

SECTION A [40 MARKS]
ANSWER ALL QUESTION

Question 1

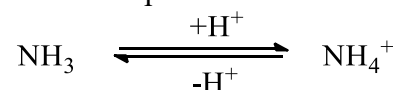
[10]

a) **For each question, there are four alternatives A, B, C and D. Choose the correct alternative and circle it. DO NOT circle more than ONE alternative. If there is more than ONE circled alternative, NO score shall be awarded**

i. Which of the following statements best describes the cryoscopic constant of a solvent?

- A freezing point of a solution of one molarity
- B freezing point of a solution of one molality
- C depression of freezing point of solution of one molarity
- D depression of freezing point of solution of one molality**

ii. The concept of acid and the base is illustrated by the equation given below.



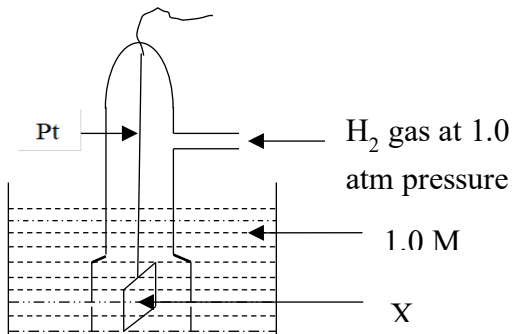
Which concept of acid and the base is being illustrated by the equation?

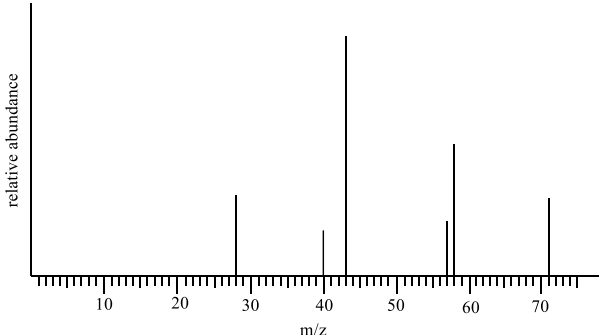
- A Lewis
- B Arrhenius
- C Bronsted-Lowry**
- D Both Arrhenius and Lewis

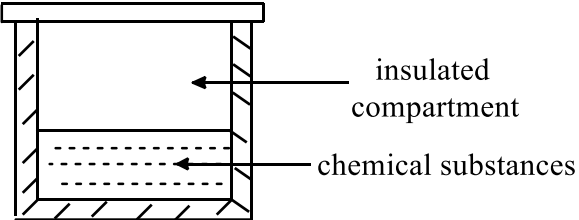
iii. The clinical drug test among the suspected abusers is carried out by analysing their urine samples using an analytical technique. Which of the following analytical techniques is the most suitable?

- A IR
- B NMR
- C HPLC**
- D mass spectrometry

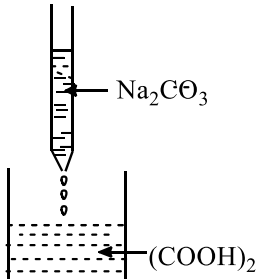
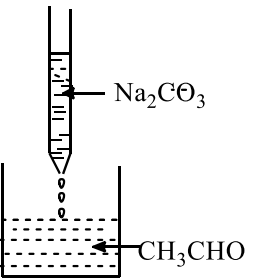
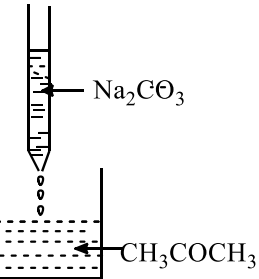
iv. The rate of a certain reaction is found to be equal to its rate constant when 0.02 mole per litre of the reactant is taken. The unit of rate constant of the reaction will be

	A sec^{-1}. B $\text{mol}^{-1}\text{Lsec}^{-1}$. C $\text{mol L}^{-1}\text{sec}^{-1}$. D $\text{mol}^{-2}\text{L}^2\text{sec}^{-1}$.	
v.	An organic compound 'X' when treated with acidified $\text{K}_2\text{Cr}_2\text{O}_7$, compound 'Y' is formed. Compound 'Y' on further oxidation forms a carboxylic acid of molecular mass 46. The compound 'X' and 'Y' are respectively A acetaldehyde and ethanol. B ethanol and acetaldehyde. C methanol and formaldehyde. D formaldehyde and methanol.	
vi.	The following set-up is that of a Standard Hydrogen Electrode (SHE).  If part labelled 'X' is replaced or removed, which of the following function will be affected? A absorption of H_2 B adsorption of H_2 C absorption of H^+ ion D adsorption of H^+ ion	
vii.	A dicarboxylic acid used as an ingredient in metallic polish is prepared by the oxidation of $\text{C}_{12}\text{H}_{22}\text{O}_{11}$. Which of the following reagent is used in the reaction? A dilute HNO_3	

