

**CLASS XII**  
**MID TERM 2023-24**  
**CHEMISTRY**  
**SET C2**

Time allowed : 3 hours

Max. Marks: 70

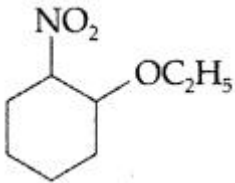
**General Instructions:**

- 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	Which of the following condition is not satisfied by an ideal solution? (a) $\Delta H_{\text{mixing}} = 0$ (b) $\Delta V_{\text{mixing}} = 0$ (c) Raoult's Law is obeyed (d) Formation of an azeotropic mixture	1
Q2	What is the correct increasing order of their reactivity in nucleophilic addition reactions?  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	Phenol reacts with Br <sub>2</sub> in CS <sub>2</sub> at low temperature to give (a) o-Bromophenol (b) o-and p-bromophenols (c) p-Bromophenol (d) 2, 4, 6-Tribromophenol	1
Q4	What happens to metallic conductivity, on increase of temperature? a) Decreases b) Increases c) No change d) First decreases than increases	1

Q5	For a spontaneous reaction, Gibbs free energy, equilibrium constant K and $E^0_{\text{cell}}$ will be respectively: (a) – ve , > 1, + ve (b) + ve, > 1 – ve (c) -ve, < 1, -ve (d) -ve, > 1, -ve	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	Which of the following is the IUPAC name of the compound in which an ethyl group replaces one of the hydrogens of ammonia? a) Ethanamine b) Aminoethane c) Ethylamine d) Ethane amine	1
Q8	Which of the following cannot be made by using Williamson Synthesis: (a) Methoxybenzene (b) Benzyl p-nitrophenyl ether (c) tert. butyl methyl ether (d) (d) Ditert. butyl ether	1
Q9	Which of the following reactions is used to prepare salicylaldehyde? (a) Kolbe's reaction (b) Etard reaction (c) Reimer- Tiemann reaction (d) Stephen's reduction	1
Q10	Which base is present in RNA, but not in DNA. (a) Uracil (b) Cytosine (c) Guanine (d) Thymine	1
Q11	By reacting with which of the following, primary amines can be separated from secondary and tertiary amines? a) Chloroform alone b) Methyl iodide c) Chloroform and alcoholic KOH d) Zinc dust	1
Q12	Denaturation of protein leads to loss of its biological activity by (a) formation of amino acids (b) loss of primary structure (c) loss of both primary and secondary structure	

	(d) loss of both secondary and tertiary structures	
Q13	<p><b>Direction(Q13 to Q16):</b> 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.</p> <p>(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.</p> <p>Assertion : It is difficult to replace chlorine by –OH in chlorobenzene in comparison to that in chloroethane.  Reason : Chlorine-carbon (C—Cl) bond in chloroethane has a partial double bond character due to resonance.</p>	1
Q14	<p>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.</p>	1
Q15	<p>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<sub>2</sub> formed gets hydrolysed to release HCl during the reaction.</p>	1
Q16	<p>Assertion (A): Mercury cell does not give steady potential.  Reason (R): In the cell reaction, ions are not involved in solution.</p>	1
Q17	Why is NH <sub>2</sub> group of aniline acetylated before carrying out nitration?	2
Q18	<p>Predict the products formed in the following cases:</p> <p>(i) Pentan-3-one reacts with PhMgBr and is then hydrolysed.  (ii) Pentan-3-one reacts with Zn amalgam and dilute hydrochloric acid</p>	2
Q19	<p>Account for the following: –</p> <p>i) CaCl<sub>2</sub> is used to clear snow from roads in hill stations.  ii) Aquatic species are more comfortable in cold water than in warm water.</p> <p style="text-align: center;"><b>OR</b></p> <p>Give reason for the following:–</p> <p>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.</p>	2
Q20	Amino acids behave like salts rather than simple amines or carboxylic acids. Explain with the help of structures.	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 hydration of ethene to yield ethanol.	3
Q23	<p>i) State Faraday's first law of Electrolysis  ii) Calculate the equilibrium constant for the following reaction at 298 K:</p>	3

