CLASS XII
POST MID TERM 2024-25
CHEMISTRY(043)
SET A1

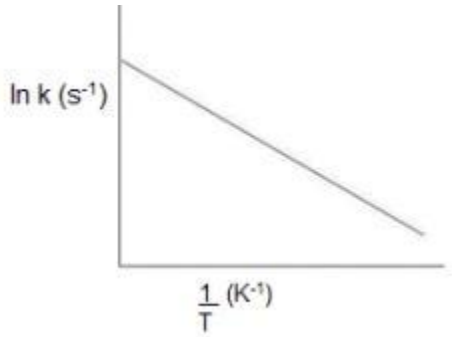
Time allowed : 3 hours **Max. Marks: 70**

Read the following instructions carefully.

(a) There are **33** questions in this question paper with internal choice.
(b) SECTION A consists of 16 multiple -choice questions carrying 1 mark each.
(c) SECTION B consists of 5 short answer questions carrying 2 marks each.
(d) SECTION C consists of 7 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

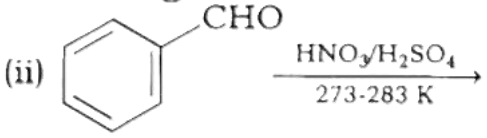
Q1	Which of the following has square planar structure? (a) $[NiCl_4]^{2-}$ (b) $[Ni(CO)_4]$ (c) $[Ni(CN)_4]^{2-}$ (d) None of these	1
Q2	Which of the following statements is not correct for amines? (a) All aliphatic amines are more basic than ammonia. (b) Boiling point of 1° amine is lower than 2° and 3° amines. (c) Aliphatic amines are soluble in water. (d) Gabriel phthalimide synthesis cannot be u**sed** for the preparation of 2° and 3° amines.	1
Q3	What is the correct increasing order of their reactivity in nucleophilic addition reactions? a) Benzaldehyde < *p*-Tolualdehyde < *p*-Nitrobenzaldehyde <Acetophenone. b) *p*-tolualdehyde <Benzaldehyde < *p*-Nitrobenzaldehyde < Acetophenone c) Acetophenone < *p*-tolualdehyde < Benzaldehyde <	1

	p-Nitrobenzaldehyde d) *p*-Nitrobenzaldehyde < Benzaldehyde < *p*-tolualdehyde < Acetophenone	
Q4	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 (d) Glycine is the only naturally occuring amino acid which is optically inactive.	1
Q5	Alkyl fluorides are synthesised by heating an alkyl chloride/bromide in presence of : (a) $Ca F_2$ (b) PF_3 (c) Hg_2F_2 (d) NaF	1
Q6	What is the most basic aromatic amine's common name? a) Benzenamine b) Benzylamine c) Aniline d) Aminobenzene	1
Q7	When $KMnO_4$ solution is added to oxalic acid solution, the decolourisation is slow in the beginning but becomes instantaneous after some time because (a) CO_2 is formed as the product. (b) Reaction is exothermic. (c) MnO_4^- catalyses the reaction. (d) Mn^{2+} acts as auto catalyst	1
Q8	Arrhenius equation can be represented graphically as follows:  The (i) intercept and (ii) slope of the graph are: a) (i) ln A (ii) Ea/R b) (i) A (ii) Ea	1

