide insoluble in water which does not give blue color with iodine. It is composed of chains of $25 - 30$D - Glucose units joined by $\alpha - D -$ glycosidic linkages between $C - 1$ of one glucose unit and $C - 4$ of the next glucose unit (similar to amylose). However, these chains are connected with each other by 1, 6-linkage.

4. **(d)**

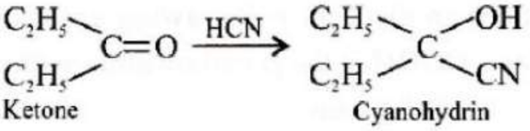
   

   Explanation:

5. **(d)** $C_2H_5COC_2H_5$

   Explanation: Ketone reacts with HCN to form an addition product, known as cyanohydrin compound.

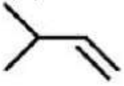
6. **(a)** Ln(III) compounds are generally colourless.

   Explanation: Ln(III) compounds are generally coloured.

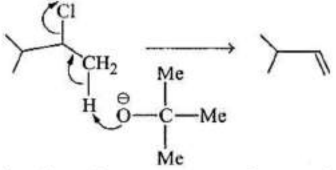
7. **(a)** isotonic to blood

   Explanation: $\pi_1 = \pi_2$ for isotonic solution and thus no osmosis.

8. **(a)** all of these
   Explanation: all of these
9. **(b)**



Explanation:



bulky base react from less hindered side.

10. **(c)** reverse osmosis
    Explanation: Reverse osmosis involves movement of solvent particles through semipermeable membrane from concentrated solution to dilute solution under pressure.
11. **(a)** 4

Explanation:

The name **hemoglobin** is derived from the words heme and globin, reflecting the fact that each **subunit** of **hemoglobin** is a globular protein with an embedded heme group. Each heme group contains one iron atom, that can bind one oxygen molecule through ion-induced dipole forces. Hence Hb has four sub-units.

12. **(d)** $Na_2Cr_2O7 \cdot 2H_2O$
    Explanation: $4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \longrightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$

    $2Na_2CrO_4 + 2H^+ \longrightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$.
13. **(b)** 3F
    Explanation: $Al_2O_3 \rightarrow 2Al^{3+} + 3O^{2-}$
    $Al^{3-} + 3e^- \rightarrow Al$ (For 1 mole)

    3F charge is required to obtain 1 mole Al from Al_2O_3. Hence to neutralize Al^{3+} ion 3F is required.
14. **(c)** $-\frac{2}{3}\frac{d[A]}{dt}$
    Explanation: $-\frac{1}{3}\frac{d[A]}{dt} = \frac{1}{2}\frac{d[B]}{dt}$
15. **(b)** Both A and R are true but R is not the correct explanation of A.
    Explanation: p-Dichlorobenzene being more symmetrical than o-isomer fits closely in the crystal lattice and hence greater amount of energy is needed to break the crystal lattice. Thus, p-isomer is less soluble than o-isomer.

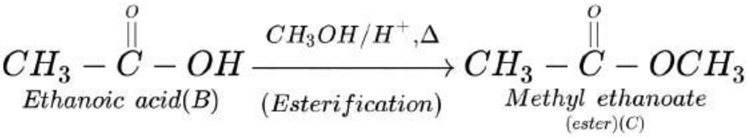
16. **(d)** Both assertion and reason are INCORRECT.
Explanation: Both assertion and reason are INCORRECT.

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: A metal having smaller reduction potential can displace metals having larger reduction potentials from the solution of their salt.
Zinc lies above copper in the electrochemical series. So zinc will displace copper from copper sulphate solution.
Both assertion and reason are correct and the reason is the correct explanation for the assertion.

Section B

19. $$\underset{Methyl\ bromide}{CH_3-Br} \xrightarrow{Mg/ether} \underset{\substack{Methyl\ magnesium\\ bromide\ (A)}}{CH_3-MgBr} \xrightarrow[(ii)\ H_2O]{(i)\ CO_2}$$

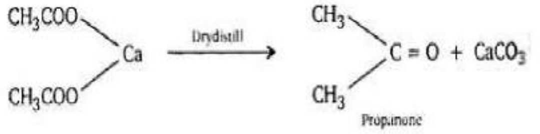


$$\underset{Ethanoic\ acid(B)}{CH_3-\overset{O}{\overset{||}{C}}-OH} \xrightarrow[(Esterification)]{CH_3OH/H^+,\Delta} \underset{\substack{Methyl\ ethanoate\\ (ester)(C)}}{CH_3-\overset{O}{\overset{||}{C}}-OCH_3}$$

Compound (A) = Methyl magnesium
Compound (B) = Ethanoic acid
Compound (C)= methyl ethanoate

OR

Calcium ethanoate on dry distillation gives propanone.



