

# MID-TERM EXAMINATION (2024-2025)

## CLASS XII CHEMISTRY

### SET-2

Date: 27.09.24  
No of pages: 9

Duration: 3 Hours  
M. Marks: 70

#### General Instructions:

Read the following instructions carefully.

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

#### SECTION - A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. For a reaction  $A \rightarrow B$ , it is found that the rate of the reaction quadruples when the concentration of A is doubled. The rate for the reaction is  $\text{Rate} = k[A]^x$ , where the value of x is: (1 mark)
- three
  - two
  - one
  - zero

2. Limiting molar conductivity for individual ions are given in the following table: (1 mark)

S.No.	Ions	Limiting molar conductivity / $\text{Scm}^2\text{mol}^{-1}$
1	$\text{H}^+$	349.6
2	$\text{Na}^+$	50.1
3	$\text{K}^+$	73.5
4	$\text{OH}^-$	199.1

Which of the following option will be the limiting molar conductivity of  $\text{CH}_3\text{COOH}$  if the limiting molar conductivity of  $\text{CH}_3\text{COONa}$  is  $91 \text{ Scm}^2\text{mol}^{-1}$ ?

- $350 \text{ Scm}^2\text{mol}^{-1}$
- $375.3 \text{ Scm}^2\text{mol}^{-1}$
- $390.5 \text{ Scm}^2\text{mol}^{-1}$
- $340.4 \text{ Scm}^2\text{mol}^{-1}$

3. If the concentration of  $N_2$  gas in water at constant pressure increases quadratically, how will value of  $K_H$  change? (1 mark)
- Increases linearly.
  - Decreases linearly.
  - Remains same.
  - Decreases quadratically.
4. Pure water boils at 373.15 K and nitric acid boils at 359.15 K. An azeotropic mixture of  $H_2O$  and  $HNO_3$  boils at 393.55 K. Distilling the azeotropic mixture will cause (1 mark)
- pure nitric acid to distil over first.
  - pure water to distil over first.
  - one of them to distil over with a small amount of the other.
  - both of them to distil over in the same composition as that of the mixture.
5. The specific sequence in which amino acids are arranged in a protein is called its: (1 mark)
- primary structure
  - secondary structure
  - tertiary structure
  - quaternary structure
6. Arrange the following compounds in increasing order of their boiling points: (1 mark)
- $$\begin{array}{c} \text{CH}_3 \\ \diagdown \\ \text{CH}-\text{CH}_2\text{Br} \\ \diagup \\ \text{CH}_3 \end{array}$$

I

$$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$$

II

$$\begin{array}{c} \text{CH}_3 \\ | \\ \text{H}_3\text{C}-\text{C}-\text{CH}_3 \\ | \\ \text{Br} \end{array}$$

III
- $II < I < III$
  - $I < II < III$
  - $III < I < II$
  - $III < II < I$
7. The process involving the reaction of an alkyl halide with sodium alkoxide yielding an ether is called: (1 mark)
- Reimer Tiemann reaction
  - Kolbe reaction
  - Hydroboration reaction
  - Williamson synthesis
8. The correct order of increasing acidic strength is: (1 mark)
- Phenol < Ethanol < Chloroacetic acid < Acetic acid
  - Ethanol < Phenol < Chloroacetic acid < Acetic acid
  - Ethanol < Phenol < Acetic acid < Chloroacetic acid
  - Chloroacetic acid < Acetic acid < Phenol < Ethanol

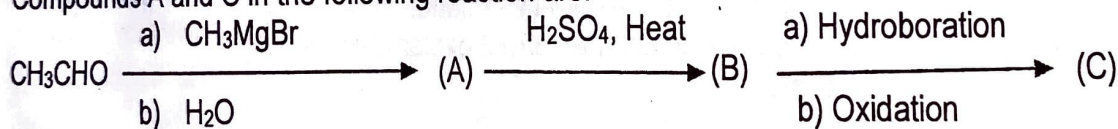
- 9 Toluene can be prepared by a reaction between the following halogenated compounds and sodium metal in the presence of dry ether as solvent. (1 mark)
- Ethyl chloride and chlorobenzene
  - Methyl chloride and chlorobenzene
  - Ethyl chloride and benzyl chloride
  - Methyl chloride and benzyl chloride

- 10 What will happen during the electrolysis of aqueous solution of  $\text{CuSO}_4$  by using platinum electrodes? (1 mark)
- Copper will deposit at cathode.
  - Copper will deposit at anode.
  - Oxygen will be released at anode.
  - Copper will dissolve at anode.

