

CLASS XII
MID TERM 2023-24
CHEMISTRY
SET C1

Time allowed : 3 hours

Max. Marks: 70

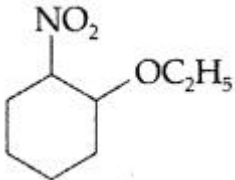
General Instructions:

- i) The question paper has 31 questions in all and all questions are compulsory.
- ii) Questions 1 to 12 are MCQs and carry 1 mark each.
- iii) Questions 13 to 16 are assertion reasoning questions and carry 1 mark each.
- iv) Questions 17 to 21 carry 2 marks each.
- v) Questions 22 to 28 carry 3 marks each.
- vi) Questions 29 and 30 are paragraph based question and carry 4 marks each.
- vii) Questions 31 to 33 carry 5 marks each

Q1	<p>Blood cells are isotonic with 0.9% sodium chloride solution, what happens if we place blood cells in a solution containing 1.2% NaCl solution?</p> <ol style="list-style-type: none"> a) Cells swells. b) Cells shrinks. c) Cells burst d) No change 	1
Q2	<p>What is the correct increasing order of their reactivity in nucleophilic addition reactions?</p> <ol style="list-style-type: none"> a) Benzaldehyde < <i>p</i>-Tolualdehyde < <i>p</i>-Nitrobenzaldehyde < Acetophenone. b) <i>p</i>-tolualdehyde < Benzaldehyde < <i>p</i>-Nitrobenzaldehyde < Acetophenone c) Acetophenone < <i>p</i>-tolualdehyde < Benzaldehyde < <i>p</i>-Nitrobenzaldehyde d) <i>p</i>-Nitrobenzaldehyde < Benzaldehyde < <i>p</i>-tolualdehyde < Acetophenone 	1
Q3	<p>In the following compounds:</p> <div style="text-align: center;"> <p style="text-align: center;"> I II III IV </p> </div> <p>The order of acidity is :</p> <ol style="list-style-type: none"> (a) III > IV > I > II (b) I > IV > III > II 	1

	(c) $\text{II} > \text{I} > \text{III} > \text{IV}$ (d) $\text{IV} > \text{III} > \text{I} > \text{II}$	
Q4	What happens to metallic conductivity, on increase of temperature? a) Decreases b) Increases c) No change d) First decreases than increases	1
Q5	Which of the following cannot be made by using Williamson Synthesis: (a) Methoxybenzene (b) Benzyl p-nitrophenyl ether (c) tert. butyl methyl ether (d) Dtert. butyl ether	1
Q6	Which of the following is major product of following reaction? $\text{CH}_3\text{CH}=\text{CH}_2 + \text{HBr} \xrightarrow{\text{peroxide}}$ a) 2-Bromo propene b) 2-Bromo propane c) 1-Bromo propene d) 1-Bromo propane	1
Q7	What is the common name of the most basic aromatic amine? a) Benzenamine b) Benzylamine c) Aniline d) Aminobenzene	1
Q8	For a spontaneous reaction, Gibbs free energy, equilibrium constant K and E°_{cell} will be respectively: (a) -ve, > 1 , +ve (b) +ve, > 1 -ve (c) -ve, < 1 , -ve (d) -ve, > 1 , -ve	1
Q9	Which of the following reactions is used to prepare salicylic acid? (a) Kolbe's reaction (b) Etard reaction (c) Reimer-Tiemann reaction (d) Stephen's reduction	1
Q10	Which of the following is not true about amino acids? (a) They are constituents of all proteins (b) Alanine having one amino and one carboxylic group (c) Most naturally occurring amino acids have D-configuration	1