20. With weak ligands $\Delta_0 < p$, the electronic configuration of cobalt Co(lll) will be $t_{2g}^4 e_g^2$. It has 4 unpaired electrons in 3d shell and is paramagnetic. With strong field ligands $\Delta_0 > p$, the electronic configuration will be $t_{2g}^6 e_g^0$. It has no unpaired electrons in its shell and is diamagnetic.

21. $K_3[Al(C_2O_4)_3$

OR

Since the coordination number of Mn^{2+} ion in the complex ion is 4, the geometry will be either tetrahedral shape (sp^3 hybridisation) or square planar shape (dsp^2 hybridisation). But the fact that the spin only magnetic moment of the$(MnBr_4)^{2-}$ complex ion is 5.9 BM, it should be tetrahedral in shape rather than square planar because of the presence of five unpaired electrons in the d orbitals.

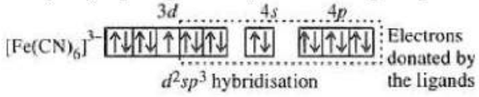
22. Zero order reaction means that the rate of reaction is proportional to zero power of concentration of reactants. For example: the decomposition of gaseous ammonia on a hot platinum surface is a zero order reaction at high pressure.

$$2NH_3(g) \xrightarrow[Pt\ catalyst]{1130} N_2(g) + H_2(g)$$

Unit of zero order reaction is $mol\,L^{-1}S^{-1}$

23. i. 2-Phenylacetaldehyde
ii. 2-Bromobutanoic acid

24. Fe(26): $[Ar]4^3d6$, Fe^{3+} : $[Ar]4s^03d^5$



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

25. Because one or more carbon atoms present in view contain asymmetric carbon atom.

Section C

26. Rate of reaction for the following reaction is given as:
Rate = - decrease in concentration of reactants/time taken = increase in concentration of products/time taken

$2A \rightarrow 4B + C$

$-\frac{1}{2}\frac{d[A]}{dt} = \frac{1}{4}\frac{d[B]}{dt} = \frac{d[C]}{dt}$

i. Rate of appearance of B:

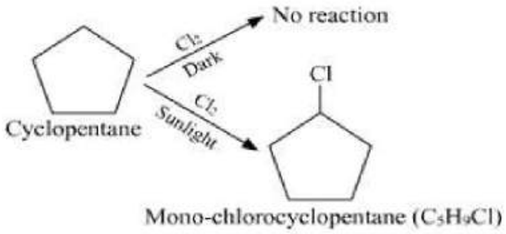
$= \frac{5 \times 10^{-3}}{10} \text{molL}^{-1} s^{-1} = 5 \times 10^{-4} \text{molL}^{-1}\text{s}^{-1}$

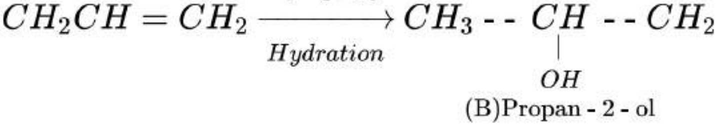
ii. $Rate\ of\ disappearance\ of\ A : \frac{-\text{d}[A]}{dt} = \frac{2}{4}\frac{d[B]}{dt} = \frac{1}{2}\frac{d[B]}{dt}$

$= \frac{1}{2} \times 5 \times 10^{-4} \text{molL}^{-1}\text{s}^{-1} = 2.5 \times 10^{4} \text{molL}^{-1}\text{s}^{-1}$

27. A hydrocarbon with the molecular formula, C_5H_{10} belongs to the group with a general molecular formula C_nH_{2n}.Therefore, it may either be an alkene or a cycloalkane. Since hydrocarbon does not react with chlorine in the dark, it cannot be an alkene. Thus, it should be a cycloalkane. Further, the hydrocarbon gives a single monochloro compound, C_5H_9Cl by reacting with chlorine in bright sunlight. Since a single monochloro compound is formed, the hydrocarbon must contain H-atoms that are all equivalent. Also, as all H-atoms of a cycloalkane are equivalent, the hydrocarbon must be a cycloalkane. Hence, the said compound is cyclopentane.

