KENDRIYA VIDYALAYA SANGATHAN, JABALPUR REGION

PRE- BOARD EXAMINATION 2025-26

CLASS - XII

CHEMISTRY (043)

Max. Marks: 70 **Time: 3 Hours**

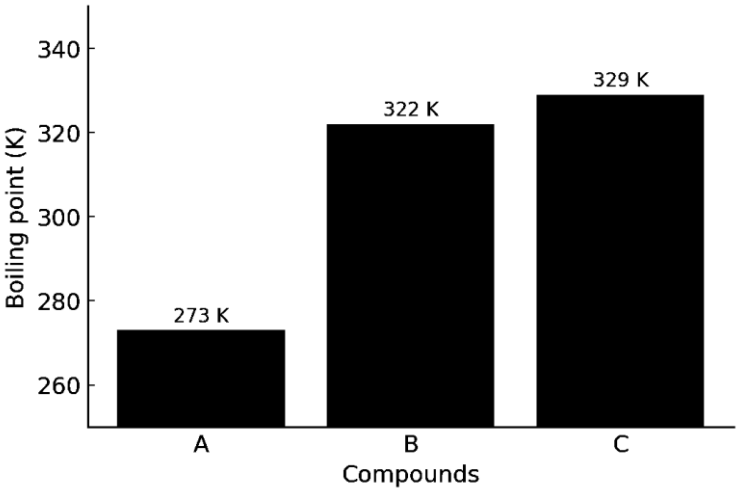
Read the following Instructions carefully.

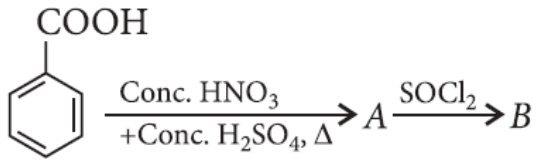
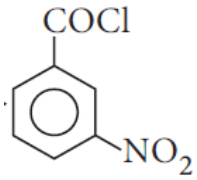
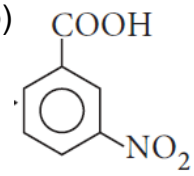
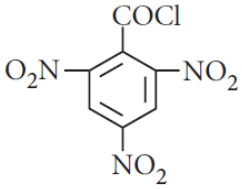
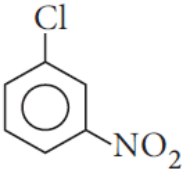
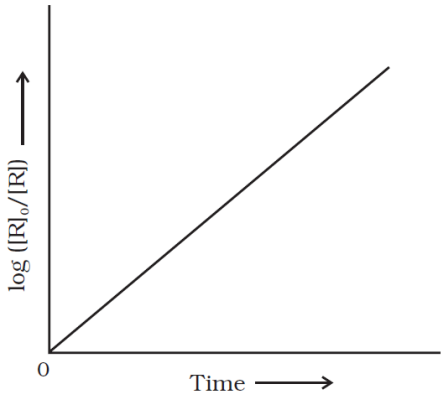
1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION 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

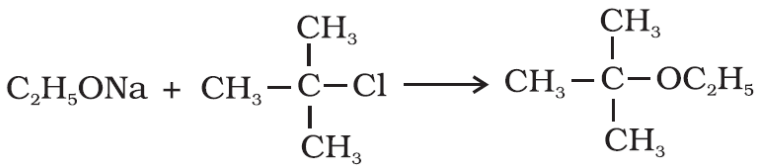
Question 1 to 16 are multiple choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions.