Choose the correct option:

- i and ii
  - i and iii
  - ii and iii
  - i and iv
- 11 The glycosidic linkage involved in linking the glucose units in amylose part of starch is: (1 mark)
- $\text{C}_1\text{-C}_4$   $\beta$ -linkage
  - $\text{C}_4\text{-C}_6$   $\beta$ -linkage
  - $\text{C}_1\text{-C}_6$   $\alpha$ -linkage
  - $\text{C}_1\text{-C}_4$   $\alpha$ -linkage

- 12 Compounds A and C in the following reaction are: (1 mark)



- Identical.
  - Metamers.
  - functional isomers.
  - positional isomers.
- 13 Given below are two statements labelled as Assertion (A) and Reason (R). (1 mark)
- Assertion (A):** When a solution is separated from the pure solvent by a semipermeable membrane, the solvent molecules pass through it from pure solvent side to the solution side.
- Reason (R):** Diffusion of solvent occurs from a region of high concentration solution to a region of low concentration solution.

Select the most appropriate answer from the options given below:

- Both A and R are true and R is the correct explanation of A.
- Both A and R are true but R is not the correct explanation of A.
- A is true but R is false.
- A is false but R is true.

(1 mark)

- 14 Given below are two statements labelled as Assertion (A) and Reason (R),  
**Assertion (A):** Aldehydes and ketones, both react with Tollen's reagent to form silver mirror.  
**Reason (R):** Both, aldehydes and ketones contain a carbonyl group.

Select the most appropriate answer from the options given below:

- Both A and R are true and R is the correct explanation of A.
- Both A and R are true but R is not the correct explanation of A.
- A is true but R is false.
- A is false but R is true.

(1 mark)

- 15 Given below are two statements labelled as Assertion (A) and Reason (R),  
**Assertion (A):** An ether is more volatile than an alcohol of comparable molecular mass.  
**Reason (R):** Ethers are polar in nature.

Select the most appropriate answer from the options given below:

- Both A and R are true and R is the correct explanation of A.
- Both A and R are true but R is not the correct explanation of A.
- A is true but R is false.
- A is false but R is true.

(1 mark)

- 16 Given below are two statements labelled as Assertion (A) and Reason (R),  
**Assertion (A):** Sucrose cannot give positive Tollen's test.  
**Reason (R):** Sucrose doesn't have a free aldehyde group.

Select the most appropriate answer from the options given below:

- Both A and R are true and R is the correct explanation of A.
- Both A and R are true but R is not the correct explanation of A.
- A is true but R is false.
- A is false but R is true.

### SECTION - B

This section contains 5 questions with internal choice in one question. The following questions are short answer type and carry 2 marks each.

- 17 Which one out of  $C_6H_5CH_2Cl$  and  $C_6H_5CH(Cl)C_6H_5$  is more easily hydrolysed by aqueous KOH? Give reason to support your answer. (2 marks)

- 18 Following data is obtained for the reaction:  $N_2O_5 \rightarrow 2NO_2 + \frac{1}{2}O_2$  (2 marks)

Time (sec)	0	300	600
$[N_2O_5]$ (mol L <sup>-1</sup> )	$1.6 \times 10^{-2}$	$0.8 \times 10^{-2}$	$0.4 \times 10^{-2}$

Calculate the half-life. (Given  $\log 2 = 0.3010$ ,  $\log 4 = 0.6021$ ).

OR

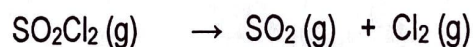
- Give one main difference between order and molecularity.
- A reaction proceeds with a uniform rate throughout. What do you conclude?

- 19 A hydrocarbon (A) with molecular formula  $C_5H_{10}$  on ozonolysis gives two products (B) and (C). Both (B) and (C) give a yellow precipitate when heated with iodine in the presence of NaOH while only (B) gives a silver mirror on reaction with Tollen's reagent. (1.5+0.5= 2 marks)
- Identify (A), (B) and (C).
  - Write the reaction of B with Tollen's reagent.
- 20 What type of azeotropic mixture will be formed by a solution showing negative deviation from Raoult's law? Explain on the basis of the strength of intermolecular interactions that develop in the solution. (2 marks)
- 21 a. Out of 1 M glucose and 2 M glucose, which one has a higher boiling point and why? (2 marks)
- What happens when the external pressure applied becomes more than the osmotic pressure of solution?

