

NOTE:

- Please check that this question paper contains-8 printed pages.
- Please check that this question paper contains 33 questions.
- Please write down the serial number of the question in the answer-book before attempting it.
- 15 minutes time has been allotted to read the question paper. The students will read the question paper only and will not write any answer on the answer-book during this period.

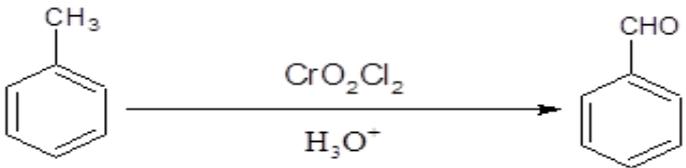
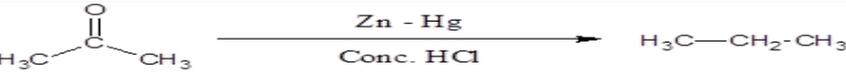
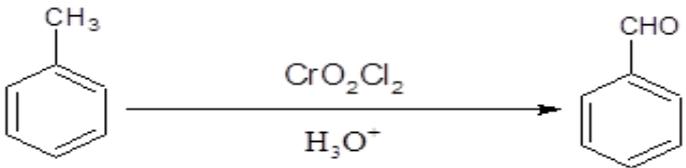
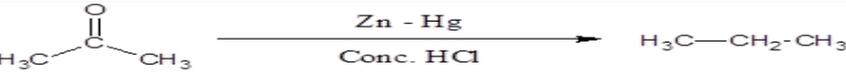
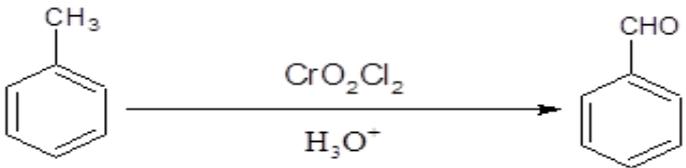
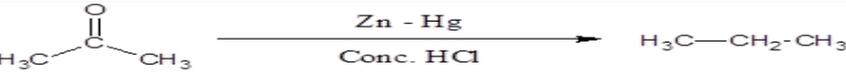
CHEMISTRY (043)**Time allowed: 3 hours****Maximum Marks: 70****GENERAL INSTRUCTIONS:**

Read the following instructions carefully.

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

Section-A

Question 1 to 16 are multiple choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions.