	c) (i)ln A (ii) - Ea/R d) (i) A (ii) -Ea	
Q9	Which one the following can be oxidized to the corresponding carbonyl compound? (a) 2-Hydroxypropane (b) o-Nitrophenol (c) Phenol (d) 2-Hydroxy-2-methyl propane	1
Q10	Which one of the following characteristics of the transition metals is with higher catalytic activity? (a) High enthalpy of atomization (b) Paramagnetic behaviour (c) Color of hydrated ions (d) Variable oxidation states	1
Q11	Which of the following statement is not correct about order of a reaction? (a) The order of a reaction can be a fractional number. (b) Order of a reaction is experimentally determined quantity. (c) The order of a reaction is always equal to the sum of the stoichiometric coefficients of reactants in the balanced chemical equation for a reaction. (d) The order of a reaction is the sum of the powers of molar concentration of the reactants in the rate law expression.	1
Q12	2-Bromopropane on reaction with alcoholic KOH produces A. A on reaction with HBr in presence of peroxide gives B. B on reaction with sodium ethoxide produces C. Find C (a) Diethyl ether (b) 1 -Ethoxypropane (c) Isopropyl alcohol (d) Propanol	1
Q13	**Direction for Q13 to 16**: 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 in each question: (a) Both A and R are true and R is the correct explanation of A. (b) Both A and R are true and R is not the correct explanation of A. (c) A is true but R is false (d) A is false but R is true (e) A and B both are false Assertion (A): Toxic metal ions are removed by the chelating ligands. Reason (R): Chelate complexes tend to be more stable.	1

Q14	Assertion: The order and molecularity of a reaction are always the same. Reason: Order is determined experimentally whereas molecularity by a balanced elementary reaction.	1
Q15	Assertion : Λ_m for weak electrolytes shows a sharp increase when the electrolytic solution is diluted. Reason **:** For weak electrolytes degree of dissociation increases with dilution of solution	1
Q16	Assertion : β-glycosidic linkage is present in maltose, Reason : Maltose is composed of two glucose units in which C–1 of one glucose unit is linked to C–4 of another glucose unit.	1

Section B

Q17	The value of E° for the cell is 1.260 V What is the value of Ecell ? $2Al\ (s) + 3Cd^{2+}\ (0.1M) \rightarrow 3\ Cd(s) + 2Al^{3+}(0.01M)$ Represent the cell in which the above reaction takes place.	2
Q18	Give reasons for the following. (a) The presence of —NO_2 group at ortho or para position increases the reactivity of haloarenes towards nucleophilic substitution reactions. (b) p-dichlorobenzene has higher melting point than that of ortho or meta-isomer..	2
Q19	For the complex $[Cr(NH_3)_4Cl_2]^+$, give (a) structures of possible geometrical isomers. (b) names of possible isomers	2
Q20	Complete the following reactions: (i) $2H—\underset{\underset{O}{\|}}{C}—H \xrightarrow{\text{Conc. KOH}}$ (ii) 	1+1
Q21	Give reason for the following:– (a) Ethylene glycol is used as antifreeze solution in radiators of vehicles. (b) The freezing point depression of 0.01 m NaCl is nearly twice that of 0.01 m glucose solution. **OR** (a) Ibrahim collected a 10mL each of fresh water and ocean water. He observed that one sample labeled "P" froze at 0°C while the other "Q" at - 1.3°C. Ibrahim forgot which of the two, "P" or "Q" was ocean water. Help him identify which container contains ocean water, giving rationalization for your answer.	2

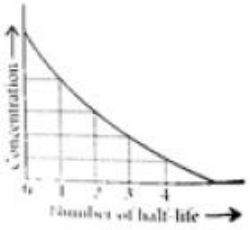
	(b)What will happens when RBC's are placed in 0.5% NaCl? Give reason.	