### SECTION C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

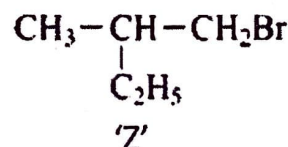
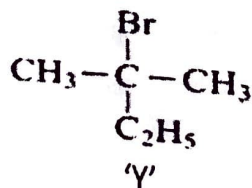
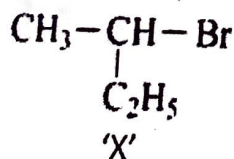
- 22 a. Sucrose is dextrorotatory but the mixture obtained after hydrolysis is levorotatory. Justify. (2+1= 3 marks)
- Draw the Haworth Projection formula of the anomers of Glucose.
- 23 Calculate Van't Hoff factor for an aqueous solution of  $K_3[Fe(CN)_6]$  if the degree of dissociation ( $\alpha$ ) is 0.852. What will be boiling point of this solution if its concentration is 1 molal? ( $K_b=0.52 \text{ K kg/mol}$ ). (3 marks)
- 24 The following data is obtained during the first order thermal decomposition of  $SO_2Cl_2$  at a constant volume: (3 marks)



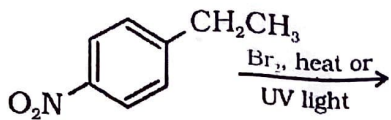
Experiment	Time/s <sup>-1</sup>	Total pressure/atm
1	0	0.4
2	100	0.7

Calculate the rate constant. (Given:  $\log 4 = 0.6021$ ,  $\log 2 = 0.3010$ )

- 25 a. Which of the following compounds – X, Y or Z will give a racemic mixture on nucleophilic substitution by  $^-OH$  ion and why? (2+1 = 3 marks)



b. Draw the structure of major mono-halo product in the following reaction:

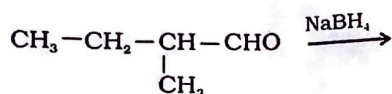


(2+1=3 marks)

- 26 a. Explain the mechanism of hydration of ethene to yield ethanol.  
 b. Explain the reaction of hydroboration-oxidation of propene to give 1-propanol.

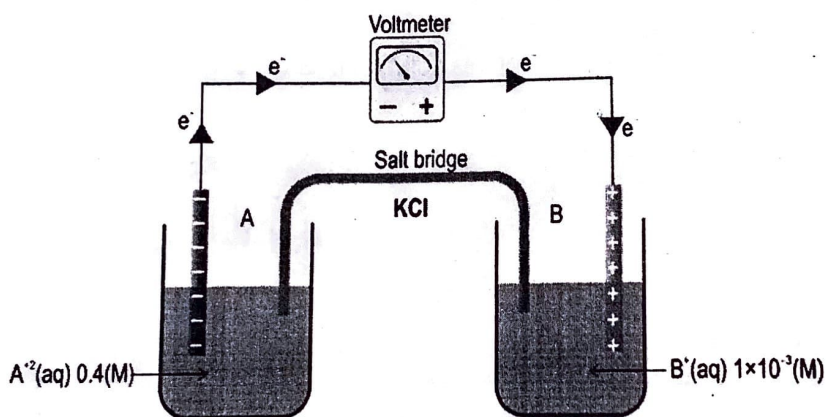
OR

- a. Write the reactions of Williamson synthesis of 2-ethoxy-3-methylpentane starting from ethanol and 3-methylpentan-2-ol.  
 b. Draw the structure and give IUPAC name of the main product for the following reaction:



- 27 Calculate the emf of the electrochemical cell given below:

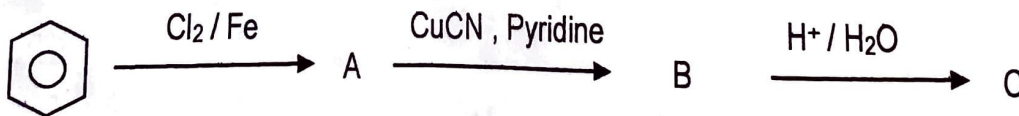
(3 marks)



Given:  $E^\circ(B^+/B) = 0.80 \text{ V}$ ,  $E^\circ(A^{2+}/A) = -2.37 \text{ V}$ ,  $\log 4 = 0.6020$ ,  $\log 10 = 1$

- 28 Analyse the given sequence. Write the names and draw the structures of A, B and C.

