



## COMMON PRE-BOARD EXAMINATION 2022-23

### Subject: CHEMISTRY -043



Time: 3Hrs

Maximum Marks: 70

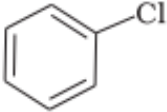
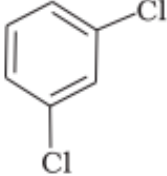
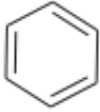
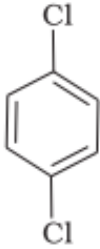
#### **General Instructions:**

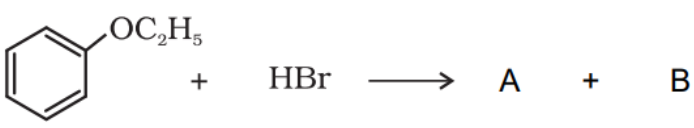
**Read the following instructions carefully.**

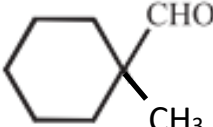
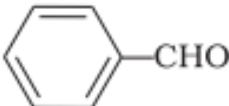
- a) There are 35 questions in this question paper with internal choice.
- b) SECTION A consists of 18 multiple-choice questions carrying 1 mark each.
- c) SECTION B consists of 7 very short answer questions carrying 2 marks each.
- d) SECTION C consists of 5 short answer questions carrying 3 marks each.
- 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	<p>CH<sub>3</sub>CH<sub>2</sub>OH can be converted into CH<sub>3</sub>CHO by _____.</p> <p>(i) catalytic hydrogenation (ii) treatment with LiAlH<sub>4</sub> (iii) treatment with pyridinium chlorochromate (iv) treatment with KMnO<sub>4</sub></p>	1
2	<p>Rate law for the reaction <math>A + 2B \rightarrow C</math> is found to be <math>\text{Rate} = k [A][B]</math></p> <p>Concentration of reactant 'B' is doubled, keeping the concentration of 'A' constant, the value of rate constant will be_____.</p> <p>(i) the same (ii) doubled (iii) quadrupled (iv) halved</p>	1

3	<p>Identify the compound 'Y' in the following reaction:</p> $\text{C}_6\text{H}_5\text{NH}_2 \xrightarrow[273-278\text{K}]{\text{NaNO}_2 + \text{HCl}} \text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^- \xrightarrow{\text{Cu}_2\text{Cl}_2} \text{Y} + \text{N}_2$ <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>(i) </p> <p>(iii) </p> </div> <div style="text-align: center;"> <p>(ii) </p> <p>(iv) </p> </div> </div>	1
4	<p><math>\text{KMnO}_4</math> is coloured due to:</p> <p>(i) d-d transitions</p> <p>(ii) charge transfer from ligand to metal</p> <p>(iii) unpaired electrons in d orbital of Mn</p> <p>(iv) charge transfer from metal to ligand</p>	1
5	<p><math>\Lambda_m^0(\text{NH}_4\text{OH})</math> is equal to _____.</p> <p>(i) <math>\Lambda_m^0(\text{NH}_4\text{OH}) + \Lambda_m^0(\text{NH}_4\text{Cl}) - \Lambda_m^0(\text{HCl})</math></p> <p>(ii) <math>\Lambda_m^0(\text{NH}_4\text{Cl}) + \Lambda_m^0(\text{NaOH}) - \Lambda_m^0(\text{NaCl})</math></p> <p>(iii) <math>\Lambda_m^0(\text{NH}_4\text{Cl}) + \Lambda_m^0(\text{NaCl}) - \Lambda_m^0(\text{NaOH})</math></p> <p>(iv) <math>\Lambda_m^0(\text{NaOH}) + \Lambda_m^0(\text{NaCl}) - \Lambda_m^0(\text{NH}_4\text{Cl})</math></p>	1
6	<p>The reaction <math>\text{ArN}_2^+\text{Cl}^- \xrightarrow{\text{Cu/HCl}} \text{ArCl} + \text{N}_2 + \text{CuCl}</math> is named as _____.</p> <p>(i) Sandmeyer reaction</p> <p>(ii) Gatterman reaction</p> <p>(iii) Claisen reaction</p> <p>(iv) Carbylamine reaction</p>	1