Section C

Q22	Write the name of the reaction, structure and IUPAC name of the product formed when: (any two) (a) phenol reacts with $CHCl_3$ in the presence of NaOH followed by hydrolysis. (b) $CH_3CH_2CH(CH_3)CH(CH_3)ONa$ reacts with C_2H_5Br (c) CH_3CH_2CN reacts with stannous chloride in the presence of hydrochloric acid followed by hydrolysis	1.5+ 1.5
Q23	(a) Why orange colour of $Cr_2O_7^{2-}$ ion changes to yellow when treated with an alkali? (b) Why is the E° value for the Mn^{3+}/Mn^{2+} couple is highly positive (+1.57 V) as compared to Cr^{3+}/Cr^{2+}? (c) Why actinoids exhibit a greater range of oxidation states than lanthanoids?	3
Q24	(a)What information do we get when D-glucose reacts with following reagent, write the reaction also (i)Hydroxylamine (ii) acetic anhydride (b)What is the biological effect of denaturation of proteins?	2+1
Q25	(a) How will you distinguish between benzaldehyde and acetaldehyde ? (b) Carboxylic acids contain carbonyl group but do not show the nucleophilic addition reaction like aldehydes or ketones. Why? (c) Draw the structure of Cyclopropanone oxime /semicarbazone of cyclobutanone derivative. **OR** (a) Arrange the following compounds in increasing order of their property as indicated: (i) Acetaldehyde, Acetone, Di-tert-butyl ketone, Methyl tert-butyl ketone (reactivity towards HCN) (ii) $CH_3CH_2CH(Br)COOH$,$CH_3CH(Br)CH_2COOH$, $(CH_3)_2CHCOOH$, $CH_3CH_2CH_2COOH$ (acid strength) b) Illustrate Hell Volhard Zeliensky reaction with the help of an example.	3
Q26	(a) 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. (b) In the electrolysis of aqueous sodium bromide, there are two possible anodic reactions. $2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$, E° = – 1.23 V $2Br^-(aq) \rightarrow Br_2(g) + 2e^-$, E° = – 1.08 V Which reaction occurs at anode and why?	2+1

Q27	Write all the possible products when: (a) Chlorobenzene is treated with $Cl_2/FeCl_3$, (b) Ethyl chloride is treated with $AgNO_2$, (c) 2-bromopentane is treated with alcoholic KOH? Write the chemical equations in support of your answer.Also mention the major product in each case.	3
Q28	(a) How much electricity is required in coulomb for the oxidation of i)1 mol of H_2O to O_2 ii) 1 mol of FeO to Fe_2O_3. (b) Predict the products of electrolysis of a dilute solution of H_2SO_4 with platinum electrodes.	2+1

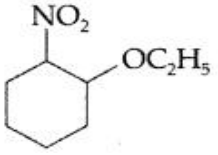
Section D

Q29	**Read the passage given below and answer the following questions:** The half-life of a reaction is the time required for the concentration of reactant to decrease by half, i.e., $[A]_t = [A]/2$ For first order reaction, $t_{1/2} = 0.693/k$ this means $t_{1/2}$ is independent of initial concentration. Figure shows that typical variation of concentration of reactant exhibiting first order kinetics. It may be noted that though the major portion of the first order kinetics may be over in a finite time, but the reaction will never cease as the concentration of reactant will be zero only at infinite time.  (a) Radioactive decay follows first - order kinetics. The initial amount of two radioactive elements X and Y is 1 gm each. What will be the ratio of X and Y after two days if their half- lives are 12 hours and 16 hours respectively? (b) State a condition under which a biomolecular reaction is kinetically first order reaction. What is the name given to these type of reactions ? (c) The half-life for radioactive decay of ^{14}C is 5730 years. An archaeological artifact containing wood had only 80% of the ^{14}C found in a living tree. Estimate the age of the sample.	1+1+2
Q30	**Read the passage given below and answer the following questions:** In amines the N atoms of the amino group are sp^3 hybridised.It can classified as primary, secondary, tritary on the basis of no. of R groups attached. Amines readily lose its electron pair and act as a	1+1+2

	base. In aliphatic amines ,the alkyl group tends to increase the electron density on the nitrogen atom due to the +I effect. In aromatic amines, the basic strengths are influenced by the presence of an electron withdrawing group at the o-, m- and p- position in the ring. Benzene ring in aniline is highly activated. This is due to the sharing of lone pair of nitrogen with the ring which results in increase in the electron density on the ring and hence facilitates the electrophilic attack. a) Aniline does not react with methyl chloride in the presence of $AlCl_3$ catalyst. Why? b) Out of $(CH_3)_3N$ and and $(CH_3)_2NH$ which one is more basic in aqueous solution? Give reason for your answer. c) Write one isomer of C_3H_9N which does not react with Hinsberg's reagent, and any one isomer which reacts with Hinsberg's reagent. Also write the reaction.	