B concentrated HNO_3 C alkaline KMnO_4 solution D acidified $\text{K}_2\text{Cr}_2\text{O}_7$ solution	
viii. An unknown hydrocarbon is analysed using mass spectrometry and the following mass spectrum is obtained.  The fragment ion corresponding to a base peak is A C_2H_5^+. B C_3H_7^+. C C_4H_9^+. D $\text{C}_5\text{H}_{11}^+$.	
ix. A complex compound, Triamminediaquabromochromium (III) chloride undergoes ionization in aqueous solution. If one mole of the complex is dissolved, how many mole(s) of anions is produced by the compound in the solution? A 0 B 1 C 2 D 3	
x. Amines are basic in nature and their basic strength depends on A electronegativity of nitrogen. B number of alkyl group attached to nitrogen. C presence of lone pair of electrons on nitrogen. D number of Hydrogen atoms attached to nitrogen.	

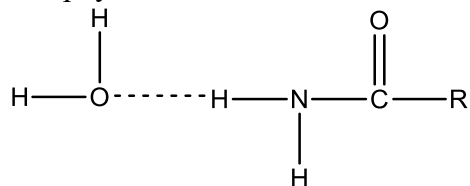
xi. When ${}_{86}\text{Rn}^{222}$ emits two α-particles followed by one β-particle, the atomic number and mass number of the product formed respectively would be A 82, 214. B 83, 214. C 84, 218. D 85, 218.	
xii. The isoelectric point of an amino acid is the pH at which it A bears no charge. B exists as internal salt. C exists as negative ion. D exists as positive ion.	
xiii. A certain chemical process is carried out in a container as shown below.  insulated compartment chemical substances Which of the following parameters of the system is likely to change? A heat B volume C entropy D temperature	
xiv. A certain organic reaction is shown by the following equation; $\text{X} \xrightarrow{\text{fehling solution}} \text{red ppt}$ $\text{X} \xrightarrow{\text{oxidation}} \text{Y}$	

The compounds 'X' and 'Y' respectively represent A ethanol and ethanal. B ethanal and ethanoic acid. C propanone and methanoic acid. D benzaldehyde and benzyl alcohol.	
xv. Derivatives of carboxylic acids such as acyl halide, amide and ester undergo nucleophilic substitution reaction. Which of the following shows the correct order of their reactivity toward nucleophile? A ester < acyl halide < amide B amide < ester < acyl halide C acyl chloride < amide < ester D amide < acyl chloride < ester	
xvi. Consider the reaction in which nitric oxide is oxidised to nitrogen dioxide: $2\text{NO (g)} + \text{O}_2\text{(g)} \rightarrow 2\text{NO}_2\text{(g)}$, rate = $k[\text{NO}][\text{O}_2]$. If the concentration of nitric oxide is doubled, the rate of reaction would A triple. B double. C quadruple. D have no effect.	
xvii. Three organic compounds are treated with Na_2CO_3 solution as shown below.	

 Set up I  set up II  set up III In which of the above set ups, brisk effervescences is observed? A set up I B set up II C set up III D set up II and III	
xviii. The following organic compound is analysed using proton NMR spectroscopy. $\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3 - \text{C} = \text{CH} - \text{CH}_3 \end{array}$ Which of the following signal will the compound produce in its NMR spectrum? A 4 singlet signals B triplet, singlet, singlet C singlet, quartet, duplet D singlet, singlet, quartet, duplet	
xix. Which of the following reactions proceed by an increase in entropy? A $\text{H}_{2(\text{g})} + \text{Cl}_{2(\text{g})} \rightarrow 2\text{HCl}_{(\text{g})}$ B $\text{N}_{2(\text{g})} + 3\text{H}_{2(\text{g})} \rightarrow 2\text{NH}_{3(\text{g})}$ C $\text{NH}_{3(\text{g})} + \text{HCl}_{(\text{g})} \rightarrow \text{NH}_4\text{Cl}_{(\text{s})}$ D $\text{CaCO}_{3(\text{s})} \rightarrow \text{CaO}_{(\text{s})} + \text{CO}_{2(\text{g})}$	
xx. The complex compound of platinum metal is represented as follows:	