7	<p>Which of the following statements is INCORRECT about the collision theory of chemical reaction?</p> <p>(i) It considers reacting molecules or atoms to be hard spheres and ignores their structural features.</p> <p>(ii) Number of effective collisions determines the rate of reaction.</p> <p>(iii) Collision of atoms or molecules possessing sufficient threshold energy results into the product formation.</p> <p>(iv) Molecules should collide with sufficient threshold energy and proper orientation for the collision to be effective.</p>	1
8	<p>The stabilisation of coordination compounds due to chelation is called the chelate effect. Which of the following is the most stable complex species?</p> <p>(i) <math>[\text{Fe}(\text{CO})_5]</math></p> <p>(ii) <math>[\text{Fe}(\text{CN})_6]^{3-}</math></p> <p>(iii) <math>[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}</math></p> <p>(iv) <math>[\text{Fe}(\text{H}_2\text{O})_6]^{3+}</math></p>	1
9	<p>Predict the products of the following reaction:</p> <div style="text-align: center;">  </div> <p>(i) A = Ethanol, B = Phenol</p> <p>(ii) A = Bromomethane, B = Phenol</p> <p>(iii) A = Phenol, B = Bromoethane</p> <p>(iv) A = Bromobenzene, B = Ethanol</p>	1
10	<p>Amongst the following, the strongest base in aqueous medium is _____.</p> <p>(i) <math>\text{CH}_3\text{NH}_2</math></p> <p>(ii) <math>\text{CH}_3\text{CH}_2\text{NH}_2</math></p> <p>(iii) <math>(\text{CH}_3)_2\text{NH}</math></p> <p>(iv) <math>\text{C}_6\text{H}_5\text{NHCH}_3</math></p>	1

11	<p>Which of the following tests/ reactions is given by aldehydes as well as ketones?</p> <p>(i) Fehling's test</p> <p>(ii) Tollen's test</p> <p>(iii) 2,4 DNP test</p> <p>(iv) Cannizzaro reaction</p>	1
12	<p>In the presence of a catalyst, the heat evolved or absorbed during the reaction ____</p> <p>(i) increases.</p> <p>(ii) decreases.</p> <p>(iii) may increase or decrease.</p> <p>(iv) remains unchanged.</p>	1
13	<p>When 1 mol <math>\text{CrCl}_3 \cdot 6\text{H}_2\text{O}</math> is treated with excess of <math>\text{AgNO}_3</math>, 3 mol of <math>\text{AgCl}</math> are obtained. The formula of the complex is :</p> <p>(i) <math>[\text{CrCl}_3(\text{H}_2\text{O})_3] \cdot 3\text{H}_2\text{O}</math></p> <p>(ii) <math>[\text{CrCl}_2(\text{H}_2\text{O})_4]\text{Cl} \cdot 2\text{H}_2\text{O}</math></p> <p>(iii) <math>[\text{CrCl}(\text{H}_2\text{O})_5]\text{Cl}_2 \cdot \text{H}_2\text{O}</math></p> <p>(iv) <math>[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3</math></p>	1
14	<p>Cannizzaro's reaction is not given by _____.</p> <p>(i) </p> <p>(ii) </p> <p>(iii) <math>\text{HCHO}</math></p> <p>(iv) <math>\text{CH}_3\text{CHO}</math></p>	1
15	<p>Given below are two statements labelled as Assertion (A) and Reason (R)</p> <p><b>Assertion (A) :</b> Bond angle in ethers is slightly less than the tetrahedral angle.</p> <p><b>Reason (R) :</b> There is a repulsion between the two bulky (<math>\text{—R}</math>) groups.</p> <p>Select the most appropriate answer from the options given below:</p> <p>(i) Both A and R are true and R is the correct explanation of A</p>	1