1.	Match the Column:	1										
	<table border="1"> <thead> <tr> <th>(COLUMN I) EXAMPLE</th> <th>(COLUMN II) REACTION</th> </tr> </thead> <tbody> <tr> <td>(A) </td> <td>(1) ETARD REACTION</td> </tr> <tr> <td>(B) $\text{H}_3\text{C}-\text{CN} + \text{SnCl}_2 + \text{HCl} \longrightarrow \text{H}_3\text{C}-\text{CH}=\text{NH} \xrightarrow{\text{H}_3\text{O}^+} \text{H}_3\text{C}-\text{CHO}$</td> <td>(2)STEPHEN'S REACTION</td> </tr> <tr> <td>(C) $\text{H}_3\text{C}-\text{COOH} \xrightarrow[\text{ii) H}_2\text{O}]{\text{i) Cl}_2 / \text{Red Phosphorus}} \text{H}_2\text{C}(\text{Cl})-\text{COOH}$</td> <td>(3)Hell-Volhard-Zelinsky (HVZ)</td> </tr> <tr> <td>(D) </td> <td>(4)Clemmensen Reduction</td> </tr> </tbody> </table>	(COLUMN I) EXAMPLE	(COLUMN II) REACTION	(A) 	(1) ETARD REACTION	(B) $\text{H}_3\text{C}-\text{CN} + \text{SnCl}_2 + \text{HCl} \longrightarrow \text{H}_3\text{C}-\text{CH}=\text{NH} \xrightarrow{\text{H}_3\text{O}^+} \text{H}_3\text{C}-\text{CHO}$	(2)STEPHEN'S REACTION	(C) $\text{H}_3\text{C}-\text{COOH} \xrightarrow[\text{ii) H}_2\text{O}]{\text{i) Cl}_2 / \text{Red Phosphorus}} \text{H}_2\text{C}(\text{Cl})-\text{COOH}$	(3)Hell-Volhard-Zelinsky (HVZ)	(D) 	(4)Clemmensen Reduction	
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	<p>(a) A-1, B-2, C-3, D-4</p> <p>(b) A-4, B-1, C-2, D-3</p> <p>(c) A-2, B-3, C-4, D-1</p> <p>(d) A-3, B-4, C-1, D-2</p>	
2	<p>Which of the following belongs to the class of vinyl halides?</p> <p>(a) $\text{CH}_2=\text{CH}-\text{CHBr}-\text{CH}_3$</p> <p>(b) $\text{CH}_3-\text{C}(\text{Br})=\text{CH}_2$</p> <p>(c) $\text{HC}\equiv\text{C}-\text{Br}$</p> <p>(d) $\text{CH}_3-\text{CH}=\text{CH}-\text{CH}_2-\text{Br}$</p>	1
3	<p>Nickel combines with a uni-negative monodentate ligand Y^- to form a paramagnetic complex $[\text{NiY}_4]^{2-}$. The number of unpaired electrons in the nickel and geometry of this complex ion is, respectively-</p> <p>(a) One, square planar</p> <p>(b) two, square planar</p> <p>(c) One, tetrahedral</p> <p>(d) two, tetrahedral</p>	1
4	<p>The reagent which reacts with acetaldehyde but not benzaldehyde is</p> <p>(a) Fehling's solution</p> <p>(b) Sodium hydrogen sulphite</p> <p>(c) Phenyl hydrazine</p> <p>(d) Grignard reagent</p>	1
5	<p>Which of the following modes of expressing concentration is independent of temperature</p> <p>(i) Molarity (ii) Molality (iii) Mole fraction (iv) Volume percentage</p> <p>(a) only (ii)</p> <p>(b) (i) and (ii)</p> <p>(c) (ii) and (iii)</p> <p>(d) (ii) and (iv)</p>	1
6	<p>Reactivity order of halides for dehydrohalogenation is</p> <p>(a) $\text{R-F} > \text{R-Cl} > \text{R-Br} > \text{R-I}$</p> <p>(b) $\text{R-I} > \text{R-Br} > \text{R-Cl} > \text{R-F}$</p> <p>(c) $\text{R-I} > \text{R-Cl} > \text{R-Br} > \text{R-F}$</p> <p>(d) $\text{R-F} > \text{R-I} > \text{R-Br} > \text{R-Cl}$</p>	1

7.	In p-cresol, the -OH group is attached to the carbon that is: (a) sp^3 hybrid (b) sp^2 hybrid (c) sp hybrid (d) dsp^2 hybrid	1								
8	Which of the following vitamin of B group can be stored in our body? (a) Vitamin B ₁ (b) Vitamin B ₂ (c) Vitamin B ₆ (d) Vitamin B ₁₂	1								
9	Match the following: <table border="1" data-bbox="252 763 1326 1061"> <thead> <tr> <th>Name of Transition Metal</th> <th>Property</th> </tr> </thead> <tbody> <tr> <td>A) Scandium</td> <td>(i) Shows highest oxidation State</td> </tr> <tr> <td>B) Manganese</td> <td>(ii) Positive standard electrode potential</td> </tr> <tr> <td>C) Copper</td> <td>(iii) Does not show variable Oxidation state</td> </tr> </tbody> </table> Which of the following option is CORRECT: (a) A-ii, B-i, C-iii (b) A-ii, B-iii, C-i (c) A-iii, B-i, C-ii (d) A-i, B-ii, C-iii	Name of Transition Metal	Property	A) Scandium	(i) Shows highest oxidation State	B) Manganese	(ii) Positive standard electrode potential	C) Copper	(iii) Does not show variable Oxidation state	1
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10	The limiting molar conductivities Λ_m^o for NaCl, KBr and KCl are 126, 152 and 150 S cm ² mol ⁻¹ respectively. The Λ_m^o for NaBr is: (a) 128 S cm ² mol ⁻¹ (b) 176 S cm ² mol ⁻¹ (c) 278 S cm ² mol ⁻¹ (d) 302 S cm ² mol ⁻¹	1								
11	What is the IUPAC name of the ketone A, which undergoes iodoform reaction to give CH ₃ CH=C(CH ₃)COONa and yellow precipitate of CHI ₃ ?	1								