1	Out of Ti^{3+}, Cr^{3+}, Mn^{2+} and Ni^{2+} ions, the one which has the highest magnetic moment is: (a) Ti^{3+} (b) Cr^{3+} (c) Mn^{2+} (d) Ni^{2+}	**[1]**
2	Molecules whose mirror image is non superimposable over them are known as chiral. Which of the following molecules is chiral in nature? (a) 2-Bromobutane (b) 1-Bromobutane (c) 2-Bromopropane (d) 2-Bromopropan-2-ol	**[1]**
3	An organic amino compound reacts with Hinsberg's reagent to form a product insoluble in alkali. The compound is: (a) CH_3NH_2 (b) $CH_3CH_2NH_2$ (c) $CH_3CH_2NHCH_2CH_3$ (d) $(CH_3CH_2)_3N$	**[1]**
4	A binary liquid mixture of HNO_3 and water boils at 393 K at 1 atm pressure, while pure water and pure HNO_3 boil at 373 K and 355 K, respectively. The solution will show —	**[1]**

	(a) Positive deviation from Raoult's law and becomes cooler on mixing (b) Negative deviation from Raoult's law and becomes warmer on mixing (c) Positive deviation from Raoult's law and becomes warmer on mixing (d) Negative deviation from Raoult's law and becomes cooler on mixing	
5	The bar graph below shows the boiling points (in K) of three compounds A, B, and C — all having molecular mass 58.  Based on the data, identify the correct option regarding the compounds and their reaction with Tollens' reagent. (a) A — n-butane; B — propanal; C — acetone. Only A reduces Tollens'. (b) A — n-butane; B — propanal; C — acetone. Only B reduces Tollens'. (c) A — propanal; B — acetone; C — n-butane. Both A and B reduce Tollens'. (d) A — acetone; B — n-butane; C — propanal. Only C reduces Tollens'.	**[1]**
6	During reduction of benzene diazonium chloride to benzene, nitrogen gas is liberated. Which reagent can achieve this transformation without introducing any substituent on the benzene ring? (a) H_3PO_2 (b) Cu/HCl (c) HBF_4 (d) $NaBH_4$	**[1]**
7	When an aqueous sample of the compound $CoCl_3 \cdot 4NH_3$ is treated with excess $AgNO_3$, one mole of AgCl is precipitated per mole of the compound. The primary valency of cobalt in this compound is: (a) +1 (b) +3 (c) +4 (d) +6	**[1]**
8	A child complains of bleeding gums and delayed healing of wounds. The doctor advises eating citrus fruits. The disease and its cause are respectively: (a) Scurvy – deficiency of vitamin D (b) Rickets– deficiency of vitamin C	**[1]**

	(c) Scurvy – deficiency of ascorbic acid (d) Rickets– deficiency of aspartic acid	
9	Two electrolytic cells containing aqueous $CuSO_4$ and molten NaCl are connected in series and a total of 2 Faradays of electricity is passed through them. The ratio of moles of Cu and Na deposited at the respective cathodes is: (a) 1 : 1 (b) 1 : 2 (c) 2 : 1 (d) 3 : 1	**[1]**
10	Identify **B** in the following reaction:  (a)  (b)  (c)  (d)  	**[1]**
11	The graph between log $[R_0/R]$ and time (t) as given below is obtained for a reaction. If the rate constant of the reaction is $2.303 \times 10^{-3}\ s^{-1}$, the value of the slope of the graph will be:  (a) $2.303 \times 10^{-3}\ s^{-1}$ (b) $0.5 \times 10^{-3}\ s^{-1}$ (c) $1.0 \times 10^{-3}\ s^{-1}$ (d) $4.6 \times 10^{-3}\ s^{-1}$	**[1]**
12	Which of the following shows the correct increasing order of pKa values? (a) 4-Methylphenol < Phenol < 3-Nitrophenol < 2,4,6-Trinitrophenol (b) Phenol < 4-Methylphenol < 3-Nitrophenol < 2,4,6-Trinitrophenol (c) 2,4,6-Trinitrophenol < 3-Nitrophenol < Phenol < 4-Methylphenol (d) 3-Nitrophenol < 2,4,6-Trinitrophenol < Phenol < 4-Methylphenol	**[1]**