(3 marks)



## SECTION D

The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks each. Read the given passage carefully and answer the questions that follow.

- 29 Proteins are the most abundant biomolecules of the living system. They form a fundamental basis of the structure and functions of life and are required for the growth and maintenance of the body. Chemically, proteins are the polymers in which the monomeric units are the  $\alpha$ -amino acids. Amino acids contain an amino ( $-\text{NH}_2$ ) and carboxylic ( $-\text{COOH}$ ) functional groups. Nucleic acids are natural polymers that are produced by cells of living organisms. They are the chief information-carrying molecules of cells. Nucleic acids are made up of nucleotides, a monomer composed of a pentose sugar, a nitrogenous base, and a phosphate group. Vitamins are distinct in several ways from other biologically important compounds such as proteins, carbohydrates, and lipids. Vitamins generally cannot be synthesized in amounts sufficient to meet bodily needs and therefore must be obtained from the diet or from some synthetic source. (1+1+2= 4 marks)

- Give two structural differences between DNA and RNA.
- What structural change will occur when a native protein is subjected to change in pH?
- Account for the following:
  - There are five  $-\text{OH}$  groups in glucose.
  - Vitamin C cannot be stored in our body.

OR

- $\alpha$ -amino acids have relatively higher melting points than the corresponding halo acids. Explain giving the required structure.

- 30 Chemical kinetics is the study of the rates of chemical reactions, the factors that affect these rates, and the reaction mechanisms by which reactions occur. Reaction rates vary greatly – some are very fast (burning) and some are very slow (disintegration of a plastic bottle in sunlight). The rate of a reaction, which may also be called its velocity or speed, can be defined with relation to the concentration of any of the reacting substances, or to that of any product of the reaction. If the species chosen is a reactant which has a concentration  $c$  at time  $t$  the rate is  $-dc/dt$ , while the rate with reference to a product having a concentration  $x$  at time  $t$  is  $dx/dt$ . Any concentration units may be used for expressing the rate; thus, if moles per litre are employed for concentration and seconds for the time, the units for the rate are  $\text{moles L}^{-1}\text{sec}^{-1}$ . The order of a reaction concerns the dependence of the rate upon the concentrations of reacting substances; thus, if the rate is found experimentally to be proportional to the  $\alpha^{\text{th}}$  power of the concentration of one of the reactants A, to the  $\beta^{\text{th}}$  power of the concentration of a second reactant B, and so forth, via.,  $\text{rate} = k C_A^\alpha C_B^\beta$  -----(1)

the over-all order of the reaction is simply

$$n = \alpha + \beta + \dots \text{ (2)}$$

Such a reaction is said to be of the  $\alpha^{\text{th}}$  order with respect to the substance A, the  $\beta^{\text{th}}$  order with respect to B and so on.

- State a condition under which a biomolecular reaction is kinetically first order reaction.
- Why does the rate of any reaction generally decrease during the course of the reaction?

- c. The half-life for radioactive decay of C-14 is 5730 years. An archaeological artifact containing wood had only 80% of the C-14 found in a living tree. Estimate the age of the sample. (Given:  $\log 1.25 = 0.0969$ )

OR

- c. A first-order reaction takes 69.3 min for 50% completion. What is the time needed for 80% of the reaction to get completed?  
(Given:  $\log 5 = 0.6990$ ,  $\log 8 = 0.9030$ ,  $\log 2 = 0.3010$ )