	<p>(a) 3-Methylpent-4-one</p> <p>(b) 3-Methylbut-2-en-3-one</p> <p>(c) 2,3-Dimethylethanone</p> <p>(d) 3-Methylpent-3-en-2-one</p>	
12	<p>Which one is most reactive towards SN^1 reaction?</p> <p>(a) $\text{C}_6\text{H}_5\text{CH}(\text{C}_6\text{H}_5)\text{Br}$</p> <p>(b) $\text{C}_6\text{H}_5\text{CH}(\text{CH}_3)\text{Br}$</p> <p>(c) $\text{C}_6\text{H}_5\text{CBr}(\text{CH}_3)$ (C_6H_5)</p> <p>(d) $\text{C}_6\text{H}_5\text{CH}_2\text{Br}$</p>	1
	<p>ASSERTION AND REASON:</p> <p>Answer the questions selecting the appropriate option given below: Q 13 to Q16</p> <p>a) Both A and R are true, and R is the correct explanation of</p> <p>b) Both A and R are true, and R is not the correct explanation of A.</p> <p>c) A is true but R is false.</p> <p>d) A is false but R is true</p>	
13	<p>Assertion(A): Hoffmann's bromamide reaction is used to prepare amines.</p> <p>Reason(R): Primary amines are always more basic than secondary amines</p>	1
14	<p>Assertion(A): Molar conductivity of an electrolyte increases with dilution</p> <p>Reason(R): Migration of Ions is independent of its counter ion.</p>	1
15	<p>Assertion (A): All naturally occurring α-amino acids except glycine are optically active.</p> <p>Reason (R): Most naturally occurring amino acids have L-configuration.</p>	1
16	<p>Assertion(A): NaCl or CaCl_2 is used to clear snow on roads in the hills.</p> <p>Reason (R): The salts depress the freezing point of water.</p>	1
17	<p>Attempt either option A or B:</p> <p>A. Answer the following:</p> <ol style="list-style-type: none"> Teacher asked a student to bring a boiled egg to class to understand the concept of osmosis. Next day teacher placed the egg in a solution containing more than 0.9% sodium chloride solution. What would have happened to that egg when it was placed for some time? When 50 mL of Ethyl bromide and 50 mL of Ethyl Iodide are mixed, predict whether the volume of the solution is equal to, greater than or less than 100 mL. Give reason to support your answer. <p style="text-align: center;">OR</p> <p>B. Answer the following:</p> <ol style="list-style-type: none"> Outer hard shells of two eggs are removed. One of the eggs is placed in saturated solution of sodium chloride and the other egg is placed in pure water. What change will be observed in both the eggs and why? What would be the value of van't Hoff factor for a dilute solution of K_2SO_4 in water. Assume that K_2SO_4 is completely ionised. 	2
18	<p>a) Imagine that you are studying the age of a dead biological sample in forensic lab. During the studies, you found that the sample decomposed by following first order kinetics. If 50% of the sample is decomposed in 120 minutes, how long will it take for</p>	2