	<p><math>\text{Cu (s)} + \text{Cl}_2 \text{ (g)} \rightarrow \text{CuCl}_2 \text{ (aq)}</math>  <math>R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}</math>; <math>E^\circ \text{Cu}^{2+} \text{Cu} = 0.34\text{V}</math>; <math>E^\circ(1/2\text{Cl}_2   \text{Cl}^-) = 1.36\text{V}</math>; (Antilog <math>0.5177 = 3.294</math>)</p> <p style="text-align: center;"><b>OR</b></p> <p>i) State Kohlrausch's law.  ii) The molar conductivity of <math>0.025 \text{ mol L}^{-1}</math> methanoic acid is <math>46.1 \text{ S cm}^2 \text{ mol}^{-1}</math>. Calculate its degree of dissociation. Given <math>\lambda^\circ(\text{H}^+) = 349.6 \text{ S cm}^2 \text{ mol}^{-1}</math> and <math>\lambda^\circ(\text{HCOO}^-) = 54.6 \text{ S cm}^2 \text{ mol}^{-1}</math></p>	
Q24	<p>A 10% solution (by mass) of sucrose in water has a freezing point of <math>269.15 \text{ K}</math>. Calculate the freezing point of 10% glucose in water if the freezing point of pure water is <math>273.15 \text{ K}</math>.</p> <p>Given : (Molar mass of sucrose = <math>342 \text{ g mol}^{-1}</math>)  (Molar mass of glucose = <math>180 \text{ g mol}^{-1}</math>)</p>	3
Q25	<p>a) How would you obtain the following :</p> <p>(i) 2-methylpentan-2-ol from 2-methyl-1-pentene  (ii) Acetophenone from phenol  (b) Write IUPAC name of the following :</p> <div style="text-align: center;">  </div>	2+1
Q26	<p>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.</p>	2+1
Q27	<p>What happens when</p> <p>(i) Chlorobenzene is treated with <math>\text{Cl}_2/\text{FeCl}_3</math>,  (ii) Ethyl chloride is treated with <math>\text{AgNO}_2</math>,  (iii) 2-bromopentane is treated with alcoholic <math>\text{KOH}</math>?  Write the chemical equations in support of your answer.</p>	3
Q28	<p>(i) Account for the following:</p> <p>(a) Aniline does not undergo Friedel-Crafts reaction.  (b) Diazonium salts of aromatic amines are more stable than those of aliphatic amines.</p> <p>(ii) A primary amine, <math>\text{RNH}_2</math> can be reacted with <math>\text{CH}_3\text{-X}</math> to get secondary amine, <math>\text{RNHCH}_3</math> but the only disadvantage is that <math>3^\circ</math> amine and quaternary ammonium salts are also obtained as side products. Can you suggest a method where <math>\text{RNH}_2</math> forms only <math>2^\circ</math> amine?</p>	3

Q29	<p><b>Read the passage given below and answer the following questions:</b></p>	4
	<p><b>Van't Hoff Factor and Abnormal mass</b></p> <p>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.</p> <p>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.</p> <p>For example, the Van't Hoff factor of <math>\text{CaCl}_2</math> is ideally 3, since it dissociates into one <math>\text{Ca}^{2+}</math> ion and two <math>\text{Cl}^-</math> 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.</p> <p>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.</p> <p><b>In the following questions (i-iv), Choose the correct answer out of the following choices:</b></p> <p>(i) The value of van't Hoff factor.s for KCl, NaCl and <math>\text{K}_2\text{SO}_4</math>, respectively, are:</p> <p>(a) 2, 2 and 2</p> <p>(b) 2, 2 and 3</p> <p>(c) 1, 1, and 2</p> <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) <math>i_A &gt; i_B &gt; i_C</math></p> <p>(b) <math>i_A &lt; i_B &lt; i_C</math></p> <p>(c) <math>i_A &lt; i_B &gt; i_C</math></p> <p>(d) <math>i_A = i_B = i_C</math></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) Less 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) Trifluoroacetic acid &gt; trichloroacetic acid &gt; acetic acid</p> <p>(b) Acetic acid &gt; trichloroacetic acid &gt; trifluoroacetic acid</p> <p>(c) Trichloroacetic acid &gt; trifluoroacetic acid &gt; acetic acid</p> <p>(d) Acetic acid &gt; trifluoroacetic acid &gt; trichloroacetic acid</p>	
Q30	<p><b>Read the passage given below and answer the following questions:</b></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 (-CH<sub>2</sub>OH) 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: <math>\alpha</math>-D-glucose and <math>\beta</math>-D-glucose. If either of the two forms is 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><b>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.</b></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>	4