$[\text{Pt}(\text{NH}_3)_4\text{Cl}_2] \text{Cl}$ If the platinum ion combines with chloride ion, what would be the formula of the salt? A PtCl B PtCl_2 C PtCl_3 D PtCl_4	
xxi. The EMF of the cell in which the redox reaction, $2\text{X}(\text{s}) + 2\text{H}^+(\text{aq}) \rightarrow 2\text{X}^+(\text{aq}) + \text{H}_2(\text{g})$ occurs is found to be 0.24 V. The standard reduction potential of X-electrode is A 0.24 V. B -0.24 V. C 0.48 V. D 0.12 V.	
xxii. A solution is prepared by dissolving 0.6 g of urea in 100 g of water. What is the maximum temperature that the solution will attain on heating adequately at sea level? (K_b for water = 0.52 K mol^{-1}) A 372.48 K B 273.052 K C 373.052 K D 372.948 K	
xxiii. A certain exothermic process occurring in a system has negative value of entropy change. The process will become spontaneous at A any temperature. B low temperature. C high temperature. D absolute 0 temperature.	
xxiv. Which of the following is the advantage of using biodiesel over fossil fuel? A easily available B less expensive C environment friendly D less corrosive to metals	

xxv. The physical interaction between the chemical substances is illustrated as given below.



Which physical property of amide is explained by the illustration?

- A solubility
- B melting point
- C boiling point
- D physical state

b) Match each item under column A with the most appropriate item in column B. Write the correct alphabet under the ‘answer’ column in the space provided.

Answer	Column A	Column B
f	i. Cell potential of a galvanic cell under non-standard condition	a) Etard reaction
g	ii. Molecule or ion that can react with HCl as well as NaOH	b) Lone pair of electrons
d	iii. Change in vapour pressure of water on adding glucose	c) Isobars
i	iv. Treatment of aromatic carboxylic acid with alkaline KMnO_4 solution	d) Raoult's Law
b	v. Ligands in coordination complexes	e) Molecular vibrations
a	vi. Treatment of toluene with chromyl chloride in CCl_4	f) Nernst Equation
k	vii. Reaction pathway of lower activation energy	g) Amphoteric

e	viii. Absorption of IR radiations by the chemical substances	h) First order reaction	
l	ix. Amino acids in solution containing 10^{-7} mol/L of H^+ ion	i) Oxidation	
c	x. Emission of a beta ray by an atom	j) Amphiprotic	
		k) Catalyst	
		l) Dipolar ion	
c) Fill in the blanks with most appropriate word(s)			[10×½]
i.	Benzaldehyde undergoes Cannizzaro reaction because of <u>no alpha hydrogen</u>		
ii.	For the effective collision, the reacting molecules must possess minimum energy called as <u>Threshold energy</u>		
iii.	The higher reactivity of acetyl chloride towards nucleophile is due to <u>negative I-effect / high electronegativity</u> of chlorine atom.		
iv.	The electrode with <u>negative</u> reduction potential can liberate hydrogen gas from the dilute acids.		
v.	The degree of dissociation of 0.12M monobasic acid solution with 6×10^{-4} mol L ⁻¹ of H^+ ions is <u>0.005 mol L⁻¹</u>		
vi.	The temperature at which vapour pressure of a liquid becomes equal to atmospheric pressure is called <u>boiling point</u>		
vii.	The appropriate analytical techniques used to determine the presence of food colorants in various food and beverage samples is <u>Thin layer Chromatography / TLC</u>		
viii.	The basic nature of amines is due to the presence of <u>lone pair of electrons</u> on the nitrogen atom		
ix.	Methyl orange indicator remains yellow in NaOH solution due to the phenomenon called <u>common ion effect</u>		
x.	For Ag to act as electrode, it must be dipped in a solution containing <u>Ag ions/ its own ions</u>		

d) Circle the appropriate letter T for True and F for False against each statement.			
i. The rusting of iron is prevented by coating it with another metal having comparatively lower reduction potential. T / F			
ii. The pH of a solution containing $1 \times 10^{-5} \text{ molL}^{-1}$ of OH^- ions at 25°C is 5. T / F			
iii. The vapour pressure of the solution is the product of mole fraction solvent and its vapour pressure in pure form. T / F			
iv. Coordination compounds often exhibit characteristic colours due to the presence of empty d-orbitals. T / F			
v. Nitrogen in aniline has a lower tendency to donate its electron pair for protonation than in ethyl amine. T / F			
vi. The radio therapeutic property of cobalt-60 is used in cancer treatment due to emission of beta radiations. T / F			
vii. The IUPAC name of the compound $\text{CH}_3\text{CH}(\text{NH}_2)\text{COOH}$ is 2-aminopropionic acid. T / F			
viii. In Hoffman degradation reaction, esters are converted into amines. T / F			
ix. In animals, blood cells do not shrink or become turgid due to hypotonic nature of the bodily fluids. T / F			
x. Chlorine is more reactive than bromine due to its lower oxidation potential. T / F			
SECTION B (60 Marks) (ATTEMPT ANY SIX QUESTIONS) Answer the following questions in your own words. Copy the correct question number and write your answer against it.			
Question 2			
a) Each of the following characteristics is either associated with rate of reaction or the rate constant. • Depends on concentration of the reactant. • Unit depends on the order of the reaction • Independent of concentration of reaction. • Its unit is fixed and is $\text{molL}^{-1} \text{ s}^{-1}$ Copy the table and categorize the above properties. <table border="1" style="width: 100%; margin-top: 10px;"> <tr> <td style="width: 50%;">Rate of reaction</td> <td style="width: 50%;">Rate constant</td> </tr> </table>	Rate of reaction	Rate constant	[2]
Rate of reaction	Rate constant		