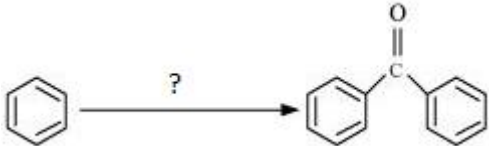
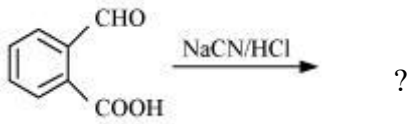
	(d) Glycine is the only naturally occurring amino acid which is optically inactive.	
Q11	For which of the following is the Hinsberg approach used? a) Preparation of primary amines b) Separation of amine mixtures c) Preparation of tertiary amines d) Preparation of secondary amines	1
Q12	Glucose on oxidation with $\text{Br}_2(\text{aq})$ gives: (a) Gluconic acid (b) Tartaric acid (c) Saccharic acid (d) Meso-oxalic acid	1
Q13	Direction(Q13 to Q16): In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below. (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. Assertion : It is difficult to replace chlorine by $-\text{OH}$ in chlorobenzene in comparison to that in chloroethane. Reason : Chlorine-carbon ($\text{C}-\text{Cl}$) bond in chloroethane has a partial double bond character due to resonance.	1
Q14	Assertion (A): For measuring resistance of an ionic solution an AC source is used. Reason (R): Concentration of ionic solution will change if DC source is used.	1
Q15	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. Reason (R): FeCl_2 formed gets hydrolysed to release HCl during the reaction.	1
Q16	Assertion (A): Mercury cell does not give steady potential. Reason (R): In the cell reaction, ions are not involved in solution.	1
Q17	Amino acids behave like salts rather than simple amines or carboxylic acids. Explain with the help of structures.	2
Q18	Draw the structure of (i) Cyclopropanone oxime (ii) semicarbazone of cyclobutanone derivative.	2
Q19	Account for the following: – i) CaCl_2 is used to clear snow from roads in hill stations.	2

	ii) Aquatic species are more comfortable in cold water than in warm water. OR Give reason for the following:– i) Ethylene glycol is used as antifreeze solution in radiators of vehicles. ii) The freezing point depression of 0.01 m NaCl is nearly twice that of 0.01 m glucose solution.	
Q20	Why is NH ₂ group of aniline acetylated before carrying out nitration?	2
Q21	What type of a battery is lead storage battery? Write the anode, cathode and overall reaction occurring in the operation of a lead storage battery.	2
Q22	Write the mechanism of acid-catalysed dehydration of ethanol to yield ethene.	3
Q23	i) State Faraday's first law of Electrolysis ii) Calculate the equilibrium constant for the following reaction at 298 K: $\text{Cu (s)} + \text{Cl}_2 \text{ (g)} \rightarrow \text{CuCl}_2 \text{ (aq)}$ $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}; E^\circ \text{Cu}^{2+} \text{Cu} = 0.34\text{V}; E^\circ(1/2\text{Cl}_2 \text{Cl}^-) = 1.36\text{V}; (\text{Antilog } 0.5177 = 3.294)$ OR i) State Kohlrausch's law. ii) The molar conductivity of 0.025 molL ⁻¹ methanoic acid is 46.1 S cm ² mol ⁻¹ . Calculate its degree of dissociation. Given $\lambda^0(\text{H}^+) = 349.6 \text{ S cm}^2 \text{ mol}^{-1}$ and $\lambda^0(\text{HCOO}^-) = 54.6 \text{ S cm}^2 \text{ mol}^{-1}$	3
Q24	A ketone A which undergoes haloform reaction gives compound B on reduction. B on heating with sulphuric acid gives compound C, which forms mono-ozonide D, that on hydrolysis in presence of zinc dust gives only acetaldehyde. Write the structures and IUPAC names of A, B, C. Also, write down the reactions involved.	3
Q25	a) How would you obtain the following : (i) 2-methylpentan-2-ol from 2-methyl-1-pentene (ii) Acetophenone from phenol (b) Write IUPAC name of the following : 	2+1
Q26	(i) Account for the following: (a) Aniline does not undergo Friedel-Crafts reaction. (b) Diazonium salts of aromatic amines are more stable than those of aliphatic amines. (ii) A primary amine, RNH ₂ can be reacted with CH ₃ -X to get secondary	2+1