	<p>(ii) Both A and R are true but R is not the correct explanation of A.</p> <p>(iii) A is true but R is false.</p> <p>(iv) A is false but R is true.</p>	
16	<p>Given below are two statements labelled as Assertion (A) and Reason (R)</p> <p><b>Assertion (A) :</b> All naturally occurring <math>\alpha</math>-amino acids except glycine are optically active.</p> <p><b>Reason (R) :</b> Most naturally occurring amino acids have L-configuration.</p> <p>Select the most appropriate answer from the options given below:</p> <p>(i) Both A and R are true and R is the correct explanation of A</p> <p>(ii) Both A and R are true but R is not the correct explanation of A.</p> <p>(iii) A is true but R is false.</p> <p>(iv) A is false but R is true.</p>	1
17	<p>Given below are two statements labelled as Assertion (A) and Reason (R)</p> <p><b>Assertion (A) :</b> Cu cannot liberate hydrogen from acids.</p> <p><b>Reason (R) :</b> Because it has positive electrode potential.</p> <p>Select the most appropriate answer from the options given below:</p> <p>(i) Both A and R are true and R is the correct explanation of A</p> <p>(ii) Both A and R are true but R is not the correct explanation of A.</p> <p>(iii) A is true but R is false.</p> <p>(iv) A is false but R is true.</p>	1
18	<p>Given below are two statements labelled as Assertion (A) and Reason (R)</p> <p><b>Assertion (A) :</b> Hoffmann's bromamide reaction is given by primary amines.</p> <p><b>Reason (R) :</b> Primary amines are more basic than secondary amines.</p> <p>Select the most appropriate answer from the options given below:</p> <p>(i) Both A and R are true and R is the correct explanation of A</p> <p>(ii) Both A and R are true but R is not the correct explanation of A.</p> <p>(iii) A is true but R is false.</p> <p>(iv) A is false but R is true.</p>	1

**Section B**

**This section contains 7 questions with internal choice in two questions. The following questions are very short answer type and carry 2 marks each.**

19	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: $\log 5 = 0.6990$ , $\log 8 = 0.9030$ , $\log 2 = 0.3010$ )	2
20	(a) Out of o-and p-dibromobenzene which one has higher melting point and why? (b) Why is the solubility of haloalkanes in water very low?  <b>OR</b> Compound 'A' with molecular formula $C_4H_9Br$ is treated with aq. KOH solution. The rate of this reaction depends upon the concentration of the compound 'A' only. When another optically active isomer 'B' of this compound was treated with aq. KOH solution, the rate of reaction was found to be dependent on concentration of compound and KOH both. (a) Write down the structural formula of both compounds 'A' and 'B'. (b) Out of these two compounds, which one will be converted to the product with inverted configuration.	2
21	Write the reactions taking place at anode, cathode and overall reaction of a lead storage battery when it is discharged. How does the density of the electrolyte change when the battery is discharged?	2
22	What happens when D – glucose is treated with the following reagents: a. acetic anhydride b. $HNO_3$  <b>OR</b> Sucrose is dextrorotatory but the mixture obtained after hydrolysis is laevorotatory. Explain.	2
23	Name the type of isomerism when ambidentate ligands are attached to central metal ion. Give two examples of ambidentate ligands.	2

24	(a) State a condition under which a bimolecular reaction is kinetically first order reaction. (b) For which type of reactions, order and molecularity have the same value?	2
25	Write the reaction and IUPAC name of the product formed when 2-Methylpropanal is treated with ethyl magnesium bromide followed by hydrolysis.	2
<p style="text-align: center;"><b>Section C</b></p> <p><b>This section contains 5 questions with internal choice in two questions. The following questions are short answer type and carry 3 marks each.</b></p>		
26	Write the chemical equation for the following : (a) Industrial preparation of phenol (b) Williamson synthesis for the preparation of 2-methoxy-2-methyl propane. (c) Kolbe's reaction	3
27	Write the IUPAC name of the following complexes : (a) $[\text{Fe}(\text{NH}_3)_6]^{2+}$ (b) $[\text{CoF}_6]^{3-}$ (c) $[\text{Ni}(\text{CN})_4]^{2-}$  OR For the complex ion $[\text{Cr}(\text{en})_2\text{Cl}_2]^+$ write the hybridization type and magnetic behaviour. Draw one of the geometrical isomers of the complex ion which is optically active. [Atomic number : Cr = 24]	3
28	(a) State Henry's law and explain why are the tanks used by scuba divers filled with air diluted with helium? (b) Henry's law constant for $\text{CO}_2$ in water is $1.67 \times 10^8$ Pa at 298 K. Calculate the solubility of $\text{CO}_2$ in when packed under $2.53 \times 10^5$ Pa at the same temperature.	3