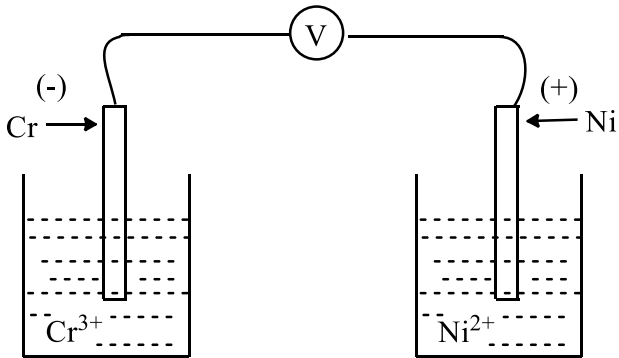
	✓ Depends upon on the concentration of the reactant. ✓ Its unit is fixed and is mole $l^{-1}t^{-1}$	✓ Independent to the concentration of the reactant. ✓ Its unit depends upon the order of the reaction.		
b)	How does the second law of thermodynamics complement the first law of thermodynamics?			[1]
c)	Certain substances represented by X, Y and Z, found in the food colourant are considered harmful to health. Samples of food colourant, I and II are analysed with the help of TLC to check the presence of such substances and the following chromatogram is obtained.			

i) List down some of the health problems associated with the consumption of such substances present in the food colourants.	[1]
(any two relevant answers)..... 0.5 + 0.5 - Indigestion - Food poisoning - Cancer (any other relevant point)	
iii) What properties of a liquid are considered for it to be used as a solvent in TLC?	[1]
(any two of the following) 0.5 + 0.5 - It must not react with the substances in the mixture. - Should be polar in nature - It should not be volatile	
d) Commercially supplied sulphuric acid has the molarity of 18 molL ⁻¹ . What volume of the acid is required to prepare its 2.0 M aqueous solution of 500 mL?	[2]
$M_1 V_1 = M_2 V_2$.....0.5 $18 \times V_1 = 0.2 \times 500$.....0.5 $V_1 = 5.55 \text{ mL}$ 0.5 +0.5	
e) Explain whether each of the following complex ions form colour compounds. i. $[\text{Cu}(\text{NH}_3)_4]^{2+}$ ion $\text{Cu}^{2+} = 4s^0 3d^9$ 0.5 Forms coloured compound due to presence of unpaired electron in the d- orbital.....0.5 ii. $[\text{Cu}(\text{NH}_3)_4]^+$ ion $\text{Cu}^+ = 4s^0 3d^{10}$ 0.5 Does not forms coloured compound due to absence of unpaired electron in the d- orbital.....0.5	[2]
Question 3	

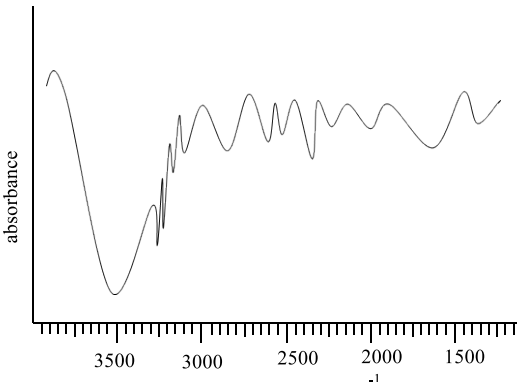
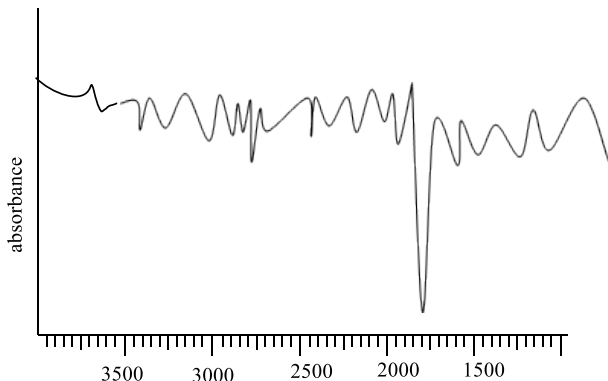
a) Define boiling point of a solvent	[1]
It is the temperature at which the vapour pressure of the solution becomes equal to the atmospheric pressure.....1	
b) Explain the effect of addition of a non-volatile solute to a solvent on the boiling point of the solution.	[2]
The boiling point increase due to decrease in the vapour pressure of the solution.....1 The solute particles occupy some portion of the surface and decrease the escaping tendency of the solvent particle 1	
c) During certain thermodynamic processes, the internal energy of the system remains constant.	
i. Name the thermodynamic processes	[1]
Isothermal process.....0.5 Cyclic process.....0.5	
ii. Deduce the relationship between 'q' and 'w' for the processes mentioned in (i) based on the first law of thermodynamics.	[1]
$\Delta E = q - w$.....0.5 $q = w$ 0.5	
d) Study the reaction given and answer the following questions $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \xrightarrow{\text{conc H}_2\text{SO}_4} \text{X} + \text{H}_2\text{O}$	
i. Write the formula of compound X.	[1]
$\text{CH}_3\text{COOC}_2\text{H}_5$ 1	
ii. Name the peculiar property of compound X which can distinguish it from other classes of organic compound.	[1]
Fruity smell.....1	
iii. Write ONE commercial use of the compound X.	[1]