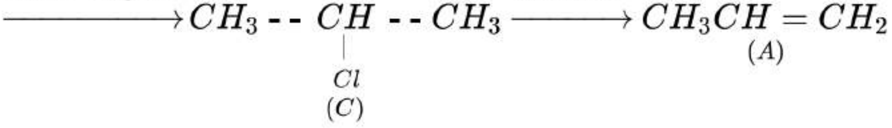
Cyclopentane (C_5H_{10}) The reactions involved in the question are:



28. 

$$CH_2CH = CH_2 \xrightarrow[Hydration]{aq.H_2SO_4} CH_3 -- \underset{\underset{OH}{|}}{CH} -- CH_2$$

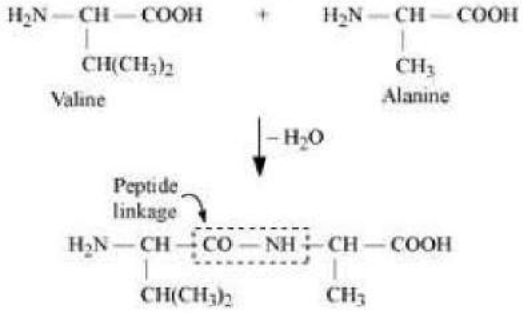
(B)Propan - 2 - ol



$$\xrightarrow[Lucas\ reagent]{ZnCl_2|HCl} CH_3 -- \underset{\underset{\underset{(C)}{Cl}}{|}}{CH} -- CH_3 \xrightarrow{alc.KOH} \underset{(A)}{CH_3CH = CH_2}$$

29. i. Peptide linkage:

The amide formed between -COOH group of one molecule of an amino acid and $-NH_2$ group of another molecule of the amino acid by the elimination of a water molecule is called a peptide linkage.



Valylalanine (Val – Ala)

ii. Primary structure: The primary structure of protein refers to the specific sequence in which various amino acids are present in it, i.e., the sequence of linkages between amino acids in a polypeptide chain. The sequence in which amino acids are arranged is different in each protein. A change in the sequence creates a different protein.

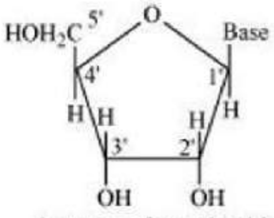
iii. Denaturation: In a biological system, a protein is found to have a unique 3-dimensional structure and a unique biological activity. In such a situation, the protein is called native protein. However, when the native protein is subjected to physical changes such as change in temperature or chemical changes such as change in pH, its H-bonds are disturbed. This disturbance unfolds the globules and uncoils the helix. As a result, the protein loses its biological activity. This loss of biological activity by the protein is called denaturation. During denaturation, the secondary and the tertiary structures of the protein get destroyed, but the primary structure remains unaltered.

One of the examples of denaturation of proteins is the coagulation of egg white when an egg is boiled.

OR

A nucleoside is formed by the attachment of a base to position of sugar.

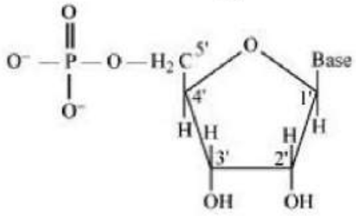
Nucleoside = Sugar + Base



Structure of a nucleoside

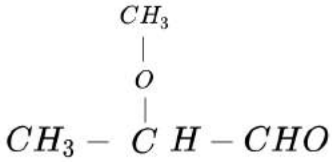
On the other hand, all the three basic components of nucleic acids (i.e., pentose sugar, phosphoric acid, and base) are present in a nucleotide.

