CLASS XII
POST MID TERM 2024-25
CHEMISTRY(043)
SET A2

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

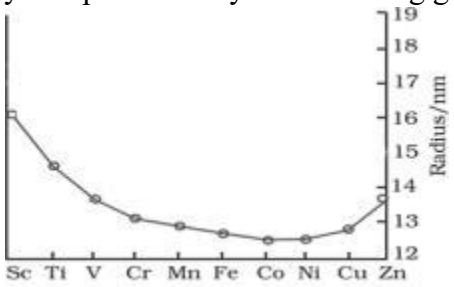
Read the following instructions carefully.

(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

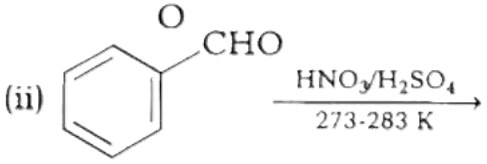
Q1	Which of the following has square planar structure? (a) $[NiCl_4]^{2-}$ (b) $[Ni(CO)_4]$ (c) $[Ni(CN)_4]^{2-}$ (d) None of these	1
Q2	Amine that cannot be prepared by Gabriel phthalimide synthesis is- a) Aniline b) benzyl amine c) tertiary-butylamine d) isobutylamine	1
Q3	What is the correct increasing 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 < *p*-Nitrobenzaldehyde d) *p*-Nitrobenzaldehyde < Benzaldehyde < *p*-tolualdehyde < Acetophenone	1
Q4	The reason for double helical structure of DNA is operation of a) Van der waals forces	1

	b) Dipole-dipole interaction c) Hydrogen bonding d) Electro static attraction	
Q5	Which of the following is not correct? (a) In haloarenes, the electron pairs on halogen atom are in conjugation with pi electrons of the ring. (b) The carbon-magnesium bond is covalent and non-polar in nature. (c) During SN1 reaction, the carbocation formed in the slow step being sp^2 hybridised is planar. (d) Out of CH_2=CH-Cl and $C_6H_5CH_2Cl$, $C_6H_5CH_2Cl$ is more reactive towards SN1 reaction	1
Q6	Which of the following is the IUPAC name of the chemical in which an ethyl group replaces one hydrogen of ammonia? a) Ethanamine b) Aminoethane c) Ethylamine d) Ethane amine	1
Q7	$KMnO_4$ is coloured due to: a) d-d transitions b) charge transfer from ligand to metal c) unpaired electrons in d orbital of Mn d) charge transfer from metal to ligand	1
Q8	Consider the Arrhenius equation given below and mark the correct option. $k = A\, e^{-Ea/RT}$ (a) Rate constant increases exponentially with increasing activation energy and decreasing temperature. (b) Rate constant decreases exponentially with increasing activation energy and decreasing temperature. (c) Rate constant increases exponentially with decreasing activation energy and decreasing temperature. (d) Rate constant increases exponentially with decreasing activation energy and increasing temperature.	1
Q9	A + B $\xrightarrow{\text{dil NaOH}}$ Identify A and B: (a) A = 1-phenylethanal , B = acetophenone (b) A = Benzophenone B = formaldehyde (c) A= Benzaldehyde , B = Acetophenone (d) A = Benzophenone , B = Acetophenone	1

Q10	The trend of which property is represented by the following graph?  (a) ionization enthalpy b) atomic radii (c) enthalpy of atomization d) melting point	1
Q11	A first order reaction is 50% completed in 1.26×10^{14} s. How much time would it take for 100% completion? (a) 1 26 x 10^{15} s (b) 2.52×10^{14} s (c) 2.52 x 10^{28} s (d) infinite	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
	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	
Q13	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
Q14	Assertion: The order of reaction can be zero or fractional. Reason: The order of a reaction cannot be determined from a balanced chemical reaction.	1
Q15	Assertion (A): Toxic metal ions are removed by the chelating ligands. Reason (R): Chelate complexes tend to be more stable.	1

Q16	Assertion : D (+) – Glucose is dextrorotatory in nature. Reason : 'D' represents its dextrorotatory nature.	1

Section B

Q17	The value of E° for the cell is 1.260 V What is the value of Ecell ? $2Al(s) + 3Cd^{2+}(0.1M) \rightarrow 3Cd(s) + 2Al^{3+}(0.01M)$ Represent the cell in which the above reaction takes place.	2
Q18	Complete the following reactions: (i) $2H-C(=O)-H \xrightarrow{\text{Conc.KOH}}$ (ii) 	2
Q19	For the complex $[Cr(NH_3)_4Cl_2]^+$, give (a) structures of possible geometrical isomers. (b) names of possible isomers	2
Q20	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. (b)What will happens when RBC's are placed in 0.5% NaCl? Give reason.	1+1
Q21	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

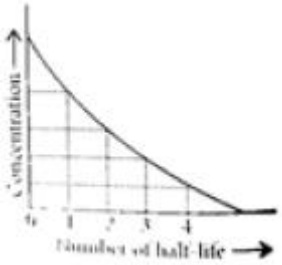
Section C

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	1.5+ 1.5

	(c) CH_3CH_2CN reacts with stannous chloride in the presence of hydrochloric acid followed by hydrolysis	
Q23	(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
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)Explain the observation: E^0M^{2+}/M values are not regular for first row transition metals of 3d-series. (b) The transition metals (with the exception of Zn, Cd and Hg) are hard and have high melting and boiling point. Give reason. (c) Why actinoids exhibit a greater range of oxidation states than lanthanoids?	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. $2H_2O(l) \rightarrow O_2(g) + 4H^+(ag) + 4e^-$, $E° = -1.23$ 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	2+1

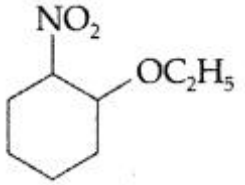
	i)1 mol of H_2O to O_2 ii) 1 mol of FeO to Fe_2O_3. (b) Predict the products of electrolysis of a dilute solution of H_2SO_4 with platinum electrodes.	

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 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	1+1 +2

	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) 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. (c) Why nucleophilic substitution reactions are not very common in phenols?	2+2+1 2+2+1
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. (ii) Inner or outer orbital complex. (iii) Magnetic behaviour. (iv) Spin only magnetic moment value. **OR**	3+2

	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) 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