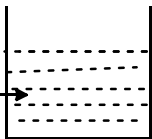
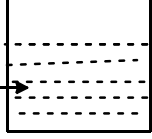
ANY TWO Used in synthetic flavours, perfumes, and cosmetics. Certain volatile esters are used as solvents for lacquers, paints, and varnishes; for this purpose, large quantities of ethyl acetate and butyl acetate are commercially produced.....0.5 +0.5		
e) Copy the table and distinguish the following pairs of compounds with the help of a relevant chemical test.		[2]
C ₆ H ₅ CHO	HCHO	
• Does not respond to Fehling's solution test	• Gives red precipitate when treated with Fehling's solution	
CH ₃ CHO	HCHO	
• When treated with Iodine solution solution concentrated NaOH solution forms yellow precipitate of iodoform.	• Does not respond to Iodoform test	
Question 4		
a) The analysis of organic compounds is carried by using chemical reagents which bring about certain type of reaction depending upon their nature.		
i. Which type of reaction is brought about by K ₂ Cr ₂ O ₇ and Tollen's reagent?		[1]
Oxidation		1
ii. Identify compounds A and B in the following reaction.		[2]
$\text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{K}_2\text{Cr}_2\text{O}_7 / \text{H}^+} \text{A} \xrightarrow{\text{Tollen's reagent}} \text{B}$		
A=CH ₃ CHO.....		1
B=CH ₃ COOH.....		1

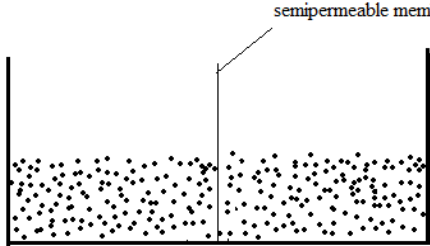
b) An energy drink is prepared by dissolving 10g of glucose in 180g of water. Will the energy drink freeze in the fridge maintained at -0.15°C? Justify your answer with proper calculation. (K _f for water is 1.86 Kkgmol ⁻¹)		[2]															
$\Delta T_f = K_f \frac{w}{mW} \times 1000 \dots\dots\dots 0.5$ $= 1.86 \times \frac{10}{180 \times 180} \times 1000 \dots\dots\dots 0.5$ $= 0.57^\circ\text{C} \dots\dots\dots 0.5$ No, because the freezing point of the solution is lower than the temperature maintained inside the refrigerator.....0.5																	
c) The m/e values of fragments of different organic compounds are given in the table below. Copy the table and write the formula of the fragments A, B, C and D under each organic compound according to the m/e value.		[2]															
<table><tr><td>Organic compound</td><td>Ethanol</td><td>Ethyl amine</td><td>Dimethyl amine</td><td>Trimethyl amine</td></tr><tr><td>m/e values</td><td>43</td><td>29</td><td>30</td><td>44</td></tr><tr><td>Formula of fragments.</td><td>A</td><td>B</td><td>B</td><td>D</td></tr></table>	Organic compound	Ethanol	Ethyl amine	Dimethyl amine	Trimethyl amine	m/e values	43	29	30	44	Formula of fragments.	A	B	B	D		
Organic compound	Ethanol	Ethyl amine	Dimethyl amine	Trimethyl amine													
m/e values	43	29	30	44													
Formula of fragments.	A	B	B	D													
<table><tr><td>A</td><td>C₂H₃O⁺</td></tr><tr><td>B</td><td>CH₃N⁺</td></tr><tr><td>C</td><td>CH₃NH⁺</td></tr><tr><td>D</td><td> CH₃N⁺ CH₃ </td></tr></table>	A	C ₂ H ₃ O ⁺	B	CH ₃ N ⁺	C	CH ₃ NH ⁺	D	CH₃N⁺ CH₃									
A	C ₂ H ₃ O ⁺																
B	CH ₃ N ⁺																
C	CH ₃ NH ⁺																
D	CH₃N⁺ CH₃																
.....0.5 X 4 = 2																	
d) Study the setup of a galvanic cell shown below and answer the questions that follow.																	