Nucleotide = Sugar + Base + Phosphoric acid



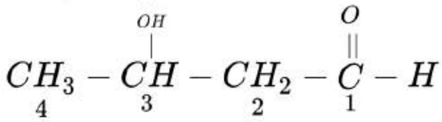
Structure of a nucleotide

30. i. $\propto$ – methoxypropionaldehyde



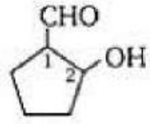
$$CH_3-\overset{\substack{CH_3\\|\\O\\|}}{C}H-CHO$$

ii. 3-Hydroxylbutanol

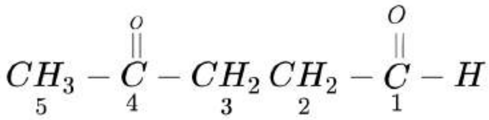


$$\underset{4}{CH_3}-\underset{3}{\overset{\substack{OH\\|}}{C}H}-\underset{2}{CH_2}-\underset{1}{\overset{\substack{O\\||}}{C}}-H$$

iii. 2-Hydroxycylopentane carbaldehyde

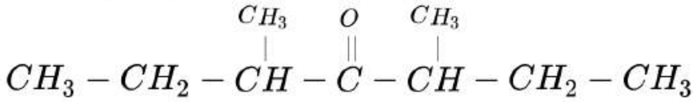


iv. 4-Oxopentanal



$$\underset{5}{CH_3}-\underset{4}{\overset{\substack{O\\||}}{C}}-\underset{3}{CH_2}\,\underset{2}{CH_2}-\underset{1}{\overset{\substack{O\\||}}{C}}-H$$

v. Di-Sec, butyl ketone



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

Section D

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

The solutions which boil at a constant temperature like a pure liquid and possess the same composition in liquid, as well as vapour state are called azeotropes. The components of azeotropes cannot be separated by fractional distillation. Only non-ideal solutions form azeotropes. Solutions with negative deviation form maximum boiling azeotrope and the solutions with positive deviation form minimum boiling azeotrope. The boiling point of azeotrope is never equal to the boiling points of any of the components of the azeotrope.

(i) The azeotropic solutions of two miscible liquids may show positive or negative deviation from Raoult's law.

(ii) The solution is a non-ideal solution and shows a negative deviation from Raoult's law.

(iii) No, ideal solutions don't form azeotropes. Only the non-ideal solution form azeotrope.

OR

The boiling point of a pure liquid is higher as compared to azeotrope showing positive deviation.

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

The d-block of the periodic table contains the elements of the groups 3 to 12 and are known as transition elements. In general, the electronic configuration of these elements is (n - 1)d^{1-10} ns^{1-2}. The d-orbitals of the penultimate energy level in their atoms receive electrons giving rise to the three rows of the transition metals i.e. 3d, 4d and 5d series. However, Zn, Cd and Hg are not regarded as transition elements. Transition elements exhibit certain characteristic properties like variable oxidation stables, complex formation, formation of coloured ions, alloys, catalytic activity etc. Transition metals are hard (except Zn, Cd and Hg) and have a high melting point.

(i) It is because neither they nor their ions have incompletely filled d-orbitals.

(ii) Scandium (Sc) and Zinc (Zn).

(iii) It is because they show variable oxidation state, can form intermediate complexes and have large surface area for adsorption of gases.

OR

It is due to strong interatomic forces of attraction due to presence of unpaired electrons.

Section E

33. i. Addition of HCl to compound 'A' shows that compound 'A' is an alkene. Compound 'B' is C_4H_9Cl.

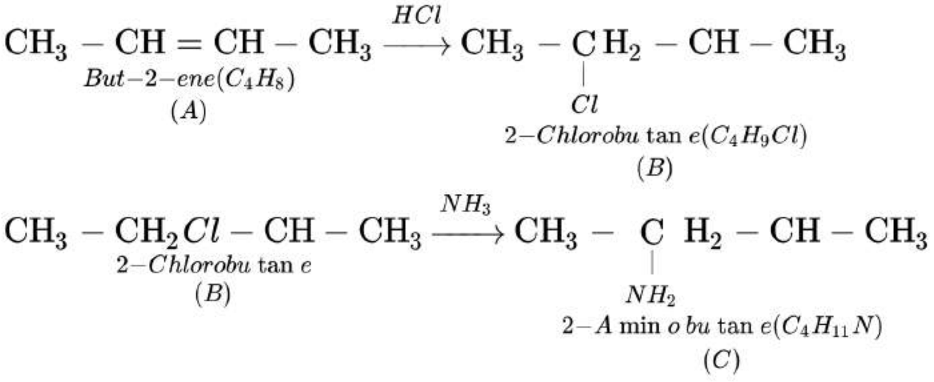
ii. Compound 'B' reacts with NH2, it forms amine 'C'. compound C is $C_4H_9NH_2$

$$\underset{(A)}{C_4H_8} \xrightarrow{HCl} \underset{(B)}{C_4H_9\,Cl} \xrightarrow{NH_3} \underset{(C)}{C_4H_{11}N} \text{ or } C_4H_9NH_2$$

iii. 'C' gives diazonium salt with $NaNO_2/HCl$, which yields optically active alcohol D(Butan-2-ol). So, 'C' is an aliphatic amine.