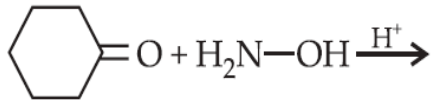
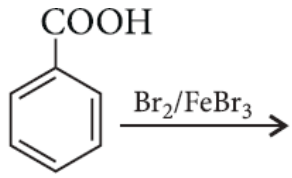
13	Given below are two statements labelled as Assertion (A) and Reason (R) **Assertion (A):** A catalyst decreases the Gibbs free energy (ΔG) of a reaction to make it spontaneous. **Reason (R):** A catalyst catalyses spontaneous reactions but does not catalyse non-spontaneous reactions. Select the most appropriate answer from the options 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.	**[1]**
14	Given below are two statements labelled as Assertion (A) and Reason (R) **Assertion (A):** Clemmensen reduction converts propanone into propane. **Reason (R):** Zn-Hg/HCl converts the carbonyl group of propanone into an alcohol group. Select the most appropriate answer from the options 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.	**[1]**
15	Given below are two statements labelled as Assertion (A) and Reason (R) **Assertion (A):** Amylopectin is insoluble in water, while amylose is water-soluble. **Reason (R):** Amylose is a straight-chain polymer, whereas amylopectin is a branched-chain polymer of α-D-glucose. Select the most appropriate answer from the options 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.	**[1]**
16	Given below are two statements labelled as Assertion (A) and Reason (R) **Assertion (A):** The geometry of $[MnBr_4]^{2-}$ is tetrahedral. **Reason (R):** Manganese in this complex is in the +2 oxidation state**.** Select the most appropriate answer from the options 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.	**[1]**

	(c) A is true but R is false. (d) A is false but R is true.	
	SECTION B Question No. 17 to 21 are very short answer questions carrying 2 marks each.	
17	Two compounds (**A)** and (**B**) are shown below:  (A) (B) (a) Which of the two compounds will undergo an S_N1 reaction faster? Give reason. (b) Write the product formed when compound (A) reacts with AgCN**.**	**[2]**
18	For a reaction $A + B \rightarrow P$, the rate is given by Rate = $k[A][B]^2$ (i) How is the rate of reaction affected if the concentration of both A and *B* is halved? (ii) What is the overall order of reaction if *B* is present in large excess?	**[2]**
19	The following is not an appropriate reaction for the preparation of t-butyl ethyl ether.  (i) What would be the major product of this reaction? (ii) Write a suitable reaction for the preparation of t-butyl ethyl ether.	**[2]**
20	(i) Blood cells are isotonic with 0.9 % sodium chloride solution. What happens if we place blood cells in a solution containing 1.5 % sodium chloride solution? (ii) An electrolyte AB partially dissociates in water as: $AB \rightleftharpoons A^+ + B^-$ At equilibrium, the freezing point depression corresponds to a Van't Hoff factor of 1.4. Calculate the degree of dissociation (α)**.**	**[1]** **[1]**
21	(i) Write a reaction which shows that all the carbon atoms in glucose are linked in a straight chain. (ii) What is the structural difference between a nucleoside and a nucleotide? **Or** (i) What type of linkage is present in nucleic acids? (ii) Name the products of hydrolysis of lactose.	**[2]**

	SECTION C Question No. 22 to 28 are short answer questions, carrying 3 marks each.	
22	A cell is prepared by dipping an iron rod in 1 M $FeSO_4$ solution and a silver rod in 1 M $AgNO_3$ solution. The standard reduction potentials of Fe^{2+}/Fe and Ag^{+}/Ag are –0.44 V and +0.80 V, respectively. (i) What will be the cell reaction? (ii) What will be the standard electromotive force (emf) of the cell? (iii) What will happen to the cell reaction and current flowing through the cell if an opposing potential of 1.24 V is applied?	**[3]**
23	(i) Name the only optically inactive amino acid. State whether it is essential or non-essential amino acid. (ii) When an egg is boiled, the transparent egg white becomes hard and opaque, though its chemical composition remains the same. Which levels of protein structure are destroyed in this process, and what is this phenomenon called?	**[3]**
24	Explain the following observation: (i) Actinoids exhibit a much larger number of oxidation states than the lanthanoids. (ii) With the same d-orbital configuration Cr^{2+} ion is reducing while Mn^{3+} ion is oxidising. (iii) The $E°M^{2+}\|M$ for copper is positive (+0.34 V). It is only metal in the first series of transition elements showing this type of behaviour.	**[3]**
25	What happens when ethanol is heated with concentrated H_2SO_4 at 443 K? Explain the mechanism of the reaction.	**[3]**
26	How will you bring about the following conversions? (a) Butene to 1-iodobutane (b) Ethanol to ethyl fluoride (c) Toluene to benzyl alcohol	**[3]**
27	(i) Complete and balance the following Chemical equations: (a) $KMnO_4 \xrightarrow{Heat}$ (b) $MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow$ (ii) What is the effect of change of pH on dichromate ion?	**[3]**