	
i. What would be the EMF reading in the voltmeter? Why?	[1]
Zero.....0.5 because of incomplete circuit due to absence of salt bridge.....0.5	
ii. Compare the electrode potentials and the reactivity of the metals used in the set up	[2]
Reduction potential of anode (Cr electrode) is lower than cathode (Ni electrode) OR Oxidation potential of anode (Cr electrode) is higher than cathode (Ni electrode).....1 Chromium metal is more reactive than Nickel metal 1	
Question 5	
a) Alanine is the second amino acids and has isoelectric point of 6.1.	
i. Draw the structure of alanine at its isoelectric point.	[1]
$ \begin{array}{c} \text{CH}_3\text{-CH-COO}^- \\ \\ \text{NH}_3^+ \end{array} $ 1	

ii. If alanine is analysed using NMR spectroscopy, write the type of signals produced?	[1]
It gives four signals.....0.5	
ANY ONE	
CH ₃ – Doublet / CH – quartet / OH and NH – Singlet.....0.5	
b) Write the IUPAC name of each of the following compounds.	
i. [Co(NH ₃) ₄ (C ₂ O ₄)]Cl ₂	[1]
Tetraamineoxalatecobalt(IV)chloride.....1	
ii. [Cr(H ₂ O) ₃ (dien)] ²⁺	[1]
Triquaodiethylenetriaminechromium(II) ion.....1	
c) Design an experiment to confirm that organic compounds R- NH ₂ and R-COOH are either acid or base.	[3]
Suitable reagents used other than those given in the question.....1	
Suitable procedures or steps listed in sequence.....1	
Results or inference	
OR	
Relevant reactions showing the products.....1	
d) A galvanic cell is represented as follows. Cd (s)/Cd ²⁺ (aq) (1M) Ag ⁺ (aq)(0.01M)/Ag (s) E° of Cd ²⁺ /Cd = -0.4V and E° of Ag ⁺ /Ag = 0.8V	
i. Determine the EMF of the cell.	[1]

$E_{\text{cell}} = E^{\circ}_{\text{cell}} + \frac{0.0591}{n} \log \frac{\text{reduction ion}}{\text{oxidation ion}}$ OR $E_{\text{cell}} = 1.2 + \frac{0.0591}{2} \log \frac{(0.01)^2}{1} \dots\dots\dots 0.5$ $E_{\text{cell}} = 1.08 \text{ V} \dots\dots\dots 0.5$	
ii. How is the spontaneity of the redox reaction in the galvanic cell determined?	[1]
Positive value of e.m.f determines the spontaneity of the reaction.....1	
iii. If the EMF of the cell is to be increased, which ion concentration needs to be increased?	[1]
Silver ion concentration needs to be increased.....1	
Question 6	
a) Following IR spectra indicated by I and II, are of organic compounds. Study the spectra and answer the questions that follow.  I  II	

i. Identify the functional group of the organic compounds represented by each of the spectrum.	[1]
I = -COOH 0.5 II = -CO- OR -CHO.....0.5	
ii. Write the general structure of the organic compounds.	[1]
I = R-COOH.....0.5 II = R-CO-R / R-CHO.....0.5	
b) Copy and complete the following nuclear reaction.	
i. ${}_{92}\text{U}^{238} \rightarrow {}_{90}\text{Th}^{234} + \dots\dots\dots$	[1]
${}_{92}\text{U}^{238} \rightarrow {}_{90}\text{Th}^{234} + {}_2\text{He}^4 \dots\dots\dots 1$	
ii. What type of radioactivity is represented by the above reaction?	[1]
Natural radioactivity.....0.5	
c) The aqueous solutions of solutes are shown below.	[2]
 solution A  solution B Design an experiment to make both the solutions of the same concentration without altering the overall amount of solute and the solvent used.	