	amine, RNHCH_3 but the only disadvantage is that 3° amine and quaternary ammonium salts are also obtained as side products. Can you suggest a method where RNH_2 forms only 2° amine?	
Q27	What happens when (i) Chlorobenzene is treated with $\text{Cl}_2/\text{FeCl}_3$, (ii) Ethyl chloride is treated with AgNO_2 , (iii) 2-bromopentane is treated with alcoholic KOH ? Write the chemical equations in support of your answer.	3
Q28	A 10% solution (by mass) of sucrose in water has a freezing point of 269.15°K . Calculate the freezing point of 10% glucose in water if the freezing point of pure water is 273.15°K . Given : (Molar mass of sucrose = 342 g mol^{-1}) (Molar mass of glucose = 180 g mol^{-1})	3
Q29	Read the passage given below and answer the following questions: Van't Hoff Factor and Abnormal mass The Van't Hoff factor offers insight on the effect of solutes on the colligative properties of solutions. It is denoted by the symbol 'i'. The Van't Hoff factor can be defined as the ratio of the concentration of particles formed when a substance is dissolved to the concentration of the substance by mass. The extent to which a substance associates or dissociates in a solution is described by the Van't Hoff factor. For example, when a non-electrolytic substance is dissolved in water, the value of i is generally 1. However, when an ionic compound forms a solution in water, the value of i is equal to the total number of ions present in one formula unit of the substance. For example, the Van't Hoff factor of CaCl_2 is ideally 3, since it dissociates into one Ca^{2+} ion and two Cl^- ions. However, some of these ions associate with each other in the solution, leading to a decrease in the total number of particles in the solution. This factor is named after the Dutch physical chemist Jacobus Henricus Van't Hoff, who won the first Nobel Prize in chemistry. It is important to note that the measured value of the Van't Hoff factor for electrolytic solutions is generally lower than the predicted value (due to the pairing of ions). The greater the charge on the ions, the greater the deviation. In the following questions (i-iv), Choose the correct answer out of the following choices: (i) The value of van't Hoff factor.s for KCl , NaCl and K_2SO_4 , respectively, are: (a) 2, 2 and 2 (b) 2, 2 and 3 (c) 1, 1, and 2	4

	<p>(d) 1, 1 and 1</p> <p>(ii) We have three aqueous solutions of NaCl labelled as 'A', 'B' and 'C' with concentrations 0.1 M, 0.01 M and 0.001 M, respectively. The value of van't Hoff factor for these solutions will be in the order:</p> <p>(a) $i_A > i_B > i_C$</p> <p>(b) $i_A < i_B < i_C$</p> <p>(c) $i_A < i_B > i_C$</p> <p>(d) $i_A = i_B = i_C$</p> <p>(iii) The van't Hoff factor i, for a compound that undergoes dissociation and association in a solvent, respectively:</p> <p>(a) Less than one and less than one</p> <p>(b) Greater than one and less than one</p> <p>(c) Greater than one and greater than one</p> <p>(d) Lessr than one and greater than one</p> <p>(iv) The depression in freezing point of water observed for the same amount of acetic acid, trichloroacetic acid and trifluoroacetic acid decreases in the order:</p> <p>(a) Trifluoroactic acid > trichloroacetic acid > acetic acid</p> <p>(b) Acetic acid > trichloroacetic acid > trifluoroacetic acid</p> <p>(c) Trichloroacetic acid > trifluoroacetic acid > acetic acid</p> <p>(d) Acetic acid > trifluoroacetic acid > trichloroacetic acid</p>	
Q30	<p>Read the passage given below and answer the following questions:</p> <p>Glucose is known as dextrose because it occurs in nature as the optically active dextrorotatory isomer. It is essential constituent of human blood. The blood normally contains 65 to 110 mg of glucose per 100 mL (hence named Blood sugar). The level may be much higher in diabetic persons. The urine of diabetic persons also contain considerable amount of glucose. In combined form, it occurs in cane sugar and polysaccharides such as starch and cellulose.</p> <p>Glucose has an aldehyde group (-CHO), one primary alcoholic group (-CH₂OH) and four secondary alcoholic groups (-CHOH) in their structure. Due to the presence five hydroxyl groups (-OH), glucose undergoes acetylation. Glucose also undergoes oxidation with mild oxidising agents like bromine water as well as with strong oxidising agents like nitric acid. Since glucose is readily oxidised, it acts as a strong reducing agent and reduces Tollen's reagent and Fehling solution. Glucose exists in two crystalline forms: α -D-glucose and β -Dglucose. If either of the two forms is</p>	4