	(i) pK_b of Aniline is more than that of Methylamine (ii) Ethylamine is soluble in water whereas aniline is not. (iii) Aniline does not give Friedel – Crafts reaction. Give a reason.	
27	What will happen when (i) Anisole reacts with chloromethane (ii) Phenol reacts with zinc dust (iii) Ethyl chloride reacts with sodium ethanoate	3
28	Complete the following reactions and balance the equations. (a) $MnO_2 + KOH + O_2 \rightarrow$ (b) $I^- + MnO_4^- + H^+ \rightarrow$ (c) $Cr_2O_7^{2-} + Sn^{2+} + H^+ \rightarrow$	3
29	Read the passage and answer the following questions: Kohlrausch's Law of Independent Migration of Ions Kohlrausch's enunciated a law, known as Kohlrausch's law. It states that: The equivalent conductance of an electrolyte at infinite dilution is equal to the sum of the equivalent conductance of the component ions. This law explains that at infinite dilution, where an electrolyte is completely dissociated and inter-ionic interactions are minimal, each ion moves independently and contributes a distinct amount to the total molar conductivity. Kohlrausch's Law is essential for calculating the limiting molar conductivity, degree of dissociation, and dissociation constant of weak electrolytes, as well as for determining the solubility of salts. It is based on the concept that at infinite dilution when dissociation is complete, each ion makes a definite contribution towards the equivalent conductance of the electrolyte. The law is beneficial in studying dilute liquids and electrolyte solutions, as it allows for calculating the behaviour of ions in such systems. From the study of the equivalent conductance of electrolytes at infinite dilution Kohlrausch's discovered an interesting relationship between conductivity and transport number. Q-i) What is molar conductivity and write its units? Q-ii) The conductivity of 0.20 M KCl solution at 298 K is 0.025 S cm^{-1} . Calculate its molar conductivity Q-iii) Which of the following solutions will have higher molar conductivity and why? 1 M CH_3COOH OR 0.01 M CH_3COOH OR Qiii) The molar conductivity at infinite dilution of $Al_2(SO_4)_3$ is $858 \text{ S cm}^2 \text{ mol}^{-1}$. Calculate the molar ionic conductivity of Al^{3+} ionic, given that $\lambda_m^\circ(SO_4^{2-}) = 160 \text{ S cm}^2 \text{ mol}^{-1}$	1+1+2=4
30	Read the passage and answer the following questions: VALENCE BOND THEORY (VBT) OF TRANSITION METAL COMPLEXES: Valence bond theory was given by Pauling and Slater in 1935. According to this theory: In coordination compounds, the ligands form covalent-coordinate bonds to the metal atom/	1+1+2=4

	<p>ion. The central metal atom/ ion provides vacant orbitals (s, p and /or d atomic orbitals) equal to its coordination number. These vacant orbitals hybridize and form the same number of new hybridized orbitals (atomic orbitals overlap) of equal energy. Ligands can donate at least one lone pair (in σ orbital) of electrons to the empty hybrid orbitals of the central metal atom/ ion. Each ligand with filled σ orbital then overlaps with the empty hybrid orbital of central metal atom/ ion.</p> <p>In view of the weaknesses of Valence Bond Theory (VBT), an alternative bonding model was applied to transition metal complexes. This is known as crystal field theory (CFT). In octahedral complexes with six ligands surrounding the metal atom/ion, the degeneracy of d-orbitals is disturbed due to repulsions between the ligands and d- orbitals. The repulsions between $d_{x^2-y^2}$ and d_{z^2} orbitals and the ligands are greater than d_{xy}, d_{yz} and d_{xz} orbitals and ligands. Thus, there is splitting of d- orbitals into two sets, i.e two orbitals of higher energy, e_g set and three orbitals of lower energy, t_{2g} set. The difference of energy between two sets of d-orbitals is called crystal field splitting energy and is represented by Δ_o. For any given metal cation, the magnitude of Δ_o depends upon the nature of the ligands. Some ligands produce strong field and hence splitting is large whereas some other ligands produce weak field and hence they result in small splitting of d- orbitals.</p> <p>Q-i On the basis of CFT, write the electronic configuration for d^4 ion if $\Delta_o > P$.</p> <p>Q-ii Predict the correct increasing order of Δ_o, for the complexes $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$, $[\text{Fe}(\text{CN})_4(\text{H}_2\text{O})_2]^{2-}$, $[\text{Fe}(\text{CN})_6]^{4-}$</p> <p>Q-iii Using VBT write the geometry and magnetic behaviour of $[\text{CoF}_6]^{3-}$</p>	
31	<p>Attempt either A or B only:</p> <p>(A) Answer the following questions</p> <p>(a) Write the reactions involved in the following:</p> <p>(i) Clemenson reduction (ii) Tollen's test</p> <p>(b) Give reason</p> <p>(i) Aldehydes are more reactive than ketones for nucleophilic addition reactions.</p> <p>(ii) The alpha hydrogen of aldehydes and ketones is acidic in nature.</p> <p>(iii) Carboxylic acids do not give reactions of carbonyl group.</p> <p style="text-align: center;">OR</p> <p>(B) Answer the following questions</p> <p>(a) Which acid in each of the following sets is a stronger acid?</p> <p>(i) $\text{F}_3\text{C}-\text{CH}_2-\text{COOH}$. OR $\text{F}_3\text{C}-\text{CH}_2-\text{CH}_2\text{COOH}$.</p> <p>(ii) $\text{CH}_3-\text{CH}_2-\text{COOH}$. OR $\text{CH}_3-\text{CH}(\text{OH})-\text{COOH}$.</p> <p>(b) Explain: (i) Rosenmund reaction (ii) Cannizzaro reaction (iii) Fehling's test</p>	2+3=5
32	<p>Attempt either A or B only:</p> <p>A) Answer the following questions:</p>	5X1=5