29	<p>Write the structures of A, B, C, D and E in the following reactions :</p> $  \begin{array}{c}  \text{C}_6\text{H}_5\text{NH}_2 \xrightarrow[\text{Pyridine}]{\text{CH}_3\text{COCl}} \text{A} \xrightarrow{\text{Br}_2 / \text{CH}_3\text{COOH}} \text{B} \xrightarrow{\text{H}^+} \text{C} \\  \downarrow \text{CHCl}_3 + \text{KOH} \qquad \qquad \qquad \downarrow \text{conc. HNO}_3 \\  \text{D} \qquad \qquad \qquad \text{E} \\  \qquad \qquad \qquad \downarrow \text{conc. H}_2\text{SO}_4  \end{array}  $	3
30	<p>(a) Electrophilic substitution reactions in haloarenes occur slowly. Why?</p> <p>(b) Arrange the following compounds in increasing order of reactivity towards <math>\text{S}_\text{N}2</math> displacement : 2-Bromo-2-Methylbutane, 1-Bromopentane, 2-Bromopentane</p> <p>(c) Thionyl chloride method is preferred for preparing alkyl chloride from alcohols.</p> <p style="text-align: center;"><b>OR</b></p> <p>(a) Write equation for preparation of 1-iodobutane from 1-chlorobutane.</p> <p>(b) Out of 2-bromopentane, 2-bromo-2-methylbutane and 1-bromopentane, which compound is most reactive towards elimination reaction and why ?</p> <p>(c) Grignard reagents should be kept away from water. Why?</p>	3
<p style="text-align: center;"><b>Section D</b></p> <p><b>The following questions 31 and 32 are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks each. Read the passage carefully and answer the questions that follow.</b></p>		
31	<p>Strengthening the Foundation: Chargaff Formulates His “Rules” Many people believe that James Watson and Francis Crick discovered DNA in the 1950s. In reality, this is not the case. Rather, DNA was first identified in the late 1860s by Swiss chemist Friedrich Miescher. Then, in the decades following Miescher’s</p>	

	<p>discovery, other scientists notably, Phoebus Levene and Erwin Chargaff carried out a series of research efforts that revealed additional details about the DNA molecule, including its primary chemical components and the ways in which they joined with one another. Without the scientific foundation provided by these pioneers, Watson and Crick may never have reached their groundbreaking conclusion of 1953: that the DNA molecule exists in the form of a three-dimensional double helix. Chargaff, an Austrian biochemist, as his first step in this DNA research, set out to see whether there were any differences in DNA among different species. After developing a new paper chromatography method for separating and identifying small amounts of organic material, Chargaff reached two major conclusions: (i) the nucleotide composition of DNA varies among species. (ii) Almost all DNA, no matter what organism or tissue type it comes from maintains certain properties, even as its composition varies. In particular, the amount of adenine (A) is similar to the amount of thymine (T), and the amount of guanine (G) approximates the amount of cytosine (C). In other words, the total amount of purines (A + G) and the total amount of pyrimidines (C + T) are usually nearly equal. This conclusion is now known as “Chargaff’s rule.” Chargaff’s rule is not obeyed in some viruses. These either have single-stranded DNA or RNA as their genetic material.</p> <p>Answer the following questions:</p>	
a	What is nucleotide?	1
b	Write two functions of DNA.	1
c	<p>The sample of a virus was tested and it was found to contain 20% adenine, 20% uracil, 20 % guanine and the rest cytosine. Is the genetic material of this virus (a) DNA- double helix (b) DNA-single helix (c) RNA? What do you infer from this data?</p> <p style="text-align: center;"><b>OR</b></p> <p>Write two structural and two functional difference between DNA and RNA.</p>	2

32	<p>Boiling point or freezing point of liquid solution would be affected by the dissolved solids in the liquid phase. A soluble solid in solution has the effect of raising its boiling point and depressing its freezing point. The addition of non-volatile substances to a solvent decreases the vapor pressure and the added solute particles affect the formation of pure solvent crystals. According to many researches the decrease in freezing point directly correlated to the concentration of solutes dissolved in the solvent. This phenomenon is expressed as freezing point depression and it is useful for several applications such as freeze concentration of liquid food and to find the molar mass of an unknown solute in the solution. Freeze concentration is a high-quality liquid food concentration method where water is removed by forming ice crystals. This is done by cooling the liquid food below the freezing point of the solution. The freezing point depression is referred as a colligative property and it is proportional to the molar concentration of the solution (<math>m</math>), along with vapor pressure lowering, boiling point elevation, and osmotic pressure. These are physical characteristics of solutions that depend only on the identity of the solvent and the concentration of the solute. The characters are not depending on the solute's identity. (Jayawardena, J. A. E. C., Vanniarachchi, M. P. G., &amp; Wansapala, M. A. J. (2017). Freezing point depression of different Sucrose solutions and coconut water.)</p> <p>Answer the following questions:</p>	
a	Define the term 'colligative properties'.	1
b	When a nonvolatile solute is added to a solvent boiling point of the solution increases. Why?	1
c	<p>An antifreeze solution is prepared by dissolving 31 g of ethylene glycol (Molar mass = 62 g/ mol) in 600 g of water. Calculate the freezing point of the solution.</p> <p style="text-align: center;"><b>OR</b></p> <p>Calculate the amount of NaCl (<math>M = 58.5</math> g/mol) that must be added to 100 g of water so that freezing point is depressed by 2 K. (<math>K_f</math> for water is 1.86 K/m.)</p>	2