Section E

Q31	(a) 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}) (b) State Raoult's law and explain the fact that Raoult's Law is a special case of Henry's Law **OR** (a) 0.6 mL of acetic acid (CH_3COOH), having density 1.06 g mL^{-1}, is dissolved in 1 litre of water. The depression in freezing point observed for this strength of acid was 0.0205°C. Calculate the van't Hoff factor and the dissociation constant of acid. (K_f for water = 1.86 K Kg/mol) (b) i) Gas (A) is more soluble in water than Gas(B) at the same temperature. Which one of the two gases will have the higher value of K_H (Henry's constant) and why? ii) Equimolal solutions of NaCl and $BaCl_2$ are prepared in water. Freezing point of NaCl is found to be -2^0C, What freezing point do you expect for $BaCl_2$ solution?	3+2 3+2
Q32	(a) $CoSO_4Cl.5NH_3$ exists in two isomeric forms 'A' and 'B'. Isomer 'A' reacts with $AgNO_3$ to give white precipitate, but does not react with $BaCl_2$. Isomer 'B' gives white precipitate with $BaCl_2$ but does not react with $AgNO_3$. Answer the following questions. (i) Identify 'A' and 'B' and write their structural formulas. (ii) Name the type of isomerism involved. (iii) Give the IUPAC name of 'A' and 'B'. (b) Using valence bond theory, explain the following in relation to the complexes gives below: (given Z for Mn = 25) $[Mn(CN)_6]^{3-}$ (i) Type of hybridisation.	3+2

	(ii) Inner or outer orbital complex. (iii) Magnetic behaviour. (iv) Spin only magnetic moment value. **OR** The wave number of light absorbed by different complexes of Cr ion are given below: | Complex	Wavenumber of light absorbed (cm^{-1})	Energy of light absorbed(kJ/mol) | |---|---|---| | $[CrA_6]^{3-}$ | 13640 | 163 | | $[CrB_6]^{3+}$ | 17830 | 213 | | $[CrC_6]^{3+}$ | 21680 | 259 | | $[CrD_6]^{3-}$ | 26280 | 314 | Answer the following questions: (a) Out of the ligands "A", "B", "C" and "D", which ligand causes maximum crystal field splitting? Why? (b)Which of the two, "A" or "D" will be a weak field ligand? Why? (c)Which of the complexes will be violet in colour? $[CrA_6]^{3-}$ or $[CrB_6]^{3+}$ and why? (Given: If 560 -570 nm of light is absorbed, the colour of the complex observed is violet.) (d)Why are low spin tetrahedral complexes not formed? (e) Arrange following complex ions in increasing order of crystal field splitting energy : $[Cr(Cl)_6]^{3-}$, $[Cr(CN)_6]^{3-}$, $[Cr(NH_3)_6]^{3+}$	1 X 5
Q33	a) How would you obtain the following : (i) 2-Methylpentan-2-ol from 2-methyl-1-pentene (ii) Acetophenone from phenol b)Write the mechanism of acid-catalysed dehydration of ethanol to yield ethene. (c) Write IUPAC name of the following :  **OR** (a) An organic compound (A) having molecular formula C_6H_6O gives a characteristic colour with aqueous $FeCl_3$ solution.On treatment with CO_2 and NaOH at 400K under pressure gives B,which on acidification gives a compound C.The compound C reacts with acetyl chloride to give D which is a popular pain killer. Deduce the structure of A,B, C and D. (b) Write the mechanism of hydration of ethene to yield ethanol. Why nucleophilic substitution reactions are not very common in phenols?	2+2+1 2+2+1