																					
Set up / diagram.....0.5																					
Mention of phenomena osmosis 0.5																					
Observation: Solvent will flow from solution A (lower concentration) to solution B (higher concentration) till it becomes isotonic.....1																					
d) Acetyl chloride is prepared by the following two methods. I. Glacial acetic acid with phosphorous pentachloride II. Glacial acetic acid with thionyl chloride																					
i. Which of the above method is recommended? Why	[2]																				
Preparation of acetyl chloride from acetic acid with Thionyl chloride (SOCl ₂) is the best method 1 because by-products formed are in gaseous state and can escape easily.....1																					
e) For the reaction 2A + B → product, following data is obtained.	[2]																				
<table><tr><th>Expt.No.</th><th>[A] molL⁻¹</th><th>[B] molL⁻¹</th><th>Initial rate in molL⁻¹min⁻¹</th></tr><tr><td>1</td><td>0.1</td><td>0.1</td><td>6.0 × 10⁻⁴</td></tr><tr><td>2</td><td>0.4</td><td>0.1</td><td>2.4 × 10⁻³</td></tr><tr><td>3</td><td>0.3</td><td>0.2</td><td>7.2 × 10⁻³</td></tr><tr><td>4</td><td>0.3</td><td>0.4</td><td>2.88 × 10⁻²</td></tr></table>	Expt.No.	[A] molL ⁻¹	[B] molL ⁻¹	Initial rate in molL ⁻¹ min ⁻¹	1	0.1	0.1	6.0 × 10 ⁻⁴	2	0.4	0.1	2.4 × 10 ⁻³	3	0.3	0.2	7.2 × 10 ⁻³	4	0.3	0.4	2.88 × 10 ⁻²	
Expt.No.	[A] molL ⁻¹	[B] molL ⁻¹	Initial rate in molL ⁻¹ min ⁻¹																		
1	0.1	0.1	6.0 × 10 ⁻⁴																		
2	0.4	0.1	2.4 × 10 ⁻³																		
3	0.3	0.2	7.2 × 10 ⁻³																		
4	0.3	0.4	2.88 × 10 ⁻²																		
Deduce the rate law and determine the order for th reaction.																					
Let the rate law be r = k[A] ^x [B] ^y Divide experiment 2 by 1																					

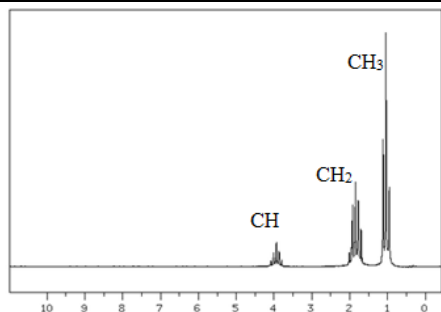
$\frac{k[0.4]^x[0.1]^y}{k[0.1]^x[0.1]^y} = \frac{2.4 \times 10^{-3}}{6.0 \times 10^{-4}}$ $4^x = 4$ $x = 1 \dots\dots\dots 0.5$ Divide experiment 4 by 3 $\frac{k[0.3]^x[0.4]^y}{k[0.3]^x[0.2]^y} = \frac{2.88 \times 10^{-2}}{7.2 \times 10^{-3}}$ $2^y = 2^2$ $y = 2 \dots\dots\dots 0.5$ Rate law= $r = k[A]^1[B]^2 \dots\dots\dots 0.5$ Order of reaction = $x + y = 1 + 2 = 3^{\text{rd}}$ order.....0.5	
Question 7	
a) Transition metals and their compounds are widely used as catalyst in various reactions.	
i. Write any TWO examples of transition metals or their compounds used as catalyst.	[1]
ANY TWO V_2O_5 / Fe / Ni / Pt / Cu or any other relevant answer 0.5+0.5	
ii. Why do transition metals or their compounds act as catalyst?	[1]
Due to unpaired electrons in d-orbitals OR d-d transition/ incompletely d-orbitals.....1	
b) Acetyl chloride get hydrolysed in the presence of water.	

i. Write the chemical equation for the reaction.	[1]
$\text{CH}_3\text{COCl} + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{COOH} + \text{HCl}$ award 0.5 each for both products.....1	
ii. Explain the mechanism of this reaction.	[2]
Step I: Addition of nucleophile $\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{Cl} + \text{H}-\ddot{\text{O}}-\text{H} \longrightarrow \text{H}_3\text{C}-\overset{\text{O}^-}{\underset{\text{O}^+-\text{H}}{\mid}}{\text{C}}-\text{Cl}$ 0.5 Step II: Elimination of Cl^- $\text{H}_3\text{C}-\overset{\text{O}^-}{\underset{\text{O}^+-\text{H}}{\mid}}{\text{C}}-\text{Cl} \longrightarrow \text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\overset{\text{O}^+-\text{H}}{\mid}{\text{H}} + \text{Cl}^-$ 0.5 Step III: Elimination of H^+ $\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\overset{\text{O}^+-\text{H}}{\mid}{\text{H}} \longrightarrow \text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{H} + \text{H}^+$ 1	

c) What happens to the entropy when the following processes occur?	
i. Photosynthesis	[0.5]
Decreases.....0.5	
ii. Liquefaction of petroleum gas	[0.5]
Decreases 0.5	
iii. Reaction between ammonia and hydrogen chloride	[0.5]
Decreases.....0.5	
iv. Boiling of an egg	[0.5]
Decreases.....0.5	
d) Oxalic acid undergoes neutralization reacts with bases. Write the balanced reaction for the reactions between oxalic acid and the following base solutions.	
i. Sodium hydroxide	[1]
$(\text{COOH})_2 + 2\text{NaOH} \longrightarrow (\text{COONa})_2 + \text{H}_2\text{O}$ 1	
ii. Calcium hydroxide	[1]
$(\text{COOH})_2 + 2\text{Ca}(\text{OH})_2 \longrightarrow (\text{COOCa})_2 + \text{H}_2\text{O}$ 1	