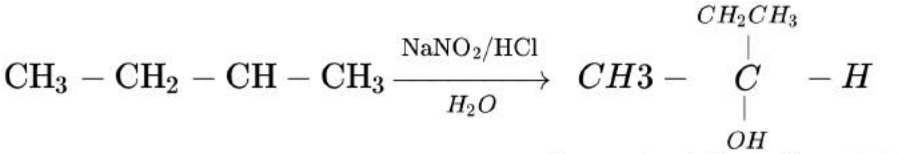
iv. 'A' on ozonolysis produces 2 moles of CH_3CHO. So, ' A ' is CH_3-CH=CH-CH_3(But-2-ene)

Reactions:



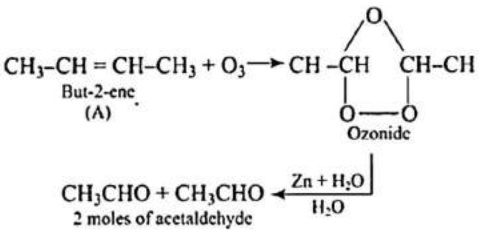
$$\underset{\substack{But-2-ene(C_4H_8)\\(A)}}{CH_3-CH=CH-CH_3} \xrightarrow{HCl} \underset{\substack{2-Chlorobu\tan e(C_4H_9Cl)\\(B)}}{CH_3-\underset{\substack{|\\Cl}}{C}H_2-CH-CH_3}$$

$$\underset{\substack{2-Chlorobu\tan e\\(B)}}{CH_3-CH_2Cl-CH-CH_3} \xrightarrow{NH_3} \underset{\substack{2-A\min o\,bu\tan e(C_4H_{11}N)\\(C)}}{CH_3-\underset{\substack{|\\NH_2}}{C}\;H_2-CH-CH_3}$$



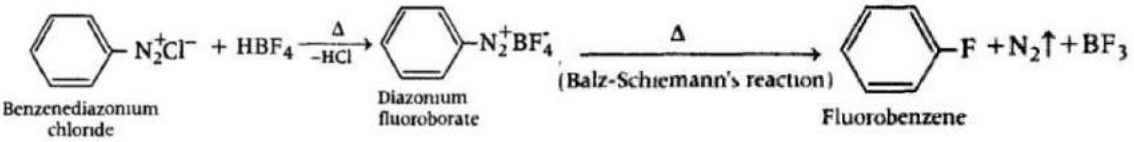
$$CH_3-CH_2-CH-CH_3 \xrightarrow[H_2O]{NaNO_2/HCl} CH3-\overset{\overset{CH_2CH_3}{|}}{\underset{\underset{OH}{|}}{C}}-H$$

Butan - 2 - ol (Optically active)
(D)

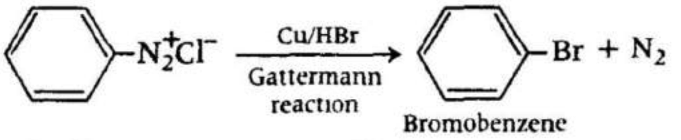


OR

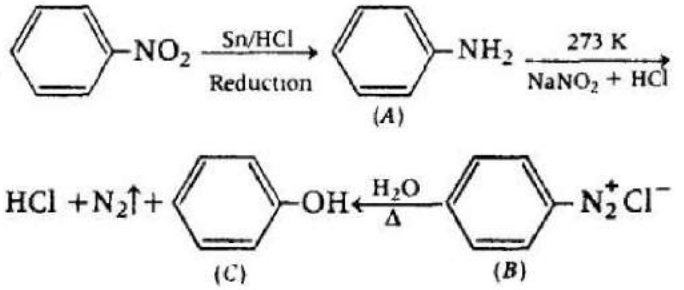
i. a.



b.



ii. a.



b. $CH3Cl \xrightarrow{KCN} \underset{(A)}{CH_3CN} \xrightarrow{LiAlH_4} \underset{(B)}{CH_3CH_2NH_2} \xrightarrow[HNO_2]{273K} \underset{(C)}{CH_3CH_2OH} + N_2\uparrow + H_2O$

34. Answer the following questions:

(i) Average rate of reaction during the interval 30 - 60 seconds.