### SECTION E

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

- 31 Attempt **any five** of the following: (5x1= 5 marks)
- How is the following conversion carried out?  
Methyl magnesium bromide  $\rightarrow$  2-Methylpropan-2-ol
  - Ortho nitrophenol is more acidic than ortho methoxyphenol. Give reason.
  - Preparation of ethers by acid dehydration of secondary or tertiary alcohols is not a suitable method. Explain.
  - Suggest one chemical test to distinguish between methanol and ethanol.
  - Give reason for the higher boiling point of ethanol in comparison to methoxymethane.
  - Name the reagent used in the bromination of phenol to 2,4,6-tribromophenol.
  - Write the equation of the reaction of hydrogen iodide with methoxybenzene.
- 32 a. i. Molar conductivity of substance "A" is  $5.9 \times 10^3$  S/m and "B" is  $1 \times 10^{-16}$  S/m. Which of the two is most likely to be copper metal and why? (3+2 = 5 marks)
- ii. What is the quantity of electricity in Coulombs required to produce 4.8 g of Mg from molten  $MgCl_2$ ? How much Ca will be produced if the same amount of electricity was passed through molten  $CaCl_2$ ? (Atomic mass of Mg = 24 u, atomic mass of Ca = 40 u).
- b. Calculate the degree of dissociation ( $\alpha$ ) of acetic acid if its molar conductivity ( $\Lambda_m$ ) is  $39.05 \text{ Scm}^2 \text{ mol}^{-1}$ .  
Given:  $\Lambda^0(H^+) = 349.6 \text{ Scm}^2 \text{ mol}^{-1}$  and  $\Lambda^0(CH_3COO^-) = 40.9 \text{ Scm}^2 \text{ mol}^{-1}$ .

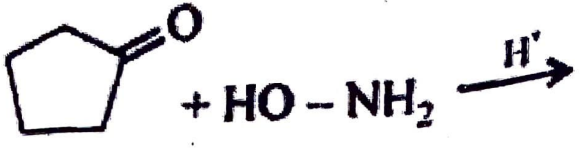
OR

- Three electrolytic cells A, B and C containing solutions of  $ZnSO_4$ ,  $AgNO_3$  and  $CuSO_4$  respectively are connected in series. A steady current of 1.5 amperes was passed through them until 1.45g of Ag deposited at the cathode of cell B. How long did the current flow? What mass of Cu and Zn were deposited?  
(Molar mass: Cu=63.5 g/mole, Zn=65.3 g/mole).
- i. Why is alternating current used for measuring resistance of an electrolytic solution?  
ii. Represent the cell in which the following reaction takes place.  
 $2Al(s) + 3Cd^{2+}(0.1M) \rightarrow 3Cd(s) + 2Al^{3+}(0.01M)$

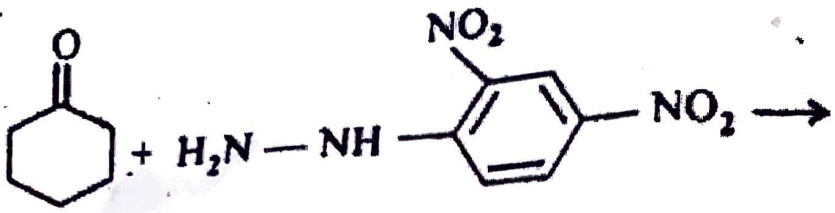


33 a. Draw the structure of the main product in each of the following reactions:

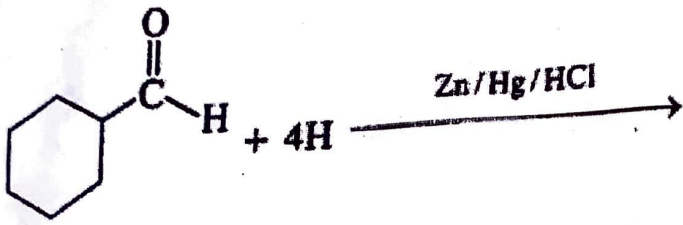
i.



ii.



iii.



b. Arrange the following carbonyl compounds in increasing order of their reactivity in nucleophilic addition reactions:

- i. Ethanal, propanal, propanone, butanone
- ii. Benzaldehyde, p-tolualdehyde, p-nitrobenzaldehyde, acetophenone

OR

a. An organic compound with the molecular formula  $\text{C}_9\text{H}_{10}\text{O}$  forms 2,4-DNP derivative, reduces Tollen's reagent, and undergoes Cannizzaro reaction. On vigorous oxidation, it gives 1,2-benzenedicarboxylic acid. Identify the compound. Give the equations involved.

b. Which acid from each of the following pairs would you expect to be a stronger acid and why?

- i.  $\text{CH}_2\text{FCOOH}$  or  $\text{CH}_2\text{ClCOOH}$
- ii.  $\text{CH}_2\text{FCH}_2\text{CH}_2\text{COOH}$  or  $\text{CH}_3\text{CHFCH}_2\text{COOH}$

ALL THE BEST