## SECTION E

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

33	<p>(a) Calculate emf for the cell made up of magnesium and copper half cells. The concentration of <math>\text{Mg}^{2+}</math> ion is <math>1 \times 10^{-3}\text{M}</math> and that of <math>\text{Cu}^{2+}</math> is <math>1 \times 10^{-4}\text{M}</math>. Given <math>E^\circ_{\text{Mg}^{2+}/\text{Mg}} = -2.36\text{V}</math> and <math>E^\circ_{\text{Cu}^{2+}/\text{Cu}} = +0.34\text{V}</math>.</p> <p>(b) What advantage do the fuel cells have over primary and secondary batteries?</p> <p>(c) A galvanic cell has electrical potential of 1.1V. If an opposing potential of 1.1V is applied to this cell, what will happen to the cell reaction and current flowing through the cell?</p> <p style="text-align: center;">OR</p> <p>(a) Why does the cell voltage of a mercury cell remain constant during its lifetime?</p> <p>(b) Write the reaction occurring at anode and cathode and the products of electrolysis of aq NaCl.</p> <p>(c) What is the quantity of electricity in Coulombs required to produce 4.8 g of Mg from molten <math>\text{MgCl}_2</math>? How much Ca will be produced if the same amount of electricity was passed through molten <math>\text{CaCl}_2</math>? (Atomic mass of Mg = 24 u, atomic mass of Ca = 40 u).</p>	5
34	<p>(a) A hydrocarbon (A) with molecular formula <math>\text{C}_5\text{H}_{10}</math> on ozonolysis gives two products (B) and (C). Both (B) and (C) give a yellow precipitate when heated with iodine in presence of NaOH while only (B) give a silver mirror on reaction with Tollen's reagent.</p> <p>(i) Identify (A), (B) and (C).</p> <p>(ii) Write down the equation for aldol condensation reaction of B.</p> <p>(b) How will you distinguish between the following:</p> <p style="margin-left: 40px;">(i) Propanal and propanone</p> <p style="margin-left: 40px;">(ii) Benzoic acid and Phenol</p>	5

	(c) There are two $\text{-NH}_2$ groups in semicarbazide. However, only one is involved in the formation of semicarbazones. Why?	
35	<p>(i) Calculate the number of unpaired electrons in the following gaseous ions : <math>\text{Cr}^{3+}</math> and <math>\text{V}^{3+}</math> (Atomic number of V = 23, Cr = 24) Which one of them is most stable in aqueous solution and why ?</p> <p>(ii) Complete the following reactions:</p> <p>(a) <math>\text{MnO}_2 + \text{KOH} + \text{O}_2 \longrightarrow</math></p> <p>(b) <math>\text{I}^- + \text{MnO}_4^- + \text{H}^+ \longrightarrow</math></p> <p>(c) <math>\text{Cr}_2\text{O}_7^{2-} + \text{Sn}^{2+} + \text{H}^+ \longrightarrow</math></p> <p style="text-align: center;">OR</p> <p>(i) Write the chemical equations for the preparation of <math>\text{KMnO}_4</math> from <math>\text{MnO}_2</math>.</p> <p>(ii) Account for the following :</p> <p>(a) Manganese shows maximum number of oxidation states in 3d series.</p> <p>(b) <math>E^\circ</math> value for <math>\text{Mn}^{3+}/\text{Mn}^{2+}</math> couple is much more positive than that for <math>\text{Cr}^{3+}/\text{Cr}^{2+}</math>.</p> <p>(c) <math>\text{Ti}^{4+}</math> is colourless whereas <math>\text{V}^{4+}</math> is coloured in an aqueous solution.</p>	5