- i. What are the hydrolysis products of i) Maltose ii) Lactose?
- ii. What happens when glucose reacts with i) HI ii) Bromine water
- iii. Niya visits a physician as she is suffering from rickets and joint pain. Which fat-soluble vitamin should the physician prescribe to her?
- iv. Sunil put few drops of vinegar in milk. What change do you think he observed in the milk after some time? What is this phenomenon known as?
- v. Name the product of hydrolysis of sucrose. Is it a reducing sugar or a non-reducing sugar?

OR

(B) Answer the following questions:

- (i) Shalini was advised to take vitamin C regularly by her doctor due to gum bleed problem. Doctor told her that vitamin C cannot be stored in our body. Help her to find Why cannot vitamin C be stored in our body?
- (ii) Nikita when was reading a book of genetics, she found that DNA and RNA also differ in nitrogenous Base. Write the name of nitrogenous base present in DNA and RNA.
- (iii) What are essential and non-essential amino acids? Give one example of each type.
- (iv) Define the following terms (a) peptide linkage (b) denaturation of Protein.
- (v) What happens when D-glucose is treated with the following reagents?
(a) conc. HNO_3 (b) Acetic anhydride

33

Attempt either A or B only:

A) Answer the following questions:

- (i) The rate of a reaction triples when the temperature changes from 298 K to 318 K. Calculate the energy of activation of the reaction assuming that it does not change with temperature. (Given $R = 8.314 \text{ JK}^{-1}\text{mol}^{-1}$, $\log 3 = 0.4771$)
- (ii) For the reaction $A + B \rightarrow C$, you find that the rate $= k[A]^2$. Calculate order of the reaction and what does this imply about the mechanism of the reaction?

OR

(B)(i) For the reaction $A + B \rightarrow \text{Product}$, following data was obtained:

Experiment number	Initial concentration of [A] (mol L^{-1})	Initial concentration of [B] (mol L^{-1})	Initial Rate ($\text{mol L}^{-1} \text{ min}^{-1}$)
1	0.15	0.15	9.6×10^{-2}
2	0.30	0.15	3.84×10^{-1}
3	0.15	0.30	1.92×10^{-1}
4	0.30	0.30	7.68×10^{-1}

Calculate the following:

- (a) The overall order of the reaction (b) The rate law equation (c) The value of rate constant
- (ii) In a graph $\ln [\text{reactant}]$ was plotted vs. time, it gave a straight line, predict the order of the reaction also give the expression of its half-life and rate constant.

3+2=5