	<p>dissolved in water and allowed to stand, the specific rotation of the solution changes gradually, until a constant value is obtained. This change is called mutarotation.</p> <p>In the following questions (i-iv), a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.</p> <p>(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.</p> <p>(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.</p> <p>(c) Assertion is correct statement but reason is wrong statement.</p> <p>(d) Assertion is wrong statement but reason is correct statement.</p> <p>(i) Assertion: A diabetic person carries a packet of glucose with him always. Reason: Glucose increases the blood sugar level almost instantaneously.</p> <p>(ii) Assertion: On oxidation with nitric acid, glucose as well as gluconic acid both yield saccharic acid. Reason : The pentaacetate of glucose does not react with hydroxylamine indicating the absence of free -CHO group.</p> <p>(iii) Assertion: Glucose reacts with acetyl chloride to form pentaacetyl glucose. Reason: The formation of pentaacetyl derivative confirms the presence of five -OH groups in glucose.</p> <p>(iv) Assertion: Glucose gives positive test with Schiff's base Reason: Glucose is a monosaccharide.</p>	
Q31	<p>(i) Two half-reactions of an electrochemical cell are given below : $\text{MnO}_4^- (\text{aq}) + 8\text{H}^+ (\text{aq}) + 5\text{e}^- \rightarrow \text{Mn}^{2+} (\text{aq}) + 4\text{H}_2\text{O} (\text{l}), E^\circ = 1.51 \text{ V}$ $\text{Sn}^{2+} (\text{aq}) \rightarrow \text{Sn}^{4+} (\text{aq}) + 2\text{e}^-, E^\circ = + 0.15 \text{ V}.$ Construct the redox equation from the standard potential of the cell and predict if the reaction is reactant favoured or product favoured.</p> <p>(ii) Given that the standard electrode potentials (E°) of metals are : $\text{K}^+/\text{K} = -2.93 \text{ V}, \text{Ag}^+/\text{Ag} = 0.80 \text{ V}, \text{Cu}^{2+}/\text{Cu} = 0.34 \text{ V},$ $\text{Mg}^{2+}/\text{Mg} = -2.37 \text{ V}, \text{Cr}^{3+}/\text{Cr} = -0.74 \text{ V}, \text{Fe}^{2+}/\text{Fe} = -0.44 \text{ V}.$ Arrange these metals in increasing order of their reducing power. Justify your answer.</p> <p>(iii) What is overpotential?</p>	2+2+1

	<p style="text-align: center;">OR</p> <p>(i) How do conductivity and molar conductivity for the solution vary when the concentration of electrolyte in the solution decreases? Explain with the help of graph.</p> <p>(ii) How much electricity is required in coulomb for the oxidation of</p> <ol style="list-style-type: none"> 1 mol of H_2O to O_2. 1 mol of FeO to Fe_2O_3. <p>(iii) Predict the products of electrolysis of a dilute solution of H_2SO_4 with platinum electrodes.</p>	
Q32	<p>i) Give chemical tests to distinguish between the following pairs of compounds:</p> <ol style="list-style-type: none"> Benzoic acid and Ethyl benzoate Benzaldehyde and Acetophenone <p>ii) Complete each synthesis by giving missing reagent or products:</p> <p>a)</p> <div style="text-align: center;">  </div> <p>b)</p> <div style="text-align: center;"> $\text{C}_6\text{H}_5\text{CHO} \xrightarrow{\text{H}_2\text{NCONHNH}_2}$ </div> <p>c)</p> <div style="text-align: center;">  </div> <p style="text-align: center;">OR</p> <p>i) Write short note on:</p> <ol style="list-style-type: none"> Cross Aldol condensation Decarboxylation <p>ii) Arrange the following compounds in increasing order of their property as indicated:</p> <ol style="list-style-type: none"> Acetaldehyde, Acetone, Di-tert-butyl ketone, Methyl tert-butyl ketone (reactivity towards HCN) $\text{CH}_3\text{CH}_2\text{CH}(\text{Br})\text{COOH}$, $\text{CH}_3\text{CH}(\text{Br})\text{CH}_2\text{COOH}$, $(\text{CH}_3)_2\text{CHCOOH}$, $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$ (acid strength) 	2+3

	c) Benzoic acid, 4-Nitrobenzoic acid, 3,4-Dinitrobenzoic acid, 4-Methoxybenzoic acid (acid strength)	
Q33	<p>(i) Write structures of compounds A, B and C in each of the following reactions:</p> $\text{C}_2\text{H}_5\text{Br} \xrightarrow{\text{Mg/dry ether}} \text{A} \xrightarrow[\text{(b) H}_3\text{O}^+]{\text{(a) CO}_2\text{ (g)}} \text{B} \xrightarrow{\text{PCl}_5} \text{C}$ <p>(ii) Give reasons :</p> <p>(a) n-Butyl bromide has higher boiling point than iso-butyl bromide.</p> <p>(b) The presence of nitro group (-NO₂) at o/p positions increases the reactivity of haloarenes towards nucleophilic substitution reactions.</p>	3+2