$= \frac{C_2-C_1}{t_2-t_1}$

$= \frac{0.31-0.17}{60-30} = \frac{0.14}{30} = 4.6 \times 10^{-3}\ mol\ L^{-1}\ s^{-1}$

(ii) The oxidation number of a metal is the charge it would carry if all the ligands are removed along with the electron pairs that are shared with the metal atom or ion.

(iii)Invertase and zymase

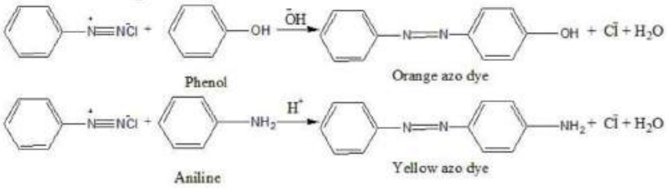
$$C_{12}H_{22}O_{11} \xrightarrow{\text{Invertase}} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$$

$$\underset{\text{Glucose or Fructose}}{C_6H_{12}O_6} \xrightarrow{\text{Zymase}} \underset{\text{Etahnol}}{2C_2H_6OH} + 2CO_2$$

These enzymes can be derived from Yeast , and the reaction required an optimum temperature for the bacterial growth and the process is known as fermentation.

(iv)**Coupling reaction:** The reactions in which a diazonium ion is joined or coupled to the ring of a phenol or an aromatic amine are called coupling reactions. The azo products obtained in the coupling reaction have an extended conjugated system having both the aromatic rings joined through the -N = N- bond. These compounds are often coloured and are used as dyes.

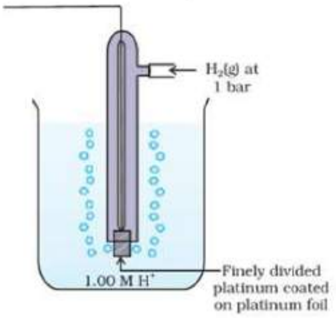
For example,



(v) Compounds formed by small atoms like H, C, or N which get trapped inside the crystal lattices of metals are called interstitial compounds. A large number of interstitial compounds are formed by transition metals. Transition metals react will small atoms like C, H, N or B to form such compounds. For eg. TiC etc. The vacant spaces inside the crystal lattice of transition elements are filled by these small atoms. These compounds are hard and rigid. The chemical properties of parent transition elements are not changed by the formation of interstitial compounds but physical properties of transition metal changes like malleability, ductility etc.

35. **Construction:** SHE consists of a platinum electrode coated with platinum black. The electrode is dipped in an acidic solution and pure Hydrogen gas is bubbled through it. The concentration of both the reduced and oxidized. Forms of Hydrogen is maintained at unity i.e) pressure of H_2 gas is 1 bar and concentration of Hydrogen ions in the solution is 1 molar.

Working – The reaction taking place in SHE is $H^+ (aq) + e^- \rightarrow 1/2H_2 (g)$ At 298 K, the emf of the cell constructed by taking SHE as anode and other half-cell as cathode, gives the reduction potential of the other f cell whereas for a cell constructed by taking SHE as anode gives the oxidation potential of other half cell as conventionally the electrode potential of SHE is zero.



OR

a. Al(s) | Al3+(0.01M) || Ni2+ (0.1 M) | Ni(s)

$$E_{(\text{cell})} = E^{\ominus}_{\text{cell}} \frac{0.059}{6} \frac{[\text{Al}^{3+}]^2}{[\text{Ni}^{2+}]^3}$$

$$E_{(\text{cell})} = 1.41\text{V} - \frac{0.059}{6} \log \frac{[0.01]^2}{[0.1]^3}$$

E(cell) = 1.4198 V

Or E_{cell} = 1.42 V

b. Λ_m decreases with increase in concentration for both strong and weak electrolyte. The limiting molar conductivity of a weak electrolyte cannot be determined reliably by extrapolation. Instead, it can be expressed as a sum of ionic contributions, which can be evaluated from the limiting molar conductivities of strong electrolytes containing the same ions.