28	The reaction between **A** and **B** is studied at a certain temperature, and the following data are obtained: **Experiment** | **[A] (mol L^{-1})** | **[B] (mol L^{-1})** | **Initial rate (mol L^{-1} min^{-1})** I | 0.10 | 0.10 | 2.0×10^{-2} II | 0.20 | 0.10 | 4.0×10^{-2} III | 0.40 | 0.10 | 8.0×10^{-2} (a) Determine the rate law for the reaction. (b) Calculate the rate constant (k) with appropriate units. (c) Calculate the half-life ($t_1/_2$) of the reaction. **Or** In a pseudo first order hydrolysis of ester in water, the following results are obtained: ***t* in seconds** | **0** | **30** | **60** | **90** **[Ester] M** | 0.55 | 0.31 | 0.17 | 0.085 (i) Calculate the average rate of reaction between the time interval 30 to 60 seconds. (ii) Calculate the pseudo first order rate constant for the hydrolysis of ester.	**[3]**
	SECTION D **Question No. 29 & 30 are case-based/data -based questions carrying 4 marks each.**	
29	Henry's law states that the solubility of a gas in a liquid at constant temperature increases as the pressure of the gas above the liquid increases. Scientists like Dalton also arrived at similar conclusions and observed that the amount of gas dissolved depends upon the partial pressure of the gas in contact with the liquid. When solubility is measured in terms of mole fraction, Henry's law can be expressed as: the partial pressure of the gas above the liquid is directly proportional to its mole fraction in the solution. This concept is very similar to Raoult's law, which states that the vapour pressure of a liquid in a solution is directly proportional to its mole fraction. Both laws establish a relationship between pressure and concentration (mole fraction), helping us understand how gases and liquids behave in various types of	**[4]**

	solutions. These principles are applied in everyday technologies such as soft drink bottling, deep-sea diving, and blood gas analysis in medicine. (i) The values of Henry's law constant (K_H) in kbar for the following gases at 298 K are: N_2 – 76.48, O_2 – 34.86, CO_2 – 1.67, He – 144.97 Arrange these gases in increasing order of their solubility in water. **Attempt either (ii) or (iii)** (ii) Raoult's law becomes a special case of Henry's law when (a) $K_H = p_1^0$ (b) $K_H > p_1^0$ (c) $K_H < p_1^0$ (d) $K_H \geq p_1^0$ **Or** (iii) A solution containing components A and B follows Raoult's law when (a) A – B attraction force is greater than A – A and B – B (b) A – B attraction force is less than A – A and B – B (c) A – B attraction force remains same as A–A and B –B (d) volume of solution is different from sum of volume of solute and solvent. (iv) At 25°C (298 K), the solubility of oxygen (O_2) in water at a partial pressure of 0.21 atm is 6.0×10^{-4} mol L^{-1}. The Henry's law constant for O_2 is 1.3 kbar at 298 K and 1.8 kbar at 308 K respectively. Calculate the solubility of O_2 in water at 308 K under the same partial pressure and explain briefly how this change in solubility affects aquatic life.	
30	Aniline is a primary aromatic amine and a resonance hybrid of five structures. The maximum electron density is at the ortho- and para-positions to the $–NH_2$ group, making it a strong activating and ortho/para-directing group. Aniline has a high pK_b value because the lone pair on nitrogen delocalizes into the benzene ring. Electron-releasing groups like $–OCH_3$ and $–CH_3$ increase aniline's basicity, while electron-withdrawing groups like $–NO_2$, $–SO_3H$, and –COOH decrease it. (i) Arrange the following in increasing order of basic strength: Aniline, p-nitroaniline and p-toluidine **Attempt either (ii) or (iii)** (ii) Why Gabriel phthalimide synthesis cannot be used to prepare aniline? **Or** (iii) Give the chemical test to distinguish between Aniline and N-methylaniline. (iv) Write the chemical equations involved when aniline is treated with the following reagents: (i) Br_2 water (ii) Conc.H_2SO_4	**[4]**