iii. Sodium carbonate	[1]
$(\text{COOH})_2 + 2\text{NaCO}_3 \longrightarrow (\text{COONa})_2 + \text{H}_2\text{O} + \text{CO}_2$ 1	
Question 8	
a) Answer the following questions with respect to a galvanic cell.	
i. Define Electromotive force of a galvanic cell.	[1]
Electromotive force is the potential difference generated when two half cells are connected in an electrochemical cell. 1	
ii. The improper disposal of used galvanic cells into the environment, poses risk to health and life of living organisms. List down some of the ways to take care of the used galvanic cell.	[1]
Proper disposal of waste/ recycle and reuse OR other relevant points.....1	
b) Formic acid is the only carboxylic acid that is reduced by Tollen's reagent. Explain.	[1]
Because it contain both aldehyde group and carboxylic group.....1	
c) 0.05M solution of acetic acid has the ionization constant of 1.74×10^{-5} . Calculate the following.	
i. Degree of dissociation of the acid	[1]
a) $\alpha = \sqrt{\frac{K_a}{c}}$ 0.5	

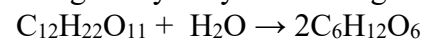
$= \sqrt{\frac{1.74 \times 10^{-5}}{0.05}}$ $= 1.865 \times 10^{-2} \dots\dots\dots 0.5$	
ii. pH of the solution	[1]
$[H^+] = c\alpha$ $= 0.05 \times 1.865 \times 10^{-5}$ $= 9.33 \times 10^{-4}$ $pH = -\log[H^+] \dots\dots\dots 0.5$ $= -\log(9.33 \times 10^{-4}) = 3.03 \dots\dots\dots 0.5$	
iii. Number of moles of un-dissociated acid remaining in the solution.	[1]
$\text{No. of moles of un-dissociated acid} = \text{Total concentration} - [H^+] \dots\dots\dots 0.5$ $= 0.05 - (9.33 \times 10^{-4})$ $= 4.9 \times 10^{-2} \dots\dots\dots 0.5$	
d) Draw the NMR spectrum of 3- bromopentane by using the approximate chemical shift values in delta scale.	[2]



.....clear digarm.....1

If labelling is done.....1

e) Sucrose undergoes hydrolysis in a single step according to the following reaction.



i. What is the order of the reaction?

[1]

$r = [\text{NO}]^2[\text{O}_2]$ 1

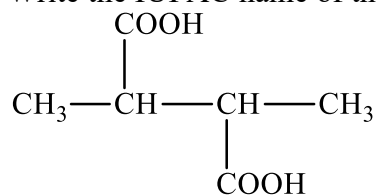
ii. How can the reaction be made of first order?

[1]

Rate of reaction is proportional to the product of concentration of reactants with each concentration raised to a power equal to the number of molecules of the reactant.....1

Question 9

a) Write the IUPAC name of the following compound.



[1]

2,3-dimethyl butan-1,4-dioic acid	1	
b) An organic reaction is represented as follows. $\text{CH}_3\text{CH}_2\text{COCl} \xrightarrow{\text{NH}_3} \text{X} \xrightarrow{\text{Br}_2, \text{KOH}} \text{Y}$		
i. Identify compound X and Y.		[2]
X = CH ₃ CH ₂ CONH ₂ 1 Y = CH ₃ NH ₂ 1		
ii. Name the reaction.		[1]
Hoffman's degradation reaction.....	1	
c) With the help of a relevant illustration or representation, explain the effect of concentration on the rate of reaction.		[2]
Rate of reaction is directly proportional to the concentration of the reactants.....1 <i>Relevant illustration or representation</i> 1		
d) All the elements have certain ratio of neutron to proton.		
i. What is the significance of n/p ratio in the atoms of element?		[1]
Stability of nucleus of the atoms/ predict the type of decay.....	1	
ii. How is appropriate n/p ratio maintained in certain elements?		[1]

By emitting alpha, beta or gamma radiations OR by ejecting or accepting any other particle capable of carrying out nuclear reactions.....1	
e) When an electrode is dipped in a solution containing its own ions, electrode potential is developed. Explain the mechanism.	[2]
Electrodes when immersed in their respective ions, they either lose or gain electrons. Oxidation electrodes lose electrons to become negatively charged and the solution positively charged. Reduction electrodes gain electrons to become positively charged and the solution negatively charged.....1 The difference in the electric charges between the electrodes and the solution develops potential difference called electrode potential.....1	