	<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) 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 (-NO<sub>2</sub>) at o/p positions increases the reactivity of haloarenes towards nucleophilic substitution reactions.</p>	3+2
Q32	<p>i) Give chemical tests to distinguish between the following pairs of compounds:</p> <p>a) Ethanal and Propanal</p> <p>b) Acetophenone and Benzophenone</p> <p>ii) Complete each synthesis by giving missing reagent or products:</p> <p>a)</p> $\text{H}_3\text{C}-\text{C}\equiv\text{C}-\text{H} \xrightarrow{\text{Hg}^{2+}, \text{H}_2\text{SO}_4} \text{_____}$ <p>b)</p> $\text{R}-\text{CH}=\text{CH}-\text{CHO} + \text{NH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}-\text{NH}_2 \xrightarrow{\text{H}^+} \text{_____}$ <p>c)</p> $\text{C}_6\text{H}_4(\text{CHO})(\text{COOH}) \xrightarrow{\text{NaCN/HCl}} ?$ <p style="text-align: center;"><b>OR</b></p> <p>i) Write short note on:</p> <p>a) Cannizzaro reaction</p> <p>b) Hell Volhard Zeliensky reaction</p>	2+3

	<p>ii) Arrange the following compounds in increasing order of their property as indicated:</p> <p>a) Acetaldehyde, Acetone, Di-tert-butyl ketone, Methyl tert-butyl ketone (reactivity towards HCN)</p> <p>b) <math>\text{CH}_3\text{CH}_2\text{CH}(\text{Br})\text{COOH}</math>, <math>\text{CH}_3\text{CH}(\text{Br})\text{CH}_2\text{COOH}</math>, <math>(\text{CH}_3)_2\text{CHCOOH}</math>, <math>\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}</math> (acid strength)</p> <p>c) Benzoic acid, 4-Nitrobenzoic acid, 3,4-Dinitrobenzoic acid, 4-Methoxybenzoic acid (acid strength)</p>	
Q33	<p>(i) Two half-reactions of an electrochemical cell are given below :  <math>\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})</math>, <math>E^\circ = 1.51 \text{ V}</math>  <math>\text{Sn}^{2+} (\text{aq}) \rightarrow \text{Sn}^{4+} (\text{aq}) + 2\text{e}^-</math>, <math>E^\circ = + 0.15 \text{ V}</math>.            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 (<math>E^\circ</math>) of metals are :  <math>\text{K}^+/\text{K} = -2.93 \text{ V}</math>, <math>\text{Ag}^+/\text{Ag} = 0.80 \text{ V}</math>, <math>\text{Cu}^{2+}/\text{Cu} = 0.34 \text{ V}</math>,  <math>\text{Mg}^{2+}/\text{Mg} = -2.37 \text{ V}</math>, <math>\text{Cr}^{3+}/\text{Cr} = -0.74 \text{ V}</math>, <math>\text{Fe}^{2+}/\text{Fe} = -0.44 \text{ V}</math>.            Arrange these metals in increasing order of their reducing power. Justify your answer.</p> <p>(iii) What is overpotential?</p> <p style="text-align: center;"><b>OR</b></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            a) 1 mol of <math>\text{H}_2\text{O}</math> to <math>\text{O}_2</math>.            b) 1 mol of <math>\text{FeO}</math> to <math>\text{Fe}_2\text{O}_3</math>.</p> <p>(iii) Predict the products of electrolysis of a dilute solution of <math>\text{H}_2\text{SO}_4</math> with platinum electrodes.</p>	2+2+1