	SECTION E **The following questions are long answer type and carry 5 marks each. All questions have an internal choice.**	
31	(a) Write the structures of the main products of the following reactions:	**[5]**
	(i)  (ii) $2C_6H_5CHO + \text{conc. } NaOH \longrightarrow$ (iii)  (b) Illustrate the following name reactions giving a chemical equations in each case : (i) HVZ Reaction (ii) Rosenmund Reaction **Or** (a) An organic compound A, having the formula, C_3H_8O, on treatment with copper at 573 K, gives B. B does not reduce Fehling's solution but gives a yellow precipitate of the compound C with I_2/NaOH. Deduce the structure of A, B and C. (b) Although phenoxide ion has more number of resonating structures than carboxylate ion, carboxylic acid is a stronger acid than phenol. Give two reasons.	
32	(i) Write the formula and IUPAC name of the following coordination compounds: (a) A platinum (II) complex with two chloride ions and two ethylenediamine (en) ligands. (b) A nickel (II) complex with four cyanide (CN^-) ligands. (ii) Explain the following: (a) $[Ni(CO)_4]$ is diamagnetic whereas $[NiCl_4]^{2-}$ is paramagnetic. (b) $[Co(en)_3]Cl_3$ is more stable complex than $[Co(NH_3)_6]Cl_3$. (c) A solution of $[Ni(H_2O)_6]^{2+}$ is green but a solution of $[Ni(CN)_4]^{2-}$ is colourless. **Or** (i) Write the state of hybridization and the magnetic behaviour of the following complex entities: (a) $K_4[Mn(CN)_6]$ (b) $[Co(NH_3)_5Cl]Cl_2$	**[5]**

	(ii) Name the type of isomerism exhibited by the following compounds. Also draw their corresponding isomers. (a) $[Co(NH_3)_6]\ [Cr(CN)_6]$ (b) $[Co(en)_3]^{3+}$ (c) $[Co(NH_3)_3(NO_2)_3]$	
33	(i) During the electrolysis of 2 mol of $CuCl_2$ solution using copper electrodes, (a) Write the reactions occurring at the anode and the cathode. (b) Calculate how many Faradays of charge are required to deposit all the copper. (ii) Calculate the standard electrode potential of Cu^{2+}/Cu electrode if emf of the cell Ni(*s*) | Ni^{2+} (0.01 M) || Cu^{2+} (0.1M) | Cu(*s*) is 0.059 V. [Given: $E^0\ Ni^{2+}/Ni = 0.31$ V] **Or** (i) When the ignition key of a car is turned on, a powerful battery supplies electricity to start the engine. Even after repeated use, the same battery can be recharged while the car is running. (a) Identify the type of electrochemical cell used in the car battery. (b) Write the electrode reactions occurring at the anode and cathode during discharge. (ii) Calculate the conductivity and the degree of dissociation of 0.01 M acetic acid at 298 K, given that the molar conductance of acetic acid, $\Lambda_m(CH_3COOH)$ = 11.7 S cm^2 mol^{-1}, CH_3COOH, and the limiting molar conductance of the ions are $\Lambda^0_m(CH_3COO^-)$ = 49.9.7 S cm^2 mol^{-1} and $\Lambda^0_m(H^+)$ = 349.1 S cm^2 mol^{-1}	**[5]**

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